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THE BIO-FILTER

To give wastewater good use

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Doña Juana Seneyda Sánchez Reyes of the Latas Lajas Community in Nicaragua (Municipality of Mateare, Department of Managua), shares her experience on her use of the bio-filter:

"With the bio-filter I can reuse the water that's left from when I wash dishes or clothes. The water that we shower with doesn't get wasted either, because I recycle it to water the plants and the garden.

The water goes through a filtration process and comes out clean. It doesn't smell bad anymore and it comes out clear, with no soap or dirtiness. With the water from my bio-filter, I water my energy parcel and my vegetable garden.

It's a big help during the dry season. It saves me money, time and effort. Before, I had to go buy water from the community well that's four kilometres away, and then bring it back in barrels to the field. Now I do it with a simple hose, and have time to do other things."

Purposes of the bio-filter

Plants need soil, water and nutrients to grow and produce crops. In dry-zone communities, the lack of water is an important limiting factor in the survival of plants and crops during the dry season or prolonged periods of drought.

Farming families in the dry tropics try to harvest as much water as possible and save it as much as possible, in order to deal with drought situations.

Wastewater from the bathroom or laundry room is generally not used. It's considered waste because it's dirty and contains products such as soap, shampoo, detergent and chlorine.

With the bio-filter, you recycle water that can be used to water plants, trees and vegetables during the dry season. But it has also maintained energy field plantations and family vegetable gardens during the rainy season in times of irregular rainfall.

Besides being a way to save money, another benefit is that there are fewer puddles and fewer mosquitoes in patios where the grey water would stagnate, reducing the risk of diseases that these bring.

In a bio-filter, the water flows by gravity and filters through the different materials (charcoal, red lava rock, fine gravel, pumice rock) which, through mechanical filtration, retain detergent, soap, and grease residues.

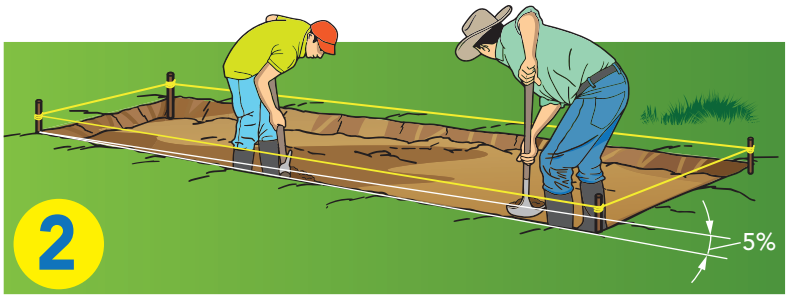
To obtain a better filtration, you can plant plants that create biological filtration thanks to the life-forms present around their roots. In this way, you can get recycled water for irrigation.

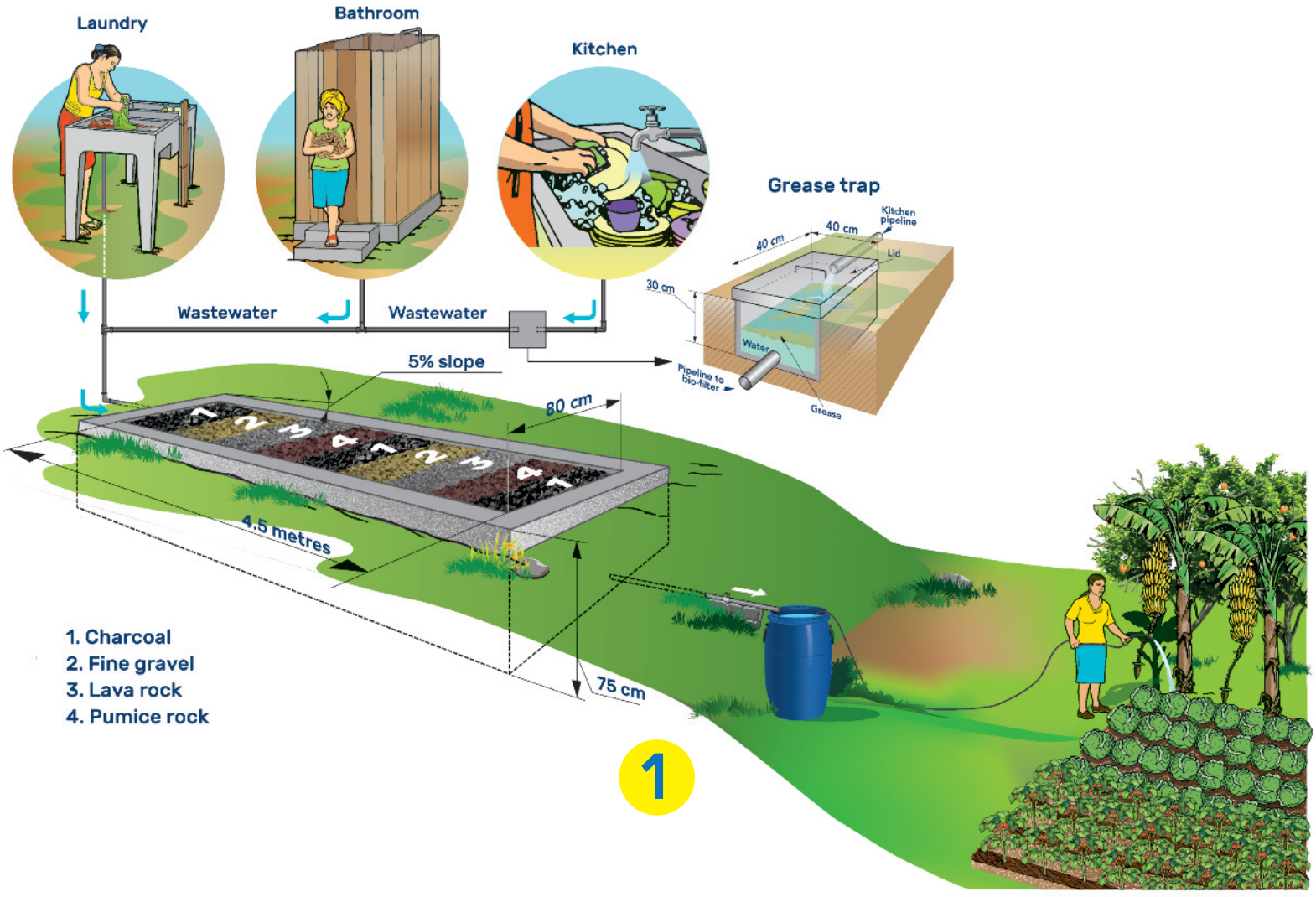
Step by step: Building a bio-filter

1 To build the basin, find a spot close to the kitchen, laundry room and bathroom. It must be lower down so that the water can flow by gravity.

Install the pipe that connects the kitchen, laundry room, and bathroom to the bio-filter. It's advisable to bury it. On the kitchen outlet you must install a grease trap: this is a buried box, 40x40 centimetres by 30 cm deep, which keeps the grease from going into the filter or clogging up the pipeline. The grease floats on top of the water in the trap and can be removed regularly. The trap must have a lid so as not to attract flies or other animals.

2 ✔ Dig a hole 4.5 metres long by 80 cm wide and 75 cm deep.
✔ The bottom of the filter should have a 5% slope towards the outlet.





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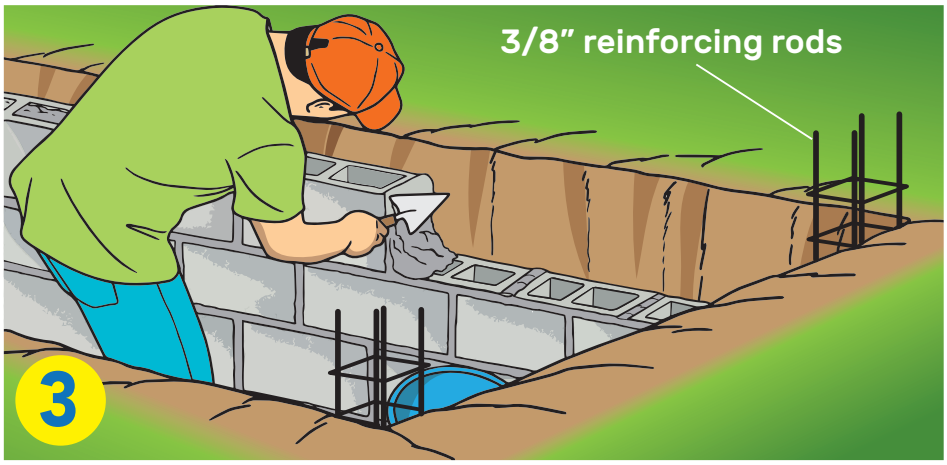
- ✔ Build the walls on the four sides, stacking three rows of 6-inch blocks.
- ✔ Place 3/8” reinforcing rods on the four corner blocks.
- ✔ To bind the four sides, build the capping beam with 3/8” rods, and join the corners with 3/8” reinforcing rods.



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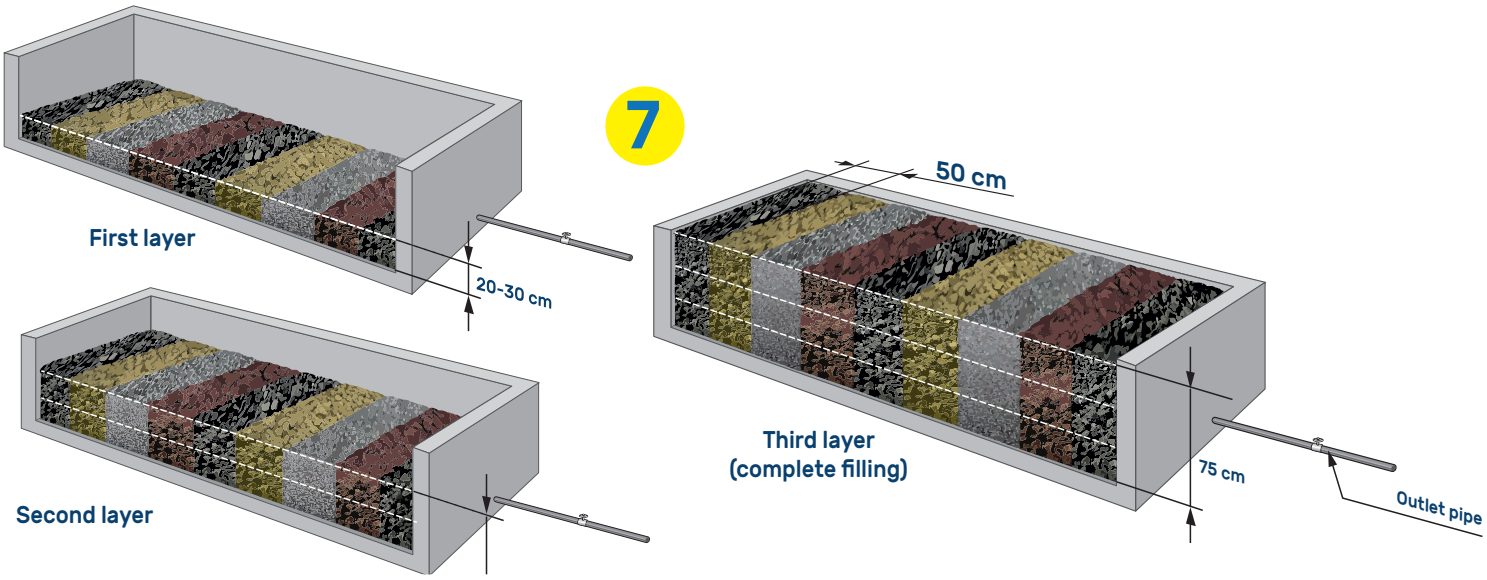
- ✔ Place the mould for the capping beam on top of the last row of blocks and fill with concrete.

5

- ✔ Compact the bottom well and fill with a 3-inch-thick layer of concrete.

6

- ✔ Plaster and smooth the walls and bottom inside the basin as a way to waterproof it and prevent water from leaking.
- ✔ Let dry for two days, wetting the plaster occasionally so that it doesn’t crack.
- ✔ At the bio-filter outlet place a 1-metre-long pipe towards the container for filtered water. Connect to a shut-off valve about 40 cm from the basin.



7 Fill the filter with the four water-filtering materials:

- ✔ The materials used for mechanical filtration are: charcoal, red lava rock, fine gravel and pumice rock, in 50cm-wide vertical layers, that cover the height of the basin in the following way:
- ✔ At the beginning of the basin, place the charcoal, then the red lava rock, fine gravel and pumice rock. Continue adding the layers in the same order until you finish filling the filter.
- ✔ As you cannot make each layer the full height of the basin because the materials would collapse, you can add different layers little by little to a height of 20-30 cm and then again until you're level with the basin.

Required materials

■ For the construction of the filter basin:

- ✔ 4 bags of cement
- ✔ 90 x 6-inch blocks
- ✔ 1 quintal (46kg) of 3/8" corrugated iron
- ✔ 80 x column stirrups (10 x 10)
- ✔ 1.5 pounds of binding wire
- ✔ 2 x 1" PVC pipes
- ✔ 1 x 1" PVC shut-off valve
- ✔ 2 x 1" PVC elbows
- ✔ 2 x 1" PVC "Tee" connectors
- ✔ 6 pounds of 3" nails
- ✔ 3 boards, 1 x 12 x 6 (for the mold)
- ✔ 1 cubic metre of sand
- ✔ 1 x 55-gallon barrel

■ To fill the filter:

- ✔ 4 sacks of charcoal
- ✔ 1 cubic metre of ½" fine gravel
- ✔ 1 cubic metre of red lava rock
- ✔ 1 cubic metre of pumice rock

Tools

- ✔ 1 trowel
- ✔ 1 shovel
- ✔ 1 pickaxe or digging bar
- ✔ 1 pair of pincers or pliers
- ✔ 1 hammer
- ✔ 1 spirit level
- ✔ 1 tape measure

Encountered costs and difficulties

- The size of the bio-filter should depend on the amount of water that the family consumes. This is because, in order to achieve a proper filtration, the water must pass slowly through the layers of material. The proposed bio-filter is for a family that consumes up to three barrels a day.
- The use of the bio-filter saved 360 barrels of water in a year, the purchasing price of which is equivalent to the cost of the bio-filter ($475 USD). Add to this the savings generated by consuming from the small family vegetable garden (which is 50-square metres), the equivalent is an annual average of $237 USD.
- If we consider that, during the following year, the investment to maintain the filter will be much lower ($125 USD), by the end of the second year, if the garden production is kept up, the savings will amount to $587 USD.

Recommendations

- Unless someone in the household knows about construction, it's better to hire a builder.
- It's better to build the filter during the dry season.
- It's advisable to place a row of blocks above ground level to prevent mud-filled rainwater runoff from damaging the filter.
- Try to prevent solid waste from the kitchen or laundry from reaching the filter, to avoid contamination from organisms that cause the water to accumulate bad odours.
- Every year you must wash the red lava rock and gravel and replace the charcoal and pumice rock.
- The bio-filter shut-off valve should stay open even though it spills, so that water does not accumulate and overflow.

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