International Organization for Migration (IOM)
The UN Migration Agency

Technical Guidelines – WaSH UNIT

Faecal Sludge Segregation in Rohingya Refugee Camps - Cox's Bazar, Bangladesh

July 2018

Key Design Considerations

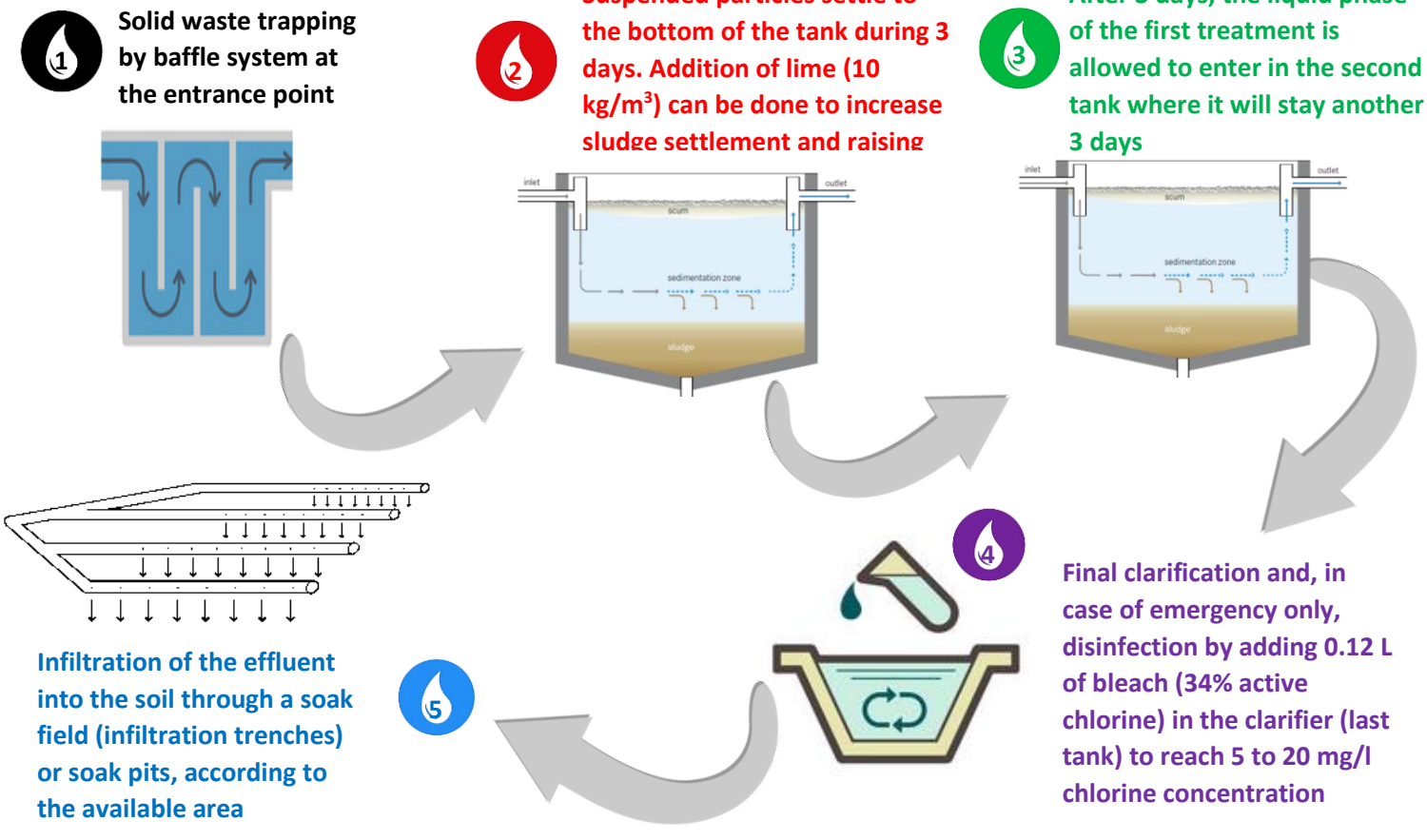
- 8 m^3 of black wastewater can be received once every 3 days by the Sludge Segregation Unit (SSU)
- The treatment capacity allow the daily treatment of 2.7 m^3 of black wastewater which correspond to the sewage production of 1000 people or an estimation of 50 latrines
- The Sludge Segregation Unit requires a concentration in manpower to feed the SSU at once every 3 days but subsequently does not need any more input
- After 3 days, the sewage batch is being moved in the downstream compartment where it will settle 3 more days
- The emptying of compacted sludge in the SSU is done by pumping once every 3 months (on average), considering the production of solid waste in black wastewater is 25 l/person/year [1]

In the first stage of the Rohingya Refugee Emergency in Cox's Bazar, IOM has constructed many latrines to ensure satisfactory sanitation conditions for the Refugees. As latrines were often over used in the emergency phase (average of 50 people per temporary emergency latrine) some Sludge Segregation Units have been subsequently installed to segregate sludge from the black wastewater to enable a satisfactory infiltration of pretreated black wastewater into the soil.

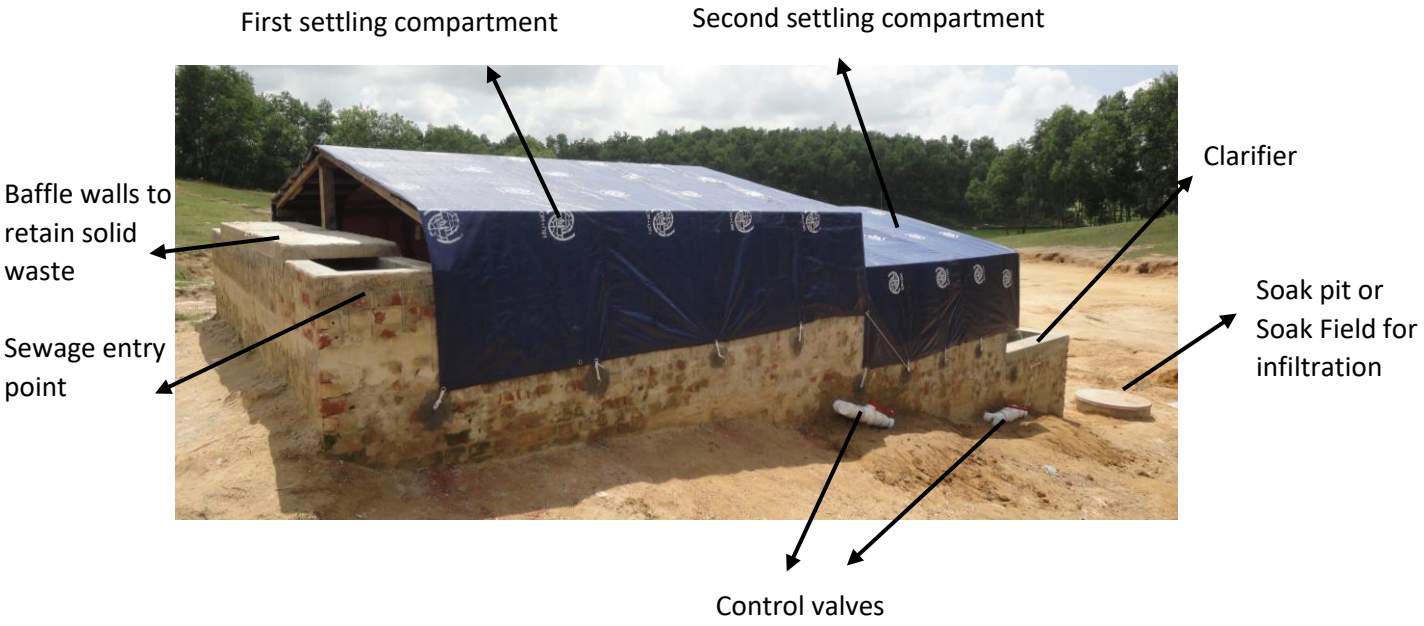
As areas are seriously restricted, IOM WaSH Unit opted for the construction of a compact settler system capable to separated suspended solid from liquid wastewater: the Sludge Segregation Unit. Such a system has been widely used by many WaSH actors and thoroughly described by EAWAG [2].

In case of AWD risk, the effluent is disinfected before being infiltrated in soak pits. Sludge are thickened with addition of lime is the first and second compartment. While dried, they are removed by pumping and disposed of in pits or safely buried after addition of lime (1 kg/100 l).

Flow sheet: Sludge Segregation Unit



Operation and Maintenance Guidelines for the Sludge Segregation Unit



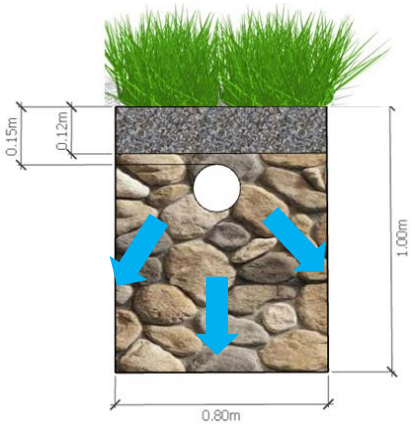
1. Collect sewage from latrines and pour up to 8 m^3 in one day to the SSU entry point
2. Leave the sewage in the 1st chamber to break down and add 88 kg (11.05 g/ litre of sewage to reach a pH of 11) of lime in the first chamber
3. After 3 days, open the outlet valve from the first compartment to drain the processed slurry into the second pond, leaving the settled sludge at the bottom
4. Closely monitor the level of the sludge accumulated at the bottom. Once it reaches the outlet pipe to the next chamber (1/3 of the tank depth which could happen once every 3 months if the facility is running at full capacity: 1000 people), it should be removed by pumping and potentially (in a second phase) manually using shovels and disposed of in pits or safely buried nearby
5. Release the processed slurry from 2st chamber to 3rd chamber after 3 days
6. Leave the pretreated sewage in the 2nd chamber to break down and add lime (quantity to be estimated with a pH probe) to reach a pH of 11
7. Add 0.12 L of bleaching solution (34% active chlorine) during discharge in the last chamber which allows dilution and sufficient mixing of the chlorine
8. Effluent (clarified wastewater) in the 3rd chamber is slowly left to drain into the soak pits (or soak field is area is sufficient) where it slowly percolates into the ground.
9. Keep an operational log to monitor frequency of sludge disposal: The supervisor in charge is required to prepare a desludging chart and maintain minimum retention timeline at each chamber and also closely work with the IOM project engineer.

Design: Soak field for effluent infiltration

The infiltration stage is crucial to ensure safe disposal of the effluent. General technical guidelines observed by IOM WaSH Unit are:

Key Design Considerations

- Natural infiltration in semi-saturated soil (during Monsoon period) of 8.3 l/hr/m^2 is considered which corresponds to an average (with safety margin) of field studies (this can be adapted upon field measures) [3] [5]
- Input of 8 m^3 of wastewater received in 72 hrs ➔ 0.11 m^3/hr is considered as treated effluent form the SSU
- The infiltration surface of the Soak Field is given by the quotient of the effluent discharge and the infiltration rate: 111 (l/hr)/8.3 l/hr/m^2) = 13.4 m^2
- The length of the Soak field is given by dividing the infiltration surface by the standard width of de Soak filed: 13.4 (m^2)/0.80 (m) = **17 m**



- Channels are dug in the ground: 0.80 m wide, 1.00 m deep and the length is determined by the effluent discharge (see Key Design Considerations).
- System flat or with very light slope
- Trenches are to be filled with stones (not easily available) or brick chips of good quality
- Half perforated PVC pipe SCH40 4'' with 0.8 cm driller at a density of 100 holes per meter of pipe (bottom only) are placed 15cm below ground level (upper level of the pipe considered, see above picture).
- A geotextile is put at the top of the pipe along the soak field to prevent vegetable root system and fine particles to enter and clog the drain pipe.
- Trenches not to exceed 10 m length and separated by a distance of 2 m.
- Manholes are to be constructed at each junction to facilitate infiltration monitoring
- Vertical vent pipe to be positioned every 3m to maintain aerobic conditions

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References

[1] **37th WEDC International Conference**: Assessing On-Site Systems and Sludge Accumulation Rates to understand pit emptying in Indonesia.

[2] **EAWAG** Swiss Federal Institute of Aquatic Science and Technology: Settlers.

[3] **FAO:** Annex 2 Infiltration rate and infiltration test.

[4] **FAO, http://www.fao.org/docrep/s8684e/s8684e0a.htm, (2018) -** Annex 2 Infiltration rate and infiltration test.

[5] **EPA, (2002)** - Onsite Wastewater Treatment Systems.