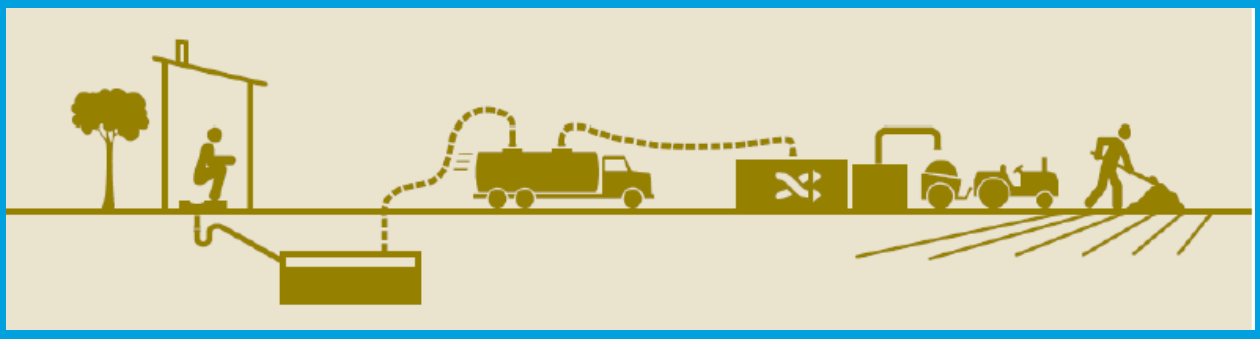
Odisha Urban Septage Management Guidelines, 2015

For Urban Local Bodies in Odisha



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1. Background

The overall goal of the Odisha Urban Sanitation Strategy, 2011 on the lines of the National Urban Sanitation Policy (NUSP) of India is to transform urban areas in Odisha into community-driven, totally sanitized, healthy and liveable cities and towns. To attain this goal, safe management of human excreta (septage) including its safe confinement, handling & transport, treatment, disposal and associated hygiene-related practices is of utmost importance.

In Odisha, the need for septage management is significant with the reliance on on-site sanitation systems (like septic tanks, dry latrines, bucket latrines, community toilets etc.) for disposal of human excreta being very high in the absence of functional sewerage systems and treatment facilities in the Urban Local Bodies (ULBs). Please refer to Annexure I for the status of sewerage projects under implementation in Odisha.

Currently, the septage removed from most of the sanitation facilities and the faecal sludge from open defecation in ULBs of Odisha are indiscriminately discharged into the environment due to lack of proper treatment and disposal facilities, thus creating negative impacts on the urban environment and on public health. This is part of the larger need to put in place a set of operative guidelines which will formalize and provide for safety and public health in the entire value sanitation chain.

These guidelines thus intend to achieve the goals of Odisha Urban Sanitation Strategy, 2011, and provide step – by – step guidance for the ULBs to carry out effective septage management i.e. improving access and compliance to design and construction standards for on-site sanitations, regulate the emptying and transportation of septage and provide guidance to ULBs for the disposal, treatment and re-use of the treatment by-products. These guidelines are intended to further strengthen the framework focused on implementing the provisions of the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 in the state of Odisha.

These guidelines conform to the advisory note on septage management developed by Ministry of Urban Development (MoUD), Government of India and the guidelines on design and construction of septic tanks issued by the Bureau of Indian Standards (BIS) and the Central Public Health and Environmental Engineering Organization (CPHEEO).

The procedure outlined in these guidelines is applicable to all ULBs of Odisha and covers following areas:

- Framework on septic tanks including standard design and construction;
- Adoption of desludging procedure for septage generated;
- Safe Transportation of septage from collection point to receiving facility;
- Technological intervention for proper treatment of septage, disposal and re-use;
- Public awareness

2. Framework on septic tanks

Septic tank is a watertight, on-site treatment system for domestic sewage.It collects all the discharges from household/commercial establishments plumbing and provides the needed time for wastes to settle or float. The heavy solids settle to the bottom of the tank where they are broken down by bacteria to form sludge. The lighter solids, fats and grease, partially decompose and rise to the surface to form a layer of scum. This process allows the partially treated wastewater to be released into the drain field.

For the effective implementation of septage management, it is imperative to conduct an initial city wide survey on availability of onsite treatment facilities in the households/commercial establishments and introduce a robust registration and supervision regime.

2.1 Preparation/maintenance of database on on-site treatment facilities

2.1.1 A ULB should conduct a city-wide door-to-door comprehensive survey of the existing on-site treatment facilities and prepare/maintain a database of information including but not limited to the following:

(a) The households and other properties with septic tanks which satisfy the standard design and construction;

(b) The households and other properties with septic tanks but do not meet the design criteria set in all relevant laws, standards or directions;

(c) The households and other properties connected to other types of on-site sanitation systems;

(d) Size, cleaning and emptying frequency of above on-site sanitation systems including septic tanks;

(e) The households and other properties having no sanitation facility;

A model survey form for the availability of septic tanks is provided in Annexure II.

2.1.2 Based on the survey that is undertaken, the ULB shall create a database of toilets and septic tanks. This database shall also be linked with the GIS depicting property level details on septic tanks. The ULB needs to update the database every three years along with property tax assessment survey.

2.2 Standardization of Septic tanks

2.2.1 A ULB shall issue notice to the owners of the premises:

(a) **In cases where the septic tank meets the standard design and construction norms** - To register the septic tanks with the ULB;

(b) **In cases where the septic tank does not meet the standard design and construction norms** - To replace or appropriately modify the existing septic tank in order to meet the standard design and construction norms and register with the ULB;

(c) **In cases where there is no sanitation facility or insanitary latrines** - To construct new septic tank of standard design and get them registered with the ULB;

(d) **In cases where other types of on-site sanitation systems are available which are not as per standard practice-** To construct new septic tank of standard design and get them registered with the ULB.

2.3 Registration of Septic Tanks

2.3.1 The owner of a premises connected to a septic tank (existing/modified/newly constructed) shall apply to the ULB for registration of septic tank within such timeframe and by paying such registration fee as notified by the ULB from time to time. An illustrative septic tank registration application form is provided in Annexure III.

2.3.2 On entry of details in the database register of septic tank, the ULB shall issue a certificate of registration to the owner of the premises connected to a septic tank.

2.4 Inspection of Septic Tanks

2.4.1 Whenever any construction/modification of septic tanks are in progress in the area under the jurisdiction of the ULB, it would be mandatory for the designated ULB official or an authorized agency through the help of ULB officials or its designated representatives to carry out field inspection to ensure that the construction is in accordance with the standard size and design.

2.5 Standard size and design for the construction of Septic tanks

2.5.1 The design, construction and installation of septic tanks shall be in accordance with the provisions of the a) National Building Code of India, 2005; b) Bureau of Indian Standards, Code of Practice for Installation of Septic Tanks; c) Manual on Sewerage and sewage treatment systems, CPHEEO, 2013; d) Swachh Bharat Mission Guidelines, 2014 and all relevant laws or directions pertaining at that time. The specifications for the construction of septic tanks are described in Annexure IV. The sizes of septic tank as recommended by IS:2470 of Bureau of Indian Standards and CPHEEO Manual for Sewerage and Sewage Treatment for 5 users and up to 300 users are given below:

No of Users	Length(m)	Breadth(m)	Liquid depth for 2yrs. Cleaning period(m)	Liquid depth for 3yrs Cleaning period (m)
5	1.5	0.75	1.0	1.05
10	2.0	0.90	1.0	1.40
15	2.0	0.90	1.3	2.00
20	2.3	1.10	1.3	1.80
50	5.0	2.00	1.0	1.24
100	7.5	2.65	1.0	1.24
150	10.0	3.00	1.0	1.24
200	12.0	3.30	1.0	1.24
300	15.0	4.00	1.0	1.24

The typical sketches of septic tanks for 5 to 20 users is presented in Annexure V A & V B.

2.5.2 All building approval plans shall include design details of the on-site sanitation systems that are proposed to be constructed.

3. Desludging of septic tanks

When the sludge in septic tank exceeds 2/3rd of its total depth, it is the time to remove sludge from the septic tank by adopting certain definite procedures. It is pertinent to highlight that regular desludging improves the performance of septic tanks and effluent quality. For proper desludging, involvement of owners of the premises connected to septic tanks is also necessary.

3.1 Responsibilities of the owners

3.1.1 The owner of a premises connected to septic tank shall be responsible:

(a) For its operation and maintenance and shall ensure that, its parts and components are fit for purpose, operational and kept in good order so as to prevent a risk to human health or the environment.

(b) For checking the sludge level at least once in a year, so that the effluent shall not emit, discharge, seep, leak or otherwise escape from the septic tank, or part thereof into surface water or onto the surface of the ground.

(c) To ensure that roof water or surface water run-off shall not enter a septic tank.

(d) For informing the ULB for emptying the septic tank, when the sum of the depth of scum and the sludge exceeds two-third of the depth of the tank.

3.2 Responsibilities of ULBs

3.2.1 The ULB may initiate scheduled septic tank desludging services by their own or through the authorized private septage transpoorters to the registered septic tank owners for both desludging and transport of septage. The ULB may send automatic reminder to the households after 3 years to clean the septic tank. The ULBs can exercise following three options for desludging of septage:

(a) Vacuum trucks (Septage Transportation Vehicles) can be purchased by ULBs and drivers and other required personnel be engaged to perform the collection and transportation activity.

(b) The persons/agencies having Septage Transportation Vehicles can be engaged for this activity, for which they need to be registered with ULB and obtain necessary permit for septage transportation after signing a Memorandum of Understanding (MoU) with the ULB.

(c) Vacuum Trucks can be purchased by ULBs and can be given to intending transporters on hire, and issue permit to them, who can take the responsibility of collection and transportation of septage to treatment site.

3.2.2 The ULB shall ensure that desludging shall be carried out by the sanitary workers of the ULB or by the registered and authorized septage transporters.

3.2.3 The ULB shall ensure that the operation and cleaning of septic tanks shall be carried out only by using mechanical devices. The desludging trucks shall be fully equipped with required tools, equipments and spares for the operation. A checklist of tools and equipment is presented in Annexure VI.

3.2.4 The ULB shall ensure that the septage and contents are disposed of in accordance with all relevant laws and directions pertaining at the time.

3.3 Registered Septage Transporter to transport septage

3.3.1 Only municipal employees or registered septage transporter shall be engaged in the collection and transportation of septage to the designated Treatment Sites. The ULBs shall develop regulations for registration of septage transporters including desludging and transportation of septage. A sample permit/registration certificate is presented in Annexure VII.

3.4 Registered Vehicle to be used for septage transportation

3.4.1 Only registered vehicle shall be engaged by the registered septage transporter in the collection and transportation of septage to the designated Treatment Sites. The ULBs shall develop Regulations for registration of septage transportation vehicle.

3.5 Precautions to be taken before/during desludging

3.5.1 The septage transporter shall take the following precautions before/during desludging:

(a) The vehicle driver shall ensure that the vehicle is parked properly, check wheels, set parking brakes, place safety cones and prepare the vehicle for pumping.

(b) It should be ensured that the sanitary workers are provided with all required safety gears.

(c) The septic tank shall be ventilated by keeping cover open for sufficient time before starting the operation.

(d) The sanitary workers shall never enter septic tank since entry of man into septic tank is banned.

(e) Care should be taken during the pump back operation that, friction fittings may come apart thus exposing workers to a safety hazard

(f) Entire contents of a tank should never be emptied at locations of high ground water. If the ground water level is above the bottom of the tank, floating condition will occur. In such conditions, enough contents in the tank shall be left out to counter act the uplift pressure. Local enquiry may be made from the area to obtain this information.

3.6 Desludging Procedure

3.6.1 After adhering to the necessary precautions, the desludging may be carried out by the sanitary workers following the procedure given below:

(a) The sanitary workers shall undertake visual inspection of the interior and exterior of the tank after opening the access covers and check for:

i. Level of water/sludge with respect to the flow line of outlet pipe

ii. Back pressure

iii. Whether inlet pipe and sanitary tee are in place

iv. Cracks in the wall using mirror on a long pole

v. Number of compartments - If more than one, sanitary worker needs to locate and remove lids from all the compartments. Each compartment will need separate pumping.

vi. Indication for high ground water, saturated soils.

(b) The sanitary workers shall use a long handle/rod to determine the sludge level in a septic tank.

(c) Workers shall take out the hoses and fittings from the tool boxrequired to complete pumping.

(d) To probe the tank, the hose shall be lowered slowly to the last length of hose, to get an indication on the volume of sludge to be pumped

(e) Then the hose shall be connected to the truck. Screw or clamp fittings shall be used in case back pressure is required to break up the sludge masses.

(f) Next, the pump or vacuum equipment shall be engaged. The worker must:

i. Ensure suction and operation of pump by checking rapid decrease in volume of tank.

ii. Monitor the level gauge on the septage cleaning tank. Always ensure there is adequate volume in the cleaning tank to accommodate the load. If only partial load can be pumped, monitor the levels closely.

iii. Monitor the septic tank as pumping progresses. Also check for blockages at the inflow and outflow pipes

iv. Check the tank for remaining sludge after pumping. Ensure that 1-2 inch of sludge should be left in the tank to facilitate future decomposition

(g) If accumulated solids are still remaining, the workers shall initiate the pump back procedure, which will send the pumped septage back to the septic tank under pressure and direct this flow towards the sludge mass. This will break the mass, making it possible to pump out again. As little as 200-300 liters will be enough to break the mass.

(h) After pump-back is completed, pumping out of the septic tank shall be done again. The above steps can be repeated if required. Pumping from the tank shall be continued till about 100-200 liters of septage remains in the tank after cleaning.

(i) On completion of pumping, the hose shall be washed with water by directing water stream back to the tank, and the cleaned hoses shall be placed back in the truck tool box.

(j) Before leaving the site, the workers shall ensure that the tank lids/access cover is securely placed.

3.7 Evidence of De-sludging

3.7.1 The owner of the premises connected to septic tank shall obtain evidence of de-sludging through a receipt in the format given in Annexure VIII from the registered septage transporter each time when their tank is de-sludged and such evidence or receipt shall be retained for a period of minimum five years. The receipt shall be presented whenever required during inspection by the ULB or its authorized officials.

3.8 User charges and its collection

3.8.1 All the owners of the premises connected to a septic tank shall pay a user charge, as notified by the ULB under the Regulations, from time to time for desludging their septic tanks, transport and treatment of septage.

3.8.2 All the owners of the premises who have their own on-site wastewater treatment system certified by the ULB as functional and compliant and also those who are connected to the existing sewage network shall be exempted from paying user fee.

3.8.3 The ULB shall revise the charges based on revisions in costs involved from time to time. Such user charges shall include cost of desludging, transportation, treatment and disposal.

3.8.4 The user charges may be collected from the owners of the premises by any of the following mode of collection:

(a) The ULB may authorize any person including septage transporter to collect user charges from the owners of the premises connected to a septic tank. A Memorandum of Understanding (MOU) shall be entered into and executed between the ULB and authorized septage transporter which authorizes the latter to collect the charges and remit the amount to the ULB.

(b) The user charges may be added to monthly water charges or property tax, or could be a special municipal environment fee or pay-as you-use programme.

3.9 Safety Measures

3.9.1 The desludging shall be carried out using appropriate procedure, equipment, safety gear and operating practices which are incompliance with all relevant laws or directions pertaining at the time.

3.9.2 The safety of the workers engaged for desludging are vested with the transporter and he shall ensure that:

(a) all desludging workers wear appropriate personal protective equipment, safety gear and accessories including shoulder length fully coated neoprene gloves, rubber boots, a face mask, and eye protection as specified in the Prohibition of Employment as Manual Scavengers and their Rehabilitation Rule, 2013;

(b) all the safety equipments checked for operational before proceeding to a collection site;

(c) first aid kit, gas detection lamp and fire extinguisher are kept in the vehicle before it goes to the collection site;

(d) there are sufficient disinfectant on the vehicle before it goes to the collection site;

(e) all desludging workers are trained to use the safety gear and follow hygiene practices;

(f) smoking is prohibited while working at septic tank;

(g) all desludging workers must be immunized for tetanus, hepatitis A and B;

(h) desludging workers shall never enter in to septic tank as entry of manhole/septic tank is banned;

(i) children are kept away and tank lids are always secured with screws and locks;

(j) all desludging workers shall wash their hands immediately after contacting with septage/septage handling tools and equipment, and always before eating and drinking;

(k) the workers shall be cautious while performing desludging process as excessive weight on lid or manhole cover may result breakage.

3.10 Monitoring Mechanism

3.10.1 The ULB shall devise a monitoring framework for scheduled desludging services provided by the authorized private septage transporters and define the performance metrics that may be linked to the payment in terms of performance

incentive or penalty in case of non-performance. An indicative monitoring mechanism for septage management activities is given in Annexure IX.

4. Septage Transportation

After desludging of septage from premises, this has to be transported to the approved treatment site designated by the ULBs for safe disposal or reuse. The septage transporter is primarily responsible for the safe transport of septage. The ULBs shall need to ensure that handling, transport and disposal are in compliance with the Environment Protection Act, the Water Act, and the Municipal Solid Waste Management (Handling) and Management Rules.

4.1 Transportation Plan

4.1.1 To ensure safe transportation of septage, the septage transporter in consultation with ULB shall prepare a transportation plan which shall include:

(a) Scheduling and routing for trucks

(b) Customer service protocols

4.2 Responsibility of Septage Transporter

4.2.1 The septage transporter shall ensure that:

(a) the registered septage transport vehicle including all equipments used for the transport of septage shall have a leak-proof body and lock to secure the septage; comply with applicable standards and must be able to withstand a collision with another vehicle or any permanent structure;

(b) the tank and equipments used to transport septage shall not be used for the transportation of any other materials or liquids;

(c) the vehicles used to transport septage shall be equipped, at all times, with spill control or absorbent materials and disinfectant materials such as lime or chlorine bleach;

(d) the company name, contact number, company logo, and body number of the septage transportation vehicle are displayed on both sides of the vehicle. The information shall be marked using permanent and legible lettering at least 3 inches high and of reflective material;

(e) list of emergency contact numbers are pasted at the prominent place in all vehicles involved in septage transport;

(f) most competent trained driver are employed for transportation of sludge and septage;

(g) each worker wear a proper uniform with company logo on dress and hold identity cards;

(h) the vehicle involved in transportation is cleaned and washed inside as well as outside after every shift; the vehicles and equipment shall be serviced, and greasing, oiling, minor repairs, etc. are done at least twice a month;

(i) the database of the ULB is updated through mobile applications or reporting systems once the septic tank is cleaned.

4.2.2 The septage transporter shall retain the documentation relating to all stages of septage management i.e. desludging and transportation for a minimum period of 5 years.

4.2.3 The septage transporter shall retain registration related documentation permanently and shall present such documentation on request by an authorised official.

4.3 Septage Transportation Procedure

4.3.1 All the septage transportation vehicles shall be directed to transport septage to the designated treatment sites. Movement of vehicle without a valid license by the ULB shall attract fine and/or even seizure of vehicle.

4.3.2 Prior to starting of journey, the driver shall ensure that the vehicle is well equipped with spill control or absorbent materials and also disinfectant materials like lime and chlorine bleach.

4.3.3 The driver of the vehicle shall take the most convenient and congestion free route considering traffic flows and plan the trip to arrive at the treatment site within the specified operating hours.

4.3.4 While transporting septage, the driver and worker shall ensure that there is no discharge or emptying of septage into locations other than designated treatment sites and without a septage manifest form.

4.3.5 At Disposal site the truck must be parked in such way that the septage may be directed to the inlet chamber with one length of hose, wheels need be checked

and parking brakes need be placed properly, then the valves be operated and septage allowed to flow by gravity into the collection chamber.

4.4 Accidental Spillage

4.4.1 In the event of accidental spillage of sludge/ septage, the septage transporter shall:

(a) Immediately take action to contain the sludge/septage, minimize the environmental impact, and begin clean-up procedures

(b) Disinfect the area of spillage by sprinkling bleach solution or lime to the area and washing it with water after 15 minutes

(c) Notify the ULB authority immediately

4.4.2 In the event that a septage transporter fails to perform cleanup operations, the ULB shall perform the clean-up and charge all the related expenses incurred to the septage transporter including applicable fines and penalties.

4.5 Manifest Form

4.5.1 All transport of domestic sludge and septage shall require a manifest form as per the format given in Annexure X of these Guidelines. The septage transporter shall complete the manifest form by providing the following required information:

(a) Origin of sludge and septage indicating the name of the owner of the premises connected to the septic tank, complete address, and contact numbers;

(b) Date and time of collection;

(c) Source of sludge and septage (whether it is residential, commercial, or institutional);

(d) Estimated volume (in cubic meters) of sludge and septage collected;

(e) Identity of septage transporter including the name of transporter, company, address, storage capacity of vehicle, vehicle registration number, and name of driver;

(f) Destination (treatment/disposal facility) of collected sludge and septage,

(g) Date and time when the sludge and septage is received by the treatment/disposal facility; the manifest form must be signed by the receiving facility, including the name and address of the facility;

(h) The manifest form shall be considered void, if it is not enclosed with the evidence of desludging forms;

(i) The septage transporters and operators of treatment and disposal facilities are required to retain copies of the manifest forms for a minimum period of 5 years.

5. Septage Treatment and Disposal

The onsite sanitation system may fail if the collected sludge has not been properly treated and disposed by suitable treatment system. Septage can be treated in a variety of ways, and there is no single best option given the widely varying conditions of urban areas. The treatment using natural processes, including lime treatment, stabilization ponds, drying beds and composting, are the most cost-effective and widely used solutions in treating septage.

The first stage of septage treatment, mostly involves the stabilization of the septage and the separation of the solid phase and the liquid phase. In this way, the liquid part can be treated specifically, usually with wastewater treatment technologies. The solid part can further be treated to enhance its characteristics for either landfilling or agricultural reuse.

Hence, septage treatment involves different treatment steps and in choosing the most appropriate treatment option, a balance between economic and technical feasibility on the one hand and land requirement on the other must be achieved to match local factors like population density, hauling distance etc.

Furthermore, septage treatment facilities are either privately or publicly owned. The privately owned systems relieve ULBs of the burden of operating and maintaining a facility, establishing tipping fees, and monitoring septage deliveries.

5.1 Designated Treatment Facilities

5.1.1 Only approved and designated treatment facilities by the ULBs shall be used for processing and treatment of the septage.

5.2 Service Provider and accreditation

5.2.1 The ULB may operate a treatment facility and in the absence of service facilities may contract with private service providers, provided that, they shall have necessary funds to support capital expenditures and operating and maintenance expenses of their septage management systems. To become accredited, service providers shall be required to obtain the permits/certifications as required by the ULB from time to time. Only accredited service providers may participate in the bidding process.

5.3 Treatment Options

5.3.1 The septage can be treated either at sewage treatment plants or at independent septage treatment plants. The details of these two types of treatment are given below.

Treatment at Sewage Treatment Plants:

5.3.1.1 If a sewage treatment plant (STP) is existing or planned, septage can be co-treated with sewage, provided the STP has sufficient capacity to treat the additional pollution load of septage. The ULBs shall ensure that the design norms are not violated with the increased load (on account of the septage).

5.3.1.2 **Receiving Facility:** The septage arriving at the STP shall usually be discharged into a receiving facility. The receiving facility shall consist of an unloading area (sloped to allow gravity draining of septage), a septage storage tank designed based on expected volume of septage generated in ULB for the next five years with one or more grinder pumps installed.

5.3.1.3 **Treatment Procedure:** The septage in storage tank shall be properly mixed by mixers, air diffusers for odor control. Further, chemicals such as lime or chlorine can also be added to the septage in the storage tank to neutralize it, to render it more treatable, or to reduce odors. Next, the septage shall be preferably discharged at the upstream of the treatment facility for the removal of grit and screening. In the absence of the screening facilities, septage shall be transferred from the storage tank to the treatment plant with grinder pumps.

When the capacity of the STP is not sufficient to treat raw septage, the option of co-treatment of effluents from primary septage treatment can be considered along with sewage of STP. Since the primary treatment eliminates the suspended solids and the STP can then treat much higher volumes of liquid effluent than of raw septage.

Treatment at Independent Septage Treatment Plants:

5.3.1.4 When STPs are not available or the existing plants are of insufficient capacity or its location is too far, a treatment plant specially meant for septage treatment becomes the option to consider. The key treatment processes at the septage treatment plants are:

(a) **Pre-treatment of septage** – Pre-treatment is a physical treatment to ease for handling the sludge for further treatment. It includes pumping of septage from desludging tank to the digester passing through screens to remove large size particles like plastics, rags from the septage and removing sand particles and cinder septage to prevent scratches of downstream equipment.

(b) **Digestion of Sludge** - As the septage is in partly digested condition, it has to be treated further under controlled conditions in an anaerobic digester.

(c) **Lime Stabilisation** - The digested sludge from the digester shall be further stabilised by addition of lime, thus by controlling the odour before letting in to sludge drying beds.

(d) **Treatment of septage**–Treatment of septage here means further stabilization of the septage after separation of solid and liquid fractions. This can be achieved in a sludge drying bed of required size. The solid portion of the septage can be treated depending upon its loading pattern and various relevant parameters. .

(e) **Treatment of the solid fraction**–Post treatment of solids enhances the characteristics of the septage for either land filling or agricultural reuse. The various treatment technologies for this process are composting by various techniques including natural drying.

(f) **Treatment of liquid fraction** - Post treatment of filtered effluent from sludge drying bed assures that the final effluent can be discharged into surface water or can be used for gardening, agricultural purpose without causing any harm to the environment and public health. The

treatment technologies for effluent are stabilisation ponds, or aerobic treatment systems etc.

5.3.1.5 **Methodology of septage treatment:** The proposed independent septage treatment method is conditioning the sludge in a digester and then mixing lime with sludge and then followed by Sludge drying bed, Stabilisation pond and Composting which are discussed below in detail:

(a) **Digestion of Sludge -** As the septage is in partly digested condition, it produces noxious odour and hence the sludge has to be treated by anaerobic process to degrade the organic matter. The anaerobic digester is a closed container in which the sludge may be allowed to be in the digester for a period of thirty days and gets digested slowly under controlled conditions. A model design of a sludge digester is enclosed in Annexure XI. Another option for treating the sludge may be in Anaerobic baffled reactors, where most of the organic matters are removed by natural and chemical process.

(b) **Lime Stabilization -** Lime is to be provided in septage, in the process of septage treatment to achieve both conditioning and stabilization before the septage is de-watered. Additionally, lime stabilization also helps to reduce / minimize odour and to kill pathogens. Lime stabilization involves adding and thoroughly mixing lime with septage to ensure that the pH is raised to at least 12. The process requires approximately 3-5 kilograms of hydrated lime for every 1,000 litres of septage. Lime is to be added with the digested sludge collected from sludge digester in a sludge holding tank and then pumped to the sludge drying bed. A model design for sludge holding tank is enclosed in Annexure XII. It must be noted that lime shall not be added directly in to septic tanks as it shall kill the beneficial bacteria that are responsible for treating the sewage.

(c) **Sludge drying beds (Primary treatment) -** When treating septage, it is imperative to remove the liquid portion of the sludge. Dewatering is a method by which the amount of water can be reduced to a large extent depending on the process used and whether or not the sludge

is conditioned. Simple natural processes to sophisticated mechanical processes can be used, including drying beds, lagoons, vacuum filters, solar inclined beds and solar dryers. Out of all these options, treatment using drying beds is most preferred.

Drying beds consist of a gravel bed filter, equipped with a drainage system. Conditioned septage is loaded on the bed and the water is evacuated mainly by percolation through the filter and to a minor part by evaporation. Weather, septage characteristics, and the time for removing the dried sludge are the factors that influence the design of the drying beds. High temperature and high wind velocity accelerate the drying process whereas high humidity and precipitation retard drying.

The dewatered sludge is suitable for disposal. Further treatment of solid portion can be achieved by composting for reuse. A model design for sludge drying bed is enclosed in Annexure XIII.

(d) **Stabilisation Pond -** The filtrate from the dewatering units needs to be further treated through treatment process such as waste stabilization ponds before discharging into the environment. Stabilization ponds can be facultative ponds with maturisation pond depending on the organic pollutant concentration. The first facultative pond shall still have some suspended solids that shall accumulate at its bottom. After occasional removal, the sediments can be treated together with the solids that have been added to the drying beds.

The liquid effluent can be used in gardening or in agricultural but it shall be chlorinated if letting in to water stream. A model design for Facultative pond and maturisation ponds are presented in Annexure XIV.

(e) **Composting -** Composting is a popular method of treating solid part of septage. Composting is the aerobic decomposition of the organic matter in the sludge to a relatively stable humus-like material similar

to fertilizer. The compost derived from the process can supply some of the nutrients required for most soils and can help the soil retain moisture. Composting techniques have three types of process (1) windrow composting; (2) Aerated static pile composting and (3) Mechanical composting. No matter which process is used, several basic principles apply. The sludge is dewatered, then a bulking agent comprised of wood chips, sawdust, or dried compost is added to bring the solids content of the mixture up to 40-50 percent. Certain composting processes use temperatures ranging from 54 to 65° C to destroy pathogens and reduce the moisture content.

Co-composting septage with the organic fraction of municipal solid waste (MSW) like food wastes, paper, leaves, branches etc. is also possible as they serve as the bulking agent.

A general layout of septage treatment plant showing the components for treating the septage for a town having population of 30,000 is enclosed in Annexure XV.

5.4 Disposal

5.4.1 The treated septage shall be spread on designated land and disposed by land filling method. The operator of the treatment facility shall ensure that the specified location is authorised and notified by the ULBs from time to time, in compliance with the Environment (Protection) Act, 1986 and the Water (Prevention and Control of Pollution) Act, 1974.

5.4.2 The ULB shall ensure that the sanitary landfill is located above the highest ground water level and emits least foul smells; also located in close proximity to treatment plant. Few types of areas shall be avoided for landfill are:

(a) Sources of aquifer and groundwater recharge,

(b) Wetland, habitat and ecological areas with conflicting land use like parks, historical and recreational areas.

(c) Prone to landslides, underlying mine areas, sinkholes, or near earthquake faults.

5.4.3 The treated septage acts as organic fertilizer hence it may be applied to agricultural field, forests and plantation areas. The reuse of sludge must be in accordance with the WHO Guidelines on the reuse of human excreta, wastewater and grey water, 2006.

5.5 Responsibilities of the Treatment Plant Operator

5.5.1 The operator of the treatment facility shall be responsible for:

(a) Operating the septage treatment facility during working hours only;

(b) Accepting septage only if it is received with corresponding manifest forms;

(c) Testing the input quality of the collected septage for presence of any metal or traces of industrial waste and ensuring that no commercial or industrial waste is unloaded in these facilities;

(d) The sanitary landfill worker shall cover the disposed sludge/septage with 15 cm of soil cover every day and final cover of 2 feet within a week after the placement of final lift;

(e) Maintenance of minimum sanitation requirements at the treatment facilities including hand wash facilities and toilet/ bathroom, drinking water, medicated soaps and approved hand-drying machines and first aid kits.

6. Administration and Enforcement

For effective and efficient administration and enforcement of septage management system in the city or town, the ULBs shall create a City Septage Management Committee (CSMC) with such composition as it may deem fit through a notification.

6.1 Functions of City Septage Management Committee

6.1.1 The function of the City Septage Management Committee shall be to:

(a) Oversee the conduct of a survey of all properties and premises to determine if a septic tank is present, and if it is accessible for desludging

(b) To accredit and license septage transporters, service providers or treatment facilities

(c) To review and approve the applications for accreditation of service providers and to recommend the same for approval

(d) To receive and hear complaints from residential owners and issue decisions

(e) Serve notices of non-conformance to the provisions of the Regulation prepared by the ULB to the owners/administrators, or occupants

(f) Visit properties for the purpose of inspection, observation, measurement, sampling and testing

(g) Plan and implement an information, education and communication (IEC) program for municipal staff, resident welfare association, community organizers, self-help groups, general public, septage transporters and private operators on wastewater management and the city's septage management.

6.2 Violations and Penalties

6.2.1 The ULB shall by way of Regulation list the violations and prescribe penalties if a person is found guilty of the contravention of the provisions of the Regulations. The CSMC shall review implementation of the Regulation in regards to compliance and penalties, and recommend revisions.

6.3 Record keeping and reporting

6.3.1 The ULB shall be responsible for record keeping of information relating to all stages of septage management i.e. desludging, transportation, treatment and disposal. These information includes, but are not limited to, the following:

(a) Data on the households and other properties with septic tanks

(b) Buildings and structures who have desludged their septic tanks

(c) Volume of septage generated, treated and disposed

(d) Septage Transporter's information including operator-in-charge for each location, vehicle details

(e) Name and location of Treatment Facilities earmarked for disposal of septage

(f) Public Grievances

6.3.2 The ULB shall also leverage the Geographical Information System (GIS) and Management Information System (MIS) to facilitate septage management system by planning the route of septage vehicles and tracking these for regular record keeping.

6.3.3 The service provider shall retain other documentation relating to all stages of septage management i.e. desludging, transportation, treatment and disposal for a minimum of 5 years, and shall on request by an authorised official, present such documentation.

6.4 Complaint redressal system

6.4.1 The ULB shall set up a complaint redressal system to track the performance of the private sector operators in terms of whether they are emptying the septic tanks properly or not and to track whether they are dumping the septage at the designated site or not.

7. Information, Education and Communication

The information, education and communication aspects pertaining to septage management must be addressed to ensure successful implementation of the guidelines.

7.1 Public Awareness

7.1.1 Members of the Resident Welfare Associations, community-organisers, self-help groups and the general public shall be periodically sensitized about:

(a) the need for a robust septage management system including health hazards associated with the improper collection and treatment of septage and the ill effects of improper disposal of septage;

(b) the standard design and construction of septic tanks, proper desludging procedures, transportation, treatment and safe disposal methods of septage;

7.2 IEC for ULB officials

7.2.1 ULB officials shall be given regular training by Directorate of Municipal Administration (DMA) on:

(a) septage management and its best practices;

(b) the standard design and construction of septic tanks, proper desludging procedures, transportation, treatment and safe disposal methods of septage;

(c) need for periodic inspection of tanks; and

(d) safety standards.

7.3 IEC for septage transporters and other private operators

7.3.1 ULB shall conduct periodic training programmes for all septage transporters and private operators for safe handling of septage at the time of desludging and transporting.

8. Public Private Partnership for Septage Management

For sustainability of septage management in the city, the ULB shall be required to draw a long term financing and investment plan. While public funding shall be needed to finance septage management systems, facilities, equipment and manpower, the ULB shall be required to innovatively explore Public Private Partnerships (PPP), wherever possible.

8.1 Structuring of an appropriate PPP Option

8.1.1 Prior to structuring of an appropriate PPP option, the ULBs need to assess work profile, interests and capacity of private sector players doing septage management activities in Odisha and explore their willingness to undertake various activities in the sanitation value chain as per their competencies and interests.

8.1.2 The ULBs need to consider the following aspects before selecting an appropriate PPP structure:

(a) Operational role of the private player;

(b) Source of revenue to meet the private players' return expectations;

(c) Investment/ownership of capital assets;

(d) Payment structure;

(e) Contract length and value;

(f) Risk mitigation and allocation measures for the private player and the ULB.

8.2 Possible PPP options

8.2.1 The ULB may consider any of the following PPP options given in the table below for septage management activities:

	PPP Options				
	Refurbishment and Cleaning of Septic Tanks + O&M of treatment facility	**Construction of treatment facility**	**Refurbishment and cleaning of septic tanks**	**Construction and O&M of treatment facility**	**Integrated contract involving refurbishment, cleaning of septic tanks, construction and O&M of treatment facility**
Source of Revenue	ULB	ULB	ULB	ULB	ULB

	PPP Options				
	Refurbishment and Cleaning of Septic Tanks + O&M of treatment facility	**Construction of treatment facility**	**Refurbishment and cleaning of septic tanks**	**Construction and O&M of treatment facility**	**Integrated contract involving refurbishment, cleaning of septic tanks, construction and O&M of treatment facility**
Ownership of Asset	Private Player ULBs may provide the cesspool trucks	ULB	Private Player	ULB	Trucks – private Plants - ULB
Payment Method	Recurring fixed fee with Fixed fee per unit for refurbishment The operators may collect the desludging fees from the owner of the premises and remit the amount to ULBs. The operators may be paid as per the contractual obligations on a monthly basis based upon the number of trips made in a month.	Overall fixed fee on a pre-decided schedule	Recurring fixed fee with Fixed fee per unit for refurbishment	Overall fixed fee on a pre-decided schedule + recurring fixed fee for O&M	Recurring fixed fee for cleaning and O&M with Fixed fee for Construction and Fixed fee per unit for refurbishment
Contract length	2-3 year	Lasting the time period of construction	2-3 year	12-18 months	2-3 years

Annexure- I

Status of sewerage projects under implementation in Odisha state

Sl. No.	Name of the ULB	Status of sewerage system	Capacity of STP/WWTP	Year in which the STP Commissioned/To be commissioned
01.	Puri Municipality	Sewer Network completion - 100% commissioned – 30%	15 MLD	2014
02.	Bhubaneswar Municipal Corporation	Works of sewer network is in progress in four districts out of six districts. STP is in progress in Sewerage district-VI	STP I 56.0 MLD STP II 28.0 MLD STP III 43.5 MLD STP IV 8.5 MLD STP V 1.2 MLD STP VI 48.0 MLD	2018
03.	Cuttack Municipal Corporation	Sewer network is in progress. STP in two sewerage districts in progress	STP I 36 MLD STP II 16 MLD	2018
			WWTP- 33 MLD WSP type functioning for I&D work at Matgajpur.	2006
04.	Rourkela Municipal Corporation	DPR for Rourkela East and Rourkela West is being implemented. Estimated cost : Rs. 96.28 crores for Rourkela (East) & Rs.351.75 cores for Rourkela (West).	STP I 8 MLD STP II 40 MLD (To be implemented)	2018
05.	Sambalpur Municipal Corporation	Administrative approval received for implementation for Rs. 416.48 crores.	STP 40 MLD (To be implemented)	2018
06.	Berhampur Municipal Corporation	Steps are being taken for DPR preparation	To be implemented	------

Annexure- II

Survey on onsite sanitation facilities

1. Date of Survey : _____
2. House No/ Holding No/ Property details :_____
3. Name of the House/ Property Owner :_____
4. No. of occupants :_____
5. Whether the house has water supply connection? (Yes/No) _____
6. Availability of onsite sanitation facility (Yes/No): _____
7. If yes, details of onsite sanitation system

   A. In case of availability of Septic tank

   i. Type of Construction (Concrete/Brick masonry/ Stone masonry):_____

   ii. Size of Septic tank: Length _____ Breadth_____ Depth (including free board) _____ Free Board_____ Liquid depth_____

   iii. Volume of Septic Tank (excluding free board):_____

   iv. Location of Septic Tank (Front/ Back side of building):_____

   v. Distance of Septic Tank from the road/ Street:_____

   vi. Can the Septic Tank be accessible by suction pump for desludging? (Yes/No)_____

   vii. Cleaning Frequency adopted by the house owner (1Yr/2Yr/3Yr)_____

   viii. Is the septage/ effluent from the septic tank is let out open? (Yes/No):_____

   B. In case of other facility:

   (The facility available may be briefly described along with disposing arrangements)

   ix. The Name and address of the agency doing regular desludging/disposal: _____

8. If No onsite sanitation system available

   i. Whether sufficient space is available to construct new Septic tank (Yes/No):_____

   ii. Distance of proposed Septic Tank from the road/ Street

   Note: *If construction of new septic tank is not feasible due to space constraint other option may be described*

Signature

(Authorized representative of Survey Agency/ ULB)

Annexure III

Form for Registration of Septic tank

(Note: Registration Fees to be paid through Demand Draft only in favour of Commissioner ----------Municipality and submitted along with this form)

OWNER / APPLICANT DETAILS

First Name _____

Site Address with assessment No _____

_____

_____

Mobile Number _____

E-mail ID _____

Address for communication _____

Status of existing on site sanitation available at the time of survey

a)Septic tank as per design (Yes/No)

If yes Details of the Septic Tank:

1. Type of construction (Concrete / Brick Masonry/ Stone Masonry) _____
2. Size of Septic Tank: Length _____; Breadth _____; Depth (Including Freeboard)_____; Freeboard _____
3. Volume of Septic Tank (Liquid Capacity in Litres) _____
4. Location of Septic Tank (Front side / Back of Building) _____
5. Distance of Septic Tank from the road / street _____

If No Details of the Septic Tank:

Whether modified or Newly constructed

If modified

1.Type of construction (Concrete / Brick Masonry/ Stone Masonry)

2.Size of Septic Tank: 2.Length _____; Breadth _____; Depth (Including Freeboard)_____; Freeboard _____

3.Volume of Septic Tank (Liquid Capacity in Litres) _____

4.Location of Septic Tank (Front side / Back of Building) _____

5.Distance of Septic Tank from the road / street

_____

If Newly constructed

1.Type of construction (Concrete / Brick Masonry/ Stone Masonry)

2.Size of Septic Tank: 2.Length _____; Breadth _____; Depth (Including Freeboard)_____; Freeboard _____

3.Volume of Septic Tank (Liquid Capacity in Litres) _____

4.Location of Septic Tank (Front side / Back of Building) _____

5.Distance of Septic Tank from the road / street

_____

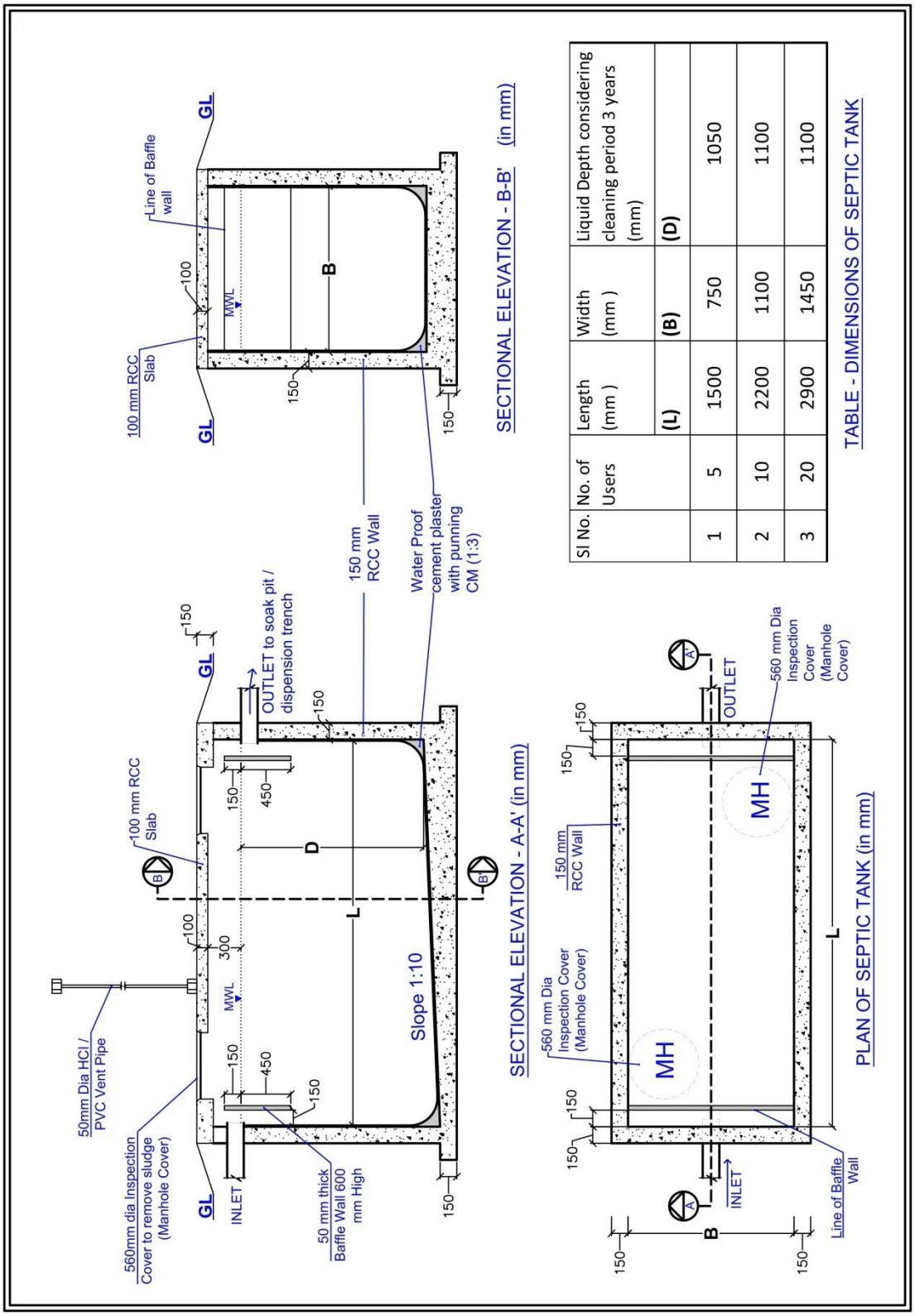
Annexure IV

Specifications for septic tank design and construction

- The sizes of septic tank as recommended by IS:2470 of Bureau of Indian Standards and CPHEEO Manual for Sewerage and Sewage Treatment for 5 users and up to 300 users are to be adopted.The septic tank is to be sized properly with appropriate detention time and volume;
    - Septic tanks are normally designed as rectangular tanks with a length to breadth ratio of 2:1 keeping liquid depth as 1-2m considering cleaning (desludging) interval of 2-3 years
    - A free board of minimum 30 cm should be kept over the liquid depth.
    - The walls of septic tanks preferably are of RCC structure having minimum thickness of 150 mm. It can also be constructed in brick with wall thickness not less than one brick length in cement mortar 1:4, and should be plastered both inside and outside in cement mortar 1:3.(1cement:3sand).The bricks to be used shall be KB bricks the compressive strength of which shall not be < 35 kg/ cm^2.
    - It should be water tight
- Concrete is a common material for septic tank construction. Steel, wood, or other materials that are subject to decomposition in soil should never be used.
- There shall be proper inlet and outlet arrangements;
    - The inlet and outlet should be located as far away as possible from each other (preferably on both ends) and at different levels to avoid short circuiting of liquid
    - The floor should have minimum slope of 1:10 sloping towards the sludge outlet to facilitate easy removal of sludge.
- Septic tanks of more than 2000 litres capacity may have 2 compartments separated by a baffle wall, the second compartment being half of the capacity of 1st one. For septic tanks of more than 100 users capacity, 2 chambers are to be constructed each of half of the total capacity.
- Hanging baffles of 45-60cm wide shall be provided after the inlet to make the inflow quiescent, and before the outlet not to allow scum going out with the effluent. The baffles should dip 25-30cm into the liquid and project 15cm above the liquid surface. A ventilation pipe not less than 50mm dia should be provided and the top of which should be covered with mosquito proof wire mesh.
- There should be an access port for each compartment that allows inspection and pumping

Annexure V A

Septic Tank for 5 to 20 users

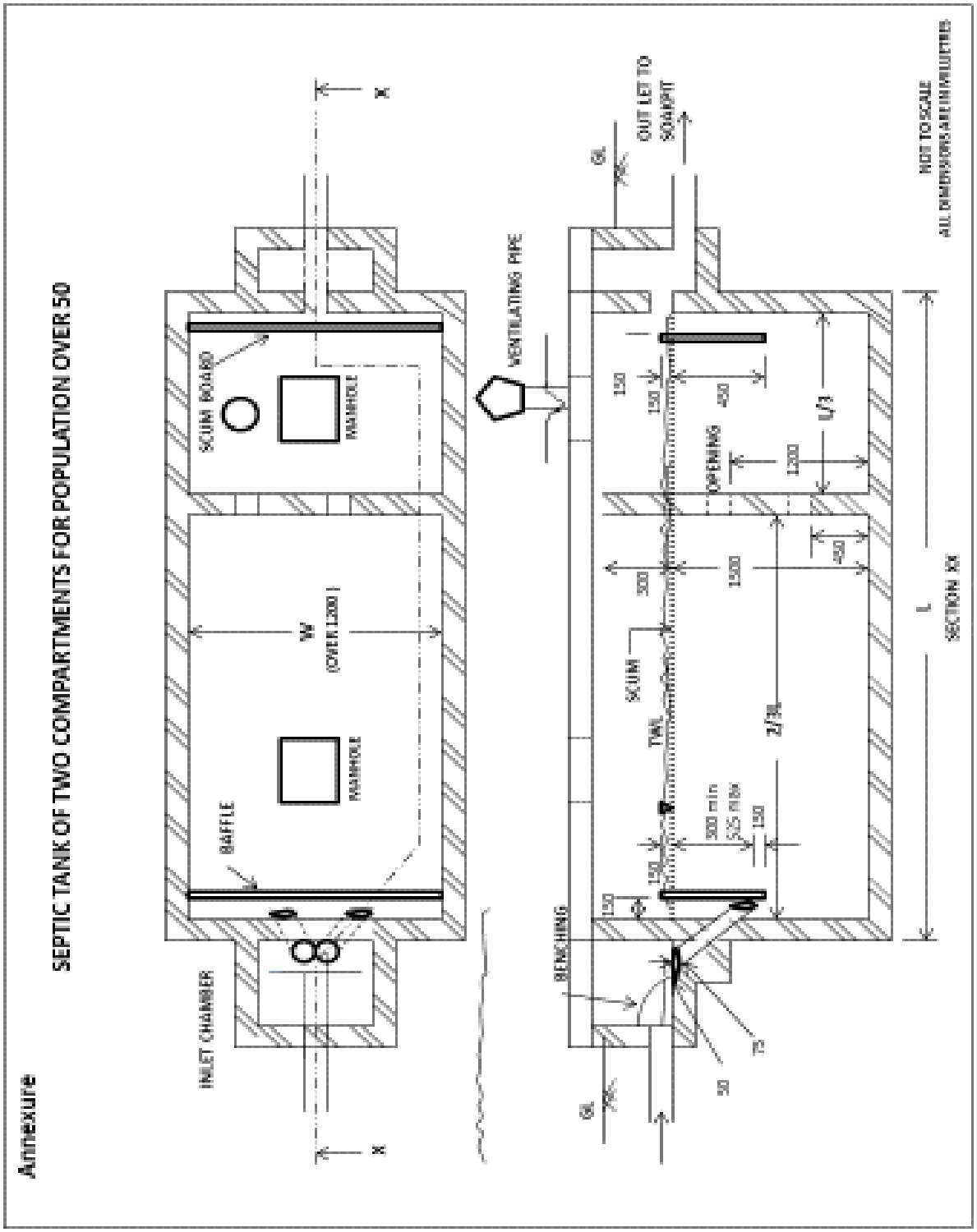


Sl No.	No. of Users	Length (mm)	Width (mm)	Liquid Depth considering cleaning period 3 years (mm)
		(L)	(B)	(D)
1	5	1500	750	1050
2	10	2200	1100	1100
3	20	2900	1450	1100

TABLE - DIMENSIONS OF SEPTIC TANK

Annexure V B

Septic Tank of Two Compartments for Population over 50



Annexure VI

Checklist of tools and equipments to be kept with the septage transport vehicle

Sl. No.	Particulars	Remarks
1	Engine Oil	
2	Air Pressure on tires	
3	Safety back up horn	
4	Pumping truck equipment	
5	Hoses inspection for cracks & wear	
6	Safety gears: a) Hand gloves b) Boots c) Hard hat d) Face mask	
7	Disinfecting and spill control equipment: a) Bleach solution b) Lime c) Safety cone	
8	Tools: a) Shovel and digging bar b) Rake trafficker c) Broom d) Lifting bar for tank lids e) Screw drivers, vice grip, pliers for opening tank lid f) Hand wash supplies(soap, towels, water, waterless hand washing soap) g) Log book, work orders, extra forms, receipts ,pens h) Work orders for the day-review for special instructions. i) Map	

Annexure VII

Permit for Septage Transporter

Septage Transporter Permit for _____ Municipality

In accordance with all the terms and conditions of the current _____ Municipality's Rates, Rules and Regulations, the special permit conditions accompanying this permit, and all applicable rules, laws or regulations of Government of Odisha, permission is hereby granted to:

NAME OF PERMITTEE:_____

ADDRESS:_____

For the disposal of septage from domestic septic tank or commercial holding tank at the_____ treatment facility. This Permit is based on information provided in the Septage Transporter Permit application which constitutes the Septage Management Hauled Permit. This Permit is effective for the period set forth below, may be suspended or revoked for Permit Condition Non Compliance and is not transferable. The original permit shall be kept on file in the Permittee's office. A copy of this Permit shall be carried in every registered vehicle used by the permittee.

EFFECTIVE DATE:

EXPIRATION DATE: ____

CHECK IF RENEWED PERMIT

Permit is liable to be cancelled in case of violations of any Acts, Rules and Regulations relating to the operation of Septage System or in cases of safety protocols not being adhered to or in case of non-permitted disposals.

Annexure VIII
Receipt/ evidence for de-sludging by owner / authorised person

1. Details of Septage Transported:
   a. Volume (Litres / Cum) _____
   b. Source (Septic Tank / Cesspool/ Others) _____
   c. Type (Residential / Commercial / Restaurant / Portable Toilet / Others)
   _____

2. Details of Septage Generator / Household:
   a. Name of the Property Owner_____
   b. House No. / Plot No. _____
   c. Detailed address _____
   _____
   d. Phone Number _____

UNDERTAKING

The undersigned being authorized does hereby certify to the accuracy of the volume of septage, the source and type of septage collected and transported.

Date_____ Signature_____

(Authorised person or Property Owner)

Annexure IX

Monitoring Framework for Septage Management Activities

Activities to be Monitored	Performance Metrics	Type of Monitoring Mechanism				
		House-holds Reporting	Self Reporting	ULB sample HH survey	ULB random treatment site inspection	Grievance Redressal
Cleaning of Septic Tanks	Percentage of households cleaned as per schedule	✓	✓	✓		✓
	Number of instances where safety regulations weren't adhered to or manual scavenging took place			✓		✓
	Number of instances of spillage during cleaning		✓	✓		✓
	Number of septic tanks damaged	✓	✓	✓		✓
	Percentage septic tanks cleaned inadequately	✓	✓	✓		✓
Transportation of fecal Sludge	Number of instance of spillage during transportation		✓			✓
	Number of instances of fecal matter being dumped at non-designated sites					✓
Safe disposal of fecal sludge	Time taken to construct sludge drying beds		✓		✓	
	Standard of constructed sludge drying beds		✓		✓	
	Number of instances where safety regulations weren't adhered to at treatment site				✓	
	BOD and COD level of the treated septage				✓	

Annexure X
Manifest form for all transport of domestic sludge and septage

GENERATOR(S)

1. Name _____
Address _____
_____
City, State _____
Zip _____
Source Residential ____ Commercial ____ Restaurant ____ Portable
Toilet____Others

Contact Number _____
Quantity of waste pumped _____ litres

2. Name _____
Address _____
_____
City, State _____
Zip _____
Source Residential ____ Commercial ____ Restaurant ____ Portable
Toilet____Others

Contact Number _____
Quantity of waste pumped _____ litres

3. Name _____
Address _____
_____
City, State _____
Zip
Source Residential ____ Commercial ____ Restaurant ____ Portable
Toilet____Others _____

Contact Number _____
Quantity of waste pumped _____ Litres

TRANSPORTER

Company _____
Address _____
_____
City, State _____
Zip _____

Contact Number _____
Registration Number _____
Vehicle Registration Number _____

TRANSPORTER CERTIFICATION: I hereby acknowledge the receipt of above listed waste and will transport and dispose of it in accordance with all applicable laws.

_____	_____	_____
Name	Signature	Date / Time

ULB use only

TREATMENT OPERATOR (RECEIVER / DISPOSAL)

CERTIFICATION OF RECEIPT: The above waste was received by this facility and will be processed, disposed of or recycled in accordance with applicable laws.

Litres/ cum Received _____

_____	_____	_____
Name	Signature	Date / Time

Annexure-XI

Design of Sludge Digester

Ratio of diameter to sludge depth = 1.5 to 4

Provide free board for fixed flat fixed roof slab = 0.80 m

Provide floor slope 1/6

Time taken for sludge digestion (t) – 30 days

Provide time for monsoon storage (t_s) – 10 days

Septage produced per day = 18 m^3 (V_f)

Digested sludge withdrawal – 15.30 m^3 (V_d) [85% of sludge produced]

Volume of sludge storage digester including monsoon storage,

$$V = [V_f – \{0.67(V_f - V_d)\} \times t] + [V_d \times t_s]$$

$$= [18.00-\{0.67(18.00-15.30)\} \times 30] + [18.00 \times 10]$$

$$= 485.73 + 180.00 = 665.73\ m^3$$

Assume side wall depth 6.00 m

Cross sectional area = A = 665.73 / 6.00 = 110.955 m2

Diameter of the digester = $\sqrt{\frac{110.96 \times 4 \times 7}{22}}$

=11.88 m Say 12.00 m dia

Provide sludge digester of 12.00 m dia with a depth of 6.60 m including free board.

Annexure-XII

Model design for capacity of sludge holding tank

Volume of sludge collected per day - 20 m^3

Assume the sludge collected in sludge holding tank are being emptied 3 times daily in each tank

The storage capacity required for holding the sludge = 20/3 = 6.67 m^3

Provide 2 sludge holding tanks of half of the capacities= 6.67/2=3.35 m^3

Provide I.50 m inner dia,

The effective depth required 22/7 X ¼ x 1.5 x1.5 x d = 3.35

d = 3.35 x 7/22 x4 x 1/1.5 x 1/1.5 = 1.89 m say 2.0 m

Provide free board of 0.30 m and dead storage of 0.20 m

The total depth required is 0.20 + 2.00 + 0.30 = 2.50 m

Hence provide two sludge holding tanks of equal capacities of 1.50 m inner dia and 2.50 m depth (The tank should be provided with semi circular cover slab to keep the tank with 50% opening for pumpset erection)

Annexure-XIII

Design calculation for sludge drying bed

Table-1: Basic assumptions for calculation for Sludge drying bed

Sl. No.	Component	Value	Unit
A	**Household sanitation infrastructure**		
1	Latrine connected to septic tank	1	Per household
2	Grit and grease trap	1	Per household
B	**Septage cleaning, treatment and disposal**		
1	No. of septic tanks cleared per vehicle per day	3	Nos.
2	Number of year interval in cleaning septic tank	2	years
3	Volume of septage removed per septic tank	2	m3
4	No. of operational days for cesspool emptiers per annum	300	days

Table-2: Calculation of number of cesspool emptiers (trucks) required

Sl. No.	Parameters	Value	Unit
1	Present population in the town	30,000	No.
2	Nos. of people per household	5	No.
3	Nos. of houses	6,000	No.
4	Frequency of desludging, i.e., number of year elapsed between successive cleaning of a septic tank	2	years
5	Nos. of houses to be desludged per annum	3,000	No.
6	Coverage with septic tank	100	%
7	Average sludge volume per house.	2.00	Cum
8	Volume to be desludged per annum, cu.m.	6,000	Cum
9	Nos. of working day per annum	300	days
10	Volume to be desludged per day	20.00	Cum/day
11	Size of each cesspool emptier (desludging truck)	3	Cum
12	Nos. of houses per trip	1	No.
13	Nos. of trip per day (depends on the distance)	3	No.
14	Volume desludged per truck per day	6	Cum
15	Nos. of truck required	3	No.
16	Standby (Range 10%-25%)	1.1	
17	Total no. of trucks required	3	Nos

Table-3: Calculation for sizing of Sludge drying beds

1	No. of septic tanks cleared per year = No. trucks x No. of tanks cleared per day per vehicle x No. of working days in a days	2700	Nos.
2	Daily septage volume = No. trucks x No. septic tank cleared x volume of sludge cleaned per septic tank	18	Cum/day
3	Single drying bed area = (WxL = 8 m x 15 m)	120	m2
4	Max. septage depth	30	cm
5	Capacity per bed = Area x depth	36	m3
6	Daily requirement of beds	1	Nos.
7	Considering a drying period of	10	days
8	total drying beds required	10	Nos.
9	Total drying bed area =	1200	m2
10	Total site area = sludge drying bed area + 50% towards (area for dried sludge + area for ancillary units)	1800	m2

Annexure-XIV

Model Design for facultative Stabilization Pond

A.MODEL DESIGN FOR FACULTATIVE STABILISATION POND

(The values of latitude, MSL & Temperature are taken for Bhubaneswar Town)

Assumptions made

a) The BOD of filtered liquid effluent from sludge drying bed is 200 mg/l (as per Page 4/16 of draft Rule Development committee Issue Research Report 2004 of Washington state department of Health – Range of BOD is 118 to 189 mg/l)

b) Average temperature in coldest month - 18 ^{0}C

c) Clear sky in an annum > 75%

d) The sludge contains 90% of liquid

Calculations

Volume of daily flow into the pond = 0.90 x 20 = 18 m^3 / d

$$\text{BOD load on oxidation pond} = \frac{18 \times 200}{1000} = 3.60 \text{ kg/day}$$

(i) Permissible surface BOD loading rate as per temperature correlation

$L_0 = 20T - 120$ (CEPHEEO 5.8.4.4.1 of chapter 5)

Where as L_0 is design organic load in g/ha/d

T is Ave. temperature during coldest month in ^{0} C

Therefore $L_0 = (20x18) – 120 = 240$ kg/ha/d

(ii) Permissible BOD as per correction for Latitude

BOD loading at Latitude L = 20^0.27′ N

Permissible surface BOD loading rate $\lambda_s = 375 – 6.25$ L

$= 375 – (6.25x20.27)$

$= 248.31$ kg/ha/d

Elevation correction factor = {1+ (0.003 EL)} (CEPHEEO 5.8.4.4.1 of chapter 5)

Where EL is elevation above MSL

Elevation correction factor = {1+ (0.003 x 45)} [EL for Bhubaneswar taken as 45m]

= 1.135

Corrected BOD loading rate = 248.31/1.135 =218.77 kg/ha/d

From the above two values the permissible BOD may be taken as 218.77 kg/ha/d

Surface area of pond is required =3.60/218.77 = 0.0164 ha

=0.0164x 10000 = 164 m^2

Check for detention time

Adopt depth of pond 1.00 m

Volume of pond provided = 164x1.00 = 164.00 m^3

Detention time t = V/Q = 164.00/18 =9.1 days > 5 days

Surface area of oxidation pond = 164 m^2

Provide two facultative pond, surface area of each pond = 164/2 = 81 m^2

Assuming L: B ratio of 4: 1, breadth B = $\sqrt{81/4}$ = 4.5 m

Overall depth of pond including free board of 0.50 m =1.50 m

Provide Two oxidation ponds of equal sizes 22 m x 4.50 m x 1.50 m

BOD removal efficiency in Aerobic pond =90%

BOD of effluent from oxidation pond = $\frac{200 \text{ X } (100\text{-}10)}{100}$ =18.00 mg/l

B. MODEL DESIGN OF MATURISATION POND

Volume of pond required for a detention time of one day = 1.80 m^3

Assume a depth of 0.90 m

Area of pond required A = 18/0.9 = 20 m^2

Assume length breadth ratio of 3:1,

Breadth B = 20/3= $\sqrt{6.67}$ or say 7 m

Length of pond L = 3 x 7 = 21 m

Assume a free board of 0.50 m

The overall depth provided = 1.40 m

Provide Maturisation pond of size 21 x 7 x 1.40 m

Annexure-XV

Septage Treatment Plant Site Plan