Faecal Sludge Treatment Plant

- Unnao, Uttar Pradesh

Project Brief

Unnao lies on the Gangetic plains of North India between the major cities of Lucknow and Kanpur, in Uttar Pradesh. Its geographic position has fueled its growth over the last couple of years, leading to its selection under this project. The town has around 35,532 households, all of which rely on some form of on-site sanitation system, such as pits or septic tanks, for containing and partially treating the excreta generated from toilets. The town's urban local body has made provisions for mechanical desludging of these on-site containment systems. However, the town lacked any dedicated disposal and treatment arrangement for the faecal sludge (FS) collected and transported through these desludging trucks.

The National Institute of Urban Affairs (NIUA) and CDD Society, with support from The Bill and Melinda Gates Foundation, came together to demonstrate sustainable and innovative solutions for managing FS in Unnao, under the Sanitation Capacity Building Platform (SCBP). The technology was further updated and modified, in order to accommodate the changing scenario and circumstances in the city, with the support from *Sarvo Water*.

Project Outcomes

- to ensure efficient treatment of FS generated in the town
- to ensure safe reuse of treatment by-products
- to demonstrate possible financial models for FSTP operations

Objective of the treatment

The objective in treating FS is to dewater the sludge so that it reduces in volume and becomes easier to handle. FS contains a high proportion of liquid. The reduction in this volume will greatly reduce the cost of transporting water weight and simplify subsequent treatment steps. Systems that decrease moisture content (or increase the concentration of total solids) at successive stages are thus needed.

Reuse Options

- The treated effluent from the collection tank is reused for landscaping at the FSTP
- The produced compost is used in agriculture

Salient Features

Source of faecal sludge: Pits and Septic tanks
Design capacity: 32,000 liters/day (32 KLD)
Area of the treatment plant: ~750 m2
Population Covered: 1,77,658(35,532 HHs)

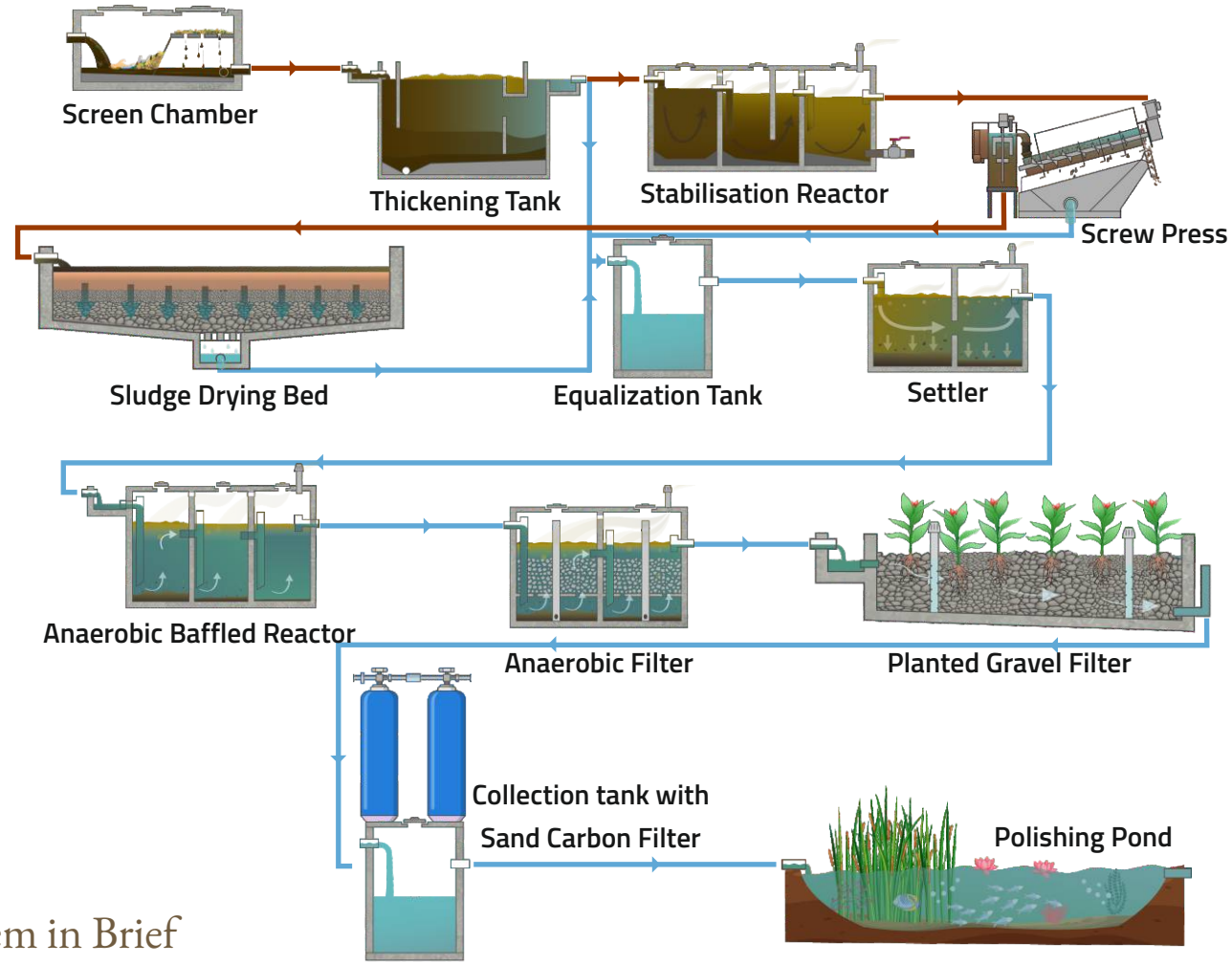
Influent quality: BOD= 3,500 – 10,000 mg/L
: COD= 9,000 – 25,000 mg/L
Effluent quality: BOD= <10 mg/L
: COD= <50 mg/L

Project Specifications

Funding Agency: AMRUT Mission, Uttar Pradesh Jal Nigam
Implementing Agency: Sarvo Water
Supporting Organizations: NIUA and CDD Society
CapEx: ~Rs. 4 crores
OpEx: ~Rs. 4- 5 lakh per month
Year of commissioning: 2019
Current Status: Operational since 2019

Modules Adopted

Components	Area of Construction
Screen Chamber	8 m^2
Thickening Tank	36 m^2
Stabilisation Reactor	116.18 m^2
Screw Press	25 m^2
Sludge Drying Bed	300 m^2
Equalization Tank	32.45 m^2
Integrated settler and ABR with AF	45 m^2
Planted Gravel Filter	80 m^2
Collection Tank with sand carbon filter	15 m^2
Polishing pond	100 m^2
Total treatment modules area	757.63 m^2



System in Brief

The main treatment steps followed in this FSTP are: solid-liquid separation, stabilization, dewatering of sludge and pathogen removal.

Treatment modules 1-5 listed in the table below are for the solid component. Treatment modules 6-11 for the liquid component.

Module	Rationale
1. Screen and Grit Chamber	Removes foreign particles present in sludge, such as plastics, metal pieces etc. The grit chamber removes silt and other heavy inert particles, which may affect downstream treatment processes.
2. Thickening Tank	The primary treatment unit, it assists in solid-liquid separation and sludge thickening by gravity. In addition, some anaerobic digestion also occurs in the sludge retention zone, leading to stabilization of sludge.
3. Stabilization Reactor	The thickened sludge is anaerobically digested in a high-rate mixer reactor. This not only stabilizes the sludge, thereby reducing its organic pollution, but also increases its dewatering ability.
4. Screw Press	This is used to dewater the stabilized sludge by using mechanical means.
5. Unplanted Drying Beds	The dewatered sludge is then dried in the beds to reduce moisture content to desired levels of 50%.
6. Equalization Tank	Here, the various liquid streams arising from dewatering and drying processes are homogenized. In addition, it aids in balancing the peak flow into the DEWATS™ modules.
7. Settler	Used for capturing any settleable solids that may have entered into the liquid stream due to less efficient upstream processes.
8. Anaerobic Baffle Reactor and Filter	Used for reducing the organic pollution load present in the liquid stream through anaerobic processes.
9. (Horizontal) Planted Gravel Filter	Used for aerobic treatment of effluent as well as for nutrient removal.
10. Sand Carbon Filter	Used for removing the residual TSS and COD through means of filtration and adsorbing.
11. Polishing Pond	Used for disinfecting the treated wastewater.

O&M

Operation tasks

- Cleaning of Screen Chamber
- Operation of Valves
- Regular desludging of the Thickening Tank and Stabilization Reactor
- Polymer/flocculent dosing and mixing
- Removal of dry sludge from the UPDBs and Screw Press

Maintenance Tasks

- Desludging of Thickening tank, Stabilization Reactor, Screw Press, Integrated Settler, Anaerobic Filter
- Cleaning of filter material in the PGF and the UPDBs

Learnings

The combination of a Thickening Tank, Anaerobic Stabilisation Reactor (ASR) and Screw press, in this sequence, with an Unplanted Drying Bed (UPDB) works well for the treatment of FS. This partially nature-based and partially electro-mechanical, hybrid system reduces the need for several UPDBs.

Faecal sludge after dewatering in the screw press

Faecal sludge being dried in the unplanted drying beds

Planted Gravel Filter (PGF)

Polishing Pond

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