



CORRECT
PLUMBING & ENGINEERING SERVICES LTD.



REPORT FOR TRAINING ON DRAIN FIELD
DESIGN AND CONSTRUCTION /
SOLUTIONS FOR WATER LOGGED AREAS /
BEST PLUMBING PRACTICES /
IMPORTANCE OF EARTHWORMS IN
DIGESTERS.

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1. BACKGROUND AND OBJECTIVES

A three day workshop (14th -16th March 2018) was organized by the Project Coordinating Unit (PCU) of GAMA Sanitation and Water Project (SWP), at the Institute of Local Government, for Sub Project Implementers (SPIs) and Metropolitan, Municipal and District Assemblies (MMDAs). The workshop was organized to educate participants on the basic principles involved in the design, development and construction of vermidigesters. Three resource persons were engaged to take participants through the training. For all the three days, challenges with the construction of household toilets under GAMA SWP were elaborated.

Ing. Nana Osei Mainoo, the Managing Director of Correct Plumbing and Engineering Services Ltd was engaged to train participants on the issues below.

1. Drain field design and construction;
2. The importance of the Percolation Test;
3. Solutions for water logged areas;
4. Plumbing best practice;
5. Importance of earthworms in digesters.

2. WORKSHOP DISCUSSIONS

The Drain field, which is a method of subsurface (below ground) wastewater treatment and disposal, was discussed. It is governed by the British Standard (BS 6297:2007). The drain field works in combination with the septic tank and distribution box, to make septic system. The principles governing wastewater treatment and disposal in the soil strata were explained to participants to help them understand the functions of the various soil layers, the layer in which the percolation test should be performed and where the drain fields should be situated or constructed.

The infiltration zone, unsaturated zone and the saturated zones of the soil were introduced. The infiltration zone, which is the top 50cm of soil, is the ideal layer for the construction of the drain field. This zone is the biologically active zone, and biofilm builds up within pipe and surrounding trench media. The unsaturated zone is below the infiltration zone. It provides storage for effluent and acts as a

pathway for oxygen diffusion into effluent. The saturation zone is for dilution and diffusion of effluent. Important notes to bear in mind when constructing drain fields include;

- Drain fields do not operate indefinitely, and eventually need to be replaced;
- Fats, oils and greases cannot enter a drain field, these organic compounds shorten the lifespan;
- The effectiveness of drain fields to disperse effluent is influenced by the ground water table, soil characteristics and moisture content;
- Detailed site investigations is necessary for assessing the viability of drain fields;

The percolation test and subsequent drain field construction requires **planning** and **organization**.

3. FIELD DEMONSTRATION

Participants were taken to the field for a demonstration of the percolation test and the drain fields.



Figure 1: Participants observing the percolation trial hole



Figure 2: Participants standing around the percolation trial hole

Participants were introduced to the trial hole as shown in Figure 1. This hole is dug adjacent to potential drain field;

- 1m × 1m hole was dug below the proposed pipe invert level;
- All materials were removed from the hole and filled with chippings;
- Textual descriptions of the soil must be noted;

From the percolation trial hole, participants were taken through the construction of the percolation test hole.



Figure 3: Percolation test hole



Figure 4: Percolation test hole with gravels

- Three percolation test holes should be located over the areas to be tested;
- 1m × 1m hole should be dug or bored to the proposed depth (min 0.3 m) and another hole dug 0.3m x 0.3m x 1m depth below the proposed pipe invert level;
- Remove all loose material from the hole;
- Add 50 mm of coarse gravel to protect the bottom from scouring;
- Carefully fill each hole with water to 300mm above the gravel and allow to seep away completely;

If the water seeps away in 10 minutes the hole should be refilled max 10 times. If the water continues to seep away, the area is not suitable for a drain field.

- Measure percolation rate by refilling each hole with water to a depth of 300 mm and observe the time in seconds for the water to seep from 75% (225mm) to 25% (75mm);
- Divide this time in seconds by 150mm, providing the average time in seconds for a 1mm drop;

Repeat the test at least three times for each hole.

To construct the drain field;

- Excavate trenches to required dimension (length, breadth and depth);
- Spread chippings in trenches to adequate thickness and levels or fall;
- Lay slotted pipes on chipping to the required direction of flow and fall;
- Spread another layer of chippings over the surface of the pipes;
- Cover the surface of the chippings with soil to grade;
- Grass over the drain field area to prevent erosion.



Figure 5: Drain field being dug out



Figure 6: Drain field construction

Participants were also introduced to Pressure pipes (class B). These are the preferred pipes for drainage (Soil and waste). Unlike the Class O pipes that are cheaper (and hence preferred by plumbers), they do

not collapse due to external forces exerted by the backfilled material, a major cause of blockage in drainage systems. Although using class B pipes will result in an increase in the total cost of the construction of the digesters under the GAMA Project, participants were encouraged to make use of it to avoid blockages in the future.



Figure 7: 4 Inches Pressure (Class B) pipes



Figure 8: 4 Inches Class O pipes

4. PLUMBING PRACTICES FOR WASTEWATER

The participants were taken through best plumbing practices and plumbing materials they need to use to enable their work last long and avoid immediate defect in the construction of their toilets under the GAMA project.

5. EARTHWORMS

Finally the earthworms required for seeding the vermidigesters were introduced. The earthworm body works like a biofilter. They grind, aerate and crush the faecal sludge, making it easier for microbes to degrade the sludge. When worms are not in the vermidigester, there is an invasion of nuisance pest like cockroaches, odor becomes an issue. There will also be an accumulation of the faecal sludge; this will result in the vermidigester getting full.

6. QUESTIONS ASKED

1. When is a percolation test not possible?

One cannot carry out a percolation test when:

- a. The area of interest is paved;
- b. The area is waterlogged; wet building sites with high groundwater or subject to surface runoff (that cannot be fully diverted);
- c. Failed septic systems: sites where an existing septic system has failed and there is limited space or other constraints on septic system repair;
- d. Rocky building sites or sites with bedrock and not enough topsoil to treat and dispose of wastewater;
- e. Small building sites which lack adequate space to install a conventional septic drain field;
- f. Steep building sites which do not permit installation of a conventional drain field;

2. Can you put chemicals in the vermidigester?

Participants were encouraged to avoid using chemicals since the system is a biological system. They were encouraged to seed their biodigesters with earthworms. Notwithstanding, some participants mentioned that they used an enzyme based biochemical called **Ecosave**. Further research needs to be done to know the effect of the chemical on the content of the vermidigester and the environment.

3. What are the alternatives for waterlogged areas?

The micro flush and dry toilets are ideal for places that are waterlogged in the GAMA project, considering the installation cost of these options fall within the budget for the project. Commercial solutions to the waterlogged areas were also reviewed. However, these options are expensive. Customers will therefore have to pay for the additional cost if purchased under the GAMA Project.

4. How do you perforate the pipes used in the drain field?

The pipes can be slashed with a hack saw blade or drilled using a drilling machine. The holes should be made along the entire pipe circumference to avoid the possibility of clogging when the base is fouled.



5. How do you calculate the length of the drain field?

The area of the drain field is calculated from the percolation rate value observed in the percolation test. The length can then be worked out after selection of a suitable drain field width. A detailed description is found in Appendix 1 below.

6. Can several digesters share a drain field?

If the drain field is sized properly, yes.

7. How many holes should be dug for the percolation test?

Ideally, three holes should be adequate, however, when the soil layers vary, more holes need to be dug to be sure of the various soil types and layers available.



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8. APPENDIX 1: POWERPOINT PRESENTATION SLIDES USED FOR THE TRAINING