

## Ecological systems design

*“Optimizing components in isolation tends to pessimize the whole system.”*

—Paul Hawken, Amory & L. Hunter Lovins

We’re a nation of specialists, but to be optimal, a water system must follow principles of ecological design, starting at the widest, global view of the context, with explicit clarity on goals, then zooming gradually into the details, always keeping one eye on the big picture to see if a detail has shifted things elsewhere.

See “Principles of Ecological Design”

<http://oasisdesign.net/design/principles.htm>

## 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) *Work on improving several problems with one design; include comprehensive as well as specialist perspectives*

Much bigger improvement from improving *connections between systems* than from improving systems

### 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  
Efficient fixtures, eg., Wood burning bathtub, Eco luxury bathing chamber

### 7) *Add used water and nutrients back into the water cycle at large 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

## Water supply

The most ecological water supply relies:

- Primarily on rainwater
- Secondarily on reused water
- Lastly on surface or groundwater

<http://oasisdesign.net/water/storage>

## Water reuse systems

### Six factors for good natural purification of water or wastewater

Observing engineered water systems, and wild water systems, I figure we’re best off doing it as much like nature as possible. Here are some principles to guide ecological water system design:

#### 1) *Plenty of contact time*

The longer the water is in contact with bacteria and plant roots, the better. To increase contact time, reduce the flow rate and or increase area.

#### 2) *Plenty of micro surface*

The more micro surface with beneficial bacteria growing on it, and the more plant roots, the better.  
Loamy soil has thousands of times more surface area than gravel.

#### 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 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 the 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*

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, 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 addition 10°C you get twice the treatment.

## Greywater systems design and construction

Greywater information central:

<http://oasisdesign.net/greywater>

Common errors and preferred practices:

<http://oasisdesign.net/greywater/misinfo>

Books on Greywater

<http://oasisdesign.net/greywater/createanoasis>

<http://oasisdesign.net/greywater/brancheddrain>

<http://oasisdesign.net/greywater/buildersguide>

Greywater system site assessment form:

<http://oasisdesign.net/downloads/GWsiteAssessment-Form.pdf>

## Rainwater harvesting

<http://www.oasisdesign.net/water/rainharvesting>



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