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Zagazig University
Banha Branch,
Faculty of Science

HYDROGEOPHYSICAL STUDY ON THE GROUNDWATER OCCURRENCE IN THE MIDDLE PART OF EL-QAA PLAIN, WEST SINAI, EGYPT.

A THESIS

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ABSTRACT

The middle part of the area of Sahal El-Qaa (El-Qaa Plain) is one of the few promising areas in Sinai Peninsula looked after for the possible integrated development, based mainly on local groundwater resources.

A geoelectrical study has been carried out through 39 Vertical Electrical Soundings with the purpose of recognizing the geometry and characteristics of the Quaternary aquifer within the subsurface rock succession of the area.

Through the qualitative and quantitative interpretation of the sounding curves it was revealed that the aquifer extends in the whole area at a depth of 3-65m below the ground surface. The aquifer was found to consist of two parts. The upper part consists of sand and gravel saturated with fresh water with a thickness of 30-86 m. This part is characterized with a resistivity range of 2-82 Ohm.m. The lower part consists of sand and gravel with clay intercalation having a resistivity of 1-23 Ohm.m which refers to water of less quality than that of the upper part. The lower part is much thicker than the upper part and extends dawnword beyond the maximum depth of investigation reached during the geoelectrical survey. However, within that depth the explored thickness of the lower part is not less than 50 m. The interpretation also indicated that the water-bearing formation is overlain to the surface by a dry sedimentry succession of a much higher resistivity and variable thickness.

The interpretation of the geoelectrical data was made possible through the application of the rather recent computer programs of Velpen (1988) and Zohdy (1989), correlation with wells of known lithologic logs present in the area and the study of all the available geophysical and hydrogeological information about the study area.

Through the sets of isoresistivity contour maps, isopach maps and geoelectrical cross sections it was possible to define the parts of the aquifer having optimum depth-to-top, thickness and water quality and consequently the best sites for the future drilling of water wells.

The Transverse Unit Resistance and the Average Transverse Resistivity (two measured geoelectrical parameters at the earth's surface) were found to be directly proportional to the aquifer Transmissivity and Hydraulic Conductivity respectively (two of the aquifer hydraulic parameters measured only through pumped wells). This makes it possible judging on the relative values of aquifer parameters in the different parts of the area from geoelectrical measurements before the drilling of the water wells.

To complete our knowledge about the aquifer characteristic, chemical analyses were applied to 24 water samples representing 24 water wells tapping the Quaternary aquifer in the study area. The analyses included the determination of the total dissolved solids, concentrations of major ions, cations and anions, the hydrochemical formula, hydrochemical parameters, hypothetical salt combinations, water types and water genesis. The salinity of the aquifer was found to vary from about 370 to about 4230 ppm. The distribution of the water salinity across the area was found to be in agreement with the distribution of the water quality as classified according to the electrical resistivity values. The distribution of the concentrations of the different chemical elements as well as the total hardness are displayed in the form of contour maps.

According to the results of the chemical analysis it was found that all the analyzed water samples in the study area are chemically suitable for drinking according to the relevant international standards with the exception of few samples where either the TDS exceed 1000 ppm. or the chloride content is relatively high. Most of the analyzed water samples

was found to be suitable for either irrigation purposes or drinking of livestock and poultry.

The geoelectrical study, so applied to the middle part of El-Qaa Plain, beside the complementary hydrological and hydrogeochemical works yielded a more detailed and satisfactory picture about the characteristics of the Quaternary aquifer in the area than what was known before.

Specific recommendations were possible to be reached regarding the optimum sites for drilling new water wells in view of the concluded convenient depth, thickness and water quality in the different parts of the study area as well as the optimum pumping rates in view of the aquifer characteristics.

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