Tamil Nadu Urban Sanitation Support Programme (TNUSSP) Trichy Phase - I

Key Findings
March, 2018
TIRUCHIRAPALLI

- Four administrative zones
  Ponmalai, Srirangam, K. Abhishekapuram, Ariyamangalam

- Trichy has a population of approximately 10 lakh people living in 65 wards. Floating Population increases during festival seasons

- Area of 167 sq. km.

- 154 notified and 108 non-notified slums

- Fourth largest Municipal Corporation in Tamil Nadu
  - Headed by a Commissioner
  - 4 Assistant Commissioners
  - 1 City Health Officer
  - 29 Engineers belonging to JE / AEE / EE / CE cadre
  - 7 departments with Public Health & Engineering departments mainly dealing with sanitation
TRICHY – KEY INTERVENTIONS

- Demonstration of co-existence of networked systems and FSM

- Building on City’s Strengths
  1. Large Infrastructure of Community and Public Toilets
  2. De-sludging vehicles meet certain standard
  3. Presence of decanting stations
TRICHY – KEY INTERVENTIONS

1. Improving access to individual household toilets through Swachh Bharat Mission – Urban (SBM-U)
2. Uyyakondan pollution study underway
3. Improvements to decanting stations
4. Proposal for improvements to STP
5. Design and construction of FSTP
6. Sustainable O & M models under preparation
7. Orientation and training of stakeholders: masons, de-sludging operators
8. Stakeholder engagement: Working Group meetings, Sanitation and Hygiene Education (SHE) Teams in slums / low income areas etc.
1. Improving access to individual household toilets through Swachh Bharat Mission – Urban (SBM-U)

2. Enforcement Drives for conversion of insanitary toilets

3. Good Quality Well-maintained Community Toilets
   - 457 Community and Public Toilets including child-friendly toilets
   - Sanitation and Hygiene Education (SHE) Teams manage Community Toilets sustainably
   - Improvement for Containment Systems proposed
ACCESS AND CONTAINMENT

Uyyakondan canal pollution – Discharge points map
ACCESS AND CONTAINMENT

Uyyakondan canal pollution – Study Methodology

- **Micro-catchment identification and delineation**
  - Micro-catchment selection criteria – Manageable size for study
  - Field recce to map boundaries of micro-catchment tracing back from outfall point
  - Finalization of micro-catchment in consultation with TCC

- **Preliminary assessment and reconnaissance**
  - Collection of primary information on micro-catchment – Property tax, Water supply and drainage connection data
  - Creating a GIS based HH level map

- **Detailed Situation Analysis**
  - HH and Establishment level - Structured questionnaires and Water consumption pattern analysis
  - Street and drain level - Observations on public/private infrastructure
  - Water sampling, Wastewater flow and quality analysis at various nodes of SWD segment
ACCESS AND CONTAINMENT

Uyyakondan canal pollution – Micro-catchment
To locate OSS, measure dimensions and estimate the sludge volume contained through the application of non-invasive geophysical techniques.

Primary objective is to identify the suitable technology that fits the field level conditions with broad parameters that can be expected / arrived at, based on such techniques.

First of its kind technology application to solve complex issue of locating & identifying structures, below the ground

**Echo sounder & LiDAR:** Among the three ranging sensors used, the laser sensor is most accurate due to the very low spread of its probing beam.

**SP survey:** Found effective for locating ‘leakages’. However need to confirm these with water quality testing to confirm the same
ACCESS AND CONTAINMENT

• **Objective** is to design simple, cost-effective a non-invasive method/s to

1. Locate hidden septic tanks
2. Estimate the volume of sludge to be evacuated and
3. Identify and locate septic leakages

• **Methods tested:**

1. Electric resistivity imaging techniques
2. EM ground conductivity survey
3. Self Potential survey
4. Shallow seismic survey
5. Echo sounding of the septic tank
6. LiDAR (Light detection and ranging) sensors

<table>
<thead>
<tr>
<th>Leakage</th>
<th>Sludge depth (cm)</th>
<th>Tank lateral dimensions (feet)</th>
<th>Tank bottom (feet)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>50</td>
<td>7' x 15'</td>
<td>13'</td>
<td>Dimensions of tank and sludge top measured &amp; Tank Bottom identified</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3 dimensions + Sludge Top</th>
<th>2 dimensions + Sludge Top</th>
<th>Only Sludge Top</th>
<th>Leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>12</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

From the 30 sites surveyed
### ACCESS AND CONTAINMENT

<table>
<thead>
<tr>
<th>Technology</th>
<th>Possibilities (inception stage)</th>
<th>Actual performance in the field</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Location &amp; Dimensions</td>
<td>Leakage</td>
</tr>
<tr>
<td>Resistivity Survey</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>EM survey</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>SP survey</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Shallow seismic</td>
<td>High</td>
<td>NP</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>LiDAR System</td>
<td>High</td>
<td>NP</td>
</tr>
</tbody>
</table>

^ in conjunction with Ultrasound readings

^^ integrated probe
COLLECTION AND CONVEYANCE

Network
- 2 Main Pumping stations - 1 Decanting station (Anna Stadium)
- 24 Sub Pumping stations - 3 Decanting stations
- 26 Lifting stations
- Existing length 330 km of network

De-sludging operators in the city
- 32 operators; 41 vehicles licensed in the year 2017-18
- Tank capacities range from 4000 L to 10000 L; common size is 6000 L

<table>
<thead>
<tr>
<th>Tank capacity</th>
<th>Within TCC limits / Periphery areas</th>
<th>Peripheral Areas (20 - 30 Kms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000 – 5000 L</td>
<td>1000 - 1200</td>
<td>1800 - 3000</td>
</tr>
<tr>
<td>6000 L</td>
<td>1200 - 1500</td>
<td></td>
</tr>
<tr>
<td>8000 – 10000 L</td>
<td>1600 - 2000</td>
<td></td>
</tr>
</tbody>
</table>
COLLECTION AND CONVEYANCE

Decanting station- Present State / Conditions

1. No control or record of the origin of septage. For example, grease and industrial solvents can be discharged to the receiving pit with no controls.

2. No mechanism or procedure for sampling and analysis of suspect loads.

3. Bar screens & grit removal systems - either inoperable or not in use.

4. Health and hygiene - No proper hand wash facilities for drivers, and no guard rails on open pits.

5. Number of trucks is recorded but no volume.

6. No monitoring during night hours.
Improvements in Decanting Stations

- Infrastructure: a ramp/platform/collection tank at or below ground level to ensure the complete emptying of FS; Placement of screens at an angle for the ease of removal screenings, reducing the spacing of bars in screens provided
- O & Maintenance: Conditioning the grit removal motors to working status, Regular removal of screenings and grit
- Establish a system to monitor FS quality, monitor night hours operations
- Worker health and safety
Collection and Conveyance

Decanting station – Monitoring of truck visits at Anna stadium

Number of truck visits

<table>
<thead>
<tr>
<th>Date</th>
<th>Anna stadium Private operators</th>
<th>Anna stadium TCC vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday 20/11/2017</td>
<td>67</td>
<td>6</td>
</tr>
<tr>
<td>Tuesday 21/11/2017</td>
<td>70</td>
<td>7</td>
</tr>
<tr>
<td>Wednesday 22/11/2017</td>
<td>74</td>
<td>8</td>
</tr>
<tr>
<td>Thursday 23/11/2017</td>
<td>82</td>
<td>4</td>
</tr>
<tr>
<td>Friday 24/11/2017</td>
<td>60</td>
<td>8</td>
</tr>
<tr>
<td>Saturday 25/11/2017</td>
<td>59</td>
<td>7</td>
</tr>
<tr>
<td>Sunday 26/11/2017</td>
<td>73</td>
<td>4</td>
</tr>
</tbody>
</table>
COLLECTION AND CONVEYANCE

Decanting station – Monitoring of truck visits at Pookollai

Number of truck visits

- Monday, 20/11/2017: 1 (Pookollai Private operators), 3 (Pookollai TCC vehicle)
- Tuesday, 21/11/2017: 14 (Pookollai TCC vehicle)
- Wednesday, 22/11/2017: 2 (Pookollai Private operators), 9 (Pookollai TCC vehicle)
- Thursday, 23/11/2017: 12 (Pookollai TCC vehicle)
- Friday, 24/11/2017: 3 (Pookollai TCC vehicle)
- Saturday, 25/11/2017: 1 (Pookollai TCC vehicle), 5 (Pookollai Private operators)
- Sunday, 26/11/2017: 3 (Pookollai TCC vehicle), 9 (Pookollai Private operators)
### COLLECTION AND CONVEYANCE

#### Decanting station monitoring – Customer types served

<table>
<thead>
<tr>
<th>Customer Category</th>
<th>Overall</th>
<th></th>
<th>Excluding Large Apt</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of loads</td>
<td>%</td>
<td>Number of loads</td>
<td>%</td>
</tr>
<tr>
<td>Household (Individual / Apartments)</td>
<td>468</td>
<td>78.66%</td>
<td>274</td>
<td>68.33%</td>
</tr>
<tr>
<td>Institutional (College, Schools, Hospital)</td>
<td>16</td>
<td>2.69%</td>
<td>16</td>
<td>3.99%</td>
</tr>
<tr>
<td>Commercial (Hotel / Lodge, Eateries, Marriage halls)</td>
<td>37</td>
<td>6.22%</td>
<td>37</td>
<td>9.23%</td>
</tr>
<tr>
<td>Community / Public Toilet</td>
<td>54</td>
<td>9.08%</td>
<td>54</td>
<td>13.47%</td>
</tr>
<tr>
<td>Industry / Factory</td>
<td>20</td>
<td>3.36%</td>
<td>20</td>
<td>4.99%</td>
</tr>
<tr>
<td></td>
<td>595</td>
<td>401</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Average of 25-30 loads per day by a Large apartment complex
- Majority of the Establishments and Institutions recorded more than one truck visit (*load*) to the decanting station which points to larger size containment structures
COLLECTION AND CONVEYANCE

Areas served by Anna stadium decanting station
COLLECTION AND CONVEYANCE

Areas served by Pookollai decanting station

Legend
- Desludging Locations
- Decanting Station
- Existing STP
- River
- Major Road
- Railway Line
- City Boundary

Source: TNUSSP surveyed 2017
Network and FSM:
- 25 wards fully covered
- 25 wards partially covered
- 15 wards un-covered

- Phased approach for networked system; FSM integrated into overall planning (under AMRUT)

- UGSS: Phase II & III : Expected time to complete is 5 - 7 years
  - Phase III, Phase IV areas – FSM is planned
### TREATMENT

**Assessment of Fecal Sludge and Sewage - Overview**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Waste stabilization ponds as treatment technology. Effluent discharge to Koraiyar River</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Defunct cells</td>
<td>30</td>
<td>MLD</td>
<td>TCC</td>
</tr>
<tr>
<td></td>
<td>Operating cells</td>
<td>58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Current inflow</td>
<td>45</td>
<td>MLD</td>
<td>Field estimation, estimated from pumping stations</td>
</tr>
<tr>
<td>3</td>
<td>Total capacity of ponds</td>
<td>577,716</td>
<td>m³</td>
<td>Topographical Survey</td>
</tr>
<tr>
<td>4</td>
<td>No. of Households covered by sewerage network</td>
<td>45000</td>
<td>No.</td>
<td>TCC</td>
</tr>
<tr>
<td>5</td>
<td>Amount of fecal sludge received (Max)</td>
<td>480</td>
<td>m³ per day</td>
<td>Decanting station survey</td>
</tr>
</tbody>
</table>

**Map Notes:**
- **Non functional**
- **Currently operating**
Improvements in Sewage Treatment Plant - Panjappur

Capacity: 88 MLD | Current sewage flow: 43 MLD | Technology: Waste Stabilisation ponds

- Infrastructure: requirements such as flow measurements, proper outlet structures for ponds to restrict the carryover of algae or solids.
- Infrastructural changes: Installation of air vac valves to removal of air block in the conveyance pipeline, retrofitting the old ponds.
- Operation: Regular desludging of ponds, scum and weed removal, regular screenings and grit removal (frequency should be increased).
Improvements in Sewage Treatment Plant - Panjappur

Capacity: 88 MLD | Current sewage flow: 43 MLD | Technology: Waste Stabilisation ponds

- Maintenance: reconditioning the valves, screen and grit removal systems, field measurements and laboratory analysis, establish sludge management
- Performance Improvements and Capacity Enhancement: Installation of aerators/baffles to reduce short-circuiting, improve BOD and Nitrogen removal
- Record keeping and reporting: Establish daily/monthly and annual report keeping of observations, analysis and plant maintenance
TREATMENT

Non Network: Fecal Sludge Treatment Plant

Design Capacity 32 m$^3$/ day

Key units:
- Stabilisation Tank,
- Sludge Drying Bed,
- Integrated Settler and Anaerobic Filter
- Planted Gravel Filter
- Collection Tank

CAPEX: Rs. 3.8 Cr; OPEX: Rs. 20 Lakhs per annum

Clearances: TNPCB, LPA

Re-use Options
- Treated water used for plantation within site and buffer zone
- Co-composting of sludge, develop market for compost
TREATMENT

Non Network: Fecal Sludge Treatment Plant Site Environmental Baseline

1. A baseline study quantifying and characterizing current environmental conditions is essential to assess the environmental impacts

2. Adherence to Consent to Establish conditions
   • Assessment of air, ground water and surface water quality.

3. To perform voluntary impact assessment.
   • Baseline assessment of soil and noise quality

4. Environmental Baseline completed
   • Air and Noise: at three locations within site for two days per week for two weeks
   • Ground water and Surface water: at two locations (upstream and downstream)
   • Soil: Composite sampling done at site, considering likely locations for the sludge storage and spill
O & M MODEL FOR FSTP

- **Households**
  - Direct payment for de-sludging services
  - Financial flows

- **De-sludging operators**
  - Service charges for treatment

- **Urban Local Body**
  - O & M fees (less tipping fees & reuse revenue)
  - Treatment services

- **FSTP service providers (Pvt)**
  - Tipping fees for decanting station / STP / FSTP
  - Disposal Facility
  - CAPEX from grant / State govt.

- **Re-sale revenue**

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- **Service flows**
- **Financial flows**
### CAPACITY BUILDING

<table>
<thead>
<tr>
<th>Orientation / Training</th>
<th>Date</th>
<th>Participants covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masons Training on construction of On-site Systems – Batch I</td>
<td>November 2016</td>
<td>32 Masons</td>
</tr>
<tr>
<td>Masons Training on construction of On-site Systems – Batch II</td>
<td>June 2017</td>
<td>38 Masons + Training of Trainers</td>
</tr>
</tbody>
</table>
## CAPACITY BUILDING

<table>
<thead>
<tr>
<th>Orientation / Training</th>
<th>Date</th>
<th>Participants covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sludge Operator's Orientation Programme</td>
<td>August 2017</td>
<td>22 Operator Owners and Workers based out of Thiruverumbur</td>
</tr>
<tr>
<td>Domestic Exposure to Devanahalli for TCC Officials</td>
<td>August 2017</td>
<td>City Engineer, Executive Engineer and 4 Junior Engineers</td>
</tr>
<tr>
<td>Engineers training on FSM</td>
<td>December 2017</td>
<td>Seven Junior Engineers covered</td>
</tr>
</tbody>
</table>
BEHAVIOUR CHANGE AND COMMUNICATION

World Toilet Day 2017 - KAKKAMAN Campaign Launch

World Toilet Day 2016 - Signature Campaign
### Association for Water, Sanitation and Hygiene
- 20 member committee – 10 men and 10 women
- Active since April 2017

### Roles & Responsibilities
- Monitoring public infrastructure – Water sources / Community toilets in their respective areas
- Reduce Open defecation in their neighborhood
- Promoting IHHL based on space availability
- Raise awareness about Sanitation and Hygiene
- Facilitate communication between ULB and area residents

### STAKEHOLDER ENGAGEMENT

#### AWASH committees

<table>
<thead>
<tr>
<th>Zone</th>
<th>AWASH Committees setup</th>
<th>Wards covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Srirangam</td>
<td>19</td>
<td>10</td>
</tr>
<tr>
<td>Ariyamangalam</td>
<td>23</td>
<td>13</td>
</tr>
<tr>
<td>Golden Rock</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>K-Abishekapuram</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>87</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>

*AWASH committees setup and wards covered per zone.*
STRENGTHS AND CHALLENGES

- Adequate individual Toilets
- Adequate CT/PT in place
- CT/PT improvements
- Most places accessible
- Adequate truck operators
- Vehicles in fairly good condition
- Adequate treatment facility
- Decanting stations in place
- Quality of containment structures for HH and Bulk Generators
- CT/PT Quality
- Open Dumping
- Lack of PPE
- Improvements in Treatment Facilities
- Re-use non-existent
SUMMARY

1. Build on existing strengths
   a. Community and Public toilets
   b. Private truck operators
   c. Decanting and co-treatment

2. Consider multiple options for sanitation planning
   a. Co-existence of network and FSM

3. Reduction of untreated waste
   a. Decentralized FSTP

4. Sustainable O & M Model

5. BCC, Capacity Building
City Wide Inclusive Sanitation (CWIS)

Trichy selected as CWIS city
City Wide Inclusive Sanitation (CWIS) City

Investments with cities that are intended to improve overall service delivery systems’ ability to deliver sanitation services that are: financially sustainable, inclusive, and safe.

1. Inclusivity and a focus on the poor

2. System integration of service provision across technologies and along the full value chain of sanitation functions, from containment, conveyance, through complete treatment

3. Helping cities embrace new technologies

4. Taking risks and showcasing innovation

5. Rigorous measurement and learning

6. Flexibility and leveraged investments

7. Using convening power

8. Access to a strong and growing community of practice
CWIS Principles

Prioritise the human right of all to sanitation
- Develop inclusive strategies and programs to reach the most vulnerable, especially women and children
- Focus on informal settlements and account for land tenure insecurity
- Show political, technical and managerial leadership
- Allocate sufficient funds for investment and O&M
- Empower qualified staff
- Take calculated risks to shift the status quo: start addressing the challenges!

Deliver ‘safe management’ along the whole sanitation service chain
- Address complex problems rather than deliver fixed solutions
- Allow for a diversity of solutions and approaches, focusing on outcomes rather than technologies
- Focus on innovation, testing and evaluating approaches
- Facilitate progressive realization, building on what is already in place – embrace incrementalism
- Recognize the trade-offs that exist along the sanitation service chain
CWIS Principles

Recognise that sanitation contributes to a thriving urban economy

- Integrate sanitation in urban planning and renewal
- Clean up city streets: remove unsightly pollution and bad odours
- Increase resource recovery and reuse
- Reform regulatory policies
- Recover water bodies for recreation and for fauna and flora

Commit to working in partnership to deliver citywide inclusive sanitation

- Embed sanitation within urban governance. Use an integrated approach: link to water supply, drainage, solid waste management, paving, affordable housing, urban development
- Leverage urban development, health, education and environmental budgets and savings thanks to improved sanitation
- Establish clear roles and responsibilities, with accountability and transparency
- Articulate and build demand and engage with civil society at the grass roots level
Thank You!