IMPACT OF DRAINAGE WATER REUSE ON SOIL AND GROUNDWATER QUALITY IN RECLAMATION AREAS- GIZA GOVERNORATE.

By

Samy Said Zaher

B.Sc. Geology, (1986). Diploma in Environmental Studies, 2001

A Thesis Submitted in Partial Fulfillment

of

The Requirement for the Master Degree

in

Environmental Science

Department of Environmental Basic Sciences

Institute of Environmental Studies and Research

Ain Shams University

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APPROVAL SHEET

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ABSTRACT

El-Saff canal is one of the projects that depend on the reuse of the treated industrial waste water for irrigation to maximize the use of water resources to irrigate the newly reclaimed lands. The treated industrial wastewater of El-Saff canal is blended with Nile water through El Hager canal and Masged Mousa canal by pipe, at 25.00 km and 45.00 km respectively. The main groundwater aquifer in the study area is built of Pleistocene graded sands and gravels interbeded with clay lenses. The groundwater in this aquifer is in hydraulic connection with surface water. The aquifer is recharged by the downward infiltration of the surface water courses that takes place directly from the main irrigation canals and indirectly through the infiltration of the return flow after irrigation.

The main objective of the present work is study the impacts of the reuse of the treated industrial waste water released from Helwan and El-Tebbin industries on the quality of irrigation water and on soil characteristics, evaluate the possibility of using both surface water and groundwater as a potential water supply for irrigation and domestic uses, in addition to determine soil texture of the study area.

The analysis for surface water indicates that the salinity of El-Saff canal varies from 738 ppm to 1351 ppm and generally decreases southward towards downstream reaches due to mixing with Nile water coming from El-Hager canal and Masged Mousa canal. The salinity of the groundwater is generally decreased westward, towards the River Nile, due to recharge from the canals and irrigation water in the old land. While the salinity increase northeastward, due to Eocene and Pliocene aquifers. The hydrochemical representation of the groundwater, based on Sulin's diagram reveals meteoric and marine water origin. The leaching of the rock constituents, the topographic position and the downward

percolation of the excess irrigation water from the cultivated land constitute the main elements affecting the hydrochemical compositions of the groundwater.

The EC values of soil samples range between 1.38 and 7.30 mmhos/cm. It appeared that the salinity increases gradually towards the south, then a drop in EC occurred afterwards at km: 28. Therefore the studied soils are mostly salt affected due to continuous irrigation with El-Saff canal before mixing with Nile water, especially in the middle and south parts and the use of this water in irrigation means addition of salts to soil layer annually and may cause a salt crust which causes a serious problem for plant.

El-Saff canal wastewater is polluted by Fe^{2+}, Mn^{2+}, and Pb^{2+} therefore the water of the canal is considered as bad water and unsuitable for drinking, while the canal are highly saline and suitable for irrigation for good permeable soils and with plants of high salt tolerant.

The heavy metals analysis of groundwater are in the permissible limits and the groundwater is considered suitable for domestic uses and also for irrigation purposes, after treated by filtration, aeration and sedimentation or by electro dialysis operation.

Generally the trace elements analysis in El-Saff canal did not contaminate the groundwater wells due to adsorption, cation exchange and deposition of trace element during groundwater transfer through the aquifer where carbonate and clayey sediments make as a filter for trace element and other cations in groundwater.

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CHAPTER I
INTRODUCTION

1.1. General outlines

Water is necessary for all forms of life and is the most abundant liquid on the earth. It is considered the most essential element in agricultural development. Many developing countries facing the problem of an over increasing of population and more pressure on the agricultural resources. Therefore, the extension of agriculture in Egypt must be carried out vertically as well as horizontally. It becomes necessary to cultivate marginal soils and to reclaim less fertile lands. The major limiting factor for high agricultural production in arid and semi-arid countries is the availability of water. Water resources are very important in country like Egypt. Such resources are necessary for the reclamation of desert land to overcome the problems of over population and production deficiency of the main crops.

Over 85% of Egypt's water resources are utilized for agriculture. Due to the limited supply of the available fresh water, great efforts have been forced to seek water resources other than the Nile water and groundwater. One of these resources is the El-Saff canal project, which use the treated industrial waste and sewage water coming from waste water treatment station in south Helwan. There is doubtful from reuse the disposal of industrial waste water because their negative impact on subsurface water, soils and crop productivity.

El-Saff canal receives water from three sources; Treated industrial waste water released from south Helwan station with discharge of about 550.000m^3 /day at the inlet of the canal, and from El- Hager and Masged Mousa canals through pipe line by water pump station. El-Hager and Masged

Mousa canals receive their water directly from the River Nile. Consequently, the treated industrial effluent and sewage water of El-Saff canal is mixed with Nile water at 25km from El-Hager and 45.5km from Masged Mousa canals and directed from north to south direction (Fig.1).

Groundwater is mainly used for irrigation in the area east of El- Saff canal and used as a supplemented source for domestic purpose like El-Saff, El-Aquas and El-Weddy drinking water plants, in the western part of the study area, adjacent to the River Nile.

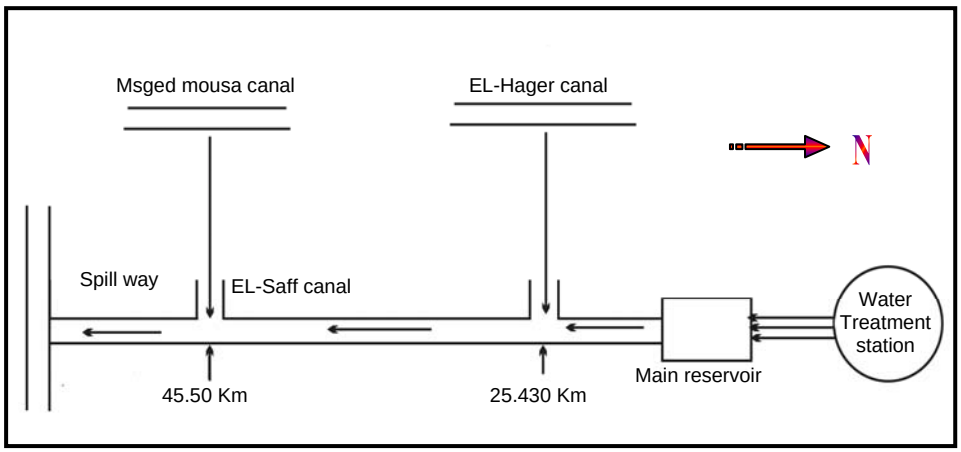

Fig. (1) Sketch diagram showing the resources and reservoirs of El-Saff canal

1.2. Location of the studied area

The area under investigation lies to south Cairo till El Kuriemat and belongs to Giza Governorate and bounded by longitudes 31° 15′ and 31° 30′ E and latitudes 29° 25′ and 29° 50′N. (Fig.2). El-Saff canal crosses the area of study, it has a length about 52 Km, extending from Ghammaza El.Kobra, south of the treatment Helwan station in the north

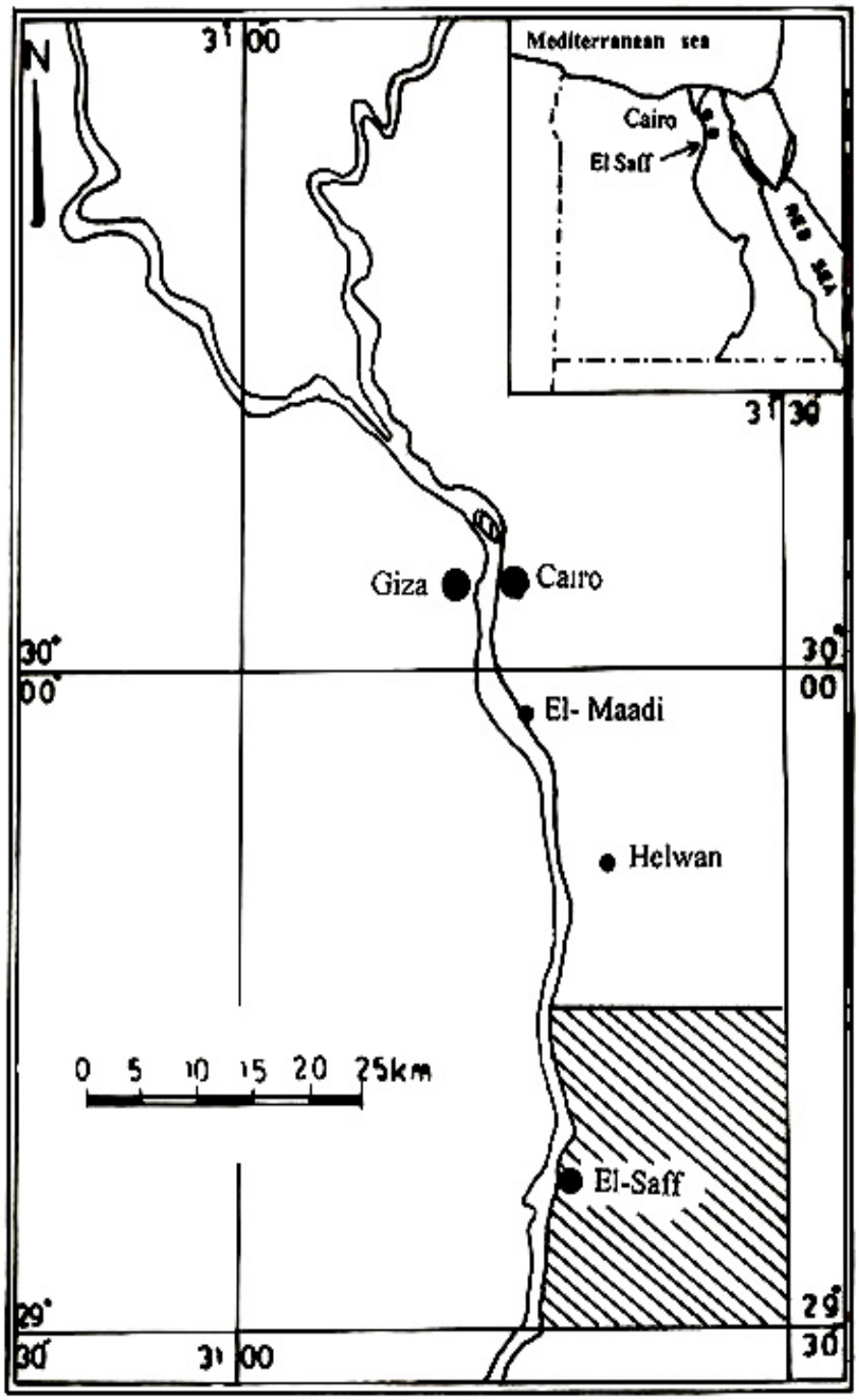

Fig. (2) Location map of El-Saff Area

to Atfeeh in the south. The canal is bounded by reclaimed area to the east and River Nile to the west. The average levels of the ground surface attains 77m (MSL) at the inlet, while attains 55m (MSL) at the outlet of the canal.

1.3. Objectives of the present work

The present work aims to:

1- Study the impacts of the re-use of the treated industrial waste water on the quality of irrigation water and on the physicochemical characteristics of reclaimed cultivated lands.

2- Construction of hydrogeological cross sections in the study area.

3- Determine soil texture of the study area.

4- Evaluate the possibility of using both surface water and groundwater as a potential water supply for irrigation and domestic uses.