

Hydrochemical and geophysical appraisal for effects of Gadoon Amazai Industrial Estate on water resources, Swabi District, Pakistan

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ABSTRACT

Pakistan is facing the serious threat of reduced availability of clean drinking water due to its growing population, industrialization and urbanization. National water demand is stressing subsurface aquifers. The present study integrated hydrochemical and geophysical tools to identify contamination associated with industrial effluents from Gadoon Amazai Industrial Estate into local water resources. Seventy water samples were taken from surface and subsurface water resources, and forty Vertical Electrical Soundings were acquired using Schlumberger electrode configuration. The results of hydrochemical tests revealed values for Ca^{2+} , K^{1+} , Mg^{2+} , Na^{1+} remained within WHO limits. As^{3+} (31%), Cd^{2+} (58%), Fe^{2+} (57%), Pb^{2+} (41%), Hg^{2+} (95%) and Zn^{2+} (2.8%) were exceeding the WHO permissible limits. pH indicated the nature an acidic nature for both surface and groundwater. 84.29% samples have values less than 7.7. Electrical conductivity, turbidity and total dissolved solids also exceed the permissible limits. Statistics of microbial analysis revealed that 61% of the samples of groundwater contain coliform. VES points correlated with boreholes revealed four discrete subsurface layers namely intermixed clay with gravels, massive clay, boulders and dry boulders. Aquifer thickness map at depth of 30m shows that the unconfined aquifer is thick in the northwest and southeast. These maps further reveal that in the north eastern part of the study area there is a thick layer of clay, while in the west there is a clay starved zone, having gravels and boulders near the surface, which may cause infiltration of industrial contaminants into groundwater. Results of the hydrochemical analysis and vertical electrical soundings reveal that the unconfined aquifer as well as surface water is contaminated and hazardous for drinking and agricultural uses. The present study will be important for the local community and government as it highlights the surface as well as surface contamination in the vicinity of Gadoon Amazai Industrial Estate.

Keywords: Coliforms; Gadoon Amazai Industrial Estate; Heavy metals; Industrial effluents; Unconfined aquifers; Vertical electrical sounding

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