



## GREYWATER

Greywater systems filter and recycle water from bathroom sinks, showers, and washing machines for use in flushing toilets and/or irrigating landscaping. When building a new building or renovating an existing one, and wanting to make an extra effort to improve water efficiency, you may wish to consider installing a greywater system. Only about 5-10% of drinking water is used for drinking and cooking, which is extravagant and unnecessary. For a typical building, reusing greywater can provide upwards of 50 to 100 gallons per day (depending on the building occupancy) for outdoor use and toilet flushing, cutting your water and sewer bills noticeably.

## LEED APPLICATION

Leadership in Energy and Environmental Design (LEED) is a program administered by the United States Green Building Council that uses a Green Building Rating System to register and certify the world's greenest buildings.

The term "energy efficient" has never truly been applied to plumbing systems. In fact, terms such as "green," "sustainable," or "environmental" have sprung up around other utilities (gas, electric) to further complicate the issue as it relates to plumbing systems. The LEED Program will change all that by solidifying definitions and actions for all utilities, including water.

LEED defines a threshold for green buildings and introduces a tool to promote and guide comprehensive and integrated building design. LEED is performance-based where possible and compatible with standard design processes. Certification is done by the U.S. Green Building Council (USGBC). The program will help change how plumbing professionals think about building design in terms of plumbing.

Water efficiency is one of the categories that LEED has defined, and greywater can be applied to Water Efficiency Credits 1.1, 1.2, and 2. Credits 1.1 and 1.2 include limiting or eliminating use of potable water for landscape irrigation. Credit 2 includes reducing the generation of wastewater and potable water demand, while increasing local aquifer recharge.

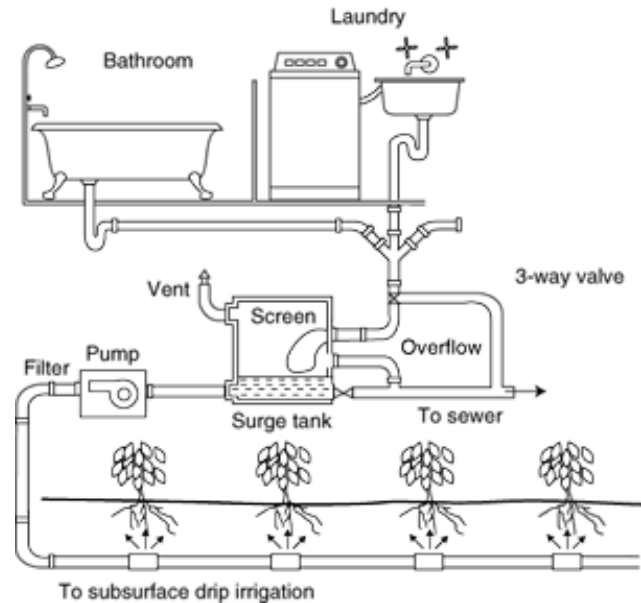


Figure 1. Greywater system schematic.

The next wave of water conservation strategy is a logical progression to LEED and will include uses of greywater. Greywater is of a lesser quality than potable water but of higher quality than blackwater. Blackwater is water flushed from toilets, as well as water from the kitchen sink, garbage disposal, and dishwasher. It is considered blackwater because of high concentrations of organic waste. While greywater is most suitably used for subsurface irrigation of non-edible landscape plants, its applications are expanding. In a commercial application, for example, chiller water can be directed to the plumbing system through filter techniques. While somewhat cost-prohibitive today, techniques to accomplish this are continually being refined and made more cost-effective.

## GREEN BUILDING ISSUES

Greywater offers potential financial advantages to regional sewage treatment facilities, since its use diminishes sewer flows and lessens the need to expand such facilities. For example, the state of California now allows greywater systems, and various municipalities and utility districts have passed specific greywater ordinances. Installation of greywater systems requires modifications to existing plumbing systems and the addition of certain components.



However, officials also have voiced concern that with increased use of greywater, less effluent will be available for treatment, resulting in less reclaimed water for municipal uses. This likely would be a problem for a community that reclaims all its wastewater. Domestic greywater use then would represent a decrease in municipal water supplies.

## DESIGN/CONSTRUCTION APPLICATION

Greywater systems filter and recycle water from bathroom sinks, showers, and washing machines for use in flushing toilets and/or irrigating landscaping.

Used water from kitchen sinks and dishwashers is excluded because too much soap, oils, fats, particulates, and food pieces clog pipes

A sand filter, much like a swimming pool filter, is used to remove unwanted solid material and a pump transports the greywater to the drip irrigation system located outside.

Where maintenance staff are not expected, pumped systems equipped with automatically back-washed sand filters are most appropriate, though more expensive. These systems, unlike other greywater systems, can be used for drip irrigation of lawns and require minimal service.

Sometimes an incorporated fluid-injection system is used to introduce water-soluble pesticides to treat for termites, fire ants, scorpions, etc. So while irrigating the landscape, you can apply fertilizers or pesticides in one simple, automatic, efficient, and economical system.

The most effective and sanitary way to apply greywater for plant growth and soil health is by drip-irrigation tubing beneath a thick, protective layer of mulch. The emitters have tiny holes and passages to regulate flow of the water, which requires the greywater to be fully filtered to work in a drip-irrigation system. There are many benefits to this type of irrigation system:

- Efficient source of irrigation
- High yields for edible plants
- Spreads the greywater over a large area with a great amount of control
- Supports low-maintenance landscaping

There are a few limitations to using greywater for irrigation:

- Use greywater around perennials, trees, and shrubs only, and wash your hands after working in soil irrigated by greywater.
- The list of diseases potentially transmitted via greywater ranges from food poisoning to typhoid fever. However, not one greywater-caused illness has been documented by any public health agency.
- Do not allow "daylighting" or surface puddling. If greywater-irrigated soil doesn't get moist on the surface, then nobody can come in contact with pathogens or parasites it may contain. Therefore, it is best that the greywater goes directly to the roots of trees and shrubs via subsurface distribution, either by a shallow leach field or buried drip irrigation.

## ADDITIONAL INFO

Sources for this bulletin and additional information can be found at the following Web sites:

### LEED Requirement Information

- [www.usgbc.org](http://www.usgbc.org)
- [http://www.edcmag.com/CDA/ArticleInformation/features/BNP\\_\\_Features\\_\\_Item/0%2C4120%2C93824%2C00.html](http://www.edcmag.com/CDA/ArticleInformation/features/BNP__Features__Item/0%2C4120%2C93824%2C00.html)

### Greywater Systems

- <http://ag.arizona.edu/AZWATER/arroyo/071rain.html>
- <http://www.rmi.org/sitepages/pid287.php>
- <http://www.graywater.net/>
- <http://hem.dis.anl.gov/eehem/95/950712.html>

### Irrigation System Details

- <http://www.ci.malibu.ca.us/download/index.cfm?fuseaction=download&cid=2957>
- <http://doityourself.com/gardenmaint/graywater.htm>

This GreenBuild Tech Bulletin was developed by Haven Alford, a student at Kansas State University. As designers and builders of structural, mechanical, electrical, and plumbing systems in buildings, architectural engineers and constructors have a tremendous opportunity and responsibility to address energy and/or environmental impacts in their work.