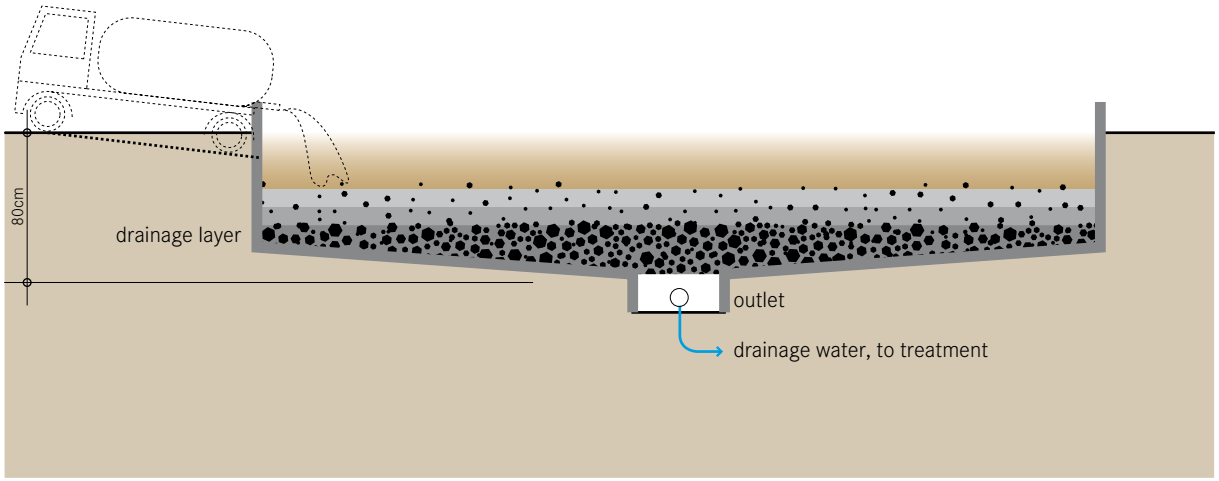
T.14 Unplanted Drying Beds

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

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



An unplanted drying bed is a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation. Approximately 50% to 80% of the sludge volume drains off as liquid or evaporates. The sludge, however, is not effectively stabilized or sanitized.

The bottom of the drying bed is lined with perforated pipes to drain the leachate away that percolates through the bed. On top of the pipes are layers of gravel and sand that support the sludge and allow the liquid to infiltrate and collect in the pipe. It should not be applied in layers that are too thick (maximum 20 cm), or the sludge will not dry effectively. The final moisture content after 10 to 15 days of drying should be approximately 60%. When the sludge is dried, it must be separated from the sand layer and transported for further treatment, end-use or final disposal. The leachate that is collected in the drainage pipes must also be treated properly, depending on where it is discharged.

Design Considerations The drainage pipes are covered by 3-5 graded layers of gravel and sand. The bottom layer should be coarse gravel and the top fine sand (0.1 to 0.5 mm effective grain size). The top sand layer should be 250 to 300 mm thick because some sand will be lost each time the sludge is removed.
To improve drying and percolation, sludge application can alternate between two or more beds. The inlet should be equipped with a splash plate to prevent erosion of the sand layer and to allow for even distribution of the sludge.
Designing unplanted drying beds has to consider future maintenance because ensuring access to people and trucks for pumping in the sludge and removing the dried sludge is essential.
If installed in wet climates, the facility should be covered by a roof and special caution should be given to prevent the inflow of surface runoff.

Appropriateness Sludge drying is an effective way to decrease the volume of sludge, which is especially important when it has to be transported elsewhere for further treatment, end-use or disposal. The technology is not effective at stabilizing the organic fraction or decreasing the pathogenic content. Further storage or treatment (e.g., Co-Composting, T.16) of the dried sludge might be required.

Unplanted drying beds are appropriate for small to medium communities with populations up to 100,000 people, but larger ones also exist for huge urban agglomerations. They are best suited for rural and peri-urban areas where there is inexpensive, available space situated far from homes and businesses. If designed to service urban areas, unplanted drying beds should be at the border of the community, but within economic reach for Motorized Emptying operators.
This is a low-cost option that can be installed in most hot and temperate climates. Excessive rain may prevent the sludge from properly drying.

Health Aspects/Acceptance Both the incoming and dried sludge are pathogenic; therefore, workers should be equipped with proper protection (boots, gloves, and clothing). The dried sludge and effluent are not sanitized and may require further treatment or storage, depending on the desired end-use.
The drying bed may cause a nuisance for nearby residents due to bad odours and the presence of flies. Thus, it should be located sufficiently away from residential areas.

Operation & Maintenance Trained staff for operation and maintenance is required to ensure proper functioning.
Dried sludge can be removed after 10 to 15 days, but this depends on the climate conditions. Because some sand is lost with every removal of sludge, the top layer must be replaced when it gets thin. The discharge area must be kept clean and the effluent drains should be regularly flushed.

Pros & Cons

+ Good dewatering efficiency, especially in dry and hot climates
+ Can be built and repaired with locally available materials
+ Relatively low capital costs; low operating costs
+ Simple operation, only infrequent attention required
+ No electrical energy is required
- Requires a large land area
- Odours and flies are normally noticeable
- Labour intensive removal
- Limited stabilization and pathogen reduction
- Requires expert design and construction
- Leachate requires further treatment

References & Further Reading

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(Comparison to planted drying beds)

_ Montangero, A. and Strauss, M. (2002). *Faecal Sludge Treatment.* Lecture Notes, UNESCO-IHE, Delft, NL.
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_ Strande, L., Ronteltap, M. and Brdjanovic, D. (Eds.) (2014). *Faecal Sludge Management. Systems Approach for Implementation and Operation.* IWA Publishing, London, UK.
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(Detailed book compiling the current state of knowledge on all aspects related to FSM)

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