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**Subsurface Geophysical Characteristics of Wadi Malakan –  
Southern Makkah Almokarramah city**

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## **ABSTRACT**

Wadi Malakan area has been studied using an integrated approach for estimating the ground water potentialities. Using satellite imagery, the direction of water flow, drainage system and the most appropriate locations for the presence of water has been identified in the region. Land- and aeromagnetic maps showed that the subsurface structures include faults and dykes. These structures take different directions; the northeast, northwest as well as north-south and east-west which indicates that the area occurred under the influence of different tectonic movements. The calculated depths using Fast Fourier transform (FFT1D) reveals that, the average depth for deep sources ranges between 27.5 to 58 meters while for shallow sources ranges between 4 to 14.5 meters. 2D modeling was also carried out for the magnetic data to clarify the subsurface structures and the depth of basement rocks. Thirty of Vertical Electrical Soundings (VES) and eight of geoelectrical cross-sections have been carried out and showed that, the area has four geoelectrical layers; the first layer consists of rock fragments, sand and clay; second layer is of dry rocks, the third is sandy alluvial layer (water-bearing layer), while the fourth one represents the basement rock and is very dry and non-permeable.

According to the results of analysis for water samples, it has been reached that value of electrical conductivity is moderate in the eastern part and increases to the west also the salinity of water increases to the west. Well no.13/7 (to the west of the study area) shows abnormal values with respect to other wells for the main components especially chloride, sodium, sulphate and calcium. This indicates that the main elements are much higher than the allowable standards for drinking water globally and the water quality becomes less tends to the west due to the concentration of dissolved salts in the groundwater. Finally, it can be concluded that, the groundwater of wadi Malakan exceeds the permissible limits for drinking while it could be used to irrigate crops some crops which can bear moderate salinity with extreme caution when dealing with the well no. 13/7 with relatively high salinity. The better locations for drilling are at vertical electrical soundings (VES) No. 1, 2, 3, 4, 5, 6, 7, 14, 15, 25, 22, and 20.