Conservation and Sustainable Management of Water Resources

Rain Water Harvesting

'Only 8% of the water received from rains in the entire year is harvested in our country. Just and just 8 per cent. Now the time has come to find a solution to this problem' – Hon'ble Prime Minister of India, Shri Narendra Modi

Freshwater issue continues to be a cause of concern for humanity owing to both anthropogenic and natural factors. One of the biggest challenges of our time is the disappearing water resources, which is leading to unprecedented water crisis around the world with as many as 10 countries, home to over 60% of the world population do not have access to clean water (Figure1).

Surface and ground water resources are naturally replenished and artificially recharged with rainwater. India has a long history of recharging ground water resources artificially through Rain Water Harvesting. However, with time, this practice has become the thing of the past. Inspite of regulatory provision that mandates certain buildings to construct Rain Water Harvesting structures, same has not been adhered to in many cases. It has been observed, Rain Water Harvesting structure many a times, are not fully functional or maintained to avail the services, it can render to recharge ground water table and save water.

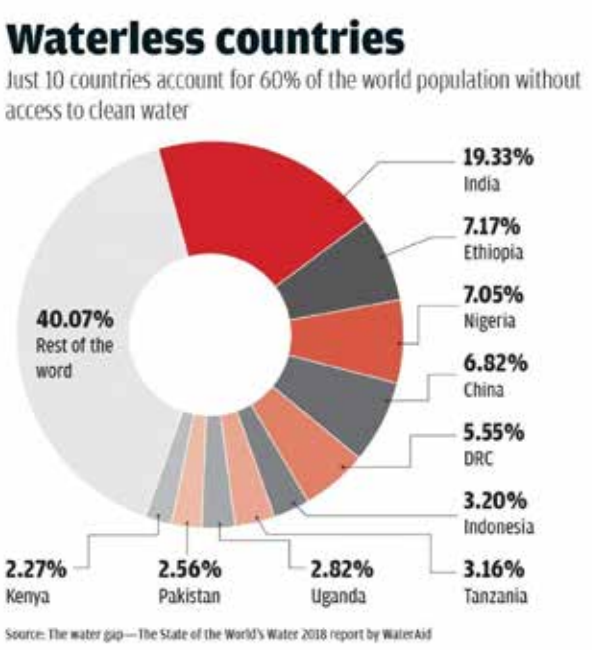

Figure 1: Water Scarce Countries

Figure 2: Water Crisis in India

into the underlying soil. Imperviousness is the most critical indicator for analyzing impacts of urbanization on the water environment (Schueler, 1994 and Arnold & Gibbons, 1996) and this can be directly attributed to increased flooding and low or no ground water recharge.

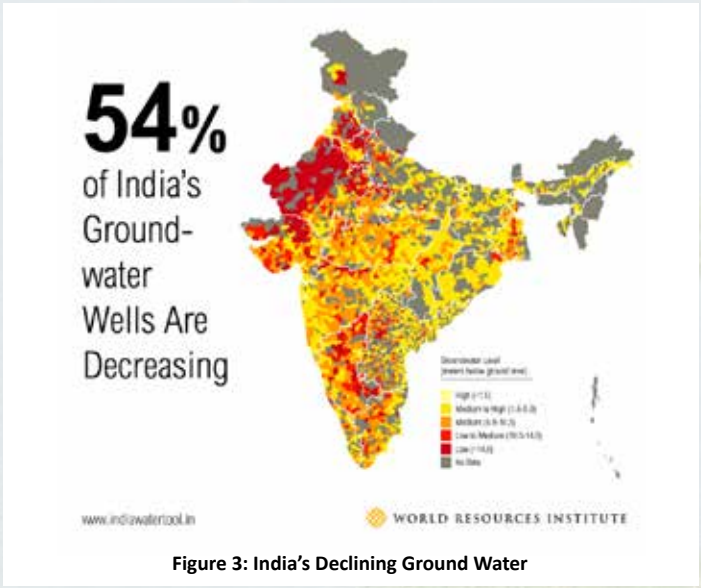

Figure 3: India's Declining Ground Water

Among the biggest threats to water availability, over-use, pollution and changing climate could be rated as the top factors. According to the United Nations' World Water Development Report 4 (2012), India is the highest extractor of ground water in the world, while changing climate is also making things worst. The changing rainfall pattern in the recent years, clearly indicates how climate change is playing havoc in the region; particularly reduced and scanty rainfall is contributing to water unavailability big time.

Additionally, rapid concretization is leading to imperviousness all over the place specially in the urban areas. Impervious surfaces are defined as the hard surfaces that prohibit the infiltration of water from the land surface

The status of ground water is not in an encouraging state, in absence of a sustainable practice to replenish the natural ground water storage, most areas today are facing acute water availability issues. With India heading towards a water crunched future as reported by many studies (Figure 2 & 3), it becomes the need of the hour to undertake mitigatory measures such as Rain Water Harvesting on an urgent basis.

The contamination of ground water sources on the other hand, particularly due to heavy metal is leading to major environment and health complications. Heavy metal contamination has not only impacted health and environment but the crippling effects of fluoride and arsenic toxicity is transforming to become a major public health issue today.

Figure 4: Prof. Giridhar at the demonstration site

Over-exploitation of ground water resources is also causing aquifer contamination in some instances, while in certain others its unscientific development with insufficient knowledge of groundwater flow dynamic and geo-hydro chemical processes has led to its mineralization (Kumar and Shah, ..).

Various studies and experiments undertaken at Jawaharlal Nehru Technological University (JNTU) Hyderabad it is clear that ground water shortage and contamination can be easily addressed by harvesting rain water (Figure 4). There are two methods in which rainwater can be harvested viz., storage method and recharge method. Storage of rainwater on surface has taken up through Tanks/Ponds/Lakes, Weirs and Roof tops. Recharge to ground water is generally done through the methods of recharge pits, recharge trenches, trench with recharge wells, recharge shafts, shaft with recharge wells, dug wells, hand pumps, abandoned tube wells, Percolation tanks, Check dams, sub-surface dykes and injection wells (Giridhar, 2017).

The installation of improvised Rain Water Harvesting model (Figure 5 & 6) developed at JNTU Hyderabad can open up new ways of addressing water scarcity issue and heavy metal contamination problem in a much simpler way than one could have expected. By introducing injection bore into a normal rain water harvesting system, successful ground water recharge is possible alongside removal of ground water contamination through dilution. Pilot Projects undertaken under the guidance of Prof. MVSS Giridhar of Centre for Water Resources, JNTU Hyderabad in the state of Telangana have successfully attained both the objectives. This success is monumental and based on the same, the JNTU Rain Water Harvesting model is now ready to travel to the other parts of the country, where water scarcity and heavy metal contamination are prevalent.

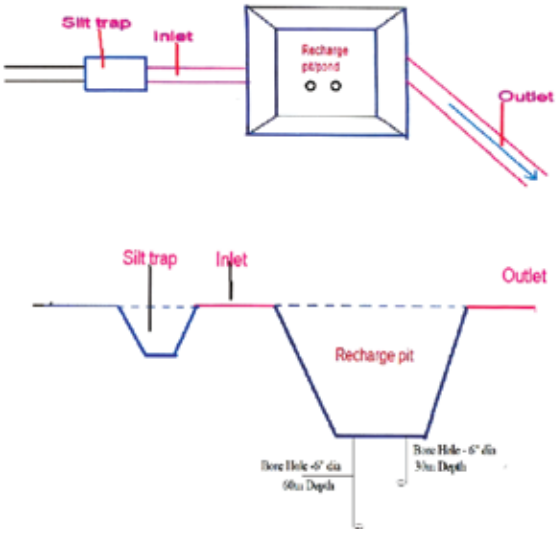

Figure 5: Rain Water Harvesting Model (JNTUH Model)

Rainwater is a pure and primary source of water and its quality is better than that of other water resources including groundwater. Each rain drop harvested at various levels increases the groundwater storage and also helps save electricity that would have been otherwise required to pump/lift water from other sources. Rainwater harvesting is a mini scale water resources project which promotes conservation and storage of excess surface water for future requirements by collecting, storing and regulating rainwater by structural measures (Giridhar, 2017).

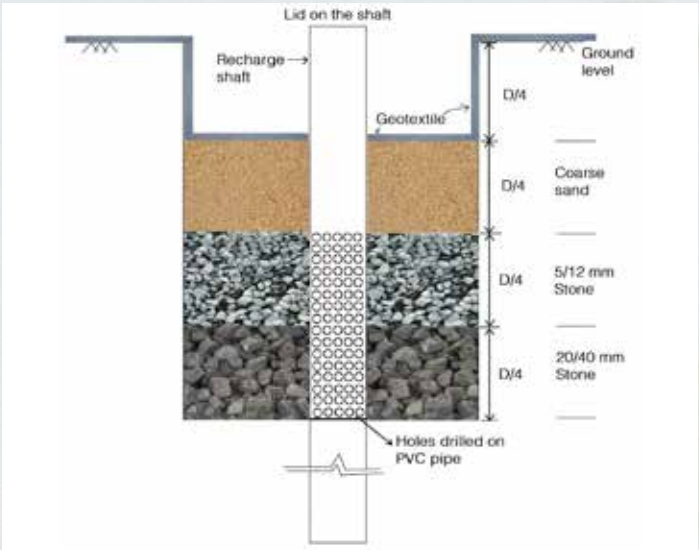

Figure 6: Rain Water Harvesting Structure (JNTUH Model)

Rainwater itself is of very good quality; it has very less contamination, even in urban or industrial areas, so it is clear, soft and tastes good. Pollutants can however be introduced into the rainwater system after the water has touched onto a surface (Thomas & Martinson 2007). Rainwater harvesting methods utilize the surplus surface runoff which otherwise drains off and reduce flooding and clogging of water channels. Rainwater is better than any other available water in terms of physical, chemical and biological characteristics.

Benefits of rainwater harvesting and advantage of JNTU Model (Figure 7):

- Harvest good quality water at low costs and conserve water
- Takes the water down to the aquifers resulting in instant ground water recharge
- Helps reduce our reliance on water sourced from dams/ reservoirs/lakes/rivers and reduce electricity consumption
- Prevents flooding by capturing excess runoff and prevents soil erosion


Figure 7: Pilot Projects in JNTU Hyderabad Campus

- It is a zero-maintenance structure with zero discharge
- Water quality improves through dilution including heavy metal contamination and removal of Flouride and Arsenic
- High benefit-cost ratio and longer life-span of the structure
- No water stagnation and mosquito breeding
- An emerging skill development and entrepreneurship opportunity for local communities.

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