

Wastewater Treatment:

A Case Study of Three Potential Solution To Wastewater Management For A Cohousing Project In Bend, Oregon.

Facts and Definitions:

Black Water - Non-reusable water that comes sources like the toilet, kitchen sink, garbage disposal, and dishwasher.

Blue (Fresh) Water - Clean, drinkable water.

Grey Water (aka Sullage) - Somewhat reusable water from sources like the bath shower, washing machine, etc.

- Grey water is suitable for reuse as subterranean irrigation for non-edible landscape plants, and in some cases, as toilet water.
- About 60 to 65% of all interior water use in households can be reused as grey water.
- Unfiltered grey water cannot be stored before use. It must be processed immediately or moved constantly.



Heifer International Headquarters

Little Rock, Arkansas

94,000 sq. feet

An AIA Top Ten Green Project

Heifer International: The organization provides sustainable solutions to hunger by providing families with the means to begin to produce their own food with help of the donated animal.

Design Process

Existing Site Conditions:

The project sits on a former railroad switching yard. Originally, 60% of the 22-acre site was paved. The site is now a thriving ecosystem. Ducks and other wildlife appeared in the wetland within months of the project's completion.

Primary Goals:

The design team's fundamental goal was to create integrated building systems that would maximize both energy savings and educational potential. Exposing the systems offered an excellent educational opportunity to the users of the building.

Restoring the existing wetlands on the site and integrating them into the buildings energy saving systems was fundamental.

Result:

The building's arced shape, wrapped on three sides by the constructed wetland, shields the main pedestrian commons from the cars. The building rests lightly on the wetlands.



Water Conservation Strategies

Collection:

Stormwater is filtered by indigenous plants in bioswales that feed a constructed wetland before being reused for irrigation.

Brick preexisting on the site and new gravel paving systems cover 51% of the parking area and provides a porous parking surface for stormwater to drain to the bioswales.

A 30,000 ft² inverted roof directs rainwater to a five-story, 42,000-gallon water tower wrapped with a glass-enclosed fire stair.

Graywater collected from sinks and drinking fountains, condensation from outside air units, and rainwater from the water tower are reused in the toilets and cooling tower.



Reducing Usage:

Waterless urinals, and low-flow toilets and lavatories minimize potable water use.

The 97,000-square-foot building is as eco-friendly as claimed: Its water bill is \$150 a month.



Applications to Co-Housing

Rainwater Collection:

The rainwater collection achieved in the Heifer International Headquarters was achieved through the use of an inverted roof design and simple ducts and pipes to collect all the rain water falling on the roof surface and funnel it to the large water tower. These same basic principles can be applied to any number of buildings including co-housing projects. When designing the building, giving consideration to roof design and the placement of other rainwater collection systems can help to integrate these features into the overall project.

Close to Home:

The collection system on the Heifer International Building can be adopted to a smaller scale. With the first permitted rainwater harvesting system in 1996, Portland, Oregon residents have been using these collection systems on their own private homes for a decade. Portland Online estimates that a home with a 500 sq. ft. roof could collect nearly 4,000 gallons of rainwater during Bend's annual rainfall of 13 inches. These rainwater collection systems can work for almost any project and a sustainable source of irrigation water would be a necessity for a community in the high desert with the goal of sustainability.

Effects on Community:

In a high desert environment like Bend, a rainwater collection system would be beneficial to a community that wishes to grow and irrigate their own food. The initial high cost of the collection system could be divided between the community and the shared responsibilities of maintaining the system and using the collected water, would give the members of the community a closer connection to the water saving systems and the importance and impact these systems have on the larger site, and environment.



Applications to Co-Housing

Stormwater Management:

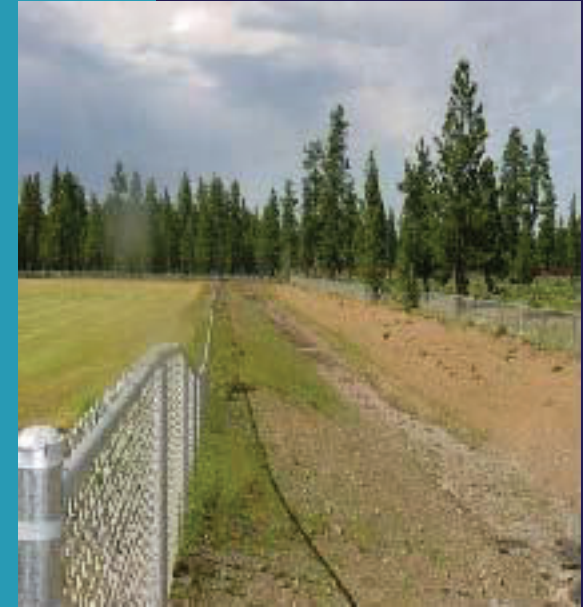
The moat-like bioswales surrounding the Heifer International Headquarters served their purpose of collecting stormwater and sending it through filtration systems, while adding to the aesthetic value of the overall project. The bioswale systems and the plant material that filters out the pollutants before returning the water to the environment, are both ideas that could be applied to a co-housing community to actively reducing run off water and removing pollutants from the environment.

Close to Home:

The High School in Sisters, Oregon is a state of the art sustainable school building that, although it does not meet LEED certification, applies many of the same principles for a green building. The school grounds include a bioswale feature where rain run-off from the parking lots, building, and athletic fields gathers and is filtered by plant material before it is absorbed by the ground. In a high desert climate, stormwater can be managed with the same techniques as a wetland site.

Effects on Community:

On the Heifer International site, the bioswales were integrated into the composition of the building and the existing wetlands on the site to not only provide sustainable solutions, but add to the architecture and the site as a whole. In a co-housing community, integrating these features into the architecture of the site can provide people with opportunities to become more actively involved in environment friendly solutions, while adding to the daily life through the use of indigenous plantings and water features.



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Milagro Cohousing Community

- Located near Tucson, Arizona.
- Started in 1994 by 4 couples sharing a common ecological and community vision
- Completed and Occupied in 2003.
- 43 acre site with 75% preserved as unoccupied open space.
- Consists of 28 clustered family homes.
- Pedestrian core with external parking.
- Uses a constructed wetlands wastewater treatment system.



More About Milagro



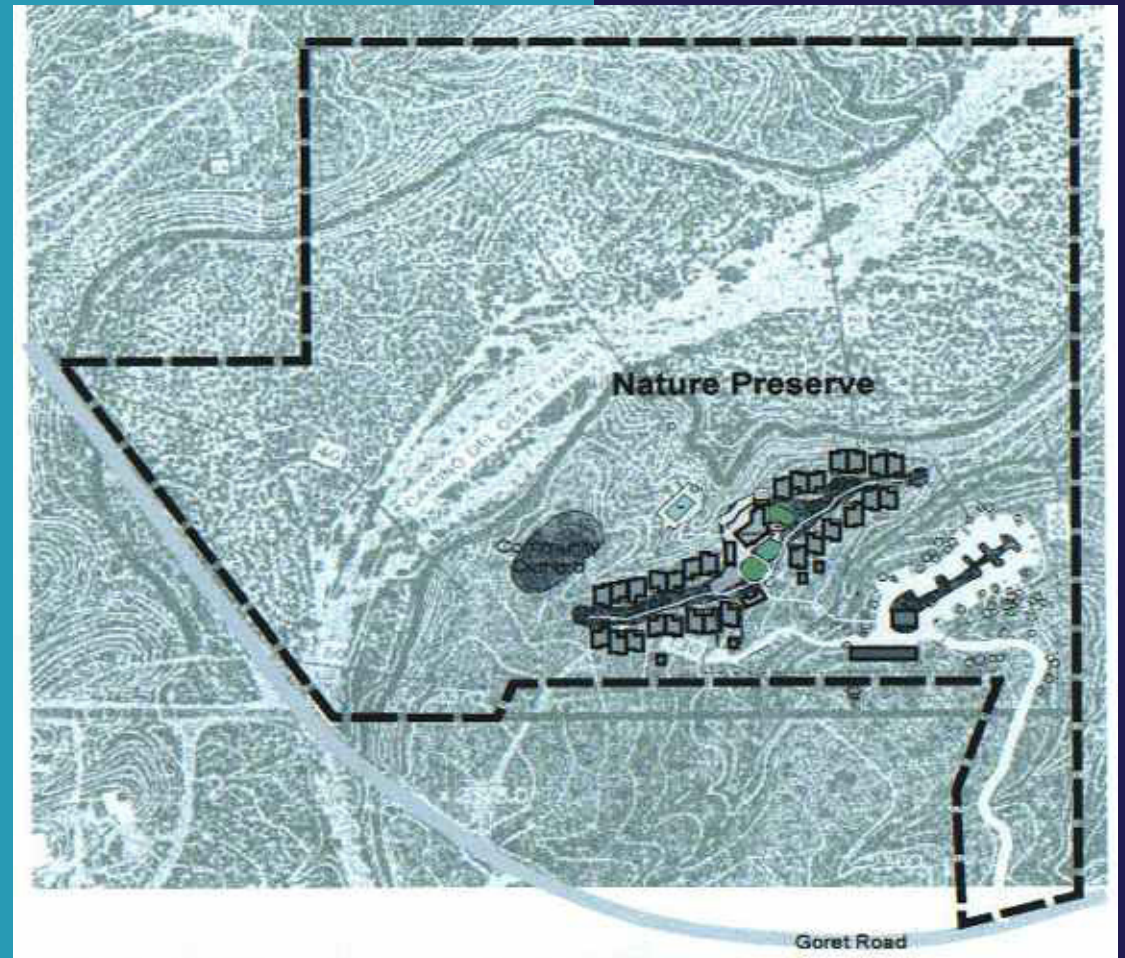
Cisterns and Swales



Arid Climate

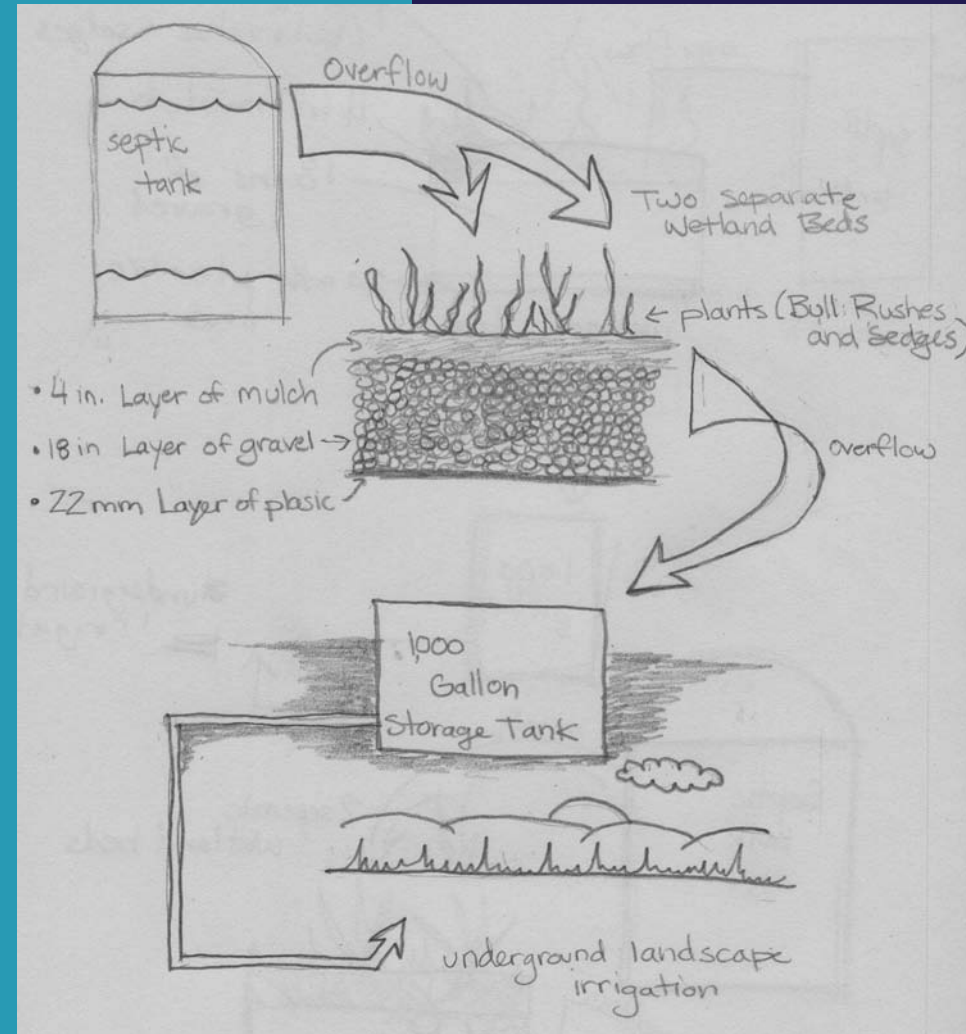
Land Preserved

Joined Housing



Constructed Wetlands

- Wastewater is sent directly to a septic tank, which settles out the solid matter. Overflow from the tank is sent to the constructed wetlands.
- The constructed Wetlands consists of a 22mm layer of plastic that stops the water from directly entering the landscape. On this is placed an 18 inch layer of gravel. Next is a 4 inch layer of mulch made up mostly of wood chips but also contains the remains of any dead plant material found on site. Native shrubs are then planted in this bed and act as a filtration system.
- The overflow from the Wetlands area is transferred to a 1,000 gallon storage tank located at the center of the community, and is then used for underground irrigation of the landscape.
- Their system is sized for 7,000 gallons a day, which they only do not meet in the scorching summer months. At these times, one of the wetland beds is shut down.
- No foul odors are present in this system, and the wetlands area can be placed at a distance from the community if fears of such odors are prevalent.
- This system has all the positive attributes of a septic system with the added advantage of reclaiming water for landscape irrigation purposes.

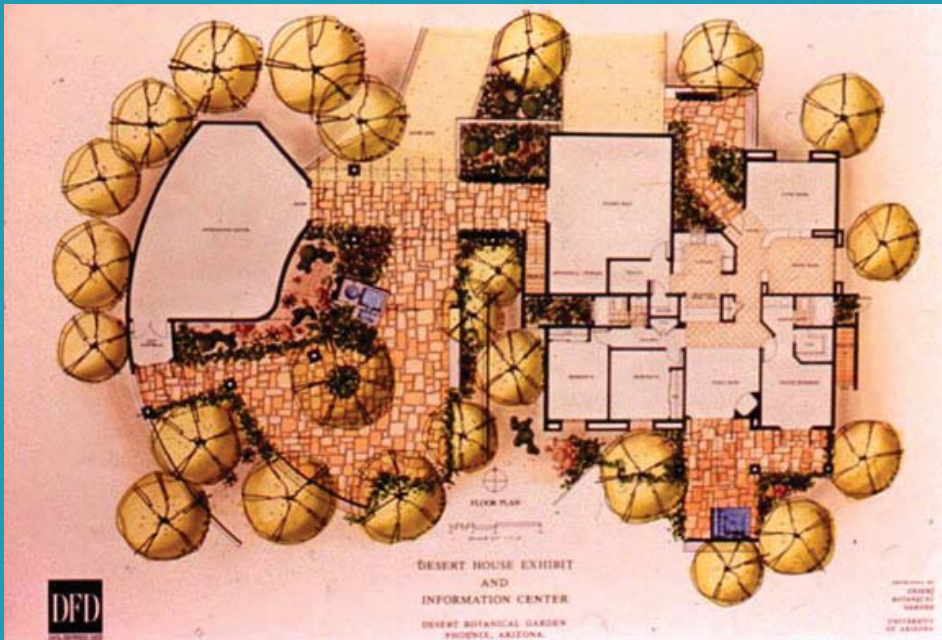


Applicability to Bend

- The annual precipitation of Bend is 11.63 inches of rain per year, while Tucson's is 11.42, meaning that the landscape will be about equally as dry.
- The temperature ranges for Tucson and Bend are similar in the winter timeframe, but Bend has milder summers. This means that there would be less water evaporation in the summer, and thus the constructed wetland system would be more successful in the Bend area.
- While 7,000 gallons a day may be excessive for our site, the size of the constructed wetland can be adjusted to fit our requirements.
 - Milagro assumed an average of 250 gallons a day per household.
 - The suggested sizing of the wetland is .5 - 1 square foot of wetland per gallon (i.e. Milagro should have 3500 to 7000 square feet of wetland).
- Constructed wetlands are generally priced at \$300 - \$15000



Casa Del Agua and Desert House



Casa Del Agua is located in Tucson, AZ and was the pre-cursor to Desert House in Phoenix, AZ.

Both of these projects are University of Arizona college of Agriculture and Life Sciences.

Casa Del Agua is a residential experiment to see how much water is consumed in a residence and how that can be reduced by retro fitting fixtures and creating rain water systems and using greywater.

Constructed in the Desert Botanical Garden in Phoenix, Desert House is a water- and energy-efficient house that a family is currently living in.

Casa Del Agua and Desert House

Water Systems:



The “hanging garden” at Casa del Agua: lettuce growing out of PVC pipes.



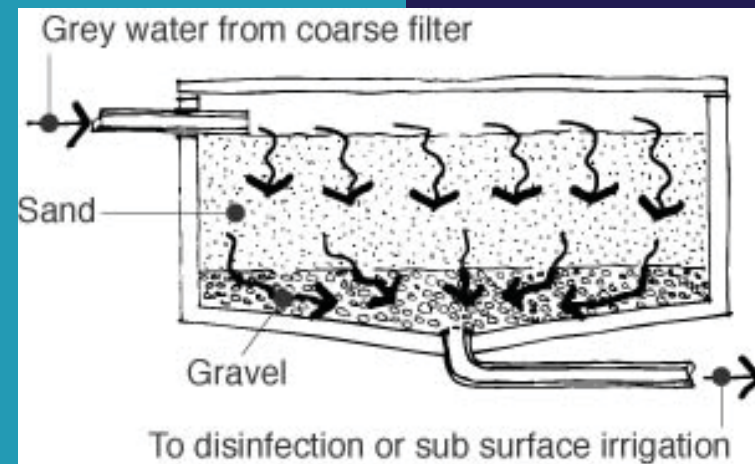
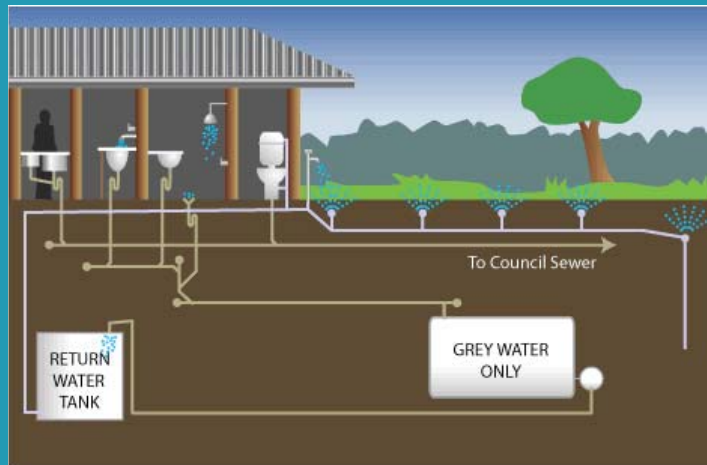
The landscaped area above the underground rainwater tanks at Casa del Agua.

- drains water from greywater systems into 55 gallon tanks
- 31% of Casa Del Agua’s total water budget is recycled graywater
- rain water supplies about 8% of total water needs
- a roof was added over the patio to gain 600 sq.ft of rain water
 - increased by 3,700 gal.
- downspouts are placed every 20ft to minimize overflow and would go into the catchment more effectively

Casa Del Agua and Desert House

Coho implementation:

- the lettuce catchments can be made for a variety of vegetables
- angling of roofs on any building with a direct link to a catchment
- underground storage for water
- using rainwater as it falls and catching for future use



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WASTE WATER MANAGEMENT

- >COMMERCIAL WATER MANAGEMENT STRATEGIES AND HOW THEY CAN BE APPLIED ON A SCHOOL AND RESIDENTIAL SCALE
- >PRACTICALITY OF WETLANDS IN BEND
- >IMPLEMENTING GREYWATER AND RAINWATER STORAGE INTO THE LANDSCAPE



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