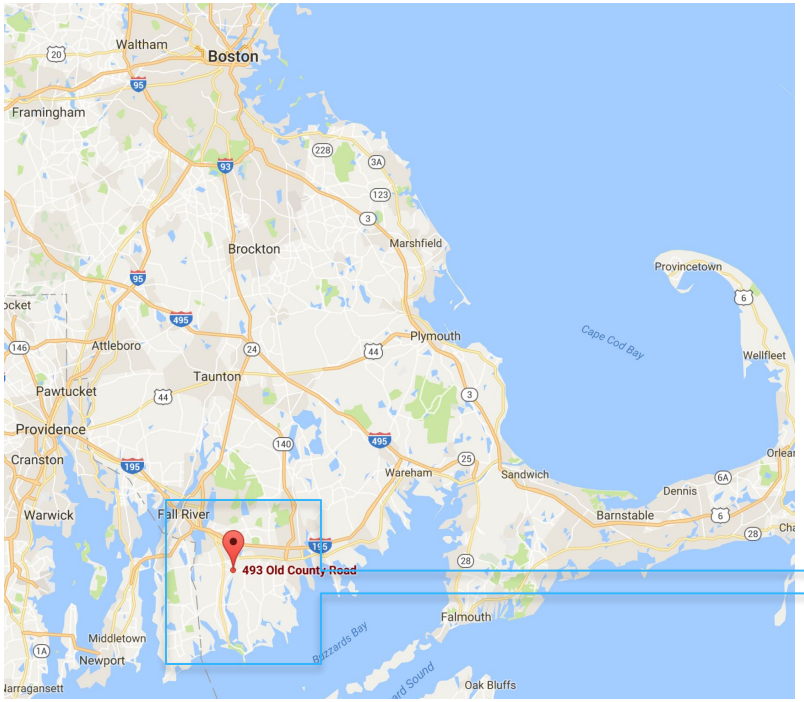
Greywater Green Wall

For Westport River Watershed Alliance (WRWA)
New Headquarters Building

Concerns for Westport River Watershed Alliance Location

* Aquifer protection zone.
* Flood plain zone.
* Well remediation is required (DEP).



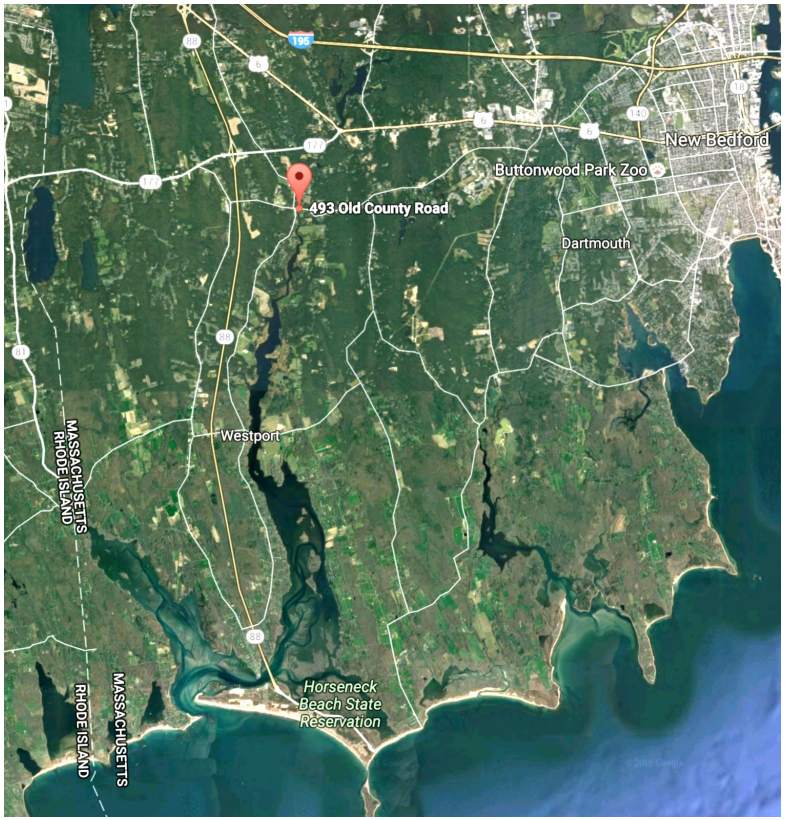


Image source: Google map

Concerns for Westport River Watershed Alliance Building

* Well remediation is required (DEP).
* Avoid use of septic system.
* Green wall to treat greywater.

* The rehabilitation of an old building once used as blacksmith shop and automotive garage.

Battle continues over WRWA plans for Head of Westport building

▲ HIDE CAPTION

An open house visitor walks past the lift on the first floor in August that speaks of the building's past as an auto repair shop. - Herald News file photo | Jack Foley

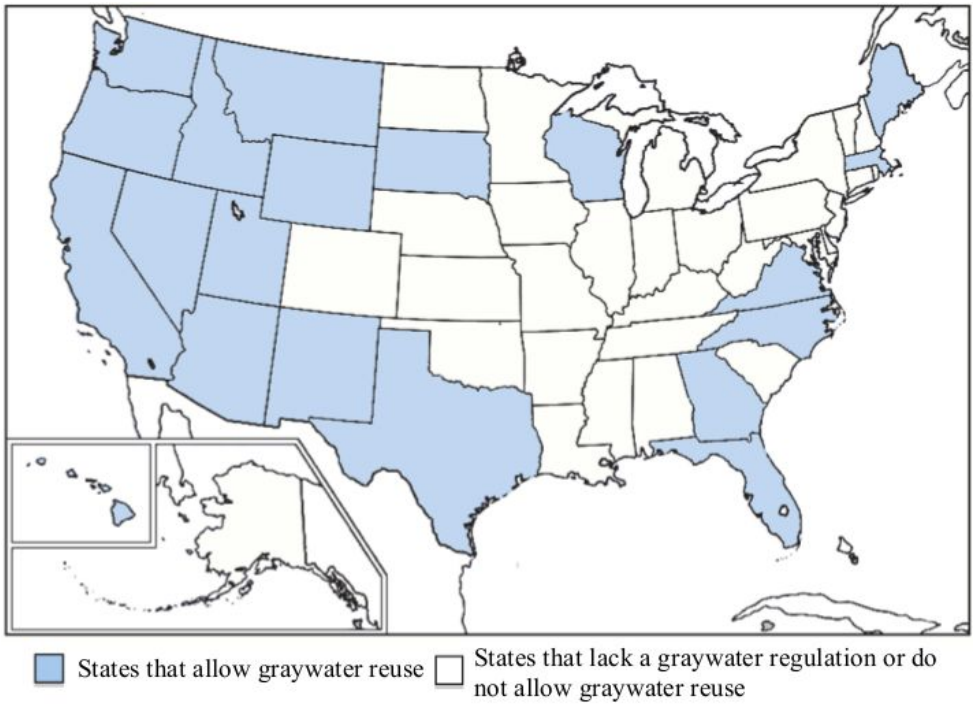
Image source: Google map / www.wickedlocal.com/

Goals for Greywater Green Wall

* Purify greywater.
* Educational tool.
* Aesthetic improvement.
* Indoor and outdoor irrigation.
* Urine flushing.

Image source: photos.prnewswire.com

Regulations for Reuse Greywater



* The Massachusetts Plumbing Code requires **a special State-issued permit** for gray water systems.
* All permits are issued by the **Board of State Examiners of Plumbers and Gasfitters**
* The Massachusetts **DEP regulates gray water systems** under state regulations 314 CMR 20.00.
* Regulatory Provisions: Composting Toilets and Greywater Systems.

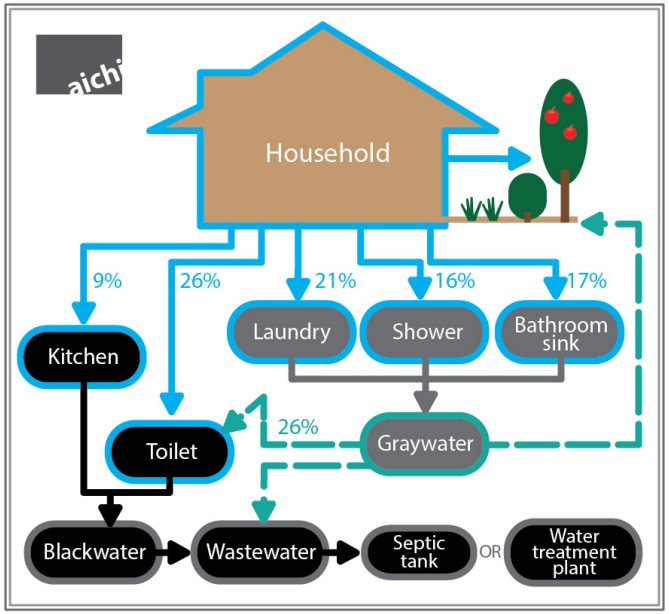
Image source: Treatment, Public Health, and Regulatory Issues Associated with GW Reuse By Sybil Sharvelle

Source: http://challengeforsustainability.org/

Considerations When Reusing Greywater

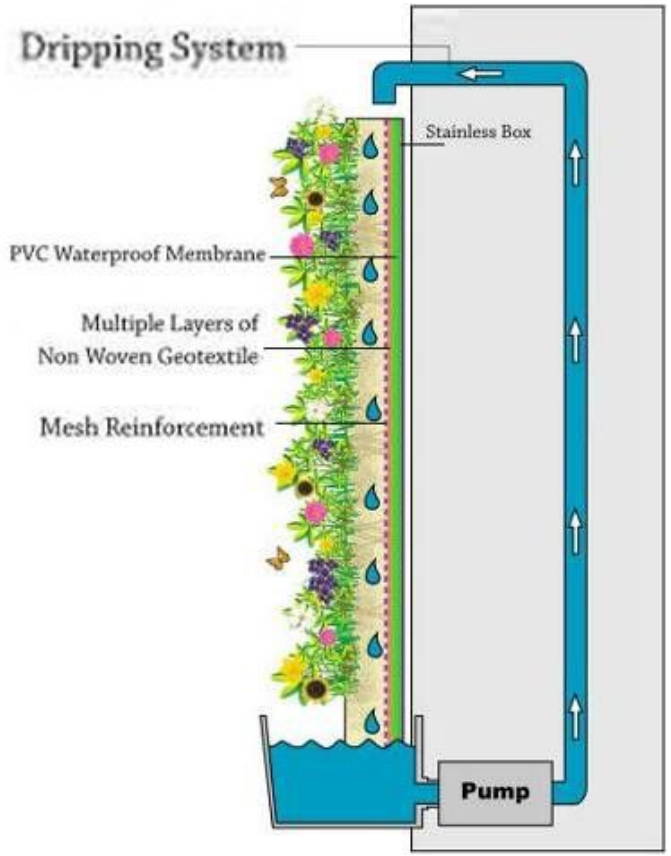
What is **Greywater**?
Untreated wastewater that has not been contacted by any human waste or infectious material.

* Minimize human contact with greywater.
* Avoid cross connection to the potable water supply.
* Stored greywater must be treated and disinfected.
* Must be irrigated by subsurface systems, never sprayed.
* Avoid irrigating edible fruit and vegetable that consumed portions of the plant that are contacted with greywater.



Source: Greywater Reuse in Sewered Single Domestic Premises - April 2000

Greywater Green Wall
Design Concepts



* Traditional Green Wall
* Greywater System
* Earthship Biotecture
* Hydroponic Growing
* Vertical Constructed Wetland
* Natural Filtration Methods

  Biosand Filter

Image source: Google

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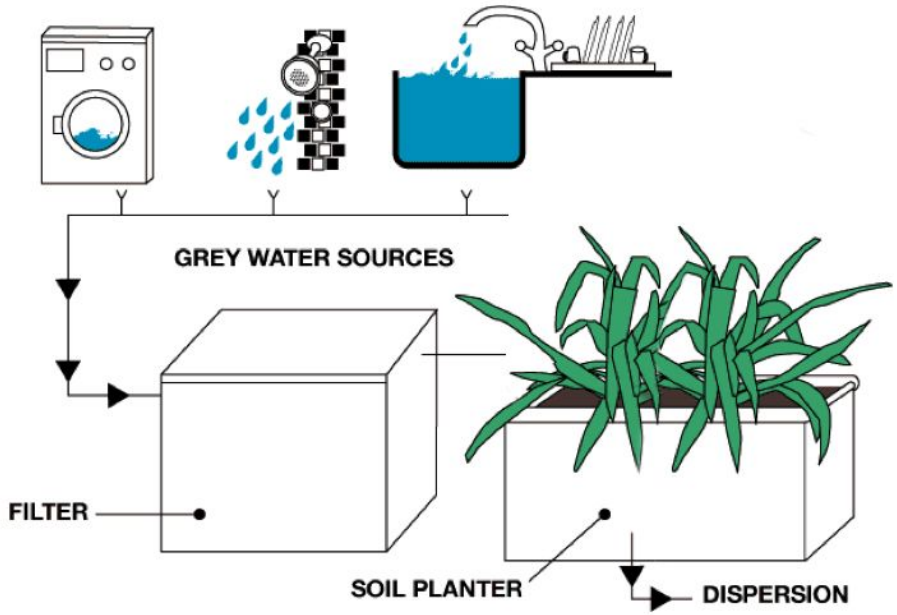

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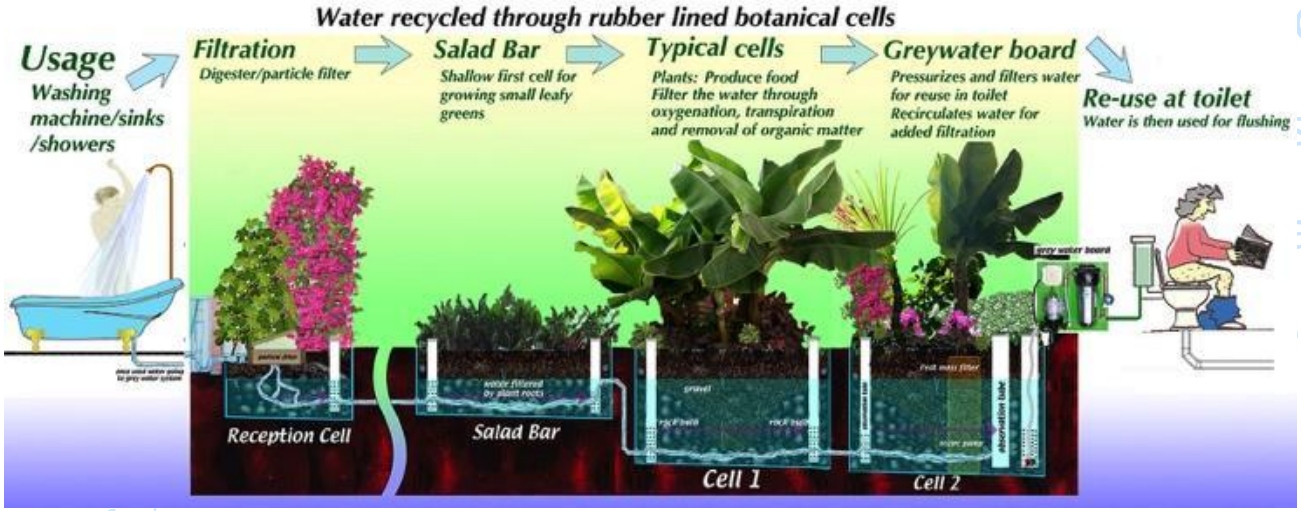

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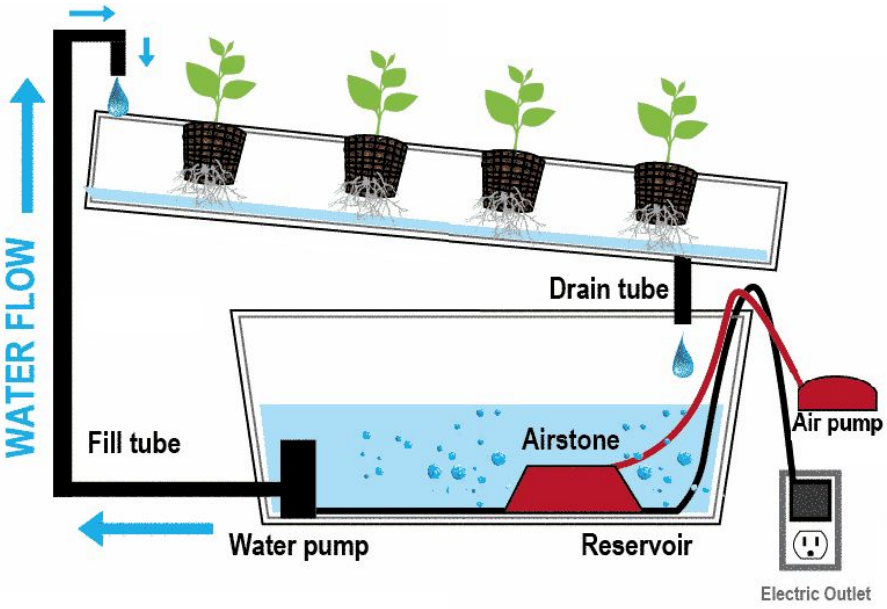

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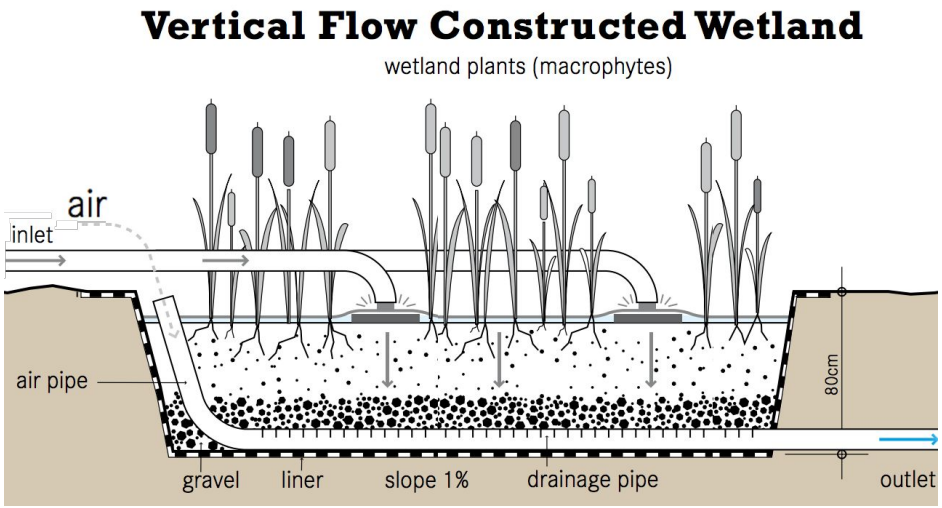

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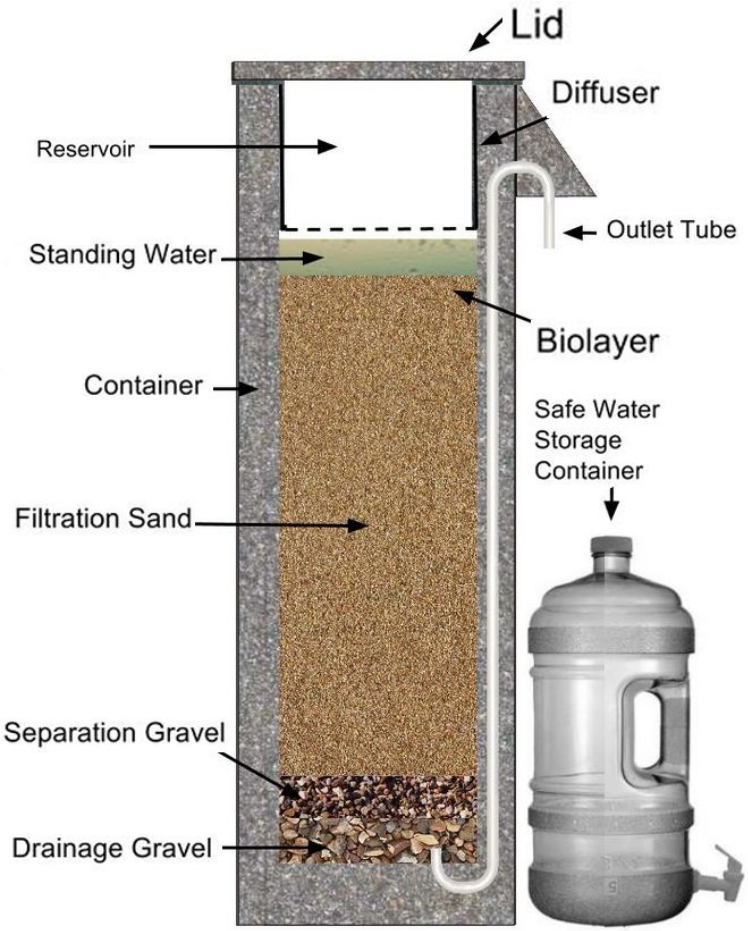

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Greywater Green Wall Technologies

	Structure Vertical /Horizontal	Plumbing Character	Growing Mediums	Nutrient Source	Indoor Capable	Characters Incompatible for Greywater Green Wall
Traditional Green Wall	Vertical	Vertical	Soil	Soil	Indoor	Limited Water Detention Time
Greywater System	Vertical	Gravity	Soil	Greywater	No	Outdoor and Growing Mediums
Earthship Biotecture	Horizontal	Circulation Methods	Soil	Greywater	Indoor	Horizontal Structure
Hydroponic Growing	Horizontal	Water Pump	Non Soil	Fertilizers	Indoor	Use Potable Water and Fertilizers
Vertical Constructed Wetland	Vertical	Anaerobic	Soil	Greywater	No	Outdoor and Growing Mediums
Biosand Filter	Vertical	Gravity	N/A	Remove Pathogens	Indoor	N/A

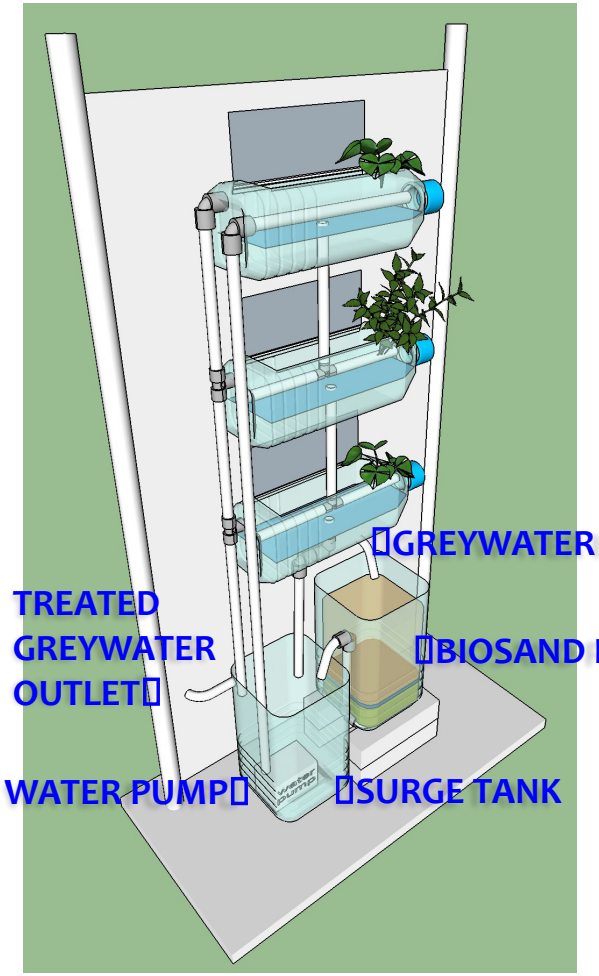
Greywater Green Wall Growing Mediums

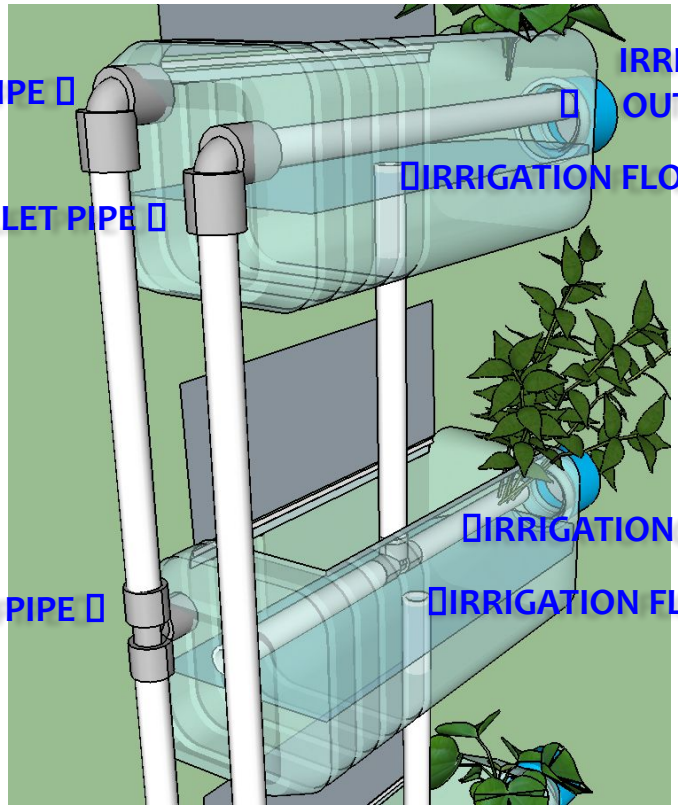
The best growing mediums for the Greywater Green Wall should be

- Light weight
- Low Water Holding Capacity (WHC)
- High Air Filled Porosity (AFP)
- High Cation Exchange Capacity (CEC)

Growing Medium	Source	Weight/movement	Nutrient	WHC (need L) Water Holding Capacity	AFP (need H) Air Filled Porosity	CEC (want H=composed) Cation Exchange Capacity	PH	Reusable	Notes
Coco Fiber (Coir/ Coco Pest)	Shredded coconut husk inner	Light/Float	Potassium. Draws down calcium	Very High (80%)	Medium (15%)	Medium	5.5 - 7.0	Yes	Naturally contains the beneficial fungus Trichoderma. Holds nutrients for a long time.
Coco Chips (Croutons)	Coconut husk cube-shaped	Light/Float	Potassium. Draws down calcium	Very low	High	Medium	6.0	Yes	Naturally contains the beneficial fungus Trichoderma. Needs frequent irrigation.
Perlite	Superheated volcanic siliceous rock	Light/Float	None buffering	Medium (30%)	High-medium (40%)	Low	Neutral	Yes	Don't hold nutrient.
Vermiculite	Heated natural mica mineral	Light	High buffering	High	Medium - Low	Medium - High	6.0 - 8.9	Yes	Easily over-watered.
Diatomaceous Earth	Fossilized remains of diatoms	Heavy weight/none	Silica. Sterile	Medium - Low	High	Medium	Neutral	Yes	Resistance and killer to soil pests/diseases.
Rockwool	Heated basalt rock	Light/Float	Sterile	High (85%)	Medium (10%)	Low	8.0	Yes	Reusable for 1-2 crops. Skin irritant before soaking
Expanded Clay (Hydroton/Clay Pebbles/Clay Balls)	Heat-expanded round-shaped clay pebbles	Light/Sink (soaked for hours) Roll	None	Low (10%)	High (45%)	Low	Neutral	Yes	Difficult to over water. Surface nutrient precipitation.
Growstones	Porous rocks made from recycle glass	Light/Sink	None	Medium – Low (30%)	High (50%)	Low	Neutral	Yes	Needs frequent irrigation. Wicking water faster than clay. Capillary up to 6".
Peat	Form in wetlands areas	Light/float	Well buffering	Medium – High (45%)	Medium (25%)	Medium - High	3.4 - 4.8	Yes	No rewet well if dry out. Limited natural rescores.
Sand (Coarse)	Earth	Heavy/Sink	None buffering	Medium	Low (7%)	Low	Neutral	Yes	Wash-off easily.
(Redwood) Sawdust	Varies	Light/Sink	Varies	Medium	High-medium	Medium	3.8 - 4.5	No	Needs frequent irrigation. Might cause N draft, depends on the tree types.
Gravel	Earth	Heavy/Sink	None	Low	High-medium	Low	Neutral	Yes	May contain soluble minerals.
(Parboiled) Rice Hulls	Varies	Light/Sink	Low	Medium – Low (15%)	High-medium (75%)	N/A	5.7 - 6.5	No	Decompose & salt build up after 1-2 crops.
(Redwood) Bark	Varies	Light/Float	Draws down N	Medium	Medium - Low	Low	3.2 - 3.8	Yes	Might cause N draft, depends on the tree types.
Composted bark	Varies	Light/Float	Varies (salt?) EC & phosphate	Medium - High	Medium (22%)	Medium	Neutral	Yes	Composting reduced N and removed pathogens.
Zeolite (Granular/powder)	Metamorphism of volcanic rocks	Light/Fine mix	Potassium. High N buffering	High 55% of its own weight	Medium	High	8.5	N/A	Improves uptake of N. Use in quantities < 10% v/v. AKA expanded potassium-calcium clinoptilolite.

Greywater Green Wall Model





Greywater Green Wall Model

The Cost for Westport River Watershed Alliance Greywater Green Wall

WRWA new office will produced **75 to 90 gallons of greywater** per week.

240 plants on the green wall will consume 13 to 15 gallons per week.

Leaving **62 to 75 gallons for outdoor irrigation and urine flushing**.

Green wall structure $19440

($180/sqft for 108 sqft, includes planting and first year maintenance)

Greywater system $2500-$4500

(excluding design fee and permit)

Maintenance $1200/year

Total for the first ten years $34740 = **$3474/year**

Image source: Google

Co-benefits for Westport River Watershed Alliance

Beside the goals for Greywater Green Wall

- Purify greywater.
- Urine flushing.
- Educational.
- Aesthetic improvement.
- Indoor and outdoor irrigation.

* Improved indoor air quality.
* Reduced background noise.
* Earn LEED credits.

Image source: Google

Greywater Green Wall for Westport River Watershed Alliance