Terms of Reference (ToRs)

Optimal Filter Design for Groundwater Recharge

BACKGROUND

Rainwater harvesting is a tool for achieving sustainable water supply system. Rainwater harvesting is a method of collecting, storing and conserving local roof top and surface rainfall runoff for future domestic utilization as well as groundwater recharge. Being a sub-tropical country, Pakistan receives considerable rainfall that can be used for domestic purposes, gardening, industries and groundwater recharge. Rainwater can be utilized for groundwater injection and recharge which can uplift groundwater depletion of urban areas.

In many parts of the world, rainwater is frequently used to deal with water scarcity and urban flooding. Rainwater harvesting is necessary in Lahore for the mitigation of existing water crisis and raising of groundwater level.

One of the main issues of groundwater recharge relates to the seasonal occurrence of rainfall. Pakistan has short but intense rainy season followed by long dry season. Most of the annual rainfall occurs in four monsoon months. This imposes serious constraints on the type of storage. Heavy sediment load cause choking of filter material and resulting in low function of recharge facility.

It is too costly to construct large local facilities with adequate capacities for continuous water supply throughout the year. Additionally, protecting the quality of harvested rainwater during periods of long storage is difficult.

A cost effective and culturally correct way of storing the harvested rainwater would be to replenish the groundwater by adopting artificial recharge (AR) methods. Groundwater recharge, in general, refers to natural replenishment of an aquifer by percolation of surface runoff, stream flows, into the ground. AR is a process in which water is introduced into the groundwater aquifers by manmade injection systems.

The ground water recharge option has been adopted by different organizations such as Pakistan Council of Research in Water Resources (PCRWR), Water and Sanitation Agency (WASA) Lahore, and Non-Government Organizations (NGO’s). Presently the filter are design based on hypothetical consideration, without know proper transitivity and other hydraulic parameters, also the thickness of different material is decided on personal judgement and common discussions. As the results after some time the recharging mechanisms don’t perform as perceived. As the result a huge investment goes waste.

The effective of groundwater recharge is un-doubted, but its long term and effective working is questionable, due to improper design, choking and other maintenance operations. So there is need of time to detail study about the working of filtering material and arrangement and design of recharge facility.
PURPOSE OF CONSULTANCY

The main objective of consultancy is design of filter for effective groundwater recharge. The designed filter will be easy to install and repair, with minimum clogging.

KEY OUTPUTS/DELIVERABLES

1. Design of filter material for groundwater recharge options.
2. Development of physical model for designed filter
3. Testing and estimation of porosity, transitivity, and hydraulic conductivity of filter media (different material used as filter layers)
4. Testing and estimation of filter performance using mathematical or numerical approach
5. Testing filter design for different hydraulic or flow conditions
6. Testing of optimal filter media design for recharging marginal water quality