THE USE OF GEOPHYSICS APPLICATIONS IN GROUNDWATER EVALUATION

A Thesis Submitted to the Faculty of Engineering
Ain Shames University for the Fulfillment
of the Requirement of M.Sc. Degree
In Civil Engineering

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Date: 19/10/2019

Dedication

This thesis is dedicated to those who contributed to educating, raising and supporting me to be able to accomplish in this picture.

A special dedication to

MY SUPPORTIVE PARENTS

And to

My wonderful Sisters

STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering.

The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University, from October 2015 to October 2019.

No part of the thesis has been submitted for a degree or a qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others

Date: - ---/-- /2019
Signature: - ----------
Name: - MOHAMED AHMED BAHAA AL DIN AL ASHMAWY

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ABSTRACT

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Abstract:-

It is important for any civil engineer to take the advantage to work on studies that can add to him/her more dimensions to his/her experience specially the environmental studies because it is a multidisciplinary science.

The objectives of the study fulfilled their aims and gave a good knowledge as a civil engineer for some important methods related to the environmental engineer`s duty.

The study was targeting using geophysical field data in evaluating the groundwater and the aquifer of Wadi El Rayan study area from an environmental perspective and doing some petro-physical studies using some important methods and theories that helped the study to accomplish this assessment.

After collecting the all available geophysical field data for Wadi El Rayan study area during the life time of the study(final processed reflected seismic data and well logs), a verification step started directly to check the validity of these data before doing any further step, the verification step required to convert the well log information from depth to time using the check shot that acquired in the field to be able to load the well logs on the stacked seismic lines in time domain to check if the formation tops of the of the well was matched with the processed seismic data or not, this step was done correctly and the results of the verification step was excellent.

The next step was calculating the total porosity and the water saturation of WR 2X well using the given information while drilling the well to know the probability of the existed groundwater in Apollonia formation`s aquifer and also to know the groundwater salinity when the well logging done by the end of year 1996.

By loading, the two new calculated logs (the total porosity and the water saturation) on the two stacked seismic lines attached to the coordinates of WR 2X well, it was concluded that the Apollonia Formation in Wadi El Rayan area is suitable for storing groundwater in it and also suitable for water/reated water injection process using the available dry wells in the study area that owned by Qarun company.

SUPERVISORS

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Associate Prof. Dr. Mohamed Sobhy Abdel Rahman,
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KEY WORDS

Groundwater, Environment, Geophysics, Geology, Applied-geophysics, Hydrogeology, Reflected seismic waves, well logging, Petrophysics, Aquifers.

Contents

CHAPTER I
INTRODUCTION

1.1 BACKGROUND

Water means life and life means water and, nowadays many studies refer to a global problem that will be happened in the future concerning the water due to the global increase of the world's population in the next decades more than the previous decades and the rate of increase of the global worming issues.

The Earth's crust is extremely dynamic in both technical (physical properties) and nontechnical (political, social and legal) terms.

Global environmental degradation, including climate change, has reached a critical level with major ecosystems approaching thresholds that could trigger their massive collapse.

This environmental issue let many countries prioritize this issue on the top of the national security issues.

Due to the increase of the rate of the climate change, the hydrological cycle on our planet earth changed directly and indirectly, which affect the runoff, the aquifer recharged, and the water quality.

"It took 200,000 years for our human population to reach 1 billion and only 200 years to reach 7 billion" by the American Museum of Natural History.

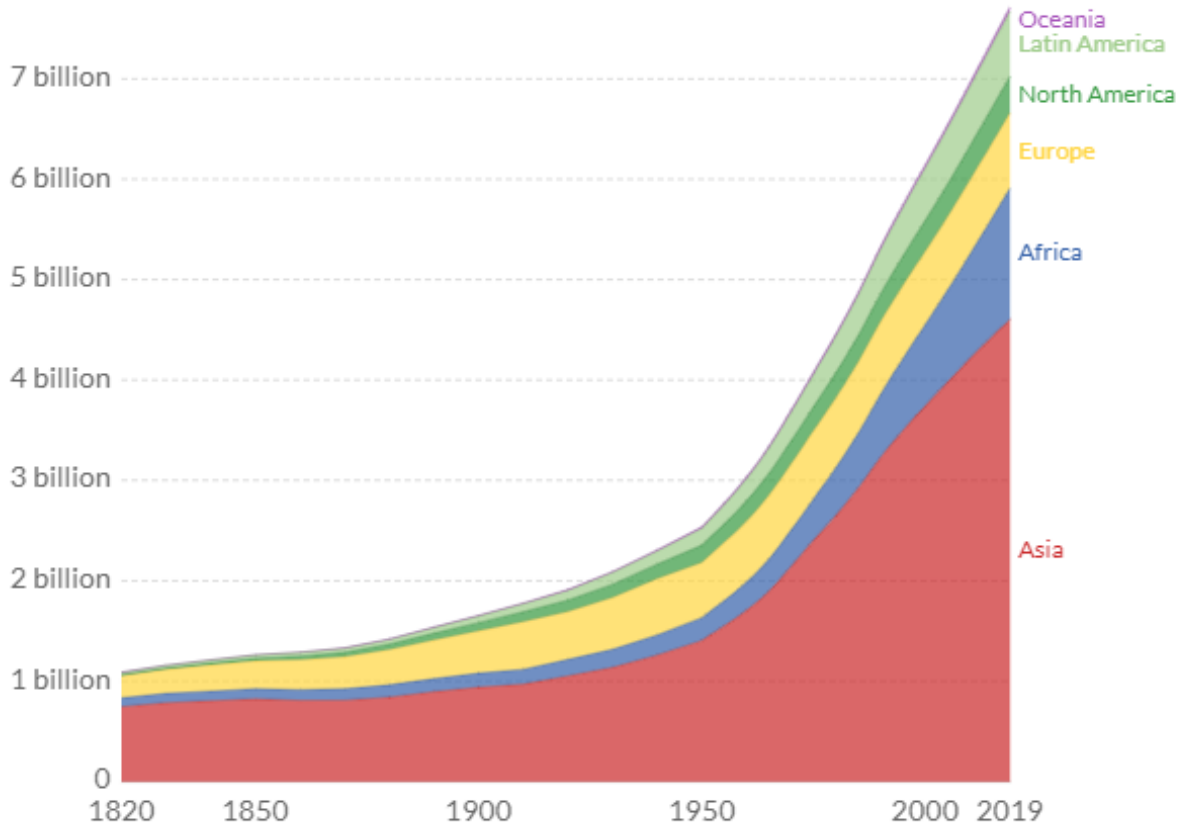

Figure 1/ 1 Population by country, available from 1800 to 2019 [1]

The earth's surface is covered by water approximately 75% of the earth`s surface, 97% of the earth`s water is saline seawater, 3% of the earth`s water is freshwater, 68.7% of the freshwater on earth is licked up glaciers, ice caps and snow cover in the polar regions, 30.1% of the freshwater on earth is groundwater while 0.3% of the freshwater on earth contained in rivers and lakes [2].

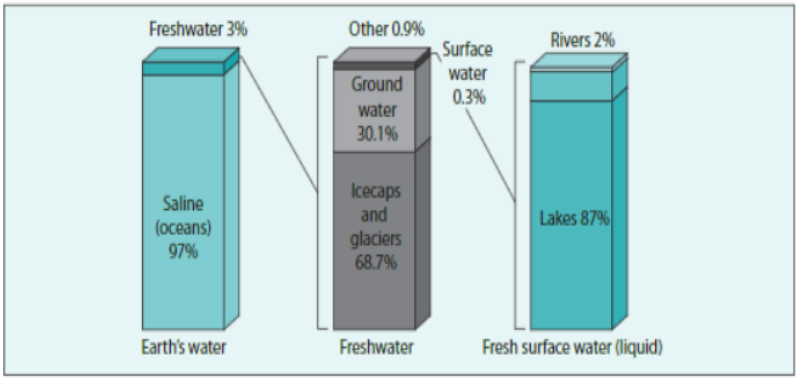

Figure 1/ 2 Water resources on Earth [2]

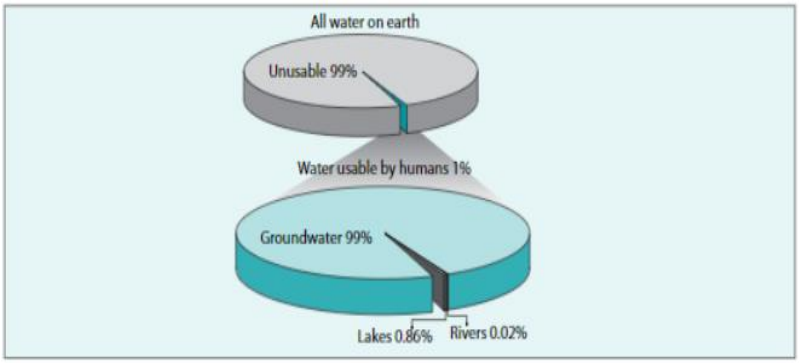

Figure 1/ 3 Groundwater resources on Earth [2]

As shown in the next figure 1/4 the total renewable water resources per capita showing the countries that are facing and will facing high water demand risks in the future.

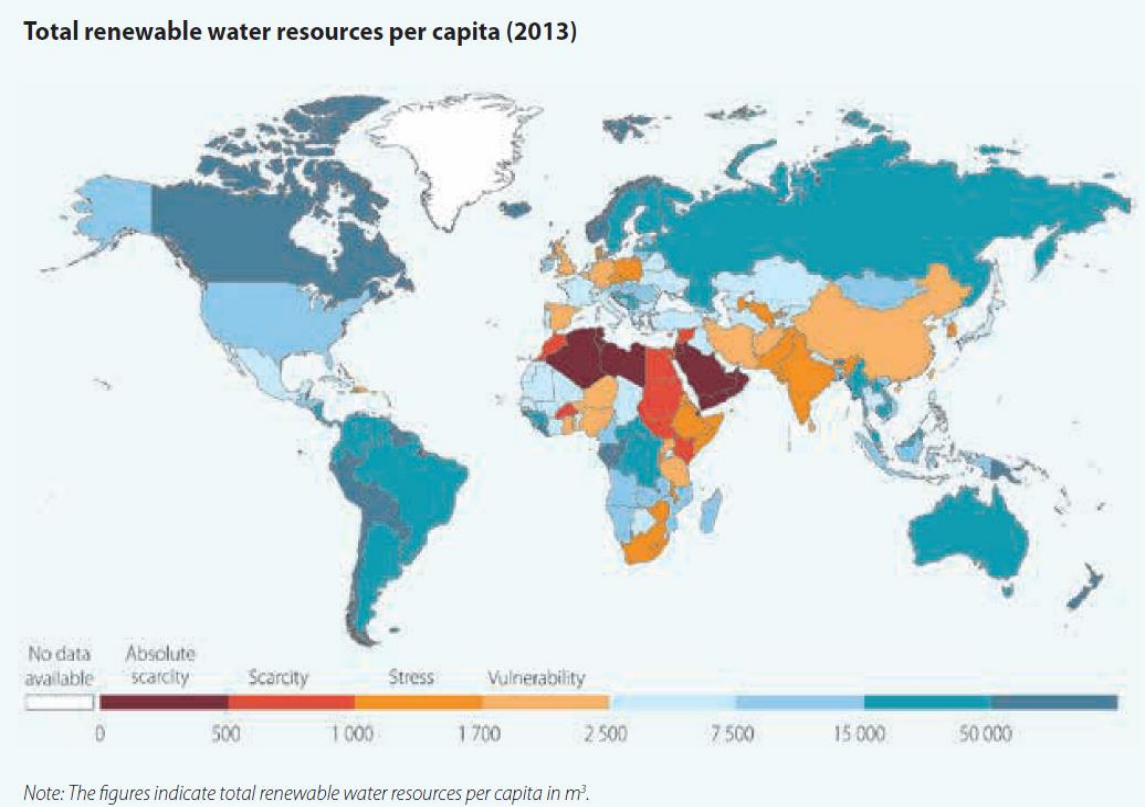

Figure 1/ 4 Total renewable water resources per capita [3]

This is a result of past failures to design decision-making mechanisms that would appropriately govern the global and national commons and the earth's shared natural resources. Despite efforts to create cooperation around environmental treaties and agreements, decisions directly affecting environmental issues are often taken outside of environmental policy circles. Any predominance of economic logic without the integration of social and environmental considerations, as it currently exists in many development approaches, means that long-term environmental objectives may be set aside in favor of short-term economic [3].

Groundwater: is the water and its wastes at the surface that stored underground and seep into it. groundwater will be one of the most important resources of securing the future of the next generations and because the water is one of the most important resources of the national security of any country then exploring and evaluating the groundwater with the modern techniques must take place more than before.

Evaluating the groundwater using one geophysical method can help but evaluating the groundwater using integrated geophysical methods could help more, in this study the groundwater will be evaluated using more than one method discussed in chapter 3.

Putting in consideration the environmental aspect in evaluating the groundwater of any area is also very important because water is a very important factor in any ecological system and if the next generation will use the groundwater as a main resource of water in some places then we have to make sure that the groundwater that will be used is clean as much as we can and also helping them by making more studies and researches they may be used as a reference in different locations to minimize their efforts and their time.