# Annex 2: Unplanted drying beds

### Design

Unplanted sludge drying beds are shallow filters filled with sand and gravel designed for solid-liquid separation and dewatering of sludge and septage. Depending on climate and faecal sludge characteristics, a variable fraction of approximately 50-80% of the sludge volume drains off as a liquid or is removed through evaporation. Unplanted drying beds are specifically designed for dewatering and limited sludge stabilization and disinfection will occur. [FSM handbook / IWMI / compendium emergencies].

In the context of Kutupalong-Balukhali refugee camp, the drying beds will treat stabilized sludge with a high free water content and are therefore designed based on a high solid loading rate. A drying bed area of 65 m2 will be required to serve a camp population of 10,000 people.

#### Design parameters

Loading rate 4 m3/day assumption: 10,000 people, 0.4 l/person/day

Hydraulic loading rate 30 cm / m2 typical range: 25 – 30 cm/m2 [M&E]

Solid loading rate 150 kg TS / m2 / year typical range: 100 – 200 kg TS/m2/year [FSM]

Drying time 7 days assumption: 1% total solids concentration

Drying area required 91 m2 0.01 m2 / person equivalent

### Construction

Drying beds are typically rectangular shaped excavations, with a sealed bottom and a collection drain. The bed is filled with a gravel bottom layer (0.3 – 0.4m) topped with a sand layer to prevent clogging (0.1- 0.3m). Sand will need to be replaced periodically, as part of the sand is removed with the dried sludge. [OVERVIEW CHAPTER]

The drying beds at the FSM treatment site are dimensioned 5x2 meters, with a depth of 70 centimetres. The beds are filled with 20 centimetres coarse gravel topped with 10 centimetres sand and a permeable sand bag cover to allow for easy removal of the dried sludge and to avoid sand removal during bed emptying. The drying beds are unlined and designed for extended infiltration before groundwater recharge. Locally made polytunnels (bamboo and see through plastic) with an easy put on-off design protect the drying beds from rainfall.

### Operation

Practice in the field has shown that in the summer the sludge layer can be removed after 3 to 5 days. In the rainy season sludge is removable after 9 days. Longer drying time is preferred when possible because it results in drier sludge, less volume and continued pathogen inactivation through UV light and desiccation. Sludge is turned every 2-3 days to ensure a uniform drying process.