Chemical quality of groundwater of Rawalpindi/Islamabad

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**Chemical quality of groundwater of Rawalpindi/Islamabad**

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**Methodology**

Representative Ninety (90) wells, both open and tube wells, were selected for collecting water samples. These well are spread through out the project area. One of the main selection criteria was that the well should be in use. This ensure collection of water sample from non-stagnant water, as stagnant water may change its chemical composition over the time. Sampling density was kept greater, where water chemical composition is expected to vary rapidly. The area of high sampling density corresponds to:

- area with non-uniform geologic formation
- vicinity of untreated waste discharge area e.g., section of Nallah Lej located downstream of Waste water treatment plant.

This section of Nallah Lej is running through the cantonment area (marked as central area on figures 1 to 6) of Rawalpindi city, which is expected to have contaminated groundwater due to anthropogenic activities.

Water samples were collected in two liter plastic bottles. All the sample were preserved and stored at 20°C before chemical analysis are carried out. Parameters such as Electrical conductivity(EC), pH value, Temperature, and Oxygen content of the samples were determined directly in the field. Rest of the parameters like Calcium, Magnesium, Sodium, Potassium, Sulfate, Nitrate, Chloride, Bicarbonate ions were determine in Laboratory. All parameters were determined using procedures as given in 19th edition of “Standard Methods”.

**Results and discussion**

The water table of the study area is on the average 7 to 15m deep. Wells located on the bank of Nallah Lej shows water table 7-10 m deep, indicating that Nallah Lej serves as a discharge area for ground water. T he lowest depth of water table near Nallah Lej has led construction of most of the well near vicinity of the area. There is a general groundwater flow towards the center of the basin from Margalla and Murree Hills. The ground water discharges its contents in Kurrange river. The dominate aquifer system of the area is built up by a very hetergeneous alluvial fill of alternating layers of clay, silt, sand and gravel which reaches a thickness of more than 200 m in the central part of the plain. Only near the mountain, which is surrounded the basin, carbonatic rocks are present.

Figures 1 to 6 show spatial variation of selected parameter namely, Electrical conductivity, Nitrate, Chloride, Sulphate, Hardness, and Sodium. All these parameter shows increasing trend as water moves from adjoining recharge areas of Margalla and Murree Hills towards center of Basin, which acts as discharge area for ground water. The electrical conductivity(EC-value) showing degradeof water mineralization, are increasing from less than 400 m S/cm nearby the mountains to a maximum of 1200 m S/cm in the center of the basin. Values of other parameters also shows the similar trend with maximum values at the center of basin. High values of Nitrate and chloride at center of basin is alarming, showing intrusion of water from Nallah Lej.
Figure 7. Presentation of water samples 1 to 90 on the piper diagram
lei into the ground water through diffusion and advection processes. Absence of Sulfatic-chloridic rocks any wherein project area reinforce the hypothesis that waste content of Nallah Lei is responsible for high values of Nitrate, Chloride, and Sulphate values.

Figure 7 shows chemical classification of ground water after PIPER diagram. The chemical classification shows that groundwater is coming from same aquifer. The groundwater of the project area is normal alkali earth freshwater with medium contents of alkalis with prevailing Hydrogencarbonatic origin.

**Recommendation**

From the hydrochemical point of view the quality of groundwater in project area, except in central area, is good and fit for human consumption and other uses. The ground water in the central part of Rawalpindi i.e. cantonment area containing high amounts of Nitrate, chloride, and Sulfates and should not be used as drinking water as it is done nowadays. Right away, ground water source shall be abandoned for drinking purpose and alternate source i.e., surface water source shall be developed. Abatement measure against anthropogenic chemical pollution of groundwater shall be adopted as long term measures and include:

- Stop discharging of untreated sewage in Nallah lei.
- Lining of Nallah lei with suitable material.
- Construction of Sewage treatment plant, for the sewage which is presently being thrown untreated in Nallah lei.
- Treatment of Groundwater before human consumption.

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