GRAYWATER

FOR CALIFORNIA NATIVE GARDENS
What is graywater?

- Water from sinks, showers, and laundry tub
- No water from toilets (black water)
- No water from kitchens sinks (food particles)
- No water from laundry if used to clean diapers
- No water containing any harmful chemicals, including bleach
California code identifies 3 systems

- Clothes Washer System
- Single Fixture and Simple Systems
- Complex Systems
CA Code Highlights

- No permit required for washing machine system (Don’t alter house plumbing & follow guidelines)
- Discharge depth raised to 2 inches from 9 inches
- Mulch basins allowed for distribution
- Edibles okay- no touching edible portion of crop
- Two tiers of systems "simple" (under 250 gpd) and "complex" (over 250 gpd)
- Location of irrigation zone rules:
  2 feet from building
  1.5 feet from property line
Don’t confuse graywater with rainwater
<table>
<thead>
<tr>
<th>Graywater</th>
<th>Rainwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produced all year long</td>
<td>Produced in wet season and held until dry</td>
</tr>
<tr>
<td>Small tanks, if any</td>
<td>season for landscapes</td>
</tr>
<tr>
<td>Only hold &lt; 24 hours</td>
<td>Large tanks</td>
</tr>
<tr>
<td>Not for some vegetables</td>
<td>Pure, great for all vegetables</td>
</tr>
<tr>
<td>Salts can build up from soaps</td>
<td>25,000 gallons for 1500 sf house and 18” of</td>
</tr>
<tr>
<td>unless flushed</td>
<td>rain per year</td>
</tr>
<tr>
<td>29,000 gallons / six months for</td>
<td>No permits required except for electrical &amp;</td>
</tr>
<tr>
<td>four people and all hookups</td>
<td>grading</td>
</tr>
<tr>
<td>Permits required for larger</td>
<td></td>
</tr>
<tr>
<td>systems</td>
<td></td>
</tr>
</tbody>
</table>
Where can you use graywater in the landscape?

- Fruit trees & vines
- Veggies-edible part can’t touch GW
- Perennials, shrubs, groundcovers, and lawns (complex systems)
- Not on root vegetables
- Not on seasonally planted annuals
- Not in the house, yet
The simplest system is the best

Fewer parts
Least maintenance
This is the only system that doesn’t require a permit.
“Laundry To Landscape”

- No permit needed
- Your washing machine has a pump!
- How much water can I get?
- What kinds of plants can I irrigate?
- What kinds of soaps can I use?
Follow these simple graywater guidelines
“Do’s”

- Be able to easily switch back to sewer
- Discharge under 2” mulch/rock/cover
- Direct water to irrigation field (no storing more than 24 hours)
- Label your system
- Have a maintenance manual
- Minimize contact with humans and pets
“Don’ts”

- Have ponding, spray or runoff
- Discharge into neighbor’s yard
- Connect to potable water supply
- Include a pump (more room for error)
- Violate other codes/laws
- Damage building
- Use diaper wash water or hazardous chemicals (oily rags, etc.)
Before you put graywater into your landscape, test your drainage.
Percolation Test

Dig a hole and prefill it if the soil is dry
Fill your hole with water
Measure how fast it drains. This soil drained 2 ½” per hour.
This is what it looks like
Tighten all connections

Leaks are not good.
Decide where the 3-way goes
3-way valve

Easily switch from the sewer to the garden.
Inlet is always in the middle.
Cut the PVC pipe
Cut a hole in the exterior wall
Seal it with silicone later

Because this is the highest point, put the air gap assembly here.
Run a PVC line out of the house

This is from the 2nd story
Diagram of system

Laundry to Landscape Greywater System Kit

*Blu-Lock fittings*

Click to buy!!

1. 2-PVC 1” 90 Elbow
2. 2-PVC 1” Male Adapter (S x MPT)
3. 1-Brass 1” 3-way valve
4. 1-Barbed 1” Male Adapter (MPT)
5. 1-PVC 1” Tee
6. 1-PVC 1.5” x 1” Reducing Bushing (SzS)
7. 1-PVC 1.5” Female Adapter (FPT x Slip)
8. 1-Auto-vent or Air Admittance Valve 1.5”
9. 1-Barbed 1” Female Hose Thread Adaptor
10. 1-Barbed 1” Adapter (BxS)
11. 1-Blu-Lock 1” Tee
12. 6-Blu-Lock 1” x 1/2” Reducing Tee
13. 10 ft-Blu-Lock 1/2” Tubing
14. 50 ft-Blu-Lock 1” Tubing
15. 8-Underground Emitter Box
16. 2-Blu-Lock Compatible 1/2” Threaded Ball Valve
17. 2-Blu-Lock 1/2” Male Adapter
18. 1-Blu-Lock 1” Coupling

Included in kit but not shown:
20-U-shaped wire hold-downs (stakes)
1-PVC Cement - Gorilla 4 ounce
1-Teflon tape 1/2”

In the laundry to landscape greywater system, the hose leaving the washing machine is attached to a 3-way valve to divert the greywater to the landscape or to the sewer. The laundry pump sends greywater to valve box outlets in the landscape where adjacent plants are watered. This system is low cost, easy to install, and gives great flexibility for irrigation. In most situations this is the number one place to start when choosing a greywater system. Read more here.

www.cleanwatercomponents.com

Additional items needed:
- PVC pipe 1”- variable length
- Silikflex adhesive sealant for sealing hole in wall
- Holesaw for 1” pipe
- Metal or plastic strap to secure PVC pipe
- Screws for strap
- Mulch

Drawing not to scale. This is a conceptual drawing only and not to be used for construction.

Courtesy of Clean Water Components
Thread into the 3-way valve ends using teflon tape.
Wrap every pipe threaded fitting, 3-4 turns clockwise.
Barbed 1” Male Adapter (MPT)

Threads into the 3-way valve and inserts into the washer hose.
PVC & couplings

Gorilla glue alternative to PVC glue and primer is a more ecological choice.
Auto-vent

Place at the highest point of the system (above the “flood rim of clothes washer”).
Connect the adapter and reducing bushing
Simple way to test the system

Always use a hose spigot vacuum breaker to avoid mixing greywater with domestic water when testing or blowing out system.

Attach barbed 1” female hose thread adapter to your garden hose, to test or clean your greywater system.
Barbed 1” adapter (BxS)

Attach the PVC to the Blu-lok pipe
Blu-loc pipe can be used with barbed fittings or locking Blu-loc fittings (which don’t come off).
Place a tee wherever you want water to come out. You can add ½” tubing to send water to a mulch basin off the 1” line.
Barbed ½” Green-back valve

Adjust the flow of first few ½” outlets. Check here for potential clogs.
Connect the PVC to 1” black poly tubing

Flexible polyethylene irrigation tubing is a better environmental choice.
Dig trenches for the pipes

They don’t have to be deep; you just don’t want anyone to trip over them.
Dig mulch basins about 12” deep. If your soil percolates slowly, make them wider.

This is a basin to hold the surge of water and sink it into the ground.
Laying pipe

Ornamental bed
With mulch basin shields
Use 1” x ½” barbed tee emitters.
Don’t cap the end.

This prevents clogging by lint . . .or pennies
Send emitters to mulch basins

Check the flow rates. Add little ball valves on some emitters to adjust the rates.
You can also use Blu-lock pipe and fittings
It works!
Mulch basins

Flow splitter register
empty 1 gal plastic pot covered with stepping stones
allows access to double ell for cleaning without
knocking dirt or leaves in (the most common
way to disturb the flow)

Outlet chamber option
upside-down, empty 5 gal
plastic pot with bottom
cut out and holes drilled in
the sides. Allows solids out
into mulch for biodegrada-
tion so clogging does not
occur. It is very important
that discharge end of pipe
is 2" or more above any
obstruction, so solids do
not accumulate and ob-
struct the outlet

Clear discharge outlet option
If subsurface distribution is not
required, GW can be discharged
2" above surface of mulch, into
which it quickly disappears. This
is much simpler to construct and
maintain and the added health risk is minimal (subsurface dis-
tribution is preferred for kitchen
sink water so vermin can’t use it
as a food source).

Flow Splitter should sit on
brick for easy leveling

Access covers

Mulch basin (volume = several
times design surge)

Outlet concealed with rocks option
This is intermediate between the outlet
chamber and clear discharge options

Pipe slope
1/4" per foot min.

Drawings from: Branched Drain Greywater Systems by Art Ludwig
Code compliant-GW discharged under mulch shield

Not code compliant
Where do you get the parts?

- [www.cleanwatercomponents.com](http://www.cleanwatercomponents.com)
- [www.oasisdesign.net](http://www.oasisdesign.net)

- Plumbing, irrigation and hardware stores carry *some* of the parts, but not all
You can purchase all parts online from cleanwatercomponents.com

Laundry to Landscape Greywater System Kit

Click to buy!
(1) 4- PVC 1" 90 Elbow
(2) 2- PVC 1" Male Adapter (5 x MPT)
(3) 1- Brass 1" 3-way valve
(4) 1- Barbed 1" Male Adapter (MPT)
(5) 1- PVC 1" Tee
(6) 1- PVC 1.5" x 1" Reducing Bushing (SxS)
(7) 1- PVC 1.5" Female Adapter (FPT x SLP)
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(10) 1- Barbed 1" Adapter (BxS)
(11) 1- Barbed 1" Tee
(12) 6- Barbed 1" x 1/2" Reducing Tee
(13) 10 ft- Poly 1/2" Tubing
(14) 50 ft- Poly 1" Tubing
(15) 8- 7" round valve box
(16) 2- Green Back Valve Barbed 1/2"
(17) 1- Barbed 1" Coupling

Included in kit but not shown:
20- U-shaped wire hold-downs (stakes)
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1- Teflon tape 1/2"

Additional items needed:
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- Silkiflex adhesive sealant for sealing hole in wall
- Holesaw for 1" pipe
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- Screws for strap
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How much GW do you have?

- Compare your winter and summer water bills – the difference is your outdoor water use.

- Analyze your use:
  - Amount of showers and length
  - Low flow shower head – 2.5 gal/min  10 minute shower= 25 gallons
  - Type of washer and # of loads
  - Top loaders: 40 gal, front loaders: 10-20 gallons each time
Water Use in Typical Bay Area Home

- Estimate of 40 gallons of gray water produced per day per person
- Family of four can produce about 9,600 gallons per two month water billing period
- Just about the water required for “typical” Bay Area landscape

Average Water Use in Typical Bay Area Home

- Water use in dry summers almost twice that of wet winter months
Graywater costs

- **Laundry to landscape**
  - $100-$200 materials only
  - $700-$2,000 full installation

- **Single fixture branched drain system**
  - $200-$400 materials only
  - $800-$3,000 full installation

- **Complex systems with tanks & pumps**
  - $400-$600 materials only
  - $2,000-$6,000 full installation
More complex systems

Surge tank, pump, and filter

Source: ReWater, Inc.
Complex Systems parts

- Special Emitters
- Complex controllers
- Automatic filter backwash
- Fresh water supplementation (when out of town)

ReWater, Inc. Cone drip emitters
ReWater’s Complete Control irrigation controller

Techline purple for recycled water
Complex systems

- Are pumped and filtered
- Have small surge tanks

Advantages
- Most flexible
- Good for most types of vegetation
- Similar to modern irrigation systems
- Good for most topographies
- Good for multi-unit and commercial sites

Disadvantages
- Most expensive – about $6,000 extra
- Most complicated – must be installed by professionals
Lawn irrigation installation

Photos from ReWater, Inc.

Lawn five years after installation
Sunnyvale Home – Installed 2006

Sand filter from ReWater

Surge tank in vault

Lawn with subsurface drip tubing from Netafim, installed by EarthCare Landscaping, plumbing by Hal Branges
What soaps to use?

Not all biodegradable products are good for plants... 

...think biocompatible!
Ingredients to avoid

Read the labels

- Salt, sodium compounds
damages soil

- Boron, borax (Bon Ami)
micronutrient turns into a microtoxin

- Chlorine
  kills bacteria/life (hydrogen peroxide better)
Use these laundry products

- Oasis
- ECOS (available at Costco and Whole Foods)
- Bio pac liquid detergent
- Wonder balls or Soap nuts

- **No** powdered detergents, salt, borax, bleach, water softener
Shower and sink products

- Aubrey Organics shampoo and conditioner
- Dr. Bronner’s
- Oasis all purpose cleaner

- No bleach, hair dye, harsh cleaners, salt baths, epson salts
Cleaning products

- Vinegar based cleaners
- Liquid soap based cleaners
- Dr. Bronner’s

No high salt products, bleach, harsh cleaners
What plants don’t like Graywater?

- Acid loving plants
  Madrones, Huckleberries, Blueberries, Azaleas, Rhododendrons

- Saline intolerant plants
  Redwood trees, Giant Sequoia

- Phosphorus intolerant plants
  Protea family (Australian)
Best Natives for Greywater

Irrigate with mulch basins:
• Plants that have a moderate or high water requirement
• Plants that do not favor acidic soil

• “California Native Plants that tolerate moist habitats”

Adapted from “California Native Plants for the Garden” (Bornstein, Fross, & O’Brien, Cachuma Press)

• Annuals, vegetables, and drought tolerant plants are best irrigated by drip irrigation
<table>
<thead>
<tr>
<th>Perennials</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Columbine</td>
<td>Aquilegia formosa</td>
</tr>
<tr>
<td>Mugwort</td>
<td>Artemisia douglasiana</td>
</tr>
<tr>
<td>Wild Ginger</td>
<td>Asarum caudatum</td>
</tr>
<tr>
<td>Sedge</td>
<td>Carex (all)</td>
</tr>
<tr>
<td>Stream Orchid</td>
<td>Epipactis gigantea</td>
</tr>
<tr>
<td>Horsetail</td>
<td>Equisetum</td>
</tr>
<tr>
<td>Wire Grass, Rush</td>
<td>Juncus (all)</td>
</tr>
<tr>
<td>Scarlet Monkeyflower</td>
<td>Mimulus cardinalis</td>
</tr>
<tr>
<td>Seep Monkeyflower</td>
<td>Mimulus guttatus</td>
</tr>
<tr>
<td>Hooker Evening Primrose</td>
<td>Oenothera elata</td>
</tr>
<tr>
<td>Redwood Sorrel</td>
<td>Oxalis oregana</td>
</tr>
<tr>
<td>Monkeyflower Savory</td>
<td>Satureja mimuloides</td>
</tr>
<tr>
<td>Point Reyes Checkerbloom</td>
<td>Sidalcea calycosa ssp. rhizomata</td>
</tr>
<tr>
<td>Golden-eyed Grass</td>
<td>Sisyrinchium californicum</td>
</tr>
<tr>
<td>Goldenrod</td>
<td>Solidago (all except californica)</td>
</tr>
</tbody>
</table>
Grasses

- Pacific Reedgrass  
  *Calamagrostis nutkaensis*
- Red Fescue  
  *Festuca rubra*
- Deer Grass  
  *Muhlenbergia rigens*
- Alkali Sacaton  
  *Sporobolus airoides*
<table>
<thead>
<tr>
<th>Tree Type</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alder</td>
<td><em>Aldus</em> (all),</td>
</tr>
<tr>
<td>California sycamore</td>
<td><em>Platanus racemosa</em></td>
</tr>
<tr>
<td>Cottonwood, Quaking Aspen</td>
<td><em>Populus</em> (all)</td>
</tr>
<tr>
<td>Western Red Cedar</td>
<td><em>Thuja plicata</em></td>
</tr>
<tr>
<td>California Bay</td>
<td><em>Umbellulararia californica</em></td>
</tr>
<tr>
<td>California Fan Palm</td>
<td><em>Washingtonia filifera</em></td>
</tr>
<tr>
<td>Shrubs &amp; Subshrubs</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Spicebush</strong></td>
<td><em>Calycanthus occidentalis</em>,</td>
</tr>
<tr>
<td><strong>Creek Dogwood</strong></td>
<td><em>Cornus sericea</em>,</td>
</tr>
<tr>
<td><strong>Poverty Weed</strong></td>
<td><em>Iva hayesiana</em>,</td>
</tr>
<tr>
<td><strong>Pacific Wax Myrtle</strong></td>
<td><em>Myrica californica</em>,</td>
</tr>
<tr>
<td><strong>Western Mock Orange</strong></td>
<td><em>Philadelphus lewsii</em>,</td>
</tr>
<tr>
<td><strong>Golden Currant</strong></td>
<td><em>Ribes aureum var.gracillimum</em>,</td>
</tr>
<tr>
<td><strong>Elderberry</strong></td>
<td><em>Sambucus (all)</em>,</td>
</tr>
</tbody>
</table>
A VERY easy graywater system:
Graywater references

- *Create an Oasis with Greywater* by Art Ludwig  
  [http://oasisdesign.net](http://oasisdesign.net)

- Greywater Guerrillas, authors of *Dam Nation*  
  [www.greywateraction.org](http://www.greywateraction.org)

- Complete graywater system: Rewater, Inc.  
  [www.rewater.com](http://www.rewater.com)

- Several slides courtesy of Sherri Osaka --  
  Sustainable Landscape Designs
The end. . .

. . .or is it just the beginning?