Harvesting Roof-top Rainwater for Direct Use

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Why Rainwater Harvesting ?

Harvesting rainwater from roof-tops is an easy and eco-friendly method of augmenting household-level water availability. Roof-top rainwater harvesting (RRH) involves diverting and recharging (or) storing part of the rainwater that falls on the roof of a house. RRH for recharging groundwater is a common practice implemented in individual houses as well as apartment complexes. In such case, harvested water is directed into a recharge pit which collects and slowly recharges to groundwater storage in that area. But, storing the rainwater and directly using it is also a feasible option for those who want to directly benefit from augmented water availability.

My RRH system

I installed a RRH system at my small house located at Boduppal (17.414363 N, 78.576998 E) in Ranga Reddy district of Andhra Pradesh (close to Hyderabad city) in June 2012, just before the on-set of south-west monsoon. Four major components of the system are –

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<tr><td>1. Roof of about 100 sq.m area</td><td>2. The down pipe connecting the roof and filter</td></tr>
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<tr><td>3. Rainy filter that screens all dust particles more than 200 micron size</td><td>4. Underground storage tank of 1000 lt. capacity</td></tr>
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The rainwater that is collected in the under-ground storage tank is pumped back to a separate over-head tank placed on the roof. Toilet flush tanks in both toilets have exclusive connection to this storage tank, apart from the taps located in kitchen and a wash-basin in the dining space.

Though my house has municipal water supply connection with sufficient supply, my intention is to avoid using such high-quality treated water meant for drinking purpose (treated at a cost of INR 25-30 per kilo litre) for non-consumptive applications requiring lower quality of water such as flushing toilets, cleaning utensils, watering the plants etc.

System performance

This system was installed in June 2012 and I observed its functioning and performance during June-Oct period, which is the predominant monsoon rainy season at my place. Average annual rainfall at my place is 804 mm with 50 average rainy days. Here are my observations on major aspects of the performance:

Filter performance

For a RRH system designed for direct use of water, filter is the most important component, like the heart in a human body. My filter (brand named 'Rainy FL-100' was purchased from a Rainwater Harvesting company in Bangalore, see www.rainyfilters.com) works on the principle of centrifugal force. Once the water enters this filter, it rotates in a spiral motion on the inner surface of the cylindrical shaped filter mesh. Water that passes through the mesh (along with dust particles of less than 200 micron) enters the storage tank. About 10-20% of water, depending on the intensity of rainfall, gets rejected by the filter. Passing of 80-90% of roof water through the filter indicates very good and satisfactory performance. But, the water reached storage tank has still some finer dust particles, which could not be removed by the filter.

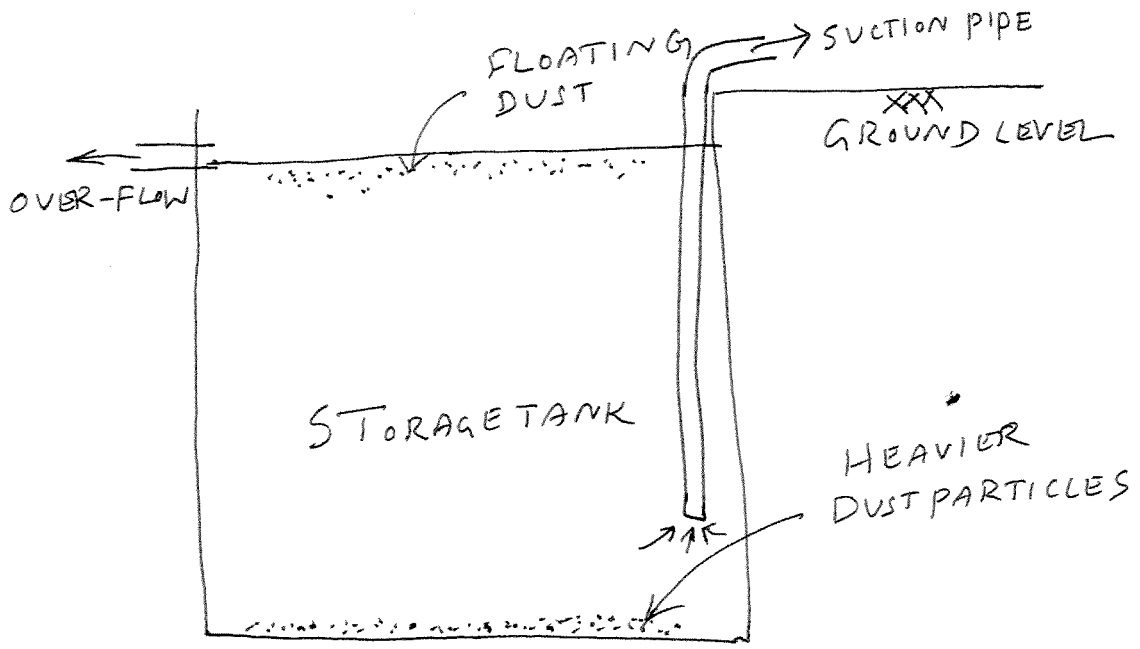
		
Water entering the filter laterally (view from top)	*Water moving in a spiral motion on the inner surface of the cylindrical mesh*	*Rejected water coming out from the bottom of the filter*

There are also practices of using simple bucket filters fillted with sand, charcoal like material or sponge. Most of such systems require a provision for 'first-flush' to prevent entry of dirt and dust into the filter. Also, those filters require frequent cleanup or replacement of filter material. This new filter is found to be really 'maintenance-free' and there is also no need for manual operation to divert the first-flush. But, the downside is during first 5-10 minutes of rain, amount of water rejected is more due to more dirt-load in the first-flush water. Over a period of 20-30 min, the rate of rejected water comes down to approx. 5-10% of total water harvested.

Quality of water harvested

Rainwater that is harvested through the filter reaches the storage tank. During the four-months observation period, my 1000 litre capacity storage tank got filled up around 15 times and when it is filled up completely, excess water was sent out through the over-flow pipe provided at the top (few inches below the ground level) of the storage tank.

A pipe (suction pipe for the pump-set) is inserted to the bottom of the storage tank (few inches above the bottom of the tank) for pumping the water to the over-head tank located on the roof.



Cross section sketch of the storage tank

Since most of the dust particles are minute in size and initially float on the surface of the water due to turbulance, clear water free from any

dust or dirt could be pumped out from the bottom of the tank and quality found to be highly satisfactory. Moreover, repeated filling of the storage tank to the brim helped in sending out the water loaded with floating dust particles through the over-flow pipe. Thus the system is functioning like a ‘self-cleaning and maintaining’ system.

Dust particles got clustered and floating on the water surface in storage tank (immediately after a rainfall event)

For any such RRH to function as a self-cleaning and self-flushing with minimum human intervention for maintenance, it is useful to size the storage tank in such a way that it over-flows several times during the rainy season. Moreover, due to availability of limited space for constructing a tank, it is better to construct a tank of 2000-3000 litre capacity or less for a roof area of 100 sq.m in a place like Hyderabad. In places with more intense rains, one can go for higher capacity storage tanks. But, to avoid wastage of more water through over-flow, one need frequently pump out water and keep the storage tank empty.

Few days after the rainfall, I observed relatively bigger dust particles settling at the bottom of the storage tank. Since pumping is done from a level few inches above the bottom of tank, most of these particles flock together and do not move with water pumped to the over-head tank. Flushing the storage tank once in a season will help to remove them and keep the tank clean.

Conclusion

The over-all performance of the RRH system is found to be good and satisfactory. Filter's performance, which influences the quality of water and functioning of whole system, is found to be very good. Careful sizing of the storage tank and proper over-flow provision to storage tank helps to make the system 'self-cleaning' and 'self-maintaining'.

My RRH system helped to harvest around 15,000 liters of water over a period of 5 months (150 days), at an average rate of 100 liters per day. In other words, 15,000 litres of drinking water supplied by the muncipality was prevented from going down the drain as toilet flush and saved so as to meet drinking water needs of people in other areas.

By adopting roof top water harvesting and implementing dual water use by modifying the household level plumbing works, one can save lot of high-value treated drinking water and help people in accessing potable water in area facing serious water shortage and also in areas (such as Nalgonda) affected by Fluoride in water.

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Watch the video on my RRH system at: http://youtu.be/aRnk40XU4cg