Action Research on "Implication of Rainwater Harvesting in Recharging Shallow Ground Water Aquifer and Its Quality"

Urban Environment Management Society
Prayag Pokhari, Lalitpur

Background

Kathmandu Valley is reeling upon shortage of drinking water owing to increasing urbanization and population growth. Valley denizen have been depending upon traditional and groundwater resources like dug wells, stone spouts as the water utility: Kathmandu Upatyaka Khanepani Limited fails to meet the increasing water demand in Kathmandu Valley. These traditional dug wells and stonespouts have been serving as an alternative source of drinking water for the urban dwellers. However, groundwater water level is depleting and traditional dug well and stonespouts are drying up as a result of surface concealing in addition with increasing urbanization and over extraction of groundwater. Considering these issues, Urban Environment Management Society (UEMS) with financial support from WaterAid Nepal conducted 5-year (2008 to 2013) action research to assess impact of rainwater harvesting in recharging shallow groundwater aquifer and its quality.

Objectives:

- To analyze the impact of rainwater harvesting systems installed in the study area on the shallow groundwater resource in the study area.
- To study the impact of rainwater harvesting in the shallow groundwater quality

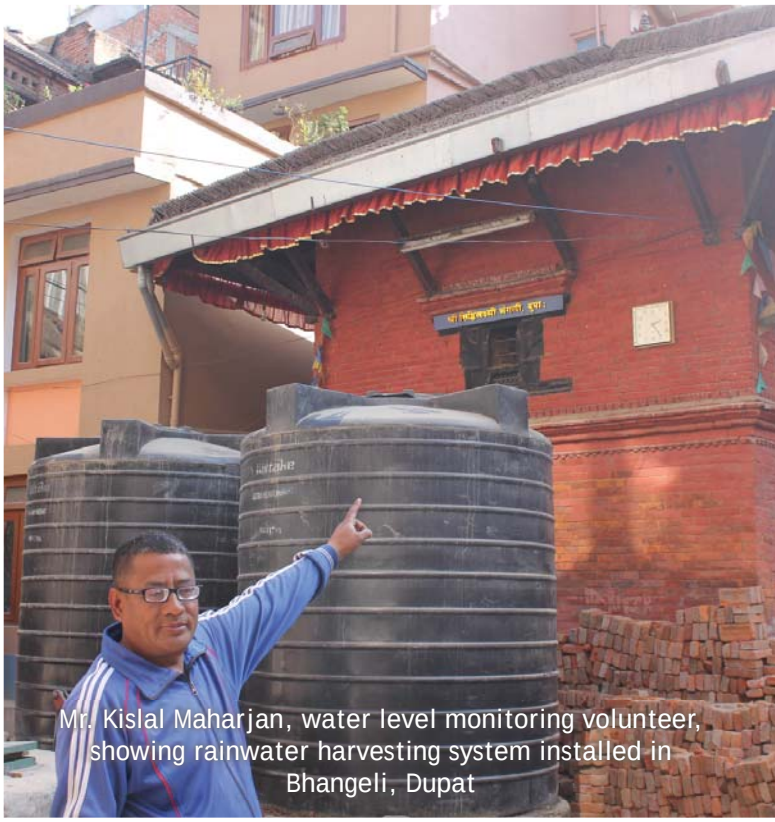
Project Duration

- 5 years (2008 to 2013)

Activities/ Interventions

The major activities that have been commenced through this action research project are

- Selected 77 community dug wells in ward nos. 7, 8, 18, 19 and 20 of Lalitpur Sub Metropolitan City
- Installed 28 Rain Water Harvesting (RWH) systems i.e. 28 dug wells were installed (equipped) with RWH systems recharging rainwater into these wells. These dug wells were selected among the 77 dug wells selected for water level monitoring.
- Constructed 25 recharge pits / soak pits in bahals/ courtyards (traditional open space for various community activities and lined with bricks) located in periphery of dug wells.
- Monitored water level of these 77 dug wells twice a month to analyze the augmentation of shallow ground water aquifer through monitoring water level fluctuation
- Measured infiltration rate of rainwater harvesting systems installed in wells and soak pits constructed in bahals/courtyards
- Monitored Water Quality of these 77 dug wells 3 times a year (in pre monsoon, monsoon and post monsoon season)



Mr. Kislal Maharjan, water level monitoring volunteer, showing rainwater harvesting system installed in Bhangeli, Dupat

Achievements/ observations:

Groundwater augmentation:

- Total volume of water augmented from 25 recharge wells and 25 recharge (soak) pits is 1663m3 and 4384m3 respectively in a year
- Out of 77 dug wells monitored, 65 percentage of dug wells showed increase in water level during wet month (August) in 2012 with respect to baseline in August 2008
- 46 percent of dug wells showed increase in water level during dry month (April) in 2012 with respect to baseline in April 2008

Ward No.	Total no. of dug wells monitored	No. of dug wells with increase in water level during wet month with respect to baseline	% of dug wells with increase in water level during wet month with respect to baseline	No. of dug wells with increase in water level during dry month with respect to baseline	% of dug wells with increase in water level during dry month with respect to baseline
7	13	10	77	3	23
8	12	10	83	4	33
18	23	9	39	8	35
19	19	15	79	9	47
20	10	6	60	6	60
Total	**77**	**50**	**65**	**30**	**46**

Indra Bahadur Shilpakar, 52, member of Bijapunani well users committee and water level monitoring volunteer, says,

"UEMS has installed a rainwater harvesting system for recharging rainwater into a community dug well in Bijapunani, located in Ward No. 18 of Lalitpur Sub-Metropolitan City. I personally believe that this is really a commendable initiative to augment water level of dug well. This has not only augmented water level of community well but also benefited the households with private wells. Rainwater harvesting has also helped to dilute iron concentration in the wells. Expansion of rainwater harvesting and groundwater recharge projects will surely contribute to augment water level of traditional dug wells in LSMC."

Subarna Lal Rajkarnikar, 61, member, Hauga Nani Well Users Committee in ward no 18, says,

"It has been four years since we have installed rainwater harvesting system and recharged the harvested rainwater in a community dug well here in Hauga Nani. We have witnessed increase in water level in the well and the well is functional year round. Until four years ago, we had to clean the dug well every year and the well water used to be filthy. Now, we have not cleaned the well for the last 3 years as the water seems clean, which I believe is the impact of rainwater harvesting. We have been using dug well water for cooking, bathing, washing and for toilet.

Water quality:

- Most chemical concentration like conductivity and iron decrease drastically due to dilution process in the monsoon and increase in post monsoon when the recharge is decreased due to stoppage of rain.
- Overall quality of water especially the microbial quality seems to have deteriorated with the recharge as evident from rise in E-coli and nitrate concentration in wells during monsoon period and fall in concentration in the post monsoon period. Though no concrete evidence is available, the contamination has occurred during passage of rainwater from the surface. It is assumed that effluents from leaking sewerage pipes or septic tank have been carried to groundwater during rainwater infiltration.

Hem Das Shilpakar, 37, water level monitoring volunteer, says,

"I monitored water level of around 5 dug wells in ward no. 19 twice a month continuously for three years. I did not witnessed significant increase in water level in the wells but the water level has not gone down as well. I believe that rainwater harvesting and groundwater recharge has helped to maintain water level in the wells.

Water level monitoring volunteer monitoring water level in community dug well

Kislal Maharjan, 50, water level monitoring volunteer, says,

"I monitored water level of around 6 dug wells in ward no. 7 twice a month continuously for five years and I found water level increase in all the six dug wells following the construction of soak pits and rainwater harvesting systems. A well in Dupat Lachhi, which used to be dry in the past, is now functional throughout the year. Thanks to rainwater harvesting and groundwater recharge, not only the water level in community dug wells have increased, but also the water level in private dug wells have gone up as well.

Dr. Suresh Das Shrestha, Hydro Geologist, says,

"I believe that rainwater harvesting and groundwater recharge is the only alternative in the Kathmandu Valley to mitigate drinking water woes as Kathmandu Valley receives plenty of rainfall every year and many locations in Kathmandu Valley seem appropriate for rainwater harvesting and groundwater recharge due to its geological features.

Conclusions:

- Installation of rainwater harvesting systems in wards 7, 8, 18, 19 and 20 have helped in augmenting shallow groundwater storage in the area. Thus rainwater harvesting can be an effective tool to supplement the shallow groundwater system in Kathmandu valley.
- Though the rainwater harvesting has produced positive results, considering the size of the area, large number of such installations are required to help the water supply system in the area which is likely to face stress as the urbanization continue to grow.
- Residents in the core areas of ward 18 can benefit from the storage potential by installing recharge mediums like pits, open ponds(in wards 19 and 20 in the south).

For additional information

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