



**United Nations Human Settlements Program**

Mekong Region Water and Sanitation Initiative “MEK-WATSAN”

**Financing Project to**

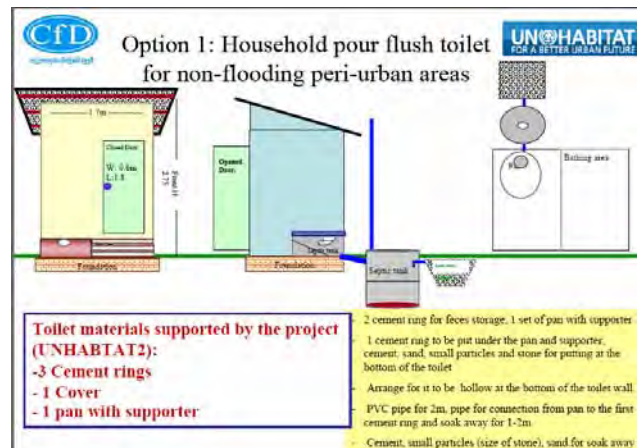


**“Provision of Improved Sanitation Services towards Reaching the MDGs in Svay Rieng Town, Svay Rieng Province and Kampong Cham Town, Kampong Cham Province in Cambodia”**

## Annex 1: Toilet Design Options and Construction Technique

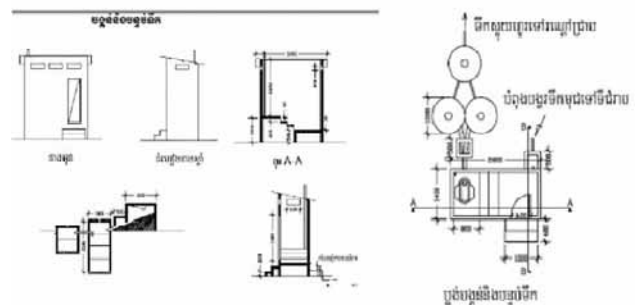
**Option 1** is a common type of pour-flush toilet and suitable for peri-urban areas that do not regularly flood.

In the first septic tank, the feces and urine are together. The volume of the feces becomes smaller and smaller. After this, the matter passes into the second septic tank which has 2 rings and a ventilation pipe. The feces stay for a long time here, become less solid and stays at the bottom of the septic tank where the organisms continue to eat each other. The liquid is at the upper section; when it reaches the pipe, it can pass to the 'soak away' whereby it is safe to drain away into the external environment without causing any harm. The 'soak away' can be made from stones, sand, charcoal or ash.



**Option 2** is a pour-flush toilet for peri-urban areas that occasionally flood.

There are 3 cement rings in each septic tank chamber apart from the last septic tank which has 1 cement ring. There is no concrete ring underneath the pan—instead there are bricks. The sludge flows from the pan to the first septic tank. Two septic tank chambers can be used if there is a want to use the dry sludge as fertilizer; whilst one chamber is being used the other can be left alone, will dry up in 2 years and can be ready to use as fertilizer. There needs to be regular O&M to check the level of the sludge in the septic tank that is being used. Once a septic tank is full, the block can be repositioned to make sure the wastewater goes into the other septic tank.



**Option 2: HH pour-flush toilet for sometime flooding peri urban areas**

**Option 3** is a pour-flush toilet for peri-urban areas that regularly flood.

Extensive flooding is very common in Svay Rieng and Kampong Cham Town. Two to three households can use this toilet option. The slab for the toilet needs to go on the 1<sup>st</sup> floor of the home. Underneath the pan there is no cement ring. The chamber can go above the ground and it can stay under water so long as there is a pillar for support and stable foundations. The wastewater goes from the pan, through the pipe to the 1<sup>st</sup> septic tank which has 3 cement rings. The more solid matter stays at the bottom of the tank and the liquid passes through the pipe into the second septic tank. At the start of the dry season (in November) the pipe leading from the second



septic tank can be opened and the treated sludge can go away but at the start of the rainy season (in June) it must be closed. A small section of the ventilation pipe is transparent therefore one can see if the second septic tank is full or not. If the second septic tank fills up before the end of the rainy season, a sludge emptying company needs to be contacted. Depending on the frequency of use, usually it takes 3 to 4 months for the second septic tank to be full during the rainy season.

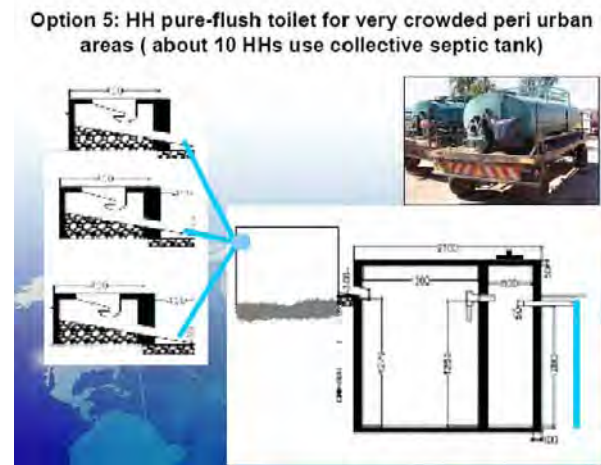
**Option 4** is a pour-flush toilet for rocky or laterite peri-urban areas that about 5 households can share 1 treatment system.

It is usual, in these areas, for the septic tank to go above the ground but it can go under the ground if a hole can be found. The wastewater goes into the first septic tank where it only stays temporarily before the liquid moves to the second septic tank. The bacteria continue to eat each other causing the temperature to go up because of the gases that are produced by the bacteria. This results in the feces becoming more like liquid. There is a lot of residue in the first septic tank but increasingly less so in the second septic tank and in the third. In the second septic tank the number of bacteria is reduced by 20% and in the third it is reduced by 80%. The final stage is the liquid passing to the 'soak away'. Plants and vegetables grow well near the soak-away.



**Option 5** is suitable for very crowded peri-urban areas.

Due to the unprecedented levels of migration to urban areas, some houses on the outskirts have been built very close to each other causing crowded conditions and sanitation has been poor as a result. There can be a slab in each house and households can be connected to a shared chamber, a chamber which can be bigger or smaller, depending on the number of households connected to it.

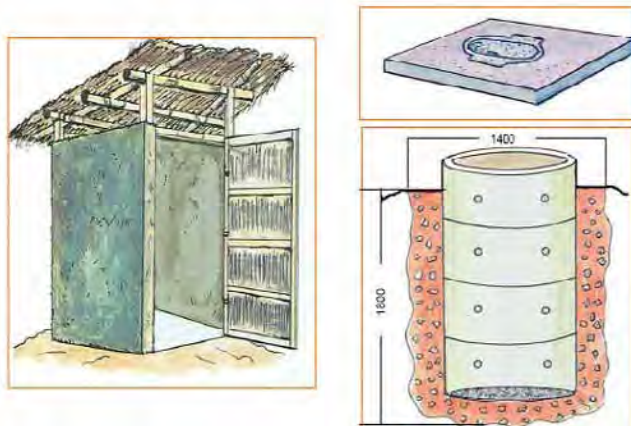


This toilet option is suitable for up to 10 households. The wastewater goes through a pipe into the first septic tank where it stays for a temporary period of 2-3 days. Mainly urine (some feces) passes into the second septic tank where the micro-organisms digest the remaining feces. When this septic tank becomes full, the liquid passes into the third septic tank. At the end, it passes into the 'soak away' and this does not affect the local environment. The tap at the end is never closed as the system is not located in an area that regularly floods.

**Option 6** is a pour-flush toilet located on the outskirts of towns in semi-agricultural areas that do not flood.

There is one septic tank with a slab on the top. When full, the septic tank can be left and during this time the bacteria and microorganisms decompose the matter until

Option 6: Household pour-flush toilet for outskirts of towns, un-flooding areas and secondary farms



there is nothing more to decompose, after which they die. It takes anything from 1-2 years for it to dry, depending on the frequency of use and after this it can be used for agricultural purposes. When one septic tank is drying, the superstructure can be moved to be placed over an empty septic tank which can then be used. As per a suggestion from a Provincial Governor, at the top of the septic tank there can be a pipe with a soak away, meaning that it takes longer

for the septic tank to fill up as liquid can go out into the environment through the soak away. This is not shown in the diagram but was agreed to by CfD management and this toilet design was revised in light of this comment.

**Option 7** is a dry toilet for areas on the outskirts of towns, in semi-agricultural areas, areas that have a lack of water.

This is a relatively cheaper toilet option. A water jar, commonly in use in peri-urban and rural areas in Cambodia for water storage purposes, can also be used as a septic tank so as long as it completely sealed all the way around. If it is not sealed, cement can be used to fill in the holes. At the top of the water jar, a layer of straw, bamboo and earth can be placed and in the middle of this, a block of wood is there which can be removed during defecation. After going to the toilet, ash is scattered to stop the smell and to make the feces drier. After approximately some time, the septic tank is full and can be left. The superstructure can be used to be placed over another water jar. There are no pipes in this toilet option.

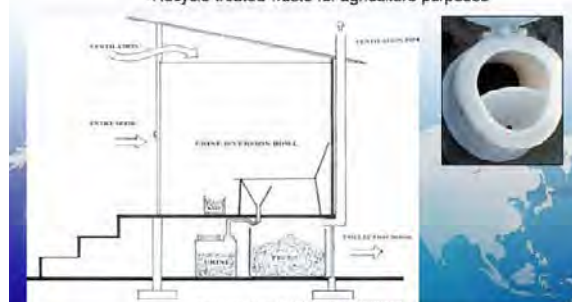
Option 7: HH dry toilet for outskirts, secondary farm, un-flooding, lack of water areas



**Option 8** is an Eco-San toilet for agricultural areas where there is a lack of water.

The urine and feces are separated; the front of the toilet is for urine and the back one is for feces. After defecation, ash can be scattered over the feces to kill the

Option 8: HH ecosan toilet for agricultural areas where there is no flood, lack of water  
-Segregating urine and feces  
-Recycle treated waste for agriculture purposes



bacteria. There is a 'collection door' for the feces and when the feces chamber is full, the feces should be taken out. The collection door needs to be monitored to see if the chamber is full or not. When the urine container is full it can be used for agricultural purposes together with the dried feces.

**Option 9** is an Eco-San toilet for agricultural areas where there is a lack of water. It is similar to option 8, but this option can be built under the shade, and wall with mental stuff.

The urine and feces are separated; the front of the toilet is for urine and the back one is for feces. After defecation, ash can be scattered over the feces to kill the bacteria. There is a 'collection door' for the feces and when the feces chamber is full, the feces should be taken out. The collection door needs to be monitored to see if the chamber is full or not. When the urine container is full it can be used for agricultural purposes together with the dried feces.

Option 9: EcoSan Toilet for Cambodia Storage and collection



**Option 10** is a pour-flush toilet for peri-urban areas that do not flood.

The pan and slab are located in the house. Both septic tanks are firmly sealed. A pipe connects the pan with the first septic tank. The end of the pipe never gets blocked because the feces break down. In the first septic tank, the feces stay at the bottom and the level of the liquid rises. Some sand and rock between the 2 rings treats the liquid as it makes its way to the top. At the top, the liquid goes through a pipe to the second septic tank; there is a dramatic reduction in the number of bacteria here. When liquid comes out of the second septic tank it can be used for farming.



**Option 11** is a household toilet for areas that flood that are next to a river bank and have a small housing plot. There is only 1 septic tank. The pipe goes from the pan to the septic tank, which has a sealed bottom. At the end of the pipe there are lots of holes to ensure that there isn't a blockage. Diving the two cement rings is a layer of sand and rock. This toilet option functions very similarly to toilet option number 10.



**Option 12** is a household toilet for areas that flood and for slum areas next to rivers.

This sharing treatment system is suitable for up to 10 households. The pan and slab are located inside the house. The sludge goes into the first septic tank; the solid particles go to the bottom and the liquid particles stay at the top. The wastewater stays here temporarily before the liquid moves to the second septic tank and here there is much less bacteria (80% reduction). At the bottom of the second septic tank there is gravel, sand and charcoal which are effective in killing the bacteria. The tap is only open during the dry season and closed in the rainy season. If the second septic tank becomes full during the rainy season, a sludge emptying service needs to be called.



**Option 13** is a household toilet for areas that flood, areas next to river banks, crowded slum communities or floating villages.

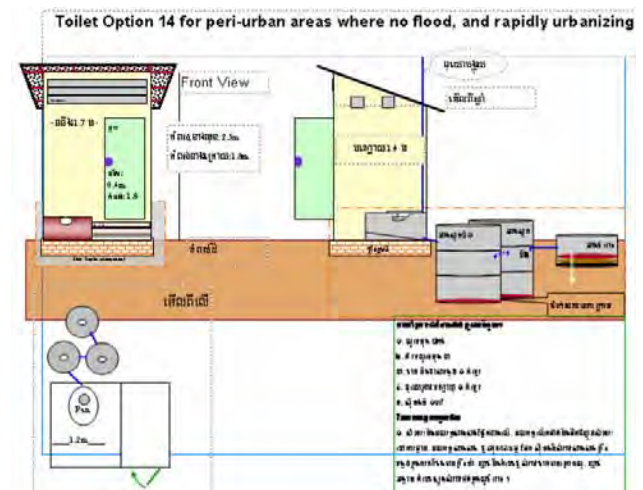
Up to 10 households can connect to a septic tank made by the company 'Cambox'. The sludge enters the septic tank, and the feces stays at the bottom. If liquid is at the level of the pipe and someone defecates solid waste, then this will cause the fan to start moving causing the level to decrease. Liquid goes out to the 'soak away' and can enter the external environment.

Option 13: Household Toilet for areas that flood, areas next to river banks, crowded slum communities or floating villages



**Option 14** is pour-flush toilet and suitable for peri-urban areas that do not regularly flood. It is an expensive option in which better off households prefer and are affordable to.

In the first septic tank, the feces and urine are together. The volume of the feces becomes smaller and smaller. After this, the matter passes into the second septic tank which has 3 rings and a ventilation pipe. The feces stay for a long time here, become less solid and stay at the bottom of the septic tank where the organisms continue to eat each other. The liquid is at the upper section; when it reaches the pipe, it can pass to the second chamber of the second septic tank for the same treatment above; and when liquid is at the upper section reaching the pipe, it can pass to 'soak away' whereby it is safe to drain away into the external environment without causing any harm. The 'soak away' can be made from stones, sand, charcoal or ash. Until the second chamber of the second septic tank is full which normally take 3-5 years—the



treated sludge in the first chamber of the second septic tank dried-up and can be recycled to fertile plants.

**Option 15** is a pour-flush toilet for non-flooding crowded areas.

There are three slabs/pans that connect to 1 treatment system. This is suitable for crowded areas. In terms of its function, it is very similar to toilet option number 1.

