TN TAMIL NADU | US URBAN SANITATION | SP SUPPORT PROGRAMME

REPORT

SANITATION SITUATION ASSESSMENT OF TIRUCHIRAPPALLI CITY

December 2018

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TN US SP
TAMIL NADU URBAN SANITATION SUPPORT PROGRAMME

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Gramalaya

Sanitation Situation Assessment of Tiruchirappalli City

December 2018

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Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
AP	Anaerobic Pond
BCC	Behaviour Change and Communication
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CSP	City Sanitation Plan
CT	Community Toilet
FOL	Flush Out Latrine
FP	Facultative Pond
FS	Fecal Sludge
GoTN	Government of Tamil Nadu
HSC	House Service Connection
IHHL	Individual Household Latrine
lpcd	Litres Per Capita Per Day
MLD	Million Litres Per Day
MoHUA	Ministry of Housing and Urban Affairs
MP	Maturation Pond
NGO	Non-governmental Organization
O&M	Operation and Maintenance
OD	Open Defecation
ODF	Open Defecation Free
OSS	On-site Sanitation Systems
PPE	Personal Protective Equipment
PT	Public Toilet
PWD	Public Works Department
Rs.	Rupees
SBM	Swachh Bharat Mission
SHG	Self-Help Group
STP	Sewage Treatment Plant
SWD	Stormwater Drain
TCC	Tiruchirappalli City Municipal Corporation
TNUSSP	Tamil Nadu Urban Sanitation Support Programme
TSS	Total Suspended Solids
UGD	Under Ground Drainage
UGSS	Under Ground Sewerage Scheme
ULB	Urban Local Body
WSP	Waste Stabilisation Pond

Executive Summary

Executive Summary

This report is an attempt to assess Tiruchirappalli ‘s (Trichy) sanitation situation by providing an understanding of existing sanitation arrangements, gaps, an action plan and the investment required to address deficiencies. Water supply as well as household sanitation and wastewater arrangements were examined to carry out the situation assessment at the city level.

E1.1 Water Supply

While Census 2011 revealed 83 per cent of households in the city receive piped supply of municipal water derived from a treated source, the actual number of household service connections is 1,08,316 (TCC CSP for AMRUT, 2018) which is nearly 50 per cent of total households in the city. This indicates that a significant share of households either rely on groundwater and public water posts/taps, or access piped water supply through unauthorised connections. In wards 61-65 of the city, water supply is about 60-70 litres per capita per day (lpcd), with a project planned to increase the supply to 135 lpcd, which is the Service Level Benchmark for water supply set by the Ministry of Housing and Urban Affairs (MoHUA). The Trichy City Corporation(TCC) lags behind the benchmarks, particularly with respect to the extent of metering connections and continuity of water supply hours.

E1.2 Household Sanitation Arrangement

As per Census 2011 data, 81 per cent of total households in the city had access to individual toilets, 14 per cent of households use a community toilet (CT) or public toilet (PT), and about 5 per cent of households practice open defecation (OD). 3,483 Individual Household Latrines (IHHLs) and 13 CT/PTs were constructed under Swachh Bharat Mission (SBM) – Urban mission between 2015 and 2018. This led to Trichy being re-certified” Open Defecation Free (ODF)” in August 2018.

For households relying on public sanitary conveniences, there are 321 CT/PTs, 18 pay-and-use toilets, and 85 integrated sanitary complexes (toilets with washing/bathing facilities). In addition to these, there are ‘Namma Toilets’, disabled friendly toilets and exclusive urinals in the city. These public conveniences have been constructed under different national and state programmes and schemes over the years, with the ownership residing with TCC. TNUSSP conducted a rapid assessment of the CT/PT infrastructure in the city during 2017-18, which revealed a high dependence on borewells for water supply and improper solid waste including menstrual waste. Improvements are needed in containment structure design and emptying model currently employed. A long running community-led management model has also been facing issues with respect to financial viability in managing toilets, where the average number of users is below 250.

E1.3 Wastewater Management

Sewerage System

Approximately 30% of the city is covered by underground drainage (UGD) network. The implementation was carried out under two schemes, the first in 1987-1992, and the second, the Trichy-Srirangam scheme between 2000 and 2008. The UGD network covers the core area of the city - 25 wards that are fully covered, 25 wards with partial coverage and 15 wards that are not covered. It was observed that even in the wards fully covered by the UGD network, not all households were connected to the network. A common issue spotted across several sewage pumping stations was the non-functioning of the screen and grit removal systems including disposal.

TCC has received funding for UGD network expansion in a four phased approach with immediate focus on the network-omitted areas in the city's core, and reducing sewage mixing load into the Cauvery, the Koraiyar river and Uyyakondan canal.

E1.4 Septic Tanks

The city had approximately 70,000 to 1,08,000 household septic tanks, as reported in the Census 2011 and city records, with a high prevalence in outer wards of the city with no UGD network. Results from the TNUSSP Baseline Study in 2016 conducted across 740 households dependent on on-site sanitation systems (OSSs) showed differences between reported types of OSS and the actual system on the ground, and only a small number of the OSSs had wastewater draining into soak-pits or cess pits.

Households, commercial establishments and institutions rely on private cesspool operators for emptying their OSS on-demand. In Trichy, there are about 25-30 active private operators providing services for the emptying and conveyance of septage and Fecal Sludge (FS) through vacuum trucks of varying capacities. Previously, the Sewage Treatment Plant(STP) located at Panjappur was the only designated disposal location for a cesspool operator. Currently, decanting arrangements exist at four sewage pumping stations – Anna Stadium serving the south and south-western parts, Pookollai catering to Tanjore Road, Vayaloor Road serving the western parts of the city, and Vasudevan Street catering to the needs of operators in the Srirangam zone. Therefore, TCC has been able to tackle challenges associated with disposal of septage and FS to certain extent. However, operators during interactions admitted that they do continue the practice of disposing into the city's canals and major drains, especially when there is more than one load to be emptied from a large-size OSS.

An assessment of the decanting facilities across the city by TNUSSP highlighted the absence of standard platform at three of the receiving facilities to ensure smooth movement of trucks as well as disposal of septage and FS. This results in in spillage at the facilities that is seldom cleaned up. These are compounded with previously mentioned issues with sewage pumping stations. Improvements in record-keeping are needed, along with introducing a screening protocol for septage/FS to ensure that there is no disposal of industrial waste at the facility.

TCC has two vacuum trucks that provide emptying services to serve the 45% of CTs/PTs dependent on septic tanks. The TCC trucks follow a schedule for emptying CT/PT OSS in each administrative zone, and each CT/PT is serviced once every 10 to 15 days until the next cycle. Challenges were reported by TCC staff in accessing CT/PTs on narrow lanes or roads which are not properly paved.'

Both private cesspool as well as TCC workers do not actively use any safety gears while carrying out their operations. They were aware of the risks in dealing with wastewater, undertake some precautions when dealing with septic tanks that haven't been opened in a long time and are prone to cuts and bruises when opening OSS lid or covers.

E1.5 Toilets Discharging into Open Drains

Trichy has approximately70% storm water drain coverage in the city, with most of the stormwater drains (SWDs) in the southern parts of the city taking advantage of the natural gradient towards the Cauvery River. By design, SWDs are intended to only carry runoff, but it has been observed that SWDs end up carrying grey water, effluent from septic tanks, and in some cases, even black water in parts of the city. Under SBM-U, the city has been engaged in the task of converting 7050 identified insanitary toilets that discharge waste directly into open drains, and are not connected to any safe containment or conveyance systems into sanitary toilets.

The problem of SWD pollution is particularly visible along the Uyyakondan canal, an irrigation canal that passes through the heart of Trichy city and has become a pain point for the TCC. A Public Works Department (PWD) report on pollution in the Uyyakondan canal indicated a combination of issues such as households discharging grey water into drains, non-existent UGD connections as well as by-pass arrangements in existing sewer network and pumping stations releasing wastewater into the canal.

E1.6 Treatment of Wastewater and Fecal Sludge

Wastewater Treatment at Sewage Treatment Plant

Sewage and FS decanted at pumping stations is conveyed to the STP at Panjappur. The site has two plants with a combined capacity of 88 MLD. The plant with 58 MLD capacity is functioning, while the one with 30 MLD capacity is non-operational. Both plants are based on Waste Stabilisation Pond (WSP) treatment technology.

A detailed evaluation of the STP was conducted under TNUSSP to determine the major causes of poor performance as well as identify opportunities for improvement. The Central Pollution Control Board (CPCB) 2013 report on Trichy WSP showed 74 per cent removal for both Biochemical Oxygen Demand(BOD) and Chemical Oxygen Demand(COD), as against 59 per cent removal of BOD and 57 per cent removal of COD when sampling was conducted in March 2017. This means that the performance of the WSP plant is not sufficient to meet effluent discharge standards. Some of the reasons that can be attributed to this include lack of maintenance of mechanical equipment at head

works, excessive sludge accumulation in all pond cells and short circuiting affecting the performance of the ponds. In addition, the lack of monitoring of key parameters including influent and effluent parameters, as well as sludge depth in all pond cells means that there is no operational data available for action.

Decentralised Treatment of Wastewater

There are examples of small-to-medium-sized decentralised treatment systems for wastewater in the city. These treatment systems include a bio-methanation plant at an urban slum at Viragupettai EB Road that fuels a community kitchen and Amma canteen, a natural biological and physical treatment system called Decentralised Wastewater Treatment Systems (DEWATS) that treats effluent from a CT at East Devadhanam, and an advanced oxidation based treatment plant at Yatri Nivas, a pilgrim residential complex at Srirangam.

The preceding sections provide a sanitation situation assessment across the city. In addition, there was limited information available on sanitation and wastewater arrangements for households residing in the city's 154 notified and 108 unapproved slums within municipal limits apart from bulk generators of wastewater such as institutions and commercial buildings like hotels and marriage halls.

E1.7 Action and Investment Plan

The penultimate section of the report describes the action plan and options to address the deficiencies across the sanitation chain - containment, conveyance, treatment and disposal. Action plan comprises of a mix of assessments and studies, actions to be undertaken by TCC, as well as communication and training needs to ensure and improve the uptake of the proposed solutions.

Action plan for improvements in containment

- Monitoring and sustaining ODF status of the city
- Analysing situation and enforce conversion of insanitary to sanitary toilets
- Improving household wastewater disposal arrangements by increasing the number of UGD household connections, training of masons, and conducting Behavioural Change and Communication (BCC) campaigns on importance of proper septic tank construction
- Ensuring adequacy of toilets for floating population as well as improvements in operation and maintenance of CT/PTs
- Understanding sanitation arrangements in institutions and commercial buildings to go along with orientation of builders/institutions to promote in-situ/on-premises wastewater treatment.

Action plan for improvements in conveyance

- Assessing actual water consumption and wastewater generation in the city
- Developing options to manage OSS effluent
- Establishing a pilot FSM Service Centre for managing requests for septic tank desludging
- Enforcing usage of safety procedures and gears by cess pool operators.

Action plan for improvements in conveyance include steps to improve performance of the STP and infrastructure at decanting stations, market assessment and a pilot for re-use of treated water and sludge.

The final section of the report presents an estimate of a phased investment plan (over a five-year period) required to operationalise the action plan.

Introduction

1. Introduction

Tiruchirappalli, also called Tiruchi or Trichy, is a city in the Indian state of Tamil Nadu and the administrative headquarters of Tiruchirappalli District. It is the fourth-largest municipal corporation, the fourth-largest urban agglomeration, and a major engineering equipment manufacturing hub in Tamil Nadu. The factories of Ordinance Factories Board, Bharat Heavy Electricals Limited (BHEL) and Golden Rock Railway Workshop are located in Tiruchirappalli. Other important industries in Tiruchirappalli include the Tiruchi Distilleries and Chemicals Limited (TDCL) and the Tiruchi Steel Rolling Mills. Tiruchirappalli is also often referred to as an educational hub and is home to nationally recognised institutions such as the Indian Institute of Management (IIM), Indian Institute of Information Technology (IIIT) and National Institute of Technology (NIT).

Tiruchirappalli Municipality was constituted on 8 July, 1866. The municipality was upgraded to a City Municipal Corporation with effect from 1 June, 1994 by adding the adjacent municipalities, town panchayats and village panchayats. The current Tiruchirappalli City Municipal Corporation (TCC) consists of erstwhile Trichy, Srirangam and Golden Rock municipalities, five town panchayats and six village panchayats. The administration of the City Municipal Corporation is carried out according to the Tiruchirappalli City Municipal Corporation Act, 1994. The TCC Council is constituted with a Mayor and 65 ward councillors representing each ward.

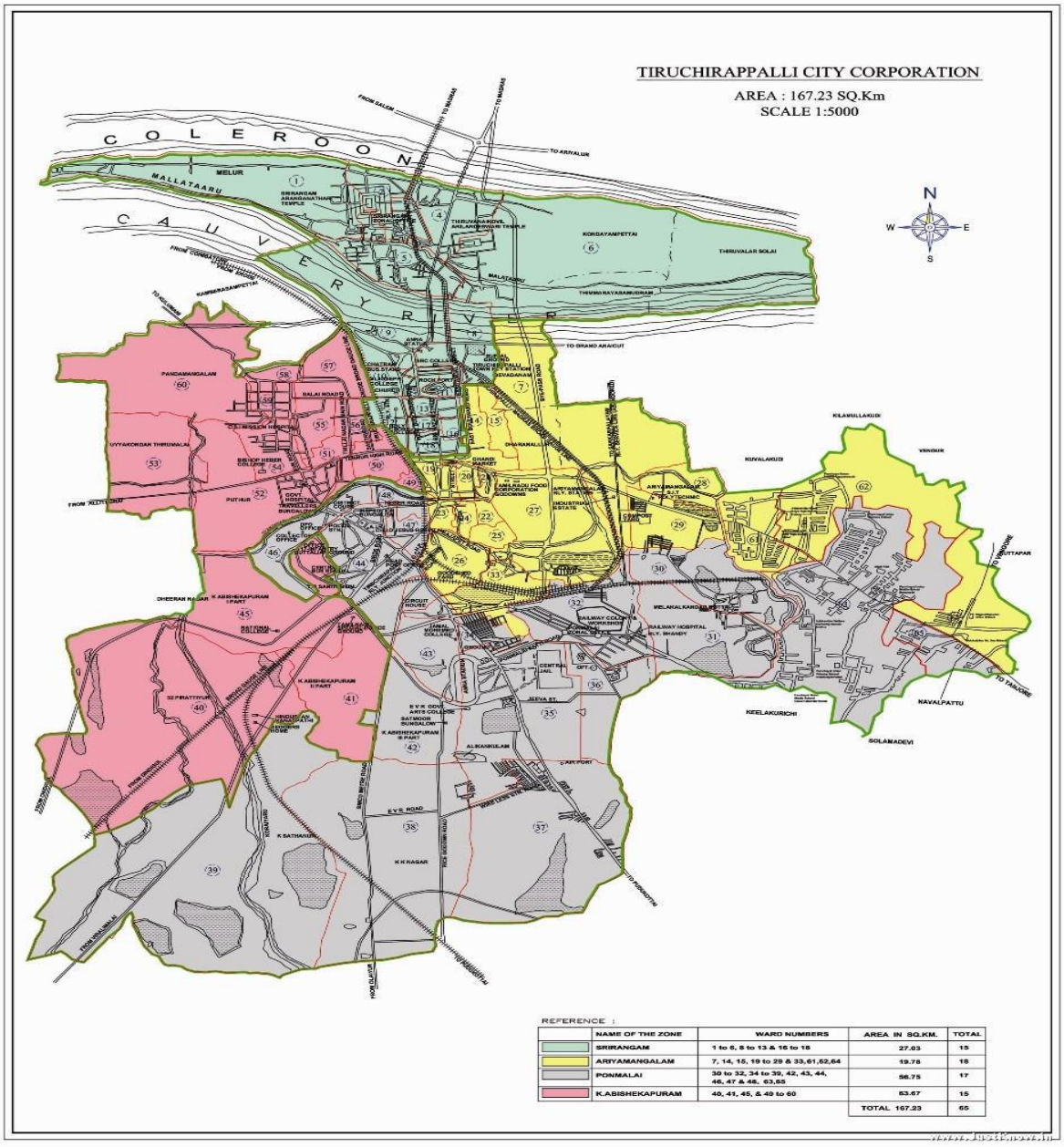
The city is subdivided into four administrative zones and 65 wards for effective administration, as summarised in Table 1.1 below. Figure 1.1 depicts the municipal boundary and wards under the TCC.

Table 1.1: **Administrative Zones and Respective Municipal Wards**

Name of the zone	**Wards in that zone**	**No. of wards**
Abhishekapuram	40, 41 & 45 to 60	15
Ariyamangalam	7, 14, 15, 19-29, 33, 61, 62 &64	18
Golden Rock	30-32, 34-39, 42, 43, 44, 46, 48, 63 & 65	17
Srirangam	1-6, 8-13, 16, 17 &18	15
Source: TCC Administrative Report, 2014 – 2015		

This City Sanitation Situation Assessment (SSA) presents an overview of the prevailing sanitation arrangements in Trichy, summarises the key gaps and presents the way forward along with a detailed investment plan and infrastructure requirements.

Figure 1.1: **Zone Boundary Map of TCC**



Source: TCC

2

Population and Households

2. Population and Households

As per Census 2011, Trichy had a population of 8,47,387 living in 2,14,529 households across 60 wards within municipal corporation limits. With the addition of five wards to TCC that year, the total population in 2011 across 65 wards amounted to 9,15,569. TCC has identified 154 notified slum areas and 108 unapproved slum areas within municipal limits. The city experiences a significant influx of floating population owing to various religious and cultural attractions and festivals. This population can exceed over 10 per cent of the total population of the city in several months, and the city sees an influx of an additional ~65 per cent population during the month of December on account of Vaikunda Egadasi – Sorkavasal, Ra Pathu and Pagal Pathu.

The population for the city is expected to be about 13,32,000 by 2030 and almost 18,00,000 by 2045. Table 2.1 presents the population projection for the city.

Table 2.1: **Zone-Wise Population Forecast for TCC**

Zone	**Population projection (2015)**	**Population projection (2030)**	**Population projection (2045)**
Abhishekapuram	2,61,304	3,34,971	4,33,763
Ariyamangalam	2,29,773	3,04,061	4,03,687
Ponmalai	2,81,425	4,19,563	6,04,827
Srirangam	2,19,497	2,73,412	3,45,718
Total	9,91,999	13,32,007	17,87,995

Source: TCC CSP for AMRUT, 2018

3 Water Supply Arrangements in TCC

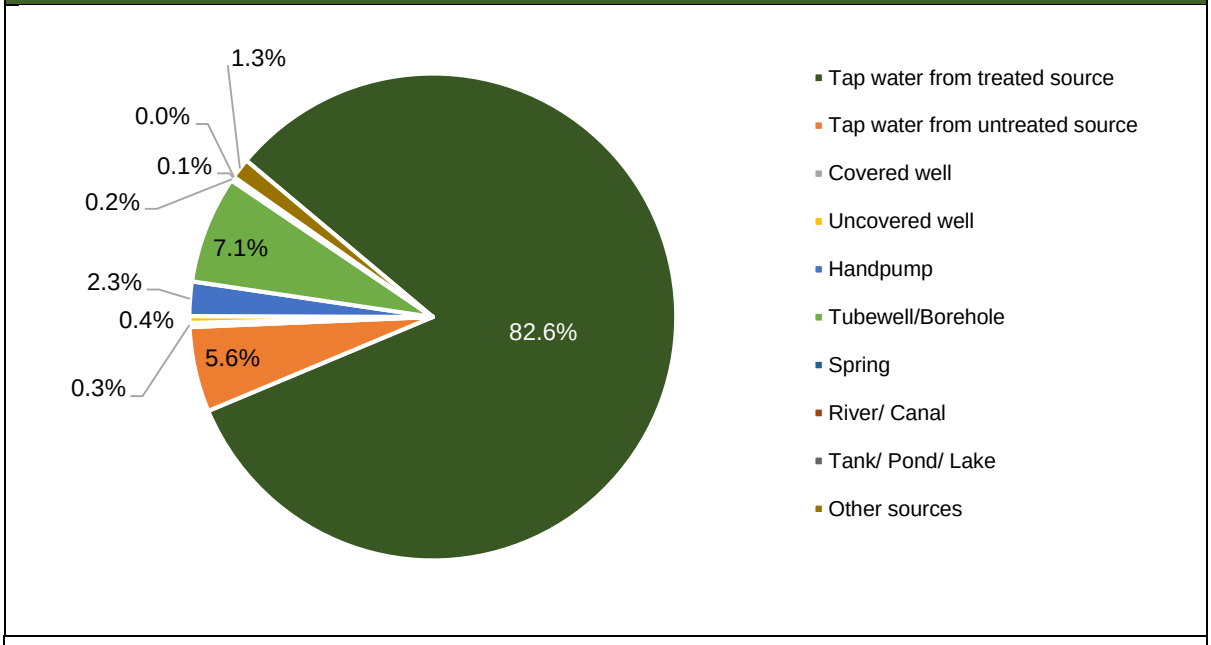
3. Water Supply Arrangements in TCC

Provision of water is the responsibility of TCC. Water supply in the city is provided using water drawn from the Cauvery and Coleroon rivers. The engineering department is responsible for pumping, treatment, city-wide water distribution, metering and billing for individual domestic, commercial and industrial connections.

3.1. Household Access to Water Supply

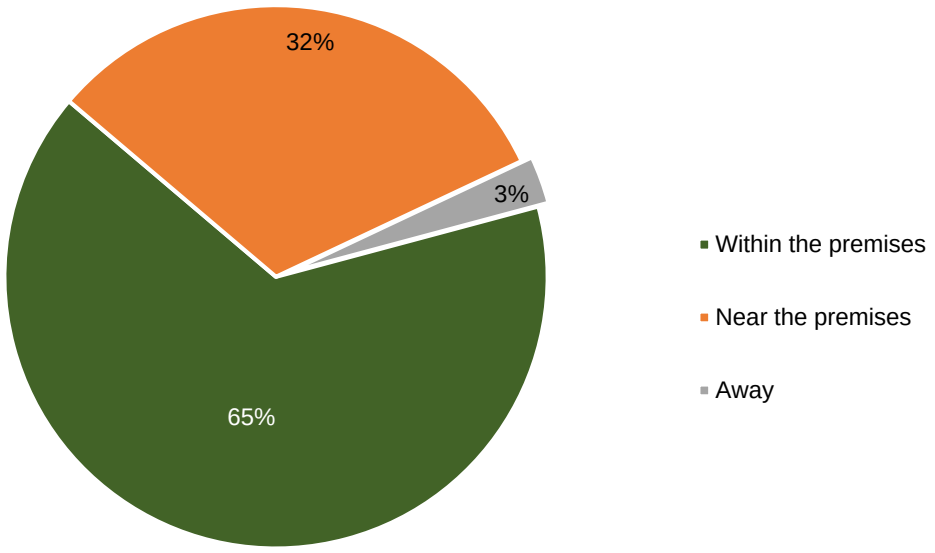
Eighty-three per cent of households in the city receive a piped supply of municipal water derived from a treated source, 7 per cent of households depend on tubewells, 5.6 per cent of households use piped water from an untreated source and the remaining (~5 per cent) depend on various other sources, as shown in Figure 3.1.

Figure 3.1: **Primary Sources of Drinking Water in TCC**



Source: Census 2011

Figure 3.2: **Location of Source of Drinking Water**



Source: Census 2011

In terms of access to drinking water, since the majority of it is through a piped supply system, 65 per cent of the households access them within their house premises, 32 per cent have the source close to their houses, and only 3 per cent of households have an access point far away.

3.2. Sources of Water Supply

3.2.1. Municipal Water Supply

TCC draws water from the Cauvery and Coleroon rivers. There are a total of 11 head works along the rivers for withdrawing water. The water extracted from the infiltration well is chlorinated prior to distribution. The treated water is pumped into 137 storage reservoirs located across the city. The storage reservoirs have a total installed storage capacity of 665.8 lakh litres (l). The city has an extensive water supply distribution network, including a pumping main spanning a length of 263.81 kilometres (km) and the distribution mains extending over 1,069.44 km. TCC supplies 128 million litres per day (MLD) of water drawn from the rivers, aimed at providing an average water supply of about 135 litres per capita per day (lpcd). City estimates place the non-revenue water at 14 per cent.[1]

Municipal piped water is supplied for 2 hours every day across most wards and in some wards the frequency of supply may reduce to 2 hours on alternate days.

Table 3.1 summarises the number of water service connections provided and the deposit and monthly tariff levied by TCC.

[1] TCC CSP for AMRUT, 2018

Table 3.1: **Water Service Connections in TCC**			
	Individual households	**Commercial establishments**	**Industrial customers**
Individual connections	108,316	1,732	55
Type of connection	Unmetered	Metered	Metered
Public taps providing municipal water supply	2615 (Provided in low-income areas/slums)		
Public fountains connected to bore wells and other sources	197		
Connection deposit (Rs.)	6,000	10,000	10,000
Monthly tariff (Rs.)	160	600	850
Source: TCC CSP for AMRUT, 2018			

3.2.2. Tanker Based Water Supply and Ground Water

In tail-end areas of the municipal corporation where the overhead tank and piped water is insufficient, as well as areas not covered through the distribution network, provisioning is made through 11 water tanker vehicles (seven with large capacity and four mini tankers).

The city corporation also ensures provisioning of water supply to the urban poor residing in both authorised and unauthorised slums, through a mix of piped water and tanker vehicle supplemented by groundwater that is non-potable. The non-potable water is provided particularly in peripheral areas and slum areas of the city through a mix of 185 borewells, 23 open wells and 1,764 hand pumps with water being used for bathing, washing, and other purposes.[2]

Private water tankers are the other major source of potable and non-potable water in the city. Some of the commercial and institutional establishments also receive water through private tanker vehicles (which is sourced from the Cauvery).

Private tankers supply water on a demand basis to households and establishments. The Cauvery River basin is the major source of water for these private operators in the city. They extract water along the Chennai By-pass Road (NH-45 – Kondayampettai, Srirangam Zone) and distribute water in the core and peripheral areas of the city. There are nine private borewell operators located on the north bank of the Cauvery. Each of them has 4-5 borewells for supplying water to the customers/ vehicles. About 40 borewells pump fresh water for supply throughout the city and nearby areas.

The capacity of the tanker varies from 8,000 to 20,000 l; the most common capacity of the tankers is 12,000 l. The maximum amount of water is distributed to the city in summer. Each vehicle delivers 4-5

[2] TCC CSP for AMRUT, 2018

loads per day in summer (March-June), but gradually decreases in the rainy and winter seasons (October-February) and some of the borewells are also closed due to the lower number of orders.

3.3. Service Level Augmentation Plans

Water supply during 2006-2011 amounted to about 101 MLD providing a water supply of about 110 lpcd. The water supply scheme was improved through assistance from a Japanese fund (JICA fund) of Rs. 221.42 crore, which resulted in an increase in the per capita availability of municipal water to 135 lpcd, through a total supply of 128 MLD across wards 1-60.

Water supply in the recently incorporated wards, 61-65, is provided by the Tamil Nadu Water Supply and Drainage (TWAD) Board with an average water supply of about 60-70 lpcd. A water supply improvement scheme is currently in progress with support of a German fund worth Rs. 63.7 crore towards augmenting supply for the five wards to 135 lpcd.[3]

3.4. Deficiency Analysis

Water supply schemes for the city need to identify and plan for the following variabilities and scenarios:

- Household service connections (in terms of number of assessments with the city) are about half the total number of households in the city. This could indicate that a substantial share of households either rely on groundwater and public water posts/taps or accessed piped water supply through unauthorised connections.

- The city plan for water supply augmentation to service the increase in population, identifying additional sources, competing users such as industrial customers and other ULBs (Urban Local Body) as well as including measures such as water conservation and recycling within TCC. This water supply augmentation plan should also factor in the water requirements of institutional/commercial establishments such as hotels, educational institutions, hospitals and floating population.

- Extent of non-revenue water and leakages in the distribution system. The city currently supplies about 128 MLD of water sourced from the river, however the actual household-level water supply received in different parts of the city is not available.

- Existing service levels against all water supply benchmarks set by Ministry of Housing and Urban Affairs (MoHUA) and deficiencies around each benchmark.

[3] G.O.Ms.No.125, Dated 12th August 2015

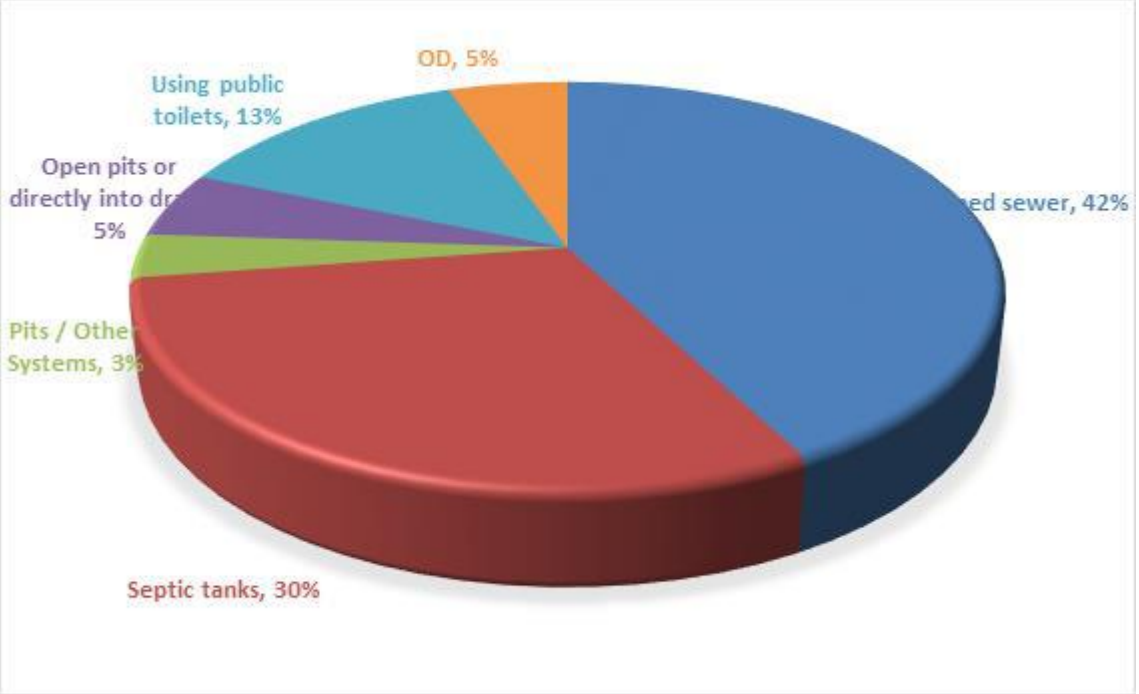
4 Household Sanitation and Wastewater Arrangement

4. Household Sanitation and Wastewater Arrangement

4.1. Household Access to Toilets

As per Census 2011 data, 81 per cent of total households in the city have access to individual toilets. 45 per cent of households are connected to a piped sewer system, and about 31 per cent of households rely on on-site sanitation systems (OSSs – with 28 per cent connected to septic tanks and 3 per cent connected to a pit with slab). The remaining 5 per cent of households connected to toilets are either insanitary or dispose fecal matter into the open. Nineteen per cent of households in the city lack access to a household toilet. Fourteen per cent of households use a community toilet (CT) or public toilet (PT) and about 5 per cent of households practice open defecation (OD).

Figure 4.1: **Household Sanitation Arrangements**



Source: Census 2011

The existing household toilet arrangements have evolved since the Census 2011 survey to partly address some of the deficiencies that existed, such as the prevalence of OD and insanitary toilets (TCC has implemented various measure to tackle these issues). Practices and deficiencies that continue to exist in the sanitation system are described in the following sections.

Progress under Swachh Bharat Mission (SBM) – Urban

The Census identified about 5 per cent of all households in TCC – about 12,330 households – that resorted to OD across the 65 wards in the city. Under SBM - Urban, TCC had initially identified 1,900 households with space available to construct Individual Household Latrine (IHHL). These targets were later revised to further promote IHHLs. Since the city already had a large number of CTs and PTs, TCC undertook the construction of 11 CTs across 10 wards, three of which were high OD wards, with the aim of providing toilet access to unserved households.

Infrastructure creation is also being supplemented with communication and awareness campaigns to promote the use of toilets and end OD. In December 2016, the MoHUA declared Trichy "Open Defecation Free (ODF)"; this status was recently re-certified in August 2018. Table 4.1 summarises the progress made by the city under SBM.

Table 4.1: **SBM Progress in TCC**

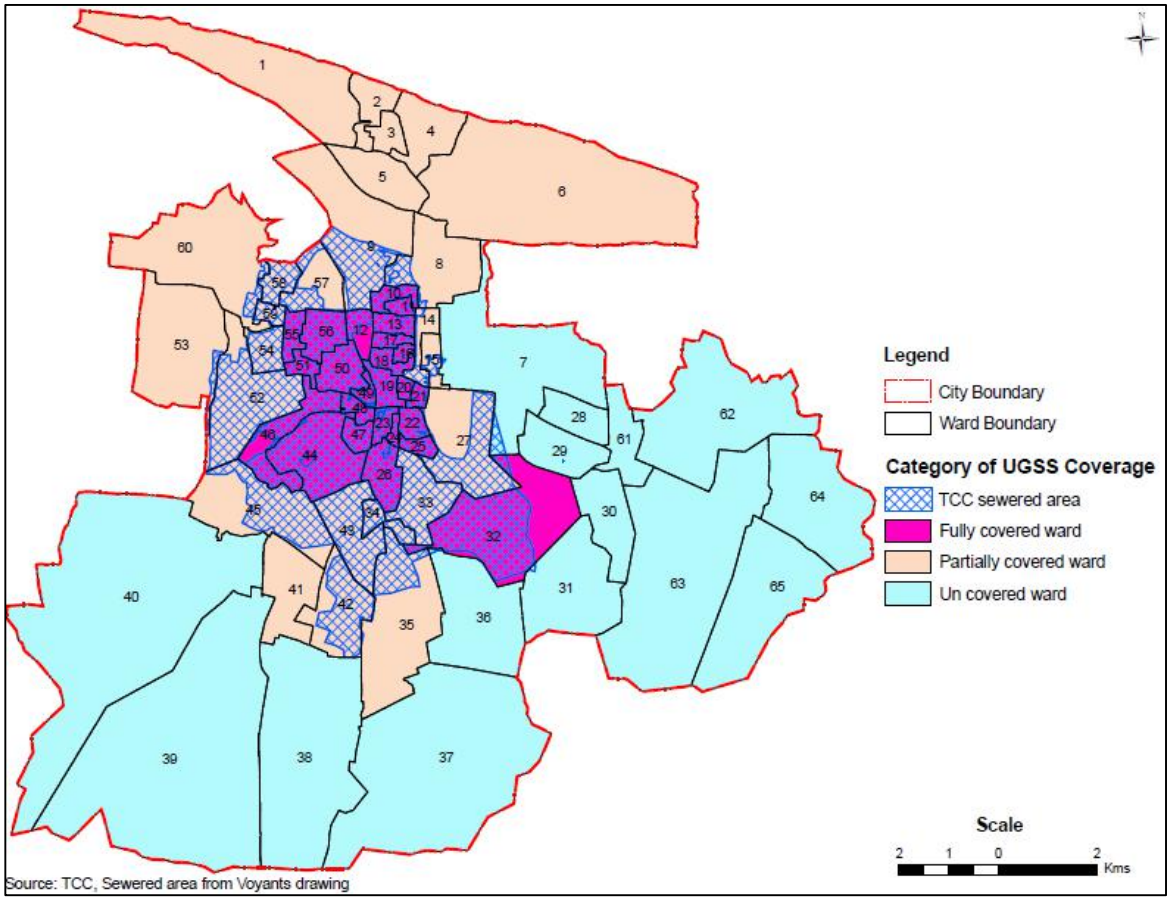
		IHHL		**CT / PT constructed**
Financial year	**Target**	**Completed**	**Pending**	
2015-16	760	760		11
2016-17	1,140	1,140		2
2017-18	2,148	1,583	565	
2018-19	4,014 (Order issued in June 2018)			

Source: TCC Budget 2017-18, 2018-19, G.O. issued

4.1.1. Households Connected to Piped Sewers

According to Census 2011, about 42 per cent of total households (~98,000 households, which is also about 52 per cent of all household with toilets) in the city are connected to a piped sewer system. The extent of underground drainage (UGD) coverage provided in each ward – whether a ward is fully covered (FC), partially covered (PC) or uncovered (UC) reveals that the city has 25 wards that are fully covered, 25 wards with partial UGD coverage and 15 wards that are not covered, as shown in Figure 4.2.

Figure 4.2: **UGD Coverage and Sewered Areas in TCC**



Source: TCC, Sewered area from Voyants drawing

Table 4.2 summarises the House Service Connection (HSC) for UGD and household septic tanks for the different UGD coverage categories. As per data obtained from TCC in late 2016, only about 16,500 households in these wards are connected to the network, even though the ward is fully covered by the UGD network, and there are about 29,700 household septic tanks in these wards – a number that significantly exceeds the report on household septic tanks in these wards under the census (~6,500).

Table 4.2: **Household Connection to UGD in Different Coverage Areas**

UGD coverage	Number of wards	Households connected to sewer		Actual connection efficiency[4]	Variance between Census and actual UGD connections	Household septic tanks	
		(Census 2011)	HSC (TCC records)			(Census 2011)	HSC (TCC records)
FC	25	43,702	16,591	36 per cent	27,111	6,506	29,731
PC	25	49,378	27,700	41 per cent	21,678	26,670	39,958

[4] Calculated based on the number of domestic connections reported by TCC and the total number of sanitary toilets (connected either to UGD or a septic tank) in TCC records for each ward.

Table 4.2: **Household Connection to UGD in Different Coverage Areas**							
UGD coverage	**Number of wards**	**Households connected to sewer**		**Actual connection efficiency[4]**	**Variance between Census and actual UGD connections**	**Household septic tanks**	
		(Census 2011)	**HSC (TCC records)**			**(Census 2011)**	**HSC (TCC records)**
UC	15	4,976	-	-	4,976	36,948	38,564
Grand Total	**65**	**98,057**	**44,291**	**29 per cent**	**53,766**	**70,124**	**108,253**
Source: TCC 2016							

The share of households connected to the network is about 29 per cent across all wards, and is relatively low even in the wards identified as fully covered by the UGD network. Septic tanks continue to be prevalent in all areas. TCC will need to understand the reason for low HSC in areas that have been provided with sewers, and develop a detailed action plan to ensure that all households in the vicinity of the network, whether they have household septic tanks or not, connect to the network.

4.1.2. Toilets Connected to Septic Tanks

The city has between 70,000 to ~108,000 household septic tanks, as reported in the Census 2011 and City records, respectively (presented in Table 4.2 in the preceding section). Figure 4.3 shows the prevalence of household septic tanks in different wards across the city. Septic tank prevalence is predictably higher in the outer wards of the city, where there is little to nil penetration of the sewerage system.

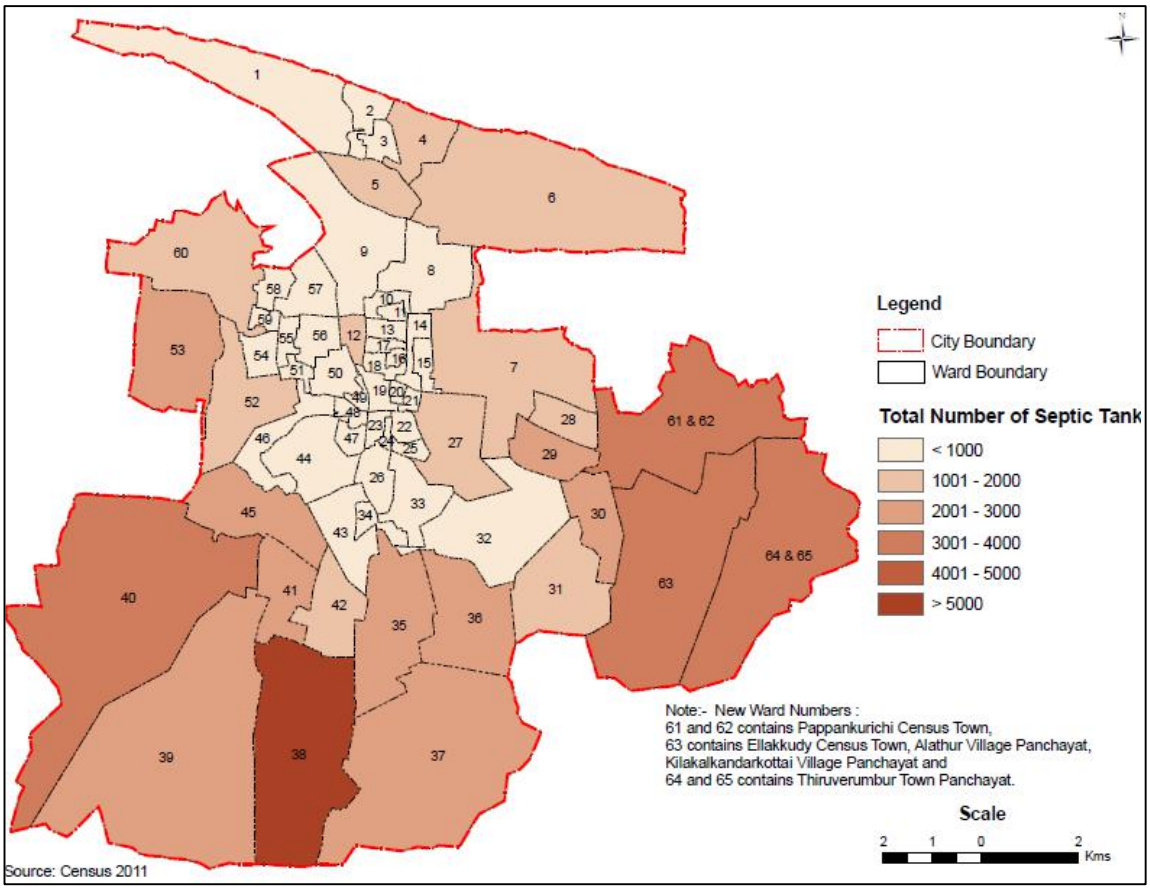
Effluent Disposal from Septic Tanks

While the state has detailed guidance on the design of septic tanks, the existing tanks do not always follow the prescribed guidelines and the current structures include a mix of configurations, including discharge into open drains or low lying areas. Disposal of wastewater from OSSs also forms an integral component of safe disposal of fecal sludge (FS), since the liquid effluent also contains harmful bacteria. Usually wastewater is transferred to a soak/cess pit, underground network or allowed to infiltrate into the ground if the soil is not very permeable. There are negligible instances where treatment is provided to the overflow from the septic tank.

Results from the TNUSSP Baseline Study, 2016 conducted across 740 households dependent on OSSs in Trichy showed that there exist differences between reported types of OSS and the actual system. This is explained by the fact that a large section of the households assume that OSSs are septic tanks, when they are actually pits. Further, households with OSSs that are not twin pits were asked where the wastewater from their systems goes to. A majority – 55 per cent to 60 per cent of the OSSs across settlements do not have any water outlets while 13-17 per cent of households' wastewater

drains out into open/surface drains and open areas and 6-8 per cent of households had wastewater draining into soak-pits or cess pits.

Figure 4.3: **Septic Tank Prevalence in TCC**



Source: Census 2011

Emptying and Cleaning of Septic Tanks

Septic tanks are emptied and cleaned as needed by households, through tank emptying services provided by numerous private operators in the city. Tank cleaning and desludging of septic tanks is not a regular scheduled activity in the city; this happens on an as-needed basis by the households. Desludging and conveyance of FS are discussed in a subsequent section on wastewater management.

4.1.3. Household Use of Public Sanitary Conveniences

According to Census 2011, 14 per cent of all households in the city (or about 31,000 households) rely on public sanitary conveniences. There are 321 CTs/PTs, 18 pay-and-use toilets, and 85 integrated sanitary complexes. In addition to these, there are Namma toilets, toilets for people with disabilities and exclusive urinals in the city. Table 4.3 presents a summary of the total number of different types of CTs and PTs available in the city.

Table 4.3: **Details of Community and Public Toilets in Trichy**					
Public toilets					
Details	**No. of units**		**No. of seats**		
		Male	**Female**	**Total**	
Public Flush Out Latrine (FOL)	303	1,382	1,645	3,027	
Pay & use FOL	18	130	92	222	
Total	321	1,512	1,737	3,249	
Integrated sanitary complex					
Details		**Male**	**Female**	**Children**	**Total**
No. of (toilet) seats	85	496	540	350	1,386
No. of bathrooms		232	232		464
Other public toilet infrastructure					
Details	**No. of units**		**No. of seats**		
		Male	**Female**	**Disabled toilet**	
Disabled toilet	19	19	19	0	
Namma toilet	17	19	36	14	
Urinals	5	52			
Source: TCC CSP for AMRUT, 2018					

A rapid survey was conducted to assess the current status of CT/PT infrastructure in the city, and interviews were done with select stakeholders to understand the existing models used to operate and maintain these toilets, including revenue generation.

In Trichy, CTs and PTs have been constructed under different national/state programmes/schemes over the years. However, ownership lies with TCC and any major structural repairs, renovation and refurbishments to the CTs and PTs are carried out by TCC. Water (mostly borewell) and electricity connections are also provisioned by the ULB.

The rapid survey revealed the following:

- Broken pan components can render a seat non-functional. However, rusted doors and broken fixtures such as taps may hinder usage but do not prevent the seat from being used. Theft of light bulbs and mugs was also reported.

- CTs/PTs are predominantly dependent on borewells for their water supply – only a handful of toilets have obtained piped water connections from TCC. Insufficient water supply has been a major obstacle in the proper upkeep of toilets. During periods of shortage, higher revenue-generating toilets may be able to afford private tanker supply, others are dependent on TCC's water tanker to supplement their water source.

- Waste bins are present in less than 20 per cent of the toilets across the city. Further, cigarette stubs or even liquor bottles left behind in the men's section and sanitary napkin improperly disposed of in the women's section, given the limited number of incinerators installed in toilets across the city, exacerbate the problem.

- ~55 per cent of the city's CTs/PTs are connected to piped sewers while the remaining are dependent on septic tanks. Toilets connected to the piped sewer require periodic clearing of blockages through inspection chamber, as solid waste including sanitary waste is flushed by users. On the other hand, septic tanks found in CTs/PTs function as holding tanks or have their outlets connected to a nearby drain, with soak-pits being seldom found.

Operation and Maintenance (O&M) Models

The O&M models for CTs/PTs prevalent in the city are summarised in Table 4.4. Four per cent of the toilets were either closed or in a decrepit condition.

Table 4.4: **Toilet Management Model Summary**

Management model	**O&M arrangement**	**User Fee**	**Share of toilets (per cent)**
Direct management by ULB	ULB appoints a caretaker/sanitary worker who is responsible for day-to-day management, cleaning, etc.	These toilets are supposed to be free. However, in some instances a user fee is charged by the caretaker or sanitary worker when present	50
Management through ULB contracted vendors	ULB calls for tender and awards a contract to a vendor for 2-3 years. Refurbishment/renovation of the infrastructure is carried out by the ULB before handing over O&M to vendor. PTs located in commercial areas such as bus stand and markets fall under this model.	Pay per use. Rs. 5 for urination/defecation	4

Table 4.4: **Toilet Management Model Summary**			
Management model	**O&M arrangement**	**User Fee**	**Share of toilets (per cent)**
Self-Help Group (SHG) /Non-governmental organization (NGO) model	O&M is handed over to the SHG that functions under guidance of a Community-based organization (CBO) or NGO. SHG members take turns as caretakers and a separate cleaner is appointed. The ULB covers for structural repair, pays for electricity in most cases. Minor repairs are borne by the SHG	Pay per use. Rs. 1 for urination Rs. 2 for defecation Rs. 5 for bathing / washing	31
Management through informal arrangement	Management is through an informal "lease" arrangement with the ULB overseen by a ward councillor/community leader or even communities themselves. A caretaker and cleaner are appointed from the community. Revenue generated is retained by for O&M.	Pay per use. Rs. 2-5 for urination/defecation	11
Source: TNUSSP study, 2018			

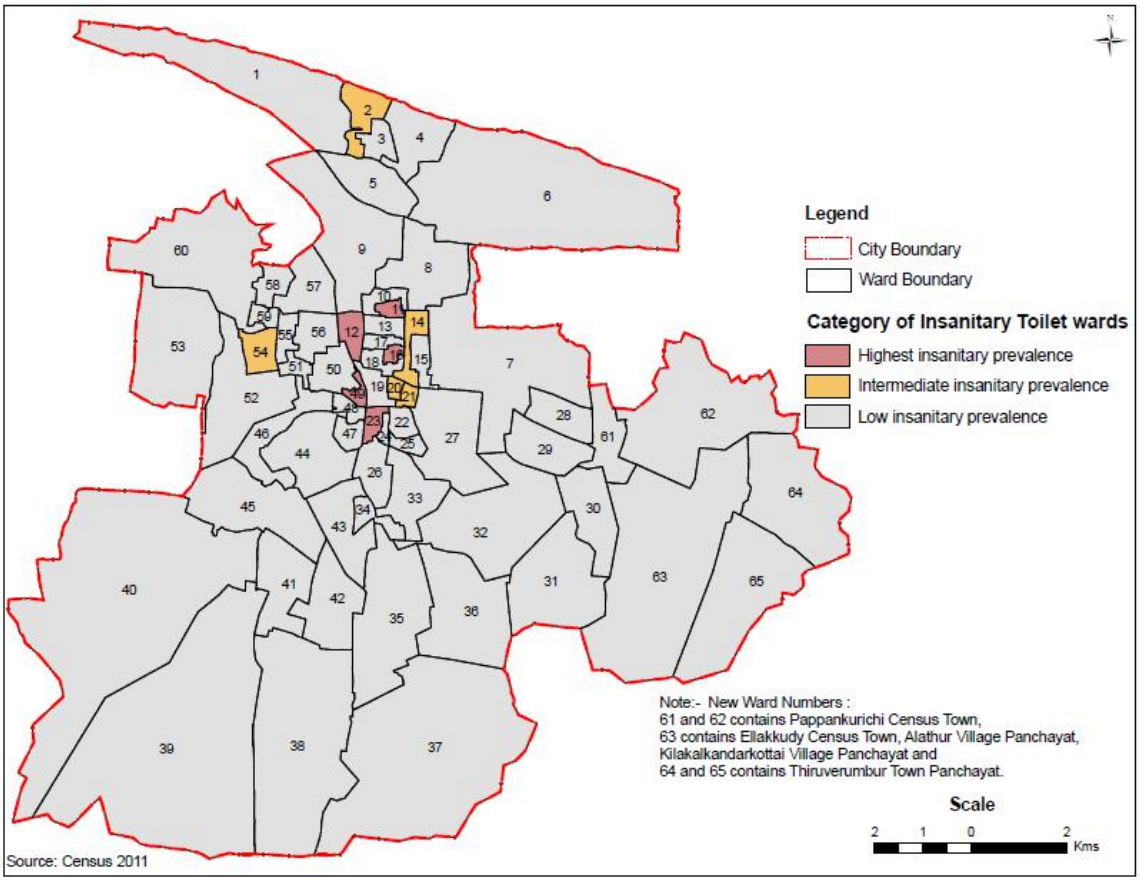
In late 2017, TCC initiated a proposal to install ATMs at 18 toilet complexes based on their location with a potential to earn around Rs. 15 lakhs per year as revenue. Similar efforts to generate advertising revenue through placement of billboards at 24 toilet complexes has also been undertaken. However, the revenue generated from both ATMs and advertising directly goes to the TCC, and is not directly shared or apportioned towards the maintenance of the CT or PT where it has been installed.

In December 2017, TCC began transferring O&M of Corporation-managed toilets primarily through their sanitary workers over to the SHGs belonging to a CBO - WAVE Federation citing staff shortage and to save costs. Orders have been issued for three zones – K. Abhishekapuram, Ponmalai and Srirangam, subject to terms and conditions primarily related to cleanliness and hygiene.

4.1.4. Toilets Discharging into Open Drains

As per data reported under Census 2011, there exist about 12,000 toilets that discharge waste directly into open drains, and are not connected to any safe containment or conveyance systems such as the city's UGD network or a safe OSS. These insanitary toilets are more prevalent in certain wards; wards 2, 8, 11, 12, 14, 16, 23, 49, and 54 account for about 57 per cent of all insanitary toilets in the city, as shown in Figure 4.4.

Figure 4.4: Prevalence of Insanitary Toilets Discharging Directly into Open Drains



Source: Census 2011

The city has been engaged in the task of converting insanitary toilets to sanitary ones under the State priorities as well as the SBM (Urban). Under SBM (Urban), 7,050 toilets were identified as insanitary toilets, 5,223 toilets have been given UGD connection, 1,340 toilets have been connected to septic tanks, and work is underway to convert the remaining 487 toilets into sanitary latrines.[5]

4.1.5. Toilet Arrangements in Commercial Establishments and Institutions

The city has 621 non-domestic connections to the sewer network, as per TCC records obtained in late 2016. Detailed information on the number and type of institutions and the number and type of toilets, along with the number of users in each institution, are currently not available. A detailed study of toilets in institutional facilities should be undertaken to develop a detailed action plan, especially if these are dependent on OSS structures.

[5] TCC Budget 2018-19

4.2. Wastewater Generation

The actual wastewater or fecal matter to be transported and treated will depend on the type of household sanitation arrangements prevalent in the city, with households connected on UGD expected to generate higher volumes of wastewater than those connected to OSSs. Table 4.5 summarises the zone-wise wastewater generation for the population estimated based on the existing number of households connected to UGD network HSCs[6].

Table 4.5: **Zone-Wise Wastewater Generation Estimate**

Zone	Length of UGD (km)	Sewered households (Census 2011)	Domestic HSC (TCC)	Estimated wastewater generation from households as per Census (MLD)	Estimated wastewater generation from households with HSC (MLD)
Abhishekapuram	151.76	30,907	16,068	13.15	6.85
Ariyamangalam	93.69	19,141	6,663	8.22	2.85
Ponmalai	61.5	18,089	5,234	7.98	2.30
Srirangam	134.98	29,920	16,326	12.59	6.62
Grand Total	441.93	98,058	44,291	41.94	18.62

Source: TCC

Given that the city currently has about 44,000 domestic UGD HSCs (49,306 reported by the TCC more recently); the estimated domestic wastewater generation will be about 19 MLD. This estimate is exclusive of the wastewater generated from commercial institutions and establishments and other non-domestic connections (at present, there are 621 non-domestic HSCs connected to the UGD network).

The city's Sewage Treatment Plant (STP) receives about 45 MLD (field measurement at the Waste Stabilisation Pond – WSP) of wastewater. This is significantly higher than the generation estimate presented in Table 4.5, and indicates one or a combination of the following:

- The household water consumption (used to estimate wastewater generation) is significantly higher than the presumed 135-lpcd water supplied by the TCC through its water distribution network. This could be a result of:
    - Unequal supply of municipal piped water, with the sewered areas receiving relatively higher water supply, exceeding the average water supply (of 135 lpcd) provided to the city.
    - Use of supplementary water supply sources such as borewells or tubewells to augment the municipal water supplied to households.

[6] Estimated based on a water supply level of 135 lpcd and 80 per cent water supply being generated as wastewater.

- Unauthorised connection by households to the UGD network, thereby exceeding the current HSC connections (of ~44,000 connections).

Households connected to septic tanks are expected to generate the following three waste streams:[7]

1. Grey water – resulting from use of water for all purposes other than in the toilet, such as for cooking, bathing, washing etc.
2. Effluent from the septic tank – comprising the overflow from the septic tank, which should ideally be connected to a soak-pit, however given the relative absence of soak-pits across all areas in the city, this effluent is expected to flow into drains or other drainage channels.
3. FS generated at the time of cleaning and emptying of septic tanks.

The volume of grey water will depend on the quantity of water consumed by households, and will need to be determined, as discussed in the preceding section, to account for supply in excess of the average in certain areas, or use of supplementary water sources. Table 4.6 summarises the volume of FS expected to be generated from the existing septic tanks in the city.

Table 4.6: **Fecal Sludge Generation Estimates**

Cleaning Frequency (in years)	**Number of septic tanks**		**Septic tanks to be cleaned daily**		**FS generation (m^3/day)**	
	Household	CT/PT	Household[8]	CT/PT[9]	Household[10]	CT/PT
2 years	108,253	442	211	3	675	22
3 years			154		493	
5 years			100		320	

Source: TCC data

These systems will require different approaches for the safe conveyance and treatment of the wastes. The existing and planned approaches for the safe management of wastewater are discussed in the following sections.

It is suggested that TCC undertakes a comprehensive survey of the water consumption and household toilet connection arrangements to determine the actual volume of wastewater generated in the city. As the city expands, the growth in population as well as the increase in coverage of the UGD network will connect an increasing number of households. It is important to understand the quantity of wastewater

[7] Based on the assumption that household septic tanks receive waste only from the toilet (black water) and the remaining wastewater generated in kitchen, bathroom etc. are not connected to the septic tank and are discharged separately.
[8] Estimated based on stated cleaning frequency, and 300 days of operation in a year.
[9] Calculated based on a presumed tank size of 4 m^3 and that 80 per cent of tank volume is emptied at the time of tank cleaning.
[10] CTs/PTs are assumed to require cleaning every 6 months and have a volume of about 9 m^3.

being generated to not only plan for the safe conveyance and treatment of same, but also understand, identify and rectify any leakages in the collection system.

4.3. Conveyance of Wastewater and Fecal Matter from Individual Households

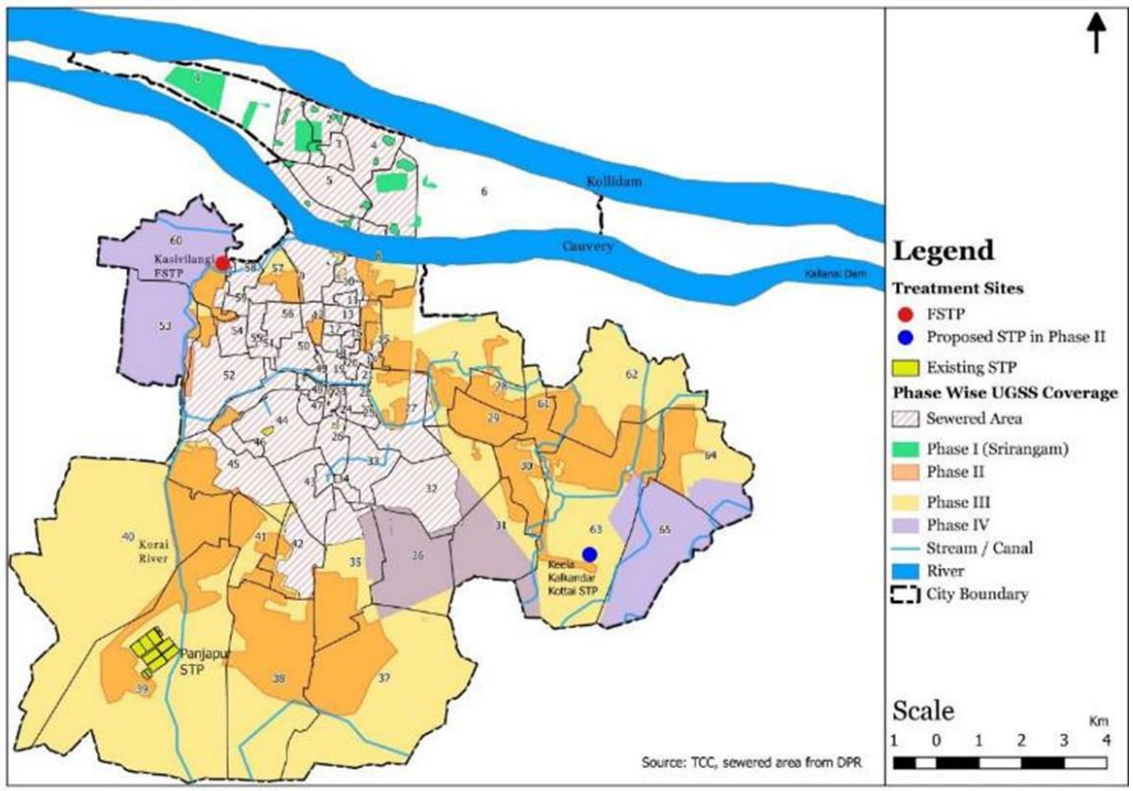
4.3.1. Conveyance through Sewerage System

About 30 per cent of total households in the city are connected to an underground sewer system for the collection and conveyance of wastewater generated in households. Twenty-five wards are fully covered by the network, 25 wards are partially covered and 15 wards do not have any UGD coverage. As observed in Section 4.1.1, the HSCs to the UGD network do not extend to all households, even in wards that are presumably fully covered by the network.

The city is covered by a sewer network spanning 441.93 km, with 26 lifting stations and 26 sub-pumping stations located across the city. Wastewater from the households and establishments connected to the sewerage system is transported through the sewers, collected at various collection sumps, and pumped to the STP for treatment.

The existing sewerage system was implemented under two schemes – the first scheme in 1987-1992 and the second scheme of Trichy-Srirangam in 2000-2008 (TCC, 2008). The UGD covers the core area of the city. Figure 4.5 shows the current sewered areas in the city, along with the planned expansions of the network in phases.

Figure 4.5: **UGD Coverage Areas in TCC**



Source: TCC; TNUSSP Analysis, 2017

The areas not covered under the sewerage scheme are proposed to be included in the network through upgrades and improvements in the existing system under programmes/schemes, primarily the Atal Mission for Rejuvenation and Urban Transformation (AMRUT).

Under Ground Sewerage Scheme (UGSS) network expansion is proposed for the city in four phases. The following is a summary of the four phases (TCC, 2017):

i. The first phase covers the network-omitted area in Srirangam Zone and is currently in progress
ii. The second covers the network-omitted area in the city's core and rehabilitates existing STP, expanding the UGSS with an additional STP at Keelakalkandarkottai. The focus is on parts of the city based on the rapid growth, population density and reducing sewage mixing load into the Cauvery and Koraiyar rivers, and Uyyakondan canal.
iii. The third phase is geared towards expanding the UGSS network with an additional STP at Panjappur
iv. The last phase is geared towards expanding the UGSS network with additional STP at Kulumani Road

Condition of Sewage Pumping Stations

There are 52 pumping stations in operation for the underground network in Trichy:

- 10 High Tension (HT) Stations
- 16 Low Tension (LT) Stations
- 26 Lifting Stations

In all the pumping stations, a common issue is performance of the screen and grit removal systems, which are not adequately functioning, and they do not have proper systems of screening and grit disposal.

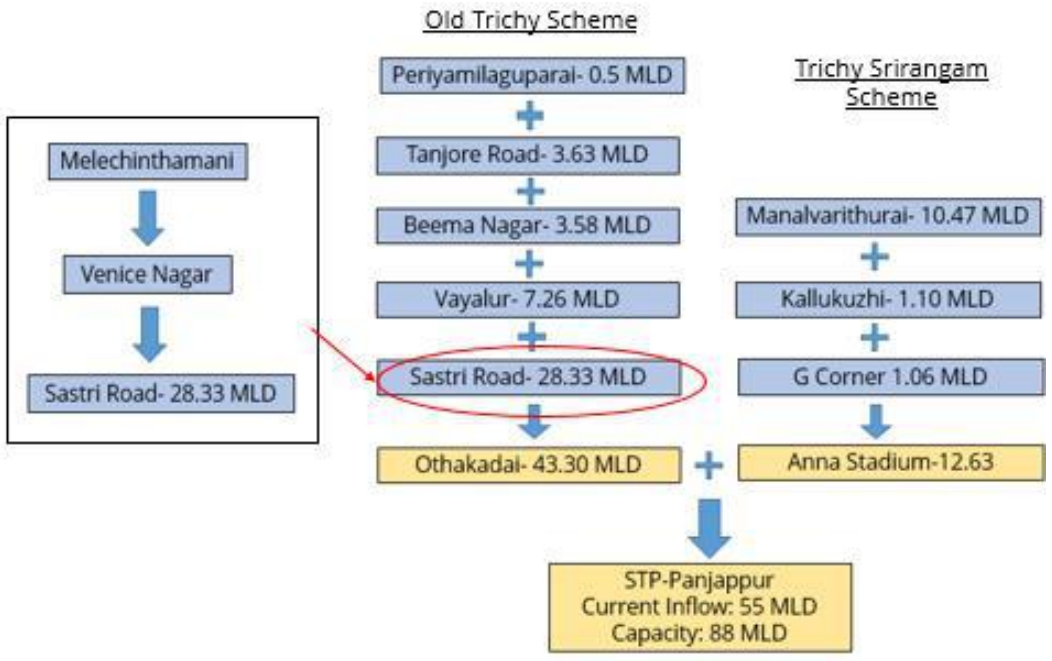
Condition of Sewer Network

Several sewered areas experience blockages with varying frequency of occurrence. Another issue experienced in the network is infiltration during rainy season.

An analysis of the sewerage network was done to estimate exfiltration and to assess the difference in inflow and outflow of sewage in pumping stations. The city has 52 pumping stations, of which Shastri Road pumping station receives the highest inflow (Figure 4.6). This pumping station and its stretch of sub-pumping stations were analysed. The actual sewage pumped was estimated from running hour data over two years. A similar analysis was done by comparing the inflow to the sub-pumping stations during rainy days in 2015 (subject to available rainfall data). The findings of the analysis are:

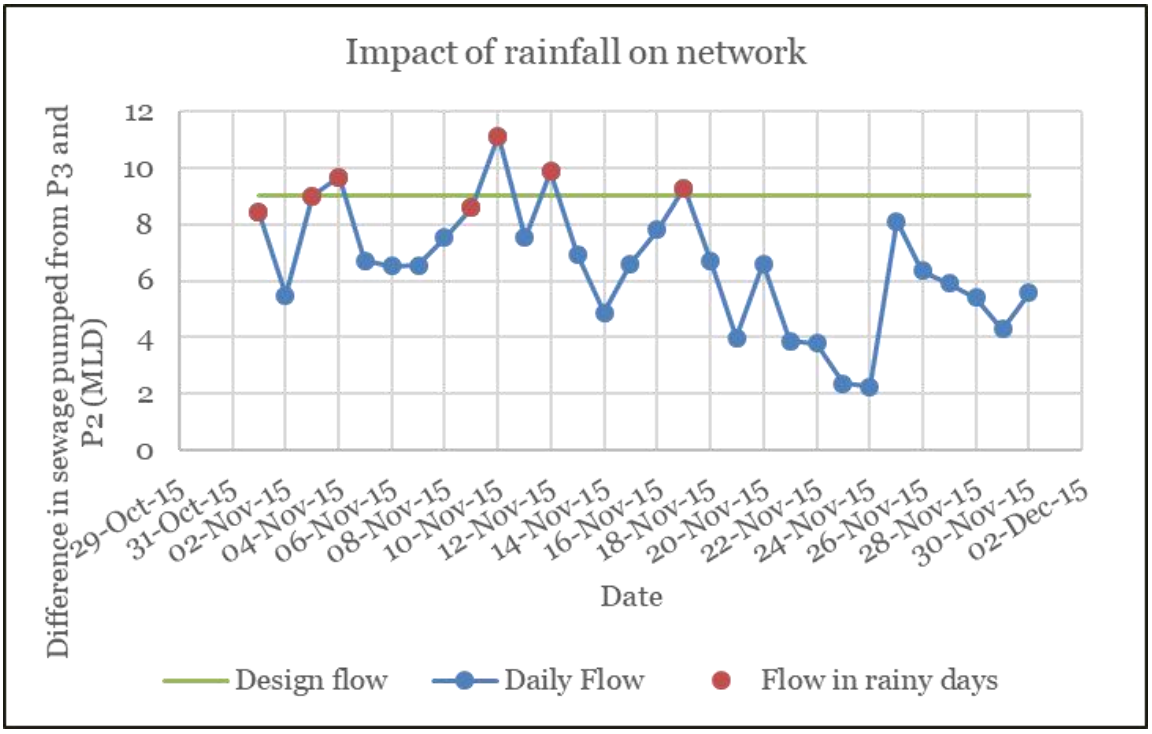
1. Approximately 30 per cent of the untreated sewage is exfiltrating to the environment (Table 4.7)
2. The Shastri Road pumping station is meeting its design outflow only on rainy days (Figure 4.7)

Figure 4.6: **Sewage Flow to STP from Pumping Stations**



Source: TCC

Figure 4.7: **Impact of Rainfall on Network**



Source: TCC; TNUSSP Analysis, 2017

Table 4.7: **Inflow and Outflow Estimated in the Pumping Stations**

Pumping station	**Design flow based on population served**	**Inflow (MLD)#**	**Outflow (MLD)***
Melechintamani	None	Not known	6
Venice Nagar	6	12	12
Shastri Road	9	21	14

*Daily average flow for the year 2017 calculated (MLD); #Calculated
Source: TNUSSP Analysis, 2017

4.3.2. Conveyance Through Storm Water Drains

Trichy has 801.14 km of stormwater drains (SWDs), as compared to 1293.59 km of roads within TCC limits. Most major SWDs take advantage of the natural gradient towards the Cauvery. While SWDs are intended to only carry runoff, it is seen that households connect grey water, effluent from septic tanks, and in some cases, even black water, making the SWDs essentially carry wastewater in many parts of the city.

Anecdotal information based on a baseline assessment study conducted at specific locations in the city suggests that the grey water in households having septic tanks or pits and are not connected to UGD network, is discharged into open drains flowing outside the house. While this grey water is relatively free from fecal contamination, it will require treatment to remove suspended solids and organic matter before disposal into surface drains or channels. Detailed and comprehensive data on the wastewater (grey water) generated in households, and the type of disposal arrangements for grey water is currently lacking, and should form the basis of a detailed action plan to address the issue of grey water management in households using OSSs.

The effluent from septic tanks are usually discharged into open drains, however, a comprehensive database is lacking on the household disposal arrangements for septic tank effluent. The city should seek this information as part of the ongoing household survey on toilet arrangements, to help develop a detailed action plan to ensure proper treatment and disposal of septic tank effluent.

The problem of storm water drain pollution is particularly acute along the Uyyakondan canal, an irrigation canal that passes through the heart of Trichy city, serving as a carrier of stormwater through its southern part. An attempt was made to understand the issues plaguing the canal using a catchment-level approach, and is described in the following section.

Uyyakondan Canal

Uyyakondan canal dates back to the Chola period and has a length of about 70 km serving an ayacut area of ~32,000 acres in the Trichy and Tanjore area. Its source is the Cauvery near Pettaivaithalai. Out of the 18 km that passes through the city limits, the first 8 km runs through the old Trichy town that is mostly sewered. The remaining stretch of 10 km passes through the eastern part of the city in and around Tanjore Road – primarily un-sewered areas. It also functions as a carrier of stormwater for southern parts of the city. The canal is polluted primarily by domestic sewage, industrial waste and bio-medical waste from hospitals.

Due to the water situation in the Cauvery, water flow in the canal has been restricted to 45–60 days over the past few years. The Public Works Department (PWD) is the custodian of the canal, they have fenced off most stretches of the canal within the city with an average width of 13-15 metres (m) and a depth of 2 m with a mild slope. Periodic maintenance is carried out mainly in terms of removing weeds twice a year and de-silting once every 4-5 years. The map below (Figure 4.8) shows the Uyyakondan canal passing through significant built-up area in the west, encircling some non-built-up patches and then skirting the next mass of built-up area.

The PWD has brought the issue of arresting canal pollution to TCC's attention since it is under the ambit of the local body. A PWD report on pollution in the Uyyakondan canal identified 36 discharge points on the banks of the canal within TCC limits – these are shown in Figure 4.9. The report has broadly identified the following issues:

i. In certain pockets, households do not have UGD connections

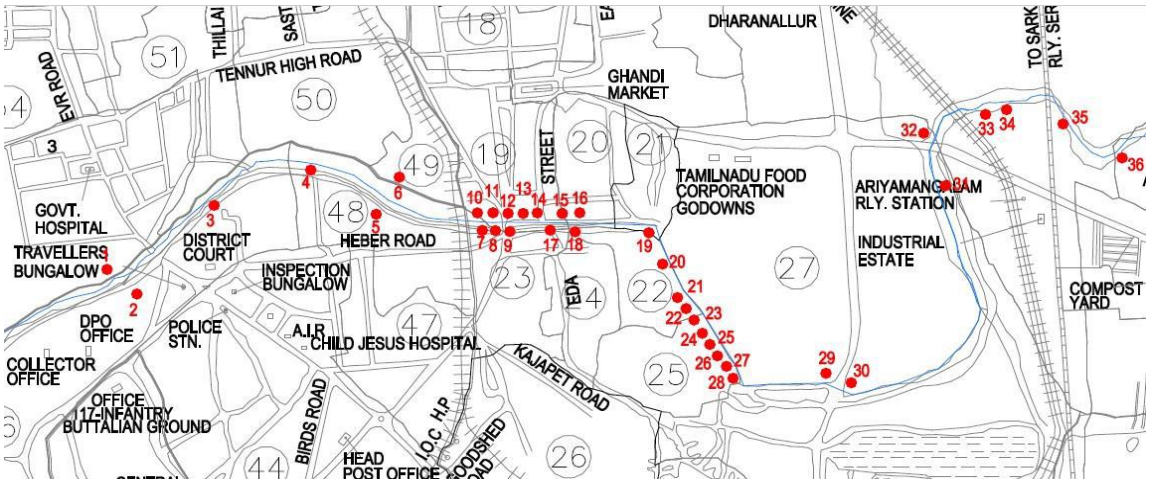
ii. In areas connected to UGD

- Grey water is being discharged by households into SWDs due to improper functioning of the UGD network
- Bypass arrangements have been set up in the existing sewer network as well as the sewerage pumping station serving the area that lead to discharge in the Uyyakondan canal

Figure 4.8: **Uyyakondan Canal in Trichy City Limits**

Source: Google maps edited, 2017

Figure 4.9: **Section of Uyyakondan Canal Map Passing Through Trichy City – Outfall Points**



Source: PWD report on pollution in the Uyyakondan canal, 2016

A reconnaissance exercise of the 36 outfall points was conducted during March–June 2017. Twenty-two outfall points were mapped using GPS, based on locations that were accessible and had visible flow of water during the time of visiting. Palakkarai, an older part of the city comprising of primarily residential as well as commercial properties, had the maximum number of outfall points (12) into the canal, which was verified by TCC officials.

Figure 4.10: **UGD By-Passed Resulting in SWD Flows**

Source: TNUSSP study, 2018

In order to examine and understand the nature of the problem in depth and the factors that contribute to it, a micro-catchment contributing to a single outfall point in the Palakkarai area was chosen. A Digital Elevation Model (DEM) based approach was considered in order to delineate the micro-catchment. However, the contribution to most of the outfalls were SWDs built by TCC along the roads/streets. Hence, the delineated micro-catchment was verified and corrected by walk-throughs along the drain and verifying the wastewater flow direction. Preliminary investigation suggests that there are issues with the slope/gradient that have rendered the underground sewerage network non-functional, which has been the case for a number of years, possibly because of other issues as well. Therefore, residents have made their own arrangements to connect to the SWD, as seen in Figure 4.10.

The key information about Udayan Thottam is presented in Table 4.8.

Table 4.8: **Information about the Udayan Thottam Micro-Catchment**

Area	- Udayan Thottam, Palakkarai - Ward 23, Ariyamangalam Zone
Landmark	- Next to Cauvery theatre - Railway land borders one side
Characteristics	- Middle/lower income residential area, nearly half on rental housing - Average household size is 3-4 Type — Total number Households — 136 Establishments — 5 Properties (buildings) — 74
Housing layout	- A couple of large parcels of land under single ownership have been sub-divided into small plots over the years, resulting in mostly densely packed properties - A few houses are below street level, concrete road exists in most parts

Table 4.8: **Information about the Udayan Thottam Micro-Catchment**	
Toilets	- Predominantly individual household toilets, some households have shared toilets, and a small section use the community toilet.
Grey water/Black water disposal arrangements	- Directly to drain or connected to UGD, which is in turn diverted to drain - Sewerage network present but residents state it has been non-functional
Outfall location	- Contributes to discharge point #7 in Figure 4.9. SWD from micro-catchment runs below Heber Road flyover at a depth of 2m before falling into canal
Source: TNUSSP study, 2018	

A GIS-based map showing the properties and public infrastructure in the micro-catchment was created and is shown below in Figure 4.11.

Figure 4.11: **Udayan Thottam Catchment**

Source: TNUSSP study, 2018

4.3.3. Conveyance of Fecal Sludge

Private Operators for Emptying Septic Tanks

Households dependent on septic tanks and pits rely on cesspool operators for emptying of their onsite infrastructure. There are about 25-30 active private operators providing services for the emptying and conveyance of FS through vacuum trucks of varying capacities plying in the city. The fees charged to households for emptying ranges from Rs. 1000–2000 per trip, depending on distance, truck capacity and number of trips.

Table 4.9 estimates the number of trucks required to empty septic tanks in the city for varying cleaning frequencies.

Table 4.9: **Truck Requirement for Septic Tank Emptying**

Cleaning Frequency (in years)	Number of septic tanks		Septic tanks to be cleaned daily		Trucks required per day	
	Household	CT/PT	Household	CT/PT	Household	CT/PT
2 years	108,253	190	180	2-3	45	Managed with two TCC trucks
3 years			120		30	
5 years			72		18	

Notes:
1. Calculations based on a household septic tank size of 4 m^3, CT/PT septic tank size of 9 m^3 and assuming that 80 per cent of the tank volume is emptied at the time of cleaning.
2. CT/PT cleaning and sludge emptying assumed to occur once every three months
3. Truck estimation based on 300 days operation, 4 trips per truck per day, and one trip required per household septic tank

The current number of operators and trucks available in the city appear to be sufficient to empty and transport FS when the emptying is undertaken once every 3-5 years, and is reflective of the current demand for septage emptying and tank cleaning services.

Licensing of Vehicle Operators

In August 2013, TCC passed a resolution to introduce a system to regulate private desludging operators in the city, saying that operators were carrying out indiscriminate disposal and not utilising the designated disposal points. To operate within TCC limits, private operators would pay an annual license fee of Rs. 2,000 every year and a tipping fee of Rs. 30 for each disposal at designated points. A penalty of Rs. 5,000 was recommended for first-time offences, and unlicensed vehicles could be seized and auctioned if caught more than three times without a license. This was later published in the district gazette in order to make it a legal requirement.

The mechanical department of TCC is entrusted with the responsibility of issuing licenses to private desludging operators in the city. The process consists of submitting a requisition form along with copies of vehicle documents, permits and tax receipts that are mandated as per the State Transport Authority (STA) for non-passenger goods carriage vehicles. The requisition form also includes a line mentioning safety accessories, namely masks, gloves and shoes to confirm if the private operator has obtained them.

In addition to the payment of the annual license fee, the owner/operator signs a non-judicial agreement complying with a state government order banning the practice of manual scavenging and a Madras High Court order preventing entry of sanitary workers into septic tanks except under extreme circumstances. It also mandates that the vehicle owner install a GPS device to track vehicle movement to prevent open disposal. Table 4.10 shows the number of vehicles licensed in the past two financial years, which run from April to March.

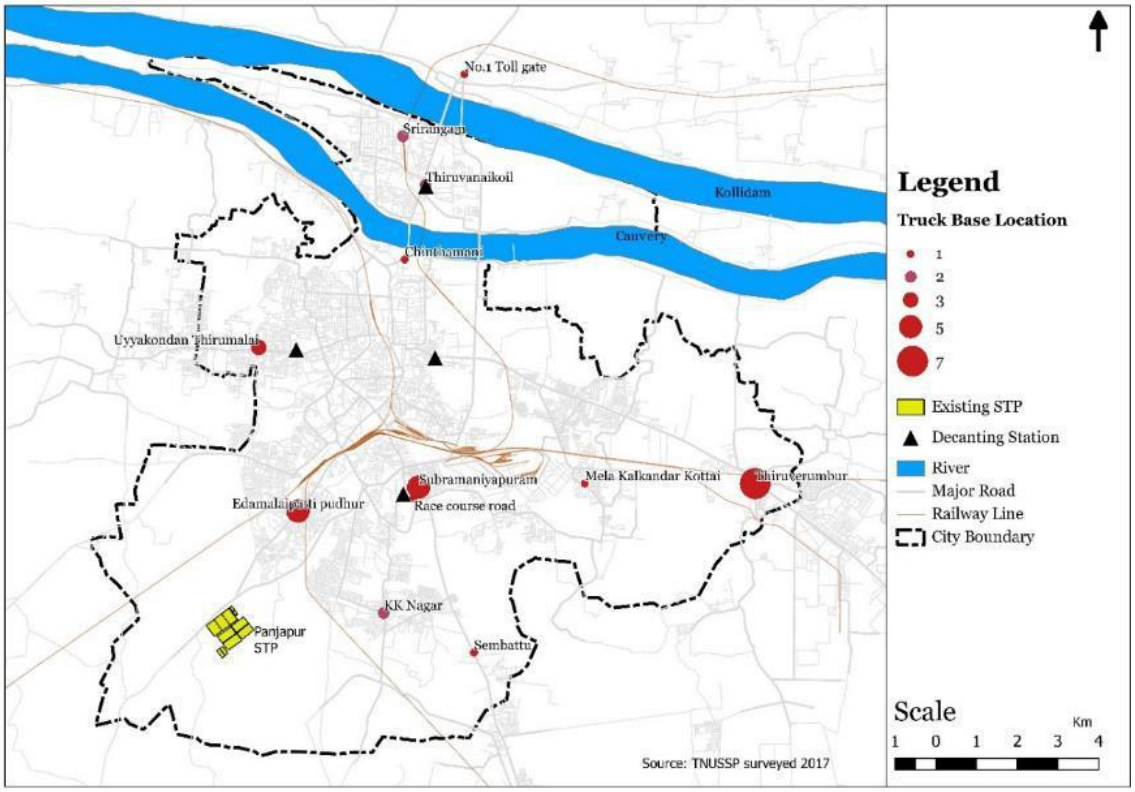
Table 4.10: **ULB Licensing of Desludging Operator Vehicles**

	Financial year	
	2017-18	**2016-17**
Vehicles registered	41	35
Number of operators	32	27
Number of unique operators	31	25

Source: TCC

It must be stated that since the vehicle is licensed rather than the operator, if the ownership of the vehicle is transferred to a different owner/operator, it can continue to run under the same license for the financial year. Figure 4.12 shows the base operating locations for the vehicles licensed in the year 2017-18.

Figure 4.12: **Private Desludging Operator's Base Location in Trichy**



Source: TNUSSP study, 2018

At the end of every financial year in March, TCC informs operators that their license is up for renewal while following up with operators who use their decanting facilities on a regular basis. While the renewal process is itself straightforward upon fee payment, it is challenging for the TCC to get the entire set of private operators to renew their licenses. On the other hand, private operators claim that TCC is not strict in enforcing renewal in that it does not restrict access to decanting facilities if the license is not renewed. Operators also claimed that they operate outside TCC boundaries and would prefer not to get their license renewed since it involves a fee, while those looking to sell their vehicle in less than a year's time do not see the benefit in licensing due to the time frame. One more practice observed is that operators with more than one vehicle typically license one vehicle first and then license the other vehicles much later. While the state government issued "Operative Guidelines for Septage Management" in September 2014, Trichy continues to follow its own licensing mechanism based on the ULB resolution issued in 2013.

Disposal Practices

Until 2012-13, the STP located at Panjappur was the only designated disposal point for private desludging operators with a tipping fee of Rs. 80 per load, which means one full tanker. This was later reduced to Rs. 30 per load through a corporation council resolution in August 2013 along with the provision of decanting arrangements at three existing sewage pumping stations – Anna Stadium serving

the south and south-western parts, Pookollai catering to Tanjore Road, and Vayaloor Road serving the western parts of the city. Provisions for decanting usually meant the addition of a decanting port or inlet chamber where vehicles could discharge the septage using gravity, without any disruption to existing pumping operations. The option of disposal at Panjappur was withdrawn once the three decanting facilities came up. A fourth decanting facility was added in the Srirangam Zone to cater to the needs of operators in the area. All of the above measures have meant that private desludging operators opt for disposal of collected septage at any one of the decanting stations, based on customer location. Thereby, TCC has been able to tackle challenges associated with disposal of septage to a certain extent.

During interactions, operators admitted that enforcement by TCC and increasing customer awareness meant they no longer disposed of septage into the open. But at the same time, they reported that the city's canals and major drains presented opportunities for septage disposal, since certain stretches were already polluted with sewage from households. This could be illustrated by when there is more than one load to be emptied from a large-size containment structure and the nearest decanting facility is more than a few km away, the focus tends to be on business needs of servicing the customer quickly. A few open disposal locations reported by multiple operators include *oyamari* (burial ground), NH45 Chennai bypass and Panjappur city boundaries. If operators were servicing periphery areas such as Samayapuram, it was highly unlikely that they would travel to the city's decanting facilities for disposal. An exception to this rule would be in the case of industry/factory loads which are served frequently by a dedicated private operator where the distance to disposal facility is factored into the price. Oversight by the owner/operator also plays a key role in ensuring that the vehicle is disposing of septage at the decanting station.

Occupational Safety and Hazard

Personal Protection Equipment (PPE) is listed as a line item on the TCC license requisition form and mentions masks, gloves and shoes/boots with no standard/quality of safety gear to be purchased. The Operative Guidelines for Septage Management issued by the Government of Tamil Nadu (GoTN) in 2014 states that "Septage Transportation Vehicle Operators involved in the process of collection, treatment and disposal of sewage should be well-trained and equipped with protective safety gears, uniforms, tools and proper vacuum trucks, to ensure safe handling of sewage." The rules under the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 provide for a comprehensive list of safety gear that should be used. The Madras High Court order W.P. No. 24403/2008 referenced as part of the agreement signed by the private operator mentions safety gear. Prescribed by the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) in a scenario where mechanical equipment is not available or able to clear the obstructions/blocks, the board permits sanitary workers to enter into a manhole with these safety gadgets. A closer look at this list reveals hand gloves (PVC, leather, rubber, satin) and safety gumboots which are once again generic in nature, failing to adopt an approach that accounts for chemical/microorganism risk as well as exposure-time when prescribing safety gears, which is commonly found in European (EN)/ISO standards.

Presently, no form of PPE is actively used by private desludging operators or TCC workers who operate the ULB desludging trucks. When queried about the availability of PPE in the local market, four operators mentioned rubber gloves and surgical masks that were available at medical shops over-the-counter, while a couple of operators referred to Palakkarai/Madurai Road where specialised stores sell safety equipment for industrial use. They further stated that using safety gear may draw unnecessary attention while working in the city. A couple of operators reported that previous attempts at using gloves showed it to be inconvenient, although there was no proper recollection of when this attempt took place. In terms of risk, operators stated that they were aware of the perils of dealing with wastewater and sludge but had not encountered any untoward incidents. In conversation with workers, they reported cuts/or bruises while working, especially with removing the covers of septic tanks and were open to trying out safety equipment.

Figure 4.13: **TCC Summary of Desludging Operator Vehicles for the Year 2016-17**

Tiruchirappalli City Corporation
Details of Collection of Sewage Liquid Waste by Private Operating Vehicles

Council Res. No.	:	200, dated, 29.08.2013
District notification No	:	1, dated: 13.01.2014
License Fees	:	Rs.2000/- Per Vehicle / Year
Collection fees for let out sewage water	:	Rs.30/- Per Trip
Fine for operating with out licensed Vehicle	:	Rs.5000/-
No. of license issued for Private Gulper Vehicles	:	41 No's (Year – 2017-18)
License fees Collected	:	Rs. 82,000/-
No. of Trips (From:1.04.2016 to 31.03.2017)	:	5240 Trips
Collected fees (From: 1.04.2016 to 31.03.2017)	:	Rs.1,57,200/-
Total Sewage water let out through decanting arrangements through private Gulper Lorries (From: 1.04.2016 to 31.03.2017)	:	31.44 MLD (5240 Trips x 6000 Ltr)
Corporation Vehicles let out Qty (From: 1.04.2016 to 31.03.2017)	:	16.85 MLD (2808 Trips x 6000 Ltr)
No. of decanting Arrangements (3 No's)	:	1.. Anna stadium Main Pumping Station 2. Tanjore Road sub pumping station 3. Vayalore Road sub pumping station

Source: TCC

An assessment of the existing decanting stations in the city was conducted and is described in the following section. A comparison of existing facilities and operational details at the decanting station is given in the Table 4.11.

Table 4.11: **Comparison of Existing Facilities and Operational Details of the Decanting Station**

Description	**Anna Stadium**	**Vayaloor Road**	**Pookollai, Thanjavur Road**	**Vasudevan Street, Srirangam**
Facilities for hand Washing	Municipal water supply tap is available, no wash basin	Municipal water supply is available, no wash basin	At micro-composting yard. municipal water supply is available	Tap with water supply
Toilet	Western type – not functional, lacks water supply	None	None	Squat type
Collection of fee	Every day, the collected fee is submitted to the TCC by the staff.			
Employee who collects the fee	TCC worker	Pump operator	Pump operator	Pump operator
Availability of sampling port	None			
Flow equalisation tank	No flow equalisation tank. FS is loaded randomly as the truck comes, when the level in the collection well reaches a pre-determined level, the operators switch on the pumps, and it is pumped to the STP			
Operational hours of decanting station	24 hours	7 am to 7 pm	6 am to 7 pm	7 am to 10 pm
Number of truck loads per day on average	25 to 35	4 to 5	4 to 5	1 to 2
Disposal and cleaning of screenings and grit	Cleaning arranged by TCC once in a month (unclear)			

Source: TNUSSP Analysis 2017

Operational details for the decanting stations

1. O&M of decanting facilities: The O&M maintenance is the same as that for a pumping station. For all pumping stations, the O&M contract has been given out for motor and pump maintenance alone as an electrical contract. The duties and responsibilities fall under the supervisor and pump operator who are a part of the private electrical firm to which the contract has been awarded. The staffing arrangements depends on whether they are main pumping stations or sub-pumping stations. Staff work at the sub-pumping stations in two shifts. Comparatively less sewage is generated at night, hence there is no requirement to operate the pumps and main pumping stations have 3 shifts. The private electrical firms might be same or different for two pumping stations.

2. Tipping fees: A fee of Rs. 30 per truck is collected from the truck operator by handing out a receipt in acceptance of payment. TCC-owned vehicles do not pay for discharging FS.

3. Record keeping: For decanting facilities, records of the date, truck details (vehicle number and operator), tipping fees collected and receipt number are maintained. A separate logbook is maintained for recording the pump run time hours. There is a dedicated person for record-keeping at Anna Stadium. At the rest of the decanting stations, since there are fewer vehicles, the pump operator is given the additional responsibility of keeping records.

4. Discharge into the collection well: Each truck operator takes about 5–7 minutes to empty a full truckload of FS into the collection tank.

5. Safety and hygiene: There is not much attention to personal safety and hygiene at the decanting facilities. While emptying the FS from trucks, it gets spilled at the decanting station. The desludging operators do not use any PPE during disposal.

Summary of issues

While pumping station layout designs are generally uniform, there are variations that are highlighted in the previous table. There is also scope for improvement in the O&M of these receiving facilities. The following section provides a summary of these issues.

Field observations and status of the preliminary treatment units at each of the decanting facilities is outlined in Table 4.12.

Table 4.12: Comparison of Status of the Preliminary Treatment Units in all Decanting Facilities			
Decanting station	**Provision for disposing of FS**	**Screen chamber**	**Grit chamber**
Anna Stadium	A small inlet chamber was constructed, but at present it is not functional. FS is directly disposed into the collection well	The screen does not seem to be functioning, one reason could be that it is placed vertically. Vertical placing of screens will be difficult for manually cleaning	The grit chamber works on simple gravity separation. Grit removal system is not functional and grit pumps are not working.
Vayaloor Road	The inlet opening to empty FS from trucks and the intermediate storage tank are both operational	The screen functions poorly, the spacing between the bars is not equal, some are too wide, it is easy for the floating debris to pass through. In addition, they are placed inside the screen well, making it difficult to remove the screenings.	The grit chamber works on simple gravity separation. Grit removal system is not functional and grit pumps are not working.
Pookollai, Thanjavur Road	The provision was permanently closed because of complaints raised by the adjacent Electricity Board TNEB office and trucks were advised to discharge the FS in the screen well directly	The screens function poorly, they are placed inside the collection well itself, which makes it difficult to remove them.	None. Design has a grit chamber, but has not been in use for a very long time. There are no grit pumps.
Vasudevan Street, Srirangam	None	The screen is functional and maintained	Works on simple gravity separation. Grit pumps are not working.
Source: TNUSSP Analysis 2017			

Design

- *Emptying of FS*: There is no platform or receipt facility that is available for multiple trucks to dispose of FS. The current practice is to dispose of FS in the collection well by using a flexible hose available at three of the facilities. Emptying of FS by multiple trucks contributes to spillage. In addition, at Vayaloor Road, having only one port available for emptying makes it difficult for other trucks waiting for disposal.

- *Flow measurement:* There are no flow measurement arrangements.

- *Screens:* Screen chambers in the decanting station are of two types:
    - Rectangular chamber with coarse and fine screen.
    - Screen placed inside the collection well.

- In both the cases it is difficult to remove the screenings (trash). The collection well is very deep, making it difficult for regular removal of the trash. In the rectangular chamber the screens are placed vertically, which causes the trash to fall back in the chamber during removal.

- *Grit chamber*: In all the facilities, the grit chambers are designed based on gravity settling. Provision for grit removal is also provided by grit pumps. These grit pumps are not functioning properly.

O&M

- Removal of screenings and grit: Visual observation indicates infrequent screening and grit removal. The vegetation growing in the grit removal basin at Anna Stadium indicates that the system has not been used in several months. (Figure 4.14)

- Record-keeping: Although there is some record-keeping of truck numbers and tipping fees, there is no control or record of the origin of FS. For example, grease and industrial effluents can be discharged to the collection well with no checks. In addition, the volume of trucks and FS discharged is not recorded, thereby making accurate assessments on the volume of FS received difficult.

- Testing: No procedure for sampling and analysis of suspect loads

Health and safety

- Health and hygiene. There are no proper hand wash/toilet facilities for drivers, no PPE for workers (Figure 4.15).

- No procedure for sampling and analysis of suspect loads

Figure 4.14: **Grit Pit and Screening Systems – Not Being Maintained in Anna Stadium**

Source: TNUSSP Analysis, 2017

Figure 4.15: **FS Disposal with No PPE and Non-Domestic Source of Sewage Discharging**

Source: TNUSSP Analysis, 2017

4.3.4. Conveyance and Treatment of Fecal Matter from Public and Community Toilets

The wastewater from ~55 per cent of CTs/PTs are connected to UGD and pumped through sewer lines to the STP.

TCC provides emptying services to serve the CTs/PTs dependent on septic tanks. The TCC has two vacuum trucks and that follow a schedule for emptying CT/PT containments. In an administration zone, each CT/PT is serviced once every 10 to 15 days until the next cycle. The size of the CT/PT containment may range between 12000–20000 l, the TCC tanker capacity is 6000 l and at times would require more than one trip to completely empty the tank. On an average, TCC vehicles service 7–8 CTs/PTs for emptying in a day, spending 15 to 20 minutes per location and can service up to a maximum of 10 CTs/PTs.

TCC staff reported issues in accessing some CT containments, particularly on narrow lanes or roads which are not properly paved. They commonly carry two hose pipes and reported a tendency to allocate lower priority or skip CTs altogether if they required three to four hose lengths to reach the containment.

4.4. Treatment of Wastewater and Fecal Sludge

4.4.1. Wastewater Treatment at Sewage Treatment Plant

Combined sewage and FS decanted at pumping stations is conveyed to the centralised STP at Panjappur, located about 7 km from Trichy Railway Station to the east of Madurai Road. The site is bounded on the west by Madurai Road and on the east by River Koraiyar. The site covers about 498 acres of land, of which about 30 acres is currently utilised for the disposal of construction and demolition waste, with the majority of the land dedicated to providing sewage treatment facilities.

In the existing STP at Panjappur, there are two plants with a capacity 30 MLD and 58 MLD respectively. The 30 MLD plant was constructed in 1987 with a lagoon system that was augmented in 2003 under the National River Conservation Plan (NRCP) by providing pre-treatment units and anaerobic ponds (APs). Additionally, the 58 MLD STP was constructed with WSP process technology. Hence, the total installed treatment capacity is 88 MLD. At present, the 58 MLD plant is functioning while the 30 MLD plant is defunct. The defunct one has two APs, two Facultative Ponds (FPs) and one Maturation Pond (MP). The 58 MLD plant has a screen chamber, grit chamber, two APs, two FPs and two MPs. Sewage from the city reaches the STP as two separate lines from each of the main pumping stations.

Effectiveness of Existing System and Operations

The STP was originally designed to accommodate 2020 litres per second (LPS) from Main Pumping Station 1 (MPS1) and 1337 LPS from MPS2, as a peak instantaneous flow, or 88 MLD as a peak daily flow (TCC, 2008) for the entire WSP system. Influent Biochemical Oxygen Demand (BOD) was estimated at 270 mg/l and Chemical Oxygen Demand (COD) at 650 mg/l. Current flows appear to be approximately 45 MLD to the head works, although a large portion of this is diverted to the old treatment system where the effluent ponds on the ground surface. Flows are much lower than would be expected if both pump stations were running full time. Actual performance of the system is not sufficient to meet effluent discharge standards. The Central Pollution Control Board (CPCB) 2013 report (Table 4.13) has performance data on Trichy WSP showing 74 per cent removal for both BOD and COD, but no date is given. In March 2017, the investigating team under this assessment conducted comprehensive sampling and analysis of the STP. The results are summarised in Table 4.14. Key points are the removal efficiency of BOD and COD: 59 per cent removal of BOD and 57 per cent removal of COD.

Table 4.13: **Performance Data on Trichy STP-CPCB 2013 Report**					
Inlet		**Outlet**			
BOD (mg/l)	**COD (mg/l)**	**BOD (mg/l)**	**Per cent removal**	**COD (mg/l)**	**Per cent removal**
100	286	26	74%	75	74%
Source: CPCB 2013 report					

Table 4.14: **Removal Percentage Based on Sampling**						
Parameter	**Average Results (mg/l)**		**Compliance with discharge standards**		**Per cent removal**	
	Head works	**Final Outlet**	**1986 standards**	**2020 standards**	**Expected**	**Actual**
Sample type	composite	grab				
BOD @ 20°C for 5 days	103	42	No	No	95% to 97%	59%
COD	303	130	Yes	No	-	57%
Total Suspended Solids (TSS)	163	40	No	No	90% to 95%	76%
Ammonia Nitrogen as NH4-N	32	21	Yes	No	-	35%
Total Nitrogen as N	45	27	Yes	No	-	39%
Fats, Oil, and Grease (FOG)	not measured		-	-	-	-
Fecal coliform (MPN/100 ml)	1600		None		95% to 98%	0%
Source: TNUSSP Analysis 2017						

Notes:

- Adjusted average results from sampling on March 22, 25, and 27, 2017
- Per cent removal expected from Central Public Health and Environmental Engineering Organisation (CPHEEO), 2012
- Per cent removal Actual = (head works - final outlet)/head works

A full evaluation of the STP was conducted to determine the major causes of poor performance as well as identify opportunities for improvement. The critical areas of concern are listed below:

- Lack of maintenance on existing mechanical equipment has left the equipment non-functional or poorly functional. This includes the flow meter, screens, and grit chambers.

- Lack of monitoring of key operational parameters including influent and effluent parameters, as well as sludge depth in all pond cells means that there is no operational data with which to make operating decisions.

- Excessive sludge accumulation in all pond cells is assumed to contribute to high levels of BOD and TSS in the effluent. Sludge depth profiling has not been performed.

- Design flaws in the pond outlet structures, specifically for the FPs and MPs, has resulted in structures that do not provide for adequate separation of algae and scum.

- The transmission sewer line between the head works and the AP has settled below its original grade, which results in an air pocket in the sewer pipe, which must be alleviated by installing a proper air release valve in order to relieve the restriction and enable full flow.

- Valving and flow distribution throughout the WSP are in need of rejuvenation for the operators to be able to i) isolate individual cells for service, and ii) assure even or measured distribution of wastewater loads from one cell to the next. Inability to evenly distribute the wastewater between the two parallel treatment trains is a major concern.

- Lack of controls on septage – such as a septage manifesting system, results in inappropriate loads, often containing high levels of fats, oil and grease or commercial and industrial chemicals being discharged at the decanting stations. Implementing an O&M programme for the decanting stations; implementing a manifesting system; taking random and spot checks of septage loads and diverting commercial wastes to stand-alone treatment facilities will be important in addressing this concern.

- Lack of an effective communications procedure for reporting and following up on O&M issues means that problems go unreported, with little follow-up on those problems that are reported.

- Lack of a i) written O&M plan ii) employee health and safety plan and iii) emergency response plan puts workers at risk and leaves the management of the facility without a strategy to achieve compliance when problems occur.

- Short circuiting is a critical issue, which is clearly affecting the performance of both the FPs and MPs and most likely in the APs.

4.4.2. Decentralised Treatment of Black Water

The city relies on a large centralised STP for sewage and FS treatment although there are many small-to-medium-sized decentralised treatment systems for sewage, CT waste, etc. A few examples of decentralised sewage/FS treatment systems are provided in Table 4.15.

Table 4.15: **Examples of Decentralised Wastewater/Sewage Treatment Systems**

Location & Commissioning date	Treatment system	Details
Urban slum at Viragupettai, EB Road Operational from February 2016	Bio-methanation plant produces methane, fuels a community kitchen and Amma canteen nearby Type of waste: FS from CT and vegetable waste from the nearby Gandhi market *Design* • Capacity - 30 m^3 • Gas generation estimate - 22 m^3 • Anaerobic digestion Requires • 250 kg per day vegetable waste • Toilet usage : 500 persons per day	*O&M* • Methanation plant: Rs. 37,000 per month overseen by TCC • CT and kitchen is managed by local SHG • As per design, slurry from the digester is to be directed to a collection pond with water hyacinth and fish, overflow is to be used as liquid manure for plants. However, this is not taking place and the slurry is diverted to UGD
Urban slum at East Devadanam Operational from 2005	Natural biological and physical treatment system titled Decentralised Wastewater Treatment Systems (DEWATS) was commissioned to treat effluent from CT (20 seats) serving 460 persons • Bio-gas generated is used for cooking *Design* • Capacity – 9 m^3 • Treated effluent standards: BOD – 100 mg/l, COD – 250 mg/l • Treated water reused for irrigation in the adjacent area	*O&M* • Managed by local SHG with support from TCC • Bio-gas chamber is desludged and conveyed to the nearest decanting station *Challenges* • Poor maintenance over the years has affected the functioning of the DEWATS system • Bio-gas generation is inadequate and Planted Gravel Filter (PGF) is also

Table 4.15: **Examples of Decentralised Wastewater/Sewage Treatment Systems**		
Location & Commissioning date	**Treatment system**	**Details**
		not functioning resulting in poor effluent quality
Ambedkar Nagar (Tamil Nadu Slum Clearance Board housing complex) Operational since 2015	Complex comprises of 18 blocks, each blocks having 24 flats making a total of 432 houses *Design* • Two units of Anaerobic Baffle Reactor (ABR) for the treatment of black water • Dimension of 9m x 3m x 2m each • Constructed with Reinforced Cement Concrete (RCC), roof slab, with manholes and vent pipe • Outlet connected to UGD • Grey water is discharged into the open drain, which finally leads into the storm water drain along the main road	*O&M* • ABR has never been desludged according to residents • No maintenance apart from pruning plants in the vicinity
Yatri Nivas (Pilgrim residential complex), Srirangam Operational since 2015	Wastewater generated is treated using an advanced oxidation process named Eco ozotex. • Capacity – 100 m^3 • Effluent quantity is 40,000–60000 l per day • Size of the unit: 7m x 7m • Power consumption: 0.75 kilowatt per m^3 Treats both grey and black water	*O&M* • Average cost per month Rs.15,000 • Maintenance is carried out by the same firm that set up the plant – KS Technologies
Source: TNUSSP Analysis 2017		

4.5. Deficiency Analysis

This section summarises the key deficiencies prevailing in the sanitation chain in the city, based on the situation assessment presented in the preceding sections.

4.5.1. Conveyance and Treatment of Wastewater Through UGD Network

The key deficiencies in this stage of the sanitation chain are as follows:

1. Lack of accurate information on the actual wastewater generated in the city and flow received at the plant. Wastewater generation could be estimated more reliably by a more detailed assessment of the different water supply sources that are available and being used by residents, and the actual water supplied to residents. This information can be used by the city to assess the collection efficiency of the UGD network, and develop a detailed plan to rectify and improve the collection and conveyance of wastewater generated in the areas currently covered by the UGD network.

2. Low household connectivity to the UGD network, despite its widespread availability. The city has about 30 per cent of its households connected to the network, which is lower than the percentage of households that reported discharging waste into the UGD network during the Census 2011. It appears that residents continue to rely on septic tanks even in wards that are fully covered by the sewer network – this arrangement needs to be confirmed and clarified through a household-level survey. It is also important to assess the current levels of household connection efficiency to understand what prevents households from connecting to and using the network, as well as the unauthorised use of the network.

3. A comprehensive assessment of the STP is needed to understand the flow received at the plant, the treatment performance of the plant, and the capacity of the existing STP to handle additional flows (either wastewater flows from augmentation of the UGD network, or FS discharged into the network at decanting stations).

4. Assessment is needed of institutional and commercial establishments connected to UGD network, and the wastewater flow contributed by these users.

4.5.2. Conveyance and Treatment of Fecal Matter from OSSs

The key deficiencies in this stage of the sanitation chain are as follows:

1. Inadequate information on the type of septic tanks constructed by residents, and whether these conform to design standards. The city requires a comprehensive survey to understand the type of septic tanks (type of septic tank bottom, discharge outlet, number of chambers, size, cleaning frequency etc.) that exist in the city.

2. Inadequate information on the type of disposal arrangements for grey water and septic tank effluent. Household surveys should help gather information on whether household septic tanks receive wastewater generated only in toilets, or from other parts of the house as well. A survey is also needed to understand the type of disposal, conveyance and treatment, if any, provided to grey water and septic tank effluent, or whether these waste components are transported through open drains without any treatment.

3. Lack of a system to treat grey water or septic tank effluent, which are often discharged into open drains.

4. Limited attention to health and safety by private operators when emptying septic tanks. Anecdotal evidence suggests that private operators often forego the use of PPE, and occasionally still enter the septic tank at the time of tank cleaning.

5. While several trucks discharge FS at the decanting stations, the city needs to continue to monitor any open dumping hotspots where discharge of FS occurs without any treatment, resulting in public health and environmental hazards.

6. Inadequate information on the performance of the STP after adding FS in the sewer network, and impact on the STP's performance.

4.5.3. Prevalence of OD

While Trichy has been declared ODF, the city needs to sustain its ODF status by ensuring construction of the required number of individual household toilets and CTs/PTs, as well as through awareness campaigns with existing budgetary allocations.

4.5.4. Community and Public Toilets

The city has 447 CTs/PTs, of which about 7 per cent are not in working condition/operation. A preliminary survey of the toilets identified some challenges and constraints in their operation. A more comprehensive survey of all CTs/PTs in the city should also form the basis of an action plan to improve toilets across the city.

Another area of deficiency is assessing the availability of PTs in areas with a large floating population. The city is a significant cultural, educational and religious hub, and attracts a stream of visitors throughout the year. While some information on the floating population expected during different times of the year is available with the city, it is important to assess the population against the PTs and sanitation facilities available in the areas frequented by this floating population, to assess whether existing infrastructure will serve their needs.

4.5.5. Prevalence of Insanitary Toilets

The city has identified 7,050 households that use insanitary toilets, and the majority have been converted to sanitary toilets by providing connections to either the UGD network or to septic tanks. The city has budgetary allocations in place to address the requirements of the remaining 487 households.

An additional ~5,000 households are expected to have insanitary toilets (based on data included in Census 2011), and the city needs to develop an action plan to identify these households that continue to have them, as well as to convert these to sanitary toilets or discontinue the use of these toilets. The conversion strategy will depend on the prevailing circumstances and factors that currently contribute to the use of the insanitary toilet (such as lack of space, financial constraints etc).

4.5.6. Access to Sanitation in Slums

Specific insights into the extent and type of sanitation arrangements in slums and other poor urban areas is not readily available. The Slum Free City Action Plan prepared in the year 2012-13 for the city under Rajiv Awas Yojana, a Government of India (GoI) sponsored scheme to improve civic infrastructure in slums, revealed that a total of 29,987 households were in slum areas. Only 8,129 (27.1 per cent) households had toilets on their premises while 7,197 (24 per cent) households depended on CTs/PTs and the remaining practiced OD. It is important to understand the same and identify deficiencies and intervention strategies to ensure development of an inclusive plan addressing the needs of 100 per cent of the city's population.

The action plan designed to mitigate the deficiencies is presented in the following section.

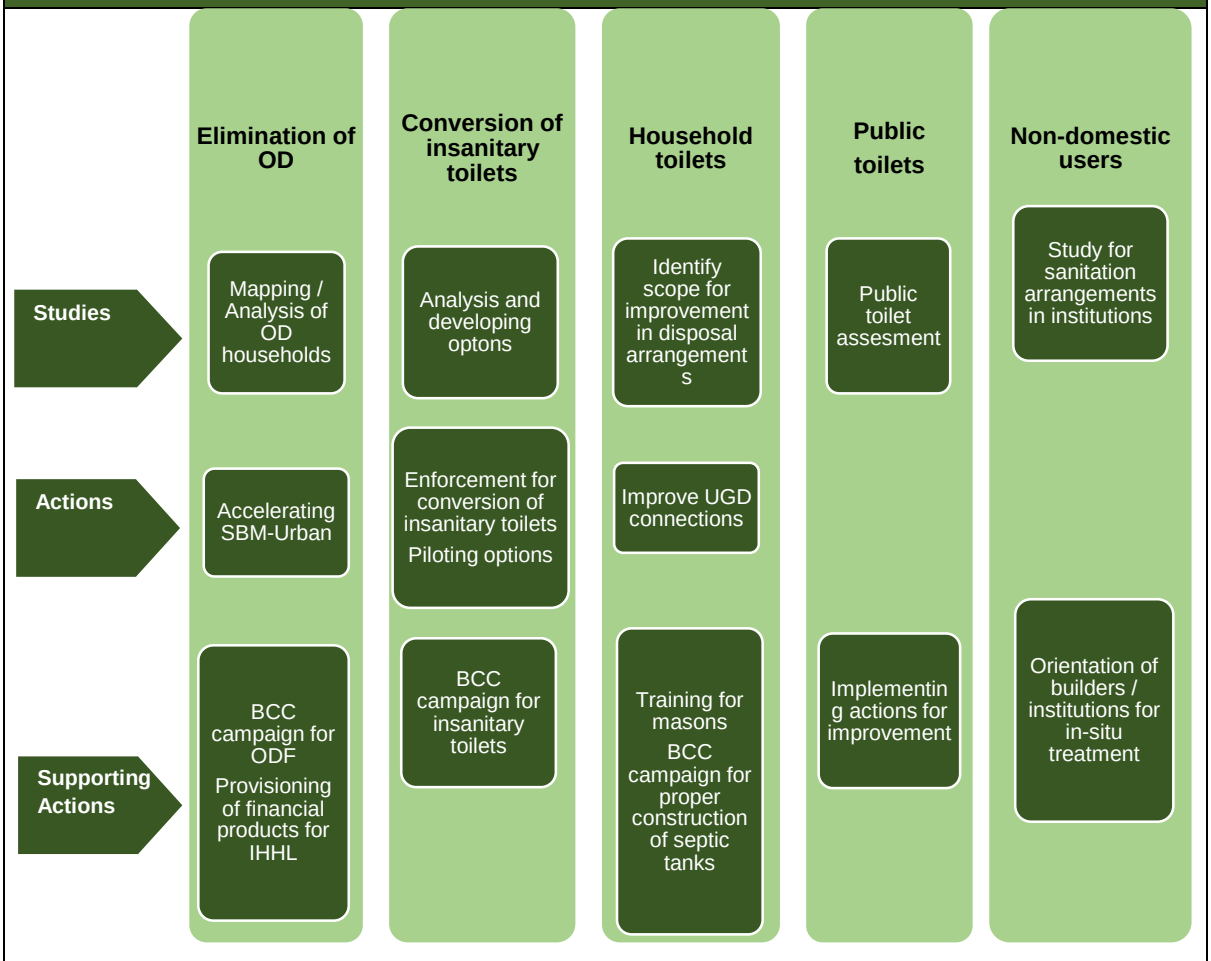
5 Action Plan to Address Deficiencies in Sanitation Planning and Management

5. Action Plan to Address Deficiencies in Sanitation Planning and Management

This section describes the action plan and options to address the deficiencies across the sanitation chain. Action plan recommendations across all stages of the sanitation chain comprise a mix of assessments/studies, actions to be taken by TCC, as well as communication and training needs to ensure/improve the uptake of the proposed solutions.

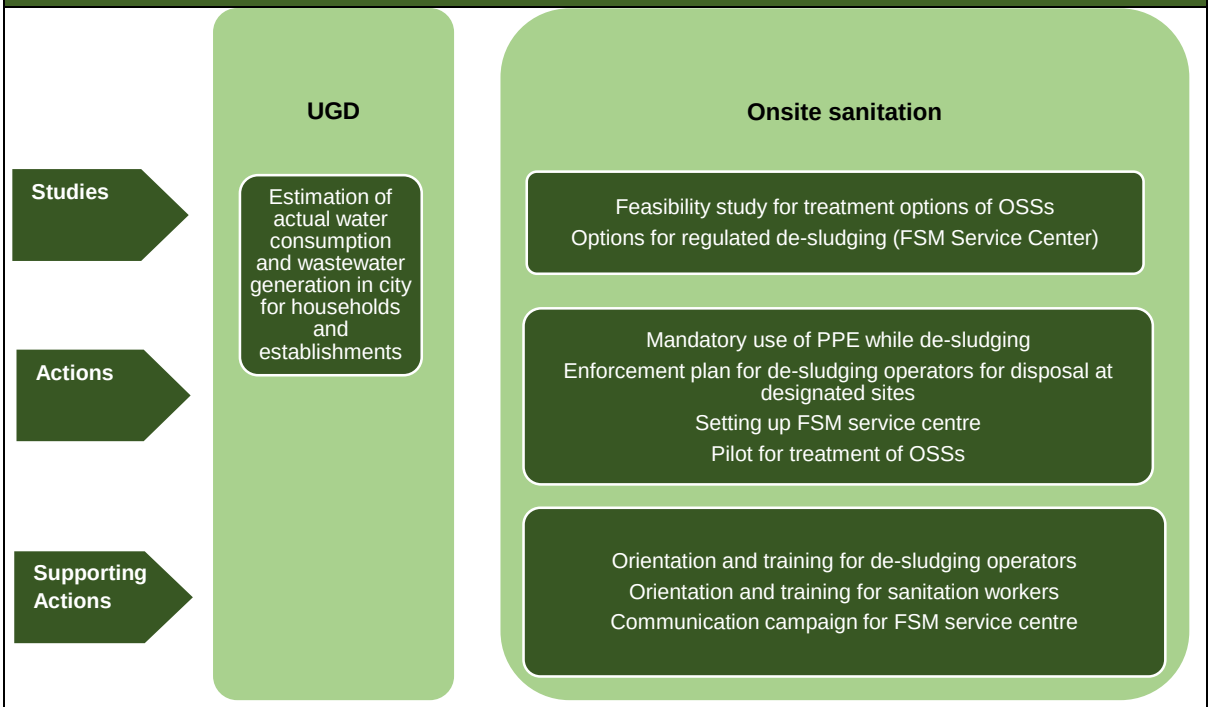
Figures 5.1 – 5.3 summarise the action plans for the containment, conveyance and treatment stages of the sanitation chain in the city.

Figure 5.1: **Action Plan for Improvements in Containment**



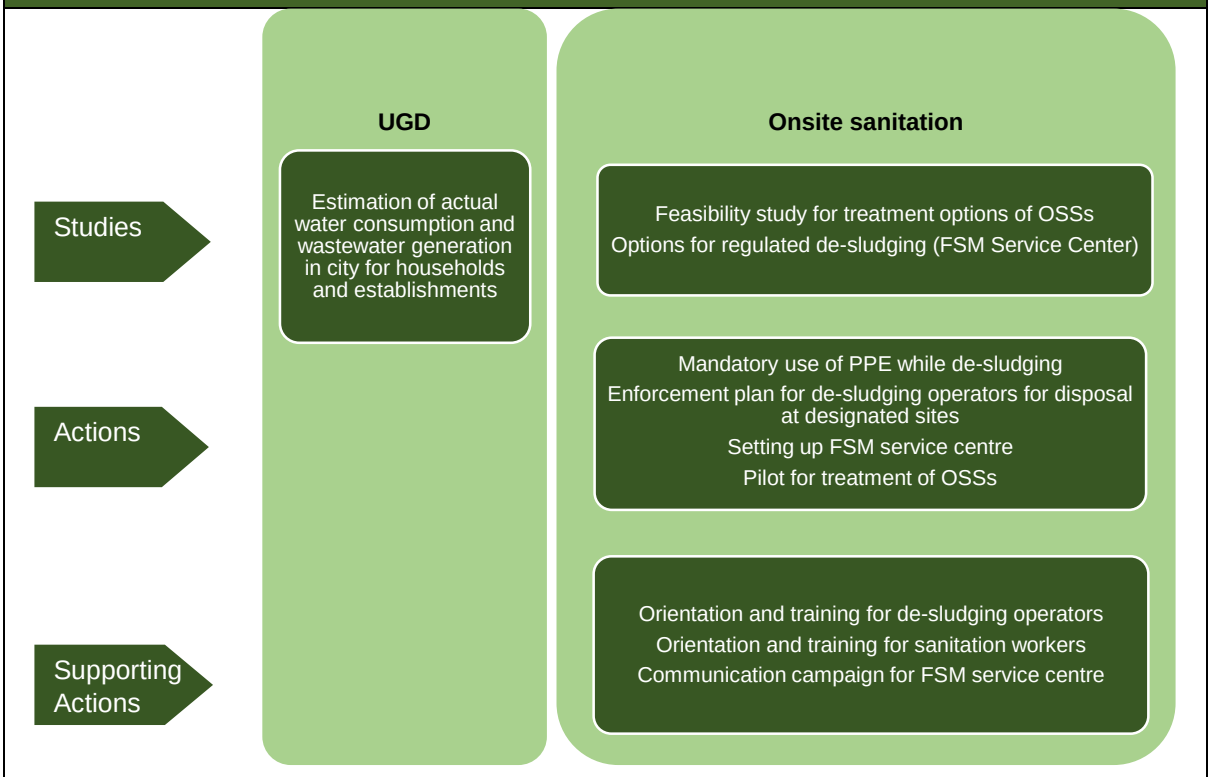
Source: TNUSSP analysis, 2018

Figure 5.2: **Action Plan for Improvements in Conveyance**



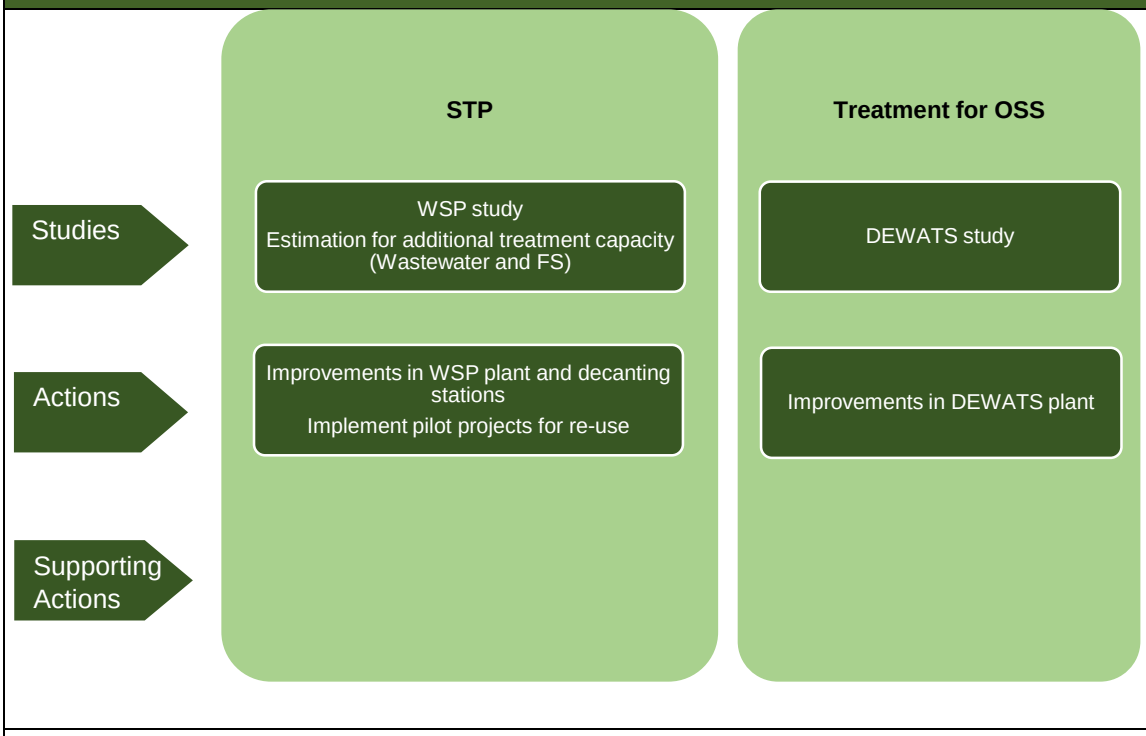
Source: TNUSSP analysis, 2018

Figure 5.3: Action Plan for Improvements in Conveyance



Source: TNUSSP analysis, 2018

Figure 5.4: Action Plan for Improvements in Treatment and Disposal



Source: TNUSSP analysis, 2018

Each of these actions are discussed in more detail in the following section.

5.1. Action Plan to Address Deficiencies in Safe Containment

The action plan for the containment stage comprises the following key elements:

5.1.1. Elimination of OD

The following actions are envisaged for implementation for elimination of OD in the city.

1. CON01: Mapping/Analysis of OD households

CON01: Mapping/Analysis of OD households	
Timeframe	Short term
Objective	Maintenance of city ODF status
Intervention type	Study/assessment
Description	This is part of an on-going exercise being undertaken by TCC, to identify households practicing OD to allow provisioning of individual household toilets or access to CTs. The city became ODF in December 2016, and has been pursuing construction of new individual household toilets as well as CTs to eliminate OD.
Investment cost	Included in existing budgetary allocations
O&M cost	-

2. CON02: Accelerating implementation of SBM-Urban

CON02: Accelerating implementation of SBM-Urban	
Timeframe	Short term
Objective	Elimination of OD
Intervention type	Implementation/Action
Description	TCC has attained ODF status, which has been largely achieved through interventions around Behaviour Change and Communication (BCC), as well as upgrading and promoting the use of existing CTs. Accelerating SBM (Urban) implementation is in line with the current priorities of the TCC and GoTN to eliminate OD in cities.
Investment cost	Rs. 2.2 crore
O&M cost	-

3. CON03: Provisioning of financial products for IHHL

CON03: Provisioning of financial products for IHHL	
Timeframe	Short term
Objective	Elimination of OD
Intervention type	Supporting actions
Description	A household financing study was conducted with the objective of assessing the following: a. Need for toilet b. Community dependence on CTs/PTs c. Understand the ability of households to repay the sanitation loan Findings from the household financing study revealed the following gaps in the sanitation chain which require financial assistance: a. Households b. Enterprises involved in running the CTs/PTs c. Enterprises involved in the desludging business This study will be followed up with consultations with MFIs and the lending agencies for financing. With their support, a range of products will be finalised for the different communities to provide financing as appropriate, based on the identified financial gap.
Investment cost	Rs. 1,50,000
O&M cost	

4. BCC campaign for maintaining city ODF status

CON04: BCC campaign for maintaining city ODF status	
Timeframe	Short term
Objective	Elimination of OD
Intervention type	Supporting actions
Description	This is a part of the larger Muzhu Sugadharam campaign of the GoTN designed to trigger and empower the community to aspire for construction and usage of household toilets that can ensure health, safety, privacy, comfort and dignity to all members of the society. The campaign will help facilitate stakeholder discussions linking unhygienic practices with ill-health impact, aimed at persuading the stakeholders to address the issue collectively.
Investment cost	Budgeted for funding under SBM (Urban) and TNUSSP
O&M cost	-

5.1.2. Conversion of insanitary toilets

The following actions are envisaged for implementation, in order to for eliminate OD in the city.

5. CON05: Situation analysis and developing options for insanitary toilets

CON05: Situation analysis and developing options for insanitary toilets	
Timeframe	Short term
Objective	Conversion of insanitary toilets
Intervention type	Study/assessments
Description	This study is proposed to be undertaken in conjunction with the household OD survey and will aim to identify households that continue to use insanitary toilets (over and above the 7,000 insanitary toilets being converted by the city at present). The study will also attempt to identify the reason for the lack of suitable containment of discharge infrastructure (lack of space, limited finances, and others), which will be used to develop the detailed action plan for conversion of all insanitary toilets.
Investment cost	Rs. 22.5 lakh
O&M cost	-

6. CON06: Piloting/enforcement for conversion of insanitary toilets

CON06: Enforcement for conversion of insanitary toilets	
Timeframe	Short term

CON06: Enforcement for conversion of insanitary toilets	
Objective	Conversion of insanitary toilets
Intervention type	Implementation/action
Description	ULB has conducted enforcement drives in the past for conversion of insanitary toilets. A similar process is being suggested to identify households with insanitary toilets and enforce conversion.
Investment cost	Budgeted for funding under SBM (Urban)
O&M cost	-

7. Piloting options for conversion of insanitary toilets

CON07: Piloting options for conversion of insanitary toilets	
Timeframe	Short term
Objective	Conversion of insanitary toilets
Intervention type	Implementation/action
Description	Findings from the study identifying insanitary toilets (CON05) will be used to develop options for conversion of insanitary toilets, depending on the specific constraints identified under the assessment. This action will be implemented to design and pilot interventions for households where an immediate/conventional solution (such as connection to the UGD network or construction of household septic tank) is not a viable option, either due to lack of space within the household or unavailability of the network in the household vicinity. Solutions could include community septic tanks, decentralised treatment etc. depending on the specific constraints identified under the assessment study.
Investment cost	Rs. 24 lakh
O&M cost	-

8. BCC campaign for conversion of insanitary toilets

CON08: BCC campaign for conversion of insanitary toilets	
Timeframe	Short term
Objective	Conversion of insanitary toilets
Intervention type	Supporting action

CON08: BCC campaign for conversion of insanitary toilets	
Description	The communication campaign will aim to emphasise conversion of insanitary toilets to sanitary toilets through animation film and opening up the issues to public discussion. The campaign will aim to engage the stakeholders on analysing options and choosing suitable solutions for safe sanitation.
Investment cost	Budgeted for funding under SBM (Urban)
O&M cost	-

5.1.3. Addressing deficiencies in design of household toilets

The following actions are envisaged for improving the existing toilets and containment arrangements in the city.

9. Identify scope for improvements in disposal arrangements

CON09: Identify scope for improvements in disposal arrangements	
Timeframe	Short term
Objective	Improving existing toilet arrangements
Intervention type	Study/assessment
Description	The study will aim to characterise existing toilet arrangements in all households with individual toilets and identify constraints vis-à-vis design and construction of toilet structure and disposal arrangements. The study will identify the households connected to improperly constructed septic tanks as well as households in sewered areas that may not be connected to the network. Specifically, the study will: 1. Conduct a survey to understand the number of HSCs connected to UGD in areas either fully or partially covered by sewerage network. 2. Identify reasons for non-connection to the network, and prevalence of septic tanks, even in areas presumably fully covered by the UGD network. 3. Identify constraints from the city, as well as city residents, to connecting to the UGD network 4. Identify the disposal method for the effluent from septic tanks in areas covered by UGD network – whether the outlet from septic tanks is connected to the UGD network (either through an authorised or unauthorised connections), flowing into open drains, inter-linkages and potential for septic tank effluent to enter the UGD network. 5. Design of septic tank, and effluent disposal arrangements in the non-sewered parts of TCC.
Investment cost	
O&M cost	Rs. 20 lakh

10. Improve house service connections to UGD

CON10: Improve house service connections to UGD network	
Timeframe	Short term
Objective	Improving toilet and disposal arrangements
Intervention type	Action/implementation
Description	The interventions to improve and increase toilet connections to the network will be designed on the basis of findings from the toilet arrangements study (CON 09) and the design basis of the existing and proposed UGD network in the city.
Investment cost	
O&M cost	Rs. 5 lakh

11. Training for Masons on Design and Construction of OSSs

CON11: Training for masons on design and construction of OSSs	
Timeframe	Short term
Objective	Improving toilet and disposal arrangements
Intervention type	Supporting action
Description	Training is being provided to masons to educate them on how to construct properly designed septic tanks and twin pits latrines and the optimal maintenance protocols for the same. A hands-on experience on building septic tanks and twin pit latrines with clay is part of the training curriculum, which is being provided by CDD and Gramalaya.
Investment cost	Rs. 4.5 lakh
O&M cost	-

12. BCC campaign for proper construction and maintenance of septic tanks

CON12: BCC campaign for proper construction and maintenance of septic tanks	
Timeframe	Short term
Objective	Improving toilet and disposal arrangements
Intervention type	Supporting action
Description	A campaign focusing on the do's and dont’s of construction and maintenance of septic tanks will complement the training being provided to masons and the households, to understand and learn how to construct a proper septic tank and maintain it. The campaign will also focus on promoting regular desludging for effective functioning of septic tanks and discuss the options available for safe disposal, treatment and reuse.

CON12: BCC campaign for proper construction and maintenance of septic tanks	
Investment cost	Included in budget allocations under SBM (Urban)
O&M cost	-

5.1.4. Addressing deficiencies in availability and operation of CTs/PTs

The following actions are envisaged to address the deficiencies in the availability and operation of CTs/PTs.

13. Assessment of existing CTs/PTs

CON13: Assessment of existing CTs/PTs	
Timeframe	Short term
Objective	Improving toilet and disposal arrangements
Intervention type	Study/assessment
Description	The PT assessment will be part of an ongoing detailed survey being undertaken for all CTs/PTs in the city, and aims to record detailed information on each toilet including water supply, electricity supply, responsibility for O&M, operational challenges, average number of users, user charges and business models. The specific objective of the survey is to understand the following: a) Number of users depending on each PT and CT b) Infrastructural and sanitary condition of CTs/PTs c) Current practices of O&M d) User perceptions e) Scope for renovation and retrofitting The assessment survey will be conducted using four types of tools: a) CT/PT condition assessment format b) Exit interview of the users c) Household interviews in communities adjacent to each CT/PT d) User tallies This study will help assess the actual number of residents using the public sanitation facilities and the number of unserved or underserved areas.
Investment cost	Rs. 1.2 lakh
O&M cost	-

14. Study on PTs available to serve floating population

CON14: Study on PTs available to serve floating population	
Timeframe	Short term
Objective	Improving toilet and disposal arrangements
Intervention type	Study/assessment
Description	This study will be undertaken to specifically assess the extent and location of PTs provisioned to meet the requirements of the floating population in the city through: 1. Identifying and listing the existing PTs in the area that serve the floating population through Rapid mapping 2. Observing and assessing the condition of each PT and tentative population it caters to through physical observation/assessment. 3. Identifying the number of toilets that require retrofitting or rehabilitation and the investment required for the same. 4. Identifying the places where extensive floating population exists and corroborating the list of floating population areas with the list of existing PTs, and identifying the areas and population size not covered. 5. Developing suitable options in the form of additional PTs or mobile toilets etc. to serve the unserved areas and floating population.
Investment cost	~Rs. 5 lakh
O&M cost	-

15. Implementing actions for improvements in CTs/PTs

CON15: Implementing actions for improvements in CTs/PTs	
Timeframe	Short term
Objective	Improving toilet and disposal arrangements
Intervention type	Implementation/action
Description	This action plan will be developed as a consequence of CON13 and CON14 assessing the status of existing CTs/PTs in TCC and the availability of PTs in high floating population areas, respectively. This will include a mix of: 1. Renovation of existing PTs that are inadequate in terms of performance and amenities. The investment required will depend on findings related to the existing conditions and inadequacies of the PTs 2. Construction of new PTs to service the floating population. The investment required will depend on the number of additional required to service the floating population load. 3. Rehabilitation of existing CTs: The scope for this action will be determined based on the findings from CON13 which will identify the scope for renovation and retrofitting required on PTs and CTs. The CT/PT condition assessment format survey tool will be used, which has

CON15: Implementing actions for improvements in CTs/PTs	
	pre-coded structured questions. The indictors will be broadly classified according to following groups and sub-groups. 1. Physical infrastructure a. Super structure b. Substructure 2. Water supply 3. Electric supply 4. Waste disposal and drainage 5. O&M arrangement
Investment cost	To be determined based on inputs sought from TCC
O&M cost	-

5.1.5. Action plan to address the deficiencies in information on non-domestic connections and consumers in TCC

The following actions are envisaged to improve understanding of the non-domestic users in TCC, and the type of toilet and disposal arrangements available with these users.

16. Study on sanitation arrangements and wastewater generation in institutions

CON16: Study on sanitation arrangements and wastewater generation in institutions	
Timeframe	Short term
Objective	Improving toilet and disposal arrangements
Intervention type	Study/assessment
Description	This study will focus on identifying the non-domestic (institutions, commercial establishments etc.) located within TCC limits, and the sanitation arrangements and users in each of these. The number of non-domestic HSCs will be identified, along with the number of users contributing to waste flows. The study will identify the existing arrangement for wastewater containment and conveyance, the prevalence of septic tanks, PTs and any on-site sewage treatment provided to determine the additional wastewater and FS contribution from these areas.
Investment cost	~Rs. 10 lakh
O&M cost	-

17. Orientation of builders/institutions for in-situ/on-premises treatment

CON17: Orientation of builders/ institutions for in-situ/on-premises treatment	
Timeframe	Short term

CON17: Orientation of builders/ institutions for in-situ/on-premises treatment	
Objective	Improving toilet and disposal arrangements
Intervention type	Supporting action
Description	The action will focus on providing training and creating awareness on the options and benefits for on-site treatment of wastewater, including decentralised wastewater treatment, for institutions and establishments.
Investment cost	Rs. 1 lakh
O&M cost	-

5.2. Action Plan to Address Deficiencies in Conveyance of Wastewater and Fecal Sludge

The following actions are envisaged for addressing the deficiencies in the wastewater conveyance and FS transportation systems within TCC.

5.2.1. Action plan to address deficiencies in conveyance through the UGD network

1. Study on actual water consumption and wastewater generation in the city

TRAN01: Assessment of actual water consumption and wastewater generation in TCC	
Timeframe	Short term
Objective	Improving wastewater and FS transportation
Intervention type	Study/assessment
Description	This assessment is required to understand the number and types of toilets that contribute wastewater to the system, either through the UGD, or through septic tanks (and therefore drains, which means FS entering the system). This information is currently lacking, and should be gathered to supplement the municipal wastewater data. This will require quantification of the likely water sources apart from typical estimates of municipal piped water supply. This will help understand leakages in the collection system, and develop an action plan for the same.
Investment cost	~Rs. 7 lakh
O&M cost	-

5.2.2. Action plan to address the deficiencies in transportation of FS

2. Feasibility study for treatment options of OSS structures

TRAN02: Feasibility study for treatment options for FS from OSS structures	
Timeframe	Short term

TRAN02: Feasibility study for treatment options for FS from OSS structures	
Objective	Improving wastewater and FS transportation
Intervention type	Study/assessment
Description	Develop options and assess feasibility of options for the treatment of FS from OSSs. Currently, these structures results in generation of partially treated effluent (overflow from the septic tanks), which is discharged untreated into the natural drains, resulting in contamination and poor health and sanitation in the vicinity of the household. The study will identify and assess the feasibility of options for the treatment of FS.
Investment cost	~Rs. 10 lakh
O&M cost	-

3. Enforcement of PPE use while desludging

TRAN03: Enforcement of PPE use while desludging and other welfare measures	
Timeframe	Short term
Objective	Improving wastewater and FS transportation
Intervention type	Action/implementation
Description	TCC will implement an enforcement plan to ensure the proper use of PPE by all operators and employees engaged in the desludging of septic tanks. The city has existing requirements for operators to include the use of PPE, and this is a stipulated requirement of the license agreements between the city and private desludging operators, and the city has been making efforts to ensure compliance with these requirements in the field. Action will continue towards ensuring that all operators use PPE to maintain the health and safety during septic tank emptying. In addition, measures to promote worker welfare such as health camps, insurance etc. will be communicated and linkages established.
Investment cost	Rs. 10 lakh
O&M cost	-

4. Setting up FSM Service Centre

TRAN04: Setting up FSM Service Centre	
Timeframe	Medium term
Objective	Improving wastewater and FS transportation
Intervention type	Action/implementation

TRAN04: Setting up FSM Service Centre	
Description	This action is linked to a recently concluded study on operationalising an FSM Service Centre and the institutional and operational recommendations arising out of the study. This action will result in the establishment of an FSM Service Centre for centralised management of requests for septic tank desludging. This could be implemented as a pilot for a portion of the city across select wards, or could be rolled out across the city, depending on the findings and recommendations from TRAN03.
Investment cost	Rs. 35 lakh
O&M cost	-

5.3. Action Plan to Address Deficiencies in Existing Wastewater and FS Treatment

The actions envisaged for improvements in the treatment stage are described in the following section.

5.3.1. Action plan for improvements in wastewater treatment

1. Study on alternatives for reuse of treated wastewater and sludge

TRT01: Study on alternatives for reuse of treated wastewater and sludge	
Timeframe	Short term
Objective	Improving wastewater and FS treatment
Intervention type	Study/assessment
Description	This action will aim to identify and assess the feasibility of different reuse options for wastewater and sludge from the STP.
Investment cost	Rs. 7.5 lakh
O&M cost	-

2. Improvements in WSP plant and decanting stations

TRT02: Improvements in WSP plant and decanting stations	
Timeframe	Short term
Objective	Improving wastewater and FS treatment
Intervention type	Action/implementation

TRT02: Improvements in WSP plant and decanting stations	
Description	This action will be implemented based on the findings of TRT01 on the wastewater flows and FS received at the STP, as well as the performance of individual units at the STP. The measures for implementation will likely include ones to improve flow and performance monitoring based on gaps identified under TRT01 as well as measures to improve the treatment performance of individual units. A more detailed investment plan is provided in the following section
Investment cost	~Rs. 2 crore
O&M cost	-

3. Implement pilot projects for re-use

TRT03: Implement pilot projects for re-use	
Timeframe	Short term
Objective	Improving wastewater and sludge treatment
Intervention type	Action/implementation
Description	This action will aim to pilot the recycling and reuse of treated wastewater, either for irrigation in the green belt surrounding the STP site, or for supply to industrial or commercial customers. The feasibility of the different options and implementation arrangements and design will be part of the study undertaken under TRT01.
Investment cost	Rs. 20 lakh
O&M cost	-

5.4. Detailed Investment Plan

This section describes the estimated investment required to implement the actions described in the preceding section, the basis for estimating the same and the phased investment plan (over a five-year period) required to operationalise the action plan.

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
CON01 CON13 TRAN01	Mapping/analysis of OD households and sanitation arrangements in TCC							
	CON01A CON05A CON09A CON010A TRAN01A	Mapping of households						
	CON01Aa CON05Aa CON09Aa CON010Aa TRAN01Aa	*Household survey covering all households in TCC and analysis to understand a) The number of HSCs connected to UGD and identify reasons for non-connection to the network b) Wastewater disposal arrangements from OSS c) Water consumption along with quantities from each source of water for households – to quantify actual water consumption*	2018	1	2018	30	67,50,000	67,50,000
	CON01Ab CON13Aa	*Feedback on condition of CTs/PTs*	2018	1	2022	50	22,500	1,12,500
	CON01Ac	*Monitoring of continued ODF status in the city*	2018	1	2018	200	18,00,000	18,00,000
CON02 CON14 CON15	Accelerating implementation of SBM-Urban							
	CON02A CON15A	Upgrading existing CTs/PTs						
	CON02Aa CON015Aa	*Upgrading infrastructure at problematic CTs/PTs, renovations and retrofits*	2018	1	2020	20	60,00,000	1,80,00,000
	CON02Ab CON015Ab	*Training to community members/volunteer groups/NGOs/enterprises on maintenance of CT/PT*	2018	4	2020	0	40,000	4,80,000

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
	CON02B CON14A CON15B	Construction of new CTs/PTs						
	CON02Ba *CON14Aa*	*Assessment of sufficiency of existing CTs/PTs to serve households without toilets, the floating and disabled population, and develop options, including mobile toilets*	2018	1	2018	0	5,00,000	5,00,000
	CON02Bb *CON15Ba*	*Design and construction of new CTs/PTs in areas with insufficient access to toilets*	2018	1	2019	4	40,00,000	80,00,000
	CON02Bb *CON15Ba*	*Procurement/hiring of mobile toilets*	2018	4	2019	0	1,50,000	12,00,000
CON03	Provisioning of financial products							
	CON03A	Supporting development of financial products for enterprises in sanitation						
	CON03Aa	*Organise consultations with MFIs and lending agencies, awareness generation/dissemination among stakeholders*	2018	1	2020	0	50,000	1,50,000
CON04 **CON08** **CON12**	BCC campaign for maintaining city ODF status, conversion of insanitary toilets and proper construction and maintenance of septic tanks							
	CON04A CON08A CON12A	Stakeholder interactions						

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
	CON04Aa *CON08Aa* *CON12Aa*	*Conduct stakeholder interactions on* *1) Linkage of unhygienic practices with ill-health,* *2) Conversion of insanitary toilets,* *3) Design of septic tanks* *4) O&M and regular desludging of septic tanks* *5) Practices for safe disposal of FS*	2018	4	2020		20,000	2,40,000
	CON04B	Constituting ward/community-level committees to promote behaviour change and proper construction and use of toilets						
	CON04Ba *CON12Ba*	*Develop communication material on behaviour change, sanitation – hygiene connect, and use of toilets, proper design and O&M of septic tanks*	2018	1	2018	0	2,50,000	2,50,000
	CON04Bb *CON12Bb*	*Initiate and continue BCC campaigns to promote use of toilets and proper design of septic tanks – through TCC and through support to NGOs/ partners.*	2018	4	2018	0	50,000	2,00,000
	CON04Bc	*Provide support for setting up and replication of ward-level committees for behaviour change and promoting toilet use to cover entire TCC area*	2018	12	2020		65,000	23,40,000
CON05	Situation analysis and developing options for insanitary toilets							
	CON05B	Pre-feasibility study to identify and assess suitability of different options for conversion of insanitary toilets						
	CON05Ba	*Identification and technical pre-feasibility assessment of different solutions to convert insanitary toilets*	2018	1	2018		20,00,000	20,00,000

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
	CON05Bb	*Identification and assessment of institutional, regulatory and policy barriers and enablers towards conversion of insanitary toilets*	2018	1	2018		2,50,000	2,50,000
CON06/ 07	Piloting/enforcement for conversion of insanitary toilets							
	CON06/7A	Supporting conversion of insanitary toilets						
	CON06/7Aa	*Pilot technical solutions for conversion of insanitary toilets in upto two locations*	2018	1	2019		10,00,000	20,00,000
	CON06/7Ab	*Uptake and rollout of conversion of all insanitary toilets across the TCC area*	2019	4	2019		1,00,000	4,00,000
	CON06/7B	Supporting policy and institutional changes/policy interventions for conversion of insanitary toilets						
	CON06/7Aa	*Institute policy changes – based on findings in pre-feasibility assessment, covering for example:* *1. Serving poor, slum and unserved areas* *2. Financial support from TCC for toilet construction* *3. Incentives for communities to convert all insanitary toilets*	2018		2020		-	-
	CON06/7Ab	*Enforce conversion for identified households with insanitary toilets*	2018		2020		-	-
CON09 CON11	Addressing deficiencies in design of household septic tanks							
	CON09C	Identifying deficiencies in design of septic tanks						
	CON09Ca	*Expand survey to determine design configurations of septic tanks structures in the city – using ground penetrating tools*	2018	1	2018		20,000	20,000

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
	CON09Cb	*Identification and technical feasibility assessment (including field testing in household septic tanks) of solutions to address deficiencies in design of septic tanks*	2018	4	2018		5,00,000	20,00,000
	CON09D CON11A	Addressing deficiencies in design of septic tanks						
	CON11Aa	*Provide training for masons on design and construction of OSSs*	2018	2	2020		75,000	4,50,000
CON10	Improving household connection to UGD							
	CON10C	Improving HSC connection to the UGD network						
	CON10Ca	*Pilot improvement of UGD connectivity and ensure no wastewater flows in storm water drains in upto two sites in the sewered part of TCC*	2018	1	2019		2,50,000	5,00,000
	CON10Cb	*Scale up improvements in UGD connectivity*	2019	1	2020		-	-
	CON10Cb	*Improve policy and institutional frameworks for the implementation and monitoring of new HSCs*	2018	1	2020		-	-
CON16	Improve understanding of non-domestic connections and consumers in TCC							
	CON16A	Identify and quantify wastewater generation from bulk generators						
	CON16Aa	*Survey of all bulk generators within TCC, identifying sanitation and wastewater disposal arrangements and quantification of wastewater generation from these users*	2018	1	2018	5,000	25,00,000	25,00,000
	CON16B	Improve wastewater treatment and disposal from bulk generators						

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
	CON16Ba	*Promote adoption of industrial/commercial wastewater pre-treatment program for one part of the city*	2019	1	2019		-	-
	CON16Bb	*Scale up the industrial/commercial wastewater pre-treatment program across the city*	2020	1	2021	2,000	2,00,000	4,00,000
	CON16Bc	*Initiate stakeholder dialogues with industry/commercial users on segregation of non-municipal wastewater and disposal solutions*	2019	2	2021		20,000	1,20,000
	CON16Bd	*Capacity building for builders/bulk generators to adopt in-situ/in-premises treatment*	2018	2	2019		20,000	80,000
Conveyance of FS								
TRAN02 TRAN03 TRAN04 TRAN05	Management of FS							
	TRAN02A TRAN03A	Pre-feasibility study to identify and assess suitability of different options for treatment of sludge and wastewater from OSS structures						
	TRAN02Aa	*Identification and technical feasibility assessment of different solutions for the treatment of FS from OSSs*	2018	1	2019		5,00,000	10,00,000
	TRAN03 /4 / 5A	Implementation of FSM collection, treatment and disposal plan						
	TRAN04Aa	*Pilot implementation of FSM Service Centre across a part/select wards within the city*	2018	1	2018		25,00,000	25,00,000
	TRAN04Ab	*Scale up and roll out implementation of FSM Service Centre across the TCC area*	2020	1	2020		10,00,000	10,00,000

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
	TRAN03Aa	*Study on welfare requirements for desludging operators (including insurance, benefits, worker health and safety etc.)*	2018	1	2018		7,50,000	7,50,000
	TRAN03Ab	*Institute policy and institutional change to regulate and enforce safe FSM practices, covering for example:* *1. Enforcement of PPE use while desludging* *2. Safe practices during emptying and transportation* *3. Disposal at designated site*	2018				-	-
	TRAN03Ac	*Stakeholder interactions, training and communication with desludging operators to impact best practices in emptying and transportation of FS, worker health and safety, worker welfare etc.*	2018	4	2020		20,000	2,40,000
Treatment and disposal of wastewater and FS								
TRT01 **TRT02** **TRT03** **TRT04**	Enhancing wastewater treatment capacity							
	TRT01A TRT02A	Alternatives for reuse of treated wastewater and sludge						
	TRT01Aa *TRT03Aa*	*Assessment study to identify/assess alternatives for reuse of treated wastewater and sludge*	2018	1	2018		7,50,000	7,50,000
	TRT02B TRT04A	Augmentation of wastewater treatment and reuse capacity						
	TRT02Ab	*Implement upgrades/initiate rehabilitation works recommended at the existing STP and four decanting stations*	2018	1	2020		65,00,000	1,95,00,000

Table 5.1: Detailed Investment Plan								
Action	**Activity description**		**Commencement year**	**Replication frequency (per year)**	**Year until completion of activity**	**Unit cost in Rs.**		**Total investment required (Rs.)**
						Per household or CT/PT	**Per activity occurrence**	
	TRT03Aa	*Pilot implementation of reuse and recycle of treated wastewater and sludge at upto two locations within the city*	2019	1	2020		10,00,000	20,00,000
	TRT03Ab	*Scale up of wastewater and sludge reuse*	2018	1	2020		-	-

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Tamil Nadu Urban Sanitation Support Programme (TNUSSP) supports the Government of Tamil Nadu and cities in making improvements along the entire urban sanitation chain.
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