SUMMARY& CONCLUSIONS AND RECOMMENDATIONS

The present study was erected in order to evaluate groundwater resources in West Delta area and managing groundwater quantityfly and qualityfly as well as to delineate the hydrological problems of reclaimed projects, such as water logging, water depletion, and groundwater salinity and groundwater pollution.

Topographically, the area is considered a low to flat land and the ground elevation not exceeds 50 m above sea level. In the north the ground surface is below sea level at abu EL Matamir and Hush Isa. The geomorphologic units can be grouped according to their regional trends into:

The young fluviatile plain, the old fluviatile plain, the structural plain and the Mediterranean fore shore plain.

The sedimentary column from bottom to top starts by Oligocene sediments. These sediments are of limited distribution in the study area where Miocene, Pliocene, and Pleistocene Formations and Holocene geologic units follow this up.

The well-developed section of Pleistocene deposits is 1000 m thickness. Gabel El Basur is a young Pleistocene terrace covered by sands and gravels. It is the floor plain of the Nile Delta during the earliest Pleistocene. Hence during the Pleistocene-Holocene period, different erosional processes produce different types of deposits. Alluvial deposits derived from Miocene rocks, alluvial deposits derived from Pliocene rocks, Sand dunes, and Deltaic deposits, and Marshes and Sabkhas, and Lakes and water ponds.

The resistivity field survey comprises measuring of the resistivity values through 35 Vertical Electrical Sounding (VESes) covering almost the whole area of study. The well known Schlumberger configuration with electrode spacing from AB/2 = 1 to AB/2 = 200 m. in successive steps is selected and applied in this work and the sounding curves of measurements belong mainly to HK, Q types.

The interpretation of these VESes was done using several softwares for modeling seven geoelectric cross-sections were constructed and they correlated with wells which located along it. Five of them take east west direction and other two take north south direction.

The geoelectrical interpretation indicates that, the area can be divided into four main geoelectric layers as follows:-

1- The first geoelectric layer

This layer is characterized by high resistivity values with respect to other geoelectric layers where it ranges between 28 Ohm.m to 100 Ohm.m. Its thickness varies from 1 meter to 6 meters in the area where it represents the surface layer, which composed of silt and dry sand (heterogeneous layer).

2- The second geoelectric layer

It represents the clay cap layer which characterized by low resistivity values ranged from 6 Ohm.m to 17 Ohm.m. The thickness varies between 3 meters to 6 meters. It composed of clay or silt and varies to sandy clay or silt in some localities in the area. This layer has a great role in waterlogging problem in the area of study as it prevents water infiltration from surface water drainage and leakage to the aquifer.

3- The third geoelectric layer

This geoelectric layer represents the water saturated zone (aquifer). It is characterized by middle resistivity values ranging from 11 Ohm.m to 39 Ohm.m.The thickness varies between 14 meters to 58 meters and increases in the east and south-east in the area. It composed mainly of sand and in some localities of clayey or silty sand where the main aquifer in the area of study (unconsolidated water saturated aquifer). It consideres the water-bearing zone in the study area where the most of drilled production wells extract from this zone.

4- The fourth geoelectric layer

This layer is characterized by low resistivity values ranges from 3 to 8 Ohm.m. It represents the base of main aquifer in the area. It acts as secondery target for drilling wells (it represents seconday aquifer). It composes mostly of sandy clay or sandy silt with quality of water mostly less than overlain zone (main aquifer).

Generally, the study area is characterized by the presence of two water-bearing formations; as the follows:

1- primary aquifer

It is largely distributed in the area forming the main water bearing formation of the study area. It is represented by the third geoelectric layer.

2- secondary aquifer

It distributed in all the area too but it is great less of water quality than the primary aquifer. It is represented by the fourth geoelectric layer

Irrigation depends mainly on the surface water diverted from Nile water through main canals and their secondary channels. The surface water system includes El Rayah El Beheri, El Rayah El Naseri, and El Nubariya canal, and El Nasr canal. The groundwater aquifers can be classified into: Nile Delta aquifer (Quaternary aquifer), which can be divided into Recent aquifer and Pleistocene aquifer, Pliocene aquifer and Miocene aquifer.

The Pleistocene aquifer is the main water bearing formation. It is a highly productive aquifer. This aquifer is made up of successive layers of sand and silty sand or clayey sand with occurrence of clay lenses of fluviatile origin where the thickness of Pleistocene-Holocene deposits ranges between 80 m near Cairo-Alexandria desert road and 300 m near Kom Hamada and between 60 m to 80 m in the area of study. The depth of water varies from a few meters close to the Delta to about 30 meters near Wadi El Natrun.

Twelve collected samples were analyzed in the area of study; they represent the Nile Delta Aquifer. Salinity varies between 600 ppm in the southern east and east and 3900 ppm in the south and of brackish type. The hydrogen ion concentration (pH) of water ranges from 7.07 to 8.10. it obvious that the groundwater is of alkaline type. Electrical conductivity (EC) distribution in the area shows that the minimum value is 0.95 ms\cm in sample of well W12 and the maximum (EC) is 5.98 ms\cm in sample of well W10 as well as well W4.

The groundwater in the area is mainly of Nacl- type in the most of the area however a board zone of Na mix water is present due to maxing of groundwater with infiltrated fresh water from the main irrigation canals and excess irrigation water. In the east and south-east of the area the water type becomes $NaSO_4$ -type which refers to dissolution of gypsum in addition to usage of fertilizers in some areas due to alkaline nature of soil there.

Groundwater evaluation for domestic and irrigation use was studied according to the hydrochmeical properties of water samples. From these analysis we can deduce that:

1. The groundwater in the area is of brackish type. It not suitable for drinking purpose where the TDS more than 1000 ppm.
2. The concentrations of Chloride, sulfate, Sodium and Potassium are over the limit of standard groundwater for drinking purpose related to European Economic Community (EEC 1975).
3. The concentrations of Magnesium, Nitrate and Calcium are in allowable limit as related to European Economic Community (EEC 1975).

The suitability of water for irrigation has been classified into five classes according to U.S. Salinity Laboratory Staff, 1954 diagram; depend on the Sodium absorption ratio and EC in the samples of water, which are

1. C3-S1 **2.** C4-S1 **3.** C4-S2 **4.** C4-S3 **5.** C4-S4

Most of samples are plotted in fifth class type which is characterized by very high salinity and Sodium hazard.

Recommendations

1) The groundwater quality in Nubariya area was improved in the last decade, this is due to installation of the drainage system. Increasing the efficiency of this system will assist in the continuity of improving groundwater quality and overcoming

waterlogging problems. Therefore, maintenance of the drainage system is a vital goal.

2) **The aquifer should be managed to make balance between discharge and recharge to reduce the problem of increasing salinity that have been observed in most wells.**
3) **The future development in the area should carry in east and south-east of the area.**
4) **Decrease the usage of the agricultural fertilization to decrease the salinity.**
5) **Reduce the extensive irrigation in reclaimed lands.**
6) **Using highly absorption salt crops to reduce salinity of the soil.**
7) **Usage of drainage pattern that penetrate impervious layer (clay) in the waterlogging areas.**
8) **Periodical and continues recording for chemical analysis and aquifer water level to observe any changes in future.**