FSM
Faecal Sludge Management
TOOLBOX

Rapid Infrastructure Plan for

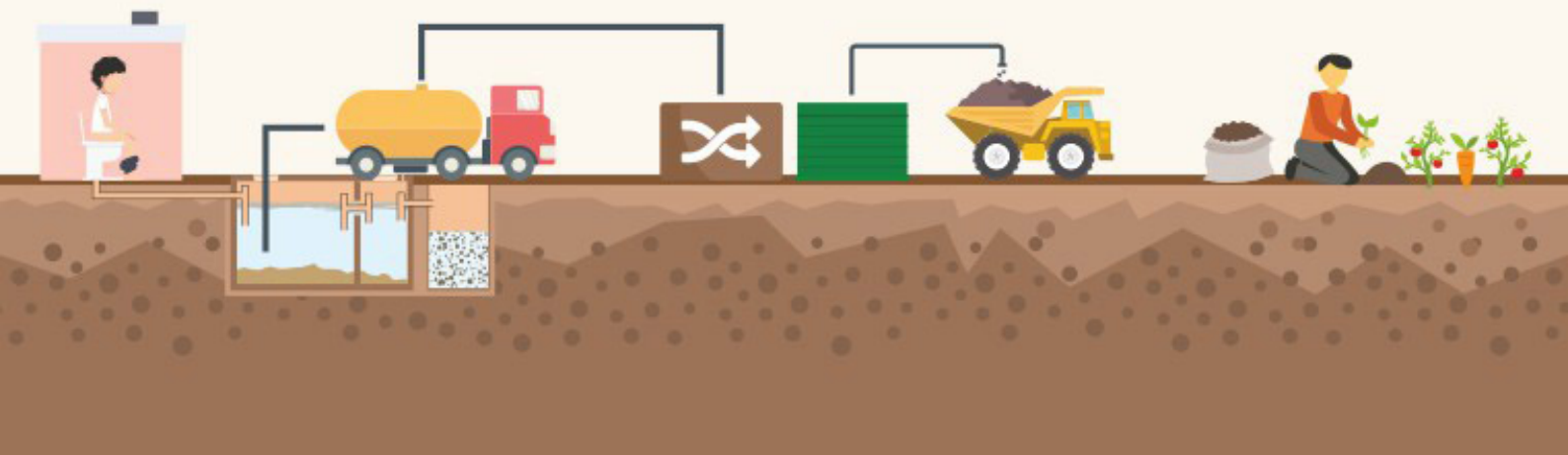
vellore

The FSM Index score indicates that the Overall FSM performance of the city is

GOOD

Scale: Poor 0-33% | Developing 33-66% | Good 67-100%.

The FSM infrastructure of the city requires improvement with a focus on - containment systems and treatment infrastructure. The enabler ecosystem assessment score indicates need for improvement in aspects of - Operation and maintenance.



Rapid Infrastructure Planning Report: vellore

12 Apr 2019

Generated By: Demo User

Produced By: Demo User, ABE Consulting, vellore, Tamil Nadu, India

www.fsmtoolbox.com

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Rapid Planning:

- City Name: vellore
- State: Tamil Nadu
- Country: India
- Total Population: 530000

Name of the organisation: ABE Consulting

The infrastructure planning tool is designed to assist users with estimating the infrastructure gap and planning the interventions across all stages of the FSM service chain - containment, emptying, transportation and treatment, in your city.

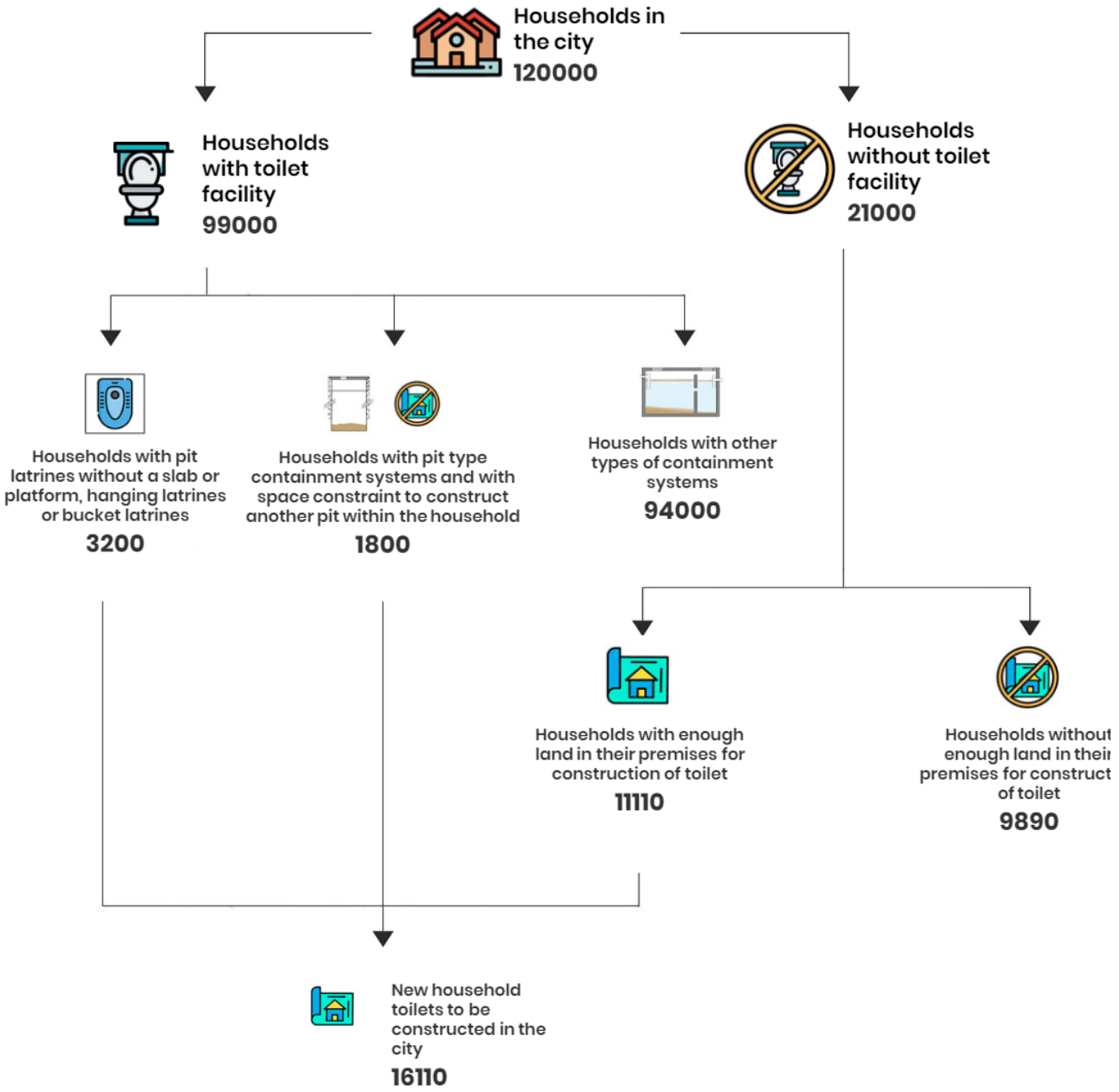
Here is a list of planning areas that you have chosen for your city/region

S#	Planning Question
1	Household toilet construction
2	Community toilet construction
3	Public toilet construction
4	Toilet interface selection
5	Containment technology selection
6	Total FS generation
7	Vehicle procurement
8	Treatment plant size
9	Treatment site location
10	Treatment technology identification
11	Regional Treatment infrastructure

Result

Household toilet construction

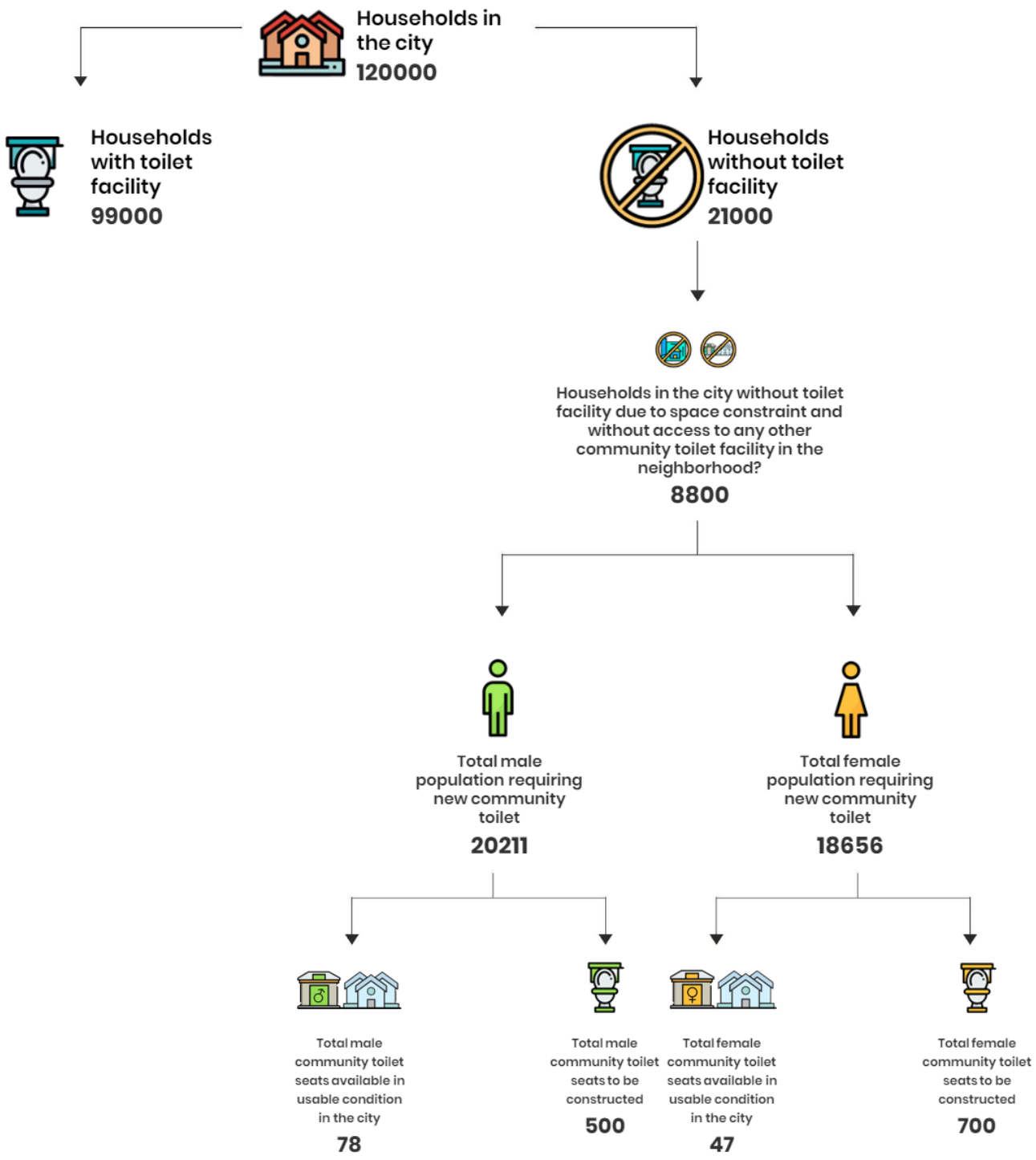
There are 120000 households in the city without toilet facility in their premises. Of them, 9890 households have space for construction of new household toilets within the household premises. It is important that cities encourage and support these households to construct toilet facility within their premises. Also, 5000 households in the city have insanitary toilets. It is recommended that the city take efforts to upgrade insanitary toilets to sanitary systems and futureproof the groundwater from further pollution due to faecal sludge seepage



Community toilet construction

8800 households in the city do not have a toilet facility due to space constraint and do not have access to a shared facility in the neighbourhood. Efforts must be made to support such households by creating access to safe shared sanitation solutions in close proximity to these households.

Total number of male community toilet seats to be constructed in the city = 500
Total number of female community toilet seats to be constructed in the city = 700



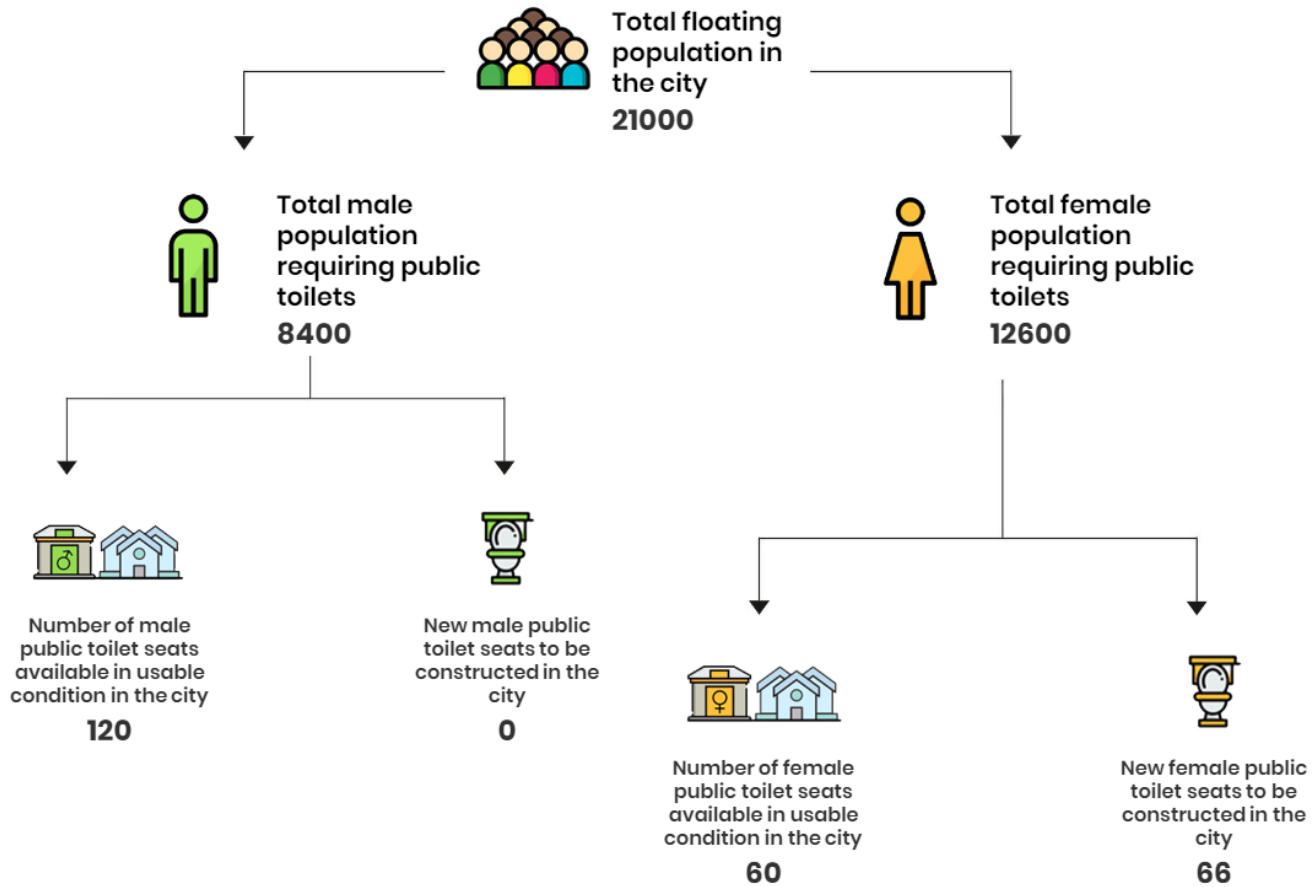
Public toilet construction

It has been established that there are **21000** floating population in the city. A total of **34** male public toilet seats and **126** female public toilet seats are required to cater to the needs of the floating population in the city.

It is impressive that the city of CityName has 60 female public toilet seats however, there are only 120 male public toilet seats available in the city to cater the sanitation needs of floating population. The city must take efforts to increase the overall availability of male public toilet seats in the city to ensure gender balance in the city sanitation infrastructure.

Total number of public toilet seats to be constructed for males:120
Total number of public toilet seats to be constructed for females:60

FSM Toolbox has dedicated modules to assist you in construction of public toilets and identification of appropriate locations for the same. Learn more.



Suggested Toilet User Interface for your city

The following are your city characteristics as identified through the online questionnaire.

What is the average water availability for toilet usage?

- 1 large bucket of water per use (10-15L per use)

What are the end use possibilities of sanitation products in the city / neighbourhood?

- Dried human feces as fertilizer for crops

What is the potential water sourcing method?

- Piped water connection supplied through overhead tank

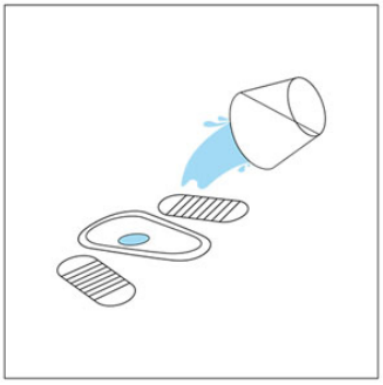
Are the users comfortable about using two different compartments in the toilet user interface regularly?

- No

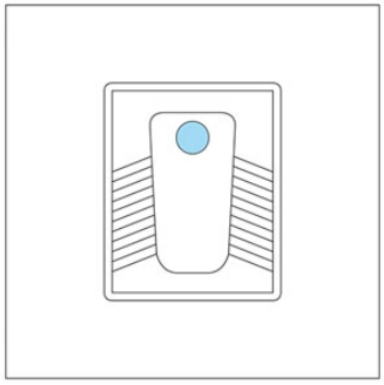
What is the preferred anal cleansing method?

- Water

After carefully studying the city characteristics, here is a menu of technologies that could be relevant to your city.



Pour Flush Toilet



Cistern Flush Toilet

To further understand about these toilet technologies, refer Compendium of Sanitation Systems and Technologies, 2nd edition, EAWAG Aquatic Research (insert link)

Though rapid planner module helps you understand the broad toilet technologies that are relevant to your city characteristics, further studies have to be conducted in order to identify the relevance / user preference between individual properties. FSMPro Planner is designed to help cities conduct a geospatial survey and accurately determine the toilet technology that is most relevant to every property after careful consideration of site characteristics and user preference. Learn more.

Suggested Containment Systems suitable for your city

The following are your city characteristics as identified through the online questionnaire.

Are the toilet users comfortable about using two different compartments for disposal of urine and faecal sludge in the toilet user interface regularly?

- No

Is the location flood prone?

- Non-flood prone area

At what depth is the ground water available?

- greater than 5m

What is the % of slope?

- Less than 5%

What is the vehicular accessibility?

- Full access (greater than 6m)

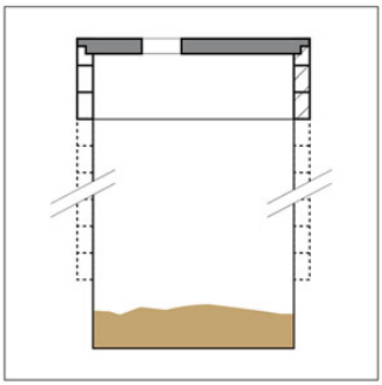
What is the soil type?

- sandy

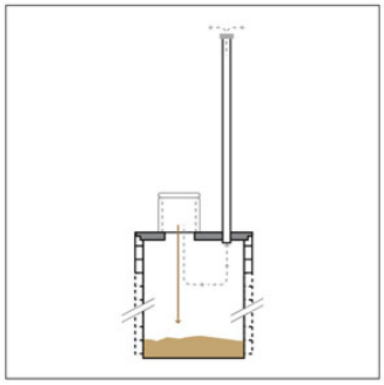
What is the willingness to pay for maintenance of the system?

- High

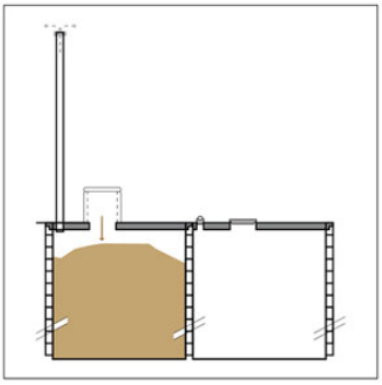
After carefully studying the city characteristics, here is a shortlist of technologies that could be relevant to your city.



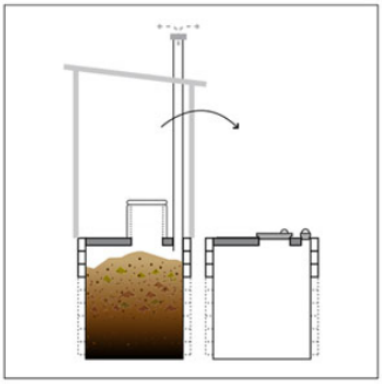
Single Pit



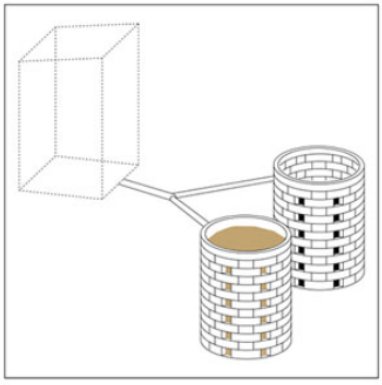
Single Ventilated Improved Pit (VIP)



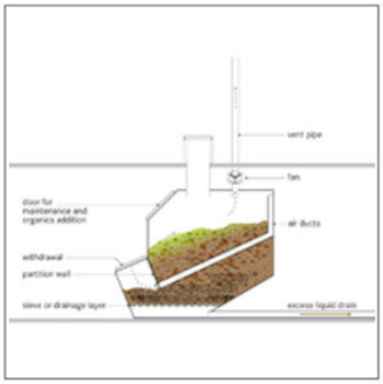
Double Ventilated Improved Pit (VIDP)



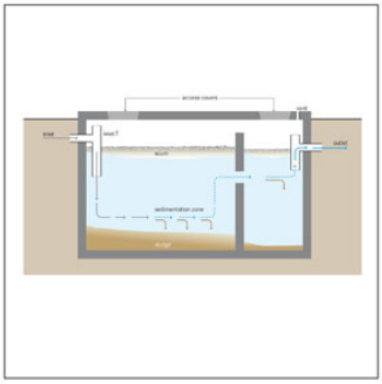
Fossa Alterna



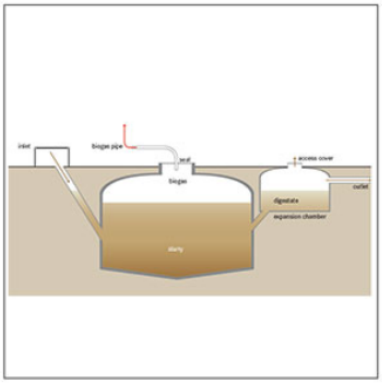
Twin Pits for Pour Flush



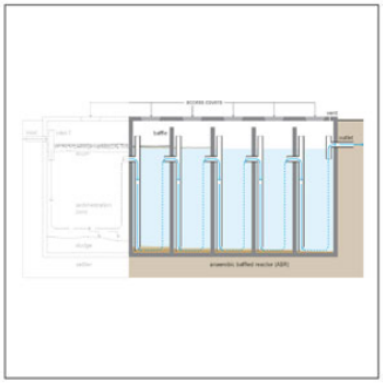
Composting Chamber



Septic Tank



Biogas digester + Anaerobic Baffle Reactor & Anaerobic Filter



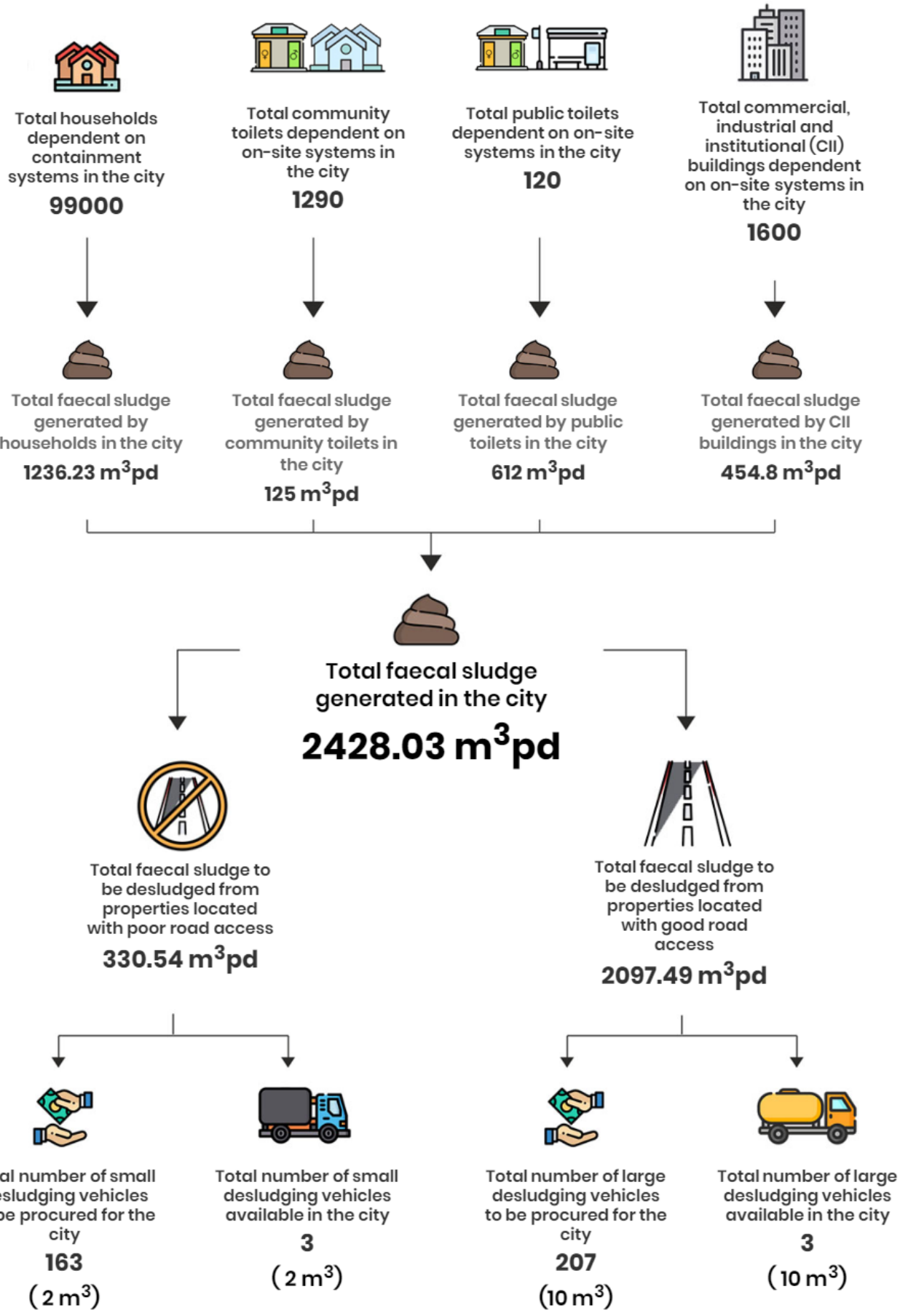
Settler+ (Anaerobic Baffle Reactor & Anaerobic Filter)

Vehicle procurement

Based on overall faecal sludge generation rate across the city from properties located on both (1) roads with poor access, and (2) roads with good access, the total volume of small and large vehicles required for desludging such properties have been identified respectively. Assuming a standard desludging frequency of **5** years for all properties in the city, it is estimated that the total volume of faecal sludge to be desludged is **330.54** m3 in properties with poor road access and **2097.49** m3 in properties with good road access. Based on a set of standard assumptions provided as input at the questionnaire stage (**8** hours of operation per day, **250** days of operation in a year, average volume of small desludging vehicles as **1** m3, average volume of large desludging vehicles as **5** m3, number of trips to be carried out by small desludging vehicles in a day as **3** trips, number of trips to be carried out by large desludging vehicles in a day as **3** trips), it is estimated that **0** small desludging vehicles and **0** large desludging vehicles are required for conducting desludging operations in the city.

Based on the existing vehicle availability (3 small desludging vehicles and **3** large desludging vehicles) in the city, **163** new small desludging vehicles and **207** new large desludging vehicles should be procured by the city.

NOTE: Small desludging vehicles refer to all vehicles which have smaller dimensions enabling them to access properties located on roads of width


Total households dependent on containment systems in the city
99000
Total community toilets dependent on on-site systems in the city
1290
Total public toilets dependent on on-site systems in the city
120
Total commercial, industrial and institutional (CII) buildings dependent on on-site systems in the city
1600
Total faecal sludge generated by households in the city
1236.23 m3pd
Total faecal sludge generated by community toilets in the city
125 m3pd
Total faecal sludge generated by public toilets in the city
612 m3pd
Total faecal sludge generated by CII buildings in the city
454.8 m3pd
Total faecal sludge generated in the city
2428.03 m3pd
Total faecal sludge to be desludged from properties located with poor road access
330.54 m3pd
Total faecal sludge to be desludged from properties located with good road access
2097.49 m3pd
Total number of small desludging vehicles to be procured for the city
163
(2 m3)
Total number of small desludging vehicles available in the city
3
(2 m3)
Total number of large desludging vehicles to be procured for the city
207
(10 m3)
Total number of large desludging vehicles available in the city
3
(10 m3)

Treatment infrastructure - Determining overall treatment plant size

The size of the treatment plant is arrived at after carefully considering the overall vehicle capacity that is likely to reach the treatment plant (vehicle capacity method) and the likely demand for treatment after 10 years (based on FS generation estimates), using population projection method.

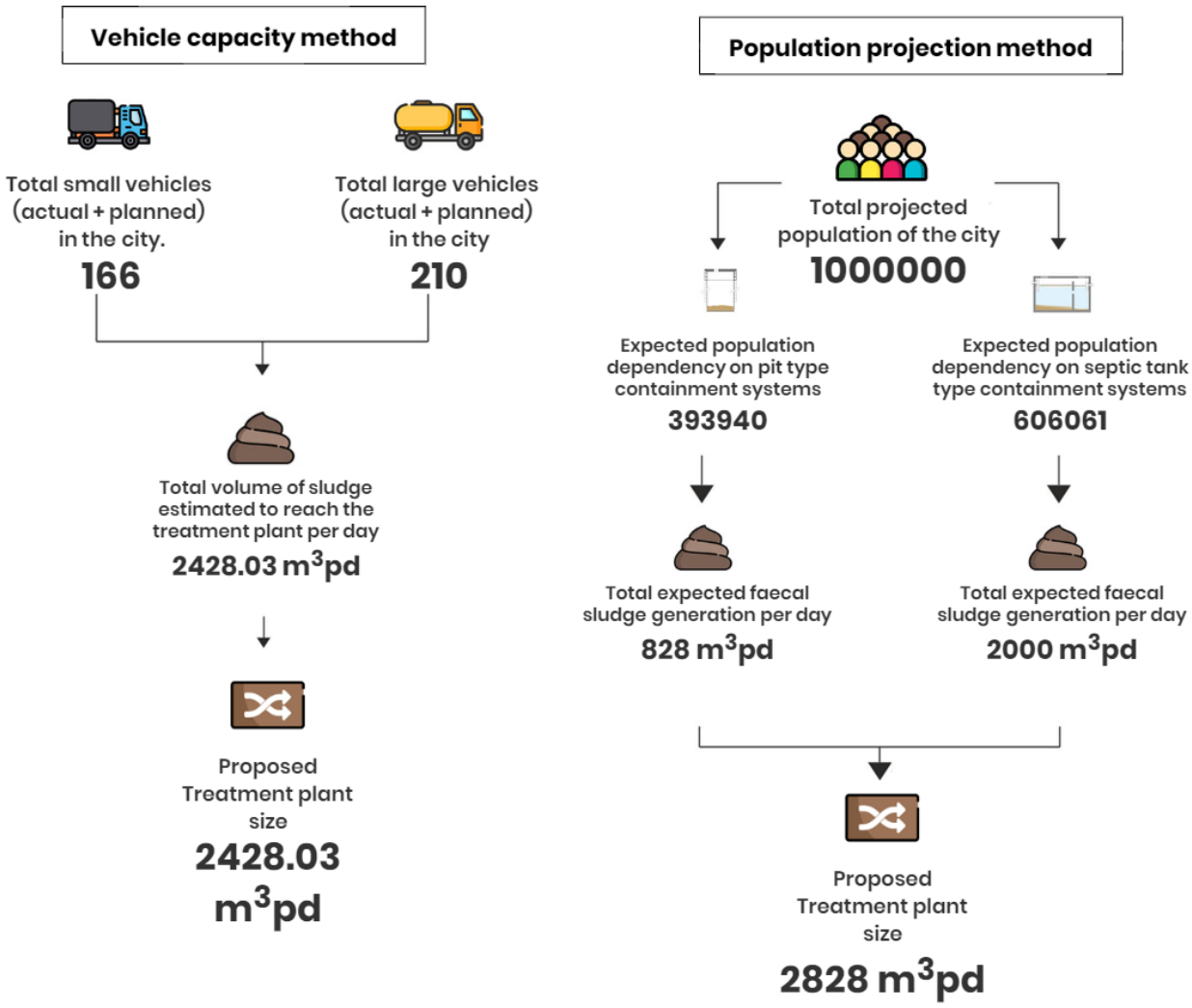
1. **Vehicle capacity method:**

   In this method, the total volume of FS from vehicles that will arrive at the treatment plant is estimated to arrive at the treatment plant size. (18211 KLD)

2. **Population projection method:**

   In this method, a projected estimate of the total volume of faecal sludge generated in the city per day is calculated for arriving at the overall treatment plant size. (2828 KLD)

Cities should carefully consider the current expected volume of faecal sludge that could arrive at the treatment plant facility (as per vehicle capacity method) and the potential demand of the treatment plant (based on population projection method) and take a calculated decision on the total size of the treatment plant.



Treatment infrastructure - Identify appropriate treatment site locations in the city

 Is there any habitation in less than 200m distance from the identified site?	NO
 Are there any water bodies in less than 200m distance from the identified site?	NO
 Is the identified site a wetland?	NO
 Is the identified site in a flood prone area?	NO
 Is there an airport site (current / proposed) in less than 20Km distance from the identified site?	NO
 Is there a heritage site in less than 10Km distance from the identified site?	NO
 Is there a drainage channel available next to the identified site?	NO
 Is the groundwater table available in less than 3m distance from the ground?	NO

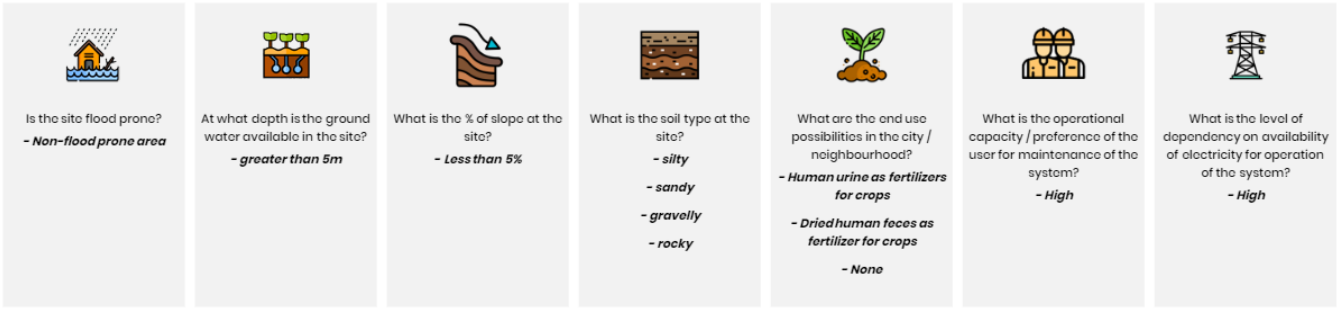
Green – site characteristics matches with the requirement
Red – site characteristics do not match with the requirement

After careful consideration of all the location/site characteristics which are mentioned in the table below:

The proposed site is suitable for construction of faecal sludge treatment plant

Treatment infrastructure - Shortlist treatment technologies suitable for identified sites

City characteristics



After carefully studying the city characteristics, here is a menu of technologies that could be relevant to your context.

It is important to note that there are 6 stages to any faecal sludge treatment plant and the technologies have been identified within each of these 6 stages. (A. Pre-treatment, B. Solid liquid separation, C. Dewatering, stabilization, D. Further treatment, E. Effluent treatment secondary, and F. Effluent treatment tertiary).

Pre-Treatment
Screen
Grit Chamber

Solid/Liquid Separation
Anaerobic Biogas Reactor
Sedimentation / Thickening Ponds
Settler / Thickening Tank
Imhoff Tank

Dewatering
Centrifugal Sludge dewatering systems
Belt Filter dewatering systems
Frame filter press dewatering systems
Screw press dewatering systems
Unplanted Drying Beds
Planted Drying Beds
Solar drying
Thermal drying (and pelletising)

Stabilization / Further Treatment
Co-composting
Solar drying
Planted Drying Beds
Deep row entrenchment
Lime / ammonia addition
Sludge incineration
Black soldier flies
Vermicomposting
Thermal Drying

Effluent Treatment – Secondary
Anaerobic Baffled Reactor (ABR)
Anaerobic Filter (AF)
Waste Stabilization Ponds (WSP)
Aerated Pond
Free-Water Surface Constructed wetland
Horizontal Subsurface Flow Constructed wetland
Vertical Flow Constructed wetland
Sequencing batch reactor
Membrane bioreactors
Upflow Anaerobic Sludge Blanket Reactor
Trickling filter
Integrated Settler and Anaerobic Filter

Effluent Treatment – Tertiary
Polishing ponds
Floating Plant (Macrophyte) Pond
Aquaculture Ponds
Free-Water Surface Constructed wetland
Horizontal Subsurface Flow Constructed wetland
Vertical Flow Constructed wetland
Depth filtration
Chlorination
UV Radiation
Ozonation

Regional Treatment infrastructure

Construction of the new treatment facility for FS is a capex intensive effort. Many city governments have cross utilized t existing treatment infrastructure in their region based on proximity and current utilization capacity of the plants. After studying various parameters:

- It is apparent that that the City of Cityname could potentially utilize the neighbouring treatment unit located at a distance of 15 km from the city. The current utilization capacity of the treatment plant is 10 m3 and has the potential to intake 120 m3 of faecal sludge load. (4.94% of total faecal sludge generated in Cityname)
- We realize that the nearest location of treatment plant is quite far away (15 Km) from the centre of Cityname and hence it is not suitable to cross utilize the treatment infrastructure. Cityname city should take efforts to establish a treatment facility within 15 km radius from the centre of the city. To determine a location for your new treatment plant, use our FSMPro Planner

Please find below a list of suitable reading materials that are most relevant to your city. Click on the links to navigate to the reports