Rain water harvesting methods pdf

Rainwater harvesting methods There are two ways of harvesting rainwater Surface drain harvesting Roof over rainwater harvesting Rainwater harvesting is collection and storage for rainwater reuse on site rather than allowing it to run off. These stored waters are used for various purposes, such as horticulture, irrigation, etc. This section describes various methods of harvesting rainwater. 1. Surface runoff harvesting In urban areas rainwater flows away, surface drain. This run-off could be caught and used to charge the water damper, adopting appropriate methods. 2. Removal of roof rainwater This is a rainwater catching system where it falls. Roof harvesting, the roof becomes catchment, and rainwater is collected from the roof of the house / building. It can either be stored in a tank or diverted to an artificial renewal system. This method is cheaper and very effective and, if properly implemented, helps to increase the level of groundwater in the area. Roof rainwater harvesting system components The illustrative design of the roof rainwater harvesting system is given in the typical schematic diagram shown in Figure 1. Figure 1: Rainwater harvesting components The system consists mainly of the following sub-components: Catchment areas Catchment area The surface of the catchment area of the first flush filter The surface of the surface which receives the rainfall directly is the catchment area of the rainwater harvesting system. It can be a terrace, courtyard, or paved or unpaveed in an open area. The terrace can have a flat RCC/stone roof or a sloping roof. The catchment area is therefore an area which actually contributes to the rainwater harvesting system. Transport rainwater from the roof should be carried through the bottom to carry the water pipe or sewer to the storage/ harvesting system. Water pipes must be uv-resistant (ISI HDPE/PVC pipes) with the required power. Water from sloping roofs can be caught through the gutters and down to carry pipes. At the terraces, the mouth of each drain must be a wire mestic to limit the floating material. First Flush First flush is a device used to rinse water received in the first shower. The first rain shower should be rinsed in order to avoid contaminating storage/rechargeable water caused by possible contaminants of the atmosphere and catchment roof. It will also help cleaning sediment and other materials deposited in the dry season Rules the first rain separator should be carried out at the exit of each drain pipe. Filter There is always some skepticism about roof top Rainwater harvesting, as doubts are raised that rainwater can pollute groundwater. There is a remote possibility that this fear will come true if a proper filter mechanism is not adopted. Secondly, care should be taken to see that underground sewage drains are not pierced and there is no leak in the vicinity. used for water purification to effectively prevent turbidity, colour and micro-organisms. After the first rinsing of precipitation, the water must pass through the filters. The gravel, sand and mesh filter shall be designed and placed on the storage tank. This filter is very important for clean rainwater storage tank. It removes the sediment, dust, leaves and other organic matter from entering the storage tank. After each rainfall, the filter environment should be cleaned daily. Clogged filters do not allow rainwater to enter the storage tank easily, and the filter may overflow. Sand or gravel carriers must be removed and washed before being replaced by a filter. A typical filter photo is shown in Figure 2. Figure 2: Photo of the typical filter for rainwater harvesting In practice, there are different types of filters, but the basic function is to purify the water. This section describes the different types of filters. Sand gravel filter These are usually used filters made with brick masonry and fillets with pebbles, gravel, and sand, as shown in the figure. Each layer must be separated by a wire mesa. A typical image of the sand gravel filter is shown in Figure 3. Figure 3: Sand gravel filter Charcoal filter Charcoal filter can be made in-situ or cylinder. Pebbles, gravel, sand and charcoal, as shown in the figure should be filled in drums or enclosure. Each layer must be separated by a wire mesa. A thin layer of charcoal is used to absorb the smell, if any. A schematic diagram of charcoal filter is shown in Figure 4. Figure 4: Charcoal filter PVC –pipe filter This filter can be made with a PVC pipe between 1 and 1,20 m in length; The diameter of the pipe depends on the area of the roof. Six inches of dia. Each component is filled with gravel and sand alternatively, as shown in the figure. Charcoal layer can also be inserted between two layers. Both ends of the filter must reduce the required size to connect the inlet and outlet. This filter can be positioned horizontally or vertically in the system. A schematic pipe filter is shown in Figure 5. Figure 5: PVC-pipe filter sponge filter This is a simple filter made of PVC cylinder with sponge layer in the middle of the cylinder. It is the simplest and cheapest form filter, suitable for residential units. A typical sponge filter number is shown in Figure 6. Figure 6: Sponge filter methods for roof rainwater harvesting different roof on top of rainwater harvesting methods are shown in this section. (a) Direct storage This method directs rainwater collected from the roof of the building to the storage tank. The storage tank must be designed in accordance with water requirements, rainfall and catchment areas. Each drain pipe should have an eye filter and the first flushing device, followed by a filtration system, before being connected to the storage tank. It is recommended that each tank should have excess water over the flow system. Excess water can be diverted to the charging system. Water from the storage tank may be used for secondary purposes such as washing and gardening, etc. This is the most expensive form of rainwater harvesting. The main advantage of collecting and using rainwater in the rainy season is not only to save water from traditional sources, but also to save energy resulting from the transport and distribution of water at the doorstep. It also retains groundwater when it is extracted to meet demand when rain is on. A typical fig of a storage tank is shown in Figure 7. Figure 7: Storage tank on a platform painted white (b) Charging of aquifers of groundwater May to be filled with different types of structures to ensure the percolation of rainwater into the ground rather than draining away from the surface. Typically used charging methods: - a) Charging wells b) Charging ground wells. c) Charge pits (d) Charge trenches (e) Soakaways or Recharge Shafts (f) Charging of holes Rainwater collected from the roof of the building, is passed through drain pipes to an inhabited or filtration tank. After settlement filtered water is directed to the bore well to charge deep into the aqueous layer. Abandoned wells can also be used for charging. The optimal capacity of the populated tank/filtration tank can be designed based on the catchment area, intensity of precipitation and charging speed. During charging, the penetration of floating substances and sediments should be restricted as this may clog the charging structure. The first one or two showers should be washed through the rain separator to avoid contamination. Figure 8 shows the schematic diagram of filling the filter tank. Figure 8: Charging the filtering tank well for the well (d) Charging pits Recharge pits are rectangular, square or circular pits of any shape sealed with brick or stone masonry wall with markup hole at regular intervals. Top pits can be covered with perforated lids. At the bottom of the pit should be filled with filter carriers. The capacity of the pit can be developed based on the catchment area, rainfall intensity and recovery rate in the soil. Usually the dimensions of the pit can be 1 to 2 m in width and 2 to 3 m deep depending on the depth of the pervious strata. These pits are suitable for the restoration of shallow aquifers, and small homes. Figure 9 shows a diagram with a rechargeable pit scheme. Figure 9: Charge the pit e) Soaked or Charge the shafts Soak away or charge the shaft if the upper layer of soil is attractive or less pervious. They are boring hole 30 cm dia. The Bore should be lined with a corrugated/perforated PVC/MS tube to prevent vertical edges. The top soak away the required size of the tank is designed to keep the runoff before the filters through the soak away. The container must be filled with a filter environment. Schematic diagram of the charging shaft is shown in Figure 10: Schematic diagram recharge shaft f) Charging dug wells Raka well can be used as a charging structure. Rainwater from the roof is diverted to the dug well after passing it through the filtering bed. Cleaning and de-de-de-deaging of the excavations must be carried out regularly to improve the charging speed. A filtering method recommended for charging the well could be used. A schematic diagram for charging the dug well is shown in figure 11 shown below. Figure 11: Schematic charging scheme for well excavated g)Charge trenches Recharge trenches if the upper tight layer of soil is shallow. It is a trench excavated on the ground and filled with porous media such as pebbles, boulder or brickbats. this is usually done for surface run-off. Bore wells can also be provided inside the trench as a recharge shaft to improve percolation. The length of the trench is decided as a foreseeable run-off. This method is suitable for small houses, playgrounds, parks and roadside gutters. Recharge trenches can be a size 0.50 to 1.0 m wide and 1.0 to 1.5 m deep. Schematic diagram of the charging trench is shown in figure 12.12 below: Charging in trenches h) Percolation tanks Percolation tanks are artificially formed surface water bodies that immerse an area of land with sufficient permeability to promote sufficient percolation to recharge groundwater. They can be built in large towns where land is available and topography is suitable. Surface runoff and roof on top of the water can be directed to this tank. The water accumulates in the tank percolates a solid boost to groundwater. The stored water may be used directly for horticulture and untreated use. Percolation tanks must be built in gardens, open spaces and green slag roads in the city area.