



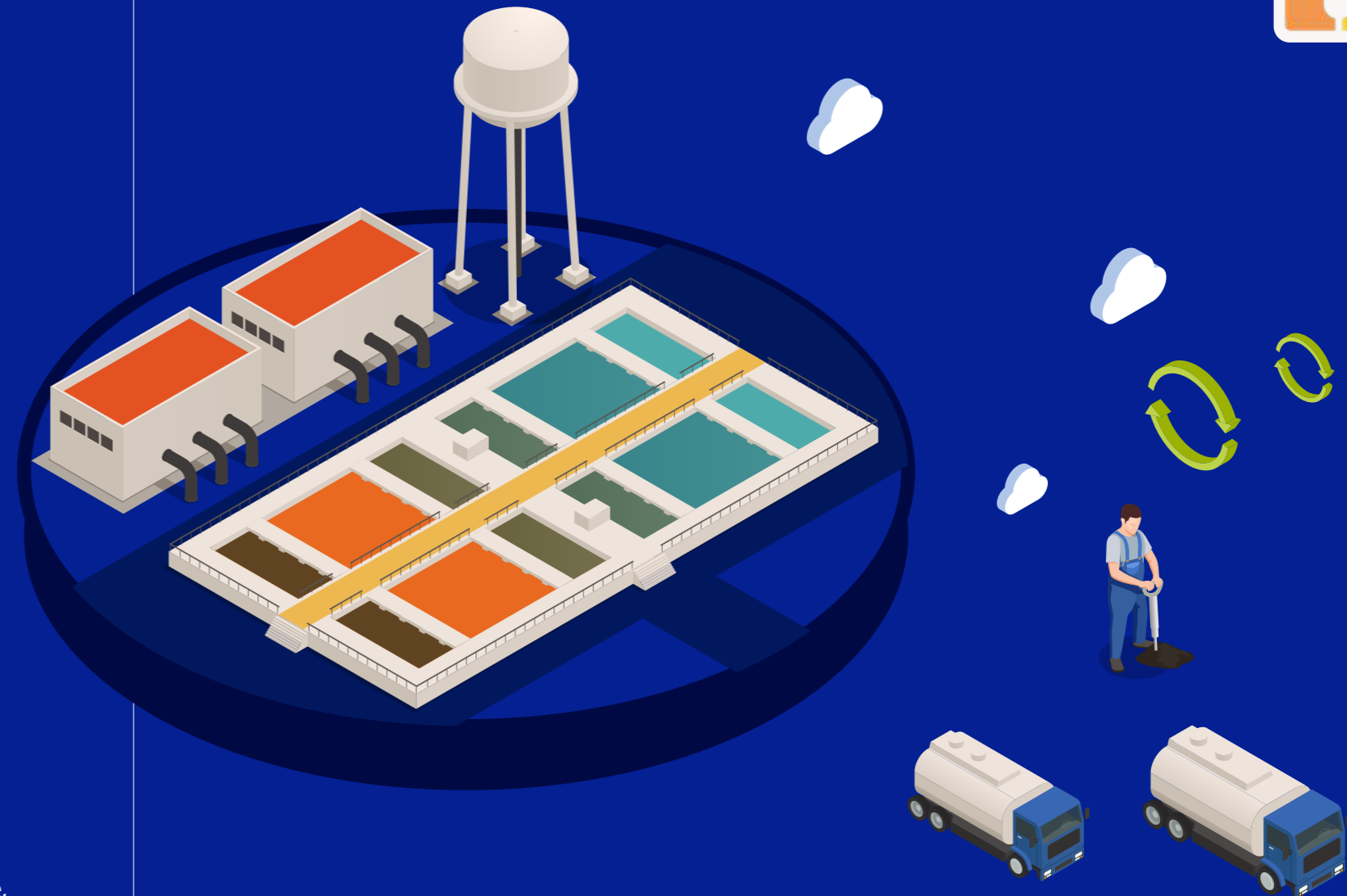
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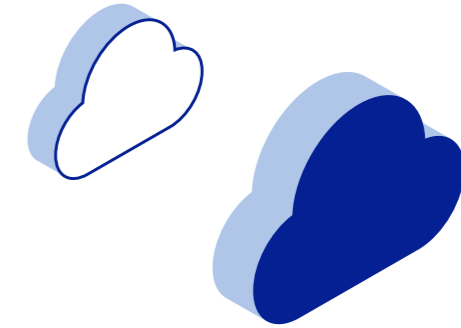
Business of Change

Models of success in Faecal Sludge and Septage Management (FSSM)



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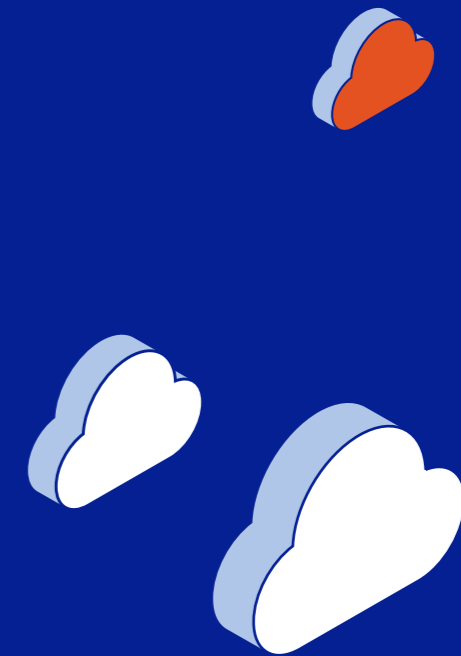
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Knowledge Partner





Preface

Some eighty percent of the world's wastewater is dumped—largely untreated—back into the environment, polluting rivers, lakes, and oceans. More than sixty percent of sewage generated by urban India enters untreated into water bodies like rivers and lakes, resulting in pollution and making the water unfit for human consumption. A study by Odisha State Pollution Control Board on water quality of eleven major river systems across the State revealed water to be found unfit for human use at ninety odd places. In Delhi too, untreated sewage makes its way to the Yamuna, adding to its pollution. Without action, the challenges will only increase by 2050, when global demand for freshwater is expected to be one-third greater than it is now.

Most importantly, within the sanitation target of SDG 6.2, for the first time, the focus is not only on toilet access, but on managing the entire sanitation value chain, encompassing containment, emptying, transport, treatment and safe reuse or disposal. This has actually paved the way for a paradigm shift, where thinking goes beyond piped sewers. Sewer-based systems are prohibitively expensive and resource-intensive. In fact, the cost of Faecal Sludge Management—FSM (decentralized) technologies is five times less expensive than conventional sewer-based ones in urban areas, depending on the local conditions. These represent viable and more affordable options, if the entire service chain gets managed adequately.

Accordingly, we look to disseminate great examples of FSM from across ten states of India through ISC's 4th best practices compendium of the series, "Business of Change" titled

“Models of Success in Faecal Sludge and Septage Management (FSSM)”. This compendium carries ten State level cases in a framework that inter alia captures inception & planning, institutional setup, operations & technology used, financial & business models, and successes & lessons learnt.

As we move towards achieving OFF+* and ODF++** cities in the urban context and ODF-S villages and communities in rural, we hope that this compendium, like the earlier ones, will be a useful publication for all the key players and sector practitioners and inspire many others to further intensify their efforts for a cleaner and healthier India.



Naina Lal Kidwai

Chair, India Sanitation Coalition

*A city / ward / work circle can be notified/declared as SBM ODF+ city/ SBM ODF+ ward/SBM ODF+ work circle if, at any point of the day, not a single person is found defecating and/or urinating in the open, AND all community and public toilets are functional and well maintained.

** A city / ward / work circle can be notified/ declared as SBM ODF++ city/ SBM ODF++ ward/ SBM ODF++ work circle if, at any point of the day, not a single person is found defecating and/ or urinating in the open, all community and public toilets are functional and well maintained, and faecal sludge/septage and sewage is safely managed and treated, with no discharging and/or dumping of untreated faecal sludge/septage and sewage in drains, water bodies or open areas.



अरुण बरोका, आई.ए.एस.

अपर सचिव

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Additional Secretary



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Foreword

Swachh Bharat Mission was launched in 2014 by Hon'ble Prime Minister of India with the vision of achieving 'Clean India' by 2nd October 2019, the 150th birth anniversary of Mahatma Gandhiji. On 2nd October, 2020, when we celebrated the unprecedented success of 6 years of the mission, we realised how every citizen of India had come together to turn that dream into reality.

Government of India, in February 2020, approved Phase-II of the SBMG with a total outlay of Rs. 1,40,881 crores to focus on the sustainability of ODF status and Solid and Liquid Waste Management (SLWM). SBMG Phase II is planned to be a novel model of convergence between different verticals of financing and various schemes of Central and State Governments. Apart from budgetary allocations from Department of Drinking Water and Sanitation and the corresponding State share, remaining funds will be dovetailed from 15th Finance Commission grants to Rural Local Bodies, MGNREGS, CSR funds, and revenue generation models, etc., particularly for SLWM.

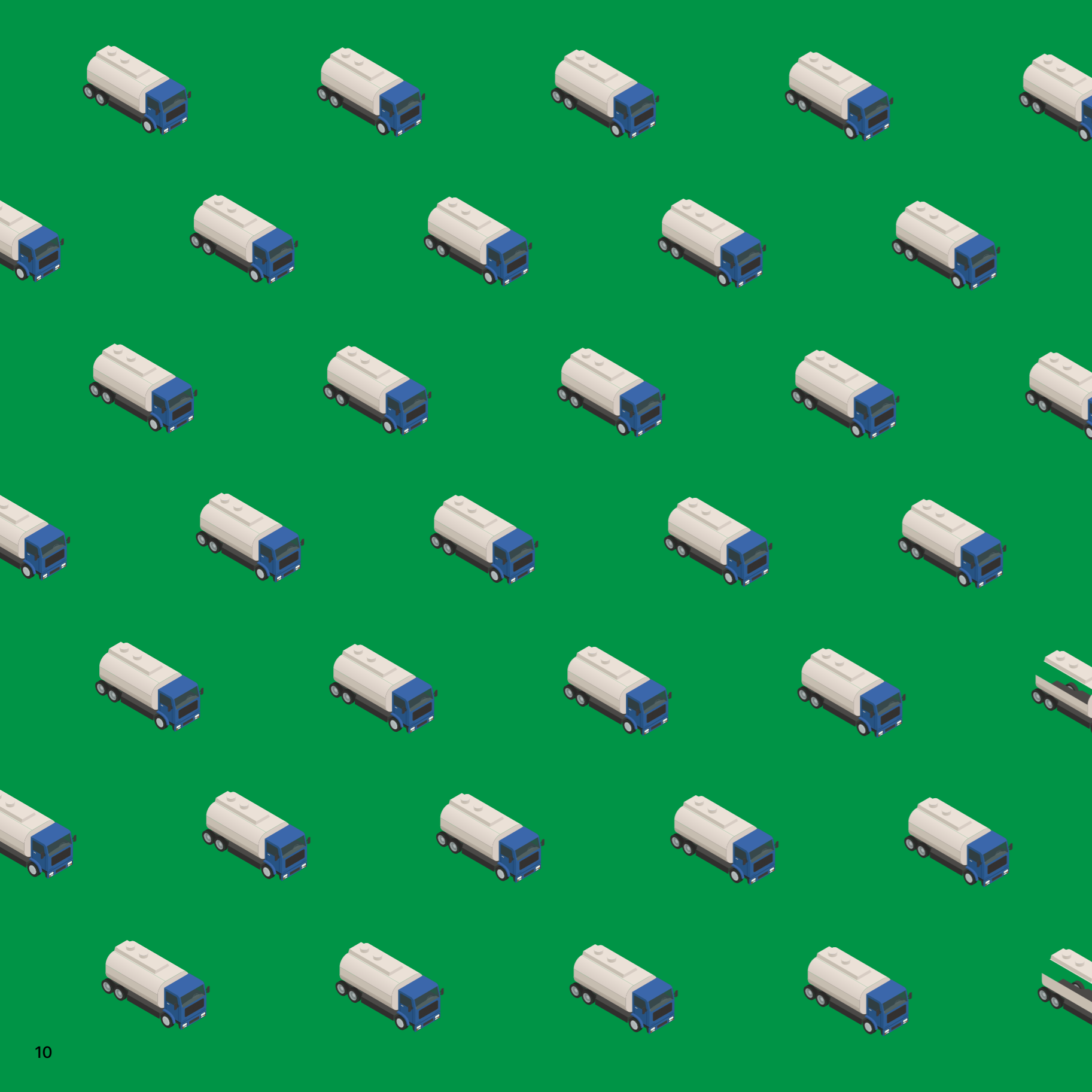
SBMG Phase II has been uniquely designed to leverage the capacity of individuals and communities in rural India to create a people's movement to ensure that the ODF status of rural areas is sustained, people continue to practice safe hygienic behaviour and that all villages have solid and liquid waste management arrangements. Accordingly, SBM 2.0 intends to pursue faecal sludge management (FSM) besides expanding the infrastructure coverage and access, biodegradable waste management, plastic waste management and greywater management.

I am happy to see that in alignment with SBM 2.0 goals, the India Sanitation Coalition, within their action framework of Build, Use, Maintain, Treat, is focusing on collecting the excreta and treating it, to remove pathogens & bacteria and looking at uses for the wastewater and waste to generate fertilizer or power. The 'treat component' in the sanitation value chain assumes extra significance amid the COVID-19 outbreak as we look to build the immunity of our citizens through good hygiene behaviour.

This compendium, "Business of change: Models for Success in Faecal Sludge and Septage Management (FSSM)," is a much needed compilation of successful cases of FSSM in the country. We need such publications, which capture lessons indicating operational approaches & solutions for the planners and sector practitioners who are active in the space of treatment with particular reference to FSM.

My best wishes to the India Sanitation Coalition team as they disseminate these case studies to catalyse FSM intervention across the country, to achieve a cleaner, healthier India.

(Arun Baroka)



Acknowledgements

The Secretariat, India Sanitation Coalition (ISC) gratefully acknowledges the support and guidance received from Ms Madhu Krishna, Deputy Director, Bill & Melinda Gates Foundation, India Office in mobilising support for data for this knowledge product from across different states through the National Faecal Sludge and Septage Management Alliance (NFSSMA) partners. And Ms Parnasha Banerjee, Team Lead-Urban Sanitation at Dasra was immensely helpful in coordinating with these partners, so deserves to be earnestly thanked by ISC.

The preparation of this compendium involved contributions from ten State partners: EY for Odisha, represented by Ms Elisa Patnaik; Centre for Water and Sanitation (C-WAS), CEPT University for Maharashtra, represented by Dr Meera Mehta, Dr Dinesh Mehta, Mr Dhruv Bhavsar and Mr Aasim Mansuri; Indian Institute for Human Settlements for Tamil Nadu, represented by Ms Gayathri Sarangan, Ms Mahima Vijendra and Ms Srinithi Sudhakar; Administrative Staff College of India for Andhra Pradesh and Telangana, represented by Prof. Srinivas Chary and Prof. Malini Reddy; KPMG for Chhattisgarh and Madhya Pradesh, represented by Dr Abhinav Akhilesh and Ms Sreejita Basu; Centre for Science and Environment for Uttar Pradesh, represented by Dr Suresh Kumar Rohilla; IPE Global for Rajasthan represented by Mr Suraj Kumar; and UNICEF for Kerala and Odisha Rural, represented by Mr Tithal Parmar and Ms Shipra Saxena, respectively. The secretariat, ISC would like to extend their gratitude to all the above organizations and individuals that contributed to the development of this compendium. Special thanks are due to our knowledge partner Nayara Energy Ltd. for kindly sponsoring the publication.



Preamble

After rural India being declared open defecation free (ODF) on 2nd October, 2019, the Union Housing and Urban Affairs Ministry announced that the Swachh Bharat Mission (SBM)-Urban had achieved its goal of making urban India free of open defecation too, though urban local bodies in West Bengal had not been declared ODF.

Indeed, 'Swachh Bharat' or Clean India is a dream come true for all of us; however, to those who have witnessed the sector at close quarters, the success of the mission is even more remarkable, for prior to the launch of the mission on October 2, 2014, the importance of sanitation always took a back seat to the more immediate demands of development that included maternal and child health and ICDS among others. And then in just about five years of the mission, if there are claims, with or without verification, to have achieved ODF status for a country of the size of ours, where half the population defecated in the open till October 2014, these can only be deemed as awe-inspiringly brave, deserving a huge round of applause.

Post these outcomes, there is now a need to sustain the gains made under the mission and to ensure that the health and hygiene benefits continue to be realized for the Indian populace. For that, it is critical that ODF behaviours are sustained, and every village / ward has access to solid and liquid waste management.

So, clearly, providing adequate access to sanitation facilities does not end when onsite technologies are built (twin pits and septic tanks). The target to achieve access to adequate and equitable sanitation has accordingly been upgraded to include the safe disposal or offsite treatment of excreta collectively called the faecal sludge and septage management (FSSM).

It is important to keep in mind that onsite or decentralized technologies can provide sustainable solutions in all areas of the country. Sewer-based solutions are effective but are also very resource-intensive and expensive.

There are several examples of successful cases of FSSM in the country—10 KLD Faecal Sludge Treatment Plant (FSTP) at Kalpetta, Wayanad, Kerala; Devanahalli plant, commissioned in 2015, handling waste from 20,000 residences; and FSTP at Leh, since 2017, with a treatment capacity of 12 cum/day are just to name a few. All these examples illustrate the importance of institutional frameworks and that of clear roles and responsibilities for FSSM. Pre-project planning and a sound operations and maintenance plan are another area of interest for whosoever wishes to provide these services on a sustainable basis.

India Sanitation Coalition believes in Build, Use, Maintain, Treat. After Build and Use, our focus now is on collecting the excreta and treating it, to remove pathogens & bacteria and looking at uses for the wastewater and waste to generate fertilizer or power. The 'treat component' in the sanitation value chain assumes extra significance amid the COVID-19 outbreak, for there are evidences that similar viruses (but no evidence to suggest that SARS-coV-2 too can) can remain infectious for days to weeks in the untreated wastewater. Anyways, human waste is hazardous and contains numerous pathogens, so should be safely managed in all settings.

We are accordingly making an attempt to curate the successful cases of FSSM in the country, leveraging advisory resources of the National Faecal Sludge and Septage Management (NFSSM) Alliance, supported by Bill and Melinda Gates Foundation, for lessons to indicate operational approaches & solutions for the planners and sector practitioners who are active in the space. This compendium, namely, Business of change: Models of Success in Faecal Sludge and Septage Management (FSSM)

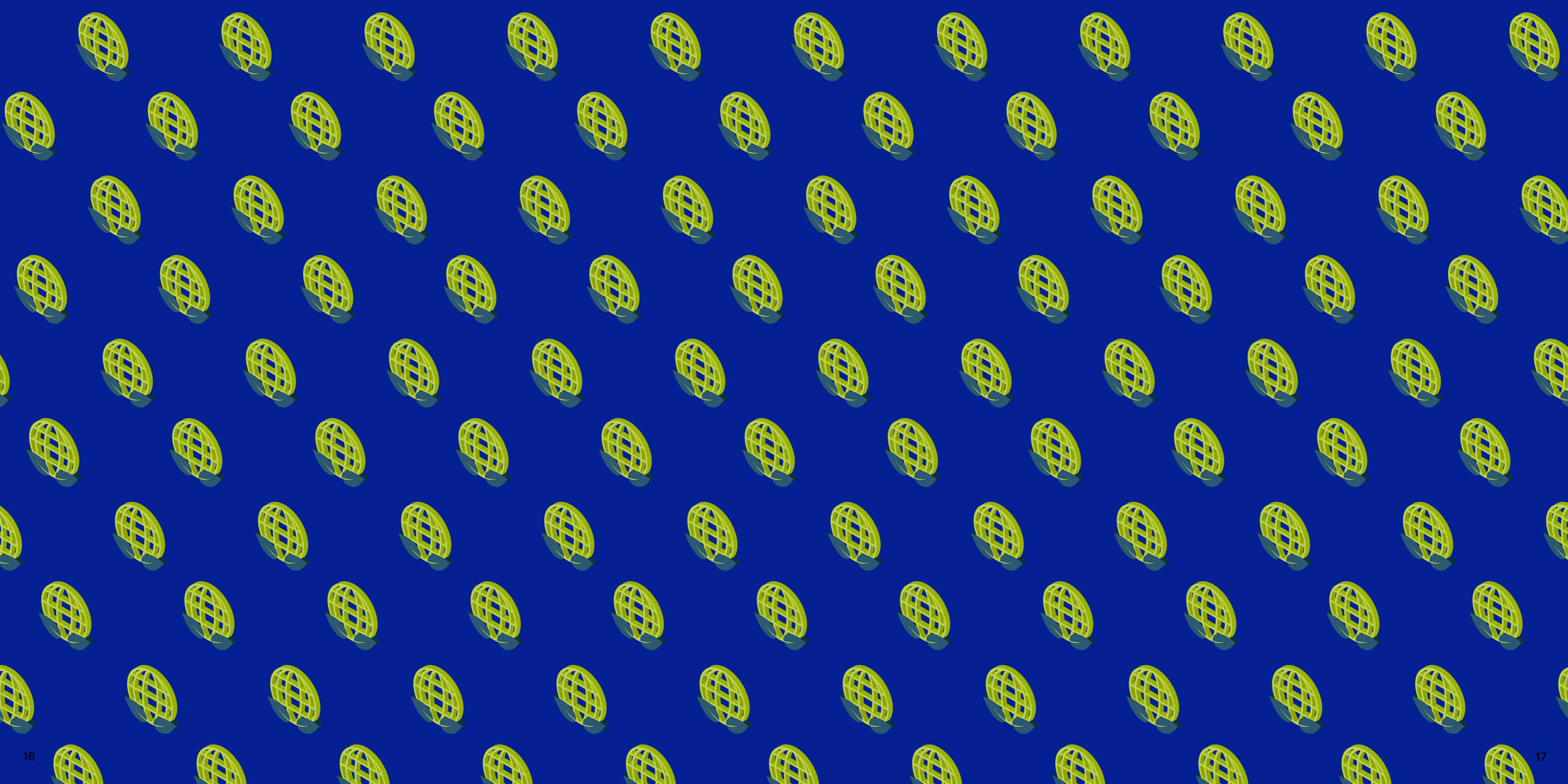
is fourth in the series, the previous three being Corporates in Sanitation; Thinking Beyond Shit-pots; and Partnerships in Sanitation.

We hope the compendium shall be well-received by its prospective readers.



Meenakshi Dewan

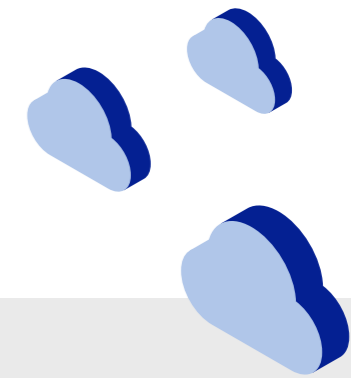
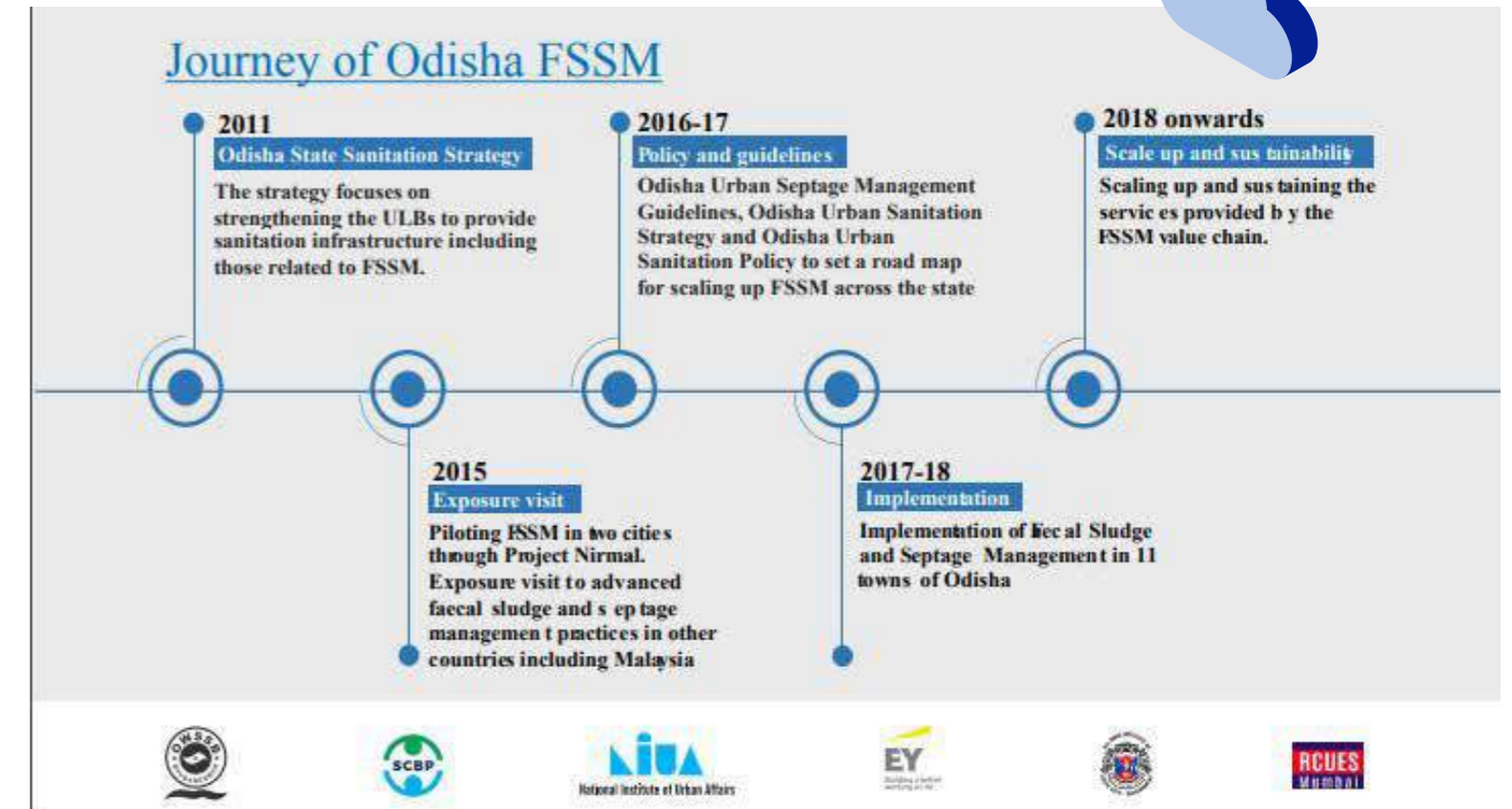
CEO, India Sanitation Coalition



Odisha

Context

With growing urbanisation, sewage and septage have emerged as one of the biggest pollutants of water bodies and ground water in urban areas. A study by Odisha State Pollution Control Board (OSPCB) on water quality of 11 major river systems across the State revealed water to be found unfit for human use at 90 places. Twelve rivers passing through major cities were identified as being contaminated due to flow of untreated sewage and septage. Realising the serious effect of untreated human waste on the water bodies of the State, the Government of Odisha in 2016 decided to adopt a non-sewer, decentralised and sustainable approach towards Faecal Sludge Management (FSM). The Housing & Urban Development Department (H&UDD) is the nodal government department responsible for implementing FSM through Urban Local Bodies (ULBs) along with parastatal organisations like the Odisha Water Supply and Sewerage Board (OWSSB), Public Health Engineering Organization (PHEO) and Water Corporation of Odisha (WATCO).



Initiation and Planning Process

Following Principal Secretary, H&UDD's visit to Malaysia in 2016 to study the implementation of FSM and the government's partnership with the Bill & Melinda Gates Foundation (BMGF), FSM was initiated in two towns of Dhenkanal and Angul under Project Nirmal. As most of the major rivers in the State flow through nine major cities having more than 50 % of the State's urban population and were polluted by untreated sewage and septage, the Department took a holistic view and decided to implement the FSM model in these nine cities.

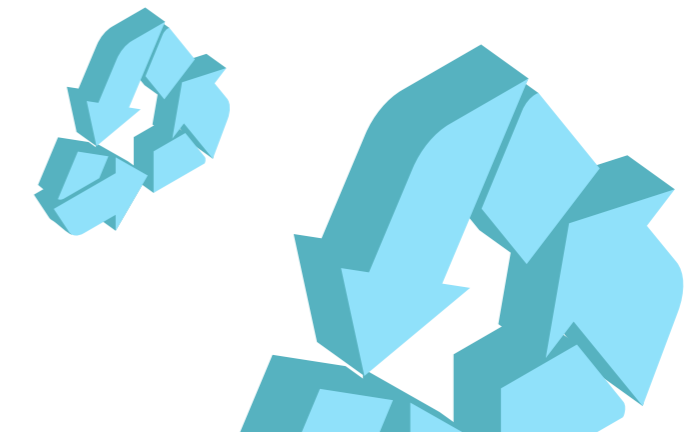
Budgetary allocation

Besides its own budgetary allocation, the State Government leveraged funds from the AMRUT scheme for setting up of faecal sludge and septage treatment infrastructure in the urban areas. This intervention helped the State in addressing the river water contamination issues.



Improving access to mechanized desludging & strengthening processes

It was seen that limited number of cesspool vehicles across the State was a key gap in the safe collection and transportation of septage from toilet septic tanks in households and other properties. So, apart from the existing cesspool vehicles, the government procured 86 additional vehicles through its own funds during 2016-17 and provided to the needy ULBs to improve services across 114 cities of Odisha. Moreover, smaller cesspool vehicles were also procured for the cities to increase mechanized desludging in areas with narrow lanes and difficult to access streets. A total of 211 cesspool vehicles are now operational in the entire State. The cesspool vehicles provided to private operators through tender basis, capping the desludging rates within INR 1000, provide affordable services to the citizens. Furthermore, the State notified guidelines and Standard Operating Procedures (SOPs) for safe emptying, transporting and disposing of septage. Innovations in low-cost and safe temporary disposal at the Deep Row Entrenchment (DRE) sites as an interim solution, technological interventions through usage of GPS for tracking movement of cesspool vehicles and establishment of single window system for seeking cesspool vehicle services were among the other steps taken.



Adoption of low-cost technology for treatment facilities

The State decided to adopt the Decentralised Wastewater Treatment System (DEWATS) technology for the treatment process considering its cost-effectiveness and requirement of semi-skilled human resource for its operation and maintenance. While land for setting up treatment facilities was provided by the state government, OWSSB was in charge of designing, developing plan and estimates and construction of the SeTPs. As a result, six SeTPs were first inaugurated in six major cities of the State in October 2018 followed by four more septage treatment facilities commissioned in 2019 in four other cities benefitting a total urban population of nearly 52%. The septage treatment facilities are now treating the waste generated by 10 major cities thus considerably reducing the disposal of untreated faecal waste into water bodies.

Scale-up from 10 to 114 cities

Strengthening its commitment to river pollution abatement and improving urban sanitation, the Hon'ble Chief Minister of Odisha Shri Naveen Patnaik announced the scaling up of FSM services from 10 ULBs to all 114 ULBs of Odisha during the National FSM Workshop held in Bhubaneswar during October 2018. Consequently, the government has started construction of another 29 treatment facilities which will be functional in 2020. With a total of 106 SeTPs under various stages of development which would be operational by 2021, Odisha will be treating septage generated by nearly 100% of the total urban populace. With the completion of sewerage system projects in Bhubaneswar, Cuttack, Sambalpur and Rourkela by 2021, the treatment coverage of sewerage and septage will increase to cover 100 % of the urban population by the year 2021.



FSM Regulations and their enforcement

Taking cognizance of the fact that creation of infrastructure alone will not bring the desired results, the government adopted a holistic approach involving capacity building, policy level changes and social engineering efforts. This led to the framing of Model FSM Regulations for the entire State in 2018 which is adopted by all the ULBs. As per the FSM Regulations, it is now mandatory for all cesspool emptier vehicles to dispose septage only at the SeTPs or designated temporary disposal sites and non-compliance results in heavy penalty for operators.

The enforcement of Regulations has led to seizure of cesspool vehicles along with imposition of fines in several cities. Besides, property owners with insanitary toilets discharging toilet waste into the open are also penalised under these regulations by the ULBs.

Sustainable FSM & system strengthening

The Odisha Government has taken several steps to implement non-sewered sanitation solution in the ULBs by laying down standard operating procedures, building capacities and regular monitoring to ensure the sustainability of the interventions. Moreover, the State is also focused on efficiency of operations of the treatment plants and optimization of the assets and facilities. The SeTP in the Capital City of Bhubaneswar for example is managing faecal waste generated by nearly two lakh people of the City. An additional plant is now being set up to treat and manage waste of the growing population. With an objective of ensuring reuse and recycle of treated water and waste, parks are

developed in the SeTP sites where the treated water is used for watering the lawn and plants and waste is used as manure in the garden. Tie-ups are been made with the Forest Department and ULBs for using the treated solids as manure for non-edible plants in parks and forests.

Community engagement for FSM

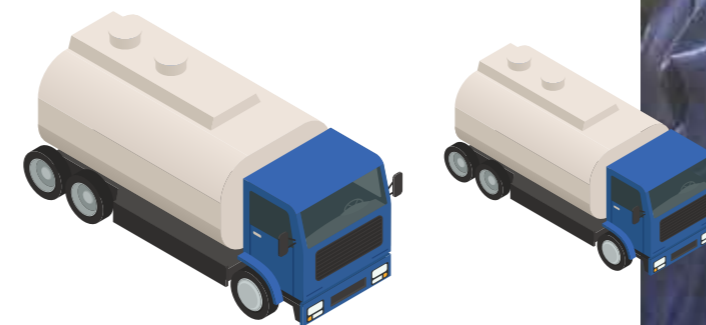
Community managed sanitation infrastructure not only results in better ownership among the larger community but also makes it sustainable in the longer run. Women and transgender Self-Help Groups (SHGs) have been now engaged for the O&M of treatment facilities in eight cities of - Berhampur, Baripada, Sambalpur, Cuttack, Angul, Dhenkanal, Balasore and Rourkela - which is soon going to be extended to other towns. The SHG members have not only a regular source of income but have also emerged as successful leaders and service providers in their communities. The State has also been undertaking regular communication campaigns for creating awareness and demand generation for FSM services. Community based organisations, particularly women SHGs have been playing a significant role in advocating key behavioural changes and in assessment of household and community level FSM infrastructure and services.





Institutional set-up

While the H&UDD is the nodal department responsible for overall implementation of FSM in the State, the OWSSB, PHEO and the ULBs collaborate at the city level. A Technical Support Unit (TSU) managed by Ernst and Young set up at the state level with city level presence provides technical assistance to both the Department and the ULBs. Aiding the H&UDD largely is OWSSB which plays a major role in providing technical guidance especially in design, construction and O&M of the SeTPs. Other parastatal organizations like the Public Health Engineering Department (PHED) and Water Corporation of Odisha (WATCO) are now involved in implementation of FSM in the State at city levels. In addition, the District Urban Development Agency (DUDA) headed by the District Collector is the focal organization at the district level to oversee and review FSM in all towns and cities under it. The ULBs have been capacitated to carry out FSM activities and are supported by Community Based Organizations (CBOs) like women SHGs, Water and Sanitation Committees (WSCs) who are closely involved in highlighting critical issues and in resolving them with the help of ULBs.

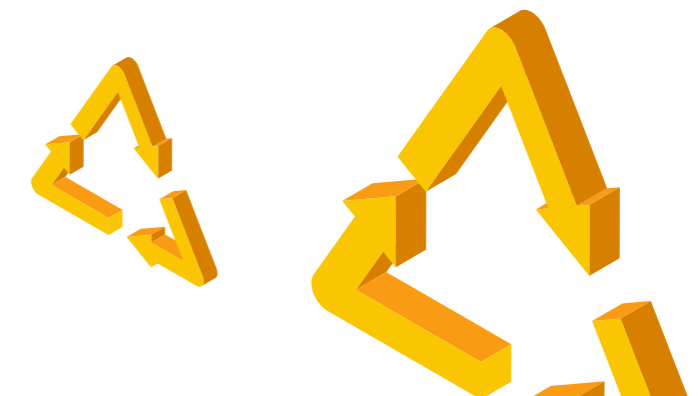


Operations and technology used

Odisha decided to adopt the DEWATS technology with sludge drying bed, a gravity based biological system. The facilities have a gravity flow-based system, where septage collected through cesspool emptier trucks is discharged to receiving chamber from where it flows to different units by gravity. The technology requires minimal electro-mechanical interventions to run the process and is cost effective as compared to other technologies. In addition, it is thought to be a plausible technical solution for the state-wide scale-up of treatment facilities. The treatment facilities were first started in 2016 under Project Nirmal - a collaborative project between Govt. of Odisha, Practical Action and Bill and Melinda Gates Foundation (BMGF) where the Faecal Sludge and Septage Treatment Plants (FSTPs) were set up in Dhenkanal and Angul. The treatment plants other than the tertiary treatment were designed to operate based on gravity model. Soon after, the DPRs for the first phase of nine SeTPs in the AMRUT cities were prepared by the OWSSB. The plant capacity for the cities was determined as per the population and the daily septage generation. While the construction of the SeTPs was carried out by tendered private contractors, the construction was closely monitored by the OWSSB and the FSM TSU. The State also utilized the existing infrastructure and adopted co-treatment technology for septage management. In Puri, for example, the solids present in the septage are separated in a setting-cum-thickener tank and taken to the sludge drying bed for drying and disposal. The liquid part of the septage is treated in the 15 MLD Sewage Treatment Plant (STP) located adjacent to the SeTP.

Key features

- User-friendly O&M such as minimum/zero energy consumption minimizes O&M costs with need for mostly semi-skilled human resource
- No human contact with faecal waste
- Minimal odor during entire process from transportation to treatment
- Gravity based system, based on natural and biological treatment, with no use of chemicals and minimal use of electricity
- The low-cost technology, O&M demonstrates a scalable and sustainable model for septage management in India
- Landscaping, plantation and solar paneling makes the SeTP environment friendly and socially acceptable
- Landscaping in the vacant area of the plants reuses the treated wastewater and the sludge



Subsequently, as the State progressed towards expansion, DPRs were prepared for other cities covering the total urban population. The treatment plants/cities are clubbed into packages and tendered to achieve scale and facilitate speedy implementation. In Odisha, the hydraulic design of SeTP is done by OWSSB while construction is tendered out using a detailed engineering, procurement and construction contract model on least cost basis. Currently, while OWSSB is responsible for the O&M of the functional plants in the State, it had been decided to outsource the O&M to a third party. After considered deliberation the Government decided to take the path-breaking decision of handing over the O&M of the plants to women SHGs and their federations. The women SHGs are chosen after careful evaluation of their capacities and past track record and are trained thoroughly and rigorously on different aspects of O&M. The O&M of the plants have now been transferred to SHGs and their federations through a service contract between the SHGs/federations and the concerned ULBs. This seems to be a viable option considering the availability of otherwise limited human resource and the scale up in the State. Also, since the operation requires semi-skilled HR, the women SHGs with adequate training are found to be appropriate for the task. While the State has been making efforts to build treatment facilities covering the entire state, it has also taken interim actions to curtail indiscriminate disposal of faecal waste through the DRE technology. The DRE method is being promoted as a temporary solution for safe disposal of faecal sludge and for towns with available land and a need for temporary disposal of faecal sludge, it is proven to be a viable solution. Currently, there are 94 functional DRE sites in Odisha. These serve as an interim measure before moving to a SeTP. Although DREs are simple and easy to construct and low on investment and O&M cost with minimum infrastructure requirement, it is inappropriate for high groundwater table or near surface water body and the approach is redundant during monsoon season.

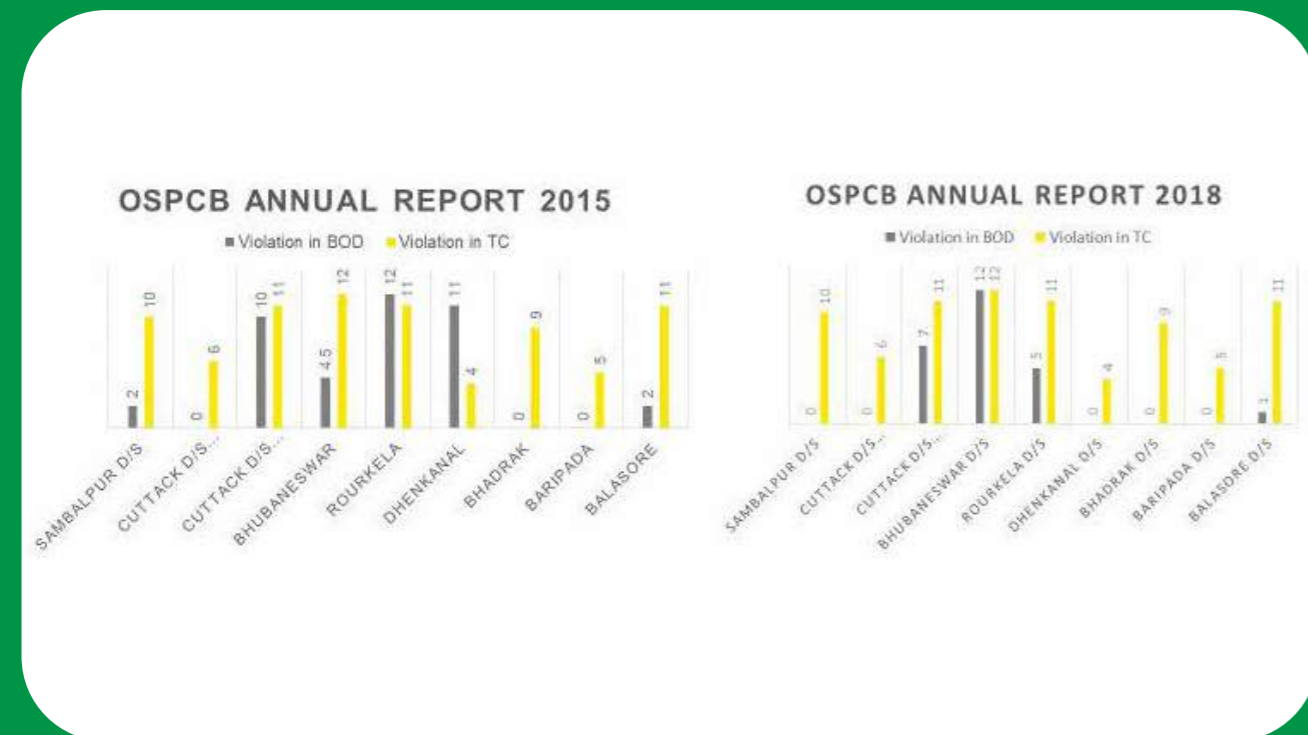
Financial and business model

Sanitation services are largely provided by the government sector in Odisha at a subsidized cost since it is considered as an essential service. The government pooled funds from various sources and programmes for implementation of FSM in the State. While the nine SeTPs in the first phase were set up through convergence from AMRUT funds, the other SeTPs are being constructed with the State funds. Funds were also sourced from convergence with other programmes like the SBM (U) and National Urban Livelihood Mission (NULM) especially for capacity building and IEC activities. Funds from other sources such as the District Mineral Fund (DMF) will now soon be accessed for sanitation including FSM.

Procurement of other assets such as cesspool emptier vehicles have been made from state funds and contracted to private operators ensuring that the desludging rates be capped at INR 1000 with annual revision of rates. The low Capex and Opex for treatment facilities along with community management also ensure that the plants remain sustainable in the future. The Department has been laying utmost stress on plant stabilization and optimization through various measures. Resource recovery from treated sludge is also being explored by the State through the Department of Forest and Directorate of Horticulture. For the additional SeTPs, the Department has payment milestones at low quantum to ensure contractors can work with minimum revolving funds thus encouraging engagement of private sector.

Successes and lessons learnt

The State's efforts in implementing FSM has resulted in a remarkable transformation - from 2% treatment of faecal waste till 2016, to 82.5% either being safely treated or disposed in 2019. Moreover, a comparison of OSPCB data reveals that the frequency of violations regarding water quality of the major rivers has either remained constant or gone down. The average total coliform in the cities of Sambalpur, Cuttack (Mahanadi system), Dhenkanal and Baripada has reduced considerably which could be attributed to the implementation of the FSM in these cities.



The State's innovative efforts in establishing DREs as an interim method for designated disposal of faecal sludge and septage has been acknowledge nationally, with the Central SBM (U) programme recognizing it as a technology to declare a city as ODF++ for population less than 20,000. With FSM being a key sanitation agenda, the H&UDD has been stressing on its regular monitoring and review at city, district and state levels. With regular capacity building on health and environmental impact of FSM, technology, O&M of infrastructure and facilities, guidelines and regulations, community engagement and communication, ULBs and other parastatal organizations have now enhanced capacities to implement FSM. The officials have also been exposed to best practices implemented in other states and countries and regularly interact with national and international delegates and FSM practitioners.

Odisha's efforts in FSM were lauded by both national and international delegates during the National FSM Workshop at Bhubaneswar in October 2018. Besides the Hon'ble Chief Minister, Housing & Urban Development Minister and the Chief Secretary of Odisha, Secretary and Additional Secretary to Government of India and several senior officials from 16 states and Union Territories (UTs) graced the event alongside more than 350 international and national participants. The State's commitment to FSM has been appreciated by senior officials from MoHUA, Ministry of Jal Shakti and the by the Hon'ble National Green Tribunal (NGT).

The steps taken by the State have also been recognised in various national level platforms and forums. The Govt. of Odisha was awarded with the AMRUT Urban Reforms Award 2017-18 for achieving reform milestones including milestones on septage management in 2018. The India Sanitation Coalition (ISC)-FICCI Sanitation Awards 2019 awarded

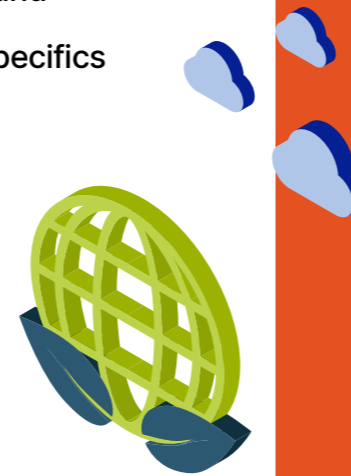
the Odisha Government under the Special Recognition Award (Urban) for its demonstrated initiatives in implementation of FSM in the State of Odisha. It was also felicitated at the National Workshop on Non-Network Sanitation Systems held at Mussorie in 2019. Witnessing the FSM solutions adopted by the State bearing results, there has been a steady stream of national and international visitors to the State to observe its treatment facilities and to understand the specifics of FSM implementation.

Lessons

- **Adoption of a multi-stakeholder approach & convergence with other programs:**

The State has adopted a multi-stakeholder approach for FSM engaging with multiple partners at various levels which includes government officials from the state, districts and cities, parastatal institutions (OWSSB, PHED, WATCO), OSPCB and also CBOs and communities. Convergence with the NULM and the National Health Mission (NHM), particularly for community engagement has not only increased awareness on the criticality of FSM but also helped in demand generation.

Convergence with the Road Transport Office (RTO) and traffic police also helped ULBs in enforcing the FSM Regulations effectively. Together, these helped in building an enabling environment for FSM in the State.



- **Allocation of suitable land for setting up treatment facilities:**

Considering its experience of setting up 10 SeTPs in the first phase where land allocation issues delayed work in three towns due to community agitation and lack of suitable land, it was realized that identifying appropriate land earlier and within a stipulated timeline is key to develop the treatment facilities faster. Five towns adopted co-location with either STP or Solid Waste treatment site which has expedited land allocation. Subsequently, the Department undertook a rigorous land identification process with support from key officials at the ground level so that it could be handed over to the private contractors for building the SeTPs.

- **Clustering of SeTPs:**

Initially the State decided to cluster the establishment of SeTPs based on geographical proximity to ensure project cost was similar. However, it created administrative challenges since the private contractor had to coordinate with multiple government divisions of PHEDs. As a result, it is now being clustered as per PHED divisions for ease of administration and reconciliation of bills.

- **Adoption and enforcement of FSM Regulations:**

It was soon realized that in order to optimize infrastructure and treatment facilities and also to penalize defaulters across the FSM value chain there was a need for an exclusive law and

its effective enforcement. This led to the formulation of the model FSM Regulations 2018 and its adoption by all the 114 ULBs of the State

- **Flexibility in government tenders related to FSM infrastructure:**

Government tenders related to FSM need to be flexible considering that it's a new and upcoming sector to promote engagement of private sector in establishing SeTPs, procurement of cesspool vehicles etc. During the first phase, the tenders were not very flexible but the eligibility criteria was relaxed subsequently.

Challenges and possible resolutions

Optimisation of Treatment Plants: The plants are established based on generation or population of a city. However, the utilisation of cesspool vehicle services is based on the demand. Thus, there is a gap between plant capacity and faecal sludge/septage desludged, as a result, the plants will remain oversized and underutilised. To meet this challenge, demand generation for periodic desludging through regular IEC campaigns and activities are being undertaken. Enforcement of FSM Regulations for both service providers and property owners are also expected to improve plant optimisation. Optimum utilization of the SeTPs is a priority area and is regularly monitored by the senior most officials.

Resource recovery: At present, no standards exist on reuse of treated bio-solids specific for FSM. So, it is a challenge to test the sludge quality especially in smaller cities where FSM is being scaled up and no facilities exist. A possible solution could be formation of standards particularly for treated sludge, setting up regional testing laboratories so that testing for resource recovery could be undertaken in the future.

Lack of after sales services for cesspool vehicles: Absence of after sales services for cesspool vehicles especially in far flung towns is a major concern resulting in vehicles remaining unutilised for a long time. Breakdown of cesspool vehicle is a major concern in the ULBs. Currently, a region-wise list of private agencies providing after sales services is being prepared so that they can be directly approached by the ULBs for quick repair of the vehicles.

Conclusion

The steps taken by the Government of Odisha in implementing FSM have been lauded by FSM championing organisations, Central and several state governments and policy makers. A sustained and integrated approach to FSM in the coming years is expected to considerably improve the water quality of the major rivers in the State.





Rural Odisha steps towards rural FSM

Background

In October 2019, India completed the first phase of Swachh Bharat Mission (SBM), which in 2014 made the commitment to provide access to household sanitation to at least 120 million homes by this date. Odisha, one of the least urbanized states in the country, as the majority of its population resides in rural areas, had heard the clarion call given by the Prime Minister, like many others, to make the State open defecation free (ODF) by increasing toilet coverage besides ensuring usage of the created toilet infrastructure. Along the way, recognizing that the toilets would eventually require the faecal waste to be disposed of to ensure their sustained use, Odisha started also focusing on how to establish the entire value chain for sanitation, from safe containment and separation of waste from human to safe disposal and potential re-use of the waste. This called for a concerted investment in faecal sludge management (FSM) practices. The Housing and Urban Development Department (HUDD) in Odisha has been engaged in addressing FSM in cities in the State since 2015, thanks to the launch of the Atal Mission for Rejuvenation and Urban Transformation (AMRUT). Since then, the Odisha government supported nine towns to invest in FSM by constructing faecal sludge treatment plants (FSTPs) in AMRUT-supported towns. Two medium-sized towns in the State, Dhenkanal and Angul, were selected for a pilot named Project Nirmal in 2014, in anticipation of advising the utilization of AMRUT funding in relation to FSM, with support provided to the State and district governments

by Centre for Policy Research (CPR) and Practical Action as implementing partners. Funding was provided by Bill and Melinda Gates Foundation, Arghyam, HUDD and the relevant municipalities. In 2016, HUDD released the authorized Urban Sanitation Policy and Strategy, which predated the national FSSM policy. In 2018, after Project Nirmal was completed and had demonstrated the benefits of implementing FSM value chains, the Chief Minister at a national workshop organized by HUDD on faecal sludge and septage management (FSSM) demonstrated his commitment to make Odisha clean and healthy by proclaiming Swachh Odisha, Sustha Odisha, or 'Clean Odisha, Healthy Odisha'. In the workshop, six such facilities in the State, including Dhenkanal FSTP were inaugurated and commissioned by the Chief Minister. Dhenkanal FSTP is one of the first FSTPs in the State for small and medium towns.

However, this left a large question unanswered: what about the large and dense villages (LDVs) and rural areas in Odisha? How can they access a sustainable and fiscally viable FSM system? Therefore, to explore if there is a solution to be found in extending an established urban FSTP's reach to the neighbouring gram panchayats (GPs), UNICEF and CPR collaborated on a pilot intervention using the Dhenkanal FSTP as a starting point for conversation.



About the Intervention

Dhenkanal district in Odisha has a total population of 11.9 lakhs and 2.7 lakh households (Census, 2011). The district declared all its GPs ODF even before the national deadline of October, 2019. According to the same Census, septic tanks were one of the most prevalent on-site systems in rural areas in Dhenkanal. In 2017-18, according to the SBM monitoring database, 96 per cent of all the toilets built, since the start of SBM in 2014 in Dhenkanal, were single pit and in 2018-19 only 40 per cent of toilets were single pits; the remaining for the latter were reported to use the twin pit model. A rapid assessment conducted in the district's rural areas in 2019 also suggested that there was a varied mix of toilet technologies in use and highlighted the need to explore how these various technologies could be catered to through a central FSM structure, like an FSTP.

It was initially observed that GPs and small towns were sometimes clustered around urban areas, which led to the idea of testing out whether they could be incorporated in the existing FSTP's serviceable area. It was also noted, based on the learning from Project Nirmal and AMRUT, the great influence that district-level administrations could have in improving uptake of FSM at the household and community levels. UNICEF and CPR were therefore also keen to position the Dhenkanal municipality as a leader in the roll-out of the intervention. Finally, another important question that was raised was how investments in FSM would fit into the larger solid and liquid waste management (SLWM) framework for the district as well as that for the State.

The Dhenkanal FSTP intervention, designed to be rolled out from 2019 to 2021 therefore aimed to:

- Leverage the available urban FSTP facility in Dhenkanal to safely manage faecal sludge generated in the neighbouring GPs, census towns and LDVs, through convergence of goals and requirements between the GPs and the municipality
- Support SLWM pilots in GPs in identified green field rural locations, which include IEC messaging and campaigns to promote uptake of existing and newly available services

Project Components

1. Plug in GPs and others in 'cluster' to available urban facility in the Dhenkanal district:



Using GIS to map out the Dhenkanal municipality and the concentric populations surrounding it, adjoining GPs, census towns (CTs) and LDVs were located within 20 kilometres from the jurisdiction of the Dhenkanal municipality which were also clustered around three existing FSTPs – one in Dhenkanal and two upcoming in Bhuban and Kamakhyanagar. These ‘clusters’ were seen as feasible to serve using the existing and planned FSTPs based on feasibility and cost analyses that incorporated the cost of running the FSTPs, the transport or ‘cesspool’ trucks, the salaries of operators, equipment and products for safe management of trucks and FSTP, etc.

There is currently an on-going study of village-based on-site systems, waste management practices and perceptions, and any existing FSM services known to various community individuals.

2. Undertake green field projects in the identified cluster of GPs of Dhenkanal district:

Based on the above study findings, the result of a sanitation market mapping exercise and an assessment of the solid and liquid waste situation in GPs, a district-wide implementation plan and roadmap will be developed for intervention in the identified cluster of GPs. Rural technologies for FSM will be compiled and disseminated for the purpose of adopting a suitable technology for green field on FSM in selected panchayats. Institutional mapping to understand the role of elected representatives, community based organisations (CBOs), other actors, including government officials have been undertaken and capacity building strategy has been designed to strengthen capacities of all stakeholders in the district for effective FSM.

Institutional processes to bring about convergence between rural and urban governance systems for facilitating SLWM will be put in place and strengthened over a period of time.

To create demand for SLWM and spread awareness on SLWM practices, information, education, and communication (IEC) materials are in the process of being developed and a strategy of communication will be built with the support of the district. The district level mechanisms and platforms will be explored for wider dissemination of FSM related awareness.

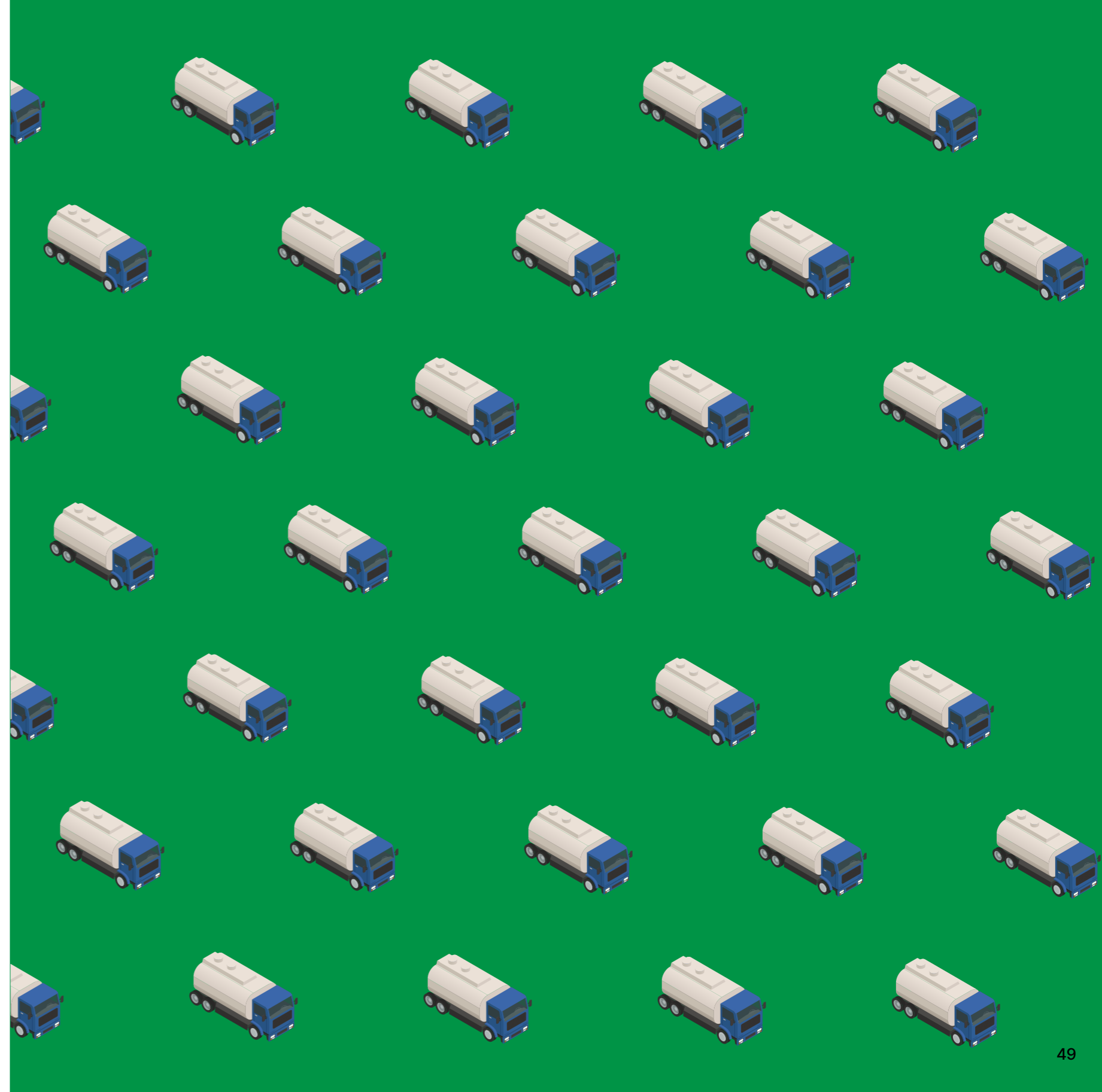
Next Steps and Envisaged Outcomes

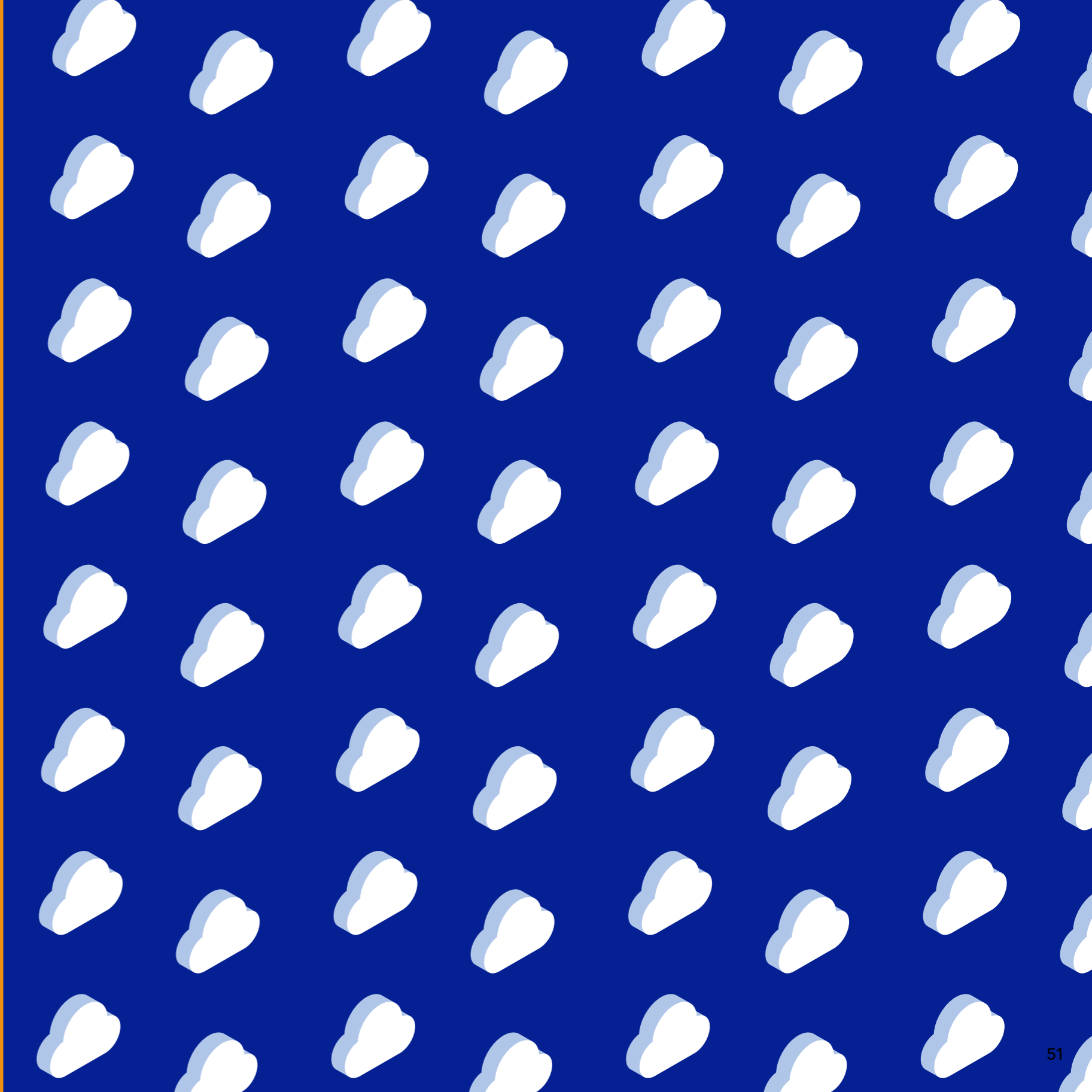
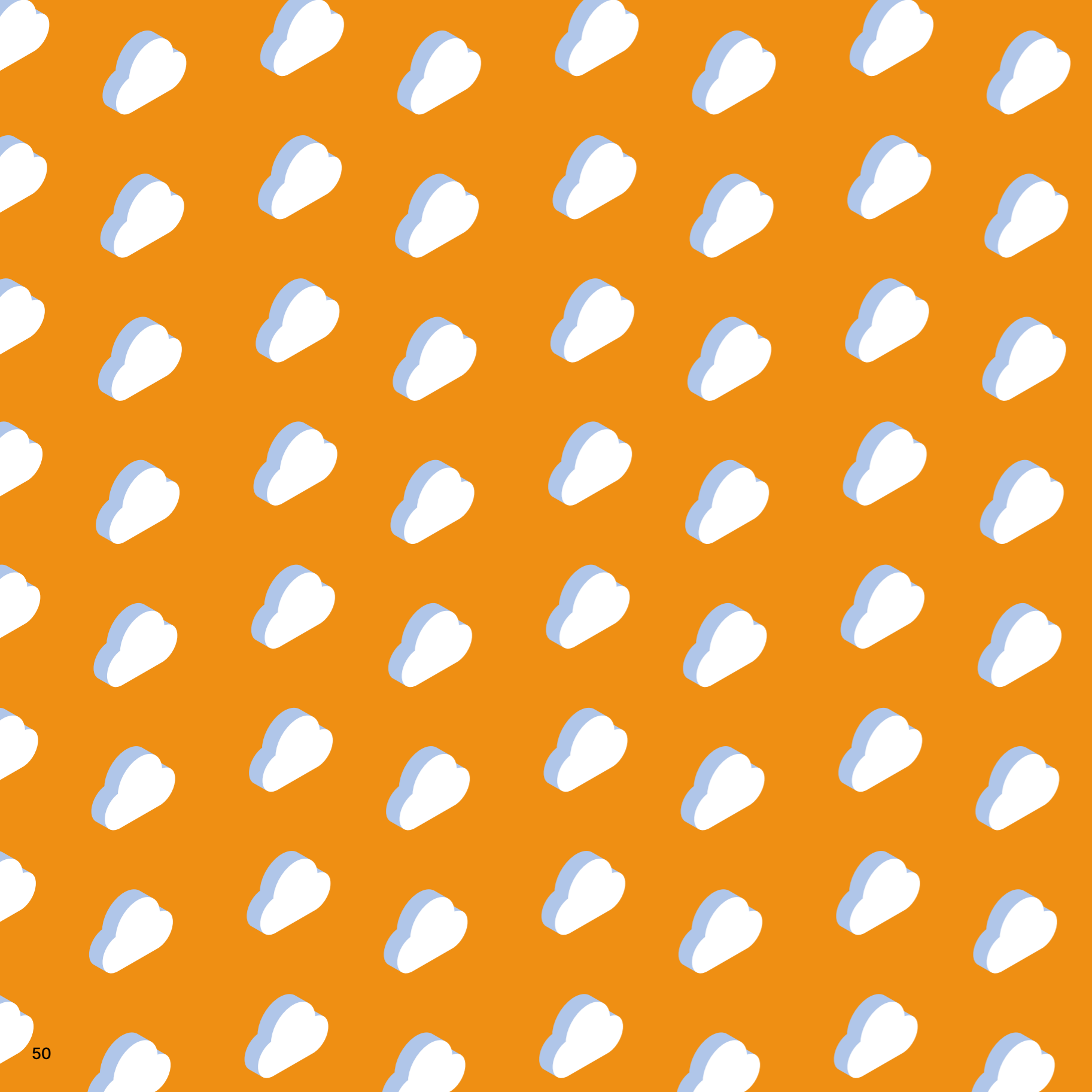
The connection between the Dhenkanal FSTP and surrounding cluster will be operationalized through the passage of Municipal Council Resolution (MCR) by the Dhenkanal Municipality, as well as those by the concerned GPs. This intends to create a convergence model, which can be replicated in the other cities and towns of the State besides ensuring that there is ownership by community and government leaders who can sustain the gains realized.

This intervention is one of a kind in the entire State, where systematic activities are being undertaken through a district-wide approach to plug in rural areas within the existing FSM solution available at a municipality level. This effort is a step towards managing the waste of the entire district of Dhenkanal, thereby addressing the issue of environmental pollution. This in turn, will support the communities being served in being healthier and live in contamination-free environments for children to play and thrive in. In 2020, SBM (Grameen) Phase II was launched, and it lays emphasis on FSM in rural areas and suggests two approaches for effective

FSM in GPs. Firstly, it enunciates that upcoming district-level FSM plans should be developed keeping in mind the adjacent rural areas that can be potentially served by existing plants and other methods of treatment, both for FSM only and co-treatment solutions. Secondly, the approach focuses on setting up a system for FSM where FSTPs do not exist by choosing technologies which are suitable to the rural context. The pilot intervention in Dhenkanal too embraces both these approaches of plug in and green field. The lessons learnt from the pilot intervention in Dhenkanal can be useful in upscaling efforts for FSM in rural areas in the State as also in the entire country as it not only creates sustainable FSM services in the district but also brings in the rural-urban convergence.

Currently, Department of Panchayati Raj and Drinking Water (DPR&DW) in Odisha with support from UNICEF's Bhubaneshwar office is drafting rural sanitation policy, to be released soon. Together with the urban-based policy, the two will sustain universal toilet coverage and usage, safe and scientific management of solid waste, and the creation of open defecation free and discharge free villages.





Maharashtra

Context

Maharashtra is the second-most urbanized State in India with its residents accounting for nearly 10% of India's population. The state of Maharashtra is having about 60 million urban population residing in 394 Urban Local Bodies. The State is divided into six administrative divisions. The Government of India (GoI) embarked upon an ambitious goal of making India "open defecation free" (ODF) by October 2019 under Swachh Bharat Mission (SBM). In Maharashtra, the State government achieved this goal on October 1, 2017, under its Swachh Maharashtra Mission for Urban Areas (SMMUA) by making all the cities ODF. There is a strong commitment from the State government to sustain the ODF status and to move forward ensuring faecal sludge and septage management (FSSM) services are provided to all urban areas in the State. The government of Maharashtra (GoM) had issued a 7-point sustainability charter in 2017 that included a focus on ODF-sustainability and ensuring the effective collection and treatment of human faecal waste in all cities. Urban Development Department (UDD), GoM adopted a systematic approach to move towards ODF+/++ in October 2017 in a time-bound manner through Statewide faecal sludge management (FSM) plan.

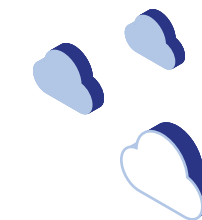


Initiation and Planning Process

The Government of Maharashtra (GoM) has adopted a systematic approach to implementing citywide FSM plans across the full sanitation service chain in the ULBs. The GoM has established technical support unit (TSU) in partnership with CWAS, CEPT University funded by Bill & Melinda Gates Foundation (BMGF) housed under UDD for institutional delivery of effective sanitation services across urban areas in Maharashtra with a focus on FSSM solutions. The TSU provides guidance and support in the implementation of FSSM plans in the cities of Maharashtra. Post declaration of ODF sustainability charter in 2017, Government of Maharashtra initiated developing Statewide strategy on faecal waste management and treatment i.e., moving towards ODF++ cities.

A two-pronged approach for the Statewide FSM strategy

Establishing treatment plants and ensuring safe disposal of faecal waste is a key component to becoming ODF++ and in order to achieve state-wide coverage, urban development department took systematic approach. The state took two-pronged approach towards FSM strategy: a) co-treatment of faecal sludge at own or nearby STPs and b) setting up independent FSTP at city level for faecal sludge treatment. All ULBs were classified into 3 categories, a) ULBs with functional sewerage treatment plant (STP), b) ULBs that can do FS co-treatment to nearby ULB's STPs and c) ULBs with independent faecal sludge treatment plant (FSTP).



a. Co-treatment of faecal sludge at own or nearby STPs

At present, there are 35 ULBs in Maharashtra which have functional STPs but do not have full coverage of sewerage systems. These ULBs can treat septage collected from onsite systems in their own STPs. In addition to this, UDD identified potential ULBs that can do co-treatment of their septage at nearby ULB's STP that is located within 20 km of radius from existing STPs. So, the government has decided to adopt a co-treatment strategy for the potential ULBs that can treat FS either at their own STPs or a nearby STP. Government has issued the government resolution (GR) on co-treatment of faecal waste at own or nearby STPs (GR: SMU-2018 /Cr No. 351/UD-34 on 15 th December 2018) in order to implement the co-treatment strategy. The dissemination workshops were conducted with FS receiving and sending cities. The standard MoU agreement was developed to institutionalize the FS co-treatment process. Currently, about 70 ULBs are practicing co-treatment of faecal sludge at their own or nearby STPs.

b. Setting up independent FSTPs

UDD decided to set up the independent FSTPs in all remaining ULB which are entirely dependent on onsite sanitation systems and there will be no plan for sewerage project in the near future. 311 ULBs have been identified for setting up the independent FSTPs in Urban Maharashtra.

- **Vetting of faecal sludge treatment technology**

Implementation of FSM projects in urban India are at a nascent stage. UDD had decided to develop pilot detailed project reports (DPR) for various types of faecal sludge treatment technology in Maharashtra. Four technical options for processing the faecal sludge on a pilot basis were developed by UDD through its technical support unit (TSU), Centre for Water and Sanitation (CWAS), CEPT University. These four sets of technologies for faecal sludge & septage (FSS) treatment were vetted by the National Environmental Engineering and Research Institute (NEERI) to facilitate quicker adoption of treatment solutions. During the same time, FSTP was implemented in five ULBs (namely, Wai, Sinnar, Mul, Sangmner, and Ballarpur) on a pilot basis using different FSTP technologies.

- **Adoption of cost effective and less mechanised technology for setting up faecal sludge treatment facilities**

Based on the experience from five ULBs and detailed consultation with ULBs and technical support partners, the State decided to adopt the conventional, cost-effective, and less mechanized treatment technology for FSTP construction for ULBs in Maharashtra. The State also conducted a series of consultations with SBM mission officials of MoHUA, other State mission offices and National PMUs before selection of FS treatment technology. The ease in construction and operation, the state of being a less energy-intensive and lower level of human interventions requirement and cost- effectiveness was the key pre-conditions of the selection of FS treatment technology.

- **Facilitate the technical and administrative approvals at State level– A single window approval system**

UDD through its technical support unit (TSU), had facilitated in preparing detailed project reports (DPRs) for FSTPs in Maharashtra. Five different sizes of FSTPs were developed based on the population size of ULBs of Maharashtra. Maharashtra Jeevan Pradhikaran (MJP), a technical nodal agency of Government of Maharashtra for water and sanitation sector, had issued a Statewide technical sanction for FSTPs for 311 ULBs.

Statewide administrative approval was provided by UDD to all 311 ULBs to use the 14th Finance Commission grants for the implementation of faecal sludge treatment plant (FSTP) vide government resolution no. SMMUA – 2019 / Circular No. 124 / UD - 34, dated 8th Nov 2019.

This GR directs ULBs to float a short tender notice for the construction of FSTPs. A standardized tender document with a model work order template was also developed for ULBs to fast track the implementation of FSTPs at scale in a stipulated time frame. This GR also indicates that the FSTP shall have to co-locate with the existing solid waste management (SWM) site.



Institutional set-up

Mission led by urban local bodies, facilitated by State government

Urban development department, GoM is the nodal department responsible for development of policy regulation and necessary directives for ULBs to implement FSM plans. Swachh Maharashtra Mission for Urban Areas (SMMUA) facilitates overall implementation of FSM in the State. SMMUA conducts regular review meetings with ULBs to ensure timely and quality implementation of FSM plans at the State level. SMMUA also coordinates with UDD, MJP, Divisional Commissionerate, district officials, ULBs and TSU for effective and smooth implementation of FSM plans. A technical support unit (TSU) managed by Centre for Water and Sanitation (CWAS), CEPT University is placed at the State and division levels to provide strategic assistance for quality implementation of FSM plans, which provides technical, advisory, monitoring and implementation assistance to both SMMUA and ULBs. This TSU is being supported by Bill & Melinda Gates Foundation through its MoU with UDD. SMMUA in consultation with CWAS developed the Statewide FSM strategy and shortlisted potential technologies for faecal waste treatment. Selected FSTP technologies were vetted by NEERI. NEERI is a pioneer institute in the field of environmental science and engineering and part of Council of Scientific and Industrial Research (CSIR), falls under the Ministry of Science and Technology, Government of India. The Divisional Commissionerate and district collector office are the focal organizations at the divisional/district level to oversee and review FSM implementation by ULBs and provide progress reports to SMMUA and UDD.

Urban local governments are responsible for on-ground implementation of FSTPs and responsible for operation and maintenance. In addition, 33 empanelled engineering/ polytechnic colleges are responsible to undertake third party technical audit of FSTP construction.

Operations and technology used

UDD decided to implement a cost-effective and non-mechanised treatment technology for FSTP construction. It involves five major treatment modules: namely 1) Screening Chamber, 2) Sludge Drying Beds (SDB), 3) Anaerobic Baffled Reactor (ABR) 4) Horizontal Planted Gravel Filter (PGF), and 5) Disinfection unit. The facilities have a gravity flow-based system, where septage collected through vacuum emptier trucks is discharged to the screening chamber from where it flows to different units by gravity (SDB > ABR > PGF > Disinfection unit > Reuse/discharge to Environment). Treated wastewater can be reused for landscaping/ tree plantation and dried sludge can be used with existing co-located vermi-composting plants.

This technology is simple in execution and easy to understand for both private contractors and ULB officials. Construction material and required human resources are easily procured from local areas.

Amplification of faecal sludge treatment solutions at scale

Statewide technical and administrative approvals were provided by the relevant State level agencies to implement provision of FSTPs in all 311 ULBs. This was also facilitated by a State Government Resolution on setting up independent FSTPs in November 2019. About 70 FSTPs have been constructed and commissioned and more than 100 FSTPs are at various stages of construction as on May 2020.

Sustained FSM service provision at scale

A set of guidelines on FSTP Operation and Maintenance, standard operating procedures for desludging operations and model service level agreements have been developed to ensure sustained and safe sanitation service delivery in ULBs. Statewide training workshops were conducted on implementation of FSM plans. Also, a State level monitoring system and quality assurance framework has been established for monitoring FSM implementation in the State. Most of the operational FSTPs are being operated by ULBs by assigning dedicated sanitation staff. Most of the FSTPs are using treated water for gardening on FSTP sites. The dried sludge is used either as manure in the gardening or mixed with compost from solid waste. Efforts are made to engage self-help groups (SHGs) for the operation and maintenance of FSTPs.

Financial and business model

Sanitation infrastructure is created using public funds in India and Maharashtra is no exception. For the construction of FSTPs in Maharashtra, the state government has authorized the use of 14th Finance commission funds. ULBs are responsible for the operation and maintenance of FSTPs. Few ULBs in Maharashtra levy sanitation tax to partially recover operation and maintenance cost for FSM services. The low Capex and Opex for FS treatment facilities will help ULBs to easily sustain the operation of FSTPs. The State government has also provided the ODF Incentive Fund for the purchase of vacuum emptier vehicles. ULBs are exploring the possibility of mobilizing revenues through resource recovery from treated sludge.



Successes and lessons learnt

Systematic approach towards building waste treatment infrastructure



The government of Maharashtra took a decision to implement FSTPs at scale. Rather than a conventional approach, where each ULB would have to seek technical and administrative approval of its FSTP, the State government decided on a set of technologies. These were vetted by NEERI and they adopted a low-cost but effective technology for all the 311 ULBs of the State. 116 ULBs have attained Open Defecation Free++ (ODF++) status post-implementation of FSTP construction and co-treatment in Maharashtra. The Statewide interventions have helped cities in improving their environment due to safe treatment and disposal of faecal waste.

Single window approval and fast track implementation

A single window approval for implementation of FSTPs at the State level helped ULBs to curtail the complex and lengthy approval process. Pre-approved technical design, structural, and hydraulic design templates of FSTP helped ULBs to fast track implementation of FS treatment facilities. Mandatory compliance of third party technical audits through the empanelled engineering/polytechnic college ensured quality assurance and quality control of implementation of FSTPs.

Institutionalise FSM service delivery

FSSM is gaining recognition nationally, and across the world, for providing safe sanitation solutions. The Maharashtra Government adopted a systematic approach beginning with ensuring that all ULBs become ODF. Once the State achieved ODF status, the next step was to make the State ODF++ by ensuring that all faecal matter is collected and treated. The UDD developed various guidelines for septage management and conducted capacity building programmes for all ULBs to implement septage management. UDD conducts regular monitoring at the city, district, division, and State levels. A series of field visits and on-call assistance was provided by technical experts to guide the ULB officials during the implementation and operation of FSTPs. Maharashtra is also developing a strategy on the convergence of NULM and SBM for improved sanitation service delivery with the participation of SHGs in operation and maintenance activities.

Scalability and Replicability

The work in small and medium towns of Maharashtra is representative of around 7600+ towns of India, including 3600+ statutory towns and 3800+ census towns. The experience in these cities can potentially impact 150 million people who live in these towns, i.e. approximately 50 percent of the total urban population of India. In addition, many small cities in South Asia and Africa are of similar size as these cities and can learn from Maharashtra's experience of developing and implementing a Statewide strategy.

Recognition and policy support at various level of government

The systematic efforts of the government of Maharashtra in sanitation space and particularly for the FSM sector have been recognized by both national government and other sector experts. It is clearly reflected in the recent result of Swachh Sarvekshan 2020, where a large number of Maharashtra ULBs secured high ranks. The lessons from Maharashtra's experience can be very useful for policy-making and developing Statewide strategy for other states of India. In the past, Maharashtra's experience has been instrumental in developing ODF/ODF+/ODF++ framework, NFSSM policy, and FSSM primer.



Challenges and possible resolutions

Land issues

UDD has directed the district administration to fast track land approval process for setting up waste management facilities for ULBs that are facing land-related issues. A detailed plan is being prepared by UDD for co-treating the septage at nearby independent FSTPs or STPs within a 20-30 km buffer for these ULBs.

Resource recovery

The quantity of generation of treated water and treated sludge is negligible in size. This poses a challenge to develop a business model around resource recovery particularly for small and medium towns.

Conclusion

The steps taken by the Government of Maharashtra in FSM space have been lauded by the Central government, state governments, and sectoral experts. A systematic and holistic approach towards citywide FSM planning at scale helps Maharashtra and India to move towards achieving SDG 6.2 goal on safely managed sanitation.





Tamil Nadu

Context

Tamil Nadu is one of the most urbanized states in India, with an urban population of 34.9 (1*) million (48.45 per cent). In 2011, about 75 percent of its households had toilets within their premises, 9 percent used public toilets, and 16 per cent defecated in the open (Census 11a)(2*) Of the households that had toilets, on-site sanitation systems were the predominant arrangement – 58 percent were connected to septic tanks and improved pits, 40 percent had sewer connections and 2 per cent had unimproved toilets. Over the years, the Government of Tamil Nadu (GoTN) has invested in network-based systems for the treatment of sewage and has the fifth-largest sewage treatment capacity in the country (CPCB, 2015) (3*) . While Chennai has about 58 percent of the installed treatment capacity, the remainder is spread across cities such as Madurai, Coimbatore, Tiruchirappalli, and Tirunelveli (Reddy, 2015) (4*). In some areas, sewage generation is higher than the existing treatment capacity, due to rising population and urbanization. This has led to unsafe disposal of sewage without treatment. In other areas, existing sewage treatment plants (STPs) are equipped to handle higher future volumes, thereby have the capacity to co-treat faecal sludge. Though co-treatment of faecal sludge has been in practice in the State for around 20 years, it is limited to a few districts. Septage collection and transportation is carried out by private vacuum truck operators (some urban local bodies [ULB] have their own vehicles), using good quality trucks, although their collection and disposal practices

are not standardized. Lack of adequate faecal sludge treatment capacity leads to de-sludging operators discharging septage into water bodies around cities, causing contamination of potential drinking water sources. Thus, for Tamil Nadu to achieve total sanitation, it is important that faecal sludge management (FSM) is prioritised.



[1] Housing and Urban Development Department, Government of Tamil Nadu accessed from <https://www.tn.gov.in/documents/dept/15>

[2] Census (2011), House Listing and Housing Census Data. Retrieved from: http://www.censusindia.gov.in/2011census/hlo/HLO_Tables.html Census 2011

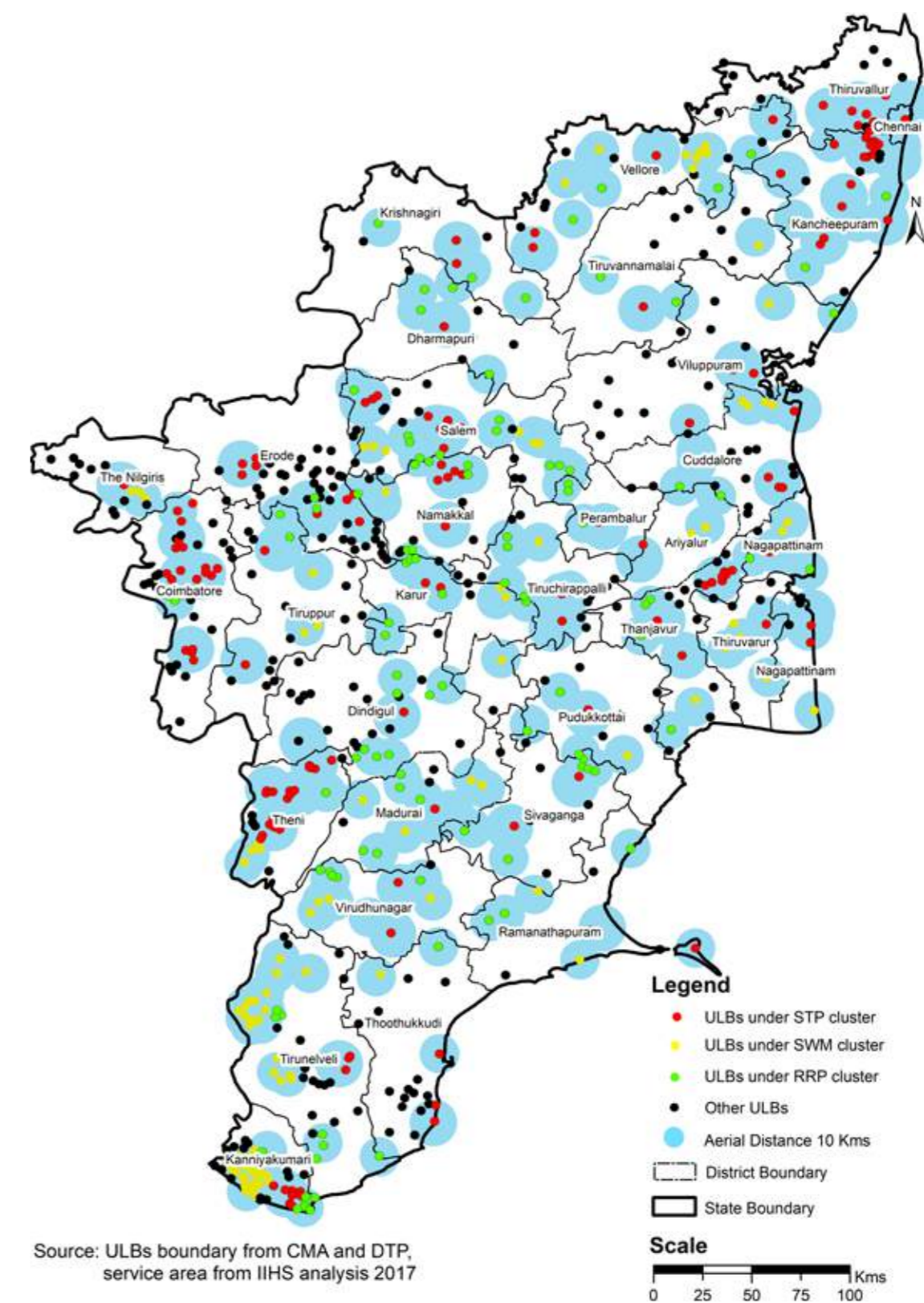
[3] Reddy, P. (2015), 'Septage Management for Local Bodies in Tamil Nadu', Presentation at FSM 3. Retrieved from: <http://www.susana.org/images/documents/07-cap-dev/b-conferences/15-FSM3/Day-2/Rm-1/2-1-1Key2Reddy.pdf>. Accessed on November 16, 2017

[4] CPCB (2015), 'Inventorization of Sewage Treatment Plants', Central Pollution Control Board, New Delhi

Initiation and Planning Process

The GoTN has been a pioneer in the sanitation sector by recognising the importance of total sanitation as core to improving public health standards. With the aim of making the State 'Open Defecation Free' (ODF) by 2015, the GoTN undertook toilet construction from 2012. In 2014, Tamil Nadu was the first State to announce the 'Operative Guidelines for Septage Management for Local Bodies in Tamil Nadu' (OGSM) which seeks to standardise existing containment structures and systematise & regulate the process of collection, transportation, treatment and disposal of faecal sludge. Since the issue of OGSM, 2014, Tamil Nadu's strategy has been to demonstrate improvements along the sanitation chain with a focus on FSM. The Tamil Nadu Urban Sanitation Support Programme (TNUSSP) was launched in 2015, to support the State in achieving improvements along the entire urban sanitation chain by demonstrating innovations in two model urban locations, as well as enabling its Statewide scaling up.

- a. Initiating State-level policies, actions and strengthening operational mechanisms to support rapid scaling-up of innovations in all urban areas of the State.
- b. Two urban sites -- the city of Tiruchirappalli and the two town panchayat (TP) clusters of Periyanaicken-palayam (PNP) and Narasimhanaicken-palayam (NNP) in Coimbatore district were selected as demonstration sites. In addition, the strategy involved the following:



Source: ULBs boundary from CMA and DTP, service area from IHS analysis 2017

1. Initiating multiple forms of intervention (engineering, capacity building, behaviour change and communication, etc.) to address barriers to safe sanitation and enable transformation;
2. Engaging with multiple stakeholders in the sanitation chain such as the private sector, community based organisations (CBOs), NGOs and civil society;
3. Demonstrating innovations on the ground to build credibility and momentum;
4. Enabling private sector development through outreach, orientation and appropriate regulation; and
5. Creating awareness among citizens and other stakeholders through behaviour change and communication.

Institutional Set-Up

A Technical Support Unit (TSU) has been set up under the Municipal Administration and Water Supply (MAWS) Department, GoTN with support from the Bill and Melinda Gates Foundation (BMGF) to implement the TNUSSP. The GoTN constituted the Advisory Committee (AC) to establish FSM as a sustainable and standalone sanitation solution and enable its quick augmentation. Key members of the AC include: Additional Chief Secretary, Municipal Administration and Water Supply Department (Chair), Heads of Departments (CMA, DTP), representatives from key departments and State agencies, and special invitees. The AC plays a key role in monitoring, reviewing, and guiding the programme. The AC is supported by a State Working Group comprising officers who are operationalizing FSM. They enable implementation of the programme, coordinate across various departments,

and expedite necessary approvals. In addition, there are working groups at the district level consisting of the heads of ULBs in Tiruchirappalli, PNP, and NNP. TNUSSP is implemented by a consortium of organizations led by the Indian Institute for Human Settlements (IIHS), with other partners like Keystone Foundation, CDD Society, Gramalaya, Yugaa, People's Development Initiative, Hasiru Dala, and Bharathidasan University.

Operations and technology used

As a part of the implementation of the OGSM, the need to create adequate fecal sludge treatment facilities was identified as a critical first step. Towards this, the TSU developed a State Investment Plan (SIP).

State Investment Plan

SIP offered a phased approach to scaling up fecal sludge treatment across the State. It was prepared on the basis of two core principles:

1. Utilization of existing STPs through co-treatment of septage with sewage; and
2. Adoption of a cluster approach, wherein ULBs are clustered around an existing treatment facility or a potential one – within 10 km of the treatment facility.

Using the cluster approach, five phases were proposed, with initial clustering around existing STPs followed by the addition of new treatment facilities. The SIP was developed to cover 663 ULBs in a phased manner as follows:

- **Phase-I & Phase-II:** Provision of Decanting Stations for Disposing Septage for Co- treatment in Existing STP Sites
- **Phase-III:** Utilising the Solid Waste Management Sites in Municipalities for Construction of New Faecal Sludge Treatment Plants (FSTPs)
- **Phase-IV:** Utilising the Resource Recovery Parks of Town Panchayats for Construction of New FSTPs
- **Phase-V:** Catering to Standalone Cities There are minimal additional investments under Phase I and II. For other phases, GoTN approved Rs. 200 crores for the construction of 49 FSTPs in 2018. Subsequently, it approved Rs. 31 crores for the construction of an additional 11 FSTPs in 2019. The SIP is projected to cover an urban population of 24 million (663 ULBs, excluding Chennai). Through the cluster approach, the 61 upcoming FSTPs and 50 STPs will serve a total urban population of nearly 14 million across 192 towns. The remaining population will be served by future STPs and faecal sludge treatment facilities.



Support for implementation and operation of treatment systems

In Phases I and II of the SIP, the focus is to enable co-treatment at existing and proposed STPs, which include the provision of decanting stations, and suitable pumping stations. It entails no additional investments on treatment other than the provision of decanting stations. Construction of new treatment capacities planned through FSTPs commenced in 2019 in select ULBs. There are currently



Seven functioning FSTPs (including one in Karunguzhi, which is discussed later) in the State and another 54 FSTPs under various stages of construction. TSU has been providing Quality Assurance (QA) and technical support for the implementation of new FSTPs included in Phase III & IV of the SIP.

Governance

A key aspect of ensuring sustainability for FSM includes strengthening the institutional framework for FSM, to ensure sustainable FSM service delivery. This includes enhancing existing as well as creating new systems and procedures that can be institutionalized into the government system. As part of this, the team has mapped the existing systems and procedures at the State, regional and ULB level to identify gaps in existing FSM service delivery and lays out a set of recommendations for potential new processes, roles, and responsibilities, within the current institutional framework.

To operationalize FSM services and ensure sustained operations and maintenance “(O&M)” of treatment facilities, a Memorandum of Understanding (MoU) was prepared to establish a formal process for ULBs to adopt and utilize the upcoming shared treatment facilities, which has been adopted.^(5*) It covers both approaches to treatment -- FSTPs and co-treatment at STPs, through separate MoUs. Simultaneously, a Standard License Agreement (SLA) was also prepared to streamline the collection and conveyance process, which has been adopted. Through this, the GoTN directs host ULBs to license de-sludging operators to operate within their cluster. The Agreement mandates de-sludging operators to not only adopt proper de-sludging and disposal practices but also improve the health



and safety of their employees. Similar to the MoU, the GoTN decided to adopt a cluster approach to licensing as well, where de-sludging operators will be registered with the host ULB, but the responsibility for overseeing their activities lies with the ULBs from which they de-sludge.

Strengthening Institutional Capacity

In order to operationalize the capacity building component, training needs assessments were conducted for government officers and masons, which helped define the training strategy. Capacity building programmes aimed to foster a higher degree of ownership towards FSM services among stakeholders – government officers, engineers, masons, de-sludging operators. In addition, the strategy highlighted the need for systematic changes in procedures in every part of the sanitation chain. For the GoTN officers, various programmes such as the Faecal Sludge and Septage Management (FSSM) orientation and engineers training programme were organized. Modules for engineers also highlighted various engineering and technological aspects of FSM. A total of 225 GoTN officers have participated in programmes conducted by TNUSSP. Further, in order to demonstrate and improve the understanding of successful models of FSM, exposure visits were organized to Malaysia as well as Devanahalli in Karnataka for 61 officers. Masons were unaware

[5] Municipal Administration and Water Supply Department, G.O (2D) No.35 dated May 15, 2020

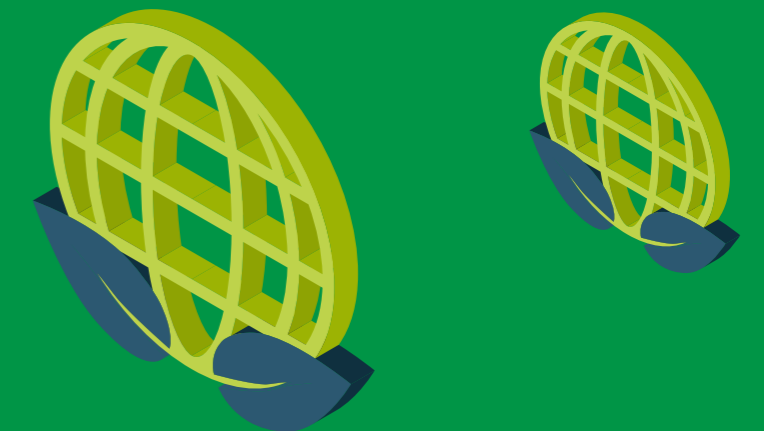
of the standards and regulations governing the construction of containment structures. A total of 127 masons participated in four workshops held in Tiruchirappalli, PNP and NNP, where they were sensitised on the importance of building safe containment structures. They were trained on the basic design and construction of septic tanks and twin pits. Desludging operators were sensitized on vehicle design, types of equipment, occupational safety procedures to ensure safe and efficient sludge management practices. As many as 89 operators participated in these programmes across Tiruchirappalli, PNP, and NNP. In addition, workshops were conducted in academic institutions in Chennai and Coimbatore to bring more professionals into the fold of FSM.



Behaviour Change Communication

Under the theme of Muzhu Sugadhara Tamizhagam (Total Sanitation in Tamil Nadu), the Behaviour Change Communication (BCC) strategy aims to emphasize the full cycle of sanitation, besides addressing the taboos and stigma surrounding it. The premise of this strategy is that since sanitation is a taboo topic, and behaviour change must be preceded by the willingness of society to speak about sanitation without embarrassment or fear.

Three short films to raise awareness about various aspects of FSM were developed and used in various capacity building programmes and other events. These included Do's and Don'ts of proper toilet construction, mechanical desludging practices, and the importance of FSM. A mascot – 'Kakaman' – was developed, around which posters and other communication material were created to raise awareness. Additionally, events on World Toilet Day and school sanitation programmes focussed on the full cycle of sanitation and the importance of toilets and hygiene practices. Such programmes have also served as platforms for felicitating sanitary workers.



Muzhu Sugadharam Information System (MuSu)

In order to monitor the OGSM's progress at the ULB level, a mobile application – Musu Information System (MuSu) – was developed. The MuSu app aims to assess the current status with respect to septage management at the ULB and to track their implementation over time.

Towards operationalizing the MuSu app, an orientation-cum-training programme for 1,992 ULB officers from 12 Corporations, 124 Municipalities, and 528 Town Panchayats was organized across the State. Broadly, the MuSu App seeks information on five components within septage management including, access to containment, collection, transport, and treatment.

Data updating in the app by ULBs is underway with some ULBs updating annual data, while others are in the process of updating. All data submitted is analyzed and presented on a dashboard which provides an at-a-glance view of key indicators on septage management by State, district, and at the ULB level. While MuSu has been managed by the TSU so far, the process of handing over the entire process of data collection and management of the app to the Government of Tamil Nadu is underway.



Initiatives in Tiruchirappalli

Tiruchirappalli (Trichy), the fourth largest municipal corporation in Tamil Nadu, has an existing underground drainage (UGD) network that partially covers the city. The city corporation has decided to adopt a combination of underground sewerage and FSM to reach 100 percent coverage. Trichy is among the eight global cities selected for the Citywide Inclusive Sanitation (CWIS) Programme by the Bill and Melinda Gates Foundation (BMGF). As part of TNUSSP and CWIS, the following initiatives are pursued across the sanitation chain:

Access and Containment

Tiruchirappalli has a network of over 400 community and public toilets, which are managed under varying models of operation. One such model is the Sanitation Hygiene Education' (SHE) team model, where volunteers in each slum manage the community toilets. Interventions have focussed on strengthening the operations and maintenance of community toilets by introducing institutional, operational, and financial guidelines, standard operating procedures, and a ranking system that incentivizes SHE teams to maintain service standards. A study on improvement measures for current standards and practices of constructing onsite-sanitation systems (OSSs) of individual households, community toilets, schools and establishments is underway. Additionally, pilots to improve existing OSSs at the household level and at community toilets are being carried out, and options to better manage grey and black water contributing to the pollution in Trichy's Uyyakondan Canal are being developed.

Emptying and Transportation

Efforts are underway to regulate and streamline the collection and conveyance process through Standard License Agreement and strengthen systems for monitoring de-sludging operators by piloting a GPS-enabled monitoring system.

Treatment and Reuse

As Trichy is a partially sewered city, improvements to current infrastructure for co-treatment are important. An assessment of decanting facilities and existing STPs was carried out in Trichy to understand the infrastructure, O&M practices. TNUSSP has made recommendations to the Trichy City Corporation (TCC) on the basis of this assessment. Infrastructural improvements are underway at Panjapur STP to allow co-treatment of faecal sludge and sewage. Infrastructural changes have been carried out at the decanting station at Anna Stadium for its safer functioning.

Inclusion

In an effort to promote inclusive sanitation in schools, trainings have been provided to students and teachers on the importance of safe water, sanitation, and hygiene practices including menstrual hygiene using interactive methods. Parallely, improvements to the sanitation infrastructure in schools have been taken up.

One of the key components of inclusive sanitation is the focus on sanitation workers. A profile of sanitation workers in the city has been developed based on in-depth discussions with workers, their children and family members. This exercise helped in understanding the critical issues and challenges faced by sanitation workers in the city. Based on the needs expressed by workers, a directory of social welfare schemes was prepared for linking sanitation workers with schemes such as health insurance.

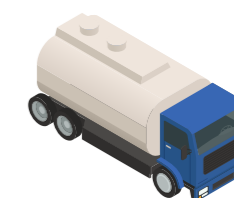
TNUSSP's gender strategy was drawn from analyses conducted in the State to understand differential sanitation needs, gendered roles, and decision-making powers. Based on this a gender action plan for Trichy is being developed.



Initiatives in PNP and NNP

Access and Containment

TNUSSP has collaborated with PNP and NNP town panchayats to develop a Swachh Bharat Mission Handbook, which contains designs and estimates of toilet construction for beneficiaries. Its key objective is to increase the capacity of beneficiaries, masons and engineers hired for the construction of these toilets to make an informed decision on the design. Based on an assessment of public sanitary conveniences, improvements plans, including sustainable operations and maintenance arrangements are being drawn up with the TPs. To improve access to community toilets, TNUSSP collaborated with town panchayats to refurbish them. Detailed mapping of containments of households, schools, industries is complete along with the identification of improvement measures and alternative technologies.



Collection and Transport

TNUSSP has worked closely with desludging operators in the two TPs to understand their practices, business models, and challenges. Apart from several orientation sessions, efforts are underway to register de-sludging operators with the TP to assist in the regularisation and streamlining of the registration process

Treatment and Reuse

In an effort to showcase FSTPs with different technology options and capacities, an FSTP of 25 KLD (Kilo Litres per Day) capacity was constructed to cater to the needs of the two TPs. The FSTP is located within the Resource Recovery Park (RRP) of PNP. It has a mechanical dewatering system that can operate under any weather with minimally skilled labour.

Inclusion

Sanitation workers are entitled by law to regular health check-ups. Over the last couple of years, health camps have been conducted for over 750 sanitation workers and 200 of their family members, which includes mandatory body check-up, counselling and awareness on medical services and diagnostics. TNUSSP is in the process of institutionalising health camps with the help of the government and private sector. Further, sanitation workers are being linked to social security and insurance schemes, with support being provided in gathering basic identification documents.

Water, Sanitation and Hygiene

Students and teachers are being sensitized on the importance of safe water, sanitation, and hygiene (WASH) practices with a special focus on FSM. Improvements to the sanitation infrastructure

in schools were taken up in parallel with the training. In an effort to promote safe WASH practices in communities, awareness programmes on safe water handling and treatment practices, and water quality testing are being conducted in selected slums.

Menstrual Hygiene Management

Based on a scoping study of menstrual hygiene practices, 'Ungal Thozhi' (Your Friend) module for menstrual health management (MHM) has been developed. It aims to disseminate knowledge and information to safely manage menstruation with confidence and dignity. Plans are underway to propagate this module among school children and women in the community.

Livelihoods

Based on a vulnerability assessment of slums in PNP and NNP, two slums were selected for further engagement. With an aim to create livelihood opportunities, a women's group has been formed to set up a soap-making unit and a tailoring unit. The initiative helps them earn an income and become economically self-sufficient and independent. As a response to the COVID-19 pandemic, the group has been trained to make masks. Ongoing engagements with communities include awareness on liquid waste management, improved solid waste management, ill effects of open defecation, sensitization on hand wash practices.

Karunguzhi

To demonstrate an effective and efficient septage management operation to be scaled up across the State, the GoTN selected a cluster of urban locations comprising Karunguzhi TP and the adjacent Madhuranthagam Municipality to pilot the State's first FSTP. Karunguzhi TP, situated 82 km from Chennai, hosts the State's first FSTP. Built on 1.5 acres of land, with a capacity of 23.40 KLD, the plant works on a natural biological treatment system. The FSTP can treat septage collected from about 10,000 households in Karunguzhi and Madhuranthagam.

The responsibility for O&M of the FSTP is being transitioned from the ULB to a private operator. A draft of the Service Level Agreement for the Karunguzhi FSTP O&M has also been prepared to assist in smooth operations. Further, to make desludging a frequent practice, an application has been developed to implement the process of scheduled cleaning and emptying of household septic tanks for Karunguzhi TP.

Financial and business model

The GoTN has committed over Rs. 250 crores towards the creation of new FSTPs. Further, to meet the O&M costs, existing water and sanitation tax will be used. In order to ensure that the burden of costs does not fall on the host ULBs alone, the GoTN has stipulated that the costs are to be shared between the ULBs within each cluster, proportional to their population. To further promote the use of FSTPs and ensure safe disposal of faecal sludge, only nominal tipping and

license fees are to be charged to de-sludging operators. Opportunities to enable a market for treated water and sludge are being explored, which would allow ULBs to generate additional revenue required to meet O&M costs. The Bill and Melinda Gates Foundation has provided a grant of Rs. 19 crore, in addition to state funding. Households bear the largely reasonable cost of desludging services provided by private operators, except in difficult terrain areas, according to TNUSSP analysis. Alternate models of service provision to certain segments such as urban poor and public institutions to address potential issues of affordability and ability to pay are being explored by TNUSSP.

Successes and lessons learnt

Tamil Nadu is the first State in India to issue OGSM, which set the context for the uptake of FSM services. However, with FSM being a relatively uncharted territory, issues in implementation had to be addressed through innovative approaches.

- The paucity of information with respect to FSM practices and services were addressed by undertaking a range of diagnostic studies – scoping studies, baseline assessments, institutional review, and needs assessments. This gave further insights into the scope of the existing problem and helped plan interventions.
- Towards implementing the OGSM, the need to create adequate fecal sludge treatment facilities was identified as a critical first step. Through the SIP, a phased approach to scaling up faecal sludge treatment using principles of co-treatment and clustering around existing or upcoming facilities has been followed. The MoU adopted by GoTN, the first such agreement in the area of sanitation to be



institutionalized at the State level, establishes a formal process by which the ULBs would utilize shared treatment facilities. MoU along with Standard Licensing Agreement have both contributed towards institutionalizing FSM as a complementary and standalone solution to networked systems. The TSU suggested changes to the existing building rules on Onsite Sanitation Systems and their implementation process. Some of the suggestions have been incorporated into the Tamil Nadu Combined Development and Building Rules, revised and issued in 2019.

- Although FSM was prioritized by the government, a higher degree of buy-in was required from officers who were implementing it. An associated issue was the lack of demonstrated models of FSM. The TSU overcame this through capacity building initiatives for the GoTN officers, including exposure visits to Devanhalli in Karnataka and Malaysia, to understand successful models of FSM. Also, mechanisms such as AC and working groups facilitated the implementation of the programme, while demonstration sites in Tiruchirappalli, PNP, and NNP, helped operationalize it. Simultaneously, the programme involved key partners in the sanitation chain such as masons and desludging operators, by training them on the importance of their role and associated best practices in their domain.
- Availability of land in urban clusters for building FSTPs, which are simultaneously away from the centre of the city, yet not too far for desludging operators to access was an issue. This was overcome by co-locating FSTPs in sites designated for solid waste management. This also offers the option of co-composting.
- While technologies for sewage treatment are well established, faecal sludge treatment is a relatively new domain for private operators, who were invited to bid for FSTP. Hence, bidding and evaluation required a large degree of hand-holding for private businesses. Further, FSTP designs were

standardized to enable greater participation. Considerable flexibility was offered to allow players to leverage their skills and co-bid for the project.

Challenges and possible resolutions

For FSM to be successful, stakeholders in different parts of the sanitation chain need to be co-opted in changing practices and behaviour.

Access: While initiatives by the State and Central governments have improved access to toilets since 2011 (6*) , their usage requires continuous efforts at behaviour change to sustain gains. Community toilet maintenance has also emerged as a barrier to usage, which needs to be addressed in sustainable ways through appropriate models of management.

Containment: Existing household containments, which are not built as per Central Public Health and Environmental Engineering Organisation (CPHEEO) norms pose a challenge, as they require households to bear the cost of upgrading to safe structures. Even though masons in two locations have been trained on proper methods of toilet and containment construction, it is the households that are primary decision-makers. It is important to educate the households on proper methods of toilet construction, maintenance, and use (regular desludging and not to throw menstrual hygiene products in the toilet which blocks septic tanks). Also, while Municipal Building Rules detail procedures for receiving and approving building proposals, they need to be followed and their implementation monitored.

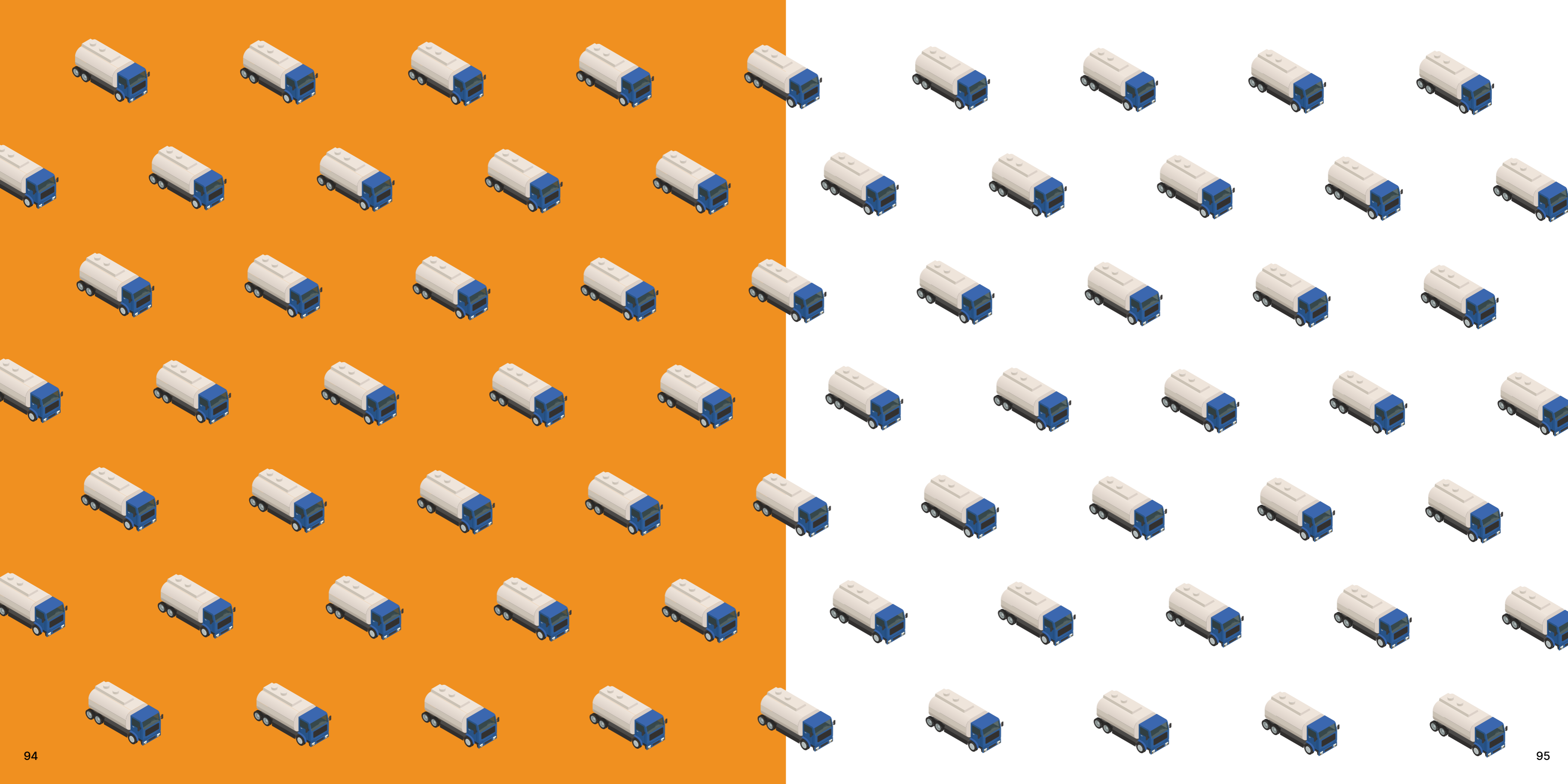
Collection and Conveyance: While a standard licensing agreement has been adopted, operational challenges including those in monitoring desludging and disposal practices need to be addressed as the agreement is implemented.

Treatment and Reuse: While co-treatment of faecal sludge poses challenges such as varying characteristics and volume of faecal sludge, the possibility of industrial waste being mixed with sewage also exists. Further, it is important to ensure that the treatment efficiency is monitored regularly by testing the effluent quality.

Strengthening the enabling environment for FSM service delivery in Tamil Nadu is a time-intensive and iterative process given the dearth of implemented and proven interventions in FSM. Inadequacy of government staff and minimal private sector participation in the sector are added challenges to sustain interventions.



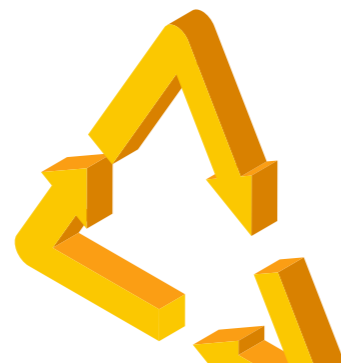
[6] Access to Toilet among urban households as per the 76th Round of National Sample Survey, 2018 stood at 76 percent, while 16 percent report using households in the building and 6 per cent of the households had no access to toilets.



Andhra Pradesh

Context

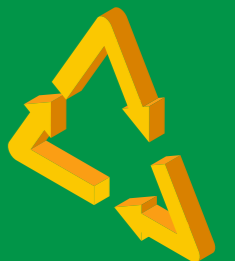
Andhra Pradesh is a rapidly urbanising State with close to 30% of its population living in urban areas. In line with the Government of India's Swachh Bharat Mission (SBM), the Government of Andhra Pradesh (GoAP hereinafter) has realised its vision to make all its urban areas free from open defecation in 2016. However, with only a few cities having access to underground sewerage network, more than 80% of the 3.5 lakh urban households are dependent on on-site sanitation systems (OSS) such as septic tanks and pits. It was estimated that 90% of the wastewater generated in urban areas is not treated scientifically. This included the untreated human excreta from OSS that is disposed of in open areas and waterbodies. To address this problem, GoAP has prioritised faecal sludge and septage management (FSSM) and taken several pathbreaking initiatives to improve the environment and public health. It has issued an FSSM policy and operationalized it too, using it as a multi-pronged and multi-stakeholder approach to provide comprehensive and inclusive safe sanitation in all its 110 towns.



Approach

The government of Andhra Pradesh has prioritized sanitation and set the goal of achieving total sanitation, which is inclusive and safe. It has launched the Swachh Andhra Mission (SAM) and established the Swachh Andhra Corporation (SAC) on 1st May 2015 as the nodal agency to guide and support the Urban Local Bodies (ULBs) in eliminating open defecation, eradication of manual scavenging, safe management of solid and liquid waste, conducting IEC campaigns and capacity building activities to maintain the desired cleanliness and hygiene levels. Over 2.2 lakh individual toilets, 585 public, and 867 community toilet blocks were constructed, and widespread behaviour change programs were conducted to address the issue of open defecation. On 2nd October 2016, GoAP declared its urban areas Open Defecation Free (ODF). With the understanding that eliminating open defecation is just the first step in ensuring safe sanitation for all, the State has taken concrete steps towards implementing Faecal Sludge and Septage Management with technical and knowledge support from the Administrative Staff College of India (ASCI) and Bill and Melinda Gates Foundation. The process and outcomes are as below:

1. The Municipal Administration and Urban Development Department (MA&UD), Swachh Andhra Corporation, and Commissioner and Director of Municipal Administration (CDMA) worked collaboratively to achieve the following integrated approaches and outcomes:



- Detailed diagnostic of the sanitation situation and challenges in urban areas and estimation of the burden of sanitation particularly on the urban poor and vulnerable
- Develop State FSSM policy and operational guidelines
- Enhance the understanding and capacities of the State and 110 ULBs to plan and deliver safe sanitation services with a focus on FSSM and decentralized wastewater systems
- Pilot innovative initiatives across the sanitation value chain and learn from the experience to scale up the initiatives across urban areas
- Develop a framework for gender integration and equity in sanitation based on a detailed study and pilot implementations in three towns (Narsapur, Kovvur, Anantapur) for scale-up
- Encourage private sector participation and partnerships for bringing requisite technical knowledge, implementation, and financial support
- Implement a comprehensive plan for operationalising faecal sludge treatment systems in all its 110 towns

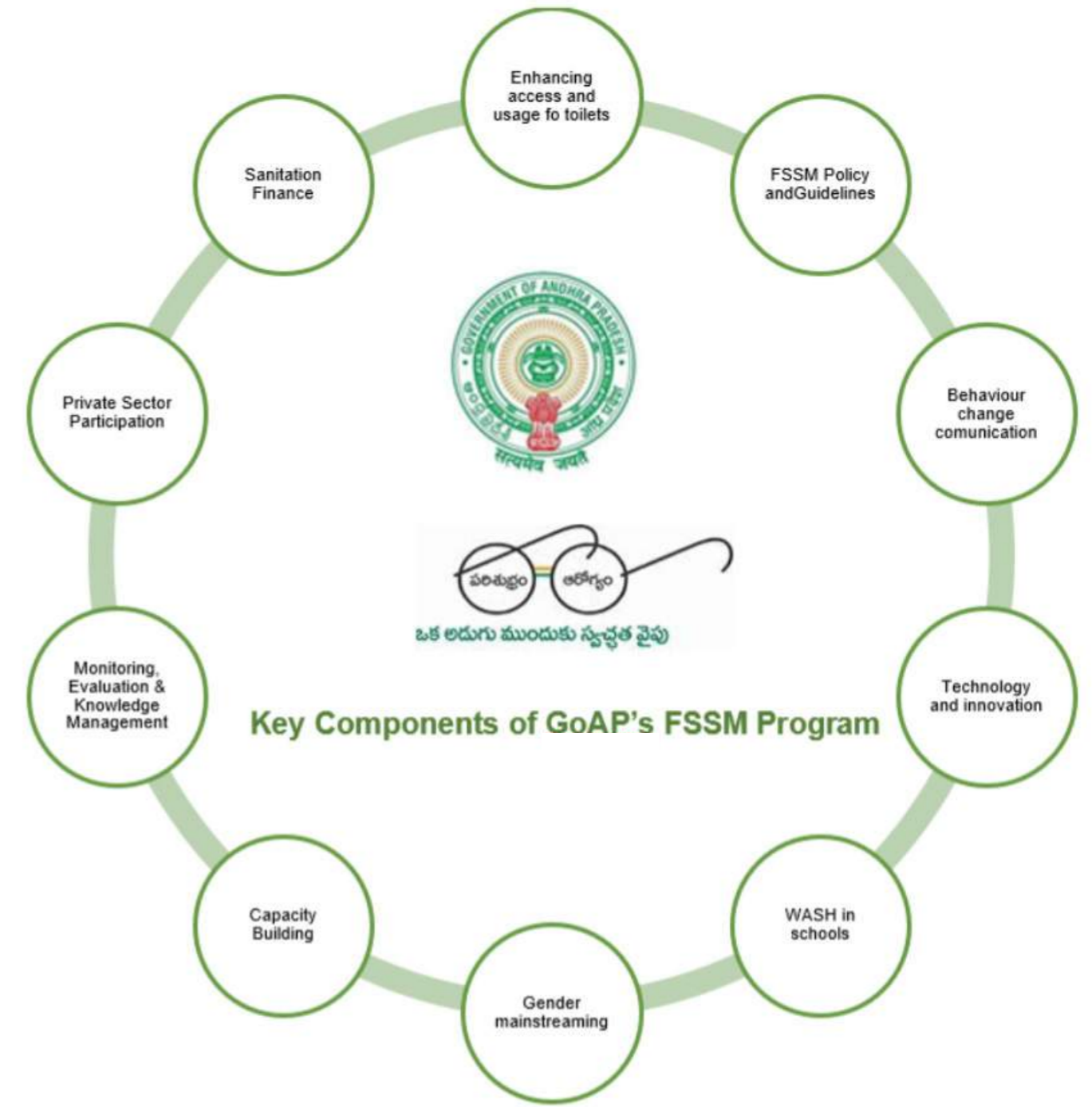
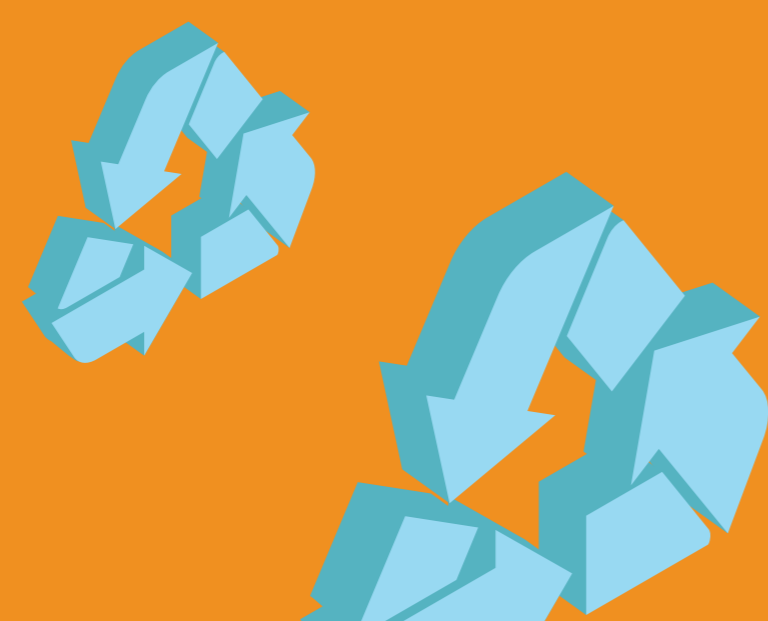


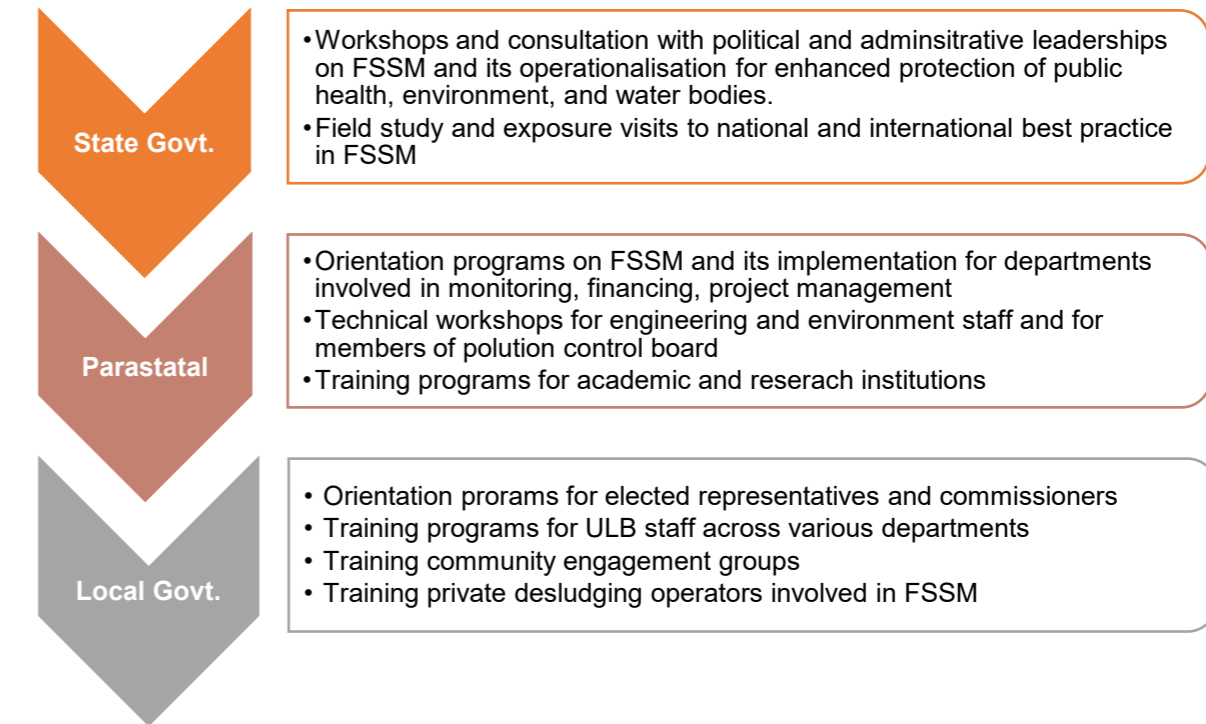
Figure 1: Key Components of Government of Andhra Pradesh's FSSM Program

2. Large scale advocacy, awareness development, and capacity building programs were undertaken with the policymakers and municipal functionaries at the State and ULB levels, for building the FSSM know-how besides enabling the ecosystem to promote the delivery of safe sanitation. Policy and operative guidelines for safe FSSM in urban AP were notified in 2017 and a decision was taken to set up the faecal sludge treatment facilities in all the towns.

These programs paved way for the development of AP State FSSM policy and Operational Guidelines (GO:134) the dissemination and implementation of which is collaboratively monitored by MA&UD, and CDMA, and SAC. The municipal councils of all the ULBs in the State accepted FSSM and issued a council resolution for its implementation in their respective ULBs. All the 110 ULBs have prepared FSSM plans and participated in training programs to build FSM capacities.



Figure 2: Capacity Building for FSSM Rollout



3. Establishing institutional mechanisms such as Non-sewerage Sanitation (NSS) Cell at SAC and State sanitation helpline has lent support to the ULBs in implementing the policy. The State also took a decentralized management approach through the Regional Directorate for Municipal Administration (RDMA) in its 4 regions – Anantapur, Guntur, Rajahmundry, and Vishakhapatnam for closer monitoring and to drive results. The identification of land for establishing treatment plants is facilitated by RDMA. Also, RDMA ensured that licensing of desludging operators, training programs for sanitation workers on processes, health, and use of personal protective equipment is implemented at scale.

4. Private sector development, partnerships with academic institutions, and alignment of sanitation agenda with key organizations with large community outreach, namely Mission for Elimination of Poverty in Municipal Areas (MEPMA) with a membership of 20 lakh women in 2 lakh active SHGs have been initiated as a move towards ensuring the sustainability of FSSM.

5. Several innovative projects have been piloted to inform implementation at scale. Faecal Sludge Treatment Plants (FSTPs) at Narsapur, co-treatment of septage in functional Sewerage Treatment Plants (STPs) at Tirupati, and Vishakhapatnam, decentralized wastewater treatment plant at Vijayawada are some such pilots. All the pilots are monitored for compliance with environmental discharge standards and have brought in credibility, confidence, and buy-in for FSSM/NSS and crucial buy-in from the State engineering wing (PHED) and State Pollution Control Board (APPCB).



Figure 3: FSTP at Narsapur and Rajam



6. The State decided to promote co-treatment of faecal sludge at functional STPs and establishment of standalone FSTPs in towns without STPs. Innovative financing options such as Public-Private Partnership (PPP) in Hybrid Annuity Model implemented for the first time in the world in FSTPs have provided the State government with an impetus to unlocking funds for FSTP projects at scale. GoAP has issued contracts in this regard and the projects are at the early stages of operationalization.

There is a strong momentum for FSSM in AP and ULBs to continue their dedicated efforts on implementation and project management, service delivery, with strong monitoring from the State agencies and leaders.



Figure 4: Co-treatment facilities at Tirupathi & Anakapalli

Institutional set-up

GoAP incorporated the Swachh Andhra Corporation (SAC) in 2015 as its nodal agency to implement the Swachh Andhra Mission's objective. FSSM is housed in MoUD—office of the Principal Secretary and implemented by CDMA, four RDMA, and SAC. The APPCB provides regulatory direction and plays a critical role in monitoring the achievement of key environmental indicators. The technical and design support for engineering activities is led by PHED while ASCI provides knowledge and transaction advisory support. Andhra Pradesh Urban Finance and Infrastructure Development Corporation (APUFIDC), the nodal agency for AMRUT supports the co-treatment projects through coordination with ULBs, STP contractors, and engineers on design parameters.

MEPMA acts as a hub and works through its regional, district, and city-level networks to achieve gender integration and inclusion in sanitation. It also supports data collection, IEC, and other activities towards sustainable implementation at scale. Further, the State has empowered community-based organizations such as Gender Forums, Self-Help Groups, Slum Level Federations, Town Level Federations, etc. to be an active interface for the community with the State to demand their needs and address their concerns. MEPMA plays a key role in facilitating these activities. Recently, in line with decentralized governance, a cadre of "Environment and Sanitation Ward Secretaries" has been created across all the ULBs in the State. It is envisaged that the ward secretaries would function as an extended arm of the local government at the ward level and will serve as an interface between the local government and citizens.

Several local institutions provide innovation, planning, implementation, and monitoring support to the State and local bodies for sustaining and furthering FSSM practice and integrating sanitation as a service. The State has also drawn partnerships with national and global organizations championing FSM.

Key initiatives and achievements

The State has built an enabling environment for achieving safe and inclusive sanitation. Evidence-based advocacy, capacity building, and sharing of best practices from pilot towns collectively contributed to the development of political will and administrative ecosystem at the State level for implementing FSM in urban AP. Some of the key achievements are as below:

- Promoting State-wide adoption of FSSM policy and guidelines. All the 110 ULBs have passed a resolution adopting GO134. All towns prepare FSSM plans.
- FSTP piloted in Narsapur town scaled up to 76 towns through Public-Private Partnership in Hybrid Annuity Model (PPP-HAM).
- State directive for the conversion of all the existing and new Sewerage Treatment Plants planned (in AMRUT-funded towns) to facilities that would co-treat faecal sludge. Co-treatment has been operationalized in four towns and is being expanded in all other functional STPs with spare capacities.
- Currently, FSTPs in urban areas have spare capacities to treat FS of rural areas, a study along the lines has been completed for Rajam ULB and may be extended to all the rural areas.

- Increased allocation of budgets towards FSTPs (INR 210 crores: for an amount of Rs 113 Cr as Capital Cost and 97 Cr as O&M cost) to account for CAPEX and OPEX for 10 years in addition to separate budgets for IEC activities and upkeep of public sanitation facilities.
- Exploring CSR partnerships for introducing and sustaining FSM interventions in ULBs. A decentralized wastewater treatment plant of 30KLD has been operationalized through CSR contributions in Vijayawada.
- Integrating sanitation curriculum in higher education to develop a stream of sanitation professionals to support AP and other states. MoUs operationalized with renowned institutions.
- Sanitation worker training on safety and well-being. Issuance of PPE to all desludging operators
- Installation of GPS tracking devices on de-sludging vehicles for effective monitoring of these vehicles is complete in pilot towns and being scaled up. A State-level dashboard to monitor these vehicles is envisaged.
- Establishment of the State-level multi-stakeholder NSS cell to plan, monitor FSM scale-up. The cell was expanded to include gender experts from MEPMA.
- Centralized monitoring of PTs/CTs at the State Command and Communication Centre.
- Low-income housing projects aim to include decentralized wastewater treatment systems in the projects across the State. Procurement procedures are being finalized.



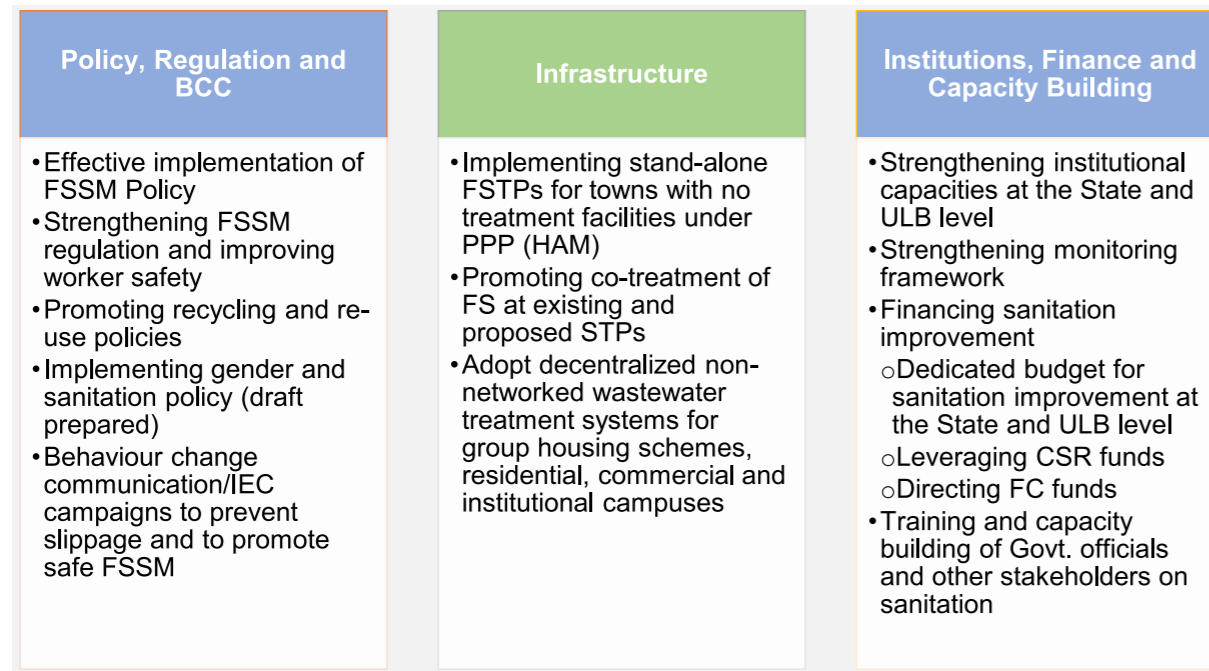


Figure 5: The key action areas implemented by GoAP

Financial and Business Model

The government has enhanced its budgetary allocations towards sanitation and pooled in fund for FSSM from the national programs (SBM and AMRUT), AIB, The World Bank (APMDP) support for capital investments related to activities viz., faecal sludge management, community toilets, toilets in schools and DEWAT systems. Private sector funds are leveraged for construction of FSTPs, public toilets on BOT basis and decentralized non networked treatment systems in private apartments and colonies. Funds from the corporates and high net worth individuals are also explored.

When GoAP planned to establish 76 FSTPs in small and medium towns, financing the capital and operating costs proved to be the significant roadblocks for achieving the vision of safe sanitation. Further, the availability of technical capacity at the municipal level to develop and manage FSTPs emerged as a critical gap.

Against this backdrop, the State opted for PPP to bridge the financial and technical gaps in urban local bodies (ULBs). The government of AP introduced the Hybrid Annuity Model (HAM) of PPP for developing FSTPs due to the following key benefits of the model:

- It enables influx of private capital for the infrastructure development and helps in diversifying financing sources.
- It leads to the staggering of cash flows for the authority while ensuring liquidity of the developer.
- The HAM developer is incentivized to take a life cycle view to reduce O&M costs in the future.

This will result in a longer life of the asset created.



The salient features of the innovative procurement model of FSTPs by GoAP are:

- 76 FSTPs clustered into seven packages to promote economies of scale and to attract credible and established operators.
- Adoption of a technology-agnostic approach for project development wherein the bidders can propose any proven technology option tested in India for safe treatment of the faecal sludge. A Technical Advisory Committee (TAC) was set up to approve the technology proposed.
- Concession period of 10 years in design, build, operate & transfer (DBOT) model requiring the construction to be completed in 6 months and plant to be operated over the balance of 9.5 Yrs.
- Technical and financial bids were evaluated using Least Cost Selection (LCS) process on the basis of the lowest assessed Bid Price which is a summation of (a) Bid Project Cost & (b) Net Present Value (NPV) of the O&M Cost.
- 50% of the CAPEX quoted is paid on completion of construction and the balance is paid over the life of the project as annuities along with O&M expenses. Further, the bidder can monetize resources recovered like biogas, treated wastewater, biochar, and compost.

While the ULBs provide encumbrance free land, and connections for water and electricity, the project management is by the State. Funds are earmarked (USD 30 million), work orders issued, and construction is initiated. It has appointed independent engineers to monitor and certify the quality of construction, a requirement for release of payment to the operators. Further a system of weekly monitoring, involving the developers, independent engineers, ULBs, and State officials are implemented for effective project implementation.

Successes

Describing the impact & lessons to keep in mind for developing a similar project or in case of replicating and scaling up the model.

FSSM has been mainstreamed in the planning process at the State and city levels. Important lessons that emerge for GoAP as well as other states are described below:

- Land acquisition for FSTP was found to be a time-consuming exercise. Dedicated land parcels are yet to be identified in several of the 76 ULBs where FSTPs tenders are finalized. The learning from this experience is that process of identifying land for the establishment of FSTP needs to be identified much ahead of the tendering process. Early identification of lands and the possibility of getting land with the irrigation department or adjacent peri-urban areas needs to be explored to manage the risk.

It was also observed that in some cities, the land allocated for FSTPs may require filling, land clearance, etc. which could be expensive. The ULBs may not be able to finance this and this could lead to delays. Therefore, the cost estimations need to be done at the land allocation stage itself which can help decide who would bear the costs. This can prevent delays in the project.

- **State/ULB officials and elected representatives demonstrate varying levels of awareness and commitment to FSSM concept and technologies.**

Building institutional mechanisms (such as FSM unit, directives, the separate budget line for FSSM, etc.), continuous capacity building, and establishing systems to monitor and report progress on FSSM and its impacts would help in sustaining FSSM implementation and risk mitigation. Capacity building through regular training programs, best practices workshops, and exposure visits for municipal functionaries at ULB level are critical for sustaining FSSM.

- **Gender equity and empowerment must be integrated into every aspect of planning and implementation right from the beginning of the program and not as an additional result area for effective mainstreaming.**

Systematic approaches to involve women groups with programmatic support are essential for ensuring community participation and gender integration in sanitation.

- **Hybrid Annuity based PPP models in India have been adopted successfully in roads and highways development. Implementing HAM in establishing FSTPs at scale is a unique experiment by GoAP.**

As the FSTP projects are being operationalized, the State government has started developing plans for accepting sludge from the rural areas within 10 km radius, thus leading the way for another innovative model of rural-urban integration in sanitation. The model is well balanced with clear commitments and risk-sharing from both the parties. One of the most important features of this model is that both the Annuity and O&M payments are linked to the performance of the FSTP.

This will ensure sustained usage of the assets created due to better accountability, ownership, and optimal performance. The role of transaction advisory is important not only in developing a balanced Request for Proposal (RFP) but also for market development through promoting the project with the right target group. Continued engagement with the private sector through the life of the project is essential for building trust.

- **Institutional mechanisms need to be developed for the long-term sustainability.**

This will include the development of an ecosystem, including development, introduction and integration of relevant policies, guidelines, and regulatory frameworks, establishing systems and processes as also monitoring mechanisms at all levels of governance in the sanitation programmes.

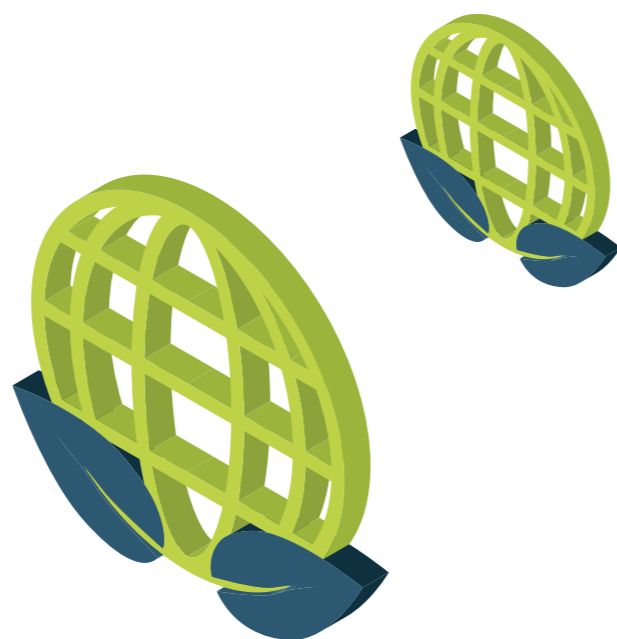
- **Forging inter-sectoral collaboration including convergence with other relevant programs is critical to the successful implementation of any integrated sanitation programme.**

The line departments and programmes that hold the key to this convergence for the sanitation work are: SBM, NULM, Smart city, Amrut, etc., Jal Shakti Mission, the State Engineering wing, CDMA, MEPMA, AP Urban Infrastructure and Finance Development Corporation, Dept. of Health and Family Welfare, Rural Development, Social Welfare, Environment Department, and Pollution Control Board.

- **Financing mechanisms should be streamlined for dedicated resources towards achieving sustained sanitation goals**

A dedicated budget line is required for gender-sensitive design improvements, Menstrual Hygiene Management, sanitation worker safety and well-being programmes, operations and maintenance of public and community toilets, operations and maintenance of treatment facilities, conversion of insanitary toilets to sanitary ones, IEC and behaviour change programmes, building municipal capacities, etc.

Strong policies, accessible sanitation infrastructure, sustainable operation, and management of services empowered community-based organizations and open-mindedness to innovative approaches are key levers for scaled implementation of FSSM. State Governments need to place a strong emphasis on implementation and project management, service delivery, with robust monitoring from State agencies and leaders.



Conclusion

GoAP has now prioritized the implementation of FSSM initiatives in urban areas by focusing on total sanitation through scientific management of human waste (ODF++). This also includes wastewater treatment and FSSM in addition to ODF sustenance. The bold and innovative measures taken by GoAP have inspired many good practices in the sector. The State strives to further enhance the impacts on the environment and public health in urban AP by finding solutions for the safe management of all domestic wastewater (black water and grey water) along with faecal sludge and septage. It aims to incorporate city-wide inclusive sanitation approaches by bringing an enhanced focus on pro-poor measures, gender integration, monitoring mechanisms, and quality assurance across the value chain for quality sanitation service delivery by all ULBs in the State. The strategic focus would be on strengthening institutional mechanisms and building capacities and institutions to ensure quality FSSM implementation at scale on a sustainable basis. It would also be on the setting-up of effective systems and processes with the ULBs and private sector players for ensuring timely and quality execution and efficient operations of FSTPs (76 locations) and co-treatment facilities in the rest of the towns to cover all urban areas (110 towns) over some time and also serve peri-urban areas and adjoining rural areas where possible.





Telangana

Context

The government of Telangana (GoT) is committed to achieving the sustainable development goal (SDG) targets in water and sanitation well ahead of the globally agreed timelines. It recognizes that domestic wastewater containing human excreta is a major contributor to water pollution. Given that underground sewerage systems with 100% coverage and connected with sewage treatment plants to treat wastewater is a time-consuming, capital- and water-intensive endeavour. Telangana has prioritized Faecal Sludge and Septage Management (FSSM) and decentralized wastewater treatment as a viable solution for the enhanced environment and public health outcomes. The State has piloted several pathbreaking initiatives in the city of Warangal and taken the initiatives to scale to benefit all its 142 Urban Local Bodies (ULBs). The historic city of Warangal has emerged as a city of innovations in FSSM and City-Wide Inclusive Sanitation (CWIS) approaches and has informed FSSM policy and practice in Telangana and many urban areas in the rest of India. GoT envisions to transform Telangana into a hub for water, sanitation, and hygiene innovations and is establishing a Sanitation Innovation Hub (S-Hub) at Administrative Staff College of India for incubating new sanitation solutions and promoting entrepreneurship in sanitation service delivery for employment generation and livelihoods. This hub will also help build municipal capacities for reinventing sanitation technologies and sustaining sanitation interventions.



Initiation and Planning Process

Telangana, the youngest State in the country, is rapidly urbanizing with close to 40% of its population living in urban areas. In line with the Government of India's Swachh Bharat Mission (SBM), the State has launched Swachh Telangana Mission and successfully provided access to individual household latrines (IHHLs), public toilets, and community toilets and achieved open defecation free (ODF) status on 2nd October 2019. With only the major cities like Hyderabad having access to the underground sewerage network, more than 50% of the urban households are dependent on on-site sanitation systems (OSS) such as septic tanks and pits. As in most other cities in India, it has to address the problem of the untreated waste from these systems being indiscriminately disposed of by unregulated private operators in open areas and water bodies, causing harm to public health and degradation of water bodies and the environment.

Telangana is one of the first states in the country to recognize the importance of Faecal Sludge and Septage Management (FSSM) and introduced a comprehensive policy on FSSM in September 2018. The policy provision provides a step-by-step approach for regulating the collection, treatment, and disposal of faecal sludge in urban areas in Telangana. It also includes guidance on awareness generation and capacity building activities; technology options for FSSM; record-keeping, reporting, monitoring, and feedback systems (MIS); private sector participation, financial resources, and considerations in FSSM.

With knowledge and technical support from the Administrative Staff College of India (ASCI) and Bill and Melinda Gates Foundation (BMGF), several innovations are piloted in Warangal city, and the experiences from the same are incorporated for scale-up of the interventions to benefit all its 142 urban areas.

Warangal Experience

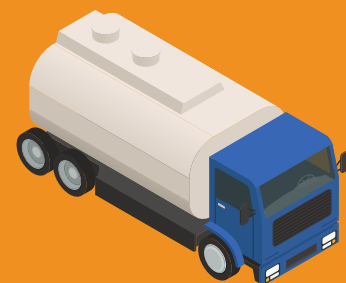
Warangal city, the second-largest city in Telangana, has an estimated population of 10 lakhs (8 lakhs as per the 2011 Census). Greater Warangal Municipal Corporation (GWMC) has extensively promoted the construction and usage of toilets in households and at public places to make the city of Warangal Open Defecation Free. Declared ODF in December 2017, Warangal took a CWIS approach to sanitation improvement.

At present, the city does not have a sewerage system and is dependent on on-site sanitation (OSS) toilet systems such as septic tanks and pits. About 93% of households have access to individual Household Latrines (IHHLs), and 78% of these are connected to septic tanks and 15% to pits (estimated). The remaining HHs, especially from low-income areas, use community and public toilets (CT/PT).

Warangal has many firsts to its credit:

- **Management (FSSM) regulation in March 2016.**

Under this policy, GWMC has issued 14 licenses, and the desludging operators are trained to



follow safety standards of emptying, including usage of Protective Personal Equipment (PPE). ICT tools are used to monitor the FSM operations continuously. Further, GWMC is planning to implement scheduled desludging of all properties once in three years in line with Telangana policy on FSSM, which recommends a minimum of the three-year desludging cycle for safe FSM. It would require licensing of additional trucks (approximately 75 more) and treatment capacities.



Figure 1: key components of regulatory framework

- It is the first city to have introduced exclusive toilets for women, made toilets in fuel stations in the city available for use by everyone and not just by employees and customers, have public toilets with investments from the private sector (PPP). It is one of the few cities in the country

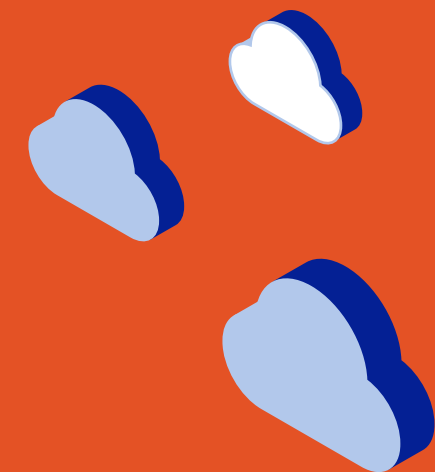
to have well-designed and maintained public toilets (PTs) in public-private partnerships (PPP). The city currently has 45 PTs and plans to increase them to 75 to cater to the floating population. It has introduced exclusive toilets for women (SHE toilets) and provisioned for 8 community toilets in urban-poor settlements. It has introduced the branding of public toilets by way of standardized signage board on the PTs for easy recognition and four direction boards per PT for enhancing visibility. It has followed national guidelines and introduced improved designs of PTs to increase the usage rate by women, children, specially-abled, and transgender community members.



Figure 2: SHE Toilet at Warangal



- **Operations and maintenance (O&M) of public sanitation facilities** is critical to ensuring their usage and sustaining ODF status. The city has developed well-defined Service Level Agreements for maintenance and issued contracts to Women Self Help Groups (SHGs), including transgender communities.
- **Established a sanitation helpline (s-line)** to smoothen and fasten the application and subsidy flow for Individual Household Latrines (IHHLs). Further, S-line is promoted extensively and has become the one-point contact for all sanitation related queries, suggestions, and concerns. The city is aiming to achieve 100% IHHL access. It has also conducted a survey to identify toilets that do not have safe containment systems and are releasing the waste directly into the open areas and drains. The city has experimented with different models for retrofitting and identified and served notices to all households with such toilets. It has also extended subsidy to below-poverty line (BPL) households to support the conversions to safe toilets.





నాకు టాయిలెట్ కావాలి!

ఫోన్ కొట్టు - టాయిలెట్ కట్టు

ఇంట్లో టాయిలెట్ లేకపోతే ఎంత కష్టమో ... ఉన్నవాల్లాకి తెలియదు. పాపం మహిళలకు, పిల్లలకు వచ్చే కష్టం చెప్పుకోలేనంతగా ఉంటుంది.

ఇప్పుడు గ్రేటర్ వరంగల్ మున్సిపల్ కార్పొరేషన్ టాయిలెట్ లేనివాల్లాకి టాయిలెట్ కట్టడానికి 12,000 రూ॥ ఇస్తున్నారు. మీరు మీ చుట్టుపక్కల బస్టిలో ఉన్నవారిని కలిసి వాల్తరపున కమిషన్ కు అర్జీ పెడితే వాల్ల ఆరోగ్యం బాగుంటుంది, వరంగల్ శుభ్రంగా ఉంటుంది.

అర్జెంటుగా టాయిలెట్ వస్తే అర్జెంటుగా టాయిలెట్ ఉండాలి. ఫోన్ కొట్టు టాయిలెట్ కట్టు. గ్రేటర్ వరంగల్ బాధ్యత చేపట్టు.



1800 425 1980
TOLL-FREE NUMBER
Call Timings: 9.30 AM to 5.30 PM

GWMC మీకు 12,000 రూ॥ ఇస్తుంది
మీ అపరిశుభ్ర టాయిలెట్ ను
పరిశుభ్ర టాయిలెట్ గా చేసుకోవడానికి.

ఇంట్లో టాయిలెట్ లేకపోతే ఎంత కష్టమో ... ఉన్నవాల్లాకి తెలియదు.

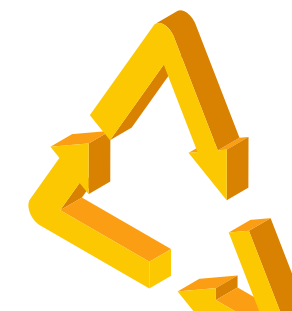
- In line with the CWIS principle of pro-poor initiatives, GMWC has undertaken a comprehensive study about sanitation in its 187 slums and identified specific recommendations. It has formed a slum sanitation improvement committee headed by an officer on special duty to drive improvement. Detailed vulnerability assessment, data collection, awareness building, and formation of slum sanitation committees with active participation by women were all facilitated through the Mission for Elimination of Poverty in Urban Areas (MEMPA), a state nodal agency for promoting livelihoods and empowerment among the vulnerable and women.
- Two innovative Faecal Sludge Treatment Plants (FSTPs), total capacity 30 KLD, have been established through grant funding at Ammavaripeta (Sanitation Resource Park) and are operational. While one plant uses pyrolysis, the other uses geo bags as a core principle of treatment. As of 31st July 2020, over 1159 trucks have decanted highly polluting septage at these FSTPs, thereby preventing pollution of water bodies in Warangal city. Around 3.650 ML of sludge has been treated. It has contributed to the improvement of the environment and health of citizens. To cater to the expected demand upon the introduction of scheduled desludging in the city, the development of a 150 KLD plant is planned under the smart city mission. Funding and land are earmarked and the tendering process is being initiated.

Figure 3: S-Line led campaigns for IHHL and conversion of insanitary toilets



Figure 4: Sanitation Resource Park with two FSTPs in Warangal


- **An integrated approach to FSSM and decentralized wastewater management.** GWMC is exploring different decentralized wastewater management systems through the construction of STPs at three strategic locations (750 KLD STP at MGM Hospital, 100 MLD STP at Reddipuram, 15 MLD at Pathinagar, and 3 MLD at Ursugutta) under the smart city development funds. One decentralized wastewater treatment (MBBR technology) plant with CSR funding from Wabag is constructed in the dignity housing (low-income housing) at Ambedkar Nagar with the capacity of 300 KLD to cater to 592 low-income housing units. Decentralized soil biotechnology-based wastewater treatment plant is under implementation at MG hospital and a packaged treatment plant of Japanese technology (JOHKASU) of 50 KLD capacity is also piloted at social welfare residential school-cum-hostel at Madikonda. These pilots have provided valuable lessons particularly with regards to maintenance, and capacity building for monitoring compliance with environmental norms, etc.
- **ICT systems** such as mobile apps and real time data analysis dashboards for monitoring various activities across the sanitation value chain – weekly monitoring of public toilet maintenance by sanitary inspectors, capture of citizen’s feedback in each of the PTs and real time review at the centralised dashboard, record keeping of desludging operations, GPS- facilitated tracking of desludging vehicles to ensure that the septage is decanted at the treatment plants.



- **Gender integration in sanitation** has been attempted through equal participation by women in all sanitation related committees, task forces and groups. Special provisions have been made in public toilet procurement to encourage participation by women. Two SHGs have been issued contracts for design, build, finance, operate and transfer (DBOFT) of public toilets in PPP mode. Sanitation livelihoods in O&M of toilets is also tested and contracts refined. Several other initiatives related to toilet builders training program for women, sanitary pad making enterprises, employing women in FSTPs etc have been implemented.

- **Behaviour change & capacity building of various stakeholders** have been undertaken, and communication products and training materials are tested. The city has conducted workshops on FSSM and CWIS awareness for policymakers, mass communication campaigns for continued usage of toilets and promoting regular desludging, and consultations with Resident Welfare Associations. Training programs on standard operating practices for safe maintenance and desludging have been conducted for toilet operators, desludging operators, and concerned municipal staff. This was followed by behavioural change, hygiene, and well-being programs for sanitation workers. Technical training on FSSM technologies and monitoring has been completed for municipal officials and other key stakeholders.

- **Established a dedicated non-sewered sanitation (NSS) unit**, including a gender expert to oversee all FSSM activities in the city. The impact on the environment and public health of all these initiatives can be reaped only through proper maintenance of the facilities



created and monitoring of service delivery as per well-defined service level standards. Further, all future initiatives need to be planned systematically to ensure sustainable safe sanitation services for all. This requires a dedicated team of officers trained in different aspects of sanitation and environment protection. The city is planning to expand the cell into a full-fledged department to plan, implement and monitor FSSM and wastewater management, using CWIS principles such that the interventions are gender-intentional, pro-poor and citywide.

- **Strong leadership and partnerships** The city leadership team's commitment towards FSSM has been supported by several organizations to help achieve their goal of safe sanitation for all – ASCI, BMGF, OICL, Wabag, REL, SBI, Tide Technocrats, LEA Associates & LASA, GIZ, Egis, Rotary International, VASAVI, Firmenich, BBC media action and UMC. It has fast-tracked the achievement of ODF++ in the city, through safe management of faecal sludge and behaviour change communication. Various stakeholders were instrumental in helping Warangal achieve its goal of total sanitation. The primary role of ASCI had been to conduct diagnostic surveys, preparation of detailed project reports, advocacy of planning initiatives, development of monitoring systems, and capacity building. The city has implemented a robust funding model comprising a combination of public funding, grant funding, investments by private sectors, and support from the corporates under CSR.

Due to all these interventions, Warangal has gained a global reputation as a city of innovations in sanitation. The innovation ecosystem of the city has encouraged several national and international organizations to partner with the city. Several of the initiatives piloted in the city have been

taken up for replication at scale in 142 ULBs in Telangana besides in other cities outside Telangana in India as well as overseas. Warangal experience has also informed national policy and directions on FSSM.

Institutional set-up

FSSM is led by the Principal Secretary, MA&UD, Government of Telangana, who issues policy directions, organizes funding, and facilitates partnerships. Implementation is being carried out by ULBs under the overall directions of the Commissioner and Director of Municipal Administration (CDMA), collectors, and additional collectors. The Telangana Pollution Control Board provides regulatory directions and plays a critical role in monitoring the achievement of key environmental indicators. The technical and design support for engineering activities is led by the State engineering wing while ASCI provides knowledge and transaction advisory support. Telangana Urban Finance and Infrastructure Development Corporation (TUFIDC) is the nodal agency for financing the faecal sludge treatment infrastructure development.

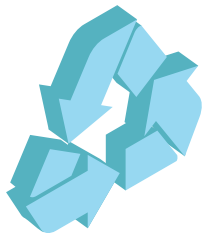
Mission for Elimination of Poverty in Municipal Areas (MEPMA) acts as a hub and works through its regional, district, and city-level networks to achieve gender integration and inclusion in sanitation. It also supports data collection, IEC, and other activities towards sustainable implementation at scale. Further, the State has empowered community-based organizations such as Gender Forums, Self-Help Groups, Slum Level Federations, Town Level Federations, etc. to be the active interface for the community vis-a-vis the State to demand their needs and address their concerns. MEPMA plays a critical role in facilitating these activities.



Recently, the State has identified sanitation mentors to each of the ULBs to provide capacity building and advisory support. State-level dashboards are created and maintained at CDMA for regular monitoring.

Several local institutions provide innovation, planning, implementation, and monitoring support to the State and local bodies for sustaining and furthering FSSM practice and integrating sanitation as a service. The State has also drawn partnerships with national and global organizations championing FSM.

Financial and business model



The government has enhanced its budgetary allocations towards sanitation to support capital investments for public sanitation facilities, toilets in schools, wastewater treatment systems, and FSTPs in 68 new municipalities. Private sector funds are leveraged for construction of FSTPs, public toilets on a DBFOT basis, and decentralized non-networked treatment systems in private apartments and colonies. In the public toilet infrastructure being operated as per the DBFOT model, the ULB provides the land free of cost and gives the rights for advertisement space. The private operator finances, constructs, and operates the facilities during the lease period. Water, electricity, and other facilities are expected to be sourced by the private agency. The O&M is met from user charges and advertisement revenues. Community toilets are built by the city government and the O&M is handled by the local SHGs. The entire desludging activity is managed by private players and hence private investment. Funds from Corporates and High Net worth Individuals are also explored.

The State opted for PPP to bridge financial and technical gaps in ULBs for developing FSTPs and introduced the Hybrid Annuity Model (HAM) of PPP to benefit from the model:

- It enables the influx of private capital for infrastructure development and helps in diversifying financing sources.
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- The concession period of 10 years in design, build, operate & transfer (DBOT) model requiring the construction to be completed in 6 months and the plant to be operated over the balance 9.5 years.
- Technical and financial bids were evaluated using the Least Cost Selection (LCS) process based on lowest assessed Bid Price which is a summation of (a) Bid Project Cost & (b) Net Present Value (NPV) of O&M Cost.
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Successes and Lessons Learnt

With the experience from Warangal in ensuring safe sanitation for all, the State has taken concrete steps towards implementing Faecal Sludge and Septage Management (FSSM) on a mission mode across all its urban areas. The initiatives, process, outcomes, and lessons are as below:

Universal Coverage of Individual Household Toilets (IHHL)

The State has constructed 2.88 lakh individual household toilets (IHHLs) under SBM besides 169 community toilets, 304 public toilets, and 40 exclusive toilets for women to achieve the open defecation free status in 74 urban areas in 2018. While more than 98% of the households in these ULBs have access to a toilet, the State added 68 municipalities in 2019, where the coverage was comparatively less. It is now making efforts to achieve 100% IHHL coverage in all the 142 ULBs and extending subsidies too accordingly. More than 1.52 lakhs additional IHHLs have already been constructed and an additional 6000 are required to be constructed to achieve the target. The regular flow of subsidy, quick processing of applications by ULBs are critical to ensure this achievement.

Improving Toilet Containment Systems

OSS is a necessary pre-condition to contain pollution, however, if the septic tanks or pits are not constructed as per the standards or if the toilets are directly connected to open drains, then the objective is not achieved. Accordingly, the State is taking a two-pronged approach to improving the quality of toilet containment systems.



To ensure that all the new toilets are built as per IS standards, it has integrated toilet containment specifications under the sanitation component in its automated Building Permission System.

Capacity building of municipal functionaries on design, system requirements, and conducting field checks is critical to ensuring compliance.

Further, all the ULBs have conducted household surveys to identify toilets that do not meet the standards and hence classified as ‘insanitary toilets.’ Notices have been issued to such households to immediately convert these toilets to safe toilets and subsidy is extended to below poverty line (BPL) households. Of the total 25,793 insanitary toilets mapped across the 142 ULBs till 31st August, 2020, 16,800 toilets are converted to safe toilets, and the rest are under the process of conversion. Retrofitting of toilets is an extremely difficult task given the challenges of space, access, and finance. Basis lessons from Warangal, different technology options for conversion have been implemented and engineers and sanitary inspectors are trained on the same to guide citizens suitably.

Enhanced provision of High-Quality and Inclusive Public Sanitation facilities

In line with national guidelines, the State has decided to build one public toilet for every 1000 population in all the ULBs. As part of this initiative, more than 9000 public toilets are planned in the State out of which 4794 are already operational and the balance under different stages of construction to be completed over the next few months. State directive and detailed guidelines on design standards and innovative public toilet models have been issued in March 2020.

Training programs have been conducted for all commissioners and engineers to clarify the standards and different models. Public-Private Partnerships (PPP) in PT development on a pay and use model is implemented at scale.

Exclusive Toilets for women (SHE toilets)

Telangana is the first state to have implemented exclusive toilets for women (SHE toilets).

This model has been tested in Warangal and scaled up to other ULBs in the State. The Minister of MA&UD, Shri K. T Rama Rao has instructed all ULBs to provision for at least 10 SHE toilets each. The State has issued directions in this regard to all ULBs and design specifications are also disseminated. Woman caretaker, CCTV, sanitary pad dispenser and incinerator, baby care space, feedback machine are some of the features included.

The State has also given the option of establishing Mobile SHE toilets by refurbishing and upcycling buses in the ULBs where construction of permanent toilets may not be feasible due to constraints of space and demand. Through these unique initiatives, Telangana has taken a lead role in prioritizing exclusive toilets for women to cater to the specific needs of women, girls, and transgender community members.

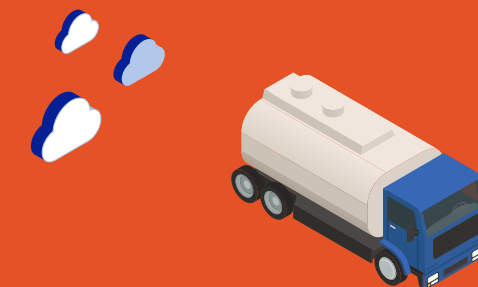
Operations and maintenance of public sanitation facilities

The large-scale construction of public sanitation facilities would lead to the creation of assets that need to be maintained properly for continued usage by the citizens. Efforts are made to develop an effective O&M plan as per defined service level standards, operating practices,

and regular monitoring systems in place. In this regard, the State had issued directions and guidelines on engaging Slum Level Federations (SLF) for O&M of public and community toilets. Model contracts for engaging the services are shared for guidance, and training modules for the operators are prepared for dissemination. Basis Warangal model and discussions with women groups on viability, a standard price of Rs. 2000 per toilet seat is finalized.

Gender integration in sanitation

In addition to bringing required improvement in public sanitation facilities to make them gender-inclusive, the State is committed to women empowerment through providing opportunities for livelihoods and entrepreneurship in sanitation. And to ensure that existing and future initiatives in sanitation show a strong commitment towards an inclusive agenda, the State has decided to strengthen gender intentional sanitation programming under the leadership of MEPMA. Capacity building programs are being conducted for women groups to enable them to become change champions of gender-inclusive urban planning and decision making. In addition to O&M of toilets, the role of women in desludging, FSTP maintenance, sanitary pad making, etc. is being explored. Financing, market linkages, and any unintended consequences are being studied in detail. Telangana is one of the first states in India to develop a systematic approach towards gender integration in sanitation.



Establishing Faecal Sludge Treatment Plants

Following the successful implementation of pilot FSTPs in Warangal and another one in Sircilla town, GoT decided to scale up the establishment of FSTPs in 71 ULBs under Public-Private Partnership (Hybrid Annuity) model. Under the Hybrid Annuity Model of PPP, 60% of the capital expenditure (CapEx) towards the construction of FSTP is paid to the private operator in three instalments during the construction phase of 6 months and the remaining 40% CapEx during the entire duration of the 9.5 years of O&M phase in quarterly instalments along with O&M costs. Seventy-one ULBs were organized in 7 Clusters based on geographical proximity amongst the ULBs to permit economies of scale and operational efficiencies for the operators. Following a competitive bidding process, work orders were issued to seven operators, one for each cluster. The construction activities were initiated at several locations. Nalgonda town inaugurated its FSTP on 29th June 2020, and more such roll-outs are in the pipeline. All the 71 plants are expected to be made operational by January 2021. All the facilities are also being developed as Sanitation Resource Parks to serve the additional purpose of education and awareness building. Further, the State has decided to establish FSTPs at the newly formed 68 ULBs for which the financial & administrative sanction was given in September 2020. The procurement process is being initiated post the sanction.



Figure 5: FSTPs in different states of construction in ULBs in Telangana

Grey water management with pro-poor focus

The State is taking an integrated approach for addressing the sanitation issues. Guidelines for wastewater management are being developed of which FSSM is an integral part. Keeping the pro-poor focus, the first decentralized wastewater treatment plant (WWTP) was piloted in Warangal's low-income housing project comprising of 550 housing units. Upon successful implementation of this project, the State has decided to implement decentralized WWTPs in all the low-income housing projects through State funding. Public procurement for 50 of the 110 such low-income housing

projects in and around Hyderabad has been initiated and tender floated. Further, the State is placing equal emphasis on the inclusion of WWTP in all apartment blocks, institutions, and commercial establishments.



Figure 6: Decentralised wastewater treatment plan in low-income housing facility in Warangal

Co-treatment of septage with sewage in existing STPs

The State FSSM policy places emphasis on co-treatment of septage with sewage at existing STPs, wherever feasible, owing to proven technology, cost, and time advantages. In alignment with the State vision, Hyderabad Metropolitan Water supply and Sewerage Board (HMWSSB) has designed co-treatment units at functional STPs; established a system of licensing to regulate desludging operations to prevent open dumping; established a monitoring mechanism; and developed a call centre for taking desludging orders. At present, 6 STPs are converted to co-

treatment facilities and have treated more than 20 million litres of septage till 31st July 2020. Trail runs and lab reports reveal that the cotreatment plants meet all the performance standards. The city has also decided to convert all the 65 proposed STPs to co-treatment facilities. The experience of Hyderabad shows that co-treatment of septage at functional STPs is the fastest and most cost-effective way to address the FSSM.

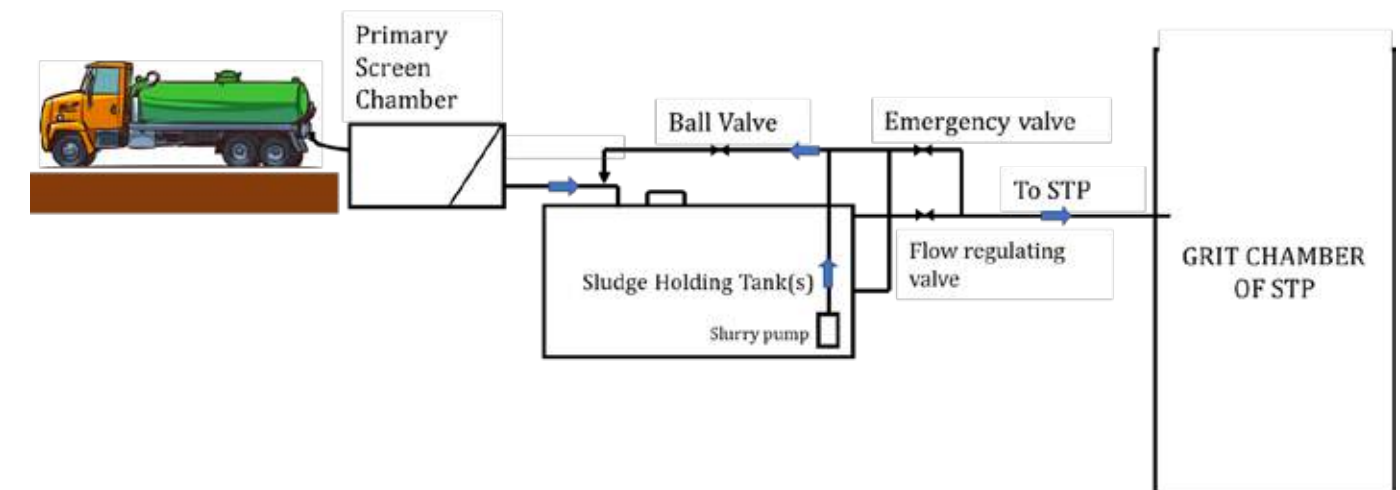


Figure 7: Design and unit operations of co-treatment facilities in Hyderabad

State level FSSM cell & Monitoring

Continuous review, measurement, and evaluation are essential for the effective implementation of FSSM. The State has established an FSSM cell under the office of CDMA to plan and monitor FSSM in the urban areas. The team comprises engineering, monitoring, urban planning, and gender expertise. Dashboards are developed to monitor the progress of FSTP construction and other service delivery components, likewise, the Swachh Telangana web portal is used to monitor IHHL and unsanitary toilet conversions. A real-time ICT system for monitoring the quality of public sanitation facilities is under development. Weekly reviews are held through video conferencing under the chairpersonship of CDMA and attended by ULB leadership and other functionaries.

Capacity building using digital tools

Awareness development and capacity building programs are undertaken to build FSS know-how, enabling the ecosystem for promoting the delivery of safe sanitation services. Several pictorial and informative communication/training materials have been developed in the local language. In addition to face-to-face training, digital tools are also being used extensively to train different stakeholder groups including municipal functionaries, private sector players, resident welfare associations, and so on. An e-exhibition on public/community toilet designs was also conducted to the engineers of all the ULBs. Similarly, an online training program on mainstreaming gender in sanitation was conducted for SHGs and was attended by over 4000 members.

Information Education and Communication

A comprehensive behaviour change communication strategy and operation plan are under development in partnership with BBC Media Action to achieve the multiple objectives of sustaining ODF (ODF-S) through continued usage of toilets, promoting regular desludging by engaging trained and licensed desludging operators, and practicing hygiene behaviours. Communication materials are developed, and the State has directed all the ULBs to roll out the campaign. A State contribution of over Rs. 1.6 crores are earmarked over and above the ULB budgets for implementation of the communication campaign that includes hoardings, wall paintings, branding of SWM vehicles, and display boards at public and community toilets, etc.



Figure 8: State level dashboards for real time monitoring

Setting up Sanitation Innovation Hub to promote innovations

The government of Telangana aims to build on its experiences and contribute to the clean India mission by establishing a sanitation innovation hub (S-hub) and earmarked initial funding of Rs. 25 crores for the same. Housed at ASCI, the S-hub will promote innovations in water, sanitation, and hygiene under twelve opportunity areas such as innovative ideas, knowledge, technologies, and processes required to catalyze areas of the sanitation value chain, as well as constraints that limit the realization of already well-understood solutions. The Hub will also offer services to Urban Local Bodies, corporations, and innovators across four critical areas of sourcing, testing, accelerating, and disseminating innovations. This will lead to an increase in innovation, jobs, funding, and services in the sanitation sector, which can enable a rapid improvement in sanitation outcomes in Telangana, along with other states in India.

The experiences and outcomes of FSSM implementation by the government of Telangana are replicable and hold important lessons. The financial and operational models described above are tested and proving to be robust for sustaining and enhancing sanitation improvements to benefit the environment and public health.

Conclusion

The State government is making targeted efforts to achieve sanitation goals. Warangal, which has emerged as a city for piloting initiatives, has been the key to scaling up many interventions across the State of Telangana. The successful initiative of toilets at fuel stations available for use by citizens has been incorporated in the Swachh Survekshan guidelines and is replicated in many

towns in the country. SHE toilets, public toilets in PPP mode with well-defined SLAs, SLFs for O&M, ICT applications for record-keeping and monitoring are being replicated by cities across India. The feedback machines introduced in PTs have led to the national government asking all cities to follow suit. The city was also able to engage two SHGs, one all women and the other a transgender group, for O&M of community toilets. Another significant learning from the Warangal experience is the sanitation funding model, which combines the investments of the national (Smart City, AMRUT, SBM) state and city funds along with the private sector and CSR funds. Through active advocacy, the city was able to receive CSR investments for school sanitation. FSTP and decentralized wastewater treatment systems.

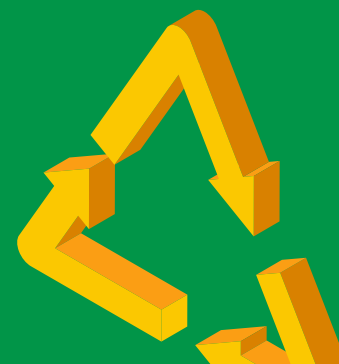
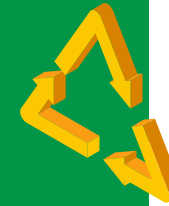
Warangal and Telangana aspire to mainstream CWIS through enabling policies, robust institutions, dedicated financing, and capacity building of stakeholders. It is a work in progress, and the State aims to become a lighthouse for FSSM.





Chhattisgarh

Safe sanitation brings significant public health and environmental benefits to the entire population. Unsafe practices in one part of the city will not only affect the adjacent population but will have substantial risk spreading across the geography. To address this, India has launched the Swachh Bharat Mission-Urban (SBM-Urban) in October 2014 and has achieved remarkable success in delivering safe sanitation to millions of urban citizens. The State of Chhattisgarh is one of the leading states when it comes to safe and sustainable sanitation. It has been ranked as the top State under Swachh Survekshan (SS) -2019 (1*) (State Category) and Swachh Survekshan 2020. Chhattisgarh has also been declared as the first ODF++ State by the central government. Ambikapur in Chhattisgarh has been certified as a 5 star rated city under the Star Rating Protocol for Garbage Free Cities (2*) . KPMG (Implementation Partner) and WASH Institute (Technical Partner) are supporting the implementation of SBM-U in the State. This support is in the form of a State Level Technical Support Unit (STSU) comprising a set of technical experts in various domains related to FSSM.



Context

Chhattisgarh's urban population has increased by 31.14% between 2001 and 2011. As per Census 2011, around 23.24% (59.37 lakh people) of Chhattisgarh's total population resides in urban areas, and current growth trends indicate that this number is expected to grow exponentially in the upcoming years. The number of Urban Local Bodies (ULBs) increased from 75 in 2000, to 168 in 2015 with the addition of 93 new ULBs and to 166 in 2019 (due to merger of 3 ULBs). (3*)

Further as per Census 2011, a mere 9.1% urban households in Chhattisgarh were connected with a piped sewerage network. On the other hand, more than half the urban population (50.71%) relied on onsite sanitation systems (OSS) such as Septic Tanks (48.6%), Pit latrines (1.15%), and other systems (0.96%) for the collection of faecal sludge and wastewater. This clearly indicates that onsite sanitation far supersedes the piped sewerage system and is the primary sanitation system in Chhattisgarh. More than 3.25 lakh toilets have already been constructed under SBM-U, as per data from GOI Census 2011, it is expected that most of these toilets are connected to various types of OSS. While Chhattisgarh has successfully eliminated open defecation in all 166 ULBs, there is an imminent need to take measures for managing the fecal sludge generated from households and community and public toilets.

[1] Swachh Survekshan is the annual cleanliness survey of urban India conducted by the Ministry of Housing and Urban Affairs (MoHUA), Government of India.

[2] <https://gfcstarrating.org/>

[3] Policy for Fecal Sludge and Septage Management, Government of Chhattisgarh, 2017

The government of Chhattisgarh has already issued a state Policy on Fecal Sludge and Septage Management as a first step in the direction of safely managing sewerage and fecal sludge.

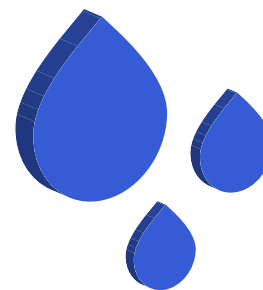
Recognizing the vital need for land for setting up fecal sludge treatment plants (FSTPs), it is understood that the Chhattisgarh Urban Administration and Development Department (UADD) has already asked ULBs to identify the land. Besides, there are 9 AMRUT cities in Chhattisgarh and some of them have already procured (or are in the process of procuring) vehicles, suction and jetting machines/equipment, where required.

This government of Chhattisgarh) commitment towards the provision of safe sanitation across the State has resulted in developing a provisional treatment capacity in more than 160 Urban local bodies. The provisional treatment facilities developed are in need to be upgraded into full-fledged FSTPs with a sustainable operational and business model ensuring recovering resources and O&M expenditures.

Facts at a glance

- No. of ULBs increased from 75 in 2000 to 168 in 2015 to 166 ULBs in 2019
- Urban population increased by 31% between 2001 and 2011
- Only 9% connected to sewerage (Census 2011)
- Around 51% relying on OSS (Census 2011), this may have increased substantially after addition of 3.25 lakh toilets constructed under SBM-U
- More than 3.25 lakh new household toilets constructed under SBM-U
- Around 20 lakh liters of fecal sludge generated every day from OSS and sewerage systems Source.
- State level policy on FSSM issued in 2017

Source: Chhattisgarh Policy on FSSM



Initiation and Planning Process

Based on a needs assessment study and field visits to various ULBs, and interactions with State Urban Development Authority (SUDA) officials, the following areas of interventions have been identified and addressed with support from the STSU:

1. Strengthening the policy and regulatory environment for FSSM:

STSU assisted the State in revising FSSM/Septage Management Rules (similar to Solid Waste Management Rules 2016), Operative Guidelines, Manuals for service providers, Standard Operating Procedures (SoPs), integration of FSSM rules in Building Codes, and other model documents/guidelines as necessary to provide legal, policy and institutional framework for FSSM implementation across ULBs.

2. Identification of various technology options for Fecal Sludge Treatment:

The STSU has facilitated the identification of various technology options available for the treatment of faecal sludge, develop technical manuals, model designs/drawings, design specifications, model DPRs, etc.

3. Capacity Building and training of various stakeholders: Intensive awareness generation and capacity building training of a wide range of stakeholders including ULB staff, residents, service providers, elected representatives, community-based and civil society organizations, private sector partners, trader associations, etc. have been undertaken.

4. Support for rolling out FSSM: Preparing State to roll out FSSM across all ULBs in the State via the development of implementation framework, guidelines, toolkits, manuals, helpline/call –centre for customer support.

5. Procurement: Formulate procurement toolkit specific to different components of the FSSM value chain, Model RFPs, Model Bidding documents, SoPs, Empanelment of Equipment and Service Providers, Technology Cost estimates, Schedule of Rates, Model Service Contracts, other contractual documents, etc.

6. Business models and Financing: Planning for private sector partnerships, resource mobilization, and identifying viable business models with access to credit along with financing options.

Institutional set-up

The FSSM value chain includes multiple stakeholders delivering safe sanitation. To achieve total sanitation practices, it was imperative to identify the stakeholder-base on governance structure and their overall role in the FSSM value chain, which has been illustrated below:

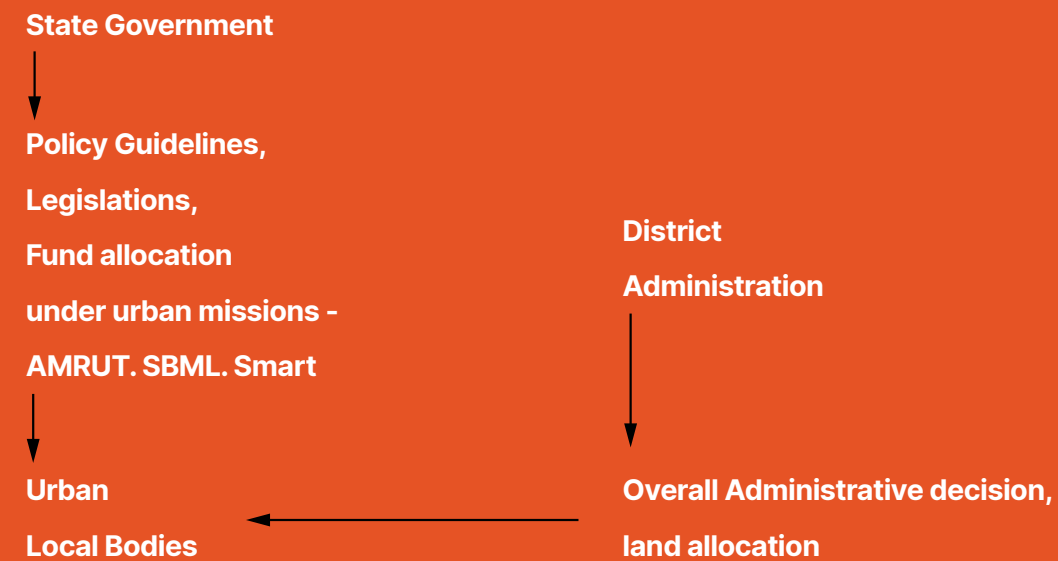


Figure 1: Governance structure for Septage Management

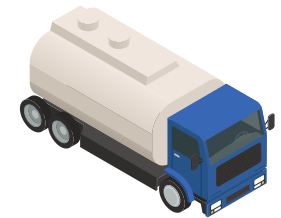
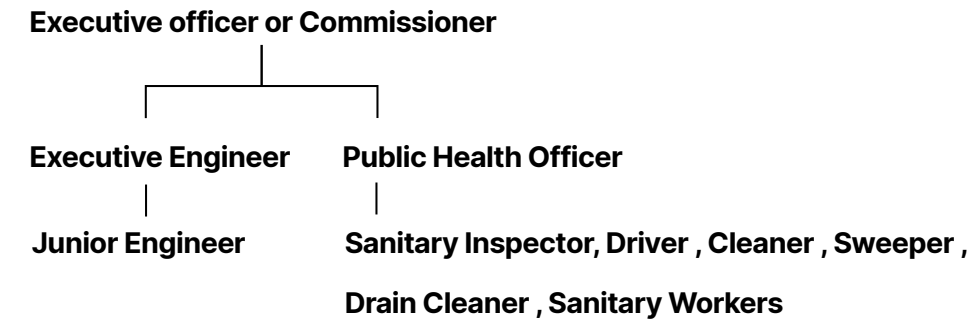


Figure 2: Governance structure at the ULB level

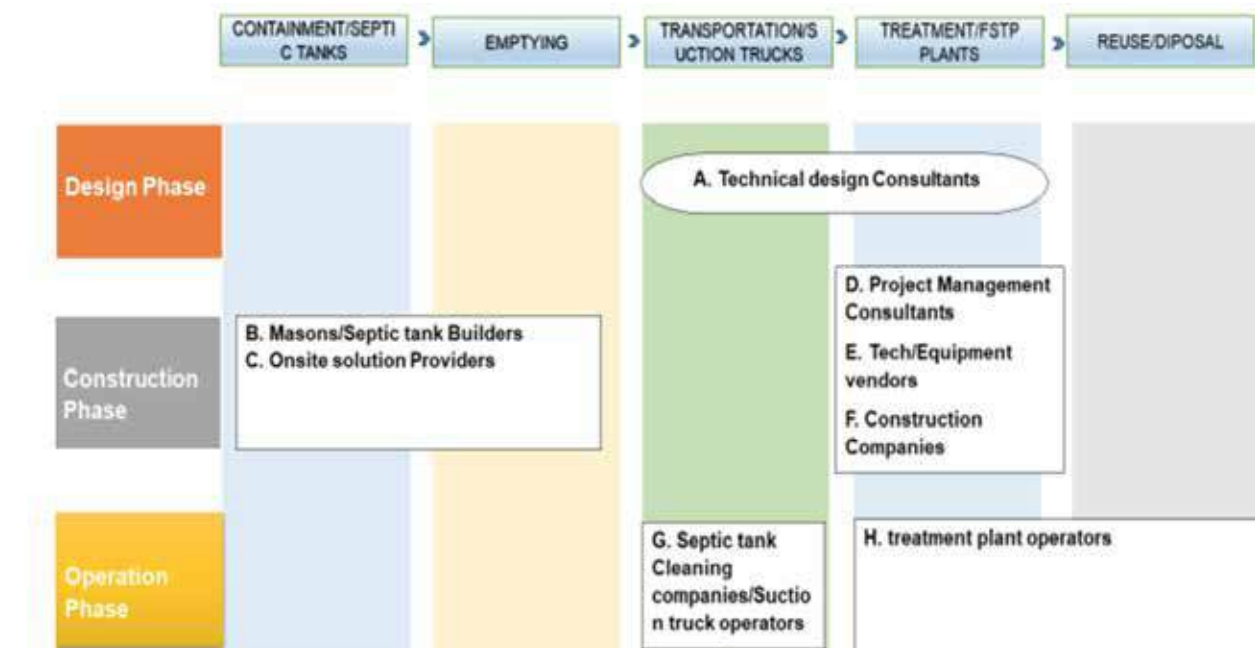


Figure 3: The key segments of private sector involvement in FSSM

Operations and technology used

Ambikapur is a national role model for sanitation and waste management. The city was also the first to become open defecation free in the State and has made bold advances in the area of FSSM by establishing the first Faecal Sludge & Septage Treatment Plant (FSTP) in the State. This plant, like the State's waste management model, has become a benchmark for its cost-efficient & sustainable design/operations and is no stranger to exposure visits from FSSM stakeholders across the country who are keen to learn and emulate its methodology. The FSTP, commissioned in November 2017, has a full-scale capacity of 5KLD to treat septage generated in Ambikapur with an 8-hour long treatment cycle. FSTP uses both anaerobic (Anaerobic Bio Digester) and aerobic (aeration & ozonation) methods for treating septage along with several other filtrations and decontaminating technologies, i.e. sand filter, carbon filter & micron filter.



Similarly, **Rajnandgaon** is a municipal corporation in the Rajnandgaon district of Chhattisgarh with an approximate population of 172,000 spread across 32,000 households and divided into 51 wards. One of the largest cities of the State, it is the only other apart from Ambikapur, to feature a Faecal Sludge Treatment Plant (FSTP). A Faecal Sludge Treatment Plant (FSTP) with a capacity of 100 KLD was built and commissioned in the "City Sanitation Park" in December 2017 and has been operational since. It is modelled on the Devanahalli Plant in Bangalore and uses DEWATS technology- a gravitational system, which is more cost-effective than conventional electromechanical technologies.



FSSM Innovation (Planted drying beds)

Planted drying bed is a crucial development that has turned around the outlook of the State.

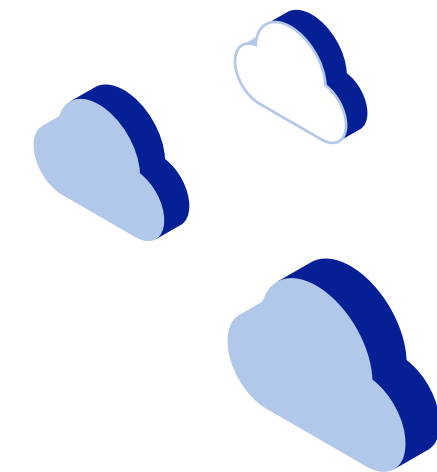
This concurrent development has put Chhattisgarh in a unique status where provisional treatment for septage is available in almost every town. Through this development and speedy implementation in 150+ ULBs, it has given the State a big push in building the most urgent sanitation infrastructure. The modules developed will work in most of the geographical locations of Chhattisgarh and other similar states.

Upgrading Drying Beds to FSTPs

STSU is working with the State government to upgrade the drying beds and provide a sustainable solution. As a pilot, 5 ULBs were shortlisted based on different geographical and demographic profiles as a representative sample of ULBs of Chhattisgarh. Technical DPRs were prepared based on primary research, and the following technologies have been identified and recommended considering the options that are affordable and scalable. The State plans to implement these pilots and intends to roll out FSSM based on outcomes of the pilot.

Treatment Methodology	Option 1	Option 2	Option 3 (only for small ULBs and is under commercialization BY WASH Institute.
Preliminary Treatment	Screen and Grit Chamber	Screen and Grit Chamber	Mobile Treatment Unit
Solid Liquid Separation	Anaerobic Microbial (AMI) Bio-digester Inoculums	Planted Drying beds	
Liquid Treatment	Settling Tank & REED Technology+ Polishing Tank	DWWT, Sand & Carbon Filter	
Sludge Handling	Not required	Composting	Composting at SRLM centre

The State plans to implement these pilots and intends to roll out FSSM based on outcomes of the pilot.



Financial and Business Model

Currently, desludging service and operation of FSTP are provided by the ULBs themselves. ULBs buy their own trucks, undertake desludging operations, and collect user charges from households. Here revenue is calculated through desludging vehicle operation, and resource recovery from the treatment plant in the case of Ambikapur treated water is also used in construction sites. Similarly, expenditure is calculated from the operation and maintenance of the desludging vehicle, fuel, human resource, PPE, and expenditure on O&M of treatment plants.

Benefits:

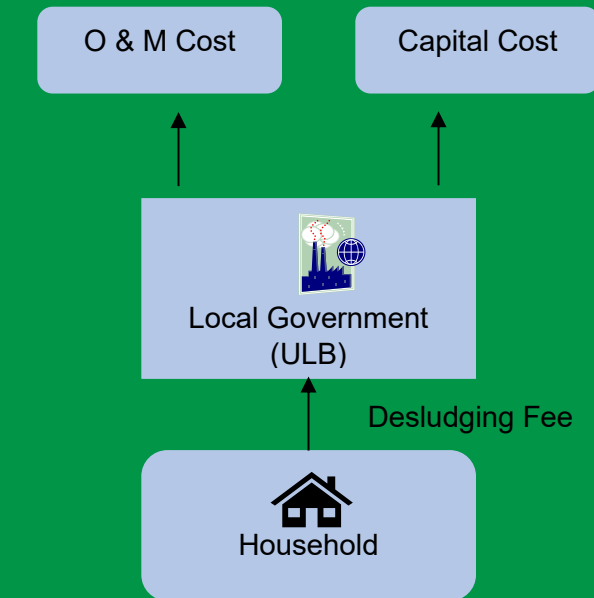
- Financially feasible for the government since charges factor in OpEx recovery
- No contracting and monitoring arrangements needed between multiple players since the govt. is the single service provider

Challenges:

- High implementation capacity required from the ULB
- Capex and OpEx burden are on the ULB
- Possibly low service delivery levels of publicly owned trucks and not maintained and if response to HH demand is inefficient.

Applicability:

Chhattisgarh has adopted this model as ULBs of Chhattisgarh have the financial and operational capacity and private desludging operators are almost negligible due to less population and low demand.

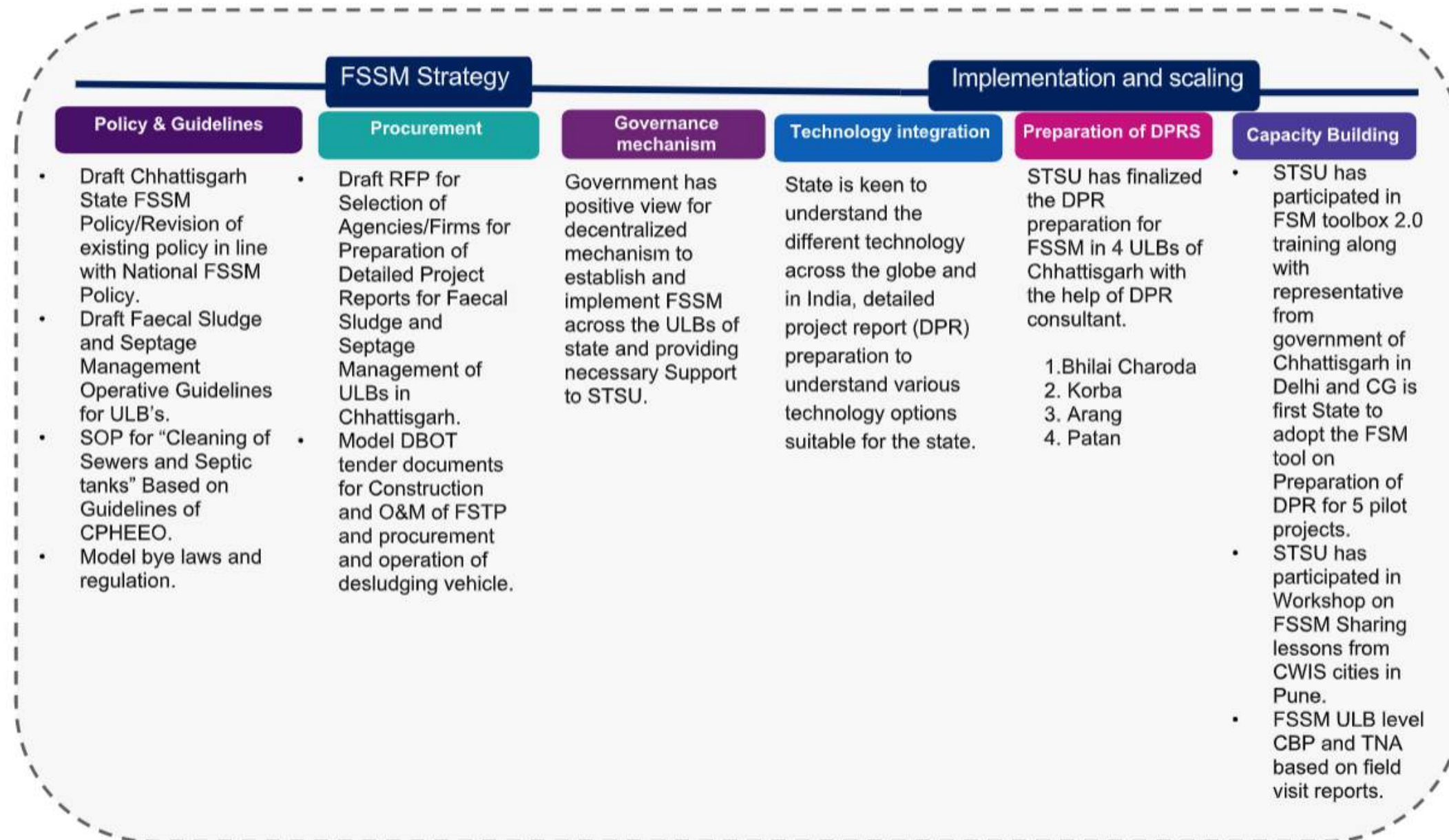


Proposed FSSM Business Model in Chhattisgarh:

There has been a significant rise in firms operating in areas of solid and liquid waste management, STPs, Water Treatment plant, etc. who are readily participating in FSTP tenders floated by various State Governments across the nation. However, the availability of competent private players is still lagging far behind in Chhattisgarh. But STSU has included the private sector in the proposed business models as private sector involvement becomes even more crucial as they are better known for effective resource mobilization and fast track implementation. This model is currently under evaluation at the state government and shall be initiated very soon.



Successes and Lessons learnt



Key Outcomes

- Increased capacity of State and ULBs to plan for and effectively
- Development of necessary policy and regulatory framework along with supporting FSSM implementation at the ULB levels which include State-level FSSM Rules, FSSM Operative Guidelines for ULBs, Technology Compendium, sample documents for procurement such as RFPs, bidding and tender documents, and so on.
- All cities/towns have developed an FSSM implementation plan with resourcing for capital investment and O&M for FSSM projects.

Outcomes Delayed due to COVID-19

- Training and capacity building interventions carried out for ULB staff for five shortlisted cities/ULBs across the State along with development and dissemination of various training materials/ documents such as manuals, toolkits, etc. as required for capacity building.
- At least 2 FSTPs set up across any of the two cities/towns in the State using own (ULB)/State government's resources.

Challenges and possible resolutions

Challenges

The issues and challenges have been summarized under three broad categories.

1. Limited Awareness and Capacities

- Uniform lack of awareness and capacities for Faecal sludge and Septage Management in urban areas, especially among the residents, service providers and ULBs.
- Active participation and organization are missing among the residents—limited knowledge on FSSM practices, no community-level monitoring of existing operation, untimely desludging of septic tanks by households, the prevalence of undesirable toilet hygiene and usages, construction of onsite system not at par with standards.
- ULBs not properly introduced to planning for FSSM technologies, standard procedures, management framework, human resource requirements and thus unable to take necessary action/initiates.
- Insufficient capacities and coordination between ULBs and State government. ULBs often lack capacities to mobilize resources (funds, human resource, expertise, equipment, etc.) on their own to deliver effective services, while the transfer of resources from the State government to the local governments is a tedious process.

2. Lack of Proper Planning, Design and Implementation of Sanitation Infrastructure

- Most stakeholders (such as various State government departments, ULBs, residents, desludging operators, service providers, etc.) are not up to date on the latest developments in FSSM-modern technologies, standard construction techniques, operating procedures, safety and hygiene safeguards, etc.
- Toilet systems such as septic tanks, single/twin pit pour-flush latrines are not constructed as per design specification—BIS, NBC, and thus there are frequent leaks, breakages, failures and contamination of soil, air and water.
- Desludging operators and service providers are not adequately trained, especially during the current pandemic situation (Covid-19) and do not use safety precaution during operation.

3. Weak institutional framework

- Insufficient funds are available for creating/O&M of city-wide FSSM infrastructure.
- ULBs are not empowered to collect sanitation tax, service charge, etc. required to maintain a steady revenue stream and sustain FSSM infrastructure.
- The poor profitability of traditional STP business models, owing to high capital investments and limited revenue potential, disincentives the private sector from investing.
- Absence of dedicated service level benchmarks for FSSM.
- Limited availability of standard designs, operating procedures, guidelines, manuals, dedicated norms, etc. for city-wide FSSM to aid the ULB for effective planning and implementation.

Way forward

To fulfil the gap of the above challenges, STSU has recommended a stepwise approach in different phases to the government of Chhattisgarh

Phase-1

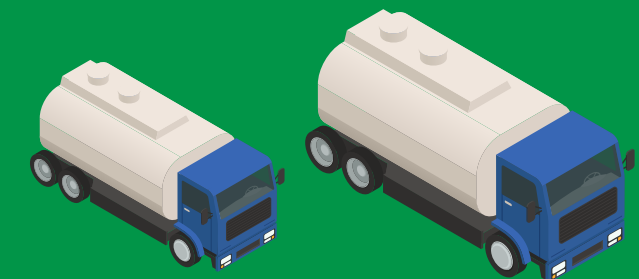
- Chhattisgarh is willing to try new innovative models for scaling up the FSSM interventions and is open to implementing SMART solutions and experiment with new but affordable technologies.
- Establishing low-cost and proven technology FSTPs across the 11 Nagar Nigam/ 9 Amrut towns in CG.
- Provision for co-treatment of the faecal sludge with STPs (existing and under construction).

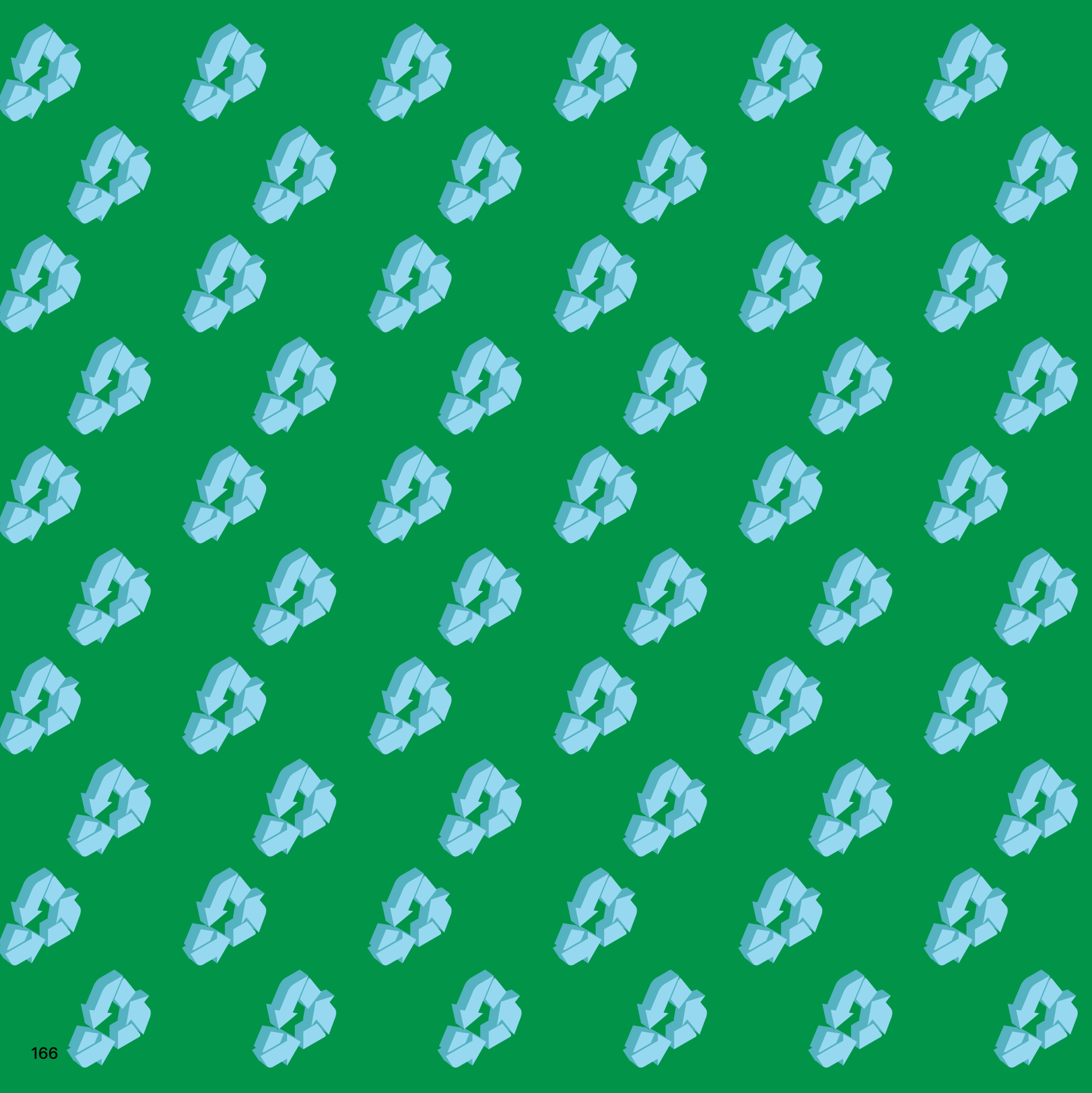
Phase-2

- Clustering of ULBs, to ensure techno-financial stability.
- Augmentation of existing FSTPs at Nagar Palika Parishad and Nagar Panchayat level.
- Establishing ERSU (Emergency Response Sanitation Unit) to handle cases like the collapse of the septic tank due to flood due to which many pandemic situations can be handled.

Phase-3

- Provision for reusing the water for FSTP for horticulture proposes.
- Establishing a robust Faecal Sludge Management (FSM) across the State viz. ICT based monitoring of desludging vehicle.
- Mapping and identification of septic tanks (data) to ensure timely emptying of the same as per CPHEEO Manual.
- Scheduled desludging of the septic tanks as per the data base of Phase-1.
- Feasibility analysis and implementation of Mobile treatment Unit (MTU's) in small ULBs.





Kerala (Thrissur, Wayanad- Kalpetta, Thiruvananthapuram)

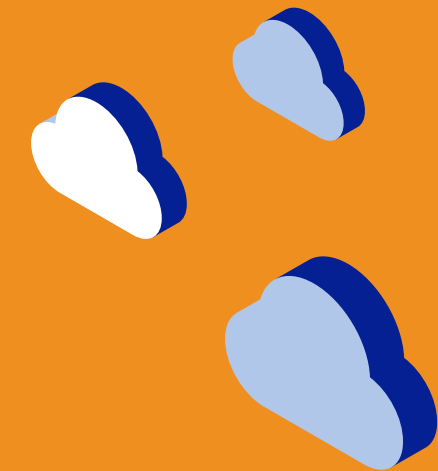
Context

In August 2018, Kerala received heavy rainfall and as a result, witnessed the worst instance of flooding in nearly a decade. A noteworthy aspect of the floods was the unintended evacuation of faecal sludge from the septic tanks built in people's homes. This incident highlighted the need for comprehensive Faecal Sludge and Septage Management (FSSM) in the State.

The towns of Thrissur and Kalpetta do not have a sewerage network and the faecal sludge is collected in septic tanks and pits. These pits and tanks are emptied using suction trucks and the faecal sludge is generally disposed of in an unhygienic manner. Given the terrain and the present habitation, it is not possible to put in a piped sewerage collection network. FSSM is, therefore, necessary to ensure safe collection and treatment of faecal waste in these towns.

In Thiruvananthapuram, the capital of Kerala, spread over 215 square kilometres, with a population of 957,730 residents (1*) generates 103 million litres per day (MLD) sewage (80% of 135 litres per capita per day, multiplied by the total population). In 2009, about 30-35 MLD sewage flowed through the sewer networks to the only sewage disposal facility, a farm located in Valiathura, through Muttathara, where the sewage is initially diluted in a stilling chamber before being used in the farm for fodder cultivation; the challenge, however, remained in the waste being untreated.

Moreover, this sewage fodder farm was constructed in 1945 with a limited capacity to handle only 8 MLD and was thus, well over capacity as per safety standards. Additionally, given its proximity to the Parvathy Puthanar (TS) canal, much of the effluent was entering into the river channels, causing significant harm to the health and environmental safety of the populations living downstream. As per 2011 calculations, approximately 353,500 residents (30 percent of total population) were connected to the sewerage, which meant that almost 60 cubic metres of septage per day remained to be added to the sewer networks. Further, only the core city area (blocks A, B, C, D & E) consisting of around 42 wards were covered with the sewer network. Therefore, there was an urgent need to establish another faecal sludge treatment plant that would cater to the existing overflow and ensure that further risk of environmental contamination was mitigated.

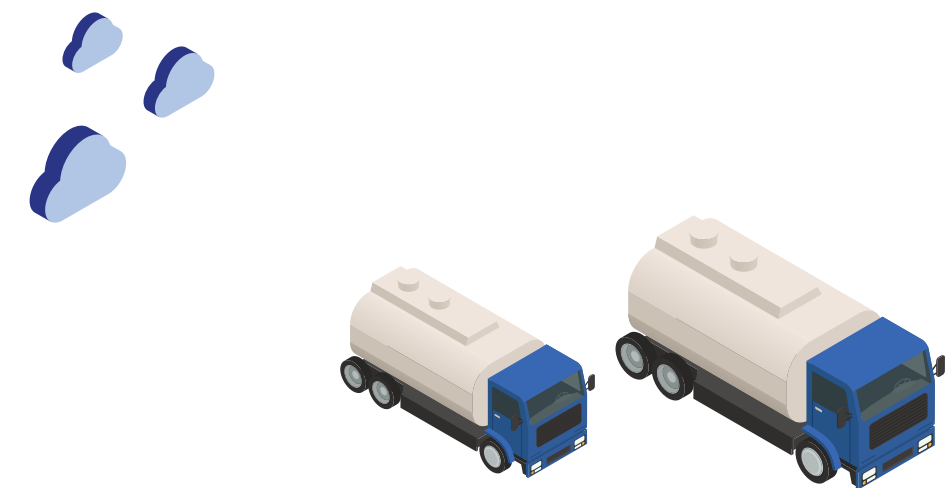


[1] 2011 census approximations being used to convey need, as that is the closest accurate measurement available on Thiruvananthapuram's population size (data was collected in the year prior).

Initiation and Planning Process

PriMove Infrastructure Development Consultants was selected as the contractor for construction of 10 KLD Faecal Sludge treatment plants (FSTP) in Thrissur and Kalpetta. The team visited the District Administration officials and Hon. District Collector for introduction and orientation of the proposed FSTP, including importance of FSSM, details of the technology, plant layout drawing, etc. Selecting sites was also a challenge as they needed to be levelled and had to have a strong stratum for a solid foundation. Additionally, the risk of heavy rainfall meant the ground needed to be stable. Stability of slopes and the safety of working personnel in terms of soil profiles and health risks were major concerns. Therefore, the sites originally selected were later revised. Besides the topographical surveys, underground strata analysis for the proposed site and designing the plant, the planning process involved discussions with the Municipality officials and citizens wherein, the concept of FSSM, the details of technology, the operational parameters and the revenue models were shared. After extensive deliberations, the Municipality approved the installation, and an MoU was signed with PriMove. The technology and design was developed such that it could achieve complete processing of septage so that the effluent could meet the latest Central Pollution Control Board norms. It was also designed to minimise power consumption and O&M complexities.

In case of Thiruvananthapuram, to meet the need and cater to the population, Kerala Water Authority (KWA), Kerala Sustainable Urban Development Project (KSUDP) and Local Self-Government Department (LSGD) decided to establish a sewage treatment plant (STP) under Jawaharlal Nehru National Urban Renewal Mission (JNNURM) scheme with support



of a loan from the Asian Development bank (ADB). The proposed STP would have the capacity to treat an average flow of 107 MLD, which would handle the overflow and currently un-collected sewage, along with the increase in effluent due to population growth. It was decided to construct the STP at Muttathara, and lay sewer lines for the unserved blocks in order to ensure optimal capture of previously untreated effluent. The government allocated 32 acres of land for this purpose.

In order to expedite the process, given the grave situation of waste management and the harm being done to the nearby waterways, KWA, LSGD and KSUDP awarded the project to UEM India Private Limited in 2009. They were responsible for designing, constructing, erecting, testing, commissioning, operating, and maintaining the STP for a period of five years, after which they would hand over the plant to the Corporation.

Institutional Set-up

The 3 main stakeholders involved in the process of installation of FSTP at Thrissur and Kalpetta were PriMove Infrastructure Development Consultants Pvt. Ltd., UNICEF India (for extending the financial and technical support) and the Municipal Corporation along with the District administration (for support with regards to provision of land, water and electricity supply).

PriMove's role

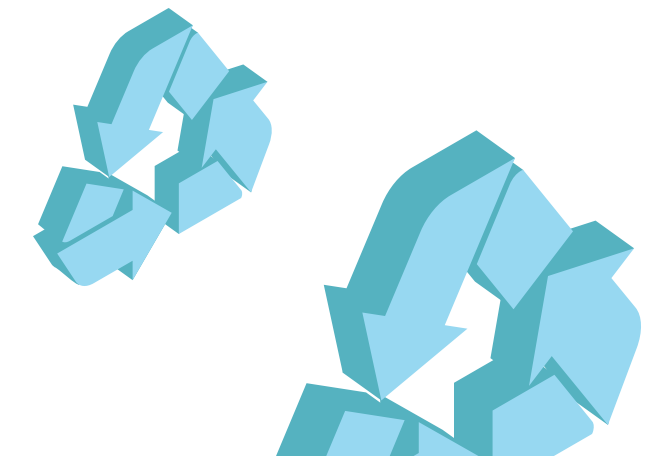
- Design construction, supply installation testing & commissioning of an aesthetic FSTP based on tiger bio filter technology.
- One-year operation and maintenance of the FSTP.
- Ensuring that the effluent quality parameters are met.
- To suggest to the authority the development of a revenue model for operating the plant in order to make it a sustainable service.
- Complete handover of the plant to the Municipal Corporation.
- Providing support in developing a questionnaire and methodology for conducting door to door sanitation survey.
- Providing capacity building and training inputs during the Operation and Maintenance (O&M) period to the staff dedicated by the municipal corporation.
- The installation work of the FSTP and its O&M, was sublet to TBF Environmental Solutions Pvt. Ltd.

Municipal Corporation's role

- Providing land space: clearing out trees, shrubs, debris; cutting and filling, site grading, and removal
- Provision of site access roads including temporary roads.
- Providing water supply connection (1 point), electrical collection (2 points) at the FSTP plot.
- Procurement of electrical power supply from the power utility company along with duplicate feeder. All the charges and fees for power procurement were to be borne by the client.

Considering that water and electricity were key resources for this project, any days where a disruption was caused by a lack of supply of the same, leading to a delay of the project were added to the overall duration of the project.

- The Wayanad Municipal Corporation carried out a detailed field level survey regarding the sanitation system for the town. The survey was carried out and included, but was not limited to, the number of septic tanks, single pit and twin pit latrines, as also any other on-site sanitation systems in place, along with the desludging period for all the above-mentioned on-site systems in years.
- It also had to formulate and implement rules regarding collection and delivery of septage to the FSTP



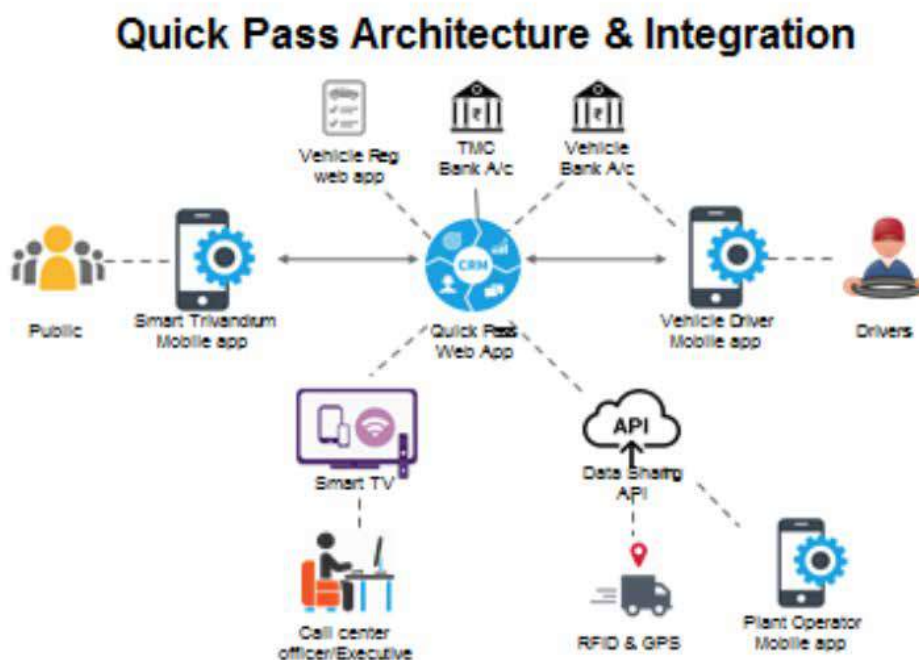
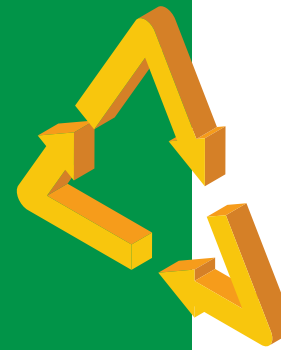
UNICEF India's role

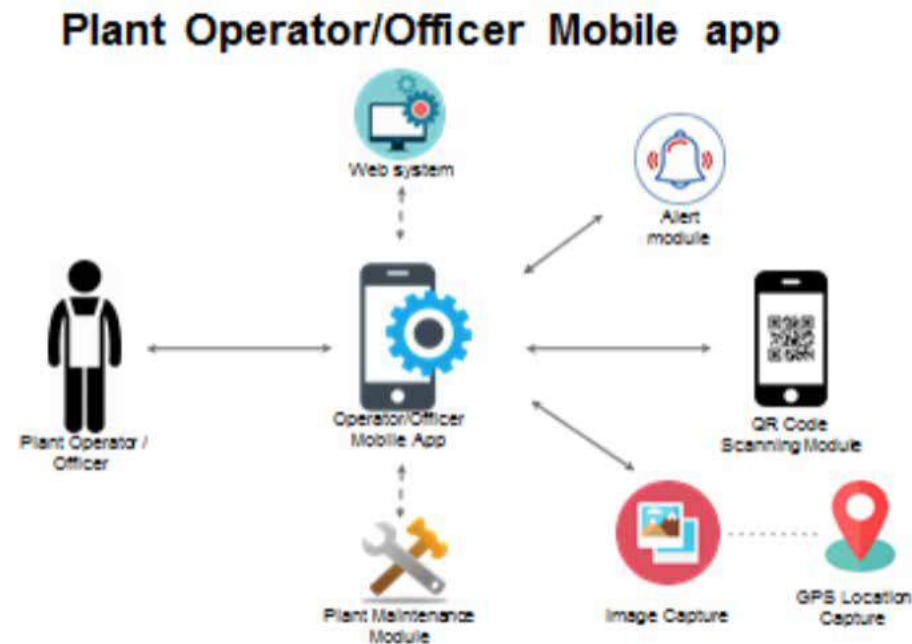
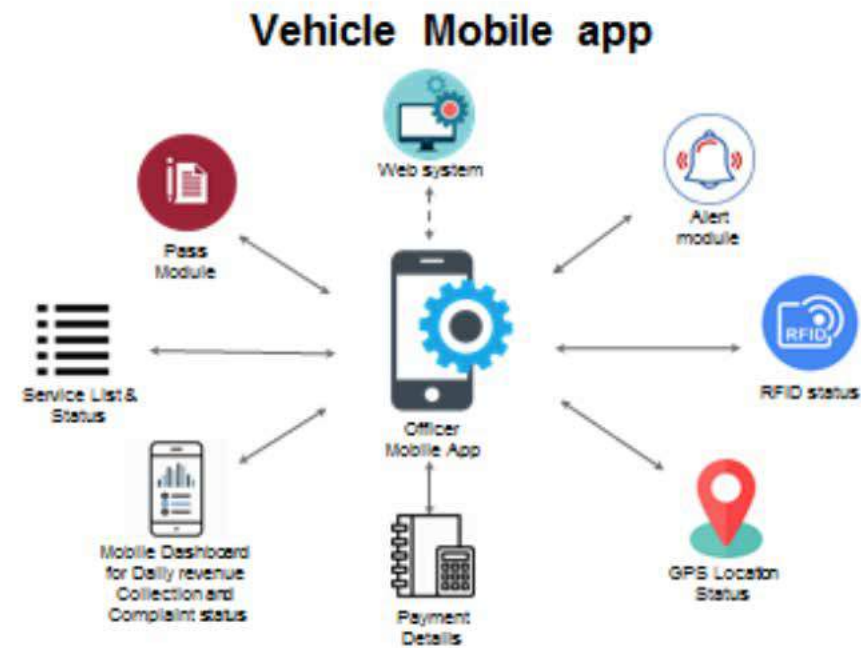
- To coordinate the overall implementation and O&M of the FSTP project
- Overall monitoring of the work and installation of FSTPs
- Funding the project
- Coordination with the Government

In the case of Thiruvananthapuram the main stakeholders were KWA and Municipal Corporation and UEM India Pvt. Limited, Toshiba Group Company initially and presently managed by ECO Chem Sales & Services. The Kerala Water Authority was responsible for the STP entirely from planning to implementation, and it was finally constructed and operational in 2015. Much of the flow that originally went to the fodder farm was diverted to the STP to ensure that the waste was being properly treated. In order to complement the existing sewer network that covered approximately 42 wards, collection and disposal trucks and routes were established.

Presently, it has a three-member team of operators who manage the day-to-day operations at the plant site. All inflow treatment is monitored daily. The quality of water treated is also tested in the lab on a daily basis. There are about 32 aerators and many clarifiers in the plant, chlorine gas is used to purify the water at the final stage. It produces 42 MLD of treated water, which is designated for various uses.

Another organisation, Origami Technologies, was recruited to support the development of an online management system that relied on GPS technology to ensure that the supply chain process was smooth and if not, where the broken links were – including trucks bringing sludge in from areas without sewers. It also allowed for tracking payment processes and connecting directly to the corporation for resolving any issues that arise. The network map below shows how many aspects of waste management were integrated with each other





Operations and technology used

Technology Used

The treatment mechanism of the proposed FSTP at Kalpetta & Thrissur is based on the Tiger technology, which uses earthworm-based vermifiltration to rapidly treat the waste matter, with no smell and need for desludging (a common phenomenon in traditional and informal faecal waste treatment). Vermifiltration is reportedly a superior form of sanitation technology, compared to conventional methods such as septic tanks and pit latrines. Earthworms are known to promote digestion of organic waste, which results in the production of vermicompost. In vermifilters, this concept is combined with filtration to digest organic matter present in septage. The worms need only air, water and organic matter to form a sustainable population in the vermifilters.

The Tiger Biofilter (TBF) Sewage Treatment System provides rapid, safe, and efficient sewage treatment. It is a patented technology that uses a unique combination of filters and worms to dispose off sludge and sewage and recycles nearly 95% of wastewater. The technology proposed for faecal sludge treatment at Kalpetta & Thrissur mainly comprises of the following:

1. Screen Chamber and Solid-liquid separation tank
2. Anaerobic Bio Digester Tank
3. Vermifiltration through Tiger Biofilter-I and Tiger Biofilter-II
4. Tertiary treatment

With an additional horizontal planted gravel filter at the Thrissur FSTP.

Operations in Kalpetta

Screen Chamber & Solid-Liquid Separation Tank

These tanks are made of Fibre-Reinforced Plastic and have 2 chambers - Screen Chamber and Solid-Liquid Separation Tank (SST). The tanks hold the faecal sludge load of 5000 litres approx. that allows the faecal sludge to stagnate into a quiescent condition. This settles the settleable inert solids (grit) from faecal sludge. These settled solids are removed periodically and treated with the vermifilter technology separately. The faecal sludge is then removed and taken to the next tank for anaerobic digestion.



Solid-Liquid Separation Tank

Anaerobic Digestion

Anaerobic digestion is a collection of processes by which microorganisms break down biodegradable material in the absence of oxygen. Two parallel sets of 3 tanks each are connected, which enable anaerobic conditions in the system with the help of an added inoculum which rapidly degrades the waste.

Tiger Biofilter

TBF I: Water Treatment

The sludge that is treated in the anaerobic digester is then spread on small beds of the Tiger Biofilter, comprising of earthworms, bacterial culture and material suitable to provide a habitat and respiration zone for earthworm growth and reproduction. Organic matter is consumed by the earthworms as an energy source for metabolism and reproduction. The system is designed accordingly with sufficient surface area and worm quantity.

In these beds, almost 90% of the sludge is separated from water by gravity filtration. Sludge remains on the bed and is processed by earthworms and converted to vermicompost. The liquid is collected and stored in a separate storage tank. This vermicompost can then be dried, sieved and sold in the market.



TBF II: Water Treatment

Liquid from the TBF I unit is stored and pumped to the TBF II system. This is a modular Vermifiltration unit designed to reduce the residual Biochemical Oxygen Demand (BOD) from the faecal sludge.

Tertiary Treatment

The treated effluent coming out from TBF II is treated with Pressure Sand Filter (PSF), Activated Carbon Filter (ACF) and is finally disinfected using chlorine to remove any objectionable colour, odour, and other pathogens from the treated effluent. The treated effluent is stored and may be used for gardening, irrigation, or other land applications.

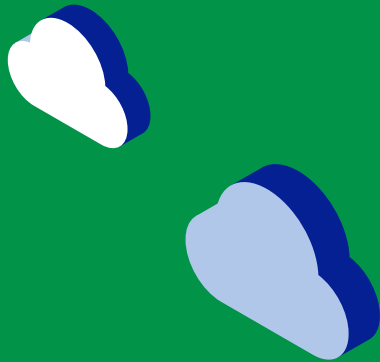
Operations in Thrissur

Screen Chamber & SST

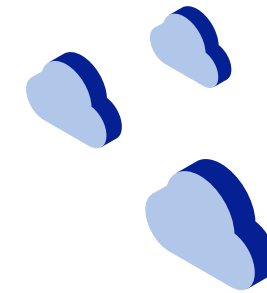
Screen Chamber is used to separate large floating matter, plastic, etc. from faecal sludge. The purpose of the SST is to hold sludge after unloading through honeysucker at FSTP. This also allows gravity to act and separate the inert grit from the faecal sludge. The tank is pre-fabricated with a capacity of 5000 litres.

Anaerobic Stabilisation Reactor

It has five chambers with three different stages - mixing, digestion and collection. This tank contains specially formulated bacterial culture which helps reduce organic load from the faecal sludge.



Tiger Biofilter



TBF I: Water Treatment

Here 90% sludge is separated from water by gravity filtration. The sludge is then spread on TBF-I beds comprising of earthworms, bacterial culture and material suitable to provide a habitat and respiration zone for earthworm growth and reproduction. The filtration bed material is selected depending on the characteristics of the sludge to be treated.

This tank is used to separate the residual solids and the liquid stream coming from the anaerobic digesters. The offensive odours are completely removed in this stage. The trapped solids are consumed by earthworms and converted to vermicompost, thus, reducing the organic load. The earthworms used in the TBF-I beds are capable of composting faecal waste rapidly. The liquid stream leaves the tank from bottom and is then stored in a separate tank.

Organic matter is consumed by earth worms as an energy source for metabolism and reproduction. The system is designed accordingly with sufficient surface area and worm quantity.

TBF II: Water Treatment

Partially treated effluent from TBF-I is stored in the intermediate storage tank and transferred through pump to TBF-II. This is a modular vermifiltration unit designed to reduce the residual BOD or remaining organic matter from faecal sludge. In this system, filter media and bio-media beds comprising of earthworms, bacteria and suitable organic culture are used for the treatment of effluent and after that the water goes to the horizontal planted gravel bed by gravity for further treatment.

Horizontal Planted Gravel Filter (HPGF)

After TBF II, by gravity, water flows to the HPGF beds, essentially for partial reduction of the BOD and nutrients. Canna plant helps in reducing the nutrients and absorbing the nitrate and phosphate from the water coming from TBF II. It also helps by absorbing the carbon.

There is simultaneous reduction in the Total Kjeldahl Nitrogen (TKN), which shows that good nitrification rate and efficient plant assimilation is a dominant nutrient removal mechanism.

The collected treated water then flows horizontally across vertical gravel and stone layers.

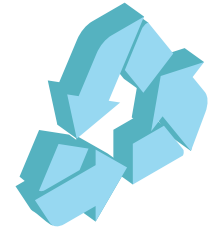
Nutrients in the form of BOD are removed here with the help of Canna Indica. Canna Indica plants have the potential to synthesize an ample variety of chemical compounds that are used to execute a major biological function. The plant roots play an important role in maintaining the permeability of the filter. Another mechanism of effective pathogen removal is the aeration and oxygen level around plant roots. Higher levels of dissolved oxygen around plant roots facilitate microorganism, such as E. coli removal. After HPGF, the treated water is collected in intermediate tank II.

Tertiary Treatment

The treated effluent coming out from HPGF is treated with Pressure Sand Filter (PSF), Activated Carbon Filter (ACF) and is finally disinfected using chlorine to remove any objectionable colour, odour, and other pathogens from the treated effluent. The treated effluent is stored and may be used for gardening, irrigation, or other land applications.

STP in Thiruvananthapuram

The technology used here is Extended Aeration Activated Sludge Method.



The STP in Thiruvananthapuram uses some of the most common and efficient systems used in treating large quantity of sewage through primary, secondary, and tertiary treatment steps. It involves aeration, filtration, grit removal, chlorination, and other processes.

Process steps

Sewage collection and treatment is typically subject to local, state and federal regulations and standards. The sewage treatment generally involves three stages, called primary, secondary, and tertiary treatment.

Pre-treatment

Pre-treatment removes all materials that can be easily collected from the raw sewage before they damage or clog pumps and sewage lines of primary treatment clarifiers. The sewage water passes through a bar screen to remove all large objects like cans, rags, sticks, plastic packets, etc. carried in the sewage stream. This is done with an automated mechanically raked bar screen. The solids are collected and later disposed in a landfill or incinerated. Here, presently, it is dumped in the available yard.

Grit removal

Grit consists of sand, gravel, cinders, and other heavy materials. It also includes organic matter such as eggshells, bone chips, seeds, and coffee grounds.

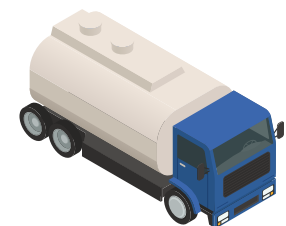
Aeration

Aeration is designed to degrade the biological content of the sewage which are derived from human waste, food waste, soaps and detergent. The effluent flows to the aerobic biological treatment after de-gritting through grit chamber. Aerobic bacteria are cultured in the aeration tanks in the presence of dissolved oxygen (DO) supplied by aerators. The aerobic bacteria biodegrade organic matter present in effluent. A DO level of around 2.00 ppm must be maintained. The biodegradation of organic matter causes additional aerobic bacteria to form which results in excess sludge production.

A mixed liquor suspended solids (MLSS) of around 4000 mg/l (sludge volume index (SVI)-400) is to be maintained in the aeration tank and balance sludge is pumped to the sludge thickener.

The MLSS concentration is maintained by recirculation of required amount of settled sludge from the clarifier.

The effluent from the aeration tanks is then transferred to a secondary clarifier from where the clarified effluent moves to a chlorine contact tank. A provision is provided to send a portion of the treated effluent to filtrate sump to fulfill the water requirement of the thickener during dilution.



Secondary treatment

This includes a secondary clarifier to settle out and separate biological floc or filter material grown in the secondary treatment bioreactor. Aerated effluent from aeration tank enters a circular central feed clarifier. The clarifier is provided with a centrally mounted motor driven clarifier-scraping mechanism. As the effluent traverses the clarifier, quiescent settling conditions are present and bacterial flocs and bio flocculate settle down as a blanket at the bottom of the clarifier.

The settled sludge is collected in a central hopper by the clarifier scrapper mechanism. This settled sludge is taken in the return activated sludge sump from where the sludge is re-circulated (80 per cent recirculation considered) to aeration tank. The excess sludge is directed to a gravity sludge thickener. Clarified effluent overflows into a collecting launder, which ensures that the effluent overflows uniformly across the clarifier. The treated effluent is then directed to a chlorine contact tank.

Gravity sludge thickener

The settled sludge from the secondary clarifier is collected in the tank provided near the recycled activated sludge pump house. About 60% of the sludge is recirculated to the aeration tank. Remaining portion of the sludge is sent to the gravity sludge thickener where the sludge is thickened. Then it can be disposed after sending it to either the sludge dewatering machine or sludge drying beds.

Tertiary treatment

This final treatment stage is for further improving the effluent quality before it is discharged into the environment. More than one tertiary treatment process may be used at any treatment plant. If disinfection is practised, it is always the final process. It is also called "effluent polishing."

Filtration

Sand filtration can be done to remove much of the residual suspended matter. Filtration by over activated carbon, also called carbon adsorption, removes the residual toxins.

Disinfection

This means to reduce the number of microorganisms in the water that has to be discharged back into the environment. The effectiveness of disinfection depends on the quality of the water being treated (e.g., cloudiness, pH, etc.), type of disinfection being used, disinfectant dosage (concentration and time), and other environmental variables.

Sludge dewatering machine

The thickened sludge is sent to the sludge dewatering machine. The sludge is first mixed with a polymer and then sent to the machine. Water from the sludge is removed by centrifugal action.

The consistency of the sludge obtained is around 20- 22%.

Sludge drying beds

The sludge drying beds are preferred when the climate is hot and sunny. Once the sludge has dried up, it is scraped off and disposed.

Quality Management

The daily parameters analysed on water samples are pH, BOD, COD, TSS and total coliform.

The design or expected values of these parameters and the actual values obtained are given in the table.

Table 1: Raw Sewage Characteristics of STP

PARAMETER	UNIT	VALUE
Feed Flow Rate	MLD	107
Peak Factor		2
Peak Flow	MLD	214
BOD ₅ @ 20 ⁰ C	mg/l	215 (Range 180 to 250)
Total Suspended Solids	mg/l	335 (Range 270 to 400) -
COD	mg/l	435 (Range 370 to 500)

Table 2: Desired Treated Sewage Characteristics

PARAMETER	UNIT	VALUE
BOD (Max.)	mg/l	30
COD (Max.)	mg/l	250
TSS (Max.)	mg/l	50
Total Coliform Count (Max.)		1000 MPN/100 ml

Table 3: Sample of Expected and actual values of parameters analysed in raw sewage and treated effluent

PARAMETER	RAW SEWAGE		TREATED EFFLUENT	
	Designed	Actual	Designed	Actual
pH		6.75		7.28
BOD (mg/L)	215	170	30	09
COD (mg/L)	435	373	250	58
TSS (mg/L)	335	278	50	10
Total coli form		45000MPN/100mL	1000MPN/100mL	< 290 MPN/100mL

Laboratory

The sewage treatment plant has a well- equipped laboratory facility for the analysis of routine parameters. The routine parameters such as solids, pH, BOD and COD of the inlet water, aeration tank and outlet water were analysed. Free residual chlorine in the outlet water is also analysed. 44 MLD reaches the STP and the BOD (incoming) - 300mg/l, BOD (outgoing) - 30mg/l.

Financial and business model

The Operation and Maintenance cost for running the FSTP was worked out and different revenue models have been proposed which are under discussion. Operation and Maintenance cost for Thrissur and Kalpetta FSTP is 13.96 Lac each. Two options for a sustainable business model under discussions are:

Rationale for Tipping Fee model

The current charges for emptying of septic tanks by private operators are in the range of Rs 6 to 7 per litre. Currently, vehicle service providers have to travel long distances, to find a place for safe disposal of the waste matter. Their transportation cost is saved substantially, in addition to ensuring safe treatment and disposal of faecal waste. This saving in transport expenditure can be meaningfully paid to the FSTP operator, creating a win-win situation. Thus, tipping fee, in a way, does not add any extra burden on consumer or on the septic vehicle operator. The municipality is preparing by-laws to regulate the collection and treatment process. The plan is to register the private service providers and arrive at recommended rates for desludging. Under this option,

tipping fee of about Rs 0.5 to Re 1 per litre is being considered to achieve adequate revenue for plant operation.

Income Stream of proposed model

The FSTP operating GP/Municipality will be entitled to charge a tipping fee from the septi vehicle service providers for every tipping/evacuation in the FSTP receiving tank.

A tipping fee of Rs.1/-per litre of septage emptied at the FSTP facility and for septage received from outside of GP/Municipality a tipping fee of Rs 1.50/- is proposed.

Under this option, it is proposed to raise revenue through additional municipal tax from residents within the municipal corporation. The service of treating the faecal waste from outside municipal area will also be provided against a tipping fee charged to the operator. Additional revenue can be generated through sale of vermicompost and treated water. The tax rate and tipping fee is under discussion.

The cost of the STP project in Thiruvananthapuram is as under:

Engineering and civil works	51.33 Cr
Cost of E & M works	20.24 Cr
Testing, commissioning, trial run	0.13 Cr
Cost of O&M	7.30 Cr
O&M period	5 Years

- In this project the land was available with the Government. The cost of the installation was supported by the JNNRUM and ADB.
- The O&M is fully subsidized by the Government of Kerala & maintained by Kerala Water Authority (KWA). It is decided to include the O&M cost in the coming projects. Decision is taken to sell the

treated wastewater to a farm. But the cost recovery is a very small amount as water availability is not an issue in the city. The O&M cost per month is 38.70 lakhs. Hence a govt. level policy decision is needed for the cost recovery.

- A routine/ breakdown maintenance is carried out by KWA.
- Cleaning of sewer lines are done as per requirement. Intercepting sewer/main sewer are cleaned annually using power bucket type sewer cleaning machine.
- There is a regular annual maintenance contract for rectification of blockages and sewer cleaning. Desilting is also done.
- Sewer cleaning machines like high pressure sewer jetting machines, power bucket type sewer cleaning machine, suction machine etc are available for O&M of the sewerage system.

Successes and Lessons Learnt

In case of Thrissur, the FSTP was originally to be installed at Pathanamthitta, but the local community was not in favour of installation of the FSTP due to local concerns. Consequently, the locals staged a protest and the site had to be changed. The next site was selected as Guruvayur.

In this case, the municipal body of Guruvayur did not provide the necessary approval of construction and installation of the FSTP. Finally, it was decided to install the plant at Thrissur. The Thrissur Municipal Corporation (TMC) provided unwavering support for the installation of the plant. In addition to the above, there were certain other concerns affecting installation of the FSTP:

1. Septage availability- septage delivery is important part of the plant function
2. Rainy season effect – Due to continuous rainfall the plant construction work delayed.
3. The TMC were practising open dumping of septage. This was unsafe and unhygienic.

But after the installation of the FSTP, the treated septage has become safe to dispose and handle.

Lessons Learnt

1. Site selection – Excess rain fall in places such as Kerala can create difficulties like water logging, landslides etc. Hence, proper identification of the site and strong protection for installation, is a crucial factor for the functioning of FSTP and septage delivery. This is so because rain affects the honey sucker vehicle operation during heavy rainfall
2. Raising awareness in the community about the benefits of the plant and conducting IEC activities accordingly is crucial to build sense of ownership in people. From the public protests, our team learnt that by arranging exposure visits of key officials of the Municipal Corporation such as the Mayor and District Collector, one can convey the benefits of the FSTP, its sustainable and odourless functioning and its environment friendliness to the people easily.

The FSTP installed at Kalpetta was a joint success of sustained and concentrated efforts of UNICEF, PriMove, the Kalpetta Municipality and TBF. The plant has become an effective solution to treat the faecal sludge of Kalpetta while simultaneously churning up small revenue through the tipping fee being charged.

- From the year of 2019-2020, the Kalpetta plant has treated a total of 2,53,000 litres of septage.
- The treated water and vermicompost generated from the plant can be reused to generate revenue, leading to sustainable management and treatment of septage.

Lessons Learnt

1. Septic tank characteristics were studied and understood in detail such as, how to handle thick septage, importance of access to the septic tank during desludging of septage.
2. Site selection – Excess rainfall in places such as Kerala can create difficulties like water logging, landslides, etc.
3. Feeding thick septage to the system challenges – In order to flow easily, sometimes the septage needs to be diluted with water.
4. Rainy season effect – Due to continuous rainfall the plant faces a shortage of septage delivery. Hence, management of the plant in such times is critical as due to zero de-sludging order, plant function is affected.
5. It is important to ensure that the honey suckers do not discharge the septage unhygienically outside and deliver the septage at the plant.
6. Raising awareness in the community about the benefits of the plant and capacity building of government officials is important for the long-term functioning of the plant and understanding its various aspects.
7. Coordination with honey suckers and government departments to ensure sludge is received regularly.

Learnings from the plant at Thiruvananthapuram:

1. The treated water is 42 MLD, of which 3% is used for irrigation purpose in the STP campus. Also, there is a proposal for sale of 5% of treated effluent to the nearby sewage farm under the dairy department. Most of it is discharged into the nearby TS canal, having been treated until it contains safe BOD levels.

2. The dried sludge is used as manure for gardening purposes at STP campus.
3. Replacing septic tanks by bio-digesters is being thought of.
4. Once the improvement of more coverage activities is finalized and prioritized after consultations, investment both in terms of capital cost and O&M cost has to be estimated (AMRUT Guidelines; para 6.5).

Based on the investment requirements, different sources of finance have to be identified.

The financial plan includes a percentage share of different stakeholders like Centre providing 50%, State providing 30%, and ULB providing 20%. It also includes financial convergence with various ongoing projects.

Challenges and Possible Resolutions

The following challenges were faced at the Thrissur FSTP:

1. Site selection – as the first location was not suitable for construction the site had to be changed which delayed the construction.
2. Heavy rainfall during construction lead to delayed delivery and availability of raw material at the construction site.
3. Water leakages in tanks.
4. Public protests not allowing septage delivery.

Possible Resolutions

1. To ensure regular septage supply – raising public awareness, advertisement of the FSTP through the local newspapers and digital news and media and continuous follow up with health department is important.
2. A strong shed and sufficient protection of different units of the plant is necessary to tackle the challenges posed by heavy rainfall and winds on the site.
3. Carrying out regular awareness programmes for the FSTP.
4. *Water leakages* – water proofing work was done for all the tanks after leakages were found.

The challenges faced at Kalpetta were as follows:

1. Site selection – the first location not being suitable had to be changed. Changing sites delayed the construction.
2. Heavy rainfall during construction led to delayed delivery and availability of raw material at the construction site.
3. Septage delivery
 - Septic tank emptying is a challenge as the road is not easily accessible.
 - Road inaccessibility during the rainy season.
 - Day time septage transport is prohibited so it can be done only during the night.
 - Vehicle availability for septage delivery is also a challenge.
4. Septage Characteristics
 - Unwanted waste material from a septic tank is likely to disturb the treatment process. Awareness about the type of waste to be disposed off in septic tanks should be ensured.
 - Irregular availability of septage.

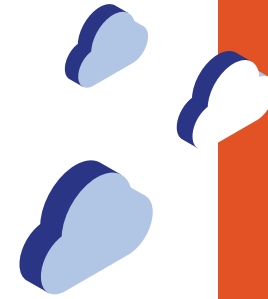


- Plant not running at 100 % capacity due to septage shortage, due to heavy rainfall vehicles not available for collection, boundary limits for septage collection and permission for transport by Municipality.
5. Power Supply
 - Failure of electrical power supply due to rainfall which affects the plant functioning.
 - Power supply fluctuations affect the plant's control panel and may damage it.
 6. Problems during the nation-wide pandemic of Covid-19
 - No permission to do plant operations.
 - Septage transport is not permitted.
 - Desludging cannot be done.



Possible Resolutions

1. To ensure regular septage supply it is important to raise public awareness, advertisement of the FSTP through the local newspapers and digital news and media and continuous follow up with the health department.
2. A strong shed and sufficient protection of different units of the plant is necessary to tackle the challenges posed by heavy rainfall and winds on-site.
3. Permissions from the municipality for daytime septage delivery
4. To tackle the issue of thick septage, changes to be done into the plant operation and valve functioning as per the septage.
5. Regular awareness programmes to be carried out for the public on the FSTP.



Challenges in Thiruvanthapuram

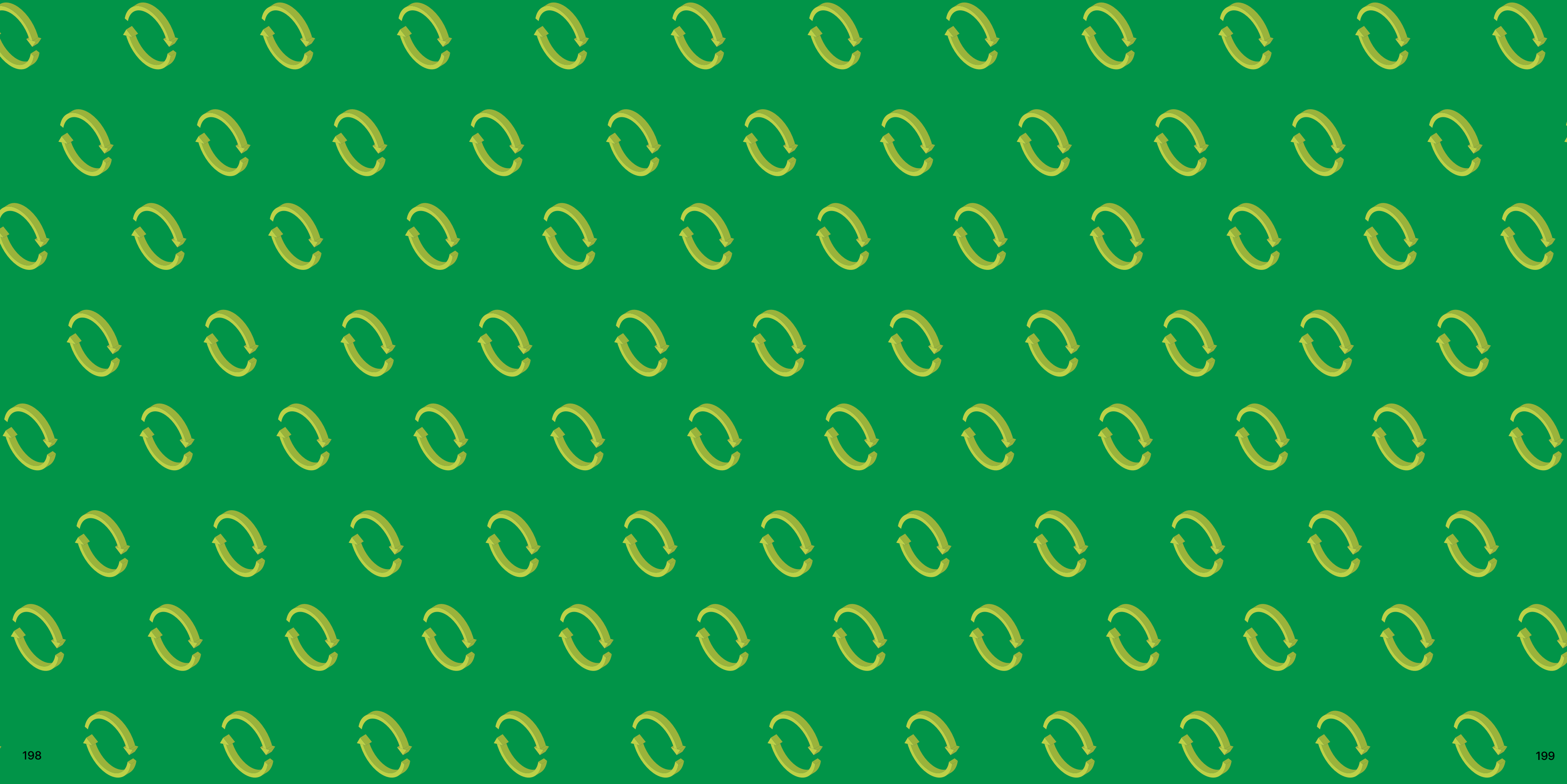
While the STP in Thiruvananthapuram provided a great opportunity to treat a significant amount of waste generated by the city's residents, there are still large gaps that remain to be addressed.

For instance:

- Due to delay in acquiring the land for pump houses, most of the projects could not be started within the closure of JNNURM schemes which had to be completed. Hence there is a need to ensure land availability in a time-bound manner.
- NOC from other departments to be available at the time of preparing the DPR.
- Thorough reconnaissance and feasibility study to arrive at materializing the project in timeframe.
- Need for splitting the projects into components to ensure competition in bidding & speedy completion.

- Heavy capital investment is required for the completion of the scheme covering all the 18 blocks (while blocks A through E are already covered, there is need for more piping in blocks F to R). Additionally, rehabilitation of existing networks and worn out pumps/machinery, decentralised sewage treatment facility in the extended corporation area, land etc., are needed to prevent new gaps from arising.
- Need for testing the manure from the plant and further arranging for selling and disposal of the manure.
- However, for centralized treatment of the septage, further modifications to the existing STP's extended aeration process is required. Decentralized community STPs can also be implemented to overcome the existing issues.
- There is still a need for enhanced STP capacity, and to cater to this need another one is being planned near the medical college area. However, land acquisition has been a major constraint, thus limiting the capacity of the planned STP to 5 MLD. Therefore, priority is being given to full capacity utilization of the STP at Muttathara by laying sewerage lines that connect blocks F to R to the sewer network, as well.
- The treatment of sludge cumulating in the 107 MLD STP requires disposal, as the gardening needs around the STP can only absorb so much dried sludge.





Uttar Pradesh

Context

Uttar Pradesh is the most populous State in the country. The State has 652 Urban Local Bodies (ULBs) and an urban population of 4.4 crores (as per 2011 census) which increased to 4.9 Crores as per the State estimate in 2018. There are 60 major cities in the State with population greater than a lakh and are covered under the AMRUT mission for development of urban infrastructure and reforms. As per the 2011 census, around 55% of households in urban Uttar Pradesh were dependent on Onsite Sanitation System (OSS). Around 610 cities are completely dependent on onsite sanitation systems.



Initiation and Planning Process

In 2018, Centre for Science and Environment (CSE) conducted a study of excreta management of 66 major cities in the State using Shit Flow Diagrams (SFD). The Shit Flow Diagram of 66 major cities in the State and key observations from the study are provided below:

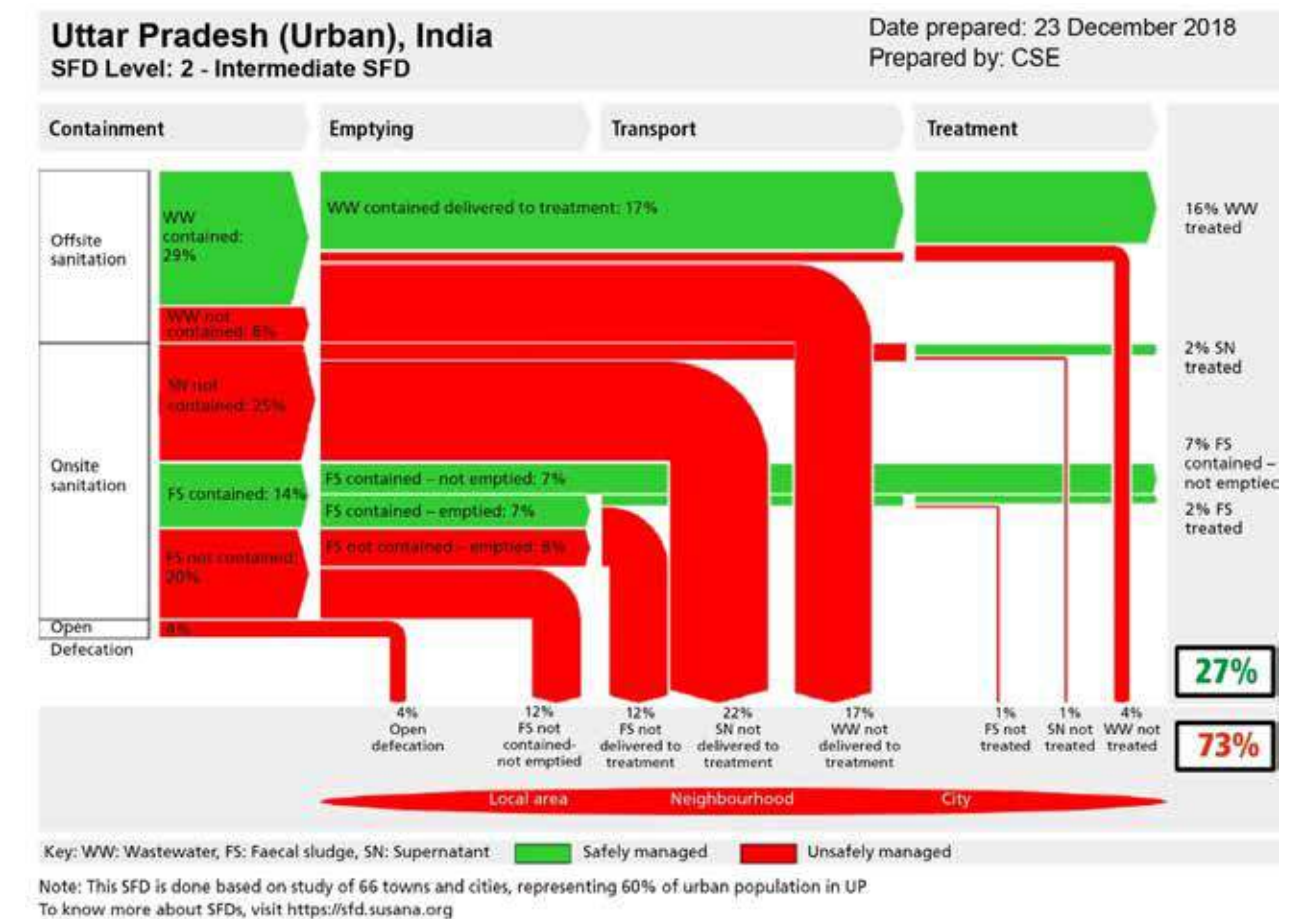


Figure 1: Shit flow diagram for Uttar Pradesh urban

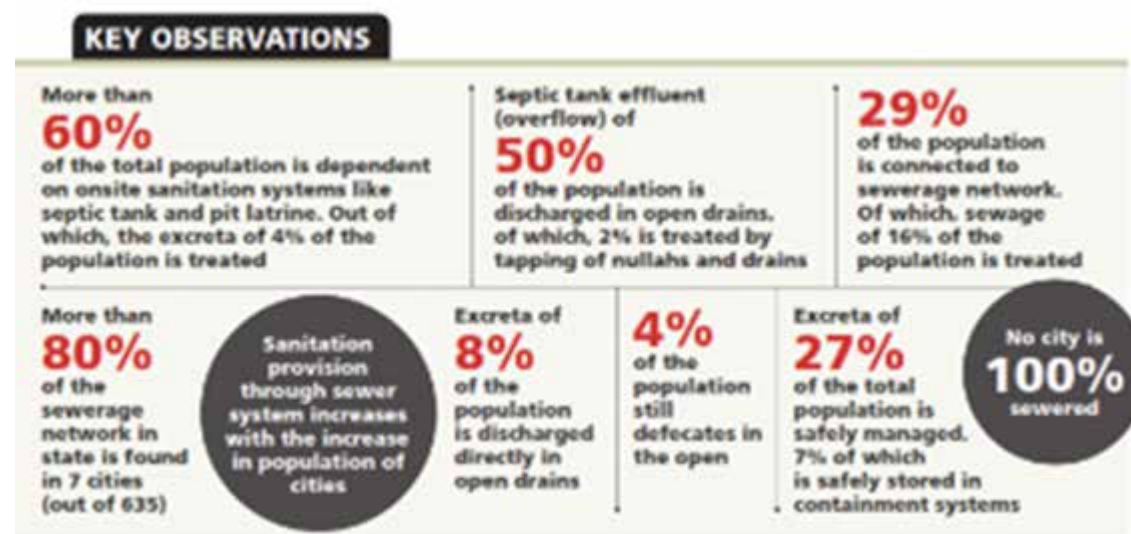
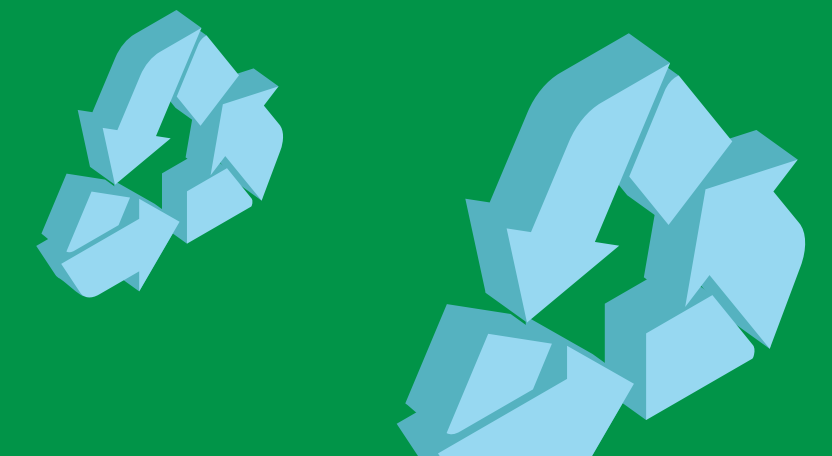


Figure 2: Key Observations from the CSE excreta management study

Institutional set-up

The following steps have been taken to mainstream Faecal Sludge and Septage Management in the State:

- INR 483 Crore were allocated under SAAP – AMRUT Mission for construction of Faecal Sludge Treatment Plants (FSTPs).
- The first FSTP operationalized in Jhansi through ULB funding and the second in Unnao through AMRUT funding.
- It was decided to register all the private de-sludgers and designate sewage pumping stations as disposal points in cities with sewerage network.
- It was decided to implement Co-treatment of Faecal Sludge in STP by adding pre-treatment modules.
- The National Mission for Clean Ganga (NMCG) to pilot an FSTP in Chunar with CSE as a knowledge partner.
- The State Septage Management Policy (2019-2023) has been issued to ensure interventions across the sanitation value chain in a time-bound manner.



Financial and Business Model

Pilot Faecal Sludge Treatment Plant (FSTP) in Jhansi

An FSTP of 6 KLD capacity was implemented by Jhansi Nagar Nigam using the 14th Finance Commission funds. This was the first FSTP implemented in the State and was operationalized in 2017. The FSTP used non-mechanized, nature-based technology using planted drying beds for solid-liquid separation followed by a decentralized wastewater treatment system.

The project follows an integrated FSSM model, wherein the private agency responsible for emptying and transportation of faecal sludge also operates the FSTP. Jhansi Nagar Nigam has issued the FSSM by-Laws and have fixed the emptying fees as INR 1500.

The plant details can be found on the web-page: <https://www.cseindia.org/faecal-sludge-treatment-plant-at-bijoli-jhansi-9070>



Figure 3: FSTP in Jhansi

Pilot FSTP under AMRUT scheme in Unnao

A 32 KLD FSTP was operationalized in October 2019 using funds from the AMRUT scheme. The plant uses a mix of mechanized and nature-based technology.

The plant uses a mechanized technology i.e., screw press for solid-liquid separation and a nature-based non-mechanized technology to treat the liquid portion of the faecal sludge.

This FSTP also has a tertiary treatment using activated carbon filters and UV treatment to meet the discharge norms directed by National Green Tribunal.



Figure 4: FSTP in Unnao



Co-Treatment of Faecal Sludge in Sewage Treatment Plants

A number of cities in Uttar Pradesh dispose of the faecal sludge using the existing sewerage network or sewage treatment plant (STP).

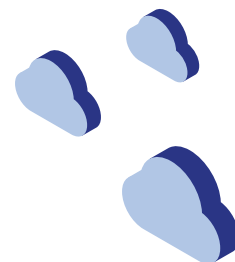
The CSE Programme Support Unit (PSU) submitted a report on co-treatment of faecal sludge in STPs to Department of Urban Development (Uttar Pradesh) and gave a presentation to the Principal Secretary, Department of Urban Development. The CSE PSU suggested various co-treatment modules for pre-treatment of faecal sludge including solid-liquid separation.

The recommendations were accepted, and tenders were floated by the UP Jal Nigam for co-treatment modules for the STPs in 21 cities.

Scaling up FSTPs across cities in Uttar Pradesh Uttar Pradesh Jal Nigam is a parastatal agency responsible for implementation of infrastructure projects related to water and sanitation.

Through the AMRUT scheme, funds have been allocated for implementation of FSSM in 60 major cities covered under the scheme. The snapshot of the FSTP implementation status (as of July 2020) in the State through AMRUT scheme is as below:

- **Operational FSTP:** Unnao
- **Under Construction:** 4 cities (Lakhimpur, Raebareli, Loni, Modinagar)
- **Contractor selected for FSTPs:** 31 Cities
- **Contractor selected for Co-treatment:** 4 Cities
- **Tenders under evaluation of Co-treatment:** 17 Cities



In addition to the above, there is an operational FSTP in Jhansi developed by the Urban Local Body and an FSTP under construction in Chunar, funded by NMCG with CSE as the knowledge partner.

Technical Support to two model cities

In order to create a model city for others to follow, CSE is giving technical support to mainstream citywide sanitation in two towns – Bijnor and Chunar. Different approaches are being tried out in these towns. In Bijnor, a City Sanitation Plan (CSP) was developed by the city sanitation task force and a faecal sludge and septage management plan was integrated in the same.

In Chunar, a strategy cum operative guidelines on implementing FSSM was developed first and now a rapid CSP is being developed. Both the CSP and operative guidelines have incorporated short-term, medium-term and long-term plans with timelines.

1) Chunar

Chunar is a small Ganga priority town which is going to get its first faecal sludge treatment plant funded by the National Mission for Clean Ganga, with technical support from CSE. The town shall be used as a model for other cities in the Ganga basin to follow. In order to ensure effective decision making, a City Sanitation Taskforce (CSTF) has been instituted by Chunar Nagar Palika Parishad. The CSTF actively meets and takes informed decisions related to the city's sanitation needs. A 6 KLD Faecal Sludge Treatment Plant is under construction.

The FSTP uses non-mechanized, nature-based technology. The FSTP proposes reuse of the treated effluent and sludge for horticulture and plantation. The capital cost of the FSTP is INR 195.9 lakhs. The FSTP is being constructed in an area of 3797 sqm with an additional 1742 sqm area to be used for plantation.



Figure 5: Faecal Sludge Treatment Plant in Chunar under construction

For safe disposal of faecal sludge trenching has been initiated in the city until the FSTP is made operational.



Figure 6: Faecal Sludge Treatment Plant in Chunar under construction

In order to ensure safe and effective FSSM across the sanitation value chain, trainings were organized for vacuum tanker operators and masons from Chunar.



Figure 7: Training of vacuum tanker operators

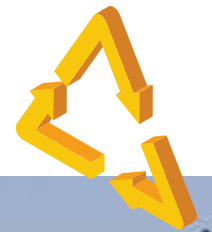


Table 1: FSSM Action Plan for Chunar Nagar Palika Parishad

A1	Preparation & implementation of city - level integrated faecal sludge, septage & wastewater management strategy cum operative guidelines
A2	Preparation of rapid Citywide Sanitation Plan
A3	Regulation of desludging service providers and installation of GPS devices in each vacuum tanker
A4	Identification, construction and designation of trenching sites for safe disposal of faecal sludge, till a scientifically - designed treatment plant is in place
A6	Construction and commissioning of faecal sludge treatment plants with effective reuse of by-products (wherever feasible) for safe management of all the collected faecal sludge
A7	Ensure adequate manpower and efficient equipment for collection and transport of faecal sludge
A8	Frame and enforce by-laws for: 1. Disposal of faecal sludge by all desludgers in the FSTP only; 2. Implementing scheduled desludging (initially in the selected ward(s) for pilot study). These include – (i) Collection of sanitation charge (minimum of INR 25 and INR 50 from each residential and non-residential property respectively); (ii) Each desludging of Community or Public toilet shall be charged at a minimum of INR 1000 per trip; (iii) Provide scheduled desludging at an interval of 3 years to each residential & non-residential property
A9	Capacity building programme for ULB, service providers, masons, operators etc.
A10	Implement scheduled desludging in the selected ward(s)
A11	Ensure enforcement of 'The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013' and provisions for penalising the defaulters
A12	Gap analysis and, construction and commissioning of the FSTPs for safe management of all the generated faecal sludge, in conjunction with the implementation of the city-wide scheduled desludging
A13	Operationalise decentralised wastewater treatment systems for the effluent generated from the OSS and grey water
A14	All households with insanitary latrines to have sanitary latrines
A15	Conducting Total Station Surveys & geo-tagging of all properties along with their respective OSS. This shall include development of web-based geo-spatial information & Management Information System (MIS) and integration of both on a GIS Platform.

Bijnor

Bijnor, a town of around 1 lakh population had constituted a city sanitation taskforce which regularly meets to take informed decisions for improving sanitation of the city.

City is implementing the sanitation plan which has a component of mainstreaming faecal sludge and septage management The city. By-laws on FSSM were developed by the CSTF and approved by the board members. Capacity building for co-treatment of faecal sludge in a recently commissioned STP is proposed in the city. The PSU aims to ensure effective implementation of interventions as per the City Sanitation Plan adopted by Bijnor Nagar Palika Parishad.

Actions	2019-20				2020-21				2021-22			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Preparation of Citywide Sanitation Plan												
Frame and notify bye-laws for implementing effective FSSM in Bijnor expanded area												
Sewer connections to all HHs (BNPP + Ladapura) in core city												
Seek no objection from Jal Nigam and prepare DPR for co-treatment of FS at STP												
Tendering, Construction and commissioning of required modules at STP for co-treatment of faecal sludge at STP												
CSTF shall pass a resolution for co-composting of co-treated FS at STP with organic solid waste and allotment of land for trenching												
Prepare DPR and implement trenching till the time co-treatment is implemented												
Regulation of desludging service providers and installation of GPS devices in each vacuum tanker												
Capacity building programme for ULB, service providers, masons, operators etc.												
Implement scheduled desludging in expanded area by first piloting in few wards												
Ensure enforcement of 'The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013' and provisions for penalising the defaulters												
Operationalise decentralised wastewater treatment systems for the effluent generated from onsite sanitation systems and grey-water												
All households with insanitary latrines to have sanitary latrines												
Conducting Total Station Surveys & geo-tagging of all properties along with their respective OSS. This shall include development of web-based geo-spatial information & Management Information System (MIS) and integration of both on a GIS Platform.												
Sensitization of farmers about the health and environmental ill effects of agricultural application of untreated wastewater and raw FSS and encourage them to use treated FS & WW from the (F)STP												
Standardization & certification of the manure manufactured												

Table 2: Timeline for implementing FSSM in Bijnor

Financial and business model

The Govt. of Uttar Pradesh issued a State Septage Management Policy (2019-2023) through a Government Order dated 30th October 2020. The policy has been issued keeping in mind the need for septage management to prevent pollution and safeguard public health of the citizens. The policy highlights the existing scenario where due to lack of regular emptying of septic tanks (i.e. at least 5 years), the supernatant water pollutes the drains and rivers. The emptying of septic tanks is done by untrained private operators who discharge the septage in open fields, drains and rivers. This highlights the need for the septage management policy.

The policy targets that by year 2023 there is an improvement in the quality of water and protection of public health. The policy articulates a three-pronged Septage Management (SM) Vision:

- By the end of 2019, all preparatory activities of realizing the SM target under the sector regulation is completed;
- By the end of 2021, SM is mainstreamed in all Urban Local Bodies (ULBs) and, all Nagar Nigams (NNs) and Nagar Palika Parishads (NPPs) have significantly moved forward towards SM and;
- By the end of 2023, all ULBs have implemented SM solutions in an inclusive manner empowering all stakeholders in the process.

Financial Sustainability for Septage Management activities:

The policy proposes levying of a septage fee with a separate accounting head. Currently, 4% Annual Rental Value (ARV) for residential houses is being charged as sewerage tax. The septage fee will be collected as a part of the property tax from households that are not connected to a sewerage network and hence not paying sewerage tax.

Capacity building of State and City Officials for effective Faecal Sludge and Septage Management

There have been a number of organizations supporting the State and city officials in capacity building and sensitization in city sanitation including faecal sludge and septage management. Some of the key workshops, training and exposure visits organized by CSE for mainstreaming FSSM in the State include:

- a) National and International Exposure Visits for mainstreaming FSSM in Uttar Pradesh
Exposure visits to Odisha and Bangladesh, where FSTPs have been implemented, were organized to promote peer-learning on challenges in FSSM in similar context. Dedicated knowledge sharing sessions were organized for UP Jal Nigam officials with Odisha Water Supply and Sewerage Boards and WaterAid Bangladesh. The programme has helped develop a pool of engineers trained in implementing FSTPs in the State.



Figure 8: Exposure Visit and Knowledge sharing between UP Jal Nigam and Odisha Water Supply and Sewerage Board



Figure 9: Exposure Visit organized by CSE for U.P. officials to FSTP in Bangladesh

b) State level workshop in Lucknow

A State level workshop was organized by CSE in Lucknow on 22 nd October 2018 to sensitize the State and city officials in mainstreaming Faecal Sludge and Septage Management in the State. The meeting was attended by all the key state level officials including Shri Manoj Kumar Singh, Principal Secretary, Department of Urban Development (Uttar Pradesh), Shri G S Priyadarshi, State Mission Director, AMRUT (U.P.), Officials from Uttar Pradesh Jal Nigam and well as the Municipal Commissioners and Executive Officers from the major cities in the State. From CSE, Ms. Sunita Narain, Director General and Dr Suresh Kumar Rohilla, Sr. Director were present. The workshop was also attended by Ms. Madhu Krishna, Country Lead for WASH, Bill and Melinda Gates Foundation India.

CSE's report on excreta management in the cities in Uttar Pradesh and the web-based tools namely, SANIKIT and MOUNT were released in the workshop. The State officials updated that a State Faecal Sludge and Septage Management Policy was being developed by Department of Urban Development, Uttar Pradesh. The State also briefed about the plan of scaling-up the implementation of FSTPs in cities across the state using the AMRUT funding. This workshop helped in leapfrogging the issue of mainstreaming FSSM in Uttar Pradesh.

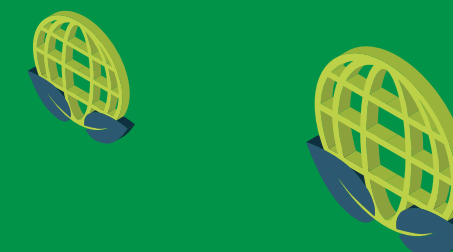
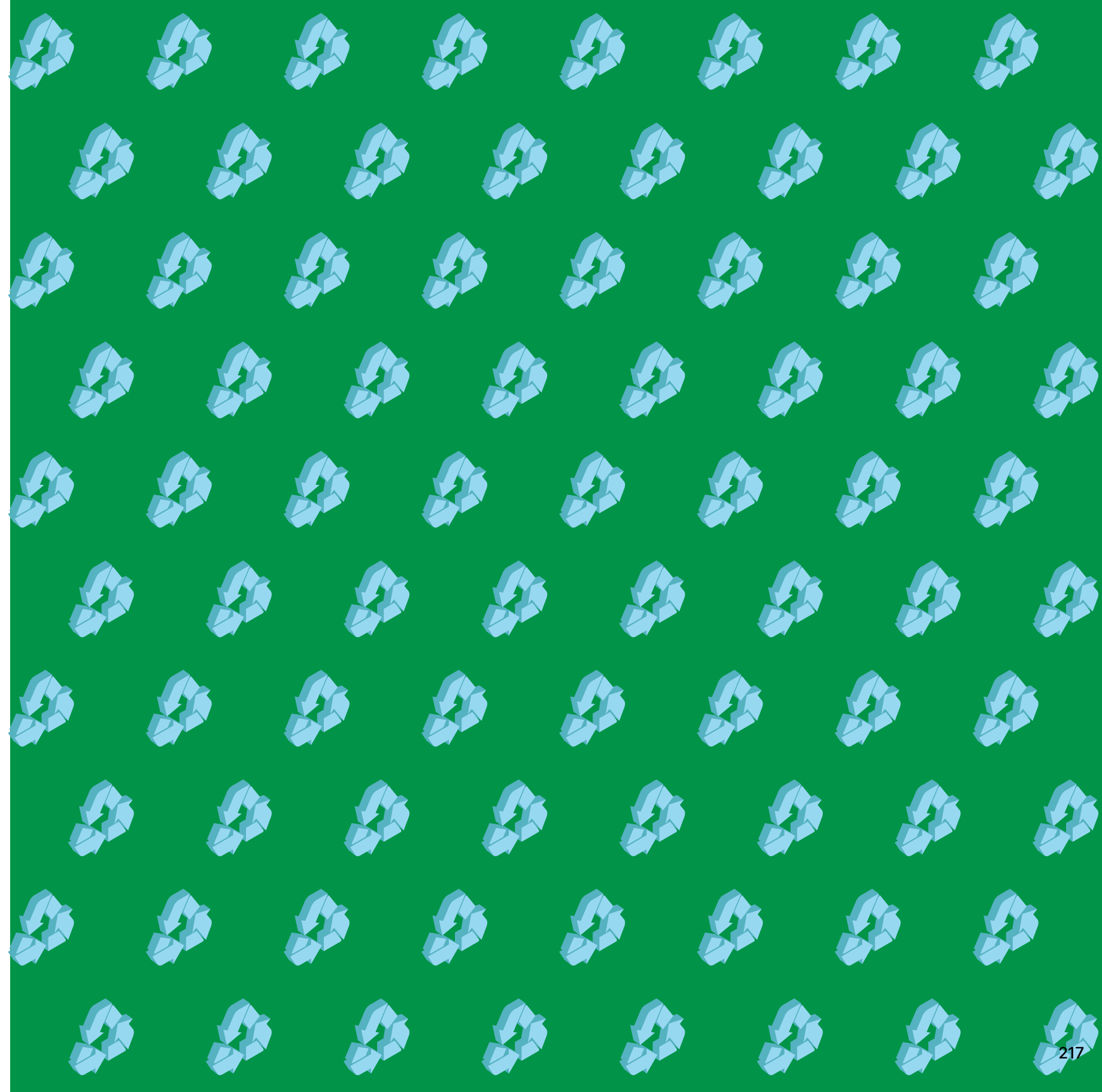
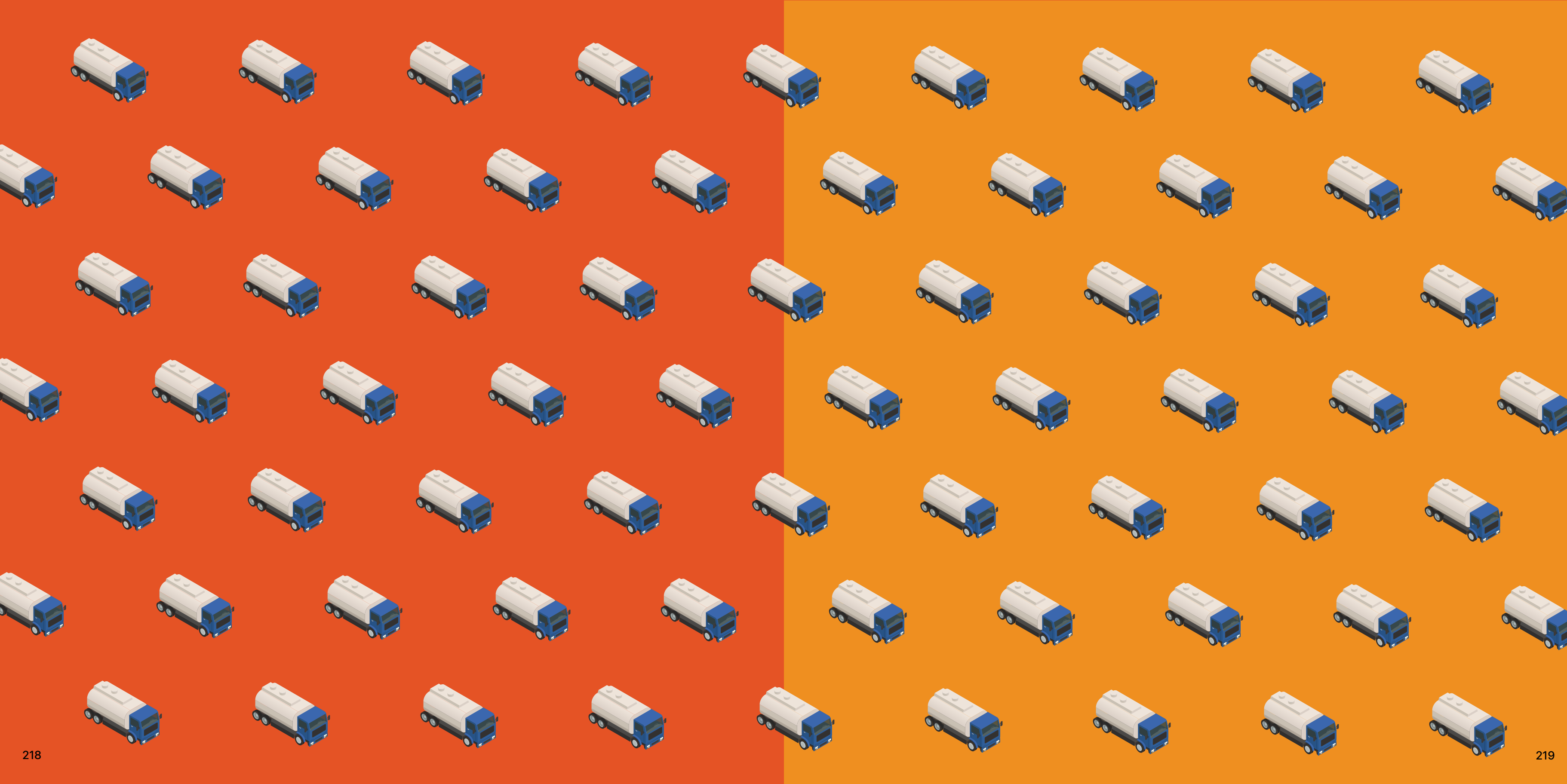




Figure 10: Workshop on mainstreaming FSSM in U.P.





Rajasthan (Phulera-Sambhar, Lalsot and Khandela)

Context

Rajasthan is emerging as one of the front-runners in urban sanitation reforms in the country, having successfully achieved open defecation free (ODF) status in both its urban and rural areas, under the national Swachh Bharat Mission. The results have been phenomenal with a huge performance jump in terms of availability of toilet containment systems (from Census year 2011 - 82% urban household to almost 100% households by October 2019). In rural Rajasthan, the program has performed even better and the household coverage has increased exponentially from 20% to 100% including toilet containment systems within the same time-frame. Rajasthan is the largest State in India in terms of geographical area, accounting for 10% of the total geographical area of the country.

With the current urbanization rate in the state which is around 25%, the municipal bodies are growing at a rapid rate. The Government of Rajasthan (GoR) has shown immense commitment towards planned urban development over the years. This is exemplified by the fact that master plans have been prepared and approved for over 184 towns (out of a total of 193), which is a remarkable achievement for any state in the country, where in 2012 almost 3/4 th of the cities were functioning without a master plan. With loan assistance from the Asian Development Bank (ADB), the GoR has successfully implemented 2 multi-sector urban investment projects (RUIDP 1 and 2). The Rajasthan Urban Infrastructure Development Program (RUIDP), a dedicated entity established for implementing these projects has become one of the most successful special purpose vehicles in the country. The investments in sanitation and sewerage have made substantial improvements in the living standards of the residents of the 34 project towns (6 in Phase – I, 15 in Phase – II and 13 in Phase - III). However, these investments have mostly been targeted towards larger cities and towns and the service delivery in remaining smaller towns of the State remains challenging.



Initiation and Planning Process

To address the gap in investments, Phase-III of the program was conceived to include a grant component contributed by Bill and Melinda Gates Foundation (BMGF), channelled through the RUIDP's existing framework to put focus on non-sewer areas, i.e. areas that are unlikely to be provided with a centralized sewerage system in the foreseeable future either due to financial or technical unviability. The project aims to find innovative solutions for pertinent sanitation issues across the value chain during the planning, design, implementation, and monitoring process. The solutions envisioned under the grant component are expected to be participatory, people-centric and gender-responsive, through a combination of

- Technological interventions,
- Institutional & regulatory reforms,
- Inclusive community engagement strategies,
- Sustainable financing & revenue models, and
- Capacity building and training in sanitation service delivery for both the government and private sector



Institutional set-up

Under the BMGF grant component, various initiatives pertaining to Faecal Sludge and Septage Management (FSSM) have been undertaken and are at different stages of completion. Some of the key highlights from the FSSM initiatives in Rajasthan include:

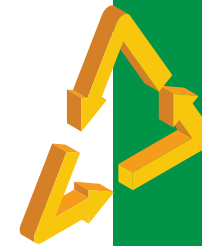
- Preparation of a State FSSM policy and guidelines
- End to end support for preparing the comprehensive FSSM Plan
- Strengthening of town level regulatory and institutional framework
- Construction, supervision, and operations of three faecal sludge treatment plants (FSTPs)
- Robust capacity building and IEC program during several stages of the project implementation

The entire process involved series of consultations with different types and levels of stakeholders and exposure visits resulting in creating an environment conducive to collective efforts for streamlining the existing sanitation situations.

The most significant outcomes of the program have materialized from the pilot project for the city wide FSSM in all three project towns: Phulera-Sambhar, Lalsot and Khandela. The management of faecal sludge was largely unorganised in terms of safe collection, transportation, treatment and further complete lack of any re-use mechanism. In absence of any regulatory mechanism and standard operating procedures (SOP), the private operators (the private operators are not registered with any Urban Local Body (ULB) and are not provided with any safety gear for desludging operations) were serving based only on user request and disposing the collected waste mostly in an open drain or

at a solid waste open dumping yard (imposing serious health and environment risks). The existing operators do not consider this as a reliable round the year business operation and hence they tend to keep higher margins on desludging services (especially during rainy seasons).

“Every monsoon or during overflow, we open the valve of the septic tank and the accumulated faecal sludge flows into open drains. On rainy days, the valve sometimes opens by itself due to pressure and sludge flows into the drain” -A local resident, Sambhar



Private operators were called from remote towns with tariff ranging from USD 35-75/trip for round the year operations. The process involved unsafe practices of collection without PPE, incidences of leakages during transportation and further open dumping in town drain/vacant land. This was causing series health risk to the entire town population and also degrading the overall community hygiene and local environment.

“There is no such designated location for disposal of faecal sludge in the town. Earlier it was disposed at a solid waste dumping yard but due to protest by the nearby residents we are forced to dispose the faecal sludge outside the town into drains of nearby villages”

–Sanitary Inspector, ULB Khandela

The objective was to streamline the entire operations and transform these towns as a replicable model for safe and effective faecal sludge management for all small and medium town population of Rajasthan. Pilot project interventions not only covered the context specific technical/ infrastructure solutions in terms of dedicated faecal sludge treatment plant but also included ULB-level robust institutional & regulatory reforms, sustainable financing for O&M of the FSSM process (including the FSTP) training, exposure visits and capacity building for relevant stakeholders in the pilot towns.

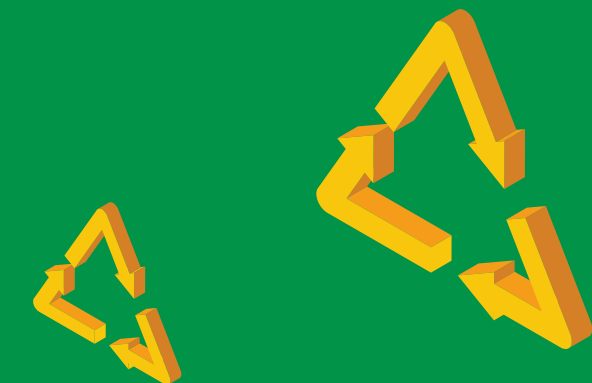


Figure1&2: Prior Situation of Sludge Collection, Disposal and Treatment in Pilot Towns

Operations and technology used

The project team proceeded with the Geographic Information System (GIS) mapping, public interactions, meetings with ward councillors and one-on-one interaction with private desludging operators in the pilot towns. Meetings were held with officials/staff of the cities for data collection, as well as discussing sanitation issues and possible interventions. Based on these, the project team identified key issues and calculated the septage generation, infrastructure demand, capacity gaps, as well as undertook GIS-based buffer analysis (to assess accessibility of households through desludging trucks), among other analysis.

These were constantly verified on ground and shared with RUIDP and the ULBs for review. Regular inputs were also taken from RUIDP officials throughout the planning process, especially about the treatment technology options, scheduled desludging, modalities of user charges for desludging, communication with other State & city level departments, and financing of the FSTP.

Six landmark resolutions were prepared in both English and the local language (for better understanding) and have been approved as ordinance at all the three municipal board meetings.

The resolutions of sanitation ordinance include:

- I. Land allocation for FSTP and making it mandatory for septage to be disposed at the FSTP
- II. Licensing of Desludging Operators – with eligibility criteria, format for application & job card
- III. Scheduled desludging in 3-5 year intervals through the ULB
- IV. Adopting city-wide Septage Management Regulations

V. Changes in the Building By-laws – model septic tank specifications & building plan approval

VI. Institutional Structure & Responsibilities for FSSM – constituting a City Sanitation Committee & Cell



Figure 3: Municipal board meeting for seeking approval on FSM Resolutions

These resolutions have been discussed with wide range of key stakeholder groups and have been brainstormed with municipal councillors in series of discussions. Municipal board meeting participants consists of the mayor, all ward councillors, and executive officers. The final sanitation ordinance (both English, Hindi) is passed by municipal board members and followed and implemented in all three towns.

The FSSM concludes with an implementation phasing for the interventions through short-term and long-term action plans. The construction of all the town FSTPs were completed in December 2019 and are successfully operating while adopting the provisions of approved sanitation ordinance.

These three pilot towns are expected to become a pioneer destination in Rajasthan to showcase the best practices of faecal sludge management. The town-wise plant and truck details are enlisted in the table 1 below:

Pilot Towns	Sambhar Phulera &	Lalsot	Khandela
Design Population (2027)	56,300	66,427	28,000
Infrastructure Development	FSTP-20 KLD	FSTP-20 KLD, 2 Nos. Desludging Equipment	FSTP-10 KLD, 1 Nos. Desludging Equipment
Cost of Work**	33.3 million	43.9 million	26.1 million
Technology	SC & GT – SR – SDBs Liquid: ISAF- PGF Solid: Dispose / Reuse/Co-composting*	SC & GT – SR – SDBs Liquid: ISAF- PGF Solid: Dispose/reuse	SC & GT – PDBs Liquid: ISAF- PGF-PP Solid: Reuse
Salient Features	Desludging through Private sector – Provision of Licenses, Sharing of Treatment facility among two Towns.	Combining O & M of treatment plant and desludging operations.	Hybrid Model – Allowing the licensing, Combining the O & M; Low Cost technology for Treatment
SC: Screen Chamber, GT: Grit Chamber, SR: Stabilization Reactor, SDBs: Sludge Drying Beds, ISAF: Integrated settler and Anaerobic Baffle Reactor, PGF: Planted Gravel Filter, PDBs: Planted Drying Beds, PP: Polishing Pond * Co-composting will be developed by Municipality once the solid waste segregation system is in Place. ** Capital Cost for FSTP + Procurement of requisite desludging equipment + O & M for five years.			

State reforms – FSM Policy and Guidelines of Rajasthan

In line with the vision of the National FSSM Policy, a State FSSM Policy for Rajasthan was prepared that builds on the provisions of the parent document and gives policy guidelines in context of the state. The document lays out measures for ensuring stakeholder participation, awareness, partnership building, funding and financing, implementation, service delivery, monitoring & evaluation and capacity building at State, city and community levels for operationalising FSSM in Rajasthan. It also includes sections on suggestive action plan for the State government and the ULBs, list of expected outcomes, and implementation timeline for achieving key milestones (differs with the size of town and type of geographical region). Similarly, a comprehensive State FSM guideline was also approved for technically guiding the State and ULBs in implementing various suggestive measures to bridge the existing gaps in FSSM operations. The State FSSM guideline is a techno-managerial document that provides a framework and step-by-step action plan to important State departments and ULBs to operationalise relevant services across the sanitation value chain. It also includes timebound actions plan for the next two years and dedicated sections for understanding each given target. The key strategic actions for the State include setting up a state-level FSSM cell and committee, empanelment of partners for supporting various activities (e.g. capacity building, knowledge partner, setting-up of dedicated urban sanitation funds, etc). Town-level section includes model town-level resolutions and regulations to be approved by the municipal board, structure and responsibility for town level

sanitation cell and committee, licensing of private operators, land identification and relevant infrastructure development, operationalizing the scheduled desludging and public awareness programme. It also highlights aspects on sharing of town resources in terms of co-treatment, clustering and desludging of nearby towns and settlements within a 20 km radius. A model town level service benchmark was included to assess the town performance in the long run.

A participatory and inclusive approach has been adopted in preparation of both policy and guideline, which includes taking inputs from all relevant state government departments, consultation meetings with several ULBs, several domain experts in the field of sanitation and FSSM, as well as learnings gathered from the pilot studies throughout the program. The provisions in the documents are heavily drawn from the challenges faced in planning and implementation of the pilot projects, including city-level reforms, institutional structure, identification of land for infrastructure, formalising desludging operations, stakeholder engagement, community consultations, etc. For getting inputs from a more diverse set of stakeholders, a State level workshop was organized where the provisions of the policy and guidelines were presented to representatives from various State government departments and ULBs across Rajasthan. These reforms are expected to streamline the entire value chain of FSSM and make progressive improvement in the overall environment and public health indicators of various small and medium towns of Rajasthan.



Figure 4: Glimpse of Knowledge Product developed for Regulatory Reforms at towns and State level

Image from top left to bottom: FSSM Guideline, FSM Resolutions Phulera- Sambhar, FSM Resolutions Lalsot, FSSM Resolution Khandela, and FSM Policy

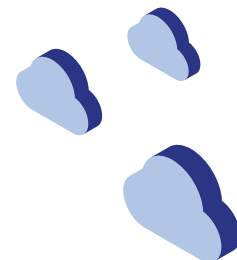
All the documents have been finalized in both English and Hindi and presented/discussed at multiple forums for feedback and suggestions. The objective was to have regulation strengthening at both the tiers of towns and state so as to have multiplier effects of learning in other urban local bodies. Rajasthan is among very few states of the country to have such massive regulatory reforms at all levels. All pilot towns have set-up city sanitation cell and committee now and recently at the state level under Department of Local Bodies (DLBs) it has also set-up a state sanitation committee for periodic discussion and suggestions for required improvement in urban sanitation at state level.

Financial and Business Model

The project has developed comprehensive approaches to sanitation improvement that encompass long-term planning, technical innovation, institutional reforms, and financial mobilisation. It also concurs with the overall approach of Citywide Inclusive Sanitation (CWIS) initiative jointly developed by the World Bank's Water Global Practice (WGP), in partnership with sector development partners (including The Bill & Melinda Gates Foundation, Emory University, The University of Leeds, WaterAid and Plan International). The application and integration of all seven principles of the CWIS in the current project are highlighted below:

Principle I: - Embedding sanitation within the framework of urban governance and municipal services provision

Sanitation Resolutions are approved as municipal ordinance, hence making it a statutory document to be followed by all relevant stakeholders in the three pilot towns. The provision of town sanitation committee would also take periodic assessment of overall progress and make further decisions to add or revise the existing rules of ordinance.



Principle II: - Establishing clear roles and responsibilities, with accountability and transparency, and robust service delivery management

A Sanitation Cell (full time set-up) and Committee (an elected body) have been established in all three ULB. This Cell will work on day-to-day functions and ensure compliance of FSM operations through a dedicated full-time staff. Similarly, the committee has been set-up for each project town comprising of key representatives from relevant groups who meet periodically to review the work progress and take decisions on required system reforms. This entire set-up is expected to create several layers of transparent information flow and will try and substantially improve the overall operational efficiency of sanitation services.

Principle III: - Delivering 'safe management' through the sanitation chain – for both onsite sanitation and sewers – to ensure separation of faecal contamination from people across the whole city

As part of the project mandate, a Geo-spatial model was developed to obtain clarity in terms of intervention suitability for sewer, non-sewer, and on-site sanitation solutions. Another aspect of the model was to devise town level full and partial scale FSM solutions (mostly sewer and left out pockets of settlements for co-treatment with FSTP) and further including gap filling recommendations (on-site solutions for areas with accessibility issues, remote areas requiring more travel time for truck operators etc.). Currently, as part of phase-IV program of RUIDP, around 42 towns are expected to be connected through sewerage network with provision of co-treatment for all the left-out population of towns.

Principle IV: - Outcomes rather than technologies – allowing for diversity of solutions and approaches

All three pilot towns of Rajasthan are class III and IV towns and their ULBs have limited resources and capacity to maintain the entire service operations and management. One of the operational challenges faced by the ULBs is ensuring restriction on open dumping of desludged waste and disposal at treatment facility. The ULBs introduced the concept of issuing manual job cards for tracking the whole service delivery chain rather than the option for technology driven solution like installation of GPS on trucks for closer monitoring. In the introduced job card system, for every service request, a signed job card is to be given to the operators which in turn needs to be also signed by the users (after completion of services) and the plant operators (after the sludge disposal at the treatment facility). Only job cards with three signs are eligible for receiving payment. The developed treatment solutions have ease of operations and based on biological treatment methods with further re-use mechanism through co-composting.

Principle V: - Basing decisions on secure operational budgets being available (always planning for operation and maintenance)

Considering the limited financial and technical capacity of the ULB, it was decided to set-up a low

CAPEX and OPEX based module, which can be operated by semiskilled manpower. The gravity-based plant was designed with treatment modules, sludge drying beds, Anaerobic Baffled Reactor (ABR) and planted gravel filter to achieve the objective of sustainability. The estimated operational cost of overall system is around 10 times lower than annual expenditure on SBM by the municipality. The entire set-up is significantly a low-cost solution (per capita CAPEX of 13 USD as compared to 335 USD in sewerage and similarly 5-year per capita OPEX of 1.5 USD as against 25 USD in sewerage).

There are mainly two sources of income generation, i.e., from collection of differential tariffs of various uses both within and outside ULBs and selling of the organic compost. This is expected to emerge as a revenue surplus model with initial expected annual profit ranging from 20-30% (i.e. 2000 – 3000 USD/year). The combined plant and truck operations in two pilot-towns have further supported cross-subsidising for cost deficiency for any of the operational components.

Principle VI: Facilitating progressive realization, building on what is already in place

Sambhar-Phulera has four private desludging operators that were integrated as part of the introduced system through means of operator licensing. Whereas in case of Lalsot and Khandela; there were no town based operators (but those available mostly come from remote town locations and charge relatively higher tariffs for tank emptying), thus truck and plant operations were combined and tendered out to a single private player.

Principle VII: Committing resources to training city leaders and technicians of the future to solve complex problems rather than deliver fixed solutions

Series of consultations were undertaken to understand the existing gaps in capacity building. On-going customized capacity building and IEC programs have further helped stakeholders understand their responsibilities. The project also involved exposure visits to different stakeholder groups in context of technology and implementation framework. The proposed city sanitation committee will also continue identifying areas of training and may communicate such need to higher state level bodies from time to time. This will help bridge the capacity gaps and work towards progressively ensuring a shift in terms of skills and knowledge domain.



Figure 5 & 6: Constructed and Operational FSTPs in Rajasthan

Images from the FSTP in Lalsot and the PSTP in Phulera

All the plants are operational and are serving the safe treatment and sludge collection needs of all three municipalities including nearby gram-panchayats up to 10-15 Km distance. Currently, a small-scale pilot of co-composting of municipal solid waste is also being undertaken, which is made available to the local farmers at affordable rates. This has been a good learning for other small and medium municipalities of Rajasthan (that currently do not have sewerage infrastructure in place). All the FSTPs have turned into research centres for various relevant educational institutes for their operations and wastewater treatment. Further, the FSTPs have started exposure visits for other ULBs and learnings are expected to be translated into more treatment plants in the near future.

“Improper Faecal Sludge Management is severely impacting the health outcomes of small-scale towns. The losses incurred due to diseases in residents, arising out of poor sanitation, is simply unacceptable. The three pilots of Phulera, Lalsot and Khandela have given an opportunity to resolve this problem with the help of Government of Rajasthan. If interventions in these pilot towns are proven successful, this will not just be a model for Rajasthan but also for the nation.”

- Project Director, RUIDP

Successes and Lessons learnt

Upfront CAPEX support and secure operational budget

Providing upfront support on full CAPEX has been a key trigger to get ULBs on board during the project inception stage itself. The entire framework (including extremely low consumption on electricity, limited skill requirement and small workforce) of the system has significantly contributed to reduce the overall operational expenditure and has kept the works within existing financial capacity of the respective municipalities. Affordable operational cost (USD 10,000 a year for 50,000 town population) and promising revenue surplus operations, are considered as a 'risk-free model' to adopt by the respective ULBs. This also works as a quick remedial measure to ease-out the pressing need of septage treatment solution in pilot towns.

Innovative project structuring

The complete project cycle from concepts, design, procurement, and construction supervision was executed by one project team. Similarly, plant construction and operations of desludging truck including composting are being undertaken by a single executing agency. This has ensured a comprehensive understanding of the entire process thus minimising the possibilities of process duplication and mistakes.

Embedding sanitation within the municipal services provision:

The town level regulation and institutional capacity needs significant improvement to make the reforms progressively aligned to the path of sustainability. This was achieved through combined

efforts of several stakeholders along with the legal backing of approved municipal ordinance on sanitation resolution in the pilot towns. One out of six landmark resolutions included setting-up of dedicated sanitation cell and committee, for improved preparedness on service delivery and system maintenance.

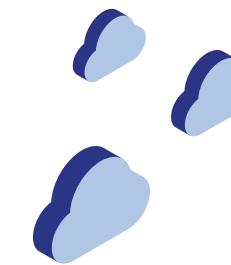
Worked as Team FSM

The consultants, executing agency, state officials and ULB officials including elected representative all have worked together as one team. Close interactions, smooth follow-ups and efficient monitoring have enabled delivery of the entire infrastructure set-up within agreed timelines and has ensured commencement of operations within a year of the contract awarded.

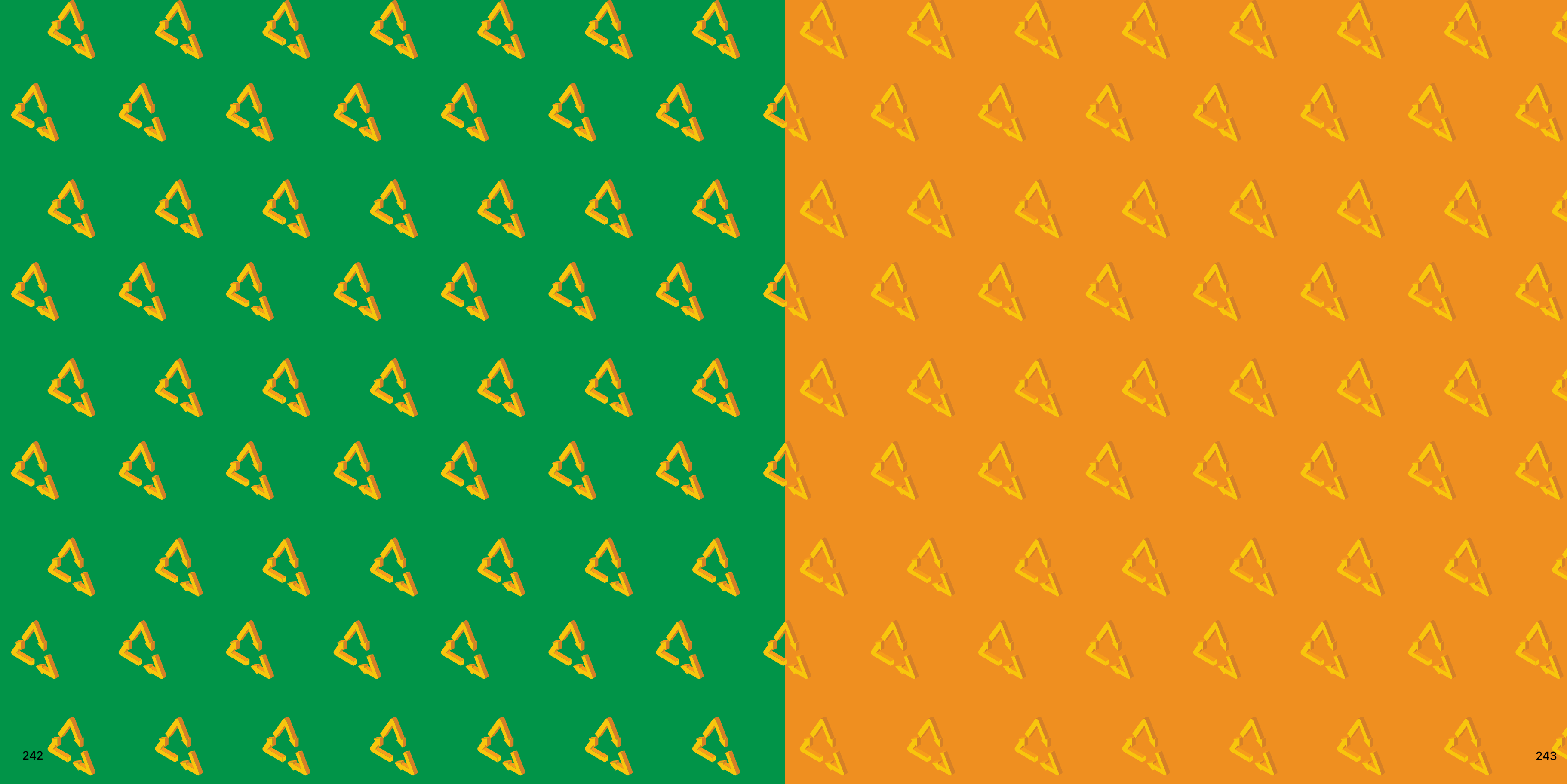


Challenges and possible resolutions

S.No.	Challenges	Resolutions
1.	Consensus on the monthly sanitation tariffs and approval from Municipal Board	With consultation it was observed that fluctuating emptying demand throughout the year was a big issue in the business. In case of assured service demand, operators were happy to reduce the cost and get associated with a ULB. Scheduled desludging was also important to reduce the level of water contamination in the community, hence, inter-linking the stakeholder groups (i.e. user, desludging operators and elected representative) led to development of win-win solutions for all the stakeholders groups.
2.	Mainstreaming the private desludging operators with municipal license	
3.	Land allocation by ULB for setting up of the treatment infrastructure	Ownership transfer ran into a deadlock and thus as advised by the Municipal Board, a No Objection Certificate (NOC) for plant construction was issued to the executing agency. Finding alternative solutions through consultation with the right target groups is important to avoid roadblocks.
4.	Proposing the non-sewered solutions instead of sewerage network for towns	Exposure visits to some of the successful FSSM sites and highlighting the cases of operational failure due to huge operational cost and skills mismatch.
5.	Creating interest of farmers for buying the co-compost manure and use in agriculture activities	Identifying the related linkages and connecting each group to understand the process flow of both organic and chemical fertilizer. Arranging visit of local farmers to the plant and showcasing the process of manure production and highlighting the scientific testing, was immensely useful to establish a strong dialogue with the farming community.



6.	High motivation for operators to run the plant successfully even with a small profit margin	The first of its kind intervention in Rajasthan and amongst the few in the country is a great branding initiative for the service providers. Moreover, further linking with the immense market opportunities has created a sense of responsibility to maintain the infrastructure and operate the services. The success story of the service providers needs to be showcased and the credit due to them should also be acknowledged.
7.	Encouraging user (households) to follow the scheduled desludging and emptying of the truck every three years	Through a series of Information, Education and Communication (IEC) activities focused on a range of subjects that is communicated through various platforms. Awareness was largely focused on health (both household and local community level) related advantages.
8.	Running the plant at design capacity	Although users have now started moving towards schedule desludging operations, the project town will take considerable time to fully adopt the process of tank emptying every three-years. The un-utilised plant capacity is now catering to the demand of nearby gram panchayats at a 10-15 Km distance range from the treatment plant location.
9.	Timely delivery of project and smooth asset ownership transfer from RUIDP to ULB	A local town level Work Monitoring Committee was constituted. It was formed by some volunteers, who were individuals with high interest in the work. The project got immense support from the town level key stakeholders including officials and elected representative of ULBs and operations started in a record nine months' timeline.

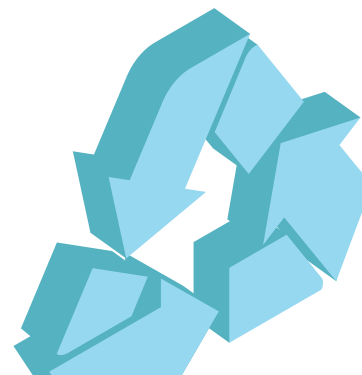


Shahganj, Madhya Pradesh

Context

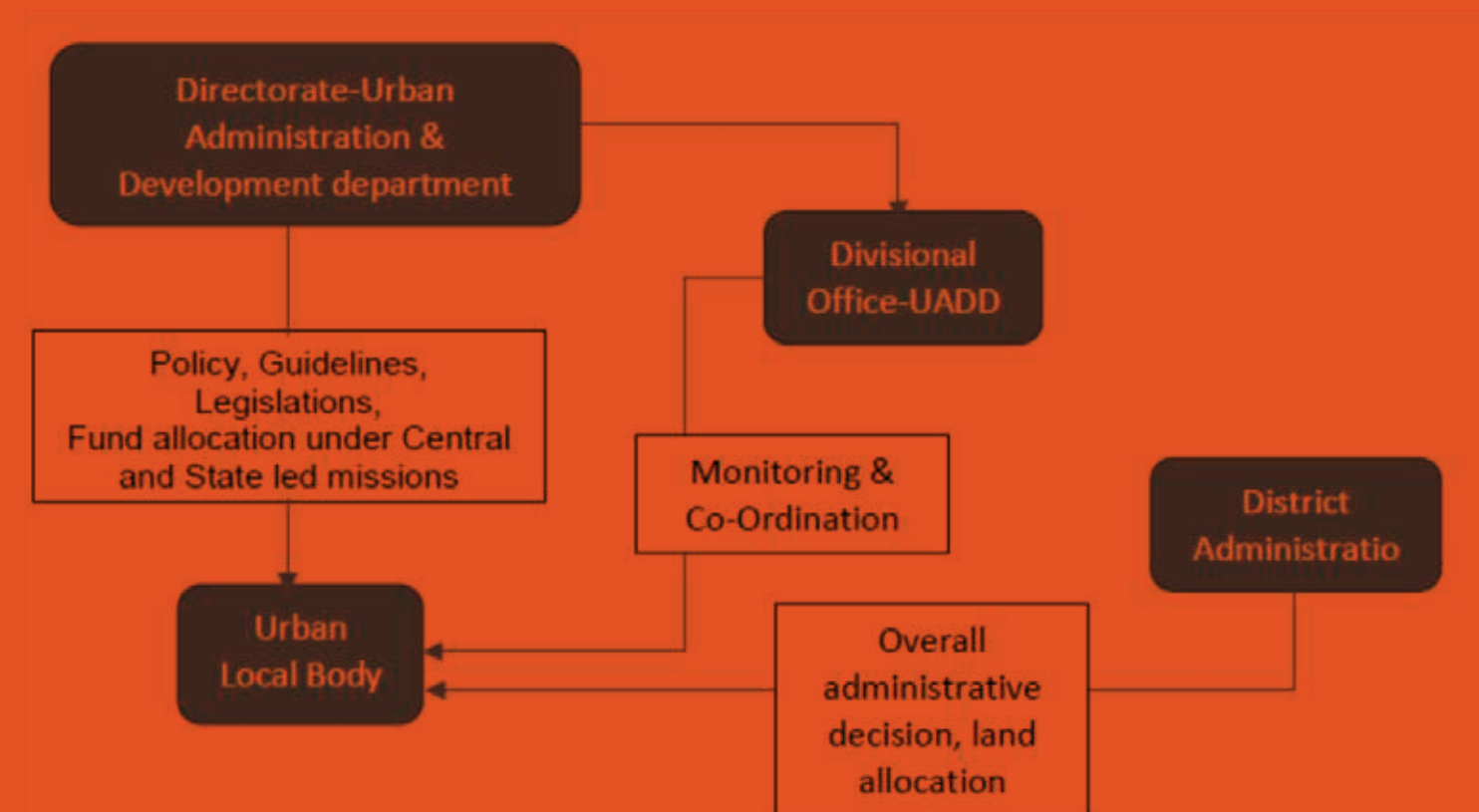
Shahganj is a small town in the Sehore district of Madhya Pradesh, with a population of around 9000. It is a picturesque location surrounded by mountains. The river Narmada flows adjacent to the town. Apart from its religious and ecological significance, the Narmada caters to the drinking water need of its adjacent towns. Shahganj has been awarded the title of the Best City in Citizen Feedback (West Zone) under the population category of up to 25 thousand in the Swachh Survekshan 2020, the fifth edition of the annual urban cleanliness survey conducted by the Ministry of Housing and Urban Affairs (MoHUA), Government of India. It has also secured a 3-star rating under the Star Rating Protocol for Garbage Free Cities (1*) . Though Shahganj is an Open Defecation Free (ODF) town and has individual household toilets in almost every house, yet in the absence of a wastewater treatment system, there was a critical need for proper disposal and treatment of black water, which contaminated the land, groundwater, and the Narmada river.

[1] <https://gfcstarrating.org/>



Institutional Set-Up

Directorate - Urban Administration and Development Department (UADD) is the primary institution under the departmental structure of the Urban Development & Housing under the Government of Madhya Pradesh and is the nodal agency for undertaking and implementing State level FSSM initiatives along with its overall supervision in the State.



Initiation and Planning Process

In consultation with the Directorate - Urban Administration and Development Department (UADD) and the City Council, Shahganj decided to build a Faecal Sludge Treatment Plant (FSTP) based on the gravity flow system with minimal mechanical and electrical interventions at the beginning of 2018. Being a small Urban Local Body (ULB), Shahganj did not want to set up an expensive treatment system, which would attract higher O&M costs.

A team went to Devanahalli, Karnataka, to better understand the intervention and to study the nuances of the gravity-based faecal sludge treatment system.

Planning Process

Post the Devanahalli visit, an initial rapid survey was conducted by Shahganj ULB to understand the FSSM scenario in the town in terms of faecal sludge generation by the existing and floating population, existing types of the containment system, infrastructure availability, and vacuum emptier trip patterns. Along with infrastructure creation, there was also a need to enhance levels of awareness of the community and skilling of ULB officials on the subject.

Key Findings from Survey

- Almost all households have toilets connected to septic tanks.
- Collected sludge was dumped in the open or in solid waste trenching grounds, or nearby nullahs / drains.

- Large sizes of septic tanks.
- Long desludging period of 6-8 years.
- Limited awareness among ULB officials on faecal sludge and septage management.
- Limited awareness among citizens regarding types of containment, periodic desludging, etc.
- Untrained staff on proper desludging operations.
- No system for record-keeping for desludging operations.
- Less technical know-how of the process amongst the ULB staff
- Lack of trained staff on proper desludging operations.
- No charges for government establishments resulting in negligible revenue collections.
- Negligible or no user charges collection

Before the finalization of the FSTP location, it was critical to get the buy-in from the community. A consultative workshop was organized to discuss and address the key issues, some of which included:

- Increased awareness of the community on the need for safe and desirable FSSM practices and its effect on public health and environment.
- Raised awareness on risks involved with untreated faecal sludge, proper construction of on-site sanitation systems (OSS), faecal waste transportation, and its safe disposal/ treatment and reuse.
- Created an understanding of correct design standards for OSS, conversion, and retrofitting of insanitary toilets to sanitary toilets and the importance of regular and periodic desludging.
- To raise demand for desludging of septic tanks/pits in the city and secure the participation of the community as equal stakeholders in the process.

Operations and Technology Used

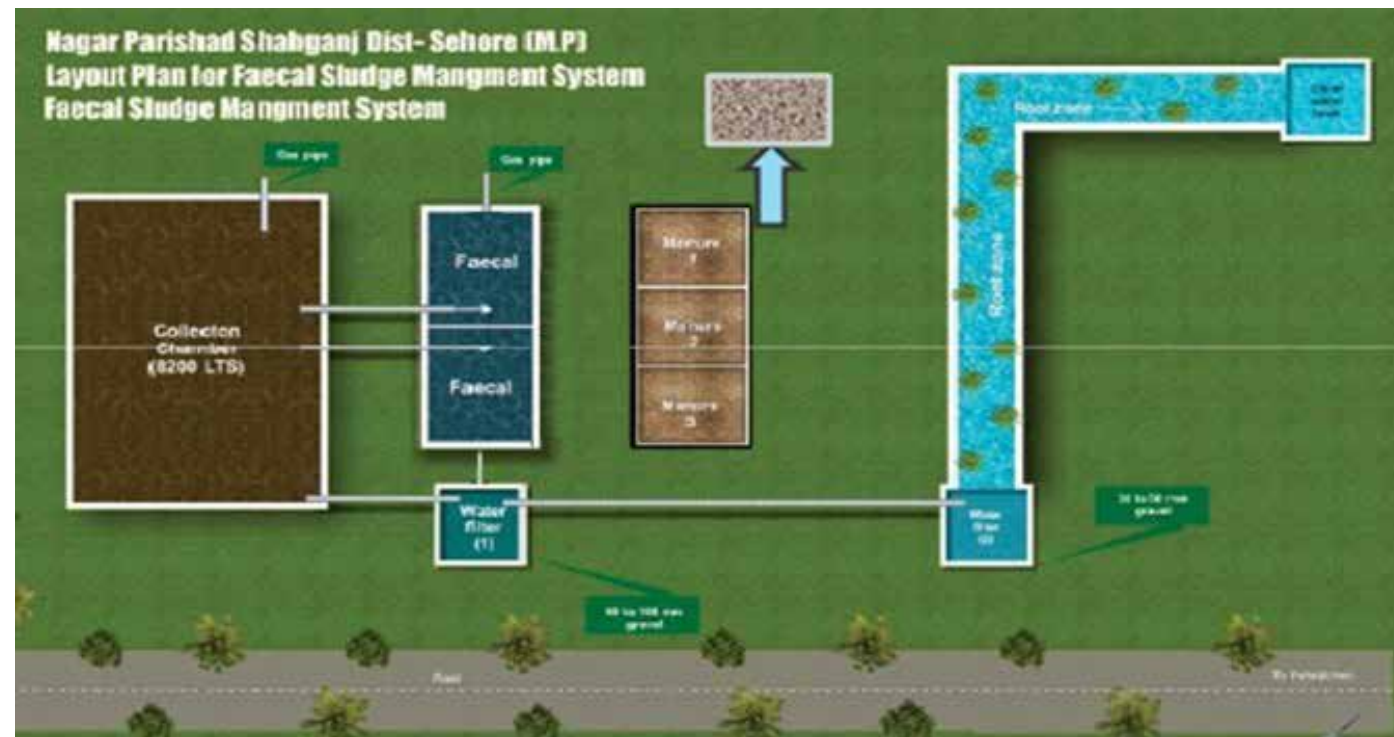
Currently, the desludging service provided for the cleaning of septic tanks by ULBs is on a demand basis. The ULB has a dedicated helpline number to provide all municipal services to the people and a service support desk for taking the application. Residents apply for cleaning services and pay the collection fee at the municipality office. Once the request is received, ULB plans the schedule for cleaning services. A record book is maintained by the service desk, carrying details about requests received, requests already attended to, and those still pending besides the number of trips done on a daily, weekly, and monthly basis, etc.

Currently, the ULB has one vacuum emptier with a capacity of 3000-liter. After collecting the sludge from the household OSS, the vehicle goes to the plant for its disposal. There is a team of two staff members to operate and maintenance activities at the plant.



Shahganj Treatment Plant: Operations and Technology Used

Shahganj ULB has constructed an FSTP of 8.2 KLD capacity, which is more than sufficient for the town's existing population. It is a low-cost plant having a moderate desludging pattern of septic tanks (15-16 trips in a month) in the town.



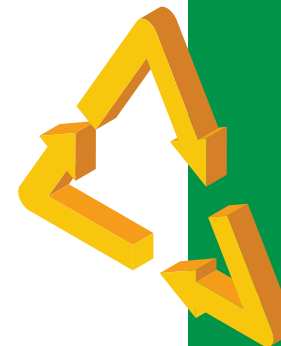
Solid-liquid separation and drying of sludge at sludge drying bed



The plant has two unplanted sludge drying beds (SDB) with a loading capacity of 8000 liters per day and a depth of 300 mm for the solid to be dried over it. Faecal sludge from the cesspool emptier tank (mud pump vehicle) is first transferred to the collection tank, where it is stored for some time and then transferred to SDB for dewatering, where the sludge is retained for a minimum of 15 days. It has layers of filter media up to 600 mm, comprising thick and fine coarse gravel and the sand bed filled at the top. During the disposal process, the solid matter remains at the top of the bed and the liquid percolates to the bottom. Post this process, the dried sludge from the bed is taken and composted with municipal waste, which is further used as soil conditioners in agricultural fields.

Treatment of Wastewater in the Planted Gravel Filter

The effluent collected in the leachate sump now flows into the Planted Gravel Filter (PGF) where it undergoes secondary treatment. It is an aerobic treatment process where the nutrients present in the effluent from leachate sump flows vertically through perforated pipes intermittently. The treatment happens through the root zone of the plants. Oxygen reaches the filter through the natural surface gas exchange and through the roots of the plants such as acalypha and Kena.

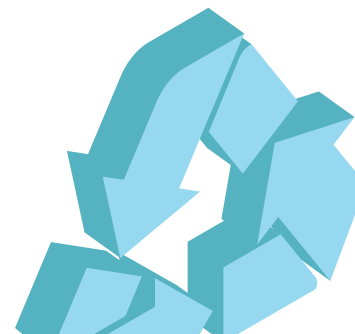


Pathogen removal in polishing pond/ clear water tank

The treated water coming out from the PGF is stored in the clear water tank for removing other biological impurities and bringing down the Biochemical Oxygen Demand (BOD) level. To remove pathogens from this water, chlorine is added in the water before being discharged into the environment. The sample of the treated water is sent to PHE lab every month to ensure that BOD levels meet the norms set by the Ministry of Environment, Forest & Climate Change (MoEF&CC).

Co-Composting of the dried sludge

The dried sludge taken out from SDB is co-composted with organic solid municipal waste in the ratio of 1:3 (1-part dried sludge and 3-part organic solid waste). The compost is sold by the ULB to farmers and nursery operators, at a nominal rate. The feedback received on the quality of the compost has been encouraging.



Financial and Business Model

Since this is a low-cost treatment plant and due to the low capital expenditure involved, the ULB had decided to bear the cost of construction. The O&M cost of the plant is negligible since there are no mechanical and electrical interventions involved. The ULB charges INR 1120 per trip with around 15-16 requests for desludging services received every month, which results in the generation of about INR 2 lakhs of annual income by the ULB. The cesspool emptier has been provided by the State Government. The O&M cost of the cesspool emptier besides the salary of 2 staff members is borne by the ULB. The compost produced in the plant is sold to farmers and nursery operators at a nominal cost.

Successes and Lessons Learnt

At the beginning of 2018, Shahganj took this initiative as a challenge for implementing a low-cost solution for treating the fecal sludge being generated, indiscriminately dumped, and openly discharged into water bodies of the city. The following are the key factors contributing to the successful implementation of this project:

Political will: After visiting Devanhalli, the Chief Municipal Officer decided to implement this project in his city, and it was his determination towards the construction of the treatment plant that gave the project the much-needed initial push. With the help of experts, a Detailed Project

Report was prepared and presented before UADD to get the approval. UADD also took this as a pilot project in the State and supported Shahganj with technical assistance. The use of locally available technology and community support were the key factors in ensuring the political will.

Sustainability: The entire FSSM value chain in the city is efficiently managed by the Municipal Council. It is a low-cost gravity-based treatment plant with minimal O&M cost, which is easy to manage. Revenue generated from the septic tank cleaning services is used in vacuum emptier and plant maintenance.

Scope for scaling up: Based on the performance of this FSTP, UADD made some minor changes in the model to scale this to other ULBs of the State. There are 306 towns (out of 378 towns in the State), with a population of less than 50,000, where the model can be easily replicated. Keeping the Shahganj model as a base, UADD has issued a design for 10, 20, and 30 KLD plants based on the DEWATS technology, which are being implemented by other ULBs.

Proliferation of FSSM in MP through SBM-Urban: Today, FSSM has become an integral component of the SBM-Urban Mission. As per the SBM-U guidelines, a ULB must have an FSTP or co-treatment mechanism to get the ODF++ certification. Madhya Pradesh has leaped in Swachh Survekshan 2020 by scaling up this low-cost model to achieve more numbers of ODF++ certified towns. In Swachh Survekshan 2019, only 14 cities achieved ODF++ status, however, in 2020, 108 cities have achieved this status, being an almost 771% jump from the previous year. This result has given a renewed thrust to the State when it comes to adopting a non-networked solution for the treatment of black water.

Challenges and Possible Resolutions

Retrofitting of septic tanks: Although nearly 80% of households in the ULB have septic tanks they are poorly designed which might pollute the groundwater. The ULB needs to undertake awareness activities for people to make them aware of the adverse effects of poorly designed OSS and incentivize them on retrofitting of their septic tanks.

Demand creation: Currently, OSS cleaning services are provided on-demand basis. The ULB needs to encourage people to get their septic tanks emptied at an interval of 2-3 years through rigorous IEC activities.

Accessibility issue of cesspool vehicle: Accessing all areas through a 3000-liter capacity vehicle often becomes challenging and the need for the hour is to therefore procure smaller vehicle(s) of lesser capacity or vacutugs to resolve the accessibility issue.

Skill up-gradation for the sustainability of FSSM: Technical capacity building of engineers at the ULB and State level needs to continue on a regular and sustained basis with exposure visits to learn from and replicate best practices from other leaders in the FSSM ecosystem.

