## **Getting Clear on Greywater** Additional Information and Resources

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#### Simple, Easy Greywater Systems

With a "Landscape Direct," "Drain Out Back," "Laundry Drum," or "Drumless Laundry" system, only need a bit of the info that follows, which is geared towards higher performance greywater systems.

#### **100+ Pages of Free Info on Greywater** http://oasisdesign.net/greywater

#### **Greywater and Rainwater Books**

http://oasisdesign.net/catalog http://harvestingrainwater.com

#### **Benefits of Reusing Greywater**

- Lower fresh water use
- Less strain on septic tank or treatment plant
- Highly effective purification
- Can work in sites unsuitable for a septic tank
- Less energy and chemical use
- Plant growth

Plumber

- Reclamation of otherwise wasted nutrients
- Increased connection to natural cycles

· Plumb as high as possible, conserving

fall along the whole length of the pipes to get outlets in proper position/height. This can take twice as much time but is

essential to enable irrigation close to the

Plumb diversions downstream from

• Plumbing GW lines totally separately

until outside the house is a good way to

go; essential if under slab. Vents may be

house-adjust your bid

• Diverter valve(s), overflow to

traps and vents

combined

septic/sewer

### **Ecological Systems Design**

- Following principles of ecological design always improves overall outcome, especially with greywater.
- you can get some benefits with much less work. You'll Optimized greywater systems are the most "systems design intensive" of common green technologies—more than solar, composting toilets, edible landscaping, etc.
  - There are more variables to take into account, and a change in many of these produces a bigger change in the design than is common. "Optimizing components in isolation tends to pessimize the whole system."

–Paul Hawken, Amory & L. Hunter Lovins

- Start at the widest, global view of the context, get clear on goals, then zoom into to the details, and forward in time. Keep an eye on the big picture.
- Ecological systems design: http://oasisdesign.net/design/principles.htm

#### **Greywater System Checklists**

http://oasisdesign.net/greywater/stubout.htm http://oasisdesign.net/design/consult/checklist.htm#checklist

### Greywater System Design Coordination

#### Landscaper

- · Locate appropriate plants to craft microclimates, provide food, privacy, and fire safety
- Coordinate with runoff from rain on site, runoff entering from off site
- Adjust landscape elevations
- Install plants and distribution plumbing...each GW zone w/ corresponding irrigation zone,
- which can be turned off independently to actualize water savings
- · Amend soil, add mulch
- Define seasonal tasks and irrigation modes

#### Gutter installer

Rainwater

Route downspouts to irrigated areas for rainwater flushing

Use,

• Design gutters and downspouts for filtration, pressure if necessary

#### Users

- Water-wise habits
- Materials management: reuse of maintecompost, excreta, mulch, brush firewood
- nance Selection of cleaners, divert GW
  - when using something nasty
  - Seasonal adjustments
  - Maintenance
  - Gardening

#### Architect/Engineer

- Site house uphill from irrigated area (as basic as facing the building south for solar)
  - Raised floors so the plumbing can exit at grade
  - Accessible plumbing, e.g., in a crawlspace
  - Efficient fixtures in workable locations
  - Passive solar greenhouse
  - Roof rainwater plan and cistern location
  - Excreta management system Water supply coordination

Inspector

Contractor

· Ensure that plumbing to

facilitated by masonry

greywater spec is

and carpentry

• Rise above role of policing for cheating on minimum standards, and fulfill potential as advocate/resource for builders who are investing effort to reduce the overall impacts from the built environment

Construction

· Ensure that systems are designed and built well, using performance of familiar systems as an indicator of quality of unfamiliar systems

**GW** collection plumbing

### Greywater system designer

Assess goals, context, and resources

Plants, soil

- · Design greywater system and connections with other systems
- Decide early to "lump" or "split" collection plumbing

#### Owner

- Clearly articulate goals
- with architect, plumber, contractor, etc.

**Buildings** 

Legalities

· Back up greywater system designer in fights

#### Water supply

Greywater system design starts with the characteristics of the water supply system.

- The most ecological water supply relies:
- Primarily on rainwater
- Secondarily on reused water
- Lastly on surface or groundwater http://harvestingrainwater.com http://oasisdesign.net/water/storage

# Guidelines for relating well with the natural water cycle

- 1) Leave as much as possible of the work to nature—The more humans intervene, the more likely the overall system will get thrown out of whack
- 2) Improve several problems with one design; include comprehensive as well as specialist perspectives—Much bigger improvement from improving connections between systems than from improving systems themselves
- 3) Divert a small amount of water
- 4) Divert just after natural purification, so little or no additional treatment is needed—Springs, rainwater harvesting, wells, sand filtration
- 5) Divert from an elevation above the use point, or as little below as possible, so less energy is needed for pumping—Low pressure plumbing
- 6) **Use water efficiently**—*REDUCE comes before reuse in the hierarchy of ecological materials management*

Always consider efficient fixtures before looking to reuse water from them

Sequence uses so water cascades from those uses which require the cleanest water to those which tolerate the dirtiest

*Use ultra-efficient fixtures, eg., wood burning bathtub, eco luxury bathing chamber* 

- 7) Add used water and nutrients back into the natural water cycle just before natural purification—Greywater systems, composting toilets, branched drain septic systems, compost, mulch, firewood...
- 8) **Absorb all runoff**—*Permeable surfaces, vegetation cover, mulch, basins and swales*
- 9) **Rigorously confine incompatible materials** (motor oil, solvents) to their own industrial cycles—Add to water only a moderate quantity of substances which biodegrade into plant nutrients or non-toxins and nothing else

#### Brad Lancaster http://harvestingrainwater.com

Osis

Oasis Design oasis@oasisdesign.net http://oasisdesign.net 805 967-9956

# Six factors for good natural purification of water or wastewater

Observing engineered and wild water systems, clearly we're best off doing it as much like nature as possible. Here are design principles for ecological water treatment:

- 1) **Plenty of contact time**—The longer the water is in contact with beneficial bacteria and plant roots, the better. To increase contact time, reduce the flow rate and or increase area.
- 2) **Plenty of micro surface contact**—The more micro surface with beneficial bacteria growing on it the better, and the more plant roots, the better. Loamy soil has thousands of times more surface area than gravel. Avoid bulk flow; percolation is millions of times better for treatment.
- 3) Moisture, oxygen and nutrient levels which support growth/survival of roots and bacteria—If the system is totally dry long enough for the bacteria and roots to die, then gets spike loading, then is dry again, the treatment won't be as good. If the soil is saturated (no air) for more than 24 hours, the dissolved oxygen will be consumed.
- 4) Apply wastewater as close as possible to the soil surface, without causing an unsanitary condition on the surface—The top of the soil has a purification capacity thousands of times greater than three feet down, because there is more life at the surface.
- 5) **Appropriate plants as nutrient sinks**—You don't have to worry about the bacteria—if the conditions are right, one will turn into trillions. However, it is generally helpful to actively manage plants to ensure there are the right number of the right kind. Evergreen plants are active all year. If you expect constant syntax saturated conditions, use spetland plants

*If you expect constant, water saturated conditions, use wetland plants, which pump oxygen out their roots.* 

6) **Warmth**—*The warmer it is, the better the treatment. The rule of thumb is that for each additional* 10°C *you get twice the treatment.* 

#### **More resources**

- Greywater Policy Center: <u>http://oasisdesign.net/greywater/law</u> Includes greywater laws and needed improvements, Cottonwood greywater stub out ordinance.
- Inspection checklist for collection/stub out plumbing: <u>http://oasisdesign.net/greywater/stubout.htm</u>
- Green septic system (no written material available-contact Oasis for design consult:

http://oasisdesign.net/design/consult/specialties.htm#gs

- Advanced Treatment: <u>http://www.orenco.com</u>
- Edible landscaping: <u>http://www.oasisdesign.net/landscaping/</u><u>fruittrees.htm</u>. *Plant list*.
- Rainwater harvesting: <u>http://harvestingrainwater.com</u>. *Good for flushing salts from soil*.
- Arizona Greywater Harvesting tax credit: <u>http://www.azdor.gov</u>. Click on "credit pre-certification" on the left hand side of the home page, then on "gray water conservation tax credit." There is general information and applications for corporations and for individuals.
- Oasis biocompatible laundry and dishwashing detergent: <u>http://www.bio-pac.com/biopac/oasis.htm</u>
- Source for three way valves and flow splitters: For flow splitters with ready-made inspection ports see <u>http://oa-sisdesign.net/catalog</u>.