Workshop Septage Treatment Technology

"Faecal sludge management, Devanahalli, Karnataka, India – A case study"

Organised by:

CEPT University
All India Institute of Local Self Government
Urban Development Department, Government of Maharashtra

Date: October 20-21st, 2016
Venue: Hotel Hyatt, Kalyani Nagar, Pune

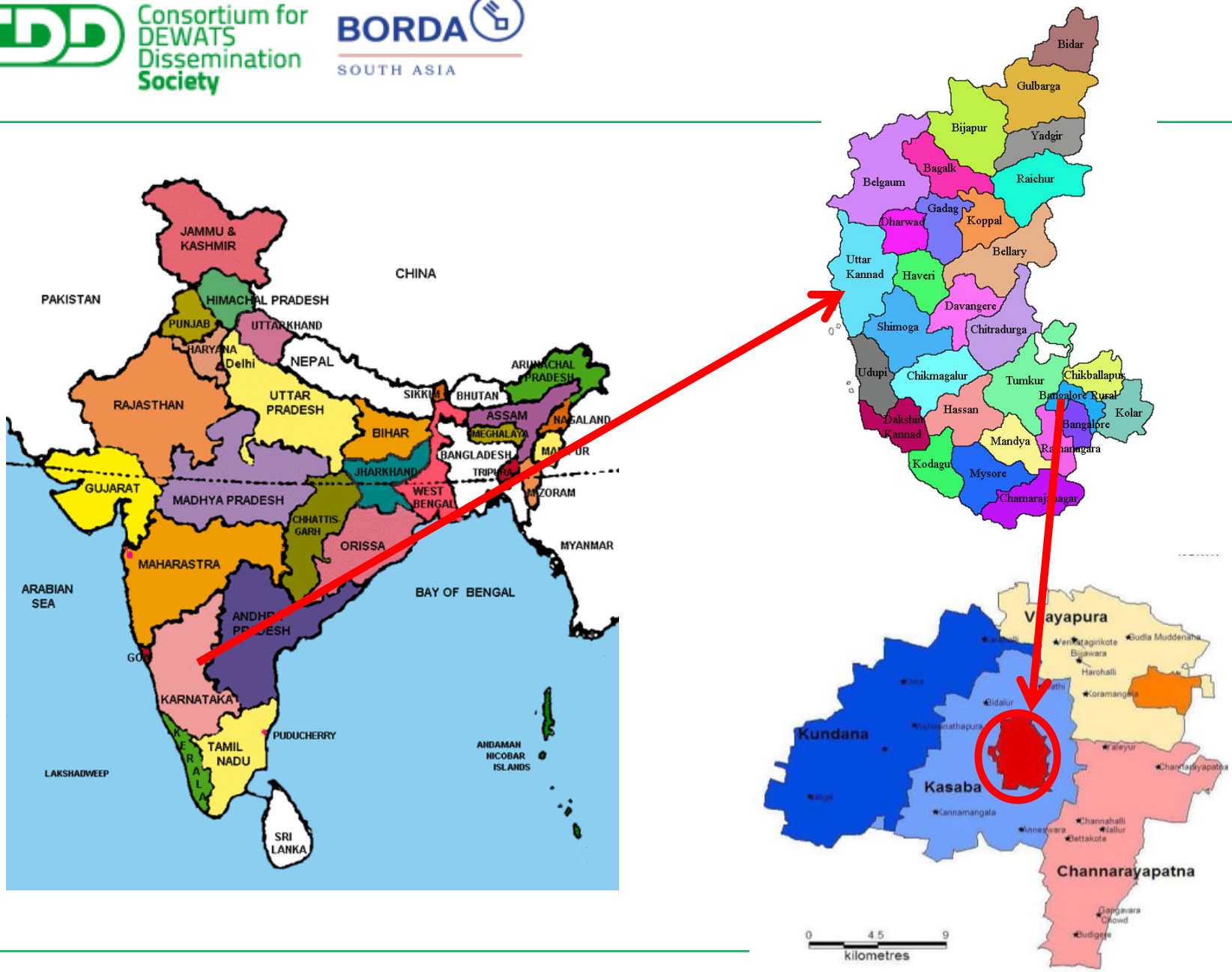
Presented By: CDD and BORDA

1. About Devanahalli
2. Sanitation situation at Devanahalli
3. FSM interventions at Devanahalli
4. Work under progress

About Devanahalli

Geographic location	Population Demography	Administrative
• Located in Bangalore rural district • 39 Kms to the North east of Bangalore • Spread across an area-16 Sq.km • Has historic significance.	• Population of 28,039 (census 2011) • Population growth rate over 21%. • Growth rate more than national average of 17.3%	• Has 23 wards • 6400 households • 1517 commercial settlements • Administered by The town municipal council.

No provision for UGD



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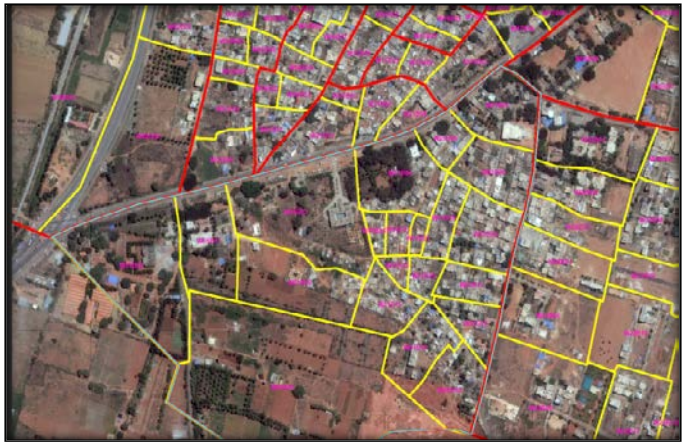
Sanitation Situation

User Interface → **Containment** → **Transport** → **Treatment and Disposal**

Household survey

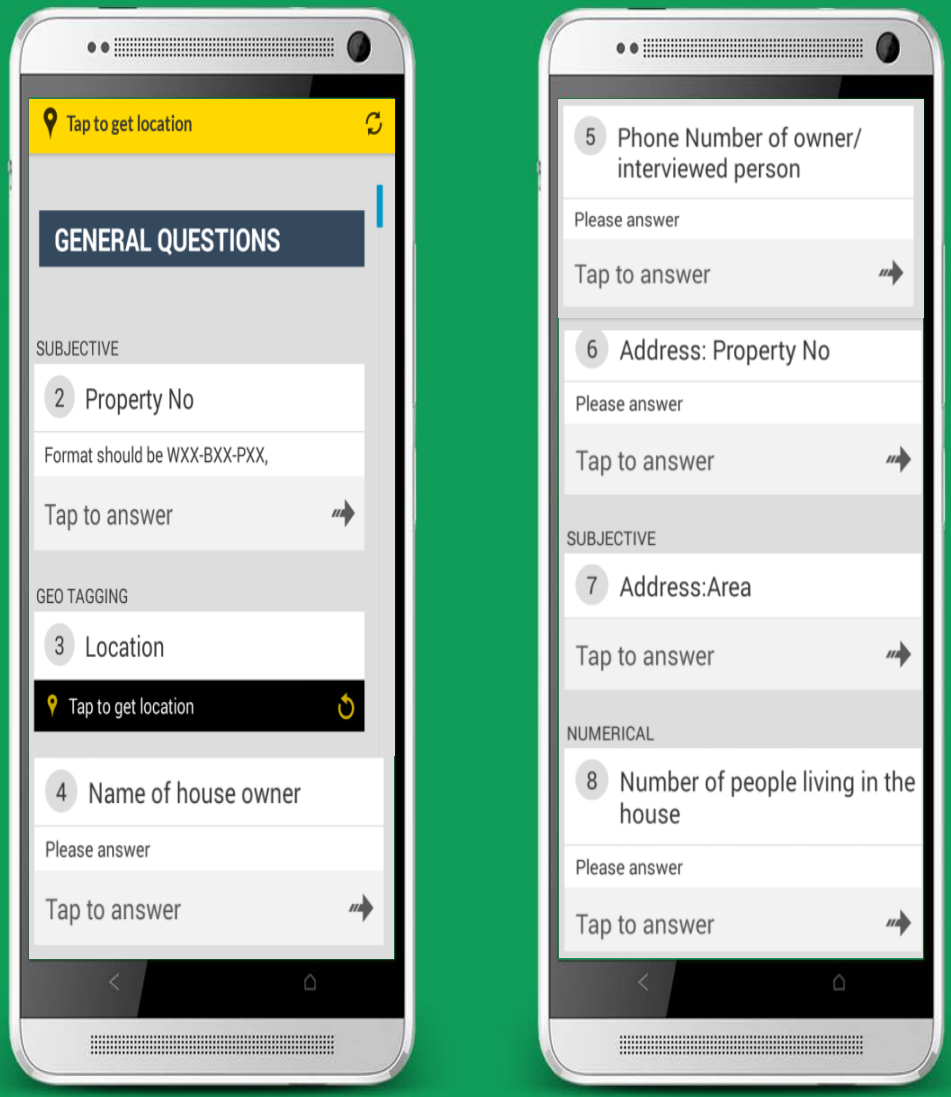


Household survey

30 Students were divided into group of 6 , with one in-house CDD staff

Entire survey was conducted in 5 days with each student covering 100-150 Surveys

App based survey



Sanitation Situation

User Interface → Containment → Transport → Treatment and Disposal

User Interface

User interface | Containment | Transport | Treatment and Disposal

5,780 (90%)
With Toilets

- Flush toilets **16.4%**
- Pour flush toilets **83.6%**

620 (10%)
Without I.Toilet

- Open defecation-**61.8**%
- Public toilets-**16**%
- Shared toilets-**22**%

Reasons for no toilets

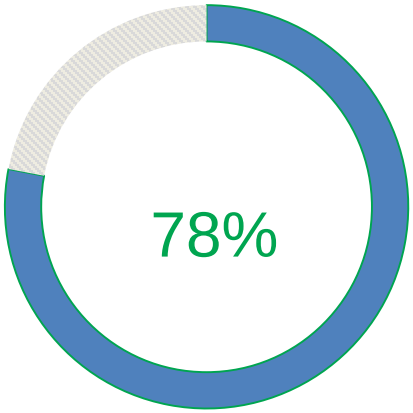
- Cost-**49%**
- Space-**39%**
- Other-**12%**

Sanitation Situation

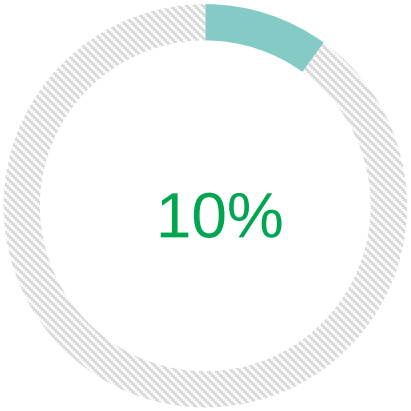
User Interface → Containment → Transport → Treatment and Disposal

Household survey

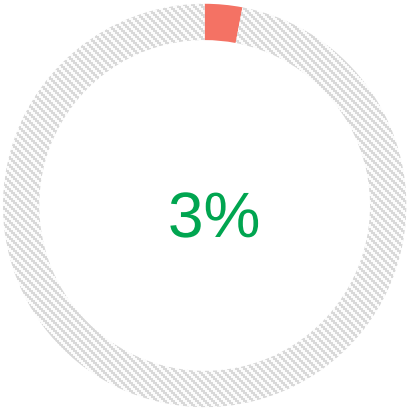
User interface | **Collection** | Transport | Treatment and Disposal



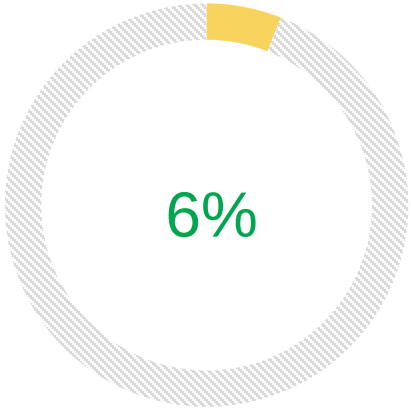
Single Pit



Septic Tank



Twin Pit



Open drain

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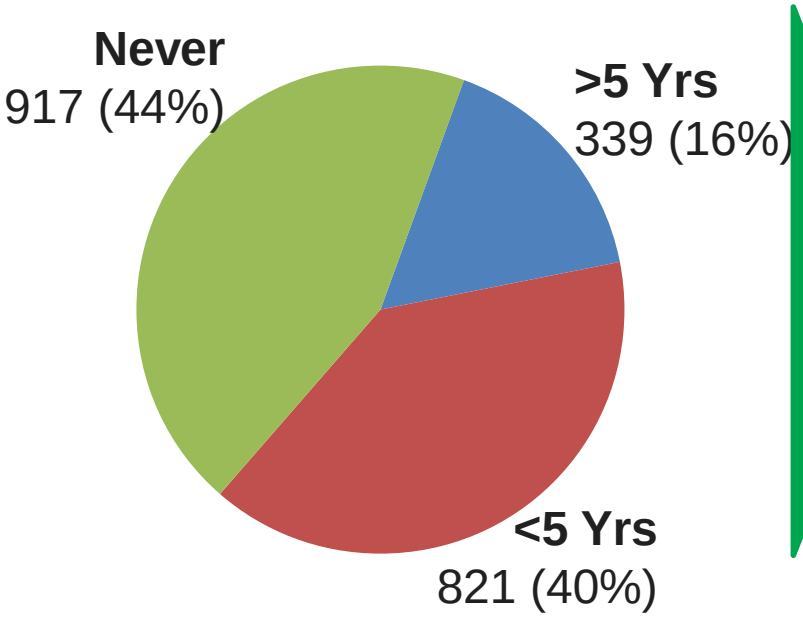
Septic tank/Pit with lining — **35% households**

Septic tank/Pit without lining — **65% households**

Desludging practices

User interface | **Collection** | Transport | Treatment and Disposal



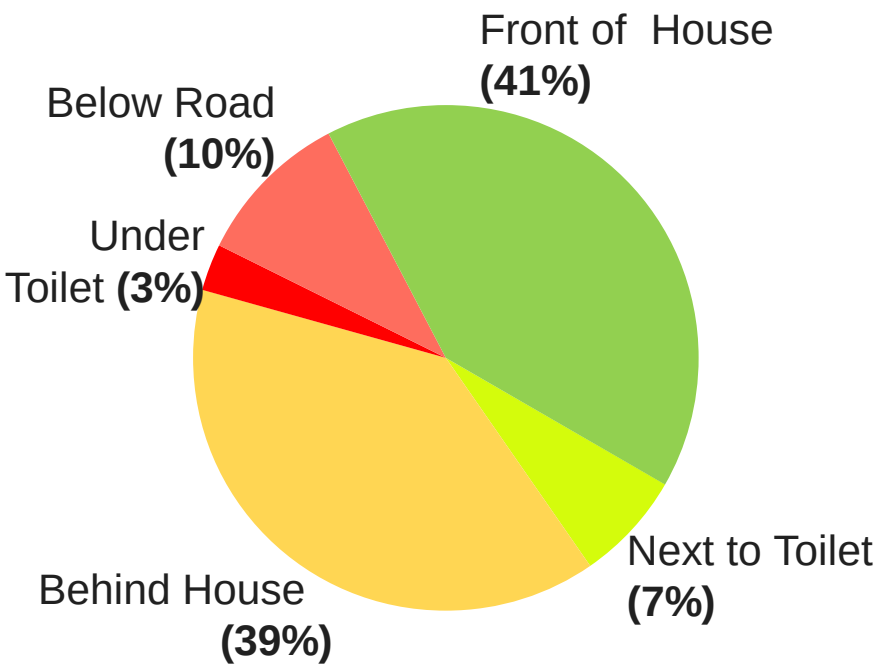
Irregular Desludging Interval

- Use of tablets/chemicals
- Majority of collection systems located such that they are not accessible
- Soil condition
- Majority of the collection systems do not have baselining
- Overflow pipe connected to drain

- Majority of collection systems are aged 5-10 years
- 3% households have their grey water connected to collection system

Access to containment systems

User interface | **Containment** | Transport | Treatment and Disposal



Location of collection systems

Key issues

User interface | **Containment** | Transport | Treatment and Disposal

- Lack of awareness on **design / construction** standards and importance of **timely desludging**
- Acts empower the ULBs to formulate local by-laws for design/construction aspects, however **no practical reference** available for the same
- Due to irregular desludging and lack of construction standards most of the sewage discharged into the **storm drain** or seeps under ground
- Manual scavenging observed in certain wards (3% households resort to manual scavenging, due to **economic factors** or **inaccessibility**)
- Majority of the collection systems are **unlined**
- Poor monitoring and accountability by local ULB

Sanitation Situation

User Interface → Containment → Transport → Treatment and Disposal

Transportation

User interface | Containment | **Transport** | Treatment and Disposal

- TMC operates one desludging vehicle with 4000L Capacity
- People prefer private players to government services
- Records indicate on an average 3 to 4 loads of faecal sludge desludged weekly
- Prominence of other private players as well, 5 such operators present
- Private operators charge 1500-2000 Rs / desludging
- Written application based requisition by households for availing TMC services

Preference analysis

User interface | Containment | **Transport** | Treatment and Disposal

- At present in Devanahalli 61% of households prefers private operators and only 35% households prefer government services.
- Reason for this perception being;
  - ✓ Written application has to be submitted, where in private players be called via telephone
  - ✓ Not arriving on time and delayed desludging
  - ✓ No cleanliness or any safety precautions handled while desludging
  - ✓ Lesser service cost compared to private players

Household preference for desludging services

O&M Cost

User interface | Containment | **Transport** | Treatment and Disposal

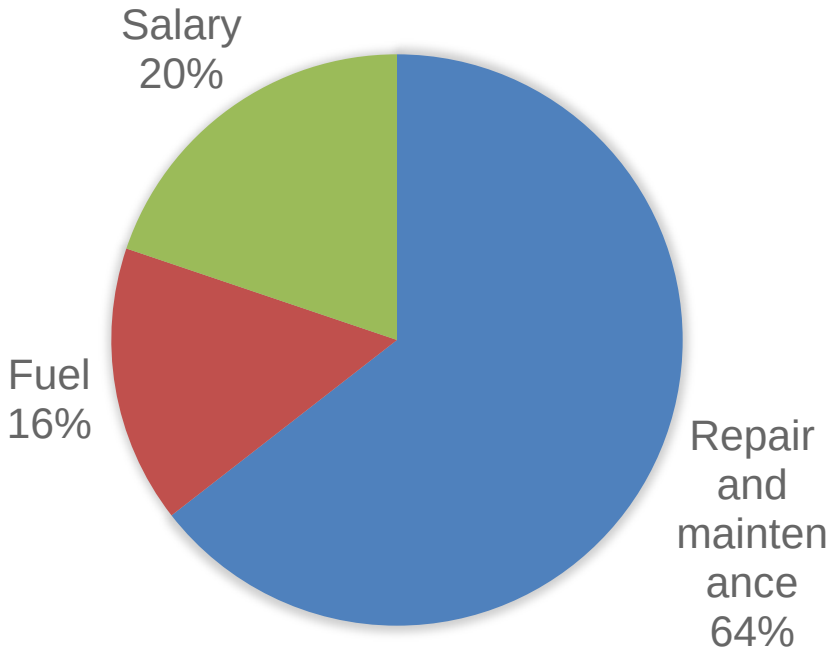
Cost of TMC Truck: Rs.16,00,000

Average annual O&M cost:

- Operation cost – Rs. 1,50,000
- Maintenance cost – Rs. 60,000 – 75,000
- Total cost – Rs. 2,25,000

Average annual income:

- Average desludging per year 150 – 180
- Cost for desludging – Rs. 1000
- Total income – Rs. 1,50,000 – 1,80,000

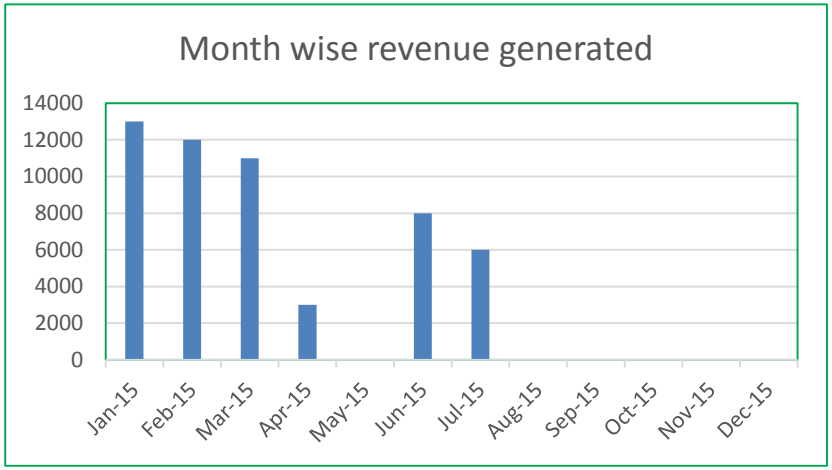


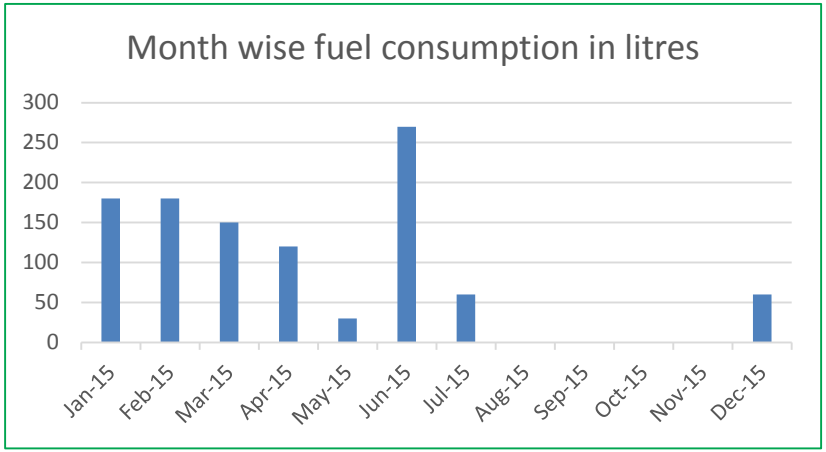
Cost apportion for the year 2015

Source: TMC Devanahalli

O&M cost analysis

User interface | Containment | **Transport** | Treatment and Disposal





Monthly average cost and revenue

Average Maintenance cost	Rs. 5,920
Average fuel consumption	130 lts
Average revenue generated	Rs. 6,625

Overview of Revenue(2015)

Revenue	Rs 53,000
Operating Costs	Rs 1,50,000
Maintenance	Rs 2,75,000
Gap	Rs 3,71,000

Source: TMC Devanahalli

Key issues

User interface | Containment | **Transport** | Treatment and Disposal

- Poor truck maintenance and lack of skilled operators
- Major repairs halts the truck for very long period
- Non availability of dedicated driver
- Truck is not used to its optimum – poor desludging demand / service
- Lack of financial accountability – income vs expenditure
- Lack of safety guidelines and safety gears for operators.
- Lack of proper operational plan and resource allocation for the same
- Difficult procedure to avail services of TMC truck

Sanitation Situation

User Interface → Containment → Transport → Treatment and Disposal

Treatment and disposal

User interface | Containment | Transport | **Treatment and Disposal**

- No treatment facility available
- Disposal of faecal sludge at designated or remote areas
- Most disposal into nearby farm lands (disposed in open pits in farmland)
- Faecal sludge directly used as a **soil conditioner** in agricultural fields without adequate treatment (mostly cash crops)
- **Lack** of regulations and **guidelines for safe reuse**
- Farmers un-aware about the health risks involved with the present practice

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Need for FSTP and FSM

- Devanahalli TMC interested to ensure feacal sludge management
- Outcome of sanitation safety Planning recommends FSM
- No sewer system planned in the near future → Limited water supply
- TMC operates one desludging vehicle with 4000L capacity
- Estimated 1 to 2 loads of faecal sludge / septage desludged daily
- Majority of containment systems not in line to the required standards

Key Stakeholders & roles

- **Devanahalli Town Municipal Council (DTMC) –** Provision of suitable land for the designed capacity, ensure regular flow of faecal sludge to the treatment facility, O&M of the treatment facility, contribution in kind for the construction of the treatment system with the resource available like earth movers, water and electricity supply, construction material etc.

- **Consortium for DEWATS Dissemination (CDD) Society -** Design and implementation of faecal sludge treatment facility, support TMC developing soft components like IEC materials for awareness campaigns, survey forms, policy and institutional framework for regulations and technical support for proper O&M of the infrastructure

- **Bremen Overseas Research and Development Association (BORDA)** – Technical expert support, sourcing of funds for different components of the project from different donor agencies like Bill and Melinda Gates Foundation (BMGF), BMZ Germany, Rotary International

Our interventions

- IEC campaigns
- Awareness programs,
- Construction of toilets

- IEC campaigns
- Design / construction standards,
- workshops

- Operational optimisation
- Business model
- Operator training

- Effective treatment
- Operation optimisation
- Streamlining O&M

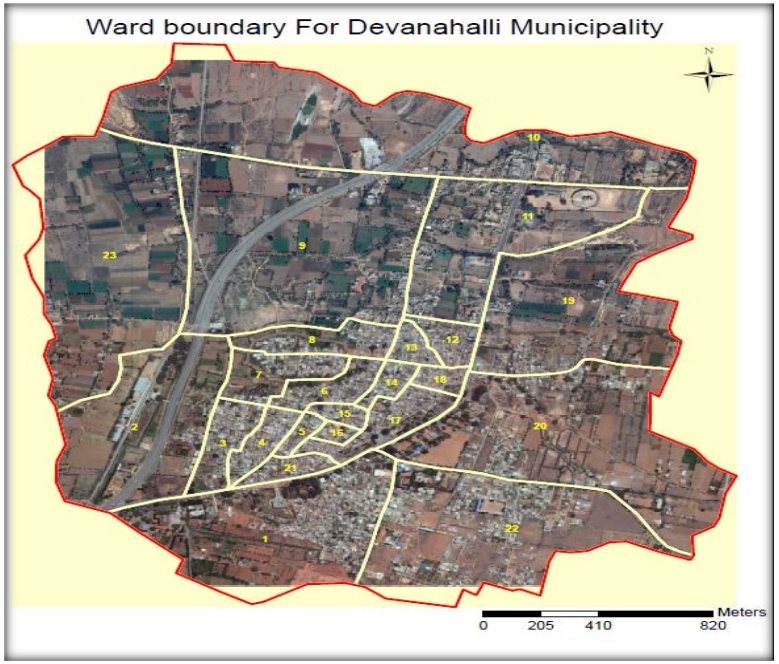
- Reuse
- Co-composting
- Farmers benefit

Framing Policy guidelines

FSM

Policy recommendations

- Toilet construction in open defecation areas
- Toilets outlet connected to drains to have containment system
- Standardization of Septic tanks and Pits design
- Database of onsite system and regular desludging guidelines
- Formalization of private honey suckers
- Requirement of appropriate treatment facility or/and safe disposal
- Training to local masons on standard designs on onsite sanitation system

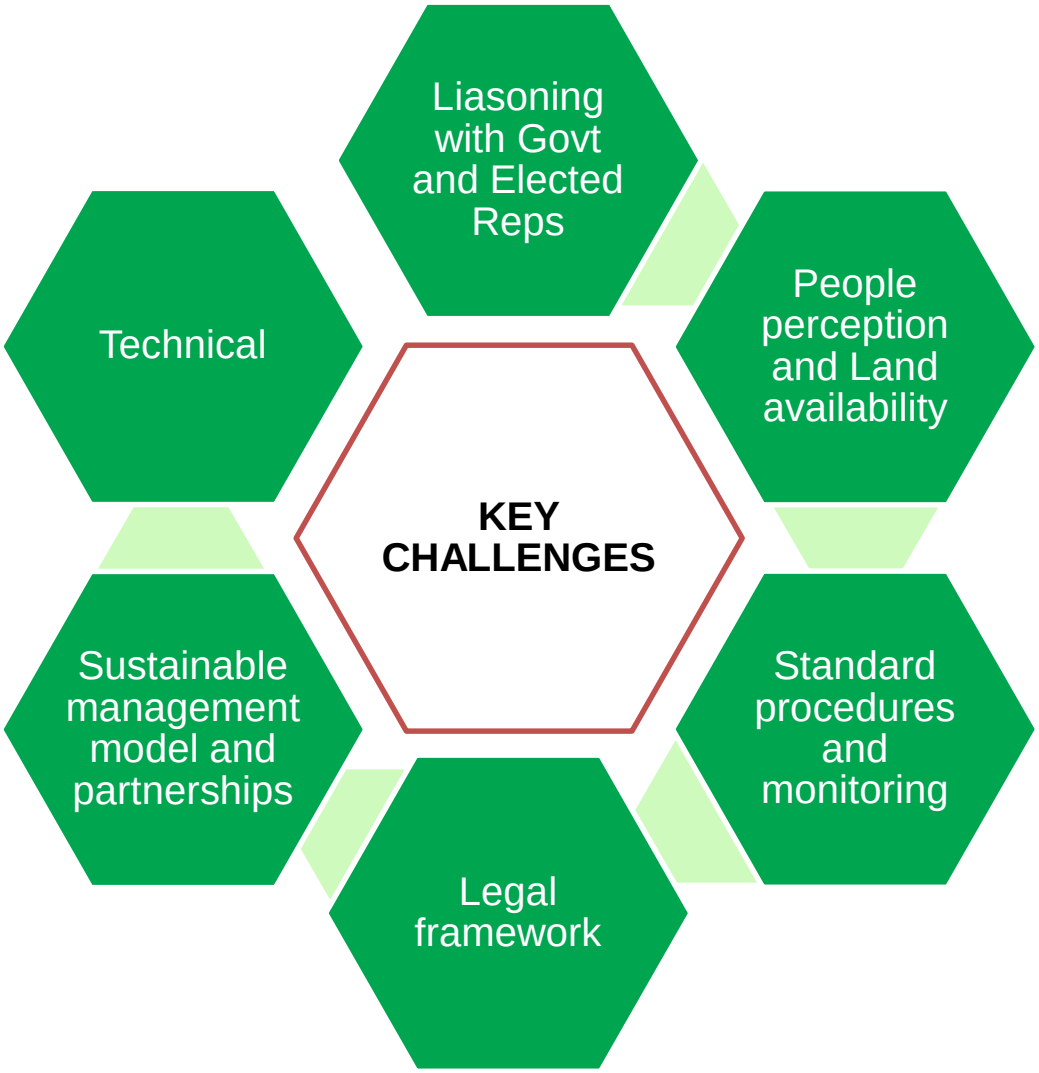


Status so Far…

- Faecal sludge Treatment facility commissioned and in operation since Nov 2015
- Operational Days = **330**
  Truck Loads received = **291**
- Faecal Sludge Received = **5,90,900 Liters**
- Engagement with local farmers—interest in buying treated water and sludge
- Regular data collection and performance monitoring and design improvements

- **100%** of Devanahalli households surveyed
- FSM Policy guidelines drafted and under implementation
- Induction to TMC officials and Operator Trained
- Dedicated landline for desludging service
- 500**+** visitors incl. **100+** international visitors, **300** senior officials

Key challenges



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Work under progress

Monitoring and operations	Policy	Upscale
• Daily Dashboard - Operations • Data analysis • Streamlining truck operations • Improvisations in tech design & o&m • Government officials and stake holder induction • Development of Sustainable management model and implementation	• Workshops for ULB level officials on policy importance • End to end policy implementation • Legal/Institutional frame work to be adopted • Regulations for desludging and dumping at FSTP	• Policy adoption at the state level • FSM initiatives in other towns in Karnataka and other states • Development various management models

FSTP plant, Devanahalli

Treatment

Concept and Technology adopted

Selection criteria

Key criteria for selection of treatment concept and modules

- To meet the required discharge standards for safe disposal
- Social acceptability and people preference
- Ease in operation (simplicity) and maintenance of the treatment unit
- Safe and hygienic operation for operators and mainatainace staff
- Affordable O&M cost for the TMC
- Minimization / No usage of electromechanical inputs for treatment as well as disposal
- Reasonable capital cost and construction area requirement
- Outcome of sanitation safety Planning recommends FSM

Design considerations

- Feed type – Faecal sludge/septage
- Feed frequency – Daily discharge
- Treatment capacity – max 6 cum/day
- Treatment approach – Gravity based biological treatment system

- Faecal sludge characteristics

Sample Parameters	Fresh Septage / Fecal Sludge mg/l	Average value mg/l
BOD, mg/l	10,000 - 30,000	**20,000**
COD, mg/l	20,000 - 60,000	**40,000**
Total Solids	30,000 - 80,000	**50,000**
pH	5.8- 7.8	**7.2**
Coliform	1×10^4 - 1×10^7	**3×10^6**

Treatment Process

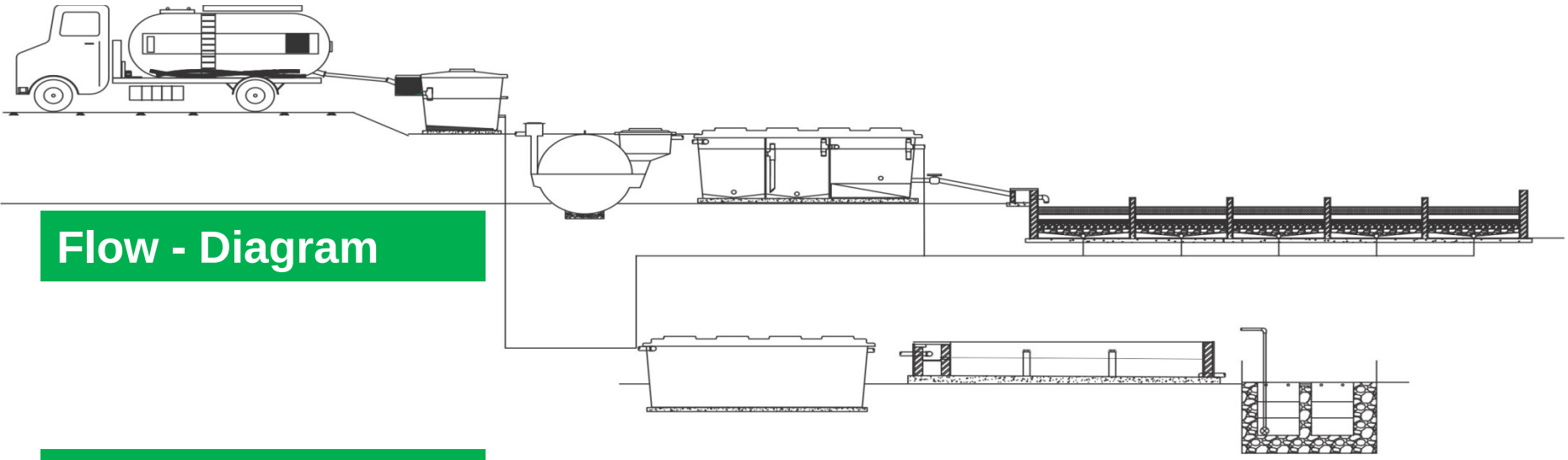
Anaerobic Digestion based Faecal Sludge Treatment Plant

1. Separation of solids
2. Sludge stabilization
3. Dewatering / Drying
4. Sludge percolate treatment
5. Disinfection
6. Safe disposal / Reuse

FSTP at Centre for Advanced Sanitation Solution (CASS)

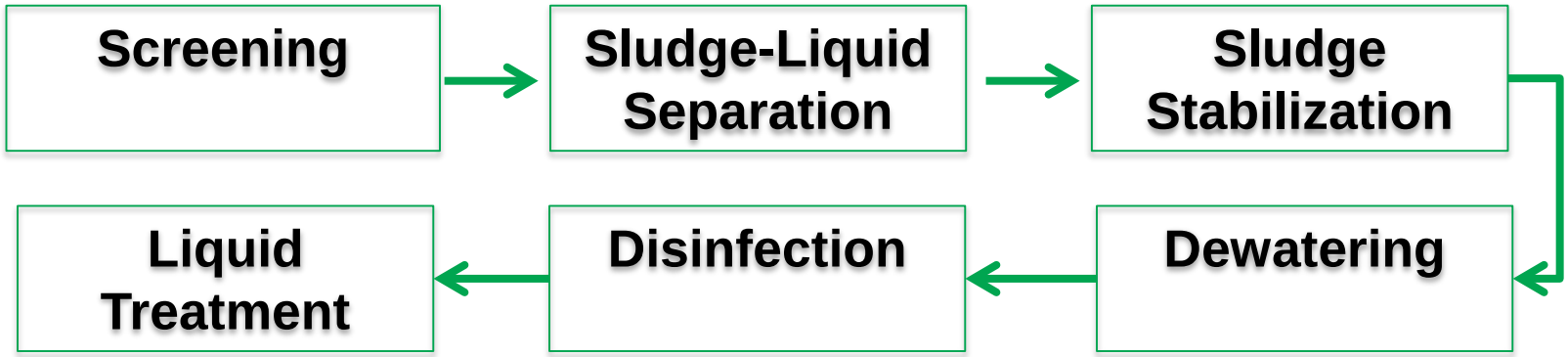
- Treatment principles and process adopted based on the experience of research unit
- Treatment Capacity – max 3m^3 of faecal sludge / septage
- Feed frequency – daily

Treatment Modules

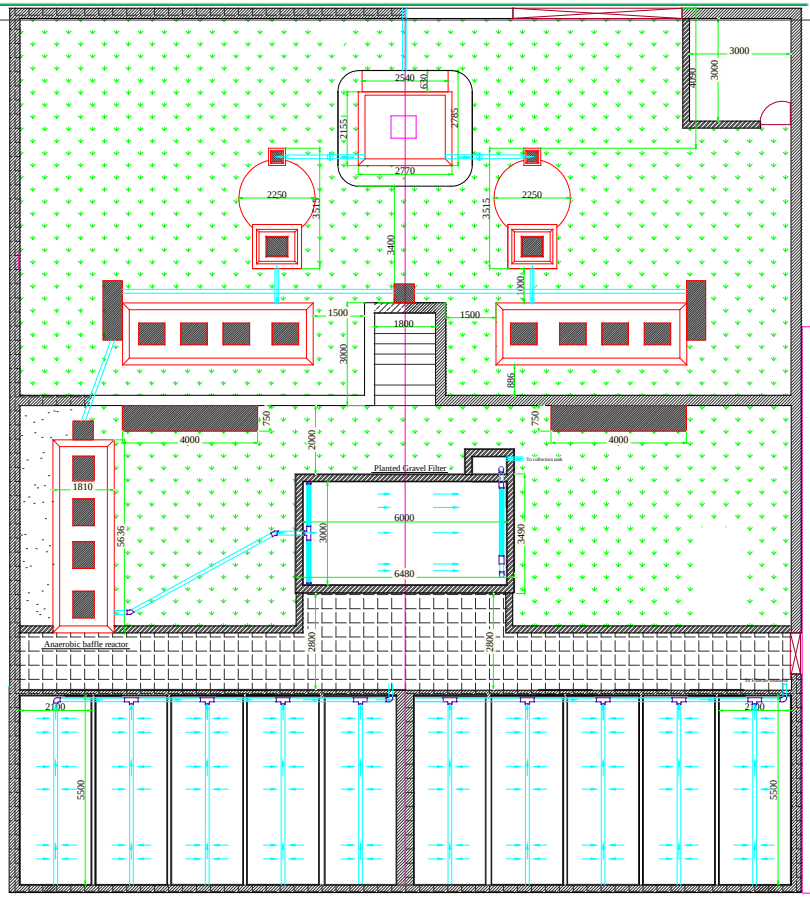


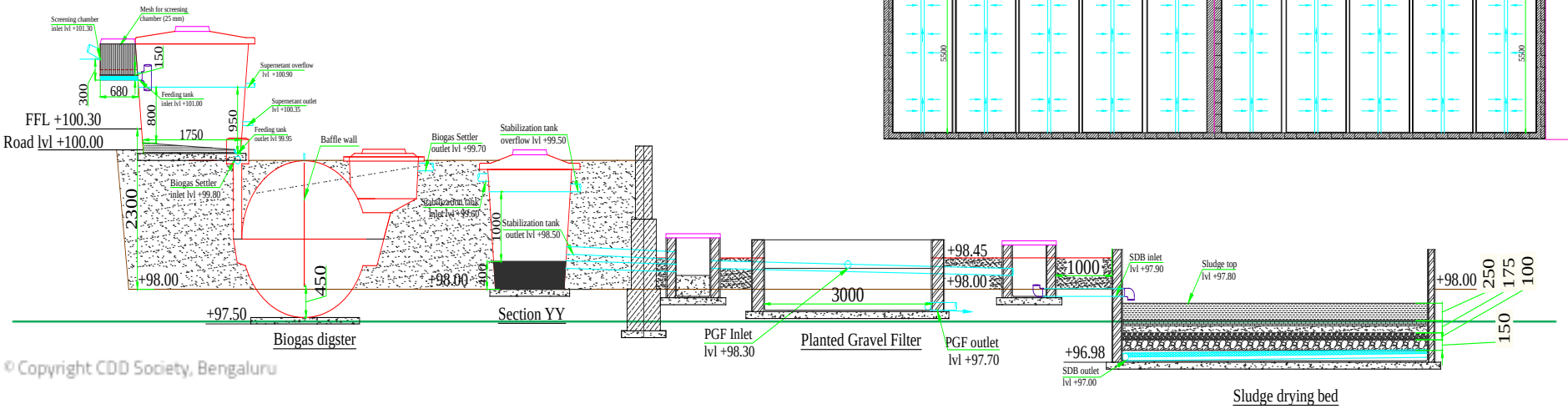
Flow - Diagram

Treatment Process



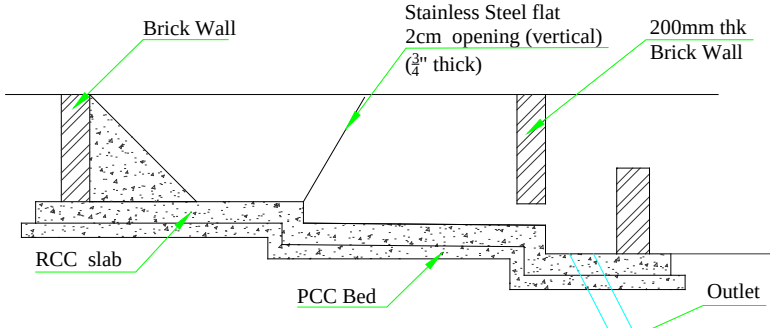
Construction Layout / Hydraulic Profile

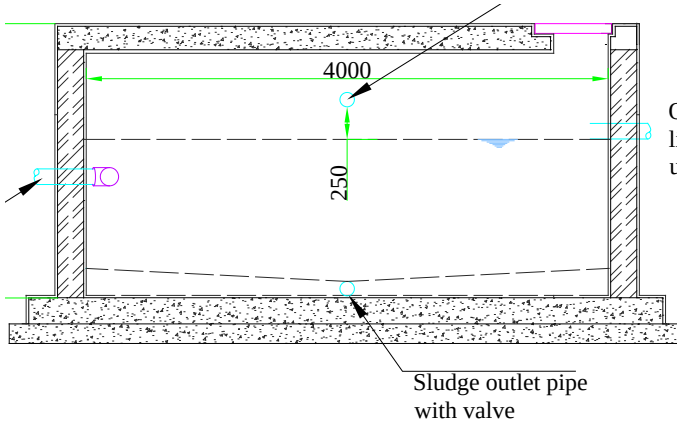




Treatment Modules

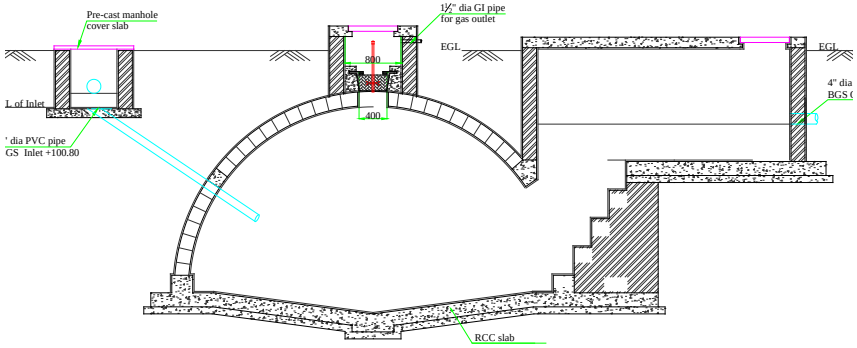
Screen chamber / Settling tank

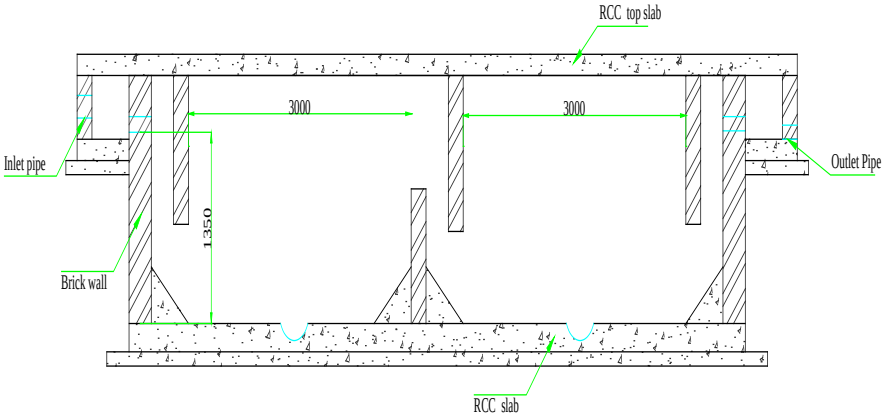




Treatment Modules

Anaerobic Stabilisation Reactor



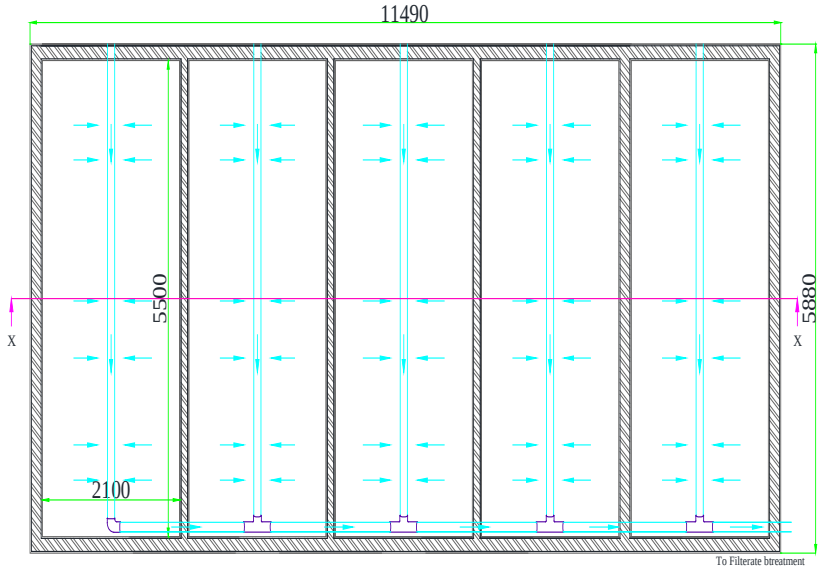


Biogas Digester

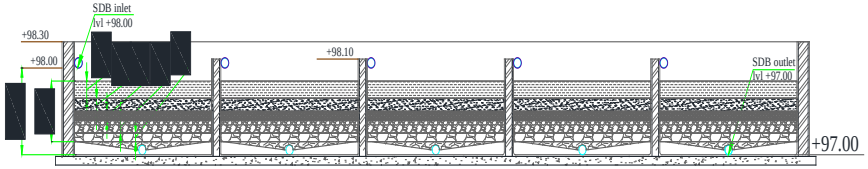
Stabilisation Tank

Treatment Modules

Unplanted Drying Bed



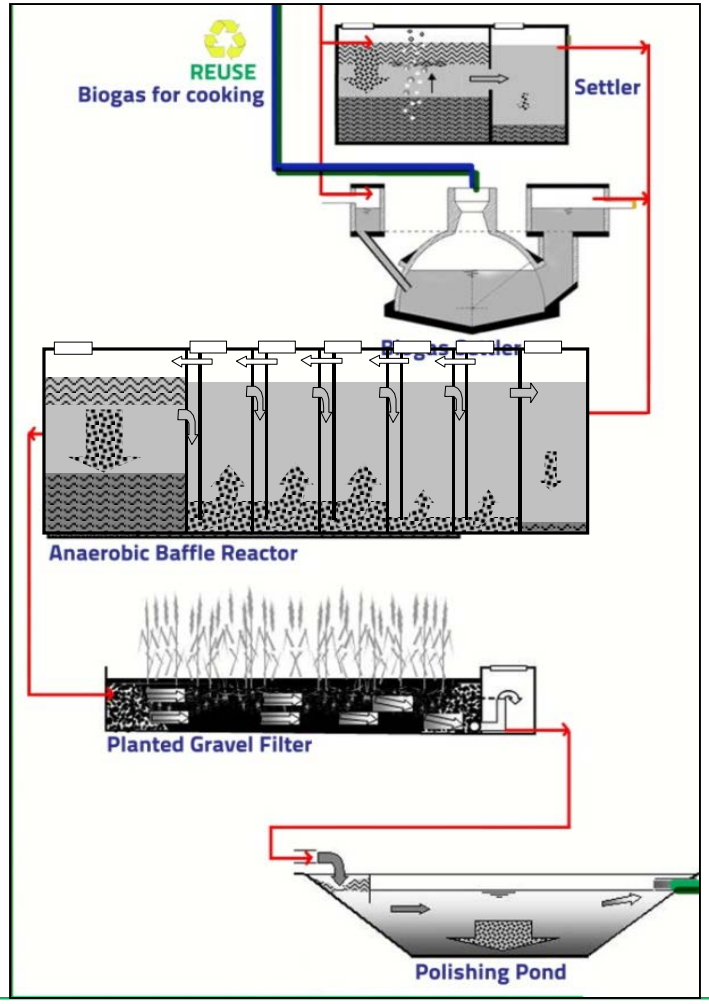
Plan: Sludge drying bed

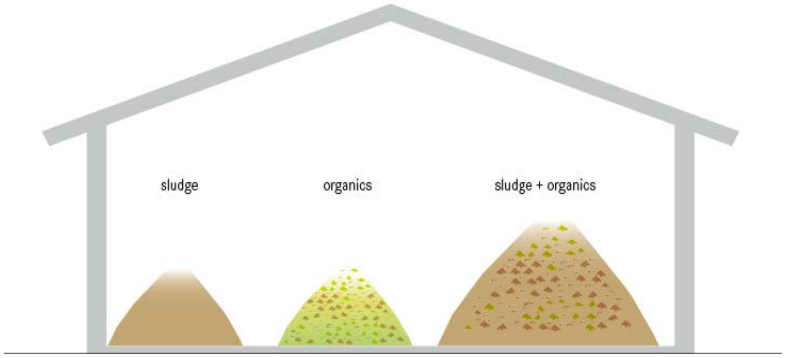


Section XX

Treatment Modules

DEWATS / Composting





O&M Requirements

Operation Requirements
• Receive Faecal sludge • Influent quality check • Cleaning of Screens • Operation of Valves • Harvesting of Plants in PGF • Removal of dried solids from SDB

Maintenance Requirements
• Cleaning of pipes • Desludging • Cleaning of filter materials in PGF • Cleaning of filter materials in SDB • Repair of pipes/valves

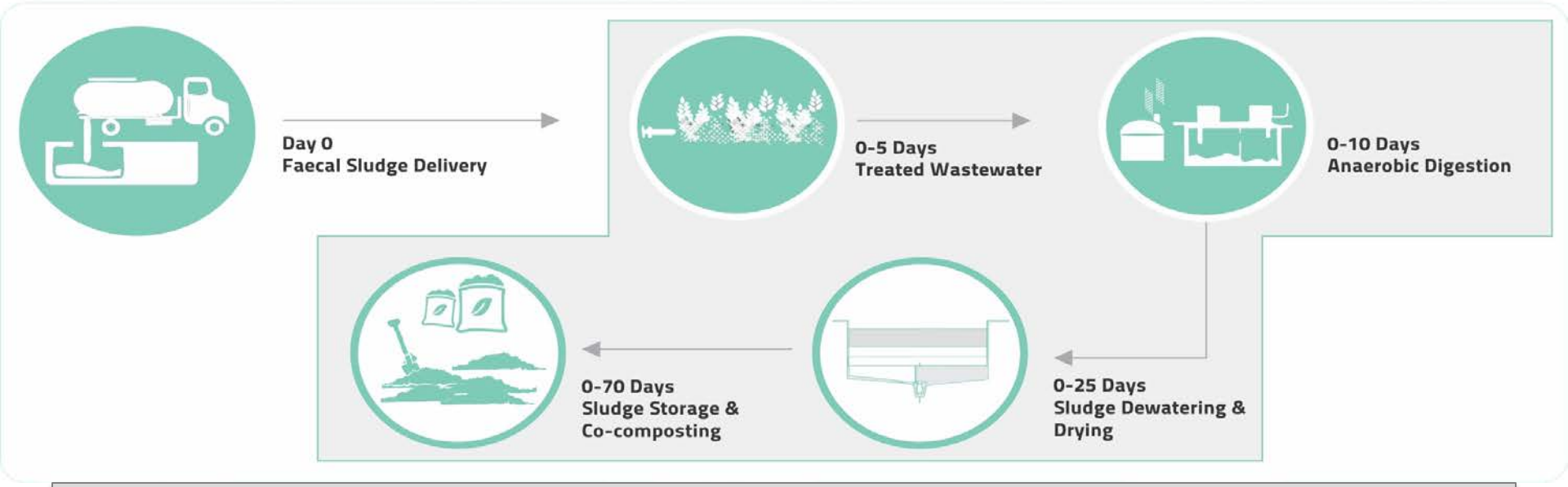
Performance Assessment

Sample Parameters	Expected Effluent quality of liquid fraction
BOD5, mg/l	30 - 50
COD, mg/l	200 - 300
pH	7.5- 8.5
NH_3 mg/l	200 - 350
PO_4 mg/l	30 - 50

Influent

Effluent

Closing the loop



Closing of nutrient cycle by ensuring the reuse of by products

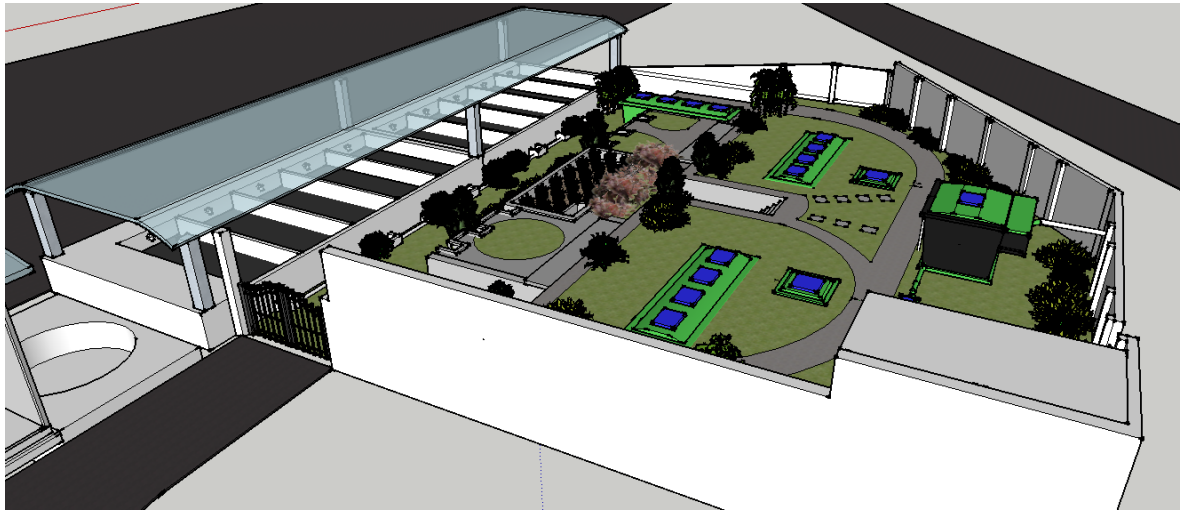
Sludge as soil conditioner

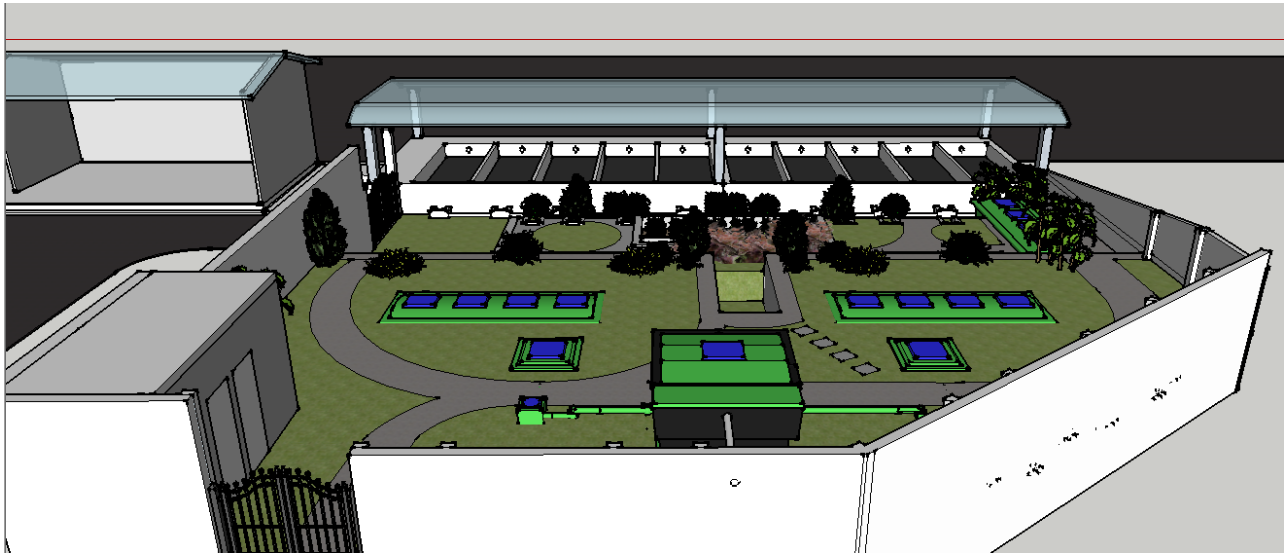
Biogas for heating

Water for irrigation

Plant Description

- **Capacity** Serves 30,000 people (de-sludging every 4-5 years)
- **Technology** Gravity-based Biological Treatment
- **Area** 650m^2
- **Priority** Simple, low cost O&M
- **Structure**: Mostly underground, completely covered, odorless
- **Capital Cost** Rs 45 + 35 Lacs (Rs 300 per capita)
- **Operating Cost `** Rs 24 Lacs per year (Rs 80 per capita per year)
- **Lifecycle cost** Rs 1,500 per capita—very low





Consortium for DEWATS Dissemination Society

BORDA SOUTH ASIA

Treatment modules

Thank you!!

CDD Society

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