

How to Build a Low-cost Ferrocement Biogas Digester

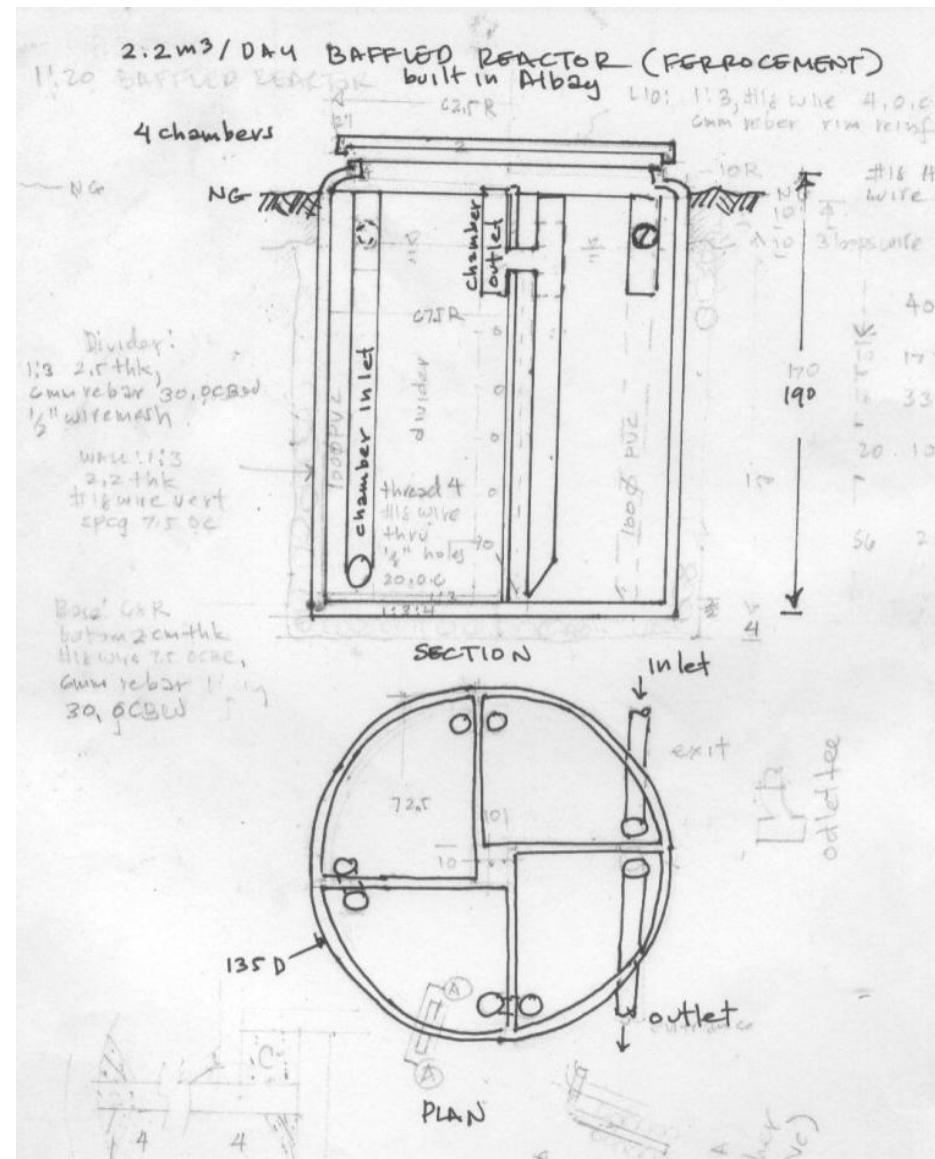


Engr. Jose Carmelo M. Gendrano
Philippine Center for Water and Sanitation
WASH Coalition Pilipinas



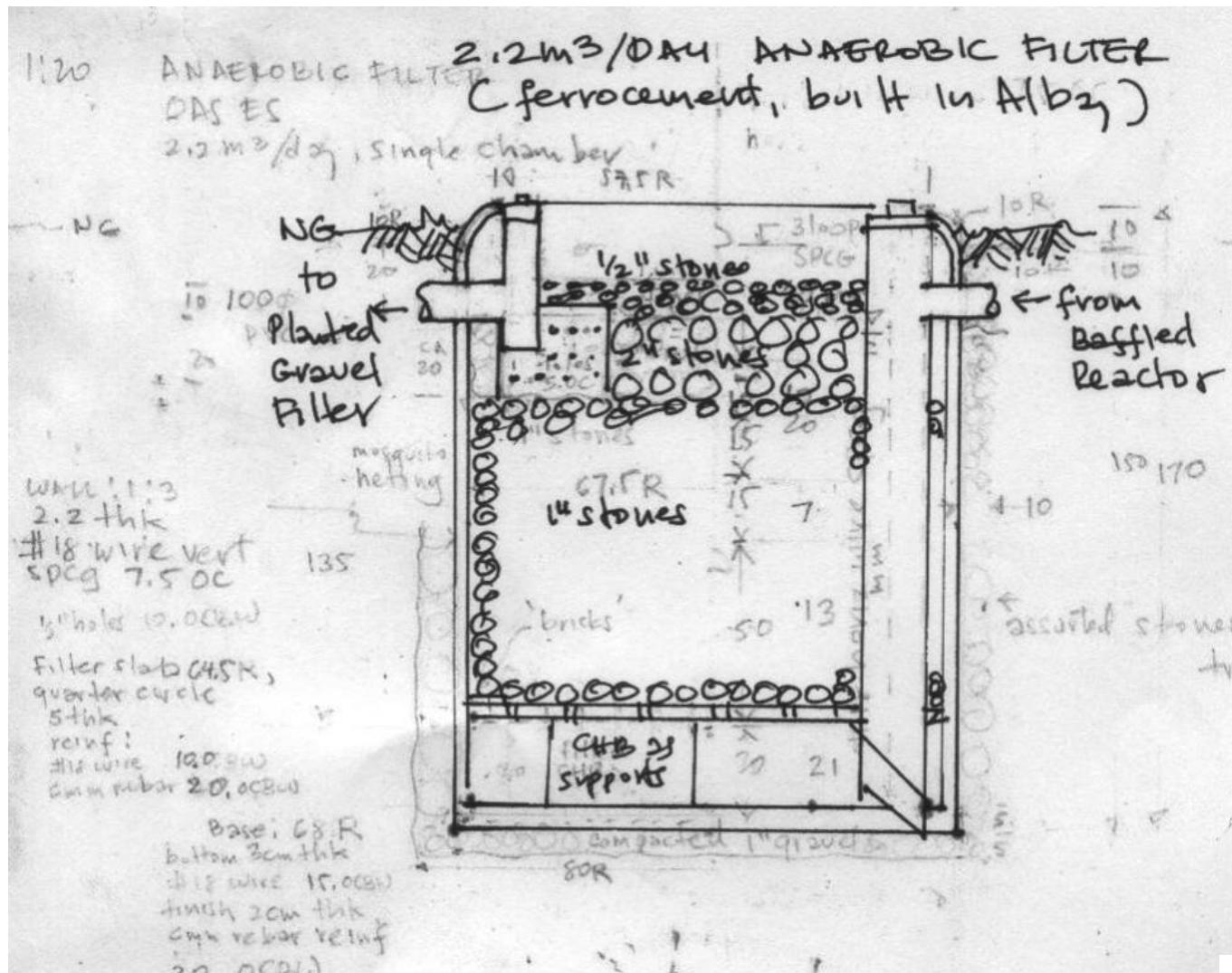
FERROCEMENT IN WASTEWATER FACILITY CONSTRUCTION

Ferro cement
is a highly
economical
method of
making septic
tanks,
baffled
reactors
(shown here).



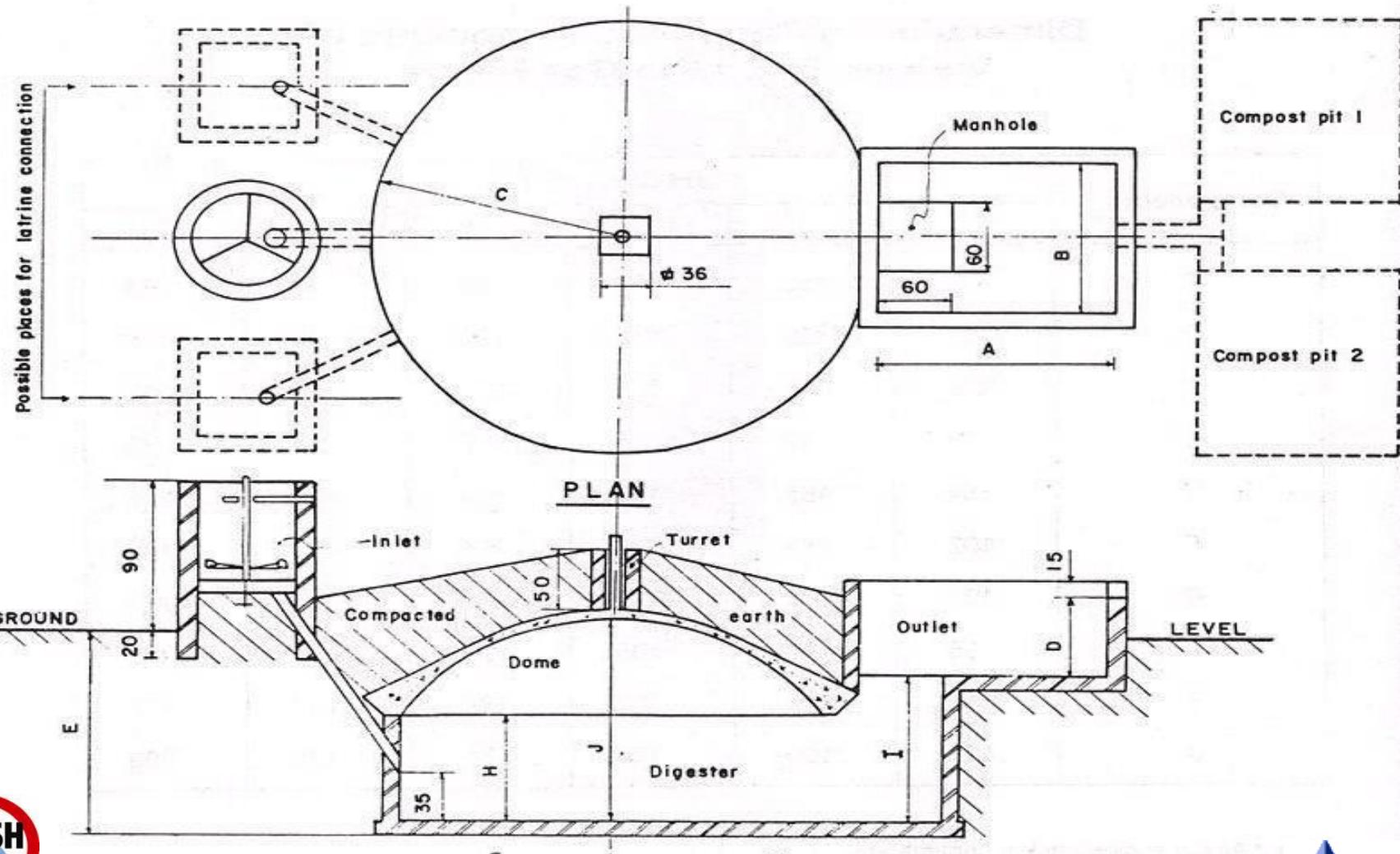
FERROCEMENT IN WASTEWATER FACILITY CONSTRUCTION

Anaerobic filter tanks



FERROCEMENT IN WASTEWATER FACILITY CONSTRUCTION

GENERAL BIOGAS PLANT



BIOGAS QUICK FACTS

1. Mainly methane plus some CO_2 (25%-50%). Methane- greenhouse gas several times more potent than CO_2 .
One cubic meter = 0.5 litres diesel.
One kg of compostable matter = theoretically $0.4m^3$ biogas, but in practice only one-half to $\frac{3}{4}$ of this is attained.

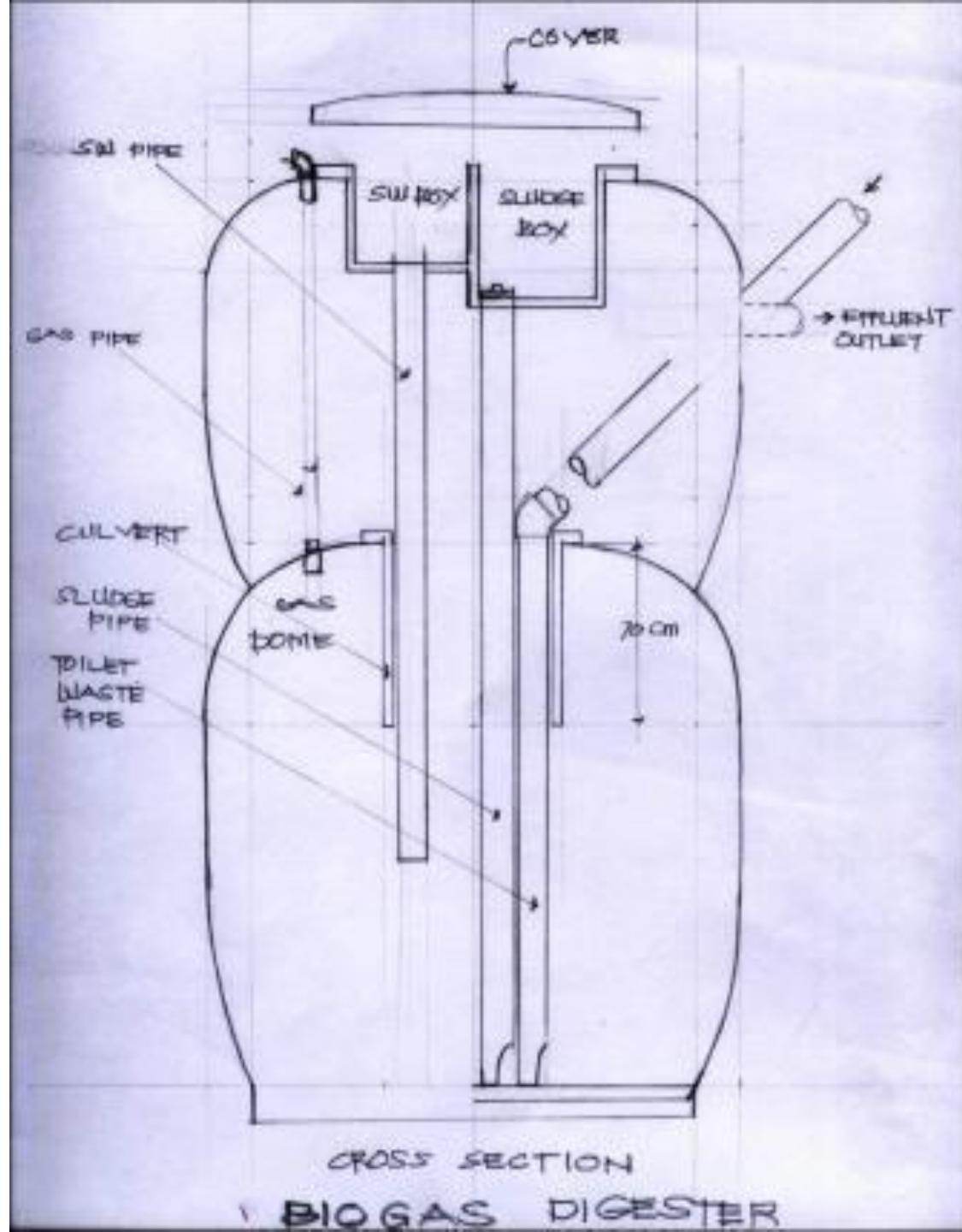


How Biogas is produced in Digesters

1. Hydrolysis and acid formation in waste by acid-forming bacteria (*hardy, active*)
2. Production of methane from acids by methane bacteria (*sensitive*).



ALL- FERROCEMENT BIO-DIGESTER (PCWS MODEL)

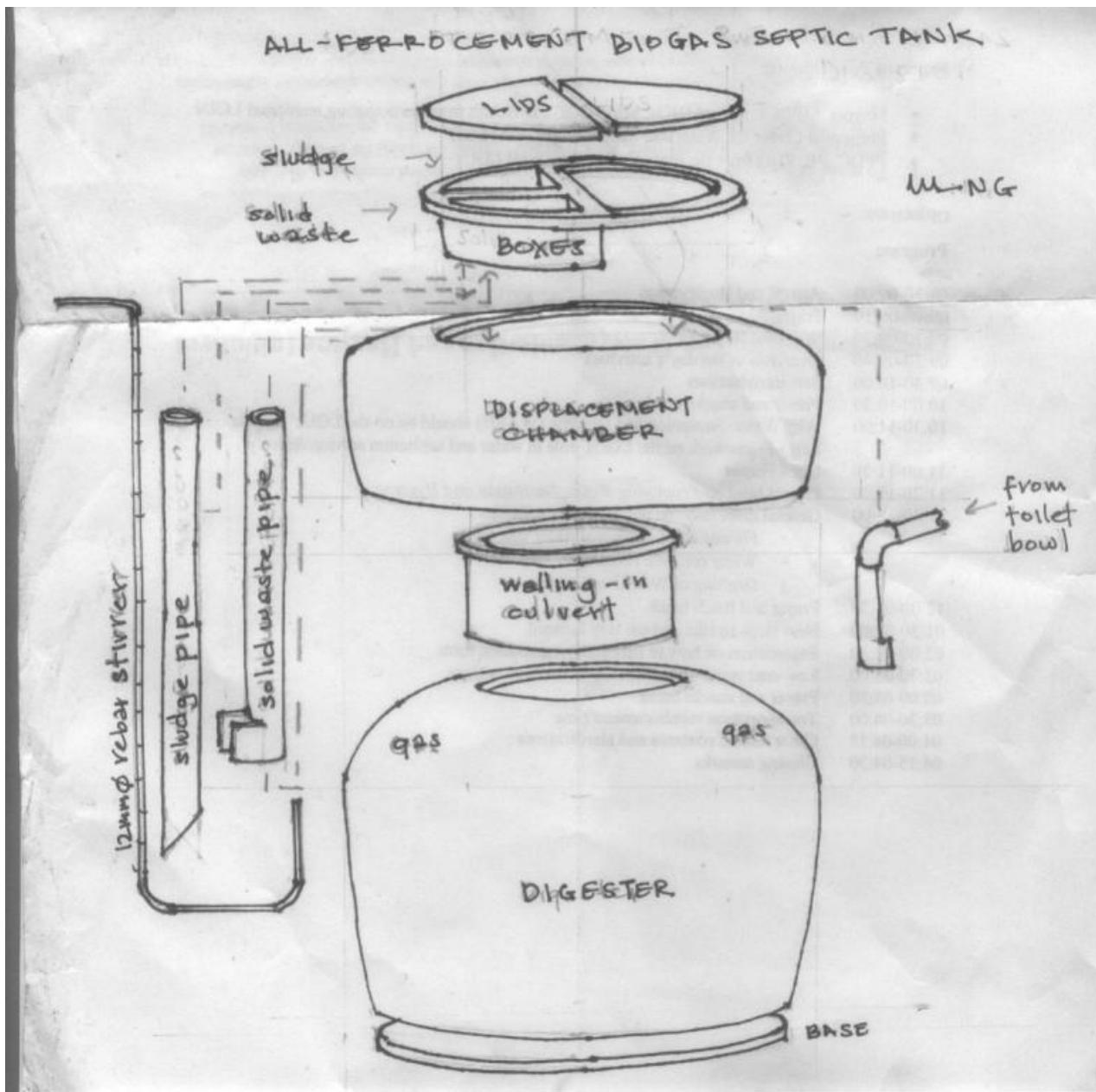


ALL- FERROCEMENT BIO-DIGESTER (PCWS MODEL) FEATURES

1. Volume = 1.2m³ displacement chamber, 3m³ digester/gas collector chamber.
2. Co-axial displacement vessel and digester; saves space and facilitate piping and maintenance.
3. Cost: PhP12,000 in materials (50%) and labor. This does not include professional fee of engineer.
4. Good for at least 8 pigs.
5. up-sizeable design to at least 25m³.
6. Stirrer for digestion efficiency.



BUILDING THE ALL-FERROCEMENT BIO-DIGESTER





Laying the Patterns





Bending the mold rebars





Welding the molds



Digester mold welding



01/04

Displacement chamber mold



Walling-in culvert mold welding





Finished molds





After cutting, the panels are clad in wire mesh.





Here the digester mold is re-assembled and wrapped in polyester curtain cloth.





Meanwhile, the hole for the biogas digester is dug.



Gravel base course for the base





Wire reinforcement for the base is laid, then cement is poured.





07/

The digester mold wrapped in cloth and standing on the fresh-cast base



First mortar coating of the digester.



Vertical wires reinforcement
for the digester



After the horizontal wiring is
laid, a finishing mortar coat.





The digester is de-molded and finished inside.





The displacement chamber is made in the same way: wrapping the assembled mold in polyester curtain cloth.





The displacement chamber mold is set atop the digester.





11/24

After a coating of mortar, the reinforcing wires are laid, the outside is finished and after a day, the chamber is de-molded.
The insides are then finished (not shown).





The sludge/solid waste box and the pipings are installed.





A lid is made for the box and manhole.



A biogas burner is made from some aluminum tubing and a beer can.



If the water table in a project site is low, the tanks can be prefabricated aboveground before setting into the excavation.

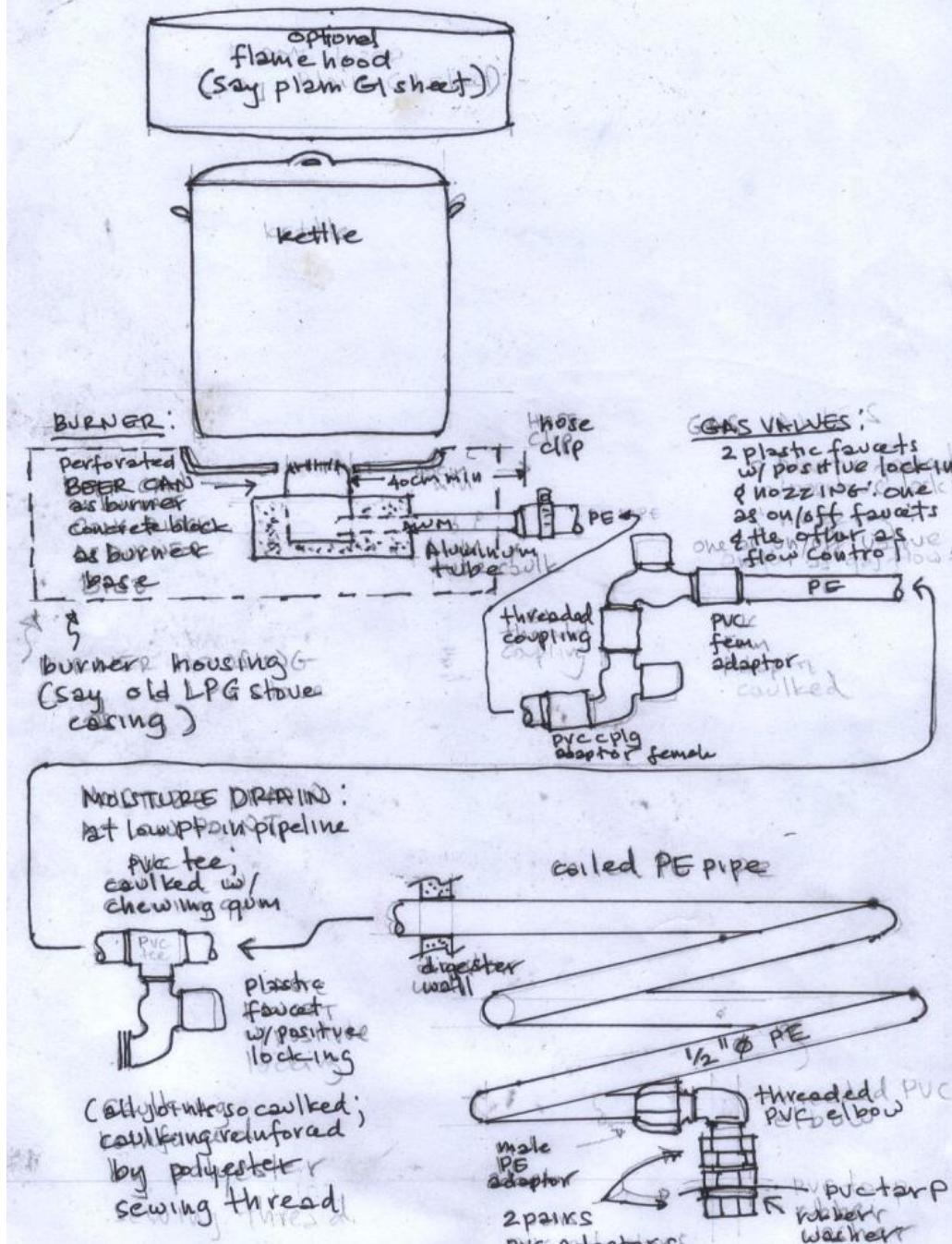




Finished but still needs leak testing, connecting to burner and operationalization.



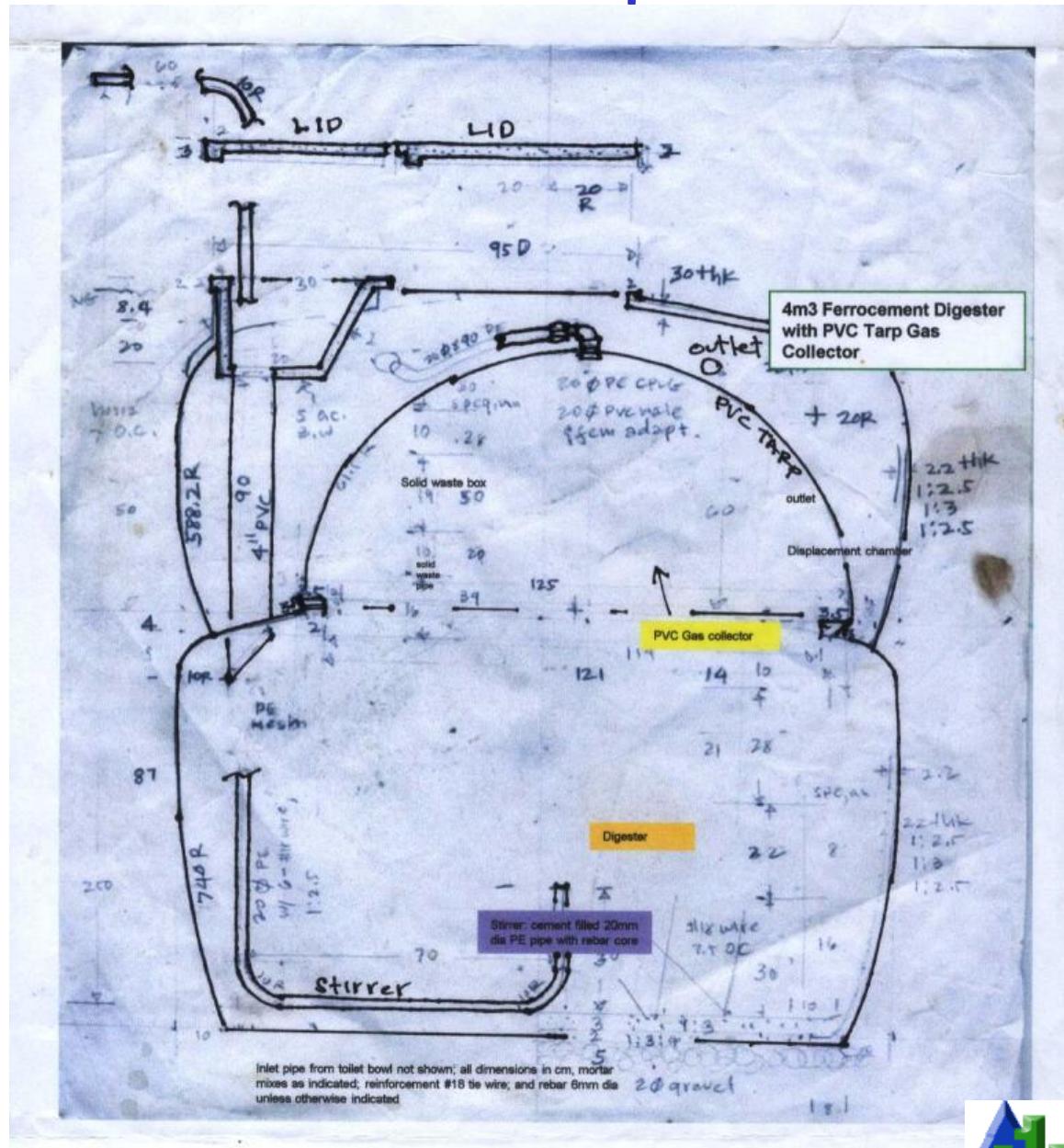
BIO GAS PIPING & BURNER



PCWS Bio-digester Version 2: PVC Tarp Gas Collector

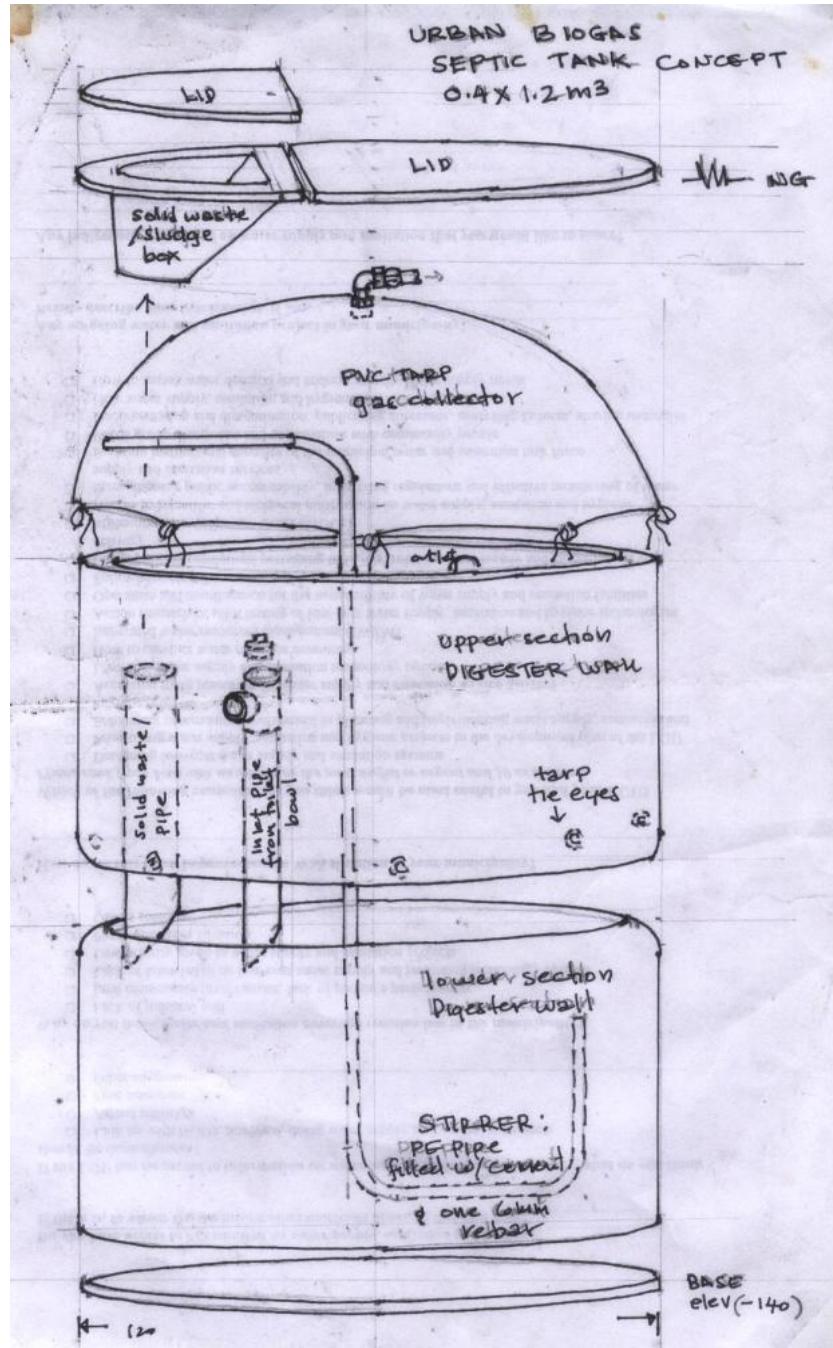
Why tarp?

1. Cheaper
(PhP5,000 per
 $1.8\text{m}^3 \times 2\text{m}^3$
digester)
1. Does not require
skilled mason for
the ferrocement
gas collector
2. Safer and easier
to maintain.

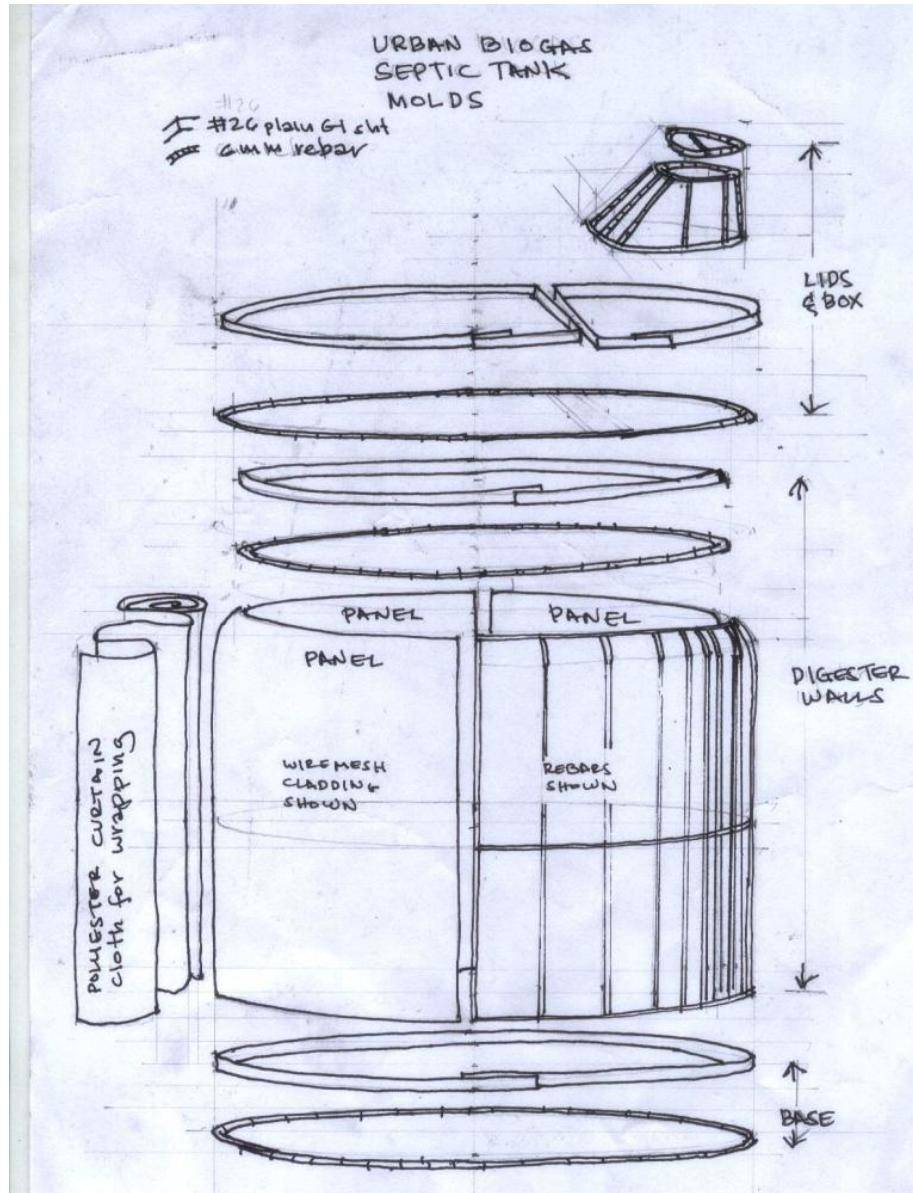


PCWS Biogester Version 3 (for piloting): Urban Bio-Digester

Small diameter of 120cm will fit into more spaces in congested urban communities



Urban Digester Mold System

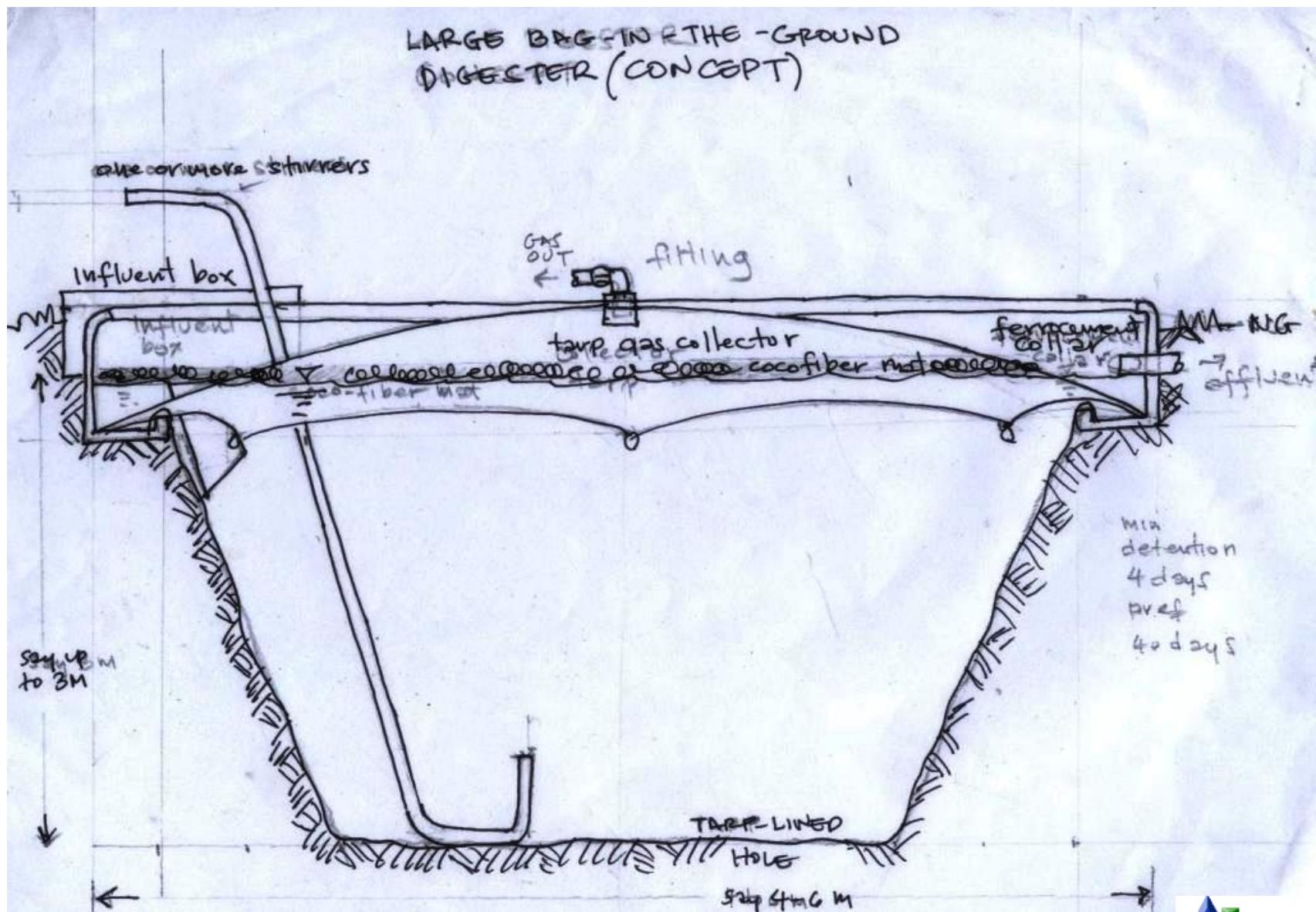


SOME FUTURE PROSPECTS FOR BIOGAS AND OTHER LOW-COST WASTEWATER TREATMENT

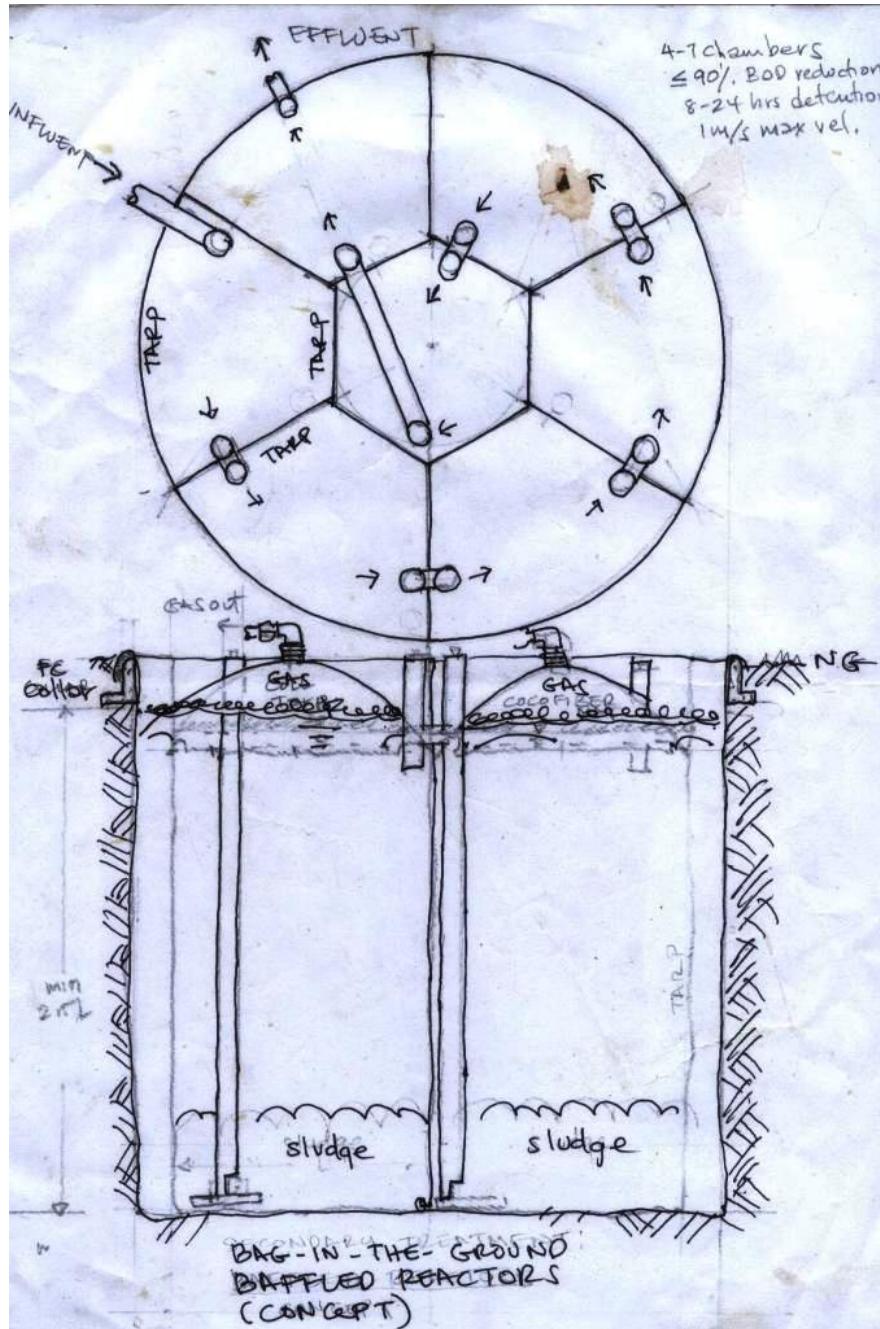
1. Possibility of replacing petroleum fuels if means to utilize cellulosic wastes are developed.
2. High-energy manure such as from pigs will probably be more valuable if a process for turning them to aquaculture feeds is found.
3. Try out /develop even cheaper wastewater treatment innovations to make them affordable:
4. Innovations for retrofitting existing wastewater installations for biogas harvesting and more efficient wastewater treatment.



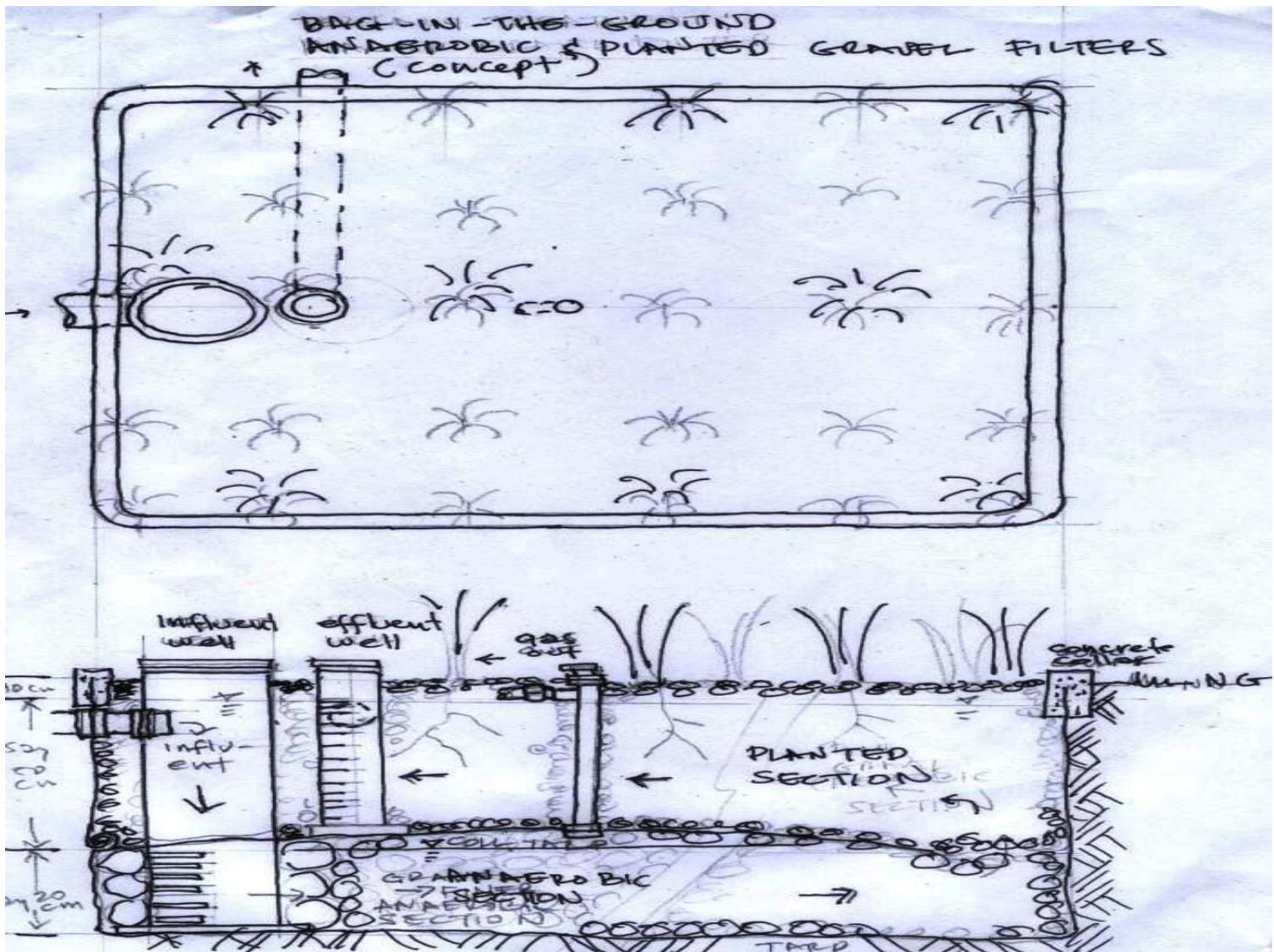
SUCH AS:



SUCH AS:



SUCH AS:



5. Prospect of Developing Bacterial Fuel Cells (Electricity Direct from Biogas or Digesting Microbes)



For more information please contact



Philippine Center for Water and Sanitation (PCWS)

and



WASH Coalition Pilipinas

Penthouse 3

Minnesota Mansion

267 Ermin Garcia Street

Cubao, Quezon City

Philippines 1102

Phone/Fax: (632) 912-0531

pcwsitnf@gmail.com

washcoalitionpilipinas@gmail.com

www.itnphil.org.ph