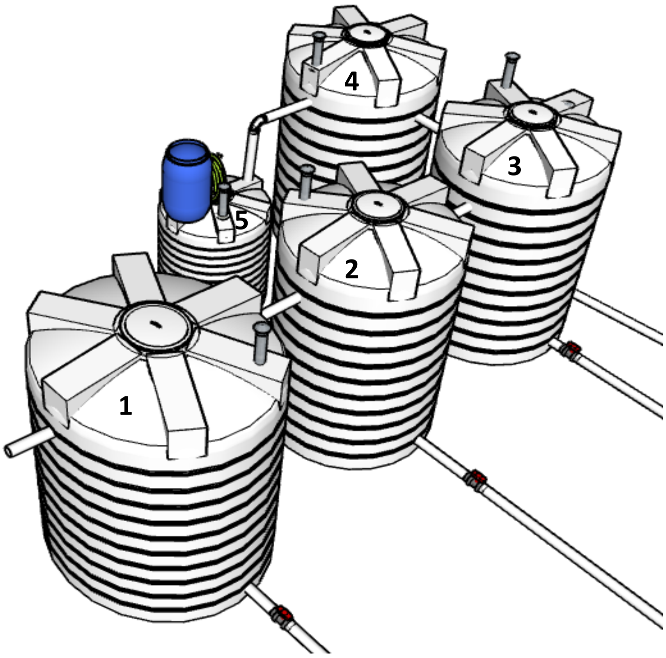
Operation and maintenance of Decentralized Wastewater Treatment System (DEWATS) in the Rohingya refugee camps in Cox's Bazar, Bangladesh



Jan-2022

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1. Objective of SOP

The SOP is an internal document to be used as guideline by IOM employees or implementing partners involved in the operation and maintenance of DEWATS. The system is designed to minimize material inputs and maintenance. However, regular monitoring and attention to operating procedures is necessary to ensure that the system works correctly and safely. To do this, the operational checklists below should be followed each time the system is used. A trouble shooting list of expected problems and solutions, as well as a summary of parameters to be tested and monitored are also included below.

2. Key design considerations

The IOM WASH unit has been confronted with a double challenge:

- Lack of space and access: treatment often occurs in crowded areas.
- Limited soil infiltration rate.

In 2018, DEWATS (Decentralized Wastewater Treatment System) was developed by IOM WASH unit. DEWATS is a compact system that includes an Anaerobic Treatment System (ATS) along with an effluent infiltration design. Its main objective is to reduce suspended solids and organic matter concentration to facilitate a better and sustainable infiltration of the effluent into the soil.

The DEWATS has a standard design to cover 3150 L of sludge per day, equivalent to 5,250 users. The treatment system has 4 steps:

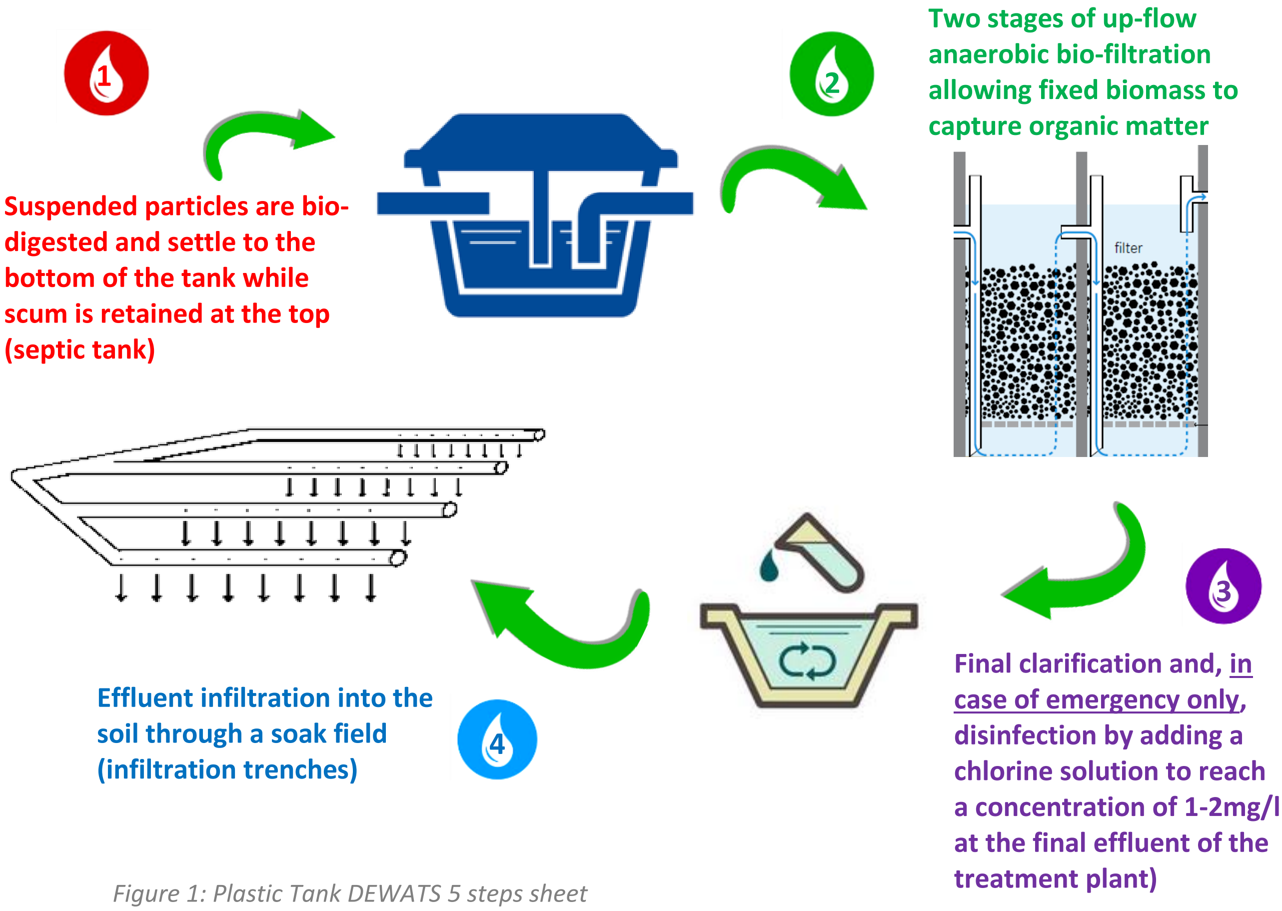

Figure 1: Plastic Tank DEWATS 5 steps sheet

The DEWATS is composed of two processes: The Anaerobic Treatment System (ATS, in plastic tanks with filter material) and the infiltration:

ATS specifications:

A total of 5 plastic tanks are needed

The first and second tanks (10,000 L and 7,500 L respectively) act as septic tanks by bio-digesting the sewage and retaining most suspended solids.

The third and fourth tanks (7,500 L each) act as Upflow Anaerobic Filters and are filled by filter media (ideally, this should be fragments of coconut husk, which have proven long life expectancy when immerged in wastewater).

The last tank (2000 L) is used for final clarification, or disinfection in case of emergency.

Each tank is fitted with a ventilation pipe filled with active carbon to eliminate bad odors.

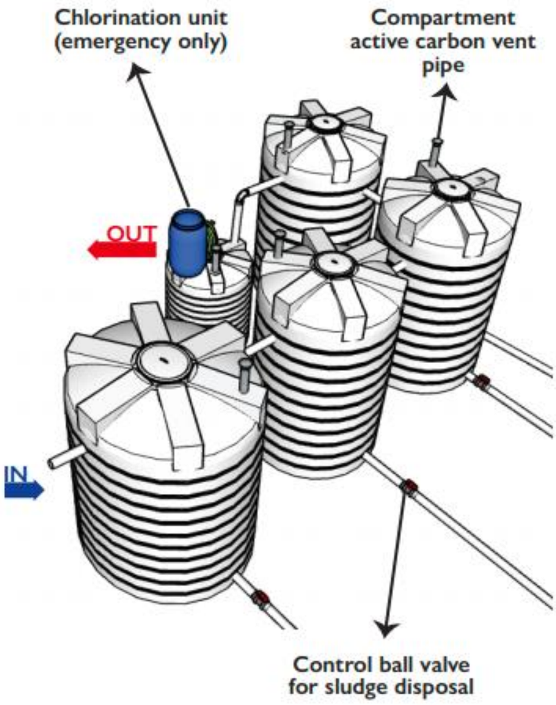

Figure 2: Anaerobic treatment system.

Figure 3: Infiltration trenches

Infiltration Soak Field:

After the last tank, the effluent is guided through perforated pipes in the infiltration soak field.

Soil infiltration tests were conducted in the camps, finding an average rate of 60 $l/m^2/d$ for semi-saturated sandy soil (within expected range for treated wastewater).

The infiltration surface needed is given by the quotient of the daily effluent discharge and the daily infiltration rate:

3150 (l/d)/60 l/m2/d) = 52.5 m^2

Infiltration happens in the bottom and lower half of the walls of the soak field, thus the needed length is given by dividing the infiltration surface by the width + ½ height of the trenches: 52.5 (m2)/1.55 (m) = 34 m.

More specific key design consideration can be found in Annex 1.

3.

3. Operational procedures

3.1. Environment, Health and Safety (EHS) procedures

The IP in charge of O&M should have clear EHS measures in place.

- Safety:

IP should provide proper personal protective equipment (PPE: boots, masks, gloves, etc.) to workers involved in the O&M. The selection of PPE depends on tasks and responsibilities of the staff and other requirements that might raise of new public health risks, such as COVID-19.

IPs must provide handwashing station on-site for workers hygiene, and proper material to operate DEWATS. The IPs are in charge to identify the risks linked to the O&M work and brief the workers accordingly. All staff and volunteers need to be trained on potential health risks and the use of PPE. IPs are in charge of ensuring dignified working conditions to the workers in the field by behaving with respect, providing safe working conditions, adapted working hours, proper tools and equipment, etc. The IPs prevent public access to the DEWATS site by clear sign and preventive measures adapted to refugees (site fencing, guard, sign board writing in Burmese, etc.)

- Environment:

All wastewater should be handled following the guidelines in order to mitigate any negative impact on the environment and public health.

- COVID-19 measures:

The IOM WASH programme in Cox's Bazar has made adaptations in COVID-19 infection, prevention and control measures throughout the pandemic. It is expected that these will continue to be utilized to ensure safe delivery, including training provided with adherence to physical distancing guidelines, wearing of face masks, adequate hand hygiene and adequate cleaning and disinfection of materials.

- Inspection:

All tools and work equipment must be inspected regularly. IOM supervisor and IP manager should be responsible for this continuous inspection. Inspections can take the form of a check list.

3.2. Desludging operations

The IP is in charge of carrying out the desludging of latrines on regular basis to the DEWATS. As described above, the system is designed to serve 5250 users. The IP must have a clear work plan for desludging teams with targeted latrines according to the time of latrines filling.

All volume of wastewater disposed and released by the DEWATS must be recorded in the monitoring tool (see Annex 2) and sent to IOM supervisor on monthly basis to ensure the proper use of the facility.

Feedback mechanism with WASH committee and community user's groups must be put in place for accountability but IP should not wait for complains to desludge the latrine pits. IOM has procured desludging surface pumps and handover them to IPs for their use. It is strongly recommended to use these specific type of pumps (surface pump). Some submersible pumps collect a large volume of solid which will negatively impact the treatment effectiveness, and thus, the quality of the effluent.

Desludging Operation steps:

1. Remove cover of holding sludge pit beside system inlet
2. Start pump and desludge latrine contents into the pit.
3. Turn off the pump.
4. Check fluid level in Tank 5:
    a. If the fluid is near the level of the outlet pipe, then proceed with next step
    b. If the fluid level is more than 0.5m above the outlet pipe, then wait for it to reduce
5. Set up the pump, put suction line into the holding tank, and connect pump to the Tank 1 inlet line using a short hose pipe.
6. Open gate valve on inlet pipe and start desludging pump.
7. When Tank 1 is full, stop desludging pump.
8. Check fluid level in Tank 5:
    a. If the tank is empty, then can pump again from the holding tank.
    b. If the tank is not empty, then wait for it to reduce.
9. Turn off pump and close gate valve on inlet pipe. Careful with sludge dropping from inlet pipe.
10. Fill monitoring tool (Annex 1)

3.3. Solid sludge removal from plastic tanks

The sludge accumulation rate is around 4.4 l/pers/day. Sludge emptying should be done as rarely as possible in the tanks and, when carried out, it should be ensured that a proportion of sludge (at least 10%) remains in the first compartment to seed bio digestion for subsequent batches.

Since the Anaerobic Treatment System presented is designed to serve 5250 users and considering the sludge proportion should not exceed 70% of the tank volume, **emptying process should be initiated once every 6 months or when the height of sludge exceed a height of 1.8m.**

Note: Desludging from Tank 1 and 2 must be done alternatively only using 3 sludge pits each time (every 6 months), to allow the sludge rest for 12 months in the pits.

In theory, the sludge would remain 6 months in the tank and 12 months in sludge pit (18 months in total), plus the time spent in the latrine pits.

DEWATS Tank Desludging procedure (after 6 months):

1. Check that the soak pits connected to tanks 1 and 2 are empty.
    a. If empty, proceed with next step
    b. If not empty, follow procedure for emptying sludge tanks in the next section
2. Open the Tank 1 cover to monitor the level of liquid/solids in the tank.
3. Open the outlet gate valve for Tank 1, the sludge should flow out from the tank into the soak pit.

4. Once the tank has reduced to about 30% full, or if the soak pits are almost full, close the gate valve.
5. Repeat for Tank 2.
6. Cover the full soak pits.

In Tank 3 and 4, the filter media is made of fragment of coconut husk (size ranges between 15 mm and 50 mm diameter). This material consists of a mixture of coconut epicarp, fibers bound-up with parenchyma. This filter media has the specificity to be resistant to compacting which prevents clogging and makes it very durable. It also allows air circulation for bacterial feeding. This material has also the properties to be granular to improve physical filtration; porous to trap the bacteria for the treatment and spongy (to keep these bacteria active for longer period). However, to ensure durability of filter media it is recommended to backwash the tanks 3 and 4 every 8 months.

Tank 3 and 4 backwash procedure (once every 8 months, or whenever the filters become clogged):

1. Check that the soak pits connected to Tank 3 and 4 are empty.
   a. If empty, proceed with next step
   b. If not empty, follow procedure for emptying sludge tanks in the next section
2. Open the outlet gate valve for Tank 3 and allow liquid to flow into the pit.
3. Pour water onto the Tank 3 filter through the tank cover.
4. Once the soak pit is almost full (within 50cm of ground level), close the gate valve.
5. Repeat for Tank 4.

3.4. Emptying sludge pits

There are 8 sludge pits connected to the plastic tanks (6 pits connected to Tank 1 and 2, and 2 pits connected to Tank 3 and 4)

For the sludge to stay 12 months in the pits before emptying them, the desludging must be done alternatively, as mentioned in the previous section, using only 3 sludge pits.

The sludge inside the pits must be removed before emptying the tanks on them. The sludge should be disposed in a safe place. Operators must ensure the location before starting the activity.

According to WHO, where ambient temperatures are >20^{o}C, less than 1-year retention time is needed for faecal sludge to be free of pathogens. Therefore, the sludge is totally safe to handle after one year spent in DEWATS pit and can be disposed of without specific restriction.

The ideal would be **to spread the sludge in an open area and leave it dry**. After drying, it can be used directly as fertilizer, added to the compost, or just buried.

3.5. Scum Cleaning

During the septic process, if soap, oil or other fats are present in the sludge, a layer of scum (foam) is produced in the top of the sludge, inside the plastic tanks (mainly Tank 1).

If there is a thick layer of scum, operators should remove it with buckets or racks and disposed safely in an open area to leave it dry. After drying the solid waste should be added to bags with inorganic compost and taken to UNDP landfill.

3.6. Disinfection procedures

According to the faecal sludge quality monitoring, the reduction of parameters tested between inlet and outlet is significant and demonstrates the effectiveness of the treatment mechanism.

The reduction is: FC = 96%; TS = 70%; COD = 83%; BOD=87%; TN=60%; TP =76%; and helminths = 99,6%. It is also showing that 80% of raw sludge samples tested with presence of vibrio cholera are free of this pathogen after treatment.

The average result of FC is 16,880 CFU/100ml and, considering that WHO standards for reuse of wastewater in agriculture is 20.000-40.000 cfu/100 ml, the quality of effluent after treatment would allow the reuse for irrigation. However, the quality of raw sludge is variable (which impacts the consistency of results) and the congestion in the camps cannot allow the reuse for irrigation.

The infiltration process remains an essential component of process where the soil characteristic is a key factor for the system. In case of any emergency like outbreak and it is decided that the effluent need to be disinfected, IP must add chlorine at the final stage to achieve a concentration of 15mg/l in tank 5 (2000liters).

Disinfection procedure (in case of emergency like disease outbreak):

1. Make 1% Chlorine solution in 2L bottle or bucket – mix 30g of High-test hypochlorite (HTH 65% of chlorine) with 2L of water.
2. Before desludging a latrine, close the outlet valve on Tank 5
3. Open the cover on Tank 5 and add Chlorine solution by pouring the 2L of 1% stock solution (to reach 15mg/l), then close the cover
4. Start desludging. The level in Tank 5 will rise to the top
5. Wait 1 hour, then open the outlet valve on Tank 5
6. Once the liquid level in Tank 5 has reduced, then the process can be repeated to dislodge more latrines

4. Quality monitoring

IOM is running a laboratory in Ukhia log base which is used for monitoring basic parameters:
Faecal coliforms (FC), Total Nitrogen (TN), pH, Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) (See Annex 2).

The International Centre for Diarrhoeal Disease Research (ICDDR) based in Dhaka is monitoring in a monthly basis additional parameter of DEWATS effluent quality: Total Solids (TS), Total Phosphorus (TP), Ammonium and Helminths in addition of FC, TN, BOD, COD. They are also checking the presence/absence of pathogens such as Salmonella, Shigella and Vibrio cholera.

The lab technicians have a workplan for all FSM facilities in the camp and communicate in advance with IPs when their facilities need to be tested. The lab technicians and IOM staff are available for any refresher training regarding the sample collection if required. Template for

Sampling procedures steps:

1. Retrieve an effluent sample from Tank 5
    a. Open the cover of Tank 5
    b. Use a small sampling container to retrieve a sample
    c. Seal the container, label it, and pass to IOM staff for testing
2. Take a sample from the top of Tank 2
    a. Before a dislodging operation has started, open the top cover of Tank 2
    b. Use a small sampling container to retrieve a sample
    c. Seal the container, label it, and pass to IOM staff for testing
3. Take an influent sample from the inlet pipe
    a. After a desludging operation has been completed, carefully open the gate valve on the inlet pipe, and collect a sample in a small sampling container
    b. Seal the container, label it, and pass to IOM staff for testing

Transport the sample to IOM laboratory <u>the same day</u> (using plastic sealed bag to prevent from contamination).

5. Troubleshooting

DEWATS is a new technology and even if it is designed for minimum O&M requirements, it's essential for IPs to monitor the system on daily basis with dedicated trained staff in order to prevent and identify problems. Please see below examples of challenges that field staff could potentially face during operations.

Problem: Inorganic waste in latrine pits

Inorganic waste like plastic bags, sanitary pads… can be found when emptying household latrine pits. These materials can obstruct the pump or the DEWATS. It must be removed when spotted, if left it can be a source of inorganic contamination. IPs need a set of tools created specifically for this purpose, long enough and have a rack to only pick the waste.

Problem: Leaking pipe during desludging process

Leaking during the desludging can be one cause of contamination considering the high congestion in the camp, the pipe is sometimes crossing the road or passing by close to shelters, etc. The leaking is mainly due to poor connection between two pipes when the latrines are located far from the DEWATS.

<u>Measures:</u>

- Using canvas hose pipe to maximize the length of the pipe and reduce the number of connections. It is also easier to operate and transport.
- If the distance between the latrines and DEWATS is more than 300m, installing transfer tanks to dispose and store temporarily the sludge before redirecting the sludge to the DEWATS
- Installing buried HDPE pipeline.
- Continuous supervision of the pipe while pumping.

<u>In case of leaking:</u>

- The pipes must be repaired and/or changed by the operator.
- The operator will spread on the leak and around (radius 1m) 1% chlorine solution* for disinfection.

  ***1 tablespoon (15g) of HTH 65% per 1 liter of water. Chlorine powder and the solution are abrasive for skin and eyes and needs to be manipulated carefully.**

  The operator should later cover the area with sand.

Problem: Spill at inlet stage in DEWATS.
Due to the distance with latrines, the pipe connecting the desludging pump to the first tank of DEWATS can leak when the operators finish the pumping (sludge remaining in the pipe).

Measures:

- Decreasing the distance between the latrines and DEWATS (transfer tanks)
- Using two desludging pumps in series. One surface pump should be installed next to the latrines pits and moved during each desludging operation and a second pump should be installed permanently close to DEWATS. This second pump will allow to empty the pipe between the two pumps and reduce the risk of leaking after filling the sludge pit.

Problem: Spilling at outlet stage when filling the first tank of DEWATS.
This kind of spill of sludge effluent is due to misuse of DEWATS. In case the tank 5 is full or fluid level is more than 0.5 m above the outlet pipe, the operators should not fill the tank 1 and must wait for the fluid level to reduce (soil infiltration). If the operators have not been trained properly, and decide to fill tank 1, the added sludge in tank will push the present sludge in different tanks and will create overflow in Tank 5. There is a control gauge in tank 5 (see picture) to facilitate the monitoring of the level of sludge effluent in tank5.

Measures:

- Operators must be properly trained by the IP supervisor. All IPs working with IOM have attended the training of DEWATS O&M and should be able to transfer this knowledge to their own staff. The checklist in this SOP will guide the workers and IP supervisor during the desludging operations.

- In case of leaking, the operators should immediately contain the spilling to prevent the sludge effluent to spread in public areas. The operators should connect the tank 5 to the closest sludge pit as temporarily storage. All sludge spread on the surface must be cover by 1% chlorine solution to reduce pathogenic contents and then with sand soil to prevent contact.

Problem: Spill during DEWATS process (Tank 1 to 5) due to damage in tanks or connections and inter-tank joining.
The plastic tanks, the core of Anaerobic Treatment System (ATS) present several advantages (See DEWATS Installation SOP). However, plastic tanks may be more vulnerable when exposed to extreme conditions as fire or cyclone (compared with concrete construction).

Measures:

- To mitigate and reduce the risk of contamination, the quality of material used is essential. GAZI tank, for instance, can resist to 70°C temperature, it has double layer, it is U.V. stabilized in outer layer. Connections and inter-tank joining must be installed properly and tested before handing over the system to IP. It must be composed of high-quality material including fittings, gate valves, flexible pipes (See DEWATS installation SOP).
- In case of cracks in the plastic tank, the implementing partner can use a plastic lapping (silicone) to fix it.
- Only tank 5, when empty could be affected by the wind. In case of extreme weather forecast, its recommended to fix safety ropes anchored into the ground to tie down the tank and prevent the risk of damage. It is also recommended to fill the tank 5 to make it heavier and consequently more resistant to strong wind.
- It is essential to coordinate with site management, site development units and SMEP to assess the risk of landslides and to take action through slope protection and site development. The site must be properly leveled and compacted to accommodate the different components of DEWATS and ensure stability when the system is operational.

- The risk of fire is real and needs to be considered during preparedness. When possible, safety distance between the DEWATS and other constructions as families shelters or public facilities should be maintained as fire break. Minimum distance of 30m is required. However due to the congestion in the camp, it is sometimes challenging to maintain this distance. Fire extinguisher must be kept on site and DEWATS operators must be trained to use it.

Problem: Flooded infiltration field.

As explained in the installation SOP, IOM engineer should use the checklist when assessing the site and calculate infiltration rate before taking final decision. Low-lying areas should be avoided as they are normally characterized by high water table and can be prone to flooding. Consequently, most of the suitable sites for DEWATS installation will be identified on the hillsides.

In some camps, there is no hillside and there is no choice but to use the flooding zone. In this case, the rainy season will create some issues and reduce infiltration rate due to elevation of the water table.

Measures:

- Decrease the volume of sludge treated to $2m^3$/day (instead of $3.15m^3$) during the rainy season in order not to overload the system.
- The DEWATS operators must regularly check the vertical control pipe in the infiltration bed to monitor the sludge effluent level and infiltration capacity.

- If infiltration field is overloaded even after reducing the daily inlet, IPs should re open the trenches and clean the infiltration bed by washing the gravel in a safe area.
- As last resort, if required to release some sludge from the system, it can be done in the sludge pits after proper disinfection of the effluent in tank 5 using a chlorine solution of 15mg/l (see procedure above).

The average result of E. coli in the effluent is 16,880 CFU/100ml. WHO standards for reuse of wastewater in agriculture is less than 100,000 cfu/100 ml (drip irrigation of high-growing crops). The quality of the effluent after treatment would allow the reuse for irrigation. After disinfection, we can consider that releasing the sludge effluent does not present risk of contamination.

Problem: The liquid is not flowing through the filters in Tank 3 and 4

Measure:

- Dislodge and backwash the filters using the "Plastic Tank Dislodging" checklist

Problem: Dislodging Tank 1 or 2 is not working because the sludge solids are not flowing through the outlet pipes

Measure:

- Use a long stick/bamboo to unclog the outlet pipe, or to mix the solids from the top of the tank.
- Use the dislodging pump and hose to pump the solids out from the top of the tank, directly into one of the soak pits.

Problem: There is a bad smell coming from the tanks

Measure:

- Check that the manhole covers are all tightly closed. If the smell continues, then replace the charcoal in the gas exhaust pipes.

Problem: Sludge from the latrines gets stuck in the inlet pipe

Measure:

- Disconnect the pump hose from the inlet pipe and use a bamboo stick to try to move the sludge. Let it drain into the holding tank, then reconnect the hose and start the pump again.

Annex 1

<u>Design considerations used for the sizing and capacity treatment of the DEWATS</u>:

Key design considerations
Treatment Capacity

• Assuming Hydraulic Retention time (HRT) = 40 hrs in the third and fourth tanks (7,500 L each) acting as Upflow Anaerobic Filters and filled by a filter media (fragment of coconut husk).
• The volume of each tank is 7500 liters and usable volume = 60%
• Filter porosity of fragments of coconut husk = 70%
    o Total usable volume of each tank = 7500 x 0.6 x 0.7 = 3150 liters.
    o For the two tanks, usable volume = 6300 liters
    o Using HRT = 40Hrs, treatment capacity = 3780 liters/day. However, we need to consider that the operations are taking place during daytime only. If we dispose 3780 liters on Day 1, 630 liters will be transferred from tank 2 to tank 4 the same day. Then, on Day 2, this volume will be transferred from tank4 to tank5 without spending 40hrs retention time. That's why the volume of wastewater treated per day must be limited to the usable volume of tank3 and tank4 (3150 liters).

⇨ **Keeping HRT >= 40hrs, DEWATS capacity ~ 3.15 m^3/day**
Users & pit latrines targeted
• According to field results and experimental evidence, the latrines used in the camps allow on-site volume reduction and reduce the frequency of desludging to 0.6 L/p/day. • Considering HRT = 40 Hrs and DEWATS capacity = 3.15m^3/d, then users = 5250 ppl
⇨ **Users = 5250 ppl or 263 pit latrines (20 ppl/latrine)**
Sludge Accumulation & sludge retention time (>1 year)

• If fecal sludge = 0.6 L/p/d, assuming 2% solids content
• A solids sludge accumulation rate of 4.4 l/person/year
Minimum sludge in first tank = 10% (1m3) and Maximum = 70% (7m3)
    ▪ Then in one year, 22750 liters of sludge accumulated
    ▪ Then tank 1 and 2 desludging is required every 6 months (11375 liters)
    ▪ Volume of sludge pit = 3.45 m^3 each (6 pits required)
• Less than 1-year retention time needed for faecal sludge where ambient temperatures are >20°C (WHO)
• The sludge will remain 6 months in septic tank and 12 months in sludge pit and will be free of pathogens after this period (18 months in total)
(Latrines are designed to store the wastewater more than 6 months in latrines pits).

➢ **6 sludge pits of 3.45 m3 for tank 1 &2 to handle the sludge safely.**
Filter media
Fragment of coconut husk consist of a mixture of coconut epicarp (The thin and smooth outer layer that surrounds a coconut), fibers bound-up with parenchyma (typically composed of living thin-walled cells). The properties of this filter media are: • Filter material size ranges between 15 mm and 50 mm diameter. • Granular: to slowly filter the wastewater • Porous: to trap the bacteria essential for effective treatment

• Spongy: to keep these bacteria active for longer period. • Resistant to compacting to allow air circulation bacterial feeding and durability.
⇨ **Fragment (15- and 50-mm) of coconut husk as filter media.**
Infiltration trenches
• Infiltration rate tests should be conducted at each site, before calculating the required trench size • Soil infiltration tests for wastewater were conducted, finding a rate of 60 $l/m^2/d$ for semi-saturated sandy soil • The infiltration surface of the Soak Field is given by the quotient of the effluent discharge and the infiltration rate: 3150 (l/d)/60 $l/m^2/d$) = 52.5 m^2 • The length of the Soak field is given by dividing the infiltration surface by 2 x depth of the trenches: 52.5 (m^2)/1.55 (m) = **34 m** • The recommended slope of the trench is 0.2% to 0.3%.
➢ **useful infiltration area = 52m^2 & length of infiltration trench = 34m**

Annex 2

Faecal sludge management – operational monitoring tool (DEWATS)

DEWATS Monitoring tool

IOM UN MIGRATION

NGO: **Camp / Block:**
DEWAT ID: **Population covered:**
Month & Year: **Latrines covered:**

Inlet						Remarks			
#	Date	Block/Sub-block	Volume disposed (m3)	Inlet Start time	Inlet End time	chlorination 15 mg/l (yes / No) - only if outbreak or no infiltration	Person in charge / DEWAT supervisor		Other (sample taken, infiltration issues, incidents, etc)
							Name	Signature	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
Total volume:						Quality information of the last sample taken:			
Average m3/day inlet:									

Annex 3

Testing Protocols for Samples of raw sewage and wastewater effluent

Parameter	Method Summary *see kit and reagent instruction manuals for full methods	Limit for infiltration release	Limit for direct environmental release (surface or inland water body), Department of Environment (DOE 2019)
Testable Parameters			
pH	Add 1 Universal pH tablet, shake, and compare to colour strip.	N/A	6 – 9
Turbidity	Use the turbidity tube to determine value in JTU.	N/A	N/A
Total Suspended Solids (TSS)	*Estimated* TSS content is equal to the JTU turbidity value, converted to mg/L.	N/A	<100 mg/L
Chemical Oxygen Demand (COD)	Use COD/20000 tubetests for influent and settling tank sample, and use COD/2000 tubetests for effluent. Will need the 0.2mL pipettor to transfer the sample.	N/A	<200 mg/L
Faecal coliforms	Use Wagtech kit to filter sample through membrane, then add growth media and incubate for 16-18 hours. Prepare two membranes for each sample.	N/A	- 1000 CFU/100mL WHO standard for reuse of wastewater in agriculture 100,000 CFU/100mL (drip irrigation of high-growing crops)
Nitrate	Use Nitrate tablets, with Nitratest 20mL tube.	N/A	<250 mg/L
Phosphate	Use Phosphate HR tablets, with normal 10mL test tubes.	N/A	<35 mg/L
Temperature	Use thermometer at sample point.	N/A	<30 ºC
Parameters of interest (but currently no testing capacity in IOM Lab – Tested by ICDRR,B in Dhaka)			
Total Nitrogen			<15 mg/L
Total Phosphorus			N/A
Biological Oxygen Demand (BOD)	Use existing influent and effluent values to establish and confirm a correlation between COD and BOD, in order to estimate the BOD value.		<30 mg/L
Oil & Grease			10 mg/L
Ammonia			<5mg/l
Helminth Eggs	WHO guideline is <1 egg/L for irrigation use on low-growing crops (no guideline for high-growing crops)		No guideline
Salmonella, Shigella and Vibrio cholera	Pathogenic bacteria tested by ICDDR,B on monthly basis (Absence/Presence)		No guideline