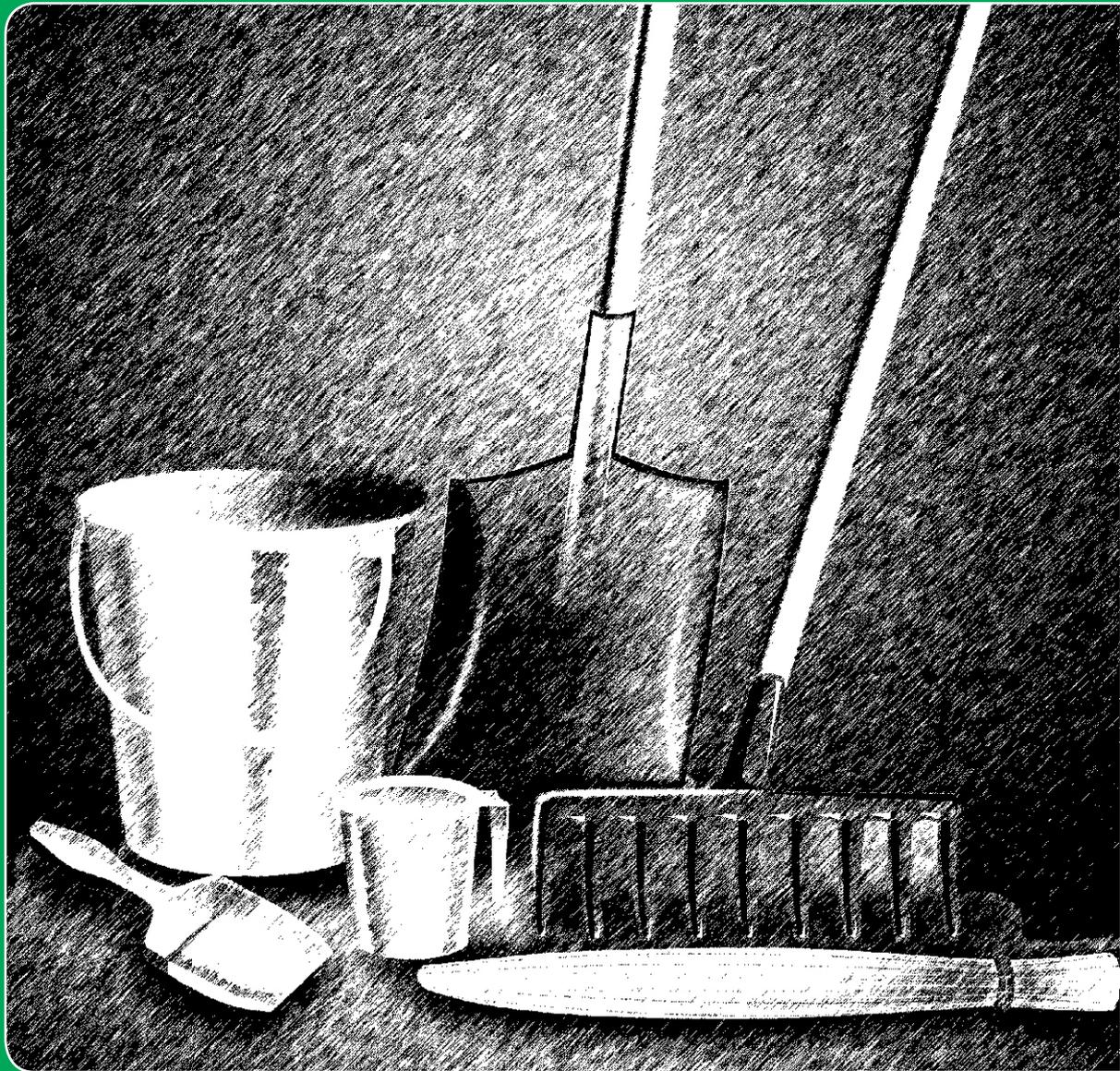


# Operational and Maintenance Tasks for the Upkeep of Decentralised Wastewater Treatment System (DEWATS)



Consortium for  
DEWATS  
Dissemination  
Society



# Foreword

Around 480 Decentralized Wastewater Treatment Systems (DEWATS) have been constructed in India over the past 20 years, with the intention of providing treatment to wastewater generated from various sectors like hospitals, hotels, institutions, small and medium scale enterprises, community based sanitation complexes, individual houses and housing colonies. In most of the DEWATS units, reuse infrastructure is provided in order to ensure a holistic approach to environmental sanitation. A DEWATS that is operated and maintained efficiently has the potential to be productive and sustainable economically, environmentally and socially.

The day-to-day operational tasks are adopted for smooth functioning and upkeep of DEWATS. The tasks are simple and require basic training. However, they are critical in ensuring the continuing high performance of the treatment system.

This Manual is intended for use by the operators/caretakers and maintenance personnel, to facilitate them to carry out the routine specific and critical tasks.

## Contents

1.0 Introduction.....	1
2.0 General Safety Measures.....	2
3.0 Operational tasks	
Task 3.1 Check for free wastewater flow.....	3
Task 3.2 Check for Solid waste at Screen.....	4
Task 3.3 Controlling pump outflow.....	5
Task 3.4 Check for swivel pipe level in the planted gravel filter.....	7
Task 3.5 Weeding, removal of dead leaf litter and other litter.....	8
Task 3.6 Backwashing sand and carbon filter.....	9
4.0 Maintenance tasks	
Task 4.1 Ensuring functionality of the vent pipes.....	10
Task 4.2 Check sludge level .....	11
Task 4.3 Desludging of the settler, anaerobic baffled reactor.....	12
Task 4.4 Cleaning of filter materials at Anaerobic Filter.....	13
Task 4.5 Replacing filter materials in Sand and carbon filter.....	14
5.0 Appendix .....	15

## Abbreviations

**BORDA** Bremen Overseas Research and Development Association  
**CBS** Community Based Sanitation  
**CDD** Consortium for DEWATS Dissemination Society  
**DEWATS** Decentralized Wastewater Treatment System  
**O & M** Operation and Maintenance

# 1.0 Introduction

DEWATS is designed such that by maximizing the reliance on natural processes, operational tasks are minimized. However, these minimal tasks are critical to ensure that DEWATS operate efficiently. A properly operated DEWATS is a productive system economically, environmentally and socially for 20 years or more.

It must be borne in mind that ensuring high performance of DEWATS requires a wide range of site specific tasks that go beyond the activities outlined in this Manual. For example, in a Community Based Sanitation (CBS) project, the task of emptying a dustbin regularly ensures that people do not throw garbage into the toilets thus preventing blockages in the DEWATS modules. Although there may be a longer list of site specific operational tasks, this Manual deals only with tasks, which have to be performed to ensure that the DEWATS modules functions properly.

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## **How to use this manual, and by whom?**

This Manual is intended for use by the beneficiaries of DEWATS, in particular caretakers and operators. Each operational task is addressed in terms of where and when it will occur, how the task should be performed and why it is needed. Simple information about DEWATS modules and how they function is outlined in the Appendix 1.0. For further information which may be beyond the scope of this Manual, one may directly contact Consortium for DEWATS Dissemination (CDD) Society.

For the majority of DEWATS, the guidelines given here will keep the system working effectively. However, changes in quantity or quality of the wastewater flowing into the unit and drastic changes in the climate may also affect the system's performance, mainly extending or shortening the intervals of the operational tasks.

Your DEWATS has been customized for your special requirements. Therefore you may not have all the modules for which operational tasks are presented in this manual.

## 2.0 GENERAL SAFETY MEASURES

This section gives a brief details about the basic Do's and Don'ts (as shown in Figure 1) in relation to the safety measures which needs to be taken while performing the O&M related activities.

### **a. General site safety**

- Do be careful and observant at all times
- Do ensure manholes are suitably covered or supervised when no operation and maintenance activity is being performed.
- Don't leave open chambers unattended

### **b. Personal safety precautions**

- Do wash your hands or disinfect them after completion of tasks. Find a clean space away from the system to eat and drink.
- Do use proper clothing (long sleeved shirt, long trousers, shoes and gloves, apron, mask) while maintaining the system.
- Do keep a first aid kit, lime or chlorine solution, hand wash and hand sanitizer, spare gloves, masks should always be kept in the vehicle/ treatment plant
- Do properly protect wounds from getting in contact with wastewater.
- Do wash clothes, gloves and boots after conducting the activity. The maintenance provider should change into off-duty clothes on completion of desludging and wash and disinfect the clothes used while desludging before the next use.
- Do avoid coming in contact with the wastewater.
- Don't be barefoot or bare handed while handling sludge and performing the O&M activities
- Don't eat or drink during work.

### **c. Proper disposal of waste**

- Do put the waste like scum, used gloves, masks and paper towels in suitable garbage bags.
- Do ensure that the waste from the operation and maintenance tasks are collected at least 10 meters away from any wells or other water bodies, so that it cannot leach into the ground and water.
- Do ensure that the garbage cannot be ransacked by animals.
- Do bring the garbage from operation and maintenance tasks to an official collection facility, where it is disposed of in a safe way.
- Don't wait longer than necessary to dispose of garbage.
- In case there is a spillage, the spill has to be cleaned by the operator either by sucking up the spill by the vacuum pump into the tank or if that is not possible to cover it with lime. In case that is not possible, then the spill should be washed and the wash water should be directed to a covered drain and chlorine should be sprayed on the spill area.
- Don't dispose garbage at unofficial dumping locations.
- Don't burn garbage

## 3.0 Operational tasks:

### Task 3.1 Check for free wastewater flow



Removal of obstacle from the sewer pipeline



Cleaning of inspection chambers

#### Where should this task be done?

- Sewer systems
- Inlet, outlet and at distribution channels of all DEWATS modules (Modules explained in Appendix)

#### When should this task be done?

- Once in 30 days, during peak usage (normally in the morning) of water
- Or, in the following cases
  - There is overflow in the inspection chamber(s)
  - There is overflow in the inlet or outlet of DEWATS modules
  - There is no wastewater flow out of DEWATS modules.

#### Why should this task be done?

- To identify possible obstructions in pipes and DEWATS modules
- To allow required free flow of wastewater through the entire system (all DEWATS modules)
- To identify possible damages or leakages.

#### How should this task be done?

##### Step 1

1. Open the manhole cover of inspection chambers
2. Open the manhole cover at inlet and outlet of each DEWATS module (settler, baffle reactor etc.).

##### Step 2

1. Check for obstructions like solid materials, floating materials, deposition at all the points
2. Check if the wastewater has its usual flow (compare with what was observed in earlier inspections).

##### Step 3

1. Remove obstruction if any, using an appropriate tool. (eg. shovel, stick, broom)
2. If no flow is observed, check whether the system is in use and if so, report to CDD Society or its certified service provider
3. If an unusual flow (extremely low, high or much dirtier than usual) is observed, repeat Step 1 and Step 2 for 3 days. If unusual flow continues during observation for 3 days report to CDD Society or its certified service provider.

#### NOTES

##### 1. Sewer system

Pipelines used to carry the wastewater and inspection chambers provided at certain intervals for regular checkup.

## Task 3.2 Check for Solid waste at Screen



Opening man hole



Man with long shovel



Solids removed

### Where should this task be done?

- Final manhole outlet

### When should this task be done?

- Every day during non-peak hours
- Or, in following cases
  - There is backflow in the manhole
  - Wastewater accumulation in manhole
  - There is no wastewater flow seen in the DEWATS modules

### Why should this task be done?

- To upkeep the flow in DEWATS
- To remove possible wastes from entering into the system and clogging it

### How should this task be done?

#### Step 1

1. Open the manhole cover of last inspection chamber before balancing tank
2. Check for obstructions like solid materials, floating materials, deposition near the screen or bottom of inspection chamber

#### Step 2

1. Remove obstruction if any, using an appropriate tool. (e.g. shovel, stick, broom, rake tool).
2. Solid waste collected needs to be disposed into municipal trucks
3. If no flow is observed, check whether the balancing tank pumps are working
4. If no flow is observed and balancing tanks' pumps are working, check for blockages in the inlet and outlet pipes

## Task 3.3 Controlling pump outflow



### Where should this task be done?

- At the valve's register near balancing tank, the control panel and the feeding tank

### When should this task be done?

Once in every month

Or, in following cases

- Wastewater seen accumulated in balancing tank
- Backflow of wastewater seen at manhole/inspection chamber

### Why should this task be done?

- To ensure right up-flow velocity in DEWATS
- To ensure optimal usage of pumps

### How should this task be done?

#### Step 1

1. At the balancing tank's control panel turn 'switch 1' to Manual' and turn 'switch 2' to 'Pump 1' or 'Pump 2' depending of which outflow needs to be controlled
2. Switch on pump by pressing green button

#### Step 2

1. At the feeding tank close the main outlet valve and turn on the timer simultaneously
2. Stop the timer once the water level in feeding tank reaches overflow pipe and note the same
3. Switch off the pump by pressing red button on balancing tank control panel
4. The time taken should be 90 seconds with tolerance of + 5 seconds for obtaining desired peak flow of 3 m<sup>3</sup>/h, if it is more than 90 seconds look into Step 3.1 and if the time taken is less than 90 seconds look into step 3.2.

#### Step 3

1. At the valve register near balancing tank, partially close the by-pass valve and open the main valve and repeat STEP 1 and STEP 2 till desired time is reached.
2. At the valve register near balancing tank, partially open the by-pass valve and close the main valve and repeat STEP 1 and STEP 2 till desired time is reached.



Switches position while controlling the flow of Pump-1



Operating valve near feeding tank with timer



Feeding tank



Balancing tank control panel

## Task 3.4 Check for swivel pipe level in the planted gravel filter



Swivel pipe chamber/ Outlet chamber



Measuring the level of swivel pipe top

### Where should this task be done?

Swivel pipes (L-pipe) inside the outlet chamber.

### When should this task be done?

Once in 30 days

Or, in the following cases

- The water level is observed above the upper surface of the filter material (coarse aggregates)
- There is dampness on the filter material
- There is no plant growth
- There is excess mosquito growth.

### Why should this task be done?

- To ensure efficient usage of filter media for wastewater treatment
- To avoid flooding
- To avoid death of plants
- To avoid mosquito growth due to flooding.

### How should this task be done?

#### Step 1

1. Open the cover slab of the outlet chamber.

#### Step 2

1. Check if the swivel pipe top is at 50cm from the bottom of the outlet chamber.

#### Step 3

1. If the swivel pipe top is not at the desired level, lower or raise it until the top of the swivel pipe is 50cm from the bottom of the outlet chamber
2. If there is no water flow from top of the swivel pipe, check for leakage at the swivel pipe joint at the bottom. If any leakage is found, inform the contractor to rectify the same immediately. If the condition prevails even after rectification, report it to CDD Society or its certified service provider

### NOTES

**1. Swivel pipe:** This is a device which can be used to regulate the water level in the planted gravel filter.

## Task 3.5 De-weeding, removal of dead leaf litter and other litter



Pond with algae growth



Weeding and cleaning of litter

### Where should this task be done?

- Inside the planted gravel filter
- On the surface of polishing pond
- Around all the treatment modules.

### When should this task be done?

- Once in 30 days  
or, in the following case
- There is excess weed or/and litter.

### Why should this task be done?

- To avoid rotting of dead leaf litter in the planted gravel filter and polishing pond
- To avoid clogging of filter material in the planted gravel filter
- To avoid algae bloom<sup>1</sup> in the polishing pond
- To expose treated water in the polishing pond to the atmosphere and to the sun
- To maintain the cleanliness and to increase aesthetics near the treatment modules.

### How should this task be done?

#### Step 1

1. Check for presence of dead leaf litter or/and weed inside the planted gravel filter and polishing pond
2. Check for weed and other litter around all the treatment modules
3. Check for excess (more than 60% coverage of water surface) algae inside the polishing pond.

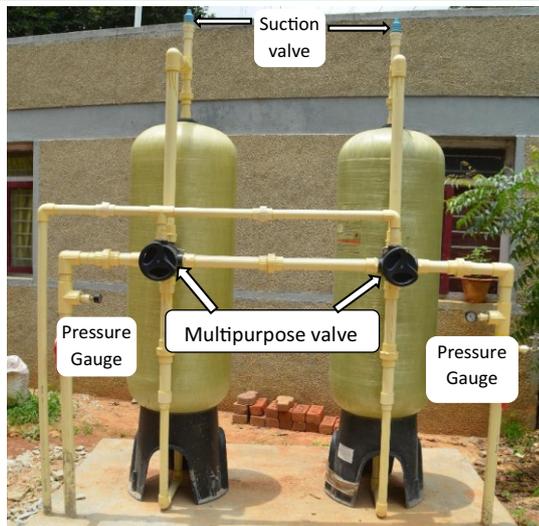
#### Step 2

1. If the dead leaf litter or other litter is present, remove it manually or using an appropriate tool (garden rake, fish net and sieve)
2. Weed should be removed by extracting the roots also
3. Remove excess algae in the polishing pond using a fish net.

#### NOTES

**1. Algae bloom:**  
Excessive growth of algae in a water body due to high nutrient content.

## Task 3.6 Backwashing sand and carbon filter



Sand and Carbon filter



Backwash flow into feeding tank

### Where should this task be done?

- At control panel
- Near sand and carbon filter

### When should this task be done?

Once in week during peak hours Or, in following cases

- The pressure difference at inlet and outlet is  $\geq 1$  Kg/cm<sup>2</sup>
- Water quality at the outlet smells or is not clear

### Why should this task be done?

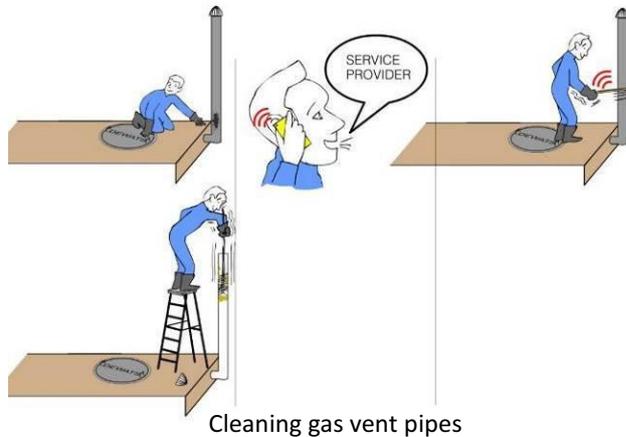
- To ensure efficient use of filter
- To ensure treated effluent quality matches desired standards

### How should this task be done?

1. At control panel of sand and carbon filter switch pumps to manual mode
2. At sand and carbon filter turn the multipurpose valve, put sand filter in 'backwash mode' and carbon filter in 'filter mode' (see if we can add picture of this)
3. At control panel of sand and carbon filter turn on the pump manually and let it run for 10 min or more till the water is clear (look in the feeding to know the water quality) and stop the pump manually
4. Keeping the carbon filter in 'filter mode', turn the sand filter to 'fast rinse mode' and switch on the pump
5. Run pump for 5-10 minutes or till the water quality is clear, then stop the pump
6. Turn the multipurpose valve at sand filter to 'filter mode' and carbon filter to 'backwash mode'
7. Run the pump for 10 minutes or till the water quality is clear and then stop the pump
8. Keeping the sand filter in 'filter mode' and carbon filter in 'rinse mode' run the pump for 10 minutes or till the water quality is seen clear and stop the pump
9. Turn the multipurpose valve of sand and carbon filter to 'filter mode'
10. At the control panel switch to auto mode and run the pump

## 4.0 Maintenance tasks:

### Task 4.1 Ensuring functionality of the vent pipes



#### Where should this task be done?

- At vent pipe in balancing tank and anaerobic baffled reactor

#### When should this task be done?

Once in a month

or, in following cases

- The treated effluent wastewater smells
- Smell from manhole openings of modules

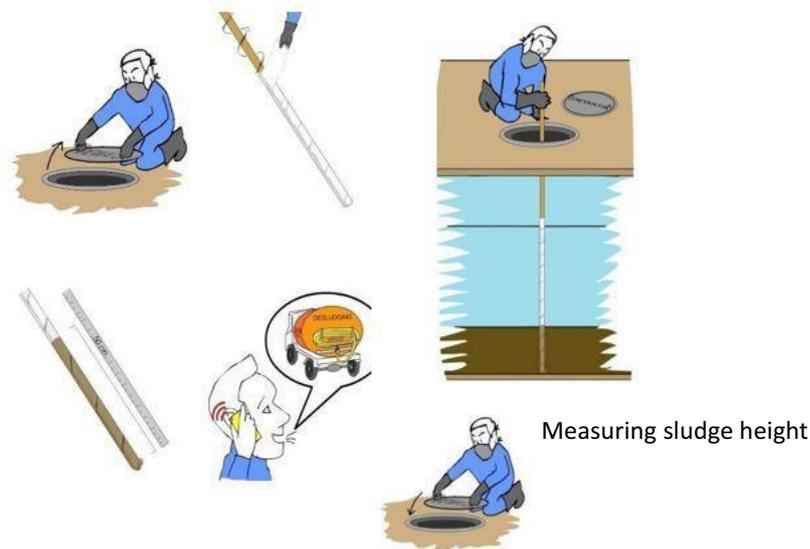
#### Why should this task be done?

- To avoid bad odour around the system.

#### How should this task be done?

1. Look for damages on the outside of the vent pipe
2. Check for blockages in the vent pipe by either looking through it, tapping it with a stick and judging if it is free from the emanating sound or through other suitable methods
3. Remove any blockages found using an L-brush. If you notice any damage, please contact your service provider for replacement.

## Task 4.2 Check sludge level



### Where should this task be done?

- At chambers of settler, anaerobic filter and anaerobic baffled reactor

### When should this task be done?

- Once in a year  
or, in following cases
- The treated effluent is not clear

### Why should this task be done?

- To provide the required retention time for new sludge and wastewater in the modules
- To ensure separation of water and solids in settler.

### How should this task be done?

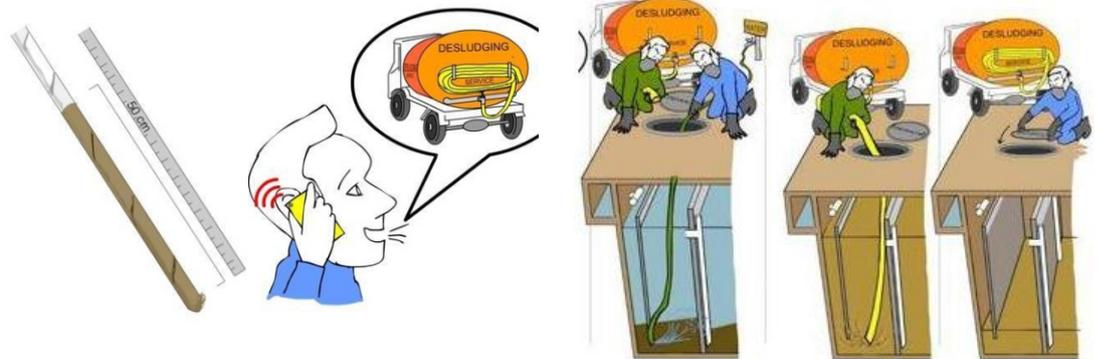
1. Open the manhole covers
2. Take a clean long stick or a scale and wrap a white cloth around it
3. Insert the cloth wrapped stick vertically and slowly into the inlet and outlet of the settler chamber till it touches the base of the module.
4. Take the stick out slowly and look at the level of sludge mark on the wrapped cloth
5. If the mark of the sludge is higher than 50 cm (which means that the sludge level in the chamber is higher than 50 cm), desludging has to be carried out according to the degree of solidification.
6. In anaerobic filter chamber insert the cloth wrapped stick through desludging pipe
7. Close the manhole with the manhole cover.

### Precautions to be taken:

1. Operators should follow the safety measures mentioned at the end of the document
2. After the sludge measurement the cloth has to be discarded

## Task 4.3 Desludging of the settler, anaerobic baffled reactor and anaerobic filter

Desludging Process of Settler, anaerobic baffled reactor and anaerobic filter



### Where should this task be done?

- At Chambers of settler, anaerobic filter and anaerobic baffled reactor

### When should this task be done?

Once in a year

or, in following cases

- The treated effluent is not clear

### Why should this task be done?

- To avoid solidification of sludge.
- To provide required retention time for wastewater flowing through the components

### How should this task be done?

1. Open the manhole covers of the chamber
2. Measure the sludge level. (Refer Maintenance, Task 2)
3. Remove excess (more than 50 cm) sludge from the chambers using the desludging equipment
4. Leave around 15 cm of sludge in each chamber to ensure continuous treatment of wastewater
5. Chambers with less sludge can be inoculated with dislodged sludge using sludge pump with hosepipe
6. In AF chamber remove the excess sludge through the desludging pipe
7. Place the manhole cover back over the manhole.

### Precautions to be taken:

1. Operators should follow the safety measures mentioned at the end of the document
2. Proper agitation of sludge with the available wastewater inside the tank will assure the pumping process faster
3. Access inside the tank is strictly prohibited. Proper cleaning and aeration should be carried out in case of entry required

## Task 4.4 Cleaning of filter materials at Anaerobic Filter



Cleaning of filter materials at Anaerobic Filter

### Where should this task be done?

- At Chambers of Anaerobic Filter

### When should this task be done?

- Once in 5 years or when the filter media is seen clogged

### Why should this task be done?

- To avoid large quantity of sludge accumulation in anaerobic filter and next DEWATS™ module.
- To retaliate the design treatment efficiency to the effluent quality.
- To avoid clogging of wastewater through the treatment system.

### How should this task be done?

1. Open the manhole covers of the anaerobic filter
  2. Using a Pump, force water above the filter materials through jetting action.
  3. Meanwhile, use a sludge pump to dewater the filter chamber through the desludging pipe
  4. Repeat the steps 3 or 4 times till you pump out clear water.
- Place the manhole cover back over the manhole.

### Precautions to be taken:

1. Operators should follow the safety measures mentioned at the end of the document
2. Stop the wastewater inflow by plugging the inlet or by bypassing or switch off balancing tank pumps.

## Task 4.5 Replacing filter materials in Sand and carbon filter

### Where should this task be done?

- At Sand and carbon filter

### When should this task be done?

- Once in a year or when the filter loses its treatment efficiency

### Why should this task be done?

- To effectively use the filter and meet reuse standards

### How should this task be done?

Call the service provider for replacing filter media

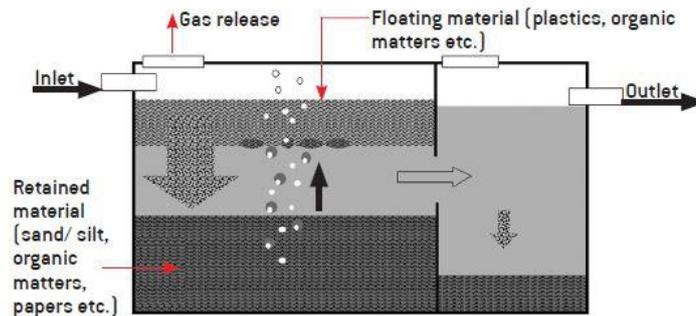
## 5.0 Appendix

# Appendix

### 1.0 DEWATS modules description

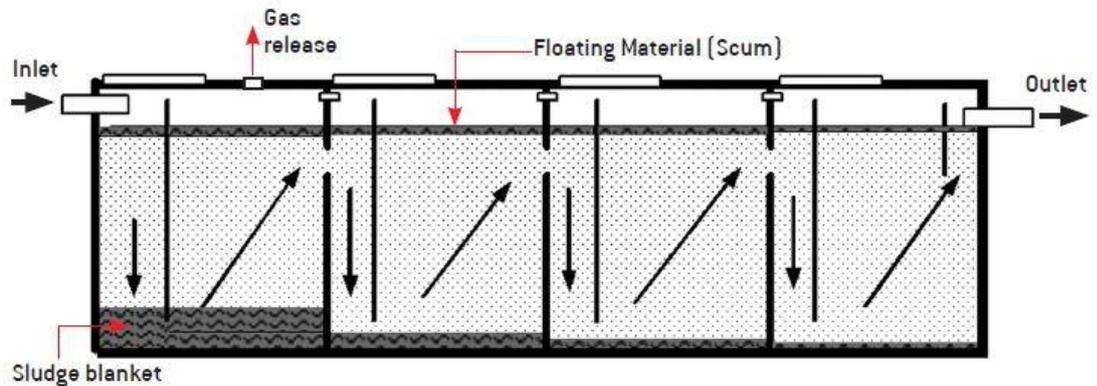
#### 1.1 Primary Treatment (Pretreatment)

1. Settlers are sedimentation tanks for retaining all that sinks in a given time. Settled (sunk) organic matter is retained in the tank, while all the rest (dissolved and suspended matter) passes untreated to the following treatment module. The wastewater is retained in this unit for 1.5 to 2 hours.

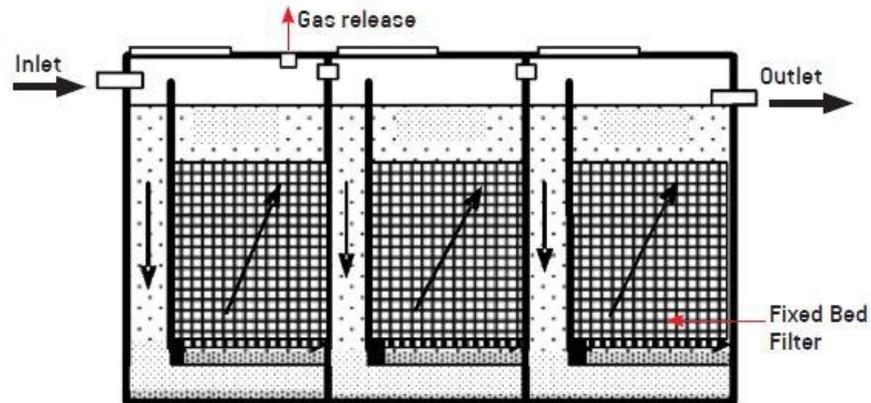


#### 1.2 Secondary treatment

1. Baffle reactors ensure anaerobic degradation of suspended and dissolved solids by mixing wastewater with active sludge blanket – these are naturally occurring bacteria that accumulate in the bottom of each chamber. The baffle reactor is suitable for all kinds of organic wastewater and its efficiency increases with more organics in the water (the dirtier the better). The wastewater is retained in this unit for 1 to 2 days.

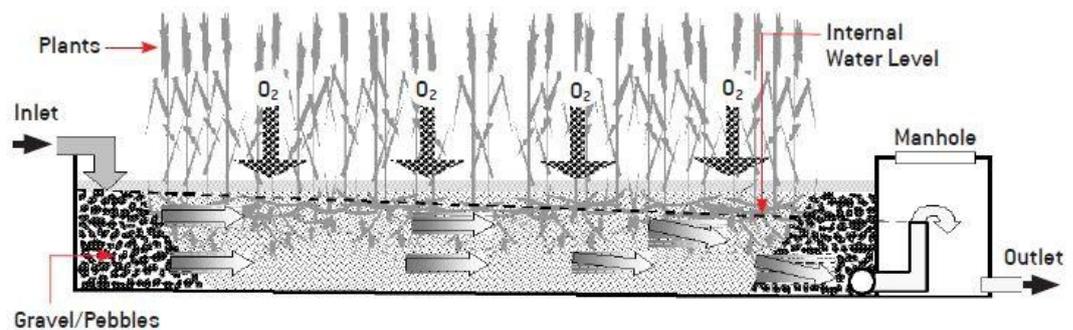


2. Anaerobic fixed bed filters make use of anaerobic digestion process with fixed bed filter—these are stones or other material in chambers. Active bacterial mass grows on the filter material (carrier). These units treat whatever is dissolved in the wastewater by bringing it in close contact with active bacteria mass. The filter media can be cinder, rock aggregates, slag, or specially designed plastic material etc. These units are ideal for wastewater with low content of suspended solids. The wastewater is retained in this unit for 1.5 to 2 days.



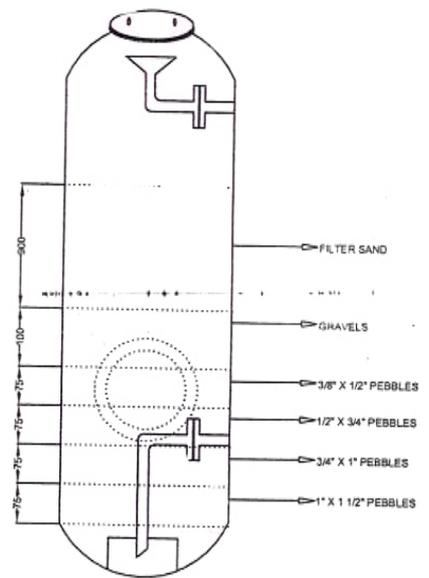
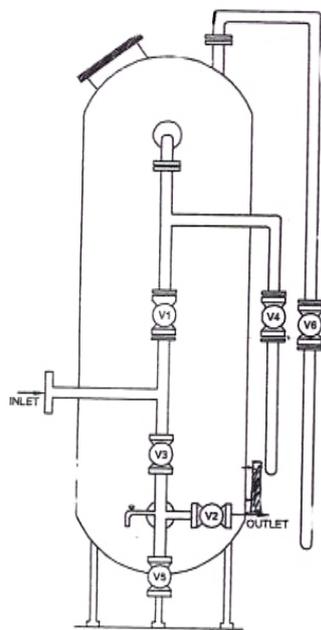
### 1.3 Tertiary treatment

1. Horizontal Planted Gravel Filter: The horizontal gravel filter is a shallow tank filled with graded gravel or pebbles, and special plants are planted in this gravel filter. The normal depth is 60cm. The main removal mechanisms are biological conversion, physical filtration and chemical adsorption. Plants commonly used are canas indica, reed juncas, phragmites etc. The filters clean the wastewater by retaining particles and digesting them with the help of bacteria growing naturally on the gravel/ pebbles. Important is the intake of air (oxygen) into the filter body. The plants help with transporting oxygen through their roots. Wastewater is retained in this unit between 5 to 10 days.



2. Pressure sand filter and activated carbon filter:

After the aerobic treatment the treated wastewater will be conveyed into pressurised sand and carbon filter for further treatment. This reduces the BOD to less than 10mg/l and therefore be reused for gardening. The sand filter helps in reducing TSS and carbon filter in reducing smell and colour.



Typical Layout of Sand and Carbon Filter

## Check List

Sl. No	Task	frequency	Date of performance of operational task	Signature of the operator	Remarks
1	Check for free wastewater flow	Once in 30 days			
2	Check for Solid waste at Screen	Once in 30 days			
3	Controlling pump outflow	Once in 30 days			
4	Check for swivel pipe level in the planted gravel filter	Once in 30 days			
5	Weeding, removal of dead leaf litter and other litter	Once in 30 days			
6	Backwashing sand and carbon filter	Every two days			
7	Ensuring functionality of the vent pipes	Once in 6 months			
8	Check sludge level	Once in a Year			
9	Desludging of the settler, anaerobic baffled reactor	Once in a year			
10	Cleaning of filter materials at Anaerobic Filter	Once in 5 years			

Note Make photo copies of this checklist and hand over to the DEWATS plant operator



