

# Nesapakkam STP, Chennai Co-treatment Case Study

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## A. City Profile

Chennai, the capital of Tamil Nadu, is located in the northern part of the state. The city covers an area of approximately 426 km<sup>2</sup> and has a population of 7.1 million<sup>1</sup>.

In October 2011, the jurisdiction of the Chennai Municipal Corporation (CMC) was expanded to include 42 local bodies lying contiguous to the core city<sup>2</sup> increasing the Corporation's area from 176 to 426 km<sup>2</sup>. In 2016, the CMC was renamed as the Greater Chennai Municipal Corporation (GCMC).

The Chennai Metropolitan Water Supply and Sewerage Board<sup>3</sup> (CMWSSB) has been entrusted with the responsibility of planning, developing and regulating water supply and sewerage services in the GCMC area. For the purposes of planning and operation, the GCMC area has been divided into 15 zones and 200 divisions (Figure 1).

The GCMC is a part of the Chennai Metropolitan Area (CMA), which is spread over an area of 1189 km<sup>2</sup> and includes 7 municipalities, 12 Town Panchayats, 30 Census Towns, 11 Urban Outgrowths and 150 villages, along with the GCMC. The CMWSSB has also been made responsible for the provision of water supply and sewerage services in the entire CMA area<sup>4</sup> which it plans to undertake in a phased manner.

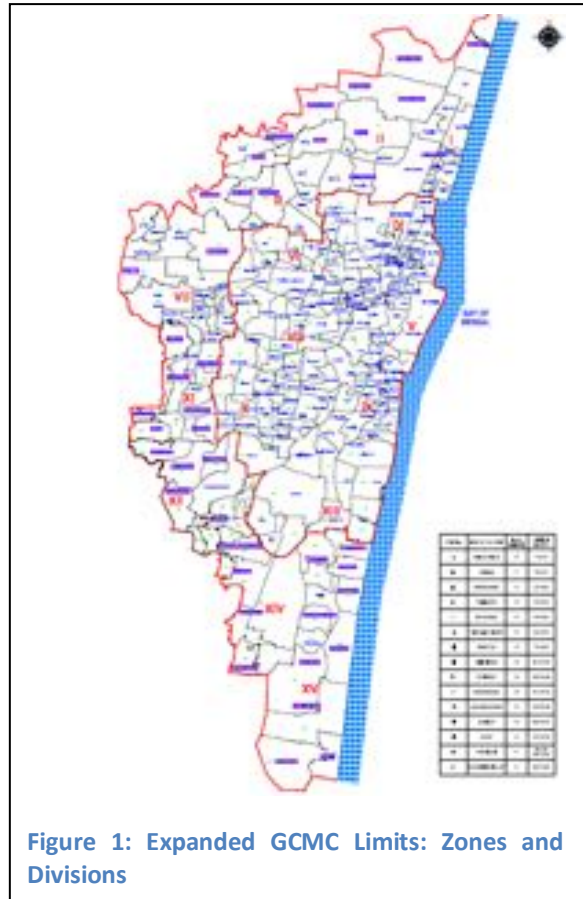


Figure 1: Expanded GCMC Limits: Zones and Divisions

**Access to toilets:** As per Census 2011, 96 percent households in the core city (erstwhile CMC area) had access to individual toilets and 3.8 percent were using public toilets. (Figure 2) Officials of CMWSSB shared that currently all households within erstwhile CMC area have individual toilets and only some households in slum pockets use public / community toilets.

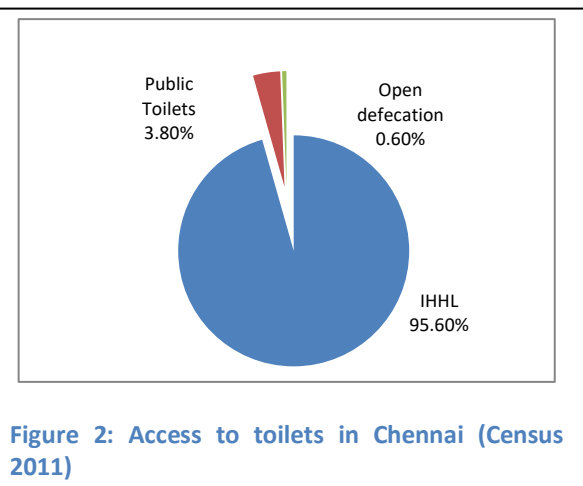


Figure 2: Access to toilets in Chennai (Census 2011)

<sup>1</sup> Source: Greater Chennai Municipal Corporation Website (<http://www.chennaicorporation.gov.in/about-chennai-corporation/aboutCOC.htm>)

<sup>2</sup> Including 9 municipalities, 8 Town Panchayats and 25 Village Panchayats

<sup>3</sup> The CMWSSB was established in 1978 under an Act of Tamil Nadu (Act 28) as a statutory body for exclusively attending to the growing needs of and for planned development and appropriate regulation of water supply and sewerage services in the Chennai Metropolitan Area.

<sup>4</sup> CMWSSB website (<http://www.chennaietrowater.tn.nic.in/metrowateroperationalarea.html>)

**Sewage collection and conveyance system:** As per Census 2011, majority of households (97 percent) in the core city (erstwhile CMC area) were connected to a piped sewer and less than 2 percent (~ 18,500 households) had septic tanks (Annex 1).

As per CMWSSB officials, currently the entire core city i.e., the erstwhile CMC area is covered with underground sewerage systems (UGSS) and CMWSSB plans to cover the entire GCMC area<sup>5</sup> in a phased manner. The details of the sewerage expansion plans are included in Annex 2.

**Sewage treatment facilities:** GCMC area is divided into five zones for sewage collection, conveyance, treatment and disposal. The city has 12 Sewage Treatment Plants (STPs) at five locations namely, Kodungaiyur, Koyambedu, Nesapakkam, Perungudi and Alandur with total installed capacity of 727 MLD.

Table 1 summarizes the installed capacities, treatment technology and the current flows received at the STPs. Details of the sewage treatment infrastructure in GCMC are included in Annex 3. The treated sewage is discharged into nearby water courses (Adiyar River, Captain Cotton Canal, BNC Canal and Cooum River) which eventually discharge into the Bay of Bengal.

**Table 1: Sewage Treatment Plants (STPs) in Chennai<sup>6</sup>**

Zone	Location	Capacity [MLD]	Waste water Flows (MLD)	Treatment Technology
1& II	Kodungaiyur	270	220	Activated Sludge Process
III	Koyambedu	214		Activated Sludge Process
IV	Nesapakkam	117	95-100	Activated Sludge Process
V	Perungudi and Alandur	126	103.5	Activated Sludge Process with anaerobic digestion (and extended aeration in Alandur)
	<b>Total</b>	<b>727 MLD</b>	<b>423.5<sup>7</sup></b>	

## B. Co-treatment – Genesis

Chennai initiated co-treatment of septage at STPs in the early 2000s. At present, co-treatment is being undertaken at three locations namely, Nesapakkam, Perungudi and Kodungaiyur. (Table 2) Nesapakkam services the south western part of the city, Perungudi services the southern part of the city and Kodungaiyur services the northern part of the city. This study on co-treatment of septage at STPs focuses on the Nesapakkam site.

**Table 2: STPs undertaking Co-treatment of Septage**

STP	Number of registered trucks	Number of trips per day
Nesapakkam	52	200
Perungudi	75	300
Kodungaiyur		50

The main driver for initiating co-treatment was to put an end to the practice of unauthorised dumping of septage into the city's waterways by private operators involved in desludging septic tanks which exist in areas that are not yet covered by UGSS. The CMWSSB started accepting discharge of septage at their STPs (three locations, Nesapakkam, Perungudi and Kodungaiyur) offering to treat the same at a nominal cost (of INR 100 per lorry per trip) in order to incentivise

<sup>5</sup> Including the additional 42 local bodies; covering an area of 250 km<sup>2</sup>.

<sup>6</sup> Source: CMWSSB

<sup>7</sup> This figure does not include the Waste water flow for Koyambedu STP

private operators to use the facility and to stop dumping septage in the city's open areas and/or waterways.

While the erstwhile CMC area is fully covered with UGSS, the adjacent local bodies (urban and rural) which were incorporated in 2011 are not yet fully covered and have a significant proportion of the households which have toilets with septic tanks. The co-treatment initiative is aimed at providing a facility for discharge of septage to private operators desludging septic tanks in these areas.

## Policy Framework for Septage Management

The Government of Tamil Nadu's (GoTN's) Vision 2023 is aimed at making the state totally sanitised by ensuring universal access to sanitation, implementation of UGSSs and setting up of adequate sewage treatment facilities. The state also notified its "Operative Guidelines for Septage Management for Urban and Rural Local Bodies" in September 2014<sup>8</sup>. The Commissioner, Municipal Administration and Water Supply Department, GoTN in his letter dated 01.09.2014<sup>9</sup> emphasised that absence of UGSS was resulting in unscientific disposal of septage and waste water which is causing environmental pollution.

The "Operative Guidelines for Septage Management for Urban and Rural Local Bodies" suggests a decentralised approach to septage management wherein clusters of ULBs have been identified for treatment of collected septage at earmarked STPs in the state. The ULBs have been entrusted with the responsibility of implementing the operative guidelines in areas under their jurisdiction. The operative guidelines provide inputs on the design and construction of septic tanks; pumping and desludging; transportation of septage; and its co-treatment at STPs. The operative guidelines require all private desludging operators to be certified and licensed by the respective ULBs.

With respect to co-treatment, the guidelines recommend that each STP should create a **decanting facility** designed on the basis of the expected volumes of septage for a five year planning horizon. Detailed design guidelines for the decanting facility are also included in the operative guidelines. In addition, in order to ensure that industrial waste is not disposed at the decanting facilities, the operative guidelines recommend **regular quality check of septage at inlet point**. The guidelines also make it mandatory for every STP to **employ a supervisor** who is to be entrusted with the responsibility of supervising the entry and exit of desludging trucks and ensuring that no industrial waste is dumped at the STP. The operative guidelines have also **suggested rates for the charges** including charges for households for desludging of septic tanks, transportation of septage and treatment costs. For details on the "Operative Guidelines for Septage Management for Urban and Rural Local Bodies" refer **Error! Reference source not found.4**.

## C. Co-Treatment at Nesapakkam STP

### Plant Background

Nesapakkam STP is located in Zone IV and serves the south western part of the GCMC area<sup>10</sup>. Spread over an area of 45 acres, the Nesapakkam site has three treatment trains with a combined installed capacity of 117 MLD (23 MLD, 40 MLD and 54 MLD respectively). All three STPs at Nesapakkam are based on an "Activated Sludge Process" (ASP) Technology. The combined waste water flow ranges from 95 to 100 MLD. The presence of spare treatment capacity (of up to 17-22 MLD) enabled implementation of co-treatment of septage at Nesapakkam STP.

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<sup>8</sup> Source: [http://www.tn.gov.in/virtual\\_directory/dtp/gorders/maws\\_e\\_106\\_2014\\_Ms.pdf](http://www.tn.gov.in/virtual_directory/dtp/gorders/maws_e_106_2014_Ms.pdf)

<sup>9</sup> Ibid

<sup>10</sup> including K. K. Nagar, Saidapet, Jaefferkhanpet, MGR Nagar, CIT Nagar, Ashok Nagar, Valasaravakkam, Ekkatuthangal, Jaibalaji Nagar, West Mambalam and part of Kodampakkam

**Table 3: Nesapakkam Sewage Treatment Plants<sup>11</sup>**

Location	Year of commissioning	Capacity [MLD]	Waste water Flows (MLD)	Treatment Technology
Nesapakkam STP	1974	23	95-100	Activated Sludge Process
Nesapakkam STP	2006	40		Activated Sludge Process
Nesapakkam STP	2014	54		Activated Sludge Process
<b>Total</b>		<b>117</b>	<b>95-100</b>	

There are 28 Sewage Pumping Stations (SPS) within the area served by the Nesapakkam STP, which pump raw sewage from their respective areas to the terminal SPS located near the STP<sup>12</sup>. Treated wastewater from the Nesapakkam STP is discharged into the Adiyar River.

A small share (0.25 million litres) of treated wastewater is supplied to the GCMC for irrigation of parks for which the Corporation pays a fixed fee of INR 15,000 per month. However, there is no formal agreement for the supply of treated wastewater (with water quality specifications). The dried sludge which is good bio manure (with 2-3% NPK) is sold at a cost of INR 71.50 per ton. Detailed information on the Nesapakkam STP is presented in Annex 5.

### Planning and Implementation of Septage Co-treatment

Co-treatment of septage at Nesapakkam STP was initiated in July 2006. The unsewered urbanised areas lying in vicinity of Nesapakkam STP including Porur, Ramapuram, Kattupakkam, Iyappanthangal, Manapakkam are served by co-treatment at this STP. A large proportion of households in these areas have septic tanks which are desludged by private operators. Typical fees levied for desludging septic tanks varies from INR 900 to INR 2,000 per trip.

Fifty two private desludging trucks, each with a capacity of 9,000 Litres (9kL), are registered with the Nesapakkam STP for discharging septage. Discussions with the CMWSSB officials revealed that each truck makes multiple trips every day and about 200 truckloads of septage are discharged at Nesapakkam on a daily basis. While septage disposal is permitted only at the decanting facility located at the STP, CMWSSB permits septage discharge at specific SPS within the city during monsoon season due to high demand for desludging and therefore higher septage volumes.

### Volume and Quality of Septage

The facility receives about 200 truckloads of septage on a daily basis or about 1.8 MLD of septage which is blended with ~100 MLD of sewage (which is ~ 2 percent of the sewage flows). The STP Manager observed that septage addition and co-treatment has not resulted in any operational challenges at the STP, and there has not been any adverse impact on the treated water quality.

**Comparison of the characteristics of sewage and septage:** Septage has higher BOD and COD levels and also higher concentration of solids in comparison to sewage. (Table 4 and Table 5)

<sup>11</sup> Source: CMWSSB

<sup>12</sup> All but 3 SPS pump to the terminal SPS. Raw sewage from Valasaravakkam, Kodampakkam (part) and Jai Balaji Nagar is directly pumped to the STP inlet chamber through three sewage pumping stations<sup>12</sup>.

**Table 4: Raw Septage Characteristics<sup>13</sup>**

Parameter	Concentration (mg/l)
Total Solids	7000
Volatile Solids	5000
Fixed solids	3500
sBOD	250
TCOD	2500
sCOD	1070
Total Nitrogen	300
Ammonia	90
Sulphate	210
Sulphide	30
Total Phosphate	240

**Table 5: Raw sewage characteristics and effluent characteristics (54 MLD train at Nesapakkam)<sup>14</sup>**

	Parameter	Unit	Raw Sewage (value)
A	Total Suspended Solids	mg/l	500
B	BOD <sub>5</sub> @20 degree C	mg/l	380
C	COD	mg/l	900
D	Faecal coliform	MPN/100 ml	4.6X10 <sup>6</sup>
E	Oil and grease	mg/l	28

## Infrastructure Investments and Operational Changes for Co-treatment

**Decanting Station:** A decanting station has been created at the Nesapakkam STP to allow desludging trucks to discharge septage loads. This is in line with the recommendations of the “Operative Guidelines for Septage Management for Urban and Rural Local Bodies” issued by GoTN. Although located within the STP complex, the decanting facility has a separate entrance which is easily accessible from the main road and is enclosed prohibiting access to the rest of the STP. The trucks are permitted entry between 5 am and 5 pm every day except on Sundays and government holidays. The trucks come mostly between 5-8 am and 11-5 pm as they are not allowed to operate in the city during 8-11 am. The decanting station has sufficient space for up to four desludging trucks to decant simultaneously and has ample parking area for another three to four trucks.



Entrance of the decanting station



Parking space for trucks in the decanting station

<sup>13</sup> Source: CMWSSB

<sup>14</sup> Ibid

The decanting station comprises of a covered receiving tank followed by grit removal chamber and screens. The receiving tank is covered and connected to an odour control air scrubbing unit. Septage from the receiving tank flows into the trunk sewer line passing outside the decanting facility and flows into the terminal SPS feeding into the STP. The decanting station also has a CCD monitoring system which is yet to be operational.



The decanting facility (as well as the STP) is located in a residential neighbourhood. The entry to the decanting facility is located directly across a large residential complex. Odour control and aesthetics are therefore key concerns for the plant personnel in order to ensure that there are no objections from the residents. The plant is investing in upgrading the decanting facility to address these concerns and has incorporated the following features into the design:

1. Odour control unit connected to the receiving tank
2. High compound walls for the decanting facility
3. Greenbelt development within the STP (plants that absorb bad odour have been planted)
4. Discharge of septage directly into pits connected to the receiving tank to minimize scope for spillage

**Sampling and Monitoring Protocols:** As per the recommendations of the “Operative Guidelines for Septage Management for Urban and Rural Local Bodies”, regular testing of input quality of septage must be carried out to identify metals or traces of industrial waste. At present, regular sampling and analysis of septage isn’t being undertaken at Nesapakkam, although officials shared that if any septage load being discharged at the STP is suspected to be coming from an industrial source (identified by the plant attendant based on the colour and smell of septage), the operators



discontinue decanting from the truck, collect septage samples and test the same in the laboratory located within the STP complex.

In order to discourage private operators from discharging industrial effluent at the STP, there is a provision to penalize any private operator / truck driver caught discharging industrial effluent at the decanting station while also cancelling the registration of that particular truck with immediate effect. The operator / truck driver is not allowed to use the decanting services subsequently.

**Retrofits or additions to the treatment process:** Discussions with staff at the STP revealed that while mixing of septage with sewage prior to treatment has not resulted in any adverse impact on the STP or necessitated any additional capital infrastructure, some modifications were required in the plant's operation and maintenance, and these are discussed below:

- **Increase in aeration capacity:** The aeration tanks have four aerators (plus two standbys) to meet the aeration requirements of the treatment process. Each aerator has a capacity of 3,000 m<sup>3</sup> / hr, resulting in total aeration capacity of 12,000 m<sup>3</sup>/hr in the plant. Addition of septage to the STP required an increase in the aeration in the tanks. Plant engineers estimated that each truckload of septage (~9 kL) requires an additional 2 kg of air to maintain reactor performance and the desired effluent quality. The installed aeration capacity was sufficient and no additional capital investments were required towards aeration, however, the operational hours for aerators have increased. This has also resulted in increasing the energy cost of the plant.
- **Increase in sludge handling load:** Septage addition increased the sludge handling load on the STP, however, plant engineers observed that existing plant capacity was sufficient to handle the higher loads.

The grit chamber was designed for peak flows so addition of septage did not require any retrofitting or additions.

The flows vary through the day – there are two peaks on in the morning (7-9 am) and another slightly smaller peak in the evening (6-8 pm). The discharge of tankers takes place mostly from 5-8 am and 11-5 pm (as the desludging trucks are not allowed to ply in the city during 8-11 am). As per the officials the septage flows do not create any issues as the STP has an equalization tank which allows the flows to be distributed evenly throughout the day.

**Record keeping protocols:** In line with the recommendations outlined in the operative guidelines the decanting facility at Nesapakkam has a supervisor who is managing and supervising the entry of the vehicles in the decanting station. He maintains a “Daily Trip Sheet” within which he records the vehicle number, challan number, amount paid, number of trips unloaded and balance number of trips (on the amount paid).



**Housekeeping protocols:** As per the recommendations of the operative guidelines, all private operators must ensure that their staff (drivers and helpers) involved in the process of collection, treatment and disposal of sewage should be equipped with protective safety gears, uniforms, tools and proper vacuum trucks, to ensure safe handling of sewage. However, our visit revealed that while they have the tools and vacuum trucks, the staff was neither using protective gear nor a uniform.

## Financial Details

**Capital Cost:** The STP had to incur capital expenditure of about INR 20 million for creating a special decanting facility for discharge of septage. No additional retrofits or modifications requiring capital investment were made at the STP to enable co-treatment.

**O&M Cost:** The plant engineer shared that the O&M cost has increased slightly due to the higher aeration requirement.

**Table 6: O&M Costs at the Nesapakkam STP**

Treatment Train (MLD)	Annual O&M Cost (Rs./year)	Annual Energy Cost (Rs./year)	Cost per ML (Total O&M)	Cost per ML (Energy)
23	12,280,000	7,400,000 (60%)	1,780	1,072
40	16,824,000	9,400,000 (56%)	1,402	783
54	20,800,000	8,100,000 (39%)	1,284	500

**Registration Fee:** The private desludging trucks are charged a one-time registration fee of INR 2000 per truck. This amounts to be about INR 0.1 million per annum.

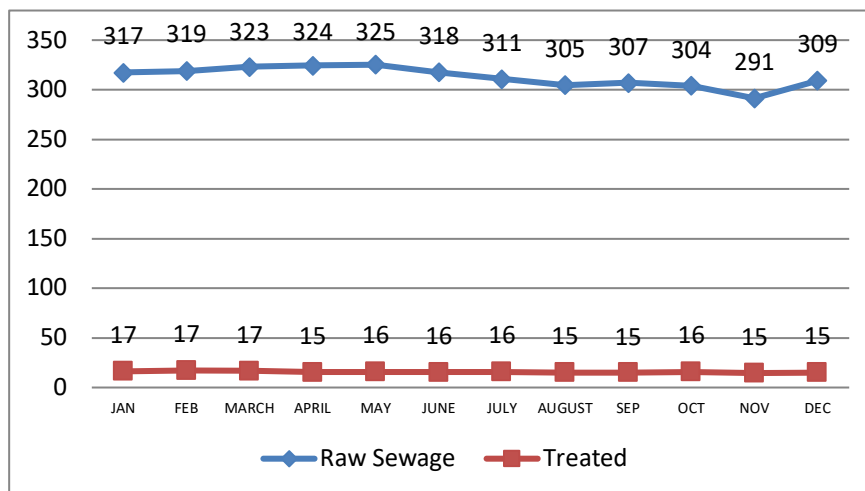
**Tipping Fee:** Fee of INR 100 is charged per trip for disposal of septage at the STP. The truck owners deposit this amount with CMWSSB. The trucks are allowed access to the STP only after showing the payment receipt. Most operators / truck drivers make advance payments as a lump sum amount. The tipping fee collections are approximately INR 6 million per annum<sup>15</sup>. (Table 7)

**Table 7: Charges for co-treatment – Registration, User Fee and Households**

Type of charge	Frequency	Rate (in INR)	Annual Collections (approximate)
Registration	One-time payment	INR 2000	1,04,000
User Fee	Per trip, payment made in advance	INR 100 per trip	60,00,000

## Performance Details

The treated water has BOD, TSS and faecal coliform levels well within range of the prescribed levels i.e., BOD < 20 mg/l (Figure 3), TSS < 30 mg/l (Figure 4) and faecal coliform <100 MPN/100 ML (Figure 5).



**Figure 3: BOD Levels – Raw Sewage and Treated Water Levels (mg/l)**

<sup>15</sup> Based on ~200 trucks paying tipping fees of Rs. 100 / trip and operating for about 300 days per year.

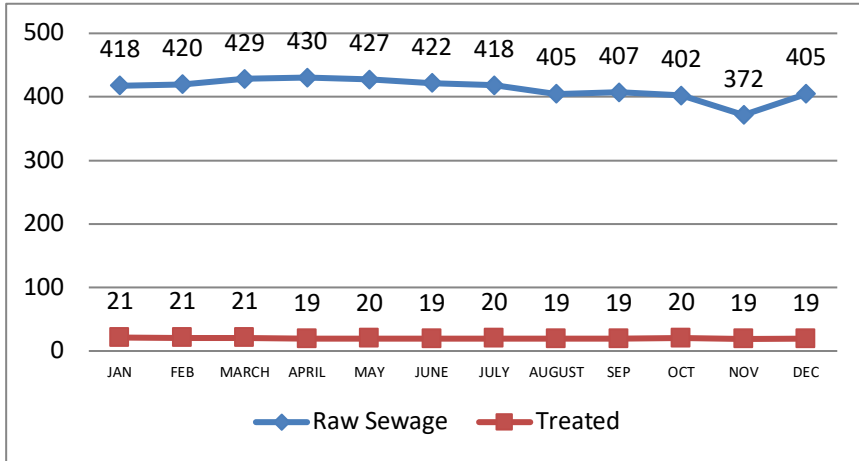


Figure 4: TSS Levels: Raw Sewage and Treated Water (mg/l)

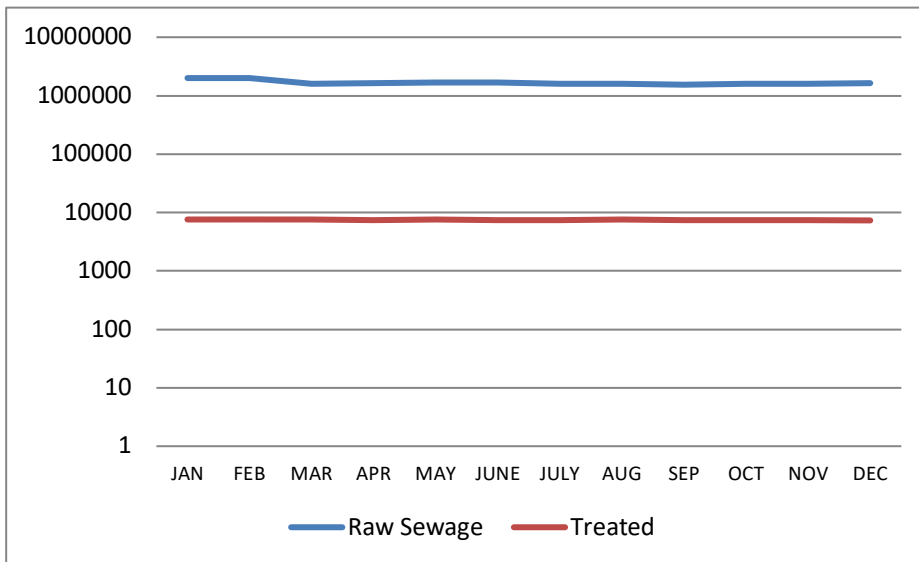


Figure 5: Faecal Coliform Raw Sewage and Treated Water (MPN/100 ml)

## D. Impact of Co-treatment

**City population being served by co-treatment:** The initiative has been successful in serving the unsewered parts of the GCMC. Given that there are approximately 200 trips per day to the Nesapakkam STP, it is estimated that the co-treatment of septage at Nesapakkam is able to provide septage treatment solution for between 180,000 to 600,000 households with septic tanks<sup>16</sup>.

**Regularisation of private desludging operators:** The 52 private trucks that are registered with the Nesapakkam STP have been provided with a safe and economical option for discharging septage.

**Environmental Impact:** The initiative has ensured that unauthorised dumping of septage in the city’s waterways has reduced substantially.

<sup>16</sup> Estimated based on number of households that can be serviced when septic tank sizes varies from 4 to 10 m<sup>3</sup> and when desludging is done once every 3 or 5 years.

**Source of Revenue for the STP:** The user charges collected from private desludging operators / trucks is resulting in generating revenue to the tune of 6 million per year.

## E. Key lessons and Practices

- The sound policy framework put in place by the GoTN in the form of the “Operative Guidelines for Septage Management for Urban and Rural Local Bodies” has laid out the broad contours for co-treatment in the state. It has created an enabling environment for the adoption of this practice by identifying Local Body clusters and their respective treatment facilities. Also the fact that the local bodies / service providers (in this case CMWSSB) have been tasked with the implementation has ensured speedy implementation.
- The fact that the costs have been kept minimal (@ INR 100 per lorry) has ensured that the private operators have patronised the facility. They now have a dedicated place to discharge the septage rather than trying to evade the enforcement authorities and discharge the septage in open areas / waterways.
- The design of the decanting facility ensures that the grit and large objects are removed through the grit chamber and screen components prior to the mixing of the septage with the sewage at the terminal pumping station.
- The odor control unit has also been put in place to ensure that there is less resistance / complaints from neighbouring residential areas. In addition to the air scrubber for odor control, other measures such as high compound walls and greenbelt plantation are useful initiatives that can be implemented by other STPs.
- Septage discharge occurs into pits connected to the covered receiving tank. This ensures that there is little spillage and less odor.
- Septage quality from Chennai indicates that the sludge pollution load, while significantly higher than sewage, is not as high as that established by the USEPA for septage and included in the MoUD Advisory on Septage Management and guidance to estimate safe septage loads. Based on the USEPA and MoUD guidance on estimating safe septage addition at an STP, the permitted septage load (based on existing STP capacity utilization and BOD levels of raw sewage and septage as observed in Chennai) is estimated to be ~ 300 m<sup>3</sup>/day or about 33 truckloads (@9 kL capacity per truck). The existing septage load at the STP is significantly higher than this, without any adverse impacts on plant performance, which indicates that for such weak strength septage, the safe loading curve may be somewhat different, and requires research to develop the same for the Indian context.

## Annex 1: Collection, Conveyance and Disposal Mechanisms in CMC Area (2011)

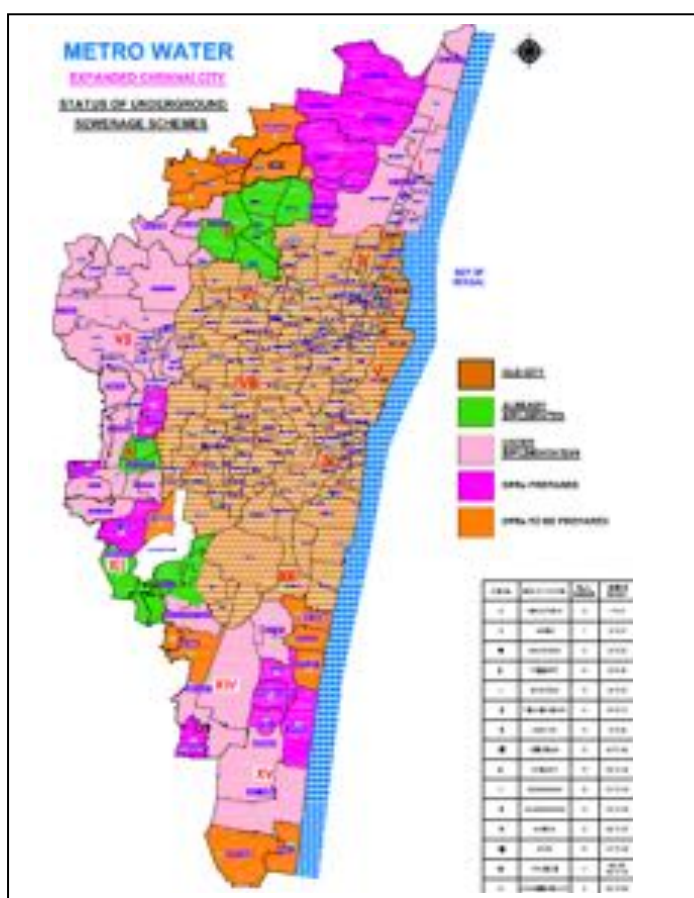
Collection, Conveyance and Disposal system	Number of Households	% of HHs with IHHLs
Piped sewer	10,70,668	96.97
Septic Tank	18,479	1.67
Other Flush System	2,309	0.21
Pit with slab / VIP	5,774	0.52
Without slab/ open pit	2,309	0.21
Night soil disposed into open drain	3,464	0.31
Night soil serviced by animal	1,154	0.10
<b>Household (with Individual Toilets)</b>	<b>11,04,157</b>	<b>95.60</b>

## Annex 2: Sewer System Expansion Plans in GCMC

As per CMWSSB officials underground sewerage systems (UGSS) have already been completed in 4 local bodies (namely, Madhavaram, Valasaravakkam, Alandur and Meenambakkam) and work is under progress in another 17 local bodies. Further, DPRs have been prepared for 8 local bodies and in another 13 the process of DPR preparation is underway.

### Progress of underground sewerage schemes in the extended GCMC area<sup>17</sup>

Stage	Local Bodies	Names of Local Bodies
Works Completed	4 local bodies	Madhavaram, Valasaravakkam, Alandur and Meenambakkam
Works Under Progress	17 local bodies	Kathivakkam, Thiruvotriyur, Surapattu, Kadirvedu, Puthagaram, Ambattur, Maduravoyal, Nerkundram, Porur, Ramapuram, Nolambur, Mugalivakkam, Ullagaram Puzhuthivakkam, Perungudi, Pallikaranai, Sholinganallur and Karapakkam
DPR Prepared	8 local bodies	Edayanchavadi, Sadayankuppam, Kadapakkam, Manali, Chinnasekkadu, Karambakkam, Manapakkam and Okkium Thoraipakkam
DPRs Under Preparation	13 local bodies (Rs.219.14 crores)	Thiyambakkam, Vadaperumbakkam, Mathur, Puzhlal, Nandambakkam, Jaladampettai, Kottivakkam, Palavakkam, Madipakkam, Neelangarai, Injambakkam, Semmancheri and Uthandi
<b>Total</b>	<b>42 local bodies</b>	



<sup>17</sup> Source: CMWSSB, 2018

### Annex 3: Sewage treatment infrastructure in CMC

CMC area is divided into five zones for sewage collection, conveyance, treatment and disposal. Each zone is equipped with sewage collection system including pumping stations and a network of conveying mains, treatment and disposal arrangements. Sewage generated in households is conveyed by gravity through a network of intercepting underground back borne sewers to a pumping station from where it is pumped and conveyed to the respective treatment facility.

The city has 12 Sewage Treatment Plants (STPs) at five locations namely, Kodungaiyur, Koyambedu, Nesapakkam, Perungudi and Alandur with total installed capacity of 727 MLD. The total amount of waste water inflow at STPs is 424 MLD (

Table 1). All the STPs are based on an “Activated Sludge Process” (ASP) Technology and in some locations including Kodungaiyur (110 MLD) and Perungudi (54 MLD and 64 MLD) the treatment technology is ASP with high rate anaerobic digestion and power generation. The Alandur STP is based on ASP with extended aeration technology. In the expanded GCMC area 6 additional STPs have been proposed. The treated sewage is discharged into nearby water courses (Adiyar River, Captain Cotton Canal, BNC Canal and Cooum River) which eventually discharge into the Bay of Bengal.

Table: Sewage Treatment Plants in Chennai<sup>18</sup>

Zone	Location	Year of commissioning	Capacity [MLD]	Waste water Flows (MLD)	Treatment Technology
I	Kodungaiyur STP	1991	80	65	Activated Sludge Process
II	Kodungaiyur STP	1989	80	65	Activated Sludge Process
I & II	Kodungaiyur STP	2006	110	90	Activated Sludge Process with anaerobic digestion and biogas
	<b>Zone I and II</b>		<b>270</b>	<b>220</b>	
III	Koyambedu STP	1978	34		Activated Sludge Process
III	Koyambedu STP	2005	60		Activated Sludge Process
III	Koyambedu STP	2015	120		Activated Sludge Process
	<b>Zone III</b>		<b>214</b>		
IV	Nesapakkam STP	1974	23	95-100	Activated Sludge Process
IV	Nesapakkam STP	2006	40		Activated Sludge Process
IV	Nesapakkam STP	2014	54		Activated Sludge Process
	<b>Zone IV</b>		<b>117</b>	<b>95-100</b>	
V	Perungudi STP	2006	54	48	Activated Sludge Process with anaerobic digestion and biogas
V	Perungudi STP	2012	60	46	Activated Sludge Process with anaerobic digestion and biogas
V	Alandur STP	2003	12	9.5	Activated Sludge Process with extended aeration
	<b>Zone V</b>		<b>126</b>	<b>103.5</b>	
	<b>Total</b>		<b>727 MLD</b>	<b>423.5</b>	

<sup>18</sup> Source: CMWSSB

## Annex 4: Operative Guidelines on Septage Management issued by GoTN – Major Components

<b>Design and Construction of Septic Tanks</b>	Evaluate existing septic tank designs and other storage/treatment systems and modify (in case of variation) based on the suggested design
	Issue notice to owners of septic tanks that do not meet the standard septic tank design under Tamil Nadu Public Health Act, 1939
	Convert insanitary latrines into sanitary latrines
<b>Pumping and Desludging</b>	Conduct Periodic and routine Desludging
	Local Bodies to ensure proper collection (transportation) system, and treatment of septage at the nearest STP and safe disposal
<b>Septage Transportation</b>	Local body clusters have been identified for treatment of collected septage at earmarked STP locations. All Septage Transportation Vehicles should be directed to transport septage to their designated STP
	Only certified and licensed Septage Transporters to de-sludge and transport waste to the designated STP
	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
<b>Treatment &amp; Final Disposal</b>	<b>Design of Decanting Facility:</b> Decanting facility should be designed based on expected volumes of septage generated in local body clusters with adequate capacity for the next five years based on urbanization trend in the cluster
	<b>Quality Check:</b> Input quality of the collected septage should be tested at the decanting facility for presence of any metal or traces of industrial waste
	<b>Operational details:</b> The septage receiving facility should be operational during working hours only and a responsible person should be appointed in the facility to ensure that no commercial or industrial waste is unloaded through these facilities
<b>IEC for municipal Staff, Households and private operators</b>	
<b>Fees/Charges for De-Sludging, Transportation and Treatment</b>	<b>Fees for DeSludging</b> is to be collected from residents by the certified / licensed tanker operators
	<b>Transport charges</b> should be determined based on market rates
	<b>Treatment Charges:</b> For treatment, the on-going rate of Rs. 150-200 can be charged for 9000 litres of waste collected.
<b>Management Information System (MIS)</b>	Information related to septage generation from residents and commercial establishments needs to be collected by the Local Bodies. Household level details of insanitary latrines, identification of septic tank location, Operator in-charge for each location, Vehicle Details, Name & Location of STP earmarked for disposal of septage, and decant facility details should be duly collected by all Local Bodies.



## Annex 5: Details of Nesapakkam STP

	STP I	STP II	STP III
<b>Design Capacity</b>	23 MLD	40 MLD	54 MLD
<b>Waste water Flows / Average quantity treated</b>	18 MLD	34 MLD	28 MLD
<b>Treatment Technology</b>	Activated Sludge Process	Activated Sludge Process	Activated Sludge Process
<b>Year of commissioning</b>	1974	2006	2014
<b>Project under which construction was funded</b>		NRCP	JNNURM
<b>Cost (In INR)</b>	57 million	194.7 million	483.8 million
<b>Number of Pumping stations</b>	28		
<b>Areas covered</b>	K. K. Nagar, Saidapet, Jaefferkhanpet, MGR Nagar, CIT Nagar, Ashok Nagar, Valasaravakkam, Ekkatuthangal, Jaibalaji Nagar, West Mambalam and Part of Kodampakkam		
<b>Area of the STP</b>	12.65 acres + 2 acres green cover	10 acres + 1 acres green cover	12 acres + 4 acres green cover
<b>O&amp;M responsibility</b>	Private agency (only manpower – M/s Sree Ventateswara Industries	Private agency (only manpower – M/s Sree Ventateswara Industries	Private agency M/s Jyothi P and C Consortium
<b>Repair and Maintenance</b>	CMWSSB	CMWSSB	
<b>Duration of the contract</b>	01.03.2016 to 28.02.2019	19.07.2017 to 20.08.2017 (subsequently given to BHEL)	1.10.2014 to 30.09.2019
<b>Contract Value</b>	INR 7.992 million for three years		50.55 million
<b>Payment per month</b>	INR 0.23 million	INR 0.482 million	0.842 million
<b>Treatment cost per ML</b>	INR 1470	INR 1160	1060
<b>Bio gas engine</b>	-	496 kw * 1 No	1064kw * 1 No
<b>Gas produced</b>	-	2400m <sup>3</sup> per day	2400m <sup>3</sup> per day
<b>Cost</b>			
<b>Electricity charge</b>	7.44 million	9.48 million	8.1 million
<b>Fuel and Lubricant</b>	0.15 million	0.36 million	12.71 million
<b>Repair and Maintenance</b>	1.93 million	1.2 million	
<b>Outsourcing of maintenance staff</b>	2.76 million	5.784 million	
<b>Discharge Point</b>	The disinfectant effluent of about 95 to 100 MLD from Nesapakkam STP is discharged into the nearby Adiyar river (water ways)		

**Performance:** Raw sewage and effluent treated sewage (details are average monthly values of the 23 MLD plant)

	Raw Sewage			Effluent treated sewage		
	BOD mg/L	TSS mg/L	Coliform MPN/100 ml	BOD mg/L	TSS mg/L	Coliform MPN/100 ml
JAN	317	418	2 x10 <sup>6</sup>	17	21	7562
FEB	319	420	2 x10 <sup>6</sup>	17	21	7600
MARCH	323	429	1.6 x10 <sup>6</sup>	17	21	7533
APRIL	324	430	1.62 x10 <sup>6</sup>	15	19	7345
MAY	325	427	1.7 x10 <sup>6</sup>	16	20	7522
JUNE	318	422	1.7 x10 <sup>6</sup>	16	19	7441
JULY	311	418	1.6 x10 <sup>6</sup>	16	20	7353
AUGUST	305	405	1.58 x10 <sup>6</sup>	15	19	7522
SEP	307	407	1.54 x10 <sup>6</sup>	15	19	7353
OCT	304	402	1.58 x10 <sup>6</sup>	16	20	7436
NOV	291	372	1.60 x10 <sup>6</sup>	15	19	7388
DEC	309	405	1.63 x10 <sup>6</sup>	15	19	7317

**Annex 6: List of officials met at Chennai**

<b>S. No.</b>	<b>Name, designation, organisation</b>	<b>Mobile</b>	<b>Email</b>
1.	G. Sathiamurthi Chief Engineer (O&M) II CMWSSB		
2.	D. Manoharan Plant Engineer Nesapakkam STP	9500027909; 8144930480	<a href="mailto:manomail1960@gmail.com">manomail1960@gmail.com</a>
3.	S. Dayalan Supreintending Engineer CMWSSB	8144931010	<a href="mailto:sewwtr@gmail.com">sewwtr@gmail.com</a>
4.	R Jeyaratchagan Supreintending Engineer, Planning and Design Wing CMWSSB		