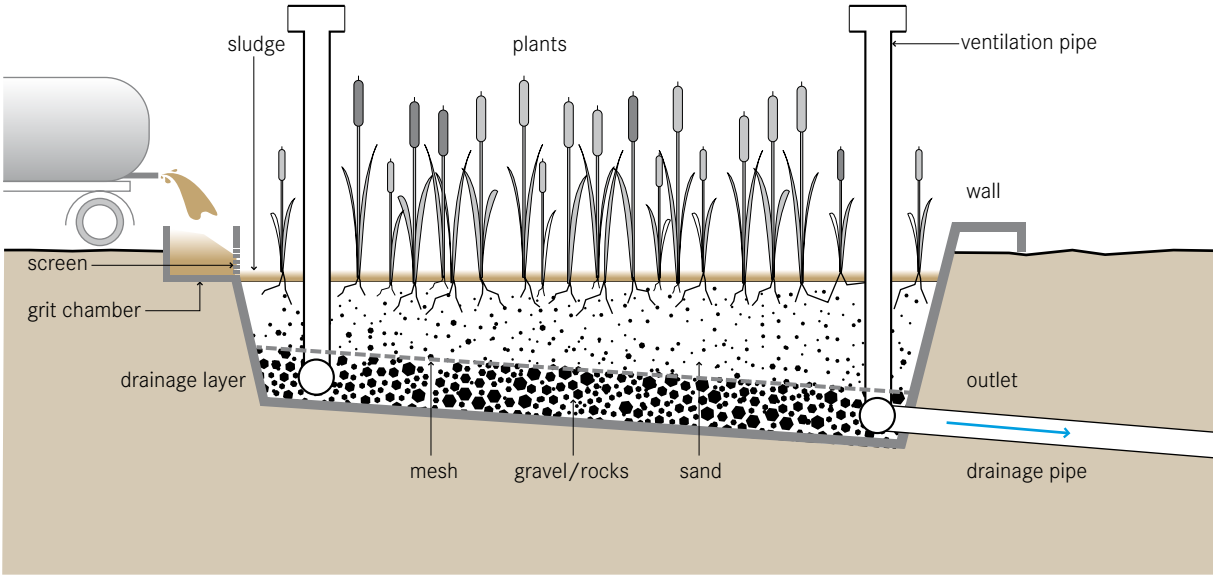
T.15 Planted Drying Beds

Applicable to: **Systems 1, 6-9**

Application Level:	**Management Level:**	**Inputs:** Sludge
Household	Household	
Neighbourhood	Shared	**Outputs:** Sludge, Effluent, Biomass
City	Public	



A planted drying bed is similar to an Unplanted Drying Bed (T.14), but has the added benefit of transpiration and enhanced sludge treatment due to the plants. The key improvement of the planted bed over the unplanted bed is that the filters do not need to be desludged after each feeding/drying cycle. Fresh sludge can be directly applied onto the previous layer; the plants and their root systems maintain the porosity of the filter.

This technology has the benefit of dewatering and stabilizing the sludge. Also, the roots of the plants create pathways through the thickening sludge that allow water to easily escape.

The appearance of the bed is similar to a Vertical Flow Constructed Wetland (T.9). The beds are filled with sand and gravel to support the vegetation. Instead of effluent, sludge is applied to the surface and the filtrate flows down through the subsurface where it is collected in drains.

Design Considerations Ventilation pipes connected to the drainage system contribute to aerobic conditions in the filter. A general design for layering the bed is: (1) 250 mm of coarse gravel (grain diameter of 20 mm); (2) 250 mm of fine gravel (grain diameter of 5 mm); and (3) 100 to 150 mm of sand. Free space (1 m) should be left above the top of the sand layer to account for about 3 to 5 years of accumulation.

Reeds (*Phragmites* sp.), cattails (*Typha* sp.) antelope grass (*Echinochloa* sp.) and papyrus (*Cyperus papyrus*) are suitable plants, depending on the climate. Local, non-invasive species can be used if they grow in humid environments, are resistant to salty water and readily reproduce after cutting.

Sludge should be applied in layers between 75 to 100 mm thick and reapplied every 3 to 7 days, depending on the sludge characteristics, the environment and operating constraints. Sludge application rates of 100 to 250 kg/m^2/year have been reported in warm tropical climates. In colder climates, such as northern Europe, rates up to 80 kg/m^2/year are typical. Two or more parallel beds can be alternately used to allow for sufficient degradation and pathogen reduction of the top layer of sludge before it is removed.

The leachate that is collected in the drainage pipes must be treated properly, depending on where it is discharged.

Appropriateness This technology is effective at decreasing the sludge volume (down to 50%) through decomposition and drying, which is especially important when the sludge needs to be transported elsewhere for end-use or disposal.
Because of their area requirements, planted drying beds are most appropriate for small to medium communities with populations up to 100,000 people, but they can also be used in bigger cities. If designed to service urban areas, planted drying beds should be at the border of the community, but within economic reach for motorized emptying operators.

Health Aspects/Acceptance Because of the pleasing aesthetics, there should be few problems with acceptance, especially if located sufficiently away from dense housing. Undisturbed plantations can attract wildlife, including poisonous snakes.
Faecal sludge is hazardous and anyone working with it should wear protective clothing, boots and gloves. The degree of pathogen reduction in the sludge will vary with the climate. Depending on the desired end-use, further storage and drying might be required.

Operation & Maintenance Trained staff for operation and maintenance is required to ensure proper functioning. The drains must be maintained and the effluent properly collected and disposed of. The plants should have grown sufficiently before applying the sludge. The acclimation phase is crucial and requires much care. The plants should be periodically thinned and/or harvested. After 3 to 5 years the sludge can be removed.

Pros & Cons

+ Can handle high loading
+ Better sludge treatment than in Unplanted Drying Beds
+ Can be built and repaired with locally available materials
+ Relatively low capital costs; low operating costs
+ Fruit or forage growing in the beds can generate income
+ No electrical energy required
- Requires a large land area
- Odours and flies may be noticeable
- Long storage times
- Labour intensive removal
- Requires expert design and construction
- Leachate requires further treatment

References & Further Reading

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_ Tchobanoglous, G., Burton, F. L. and Stensel, H. D. (2004). Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy, 4th Ed. (Internat. Ed.). McGraw-Hill, New York, US. p. 1578.