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Causes of Groundwater Rise at Al-Qurain Residential Area, Kuwait

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Abstract

Residential areas of Kuwait have been affected by rising groundwater levels for many years. The main reason for this problem is the increased recharge derived from the excessive irrigation of gardens and parks, and leaks from sewage networks, where the hydraulic characteristics of the lithology play an important role in intensifying the impacts of this phenomenon at local scale. The objective of this paper is to assess the hydrological conditions of Al-Qurain residential area to identify the extent and the causes of the water rise problem.

A total of 25 wells of various depths were drilled, constructed and sampled at the study area. Water level loggers installed in the drilled wells indicated that water levels are fluctuating on daily bases and increasing up to 50 cm during winter months due to the reduction of evapotranspiration and recharge from rainfall.

Combining the water level records and the results of the isotopic, chemical and biological analysis, it was concluded that the top 20 m of the aquifer water is made up of mostly irrigation, waste and rain water in addition to the aquifer groundwater. It was also observed that the intruding water from lower Dammam aquifer is dominating the aquifer beneath 40 m depth. This conclusion along with the steep topography of the area explained why this area is naturally prone to water rise.

The study recommended the utilization of integrated system of dewatering wells along with desalination units to lower the water level and re-utilize the groundwater. On the prevention side, it is recommended to conduct an awareness campaign that educate the residents of the impacts of over use of water on their own properties.

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Keywords: wells; hydrological; levels; dewatering

1. Introduction

Residential areas of Kuwait City, being a costal megacity within an arid region, have been affected by rising groundwater levels and the environmental problems that are typically associated with it for many years. The impacts of such a water rise are typically numerous and severe including flooding of basements and foundations, corrosion of network pipes, deterioration of underground installations, deterioration of groundwater quality, surface water logging and other effects which are objectionable on environmental and health grounds [1-5].

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The study area (Al-Qurain, Al-Adan, Al-Qusour and Mubarak Al-Kabeer) is one of the significantly impacted urban areas of Kuwait. However, the problem is compounded even further in the case of the study area by the presence of an old landfill, which has the potential of contaminating the rising water.

The Al-Qurain area (Fig. 1) is one of the largest recently (1988) developed urbanized suburbs in Kuwait with a population of more than 100,000. Different types of private houses and governmental buildings are present in this area, with attendant support facilities. These support facilities include water supply and sewer system networks, landscaping projects and public gardens. A large number of private gardens of different sizes also abound in the area.

An old and abandoned landfill is located within the perimeter of the area. The Environment Public Authority (EPA) monitors the landfill site with the aim of protecting the inhabitants of the area from the adverse effects of any environmental deterioration, and of rehabilitating the site.

Residents in certain localities of this suburb have recently experienced the problem of subsurface water rise that has threatened the foundations and basements of their houses. The objective of this paper is to assess the hydrological conditions of Al-Qurain residential area to identify the extent and the causes of the water rise problem.

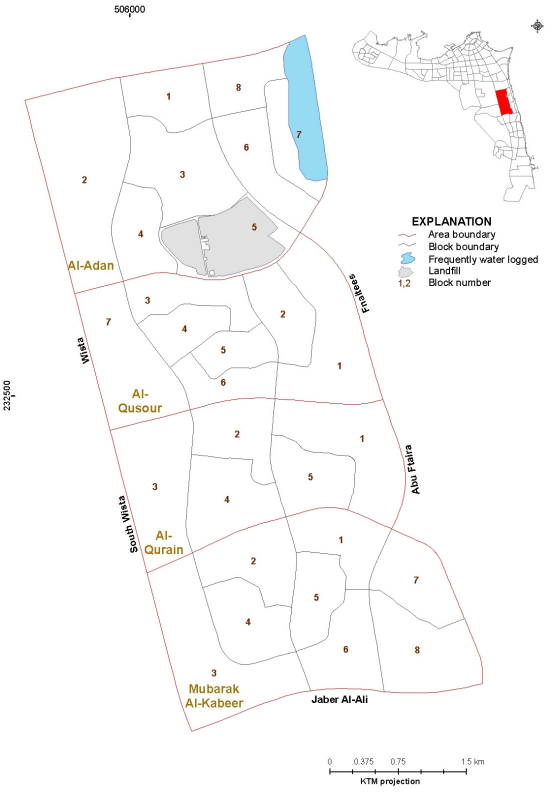

Fig. 1. Study Area.

2. Methodology

To achieve its objectives, this study adopted the following approach. The localities affected by the water rise within the study area were identified based on the available data as well as field surveys. A total of 25 monitoring wells and one production well have been drilled. For the purpose of characterizing and monitoring the uppermost portion of the groundwater, 19 wells were distributed over the study area to provide spatial