

## ABSTRACT

Groundwater in Sudan is the main water supply source for drinking water and domestic use for more than 80% of the human population and is found under about 50% of the country's area.

Khartoum state the capital of Sudan is not covered with sewerage system except for a small area at Khartoum centre and industrial areas in Khartoum North covering only 25% of the area. The main sewage treatment system in the other areas of the state is septic tanks and disposal wells.

This study seeks to estimate the extent of ground water contamination due to septic tanks in Khartoum city, it presents a case study in which a contaminant transport model, (MT3D) is used to so predict the level of contamination of groundwater due to septic tank effluent (Ammonia was considered to be the major output contaminant from septic tanks).

The model results show that an increase in the ammonia concentration was projected in the vertical directions through the ground layers and horizontal directions to the point source areas.

Considering a threshold value of ammonia concentration of (1.5 ppm) according to the Sudanese Drinking Water Standards, the study shows that the contamination front emanating from the use of septic tanks travels horizontally at a rate of (500 m/year) reaching to the depths of (75 m) below the water table after 60 years from the beginning of simulation period (time zero).

## الخلاصة

تعتبر المياه الجوفية المصدر الرئيسي لإمدادات المياه لأغراض الشرب والاستعمال المنزلي لأكثر من 80 % من السكان في السودان وتغطي هذه المياه حوالي 50 % من مساحة البلد. وقد أوضحت الدراسة أن شبكة الصرف الصحي لا تنتشر في جميع ولاية الخرطوم وإنما بمناطق محددة في مركز الخرطوم والمنطقة الصناعية في شمال الخرطوم. أما في المناطق الأخرى فان احواض التخمير وآبار التخلص من المياه تمثل السبيل الأكثر انتشارا لمعالجة مياه الصرف بالولاية.

قامت هذه الدراسة باستخدام نموذج (mt3d) لتقدير حجم التلوث المتوقع من المياه الجوفية بولاية الخرطوم والذي يمكن ان ينبع بسبب الاستمرار في استخدام طرق الصرف الصحي التقليدية (احواض التخمير + ابار الصرف الصحي).

أظهرت نتائج النموذج زيادة في تركيز الامونيا في الاتجاه العمودي من خلال طبقات الارض وكذلك في الاتجاه الافقى في منطقة الدراسة.

تعتمد الشروط السودانية لمياه الشرب تركيز ( $1.5 \text{ mg/l}$ ) كالحد الاقصى المسموح به لتركيز الامونيا، وقد تم في هذه الدراسة استخدام هذا الحد لقياس مدى تقدم التلوث في منطقة الدراسة. حيث خلصت النتائج الى ان التلوث الناتج من احواض التخمير ينتقل افقيا بمعدل (500 م/العام) وانه سوف يصل الى عمق 75 م بعد 60 سنة من بداية المحاكاة.

## **DEDICATION**

This thesis would be incomplete without a mention of the support given me throughout the entire venture by the most wonderful individuals;  
My mother, my father, brothers, sisters and stepmother;  
I dedicate this work for their love, support and encouragement.

## **ACKNOWLEDGMENTS**

- I wish to thank Dr Salma Yehea Head of the Department of Civil Engineering for facilitating this Thesis. I express my sincere thanks to Dr. Abdalla Mohammed Taha Shigidi for his persistent encouragement to carry out this work and his assistance during the investigation and for his valuable supervision and continuous help throughout this study and manuscript preparation.
- I also thanks Dr. Yosuf Ali Yosuf and Dr. Mohammed Ali Al-Haj Alloba for their valuable suggestions they made after reading the manuscript and for the fruitful discussions.
- My appreciation and gratitude is extended also to all those who have helped me to complete this work from the Department of Civil Engineering and the Higher Studies Department in Sudan University for Science and Technology.

# CONTENTS

ABSTRACT.....	i
ABSTRACT (Arabic) .....	ii
DEDICATION .....	iii
ACKNOWLEDGMENTS .....	iv
CONTENTS.....	v
LIST OF TABLES.....	viii
LIST OF FIGURES.....	ix
SYMBOLS.....	xi

## CHAPTER ONE: INTRODUCTION

1.1 GENERAL INTRODUCTION.....	1
1.2 SEPTIC TANKS.....	3
1.3 SCOPE AND OBJECTIVE OF STUDY.....	4

## CHAPTER TWO: LITERATURE REVIEW

2.1 WATER RESOURCES IN SUDAN.....	5
2.1.1 Rain Water.....	6
2.1.2 Surface Water.....	6
2.1.3 Ground Water.....	7
2.2 MAIN AQUIFERS IN SUDAN.....	7
2.2.1 The Nubian Sandstone Aquifers.....	8
2.2.2 The Quaternary–Tertiary Aquifers.....	11
2.2.3 The Alluvial Aquifers.....	11
2.2.4 The Basement Complex Rocks.....	12
2.3 POLLUTION OF GROUND WATER.....	13
2.3.1 Pollution Risks due to Urbanization Activities.....	15

2.3.2	Pollution Risks due to Industrial Activities.....	16
2.3.3	Pollution Risks due to Agricultural Activities.....	17
2.4	GROUND WATER MODELING.....	17
2.5	PROCESSING MODFLOW (PMWIN) .....	17
2.6	THE MODFLOW PACKAGE.....	20
2.7	THE MT3D PACKAGE.....	21
2.8	PREVIOUS WORKS.....	21

## **CHAPTER THREE: CASE STUDY**

3.1	THE STUDY AREA.....	24
3.2	LOCATION OF THE STUDY AREA.....	25
3.3	MODEL CONSTRUCTION.....	26
3.3.1	Modflow.....	26
3.3.1.1	Grid Design.....	26
3.3.1.2	Boundary Conditions.....	28
3.3.1.3	Top and Bottom Layers of The Model.....	29
3.3.1.4	Initial Hydraulic Head.....	29
3.3.1.5	Model Calibration.....	30
3.3.1.6	Result of Model Calibration.....	34
3.3.1.7	Water Budget.....	34
3.3.1.8	Transient Simulation .....	36
3.3.2	Contamination Data Collection.....	37
3.3.3	MT3D.....	37
3.3.3.1	Initial Concentration.....	38
3.3.3.2	Sink/Source Concentration.....	39

## **CHAPTER FOUR: MODEL RESULTS**

4.1. MODEL OUTPUT RESULT.....	41
4.1.1 Contaminant Concentration at The Surface.....	42
4.1.2 Contaminant Concentration in Depth Below The Surface.....	44

## **CHAPTER FIVE: CONCLUSION & RECOMMENDATIONS**

5.1. CONCLUSION.....	52
5.2. RECOMMENDATIONS.....	53

<b>REFERENCES .....</b>	55
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## **APPENDICES**

6.1 APPENDIX A: WELLS LITHOLOGICAL DESCRIPTION .....	63
6.2 APPENDIX B: WELLS INORGANIC CONSTITUENTS.....	99
6.3 APPENDIX C: WELLS AESTHETIC QUALITY .....	101
6.4 APPENDIX D: SUDANESE DRINKING WATER STANDARDS.....	103

## LIST OF TABLES

Table (2.1):	The Percentage of Water Quantities Contributed to the Nile in Sudan During The Regular and Rainy Season.....	7
Table (3.1):	Location of The Wells in The Study Area with the Well Surface Area, Well Depth, Static Water Level, Dynamic Water Level and Yield per Hour.....	33
Table (3.2):	The Calculated Hydraulic Heads From The Calibrated Model of The (17) Wells between Two Periods.....	35
Table (3.3):	The Water Budget of The Steady State Simulation.....	36
Table (3.4):	Test Parameters of The Septic Tanks in The Three Cities in Sudan, 2005.....	38
Table (4.1):	Concentration – Depth at (25 m) below the Surface .....	51
Table (A.1):	The Lithology Information of Well 01.....	65
Table (A.2):	The Lithology Information of Well 02.....	67
Table (A.3):	The Lithology Information of Well 03.....	69
Table (A.4):	The Lithology Information of Well 04.....	71
Table (A.5):	The Lithology Information of Well 05.....	73
Table (A.6):	The Lithology Information of Well 06.....	75
Table (A.7):	The Lithology Information of Well 07.....	77
Table (A.8):	The Lithology Information of Well 08.....	79
Table (A.9):	The Lithology Information of Well 09.....	81
Table (A.10):	The Lithology Information of Well 10.....	83
Table (A.11):	The Lithology Information of Well 11.....	85
Table (A.12):	The Lithology Information of Well 12.....	87
Table (A.13):	The Lithology Information of Well 13.....	89
Table (A.14):	The Lithology Information of Well 14.....	91
Table (A.15):	The Lithology Information of Well 15.....	94
Table (A.16):	The Lithology Information of Well 16.....	96
Table (A.17):	The Lithology Information of Well 17.....	98
Table (B.1):	The Inorganic Constituents of The Wells.....	100

Table (C.1):	The Aesthetic Quality of The Wells.....	102
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## LIST OF FIGURES

Figure (1.1):	The Distribution of Water in The World.....	2
Figure (2.1):	Sudan Major Basins.....	9
Figure (2.2):	Ground Water Pollution by Different Chemical Composition, Biological and Chemical Reactions.....	16
Figure (3.1):	Location of The Study Area between The Coordinates (439640) W to (465425) E and (1707650) S to (1729250) N .....	26
Figure (3.2):	Grid Design of The Study Area Lies between The Coordinates (439640 km) W to (465425 km) E and (1707650 km) S to (1729250 km) N.....	27
Figure (3.3):	Boundary Conditions of The Study Area by using The MODFLOW Model.....	28
Figure (3.4):	The Initial Hydraulic Heads at 1978 of the Study Area in Khartoum showing the Location of The Wells.....	30
Figure (3.5):	Rivers Head in the Study Area.....	32
Figure (3.6):	Contour Map of the Hydraulic Head at 1978 after Run Modflow.....	36
Figure (3.7):	The Ammonia (NH4+) Concentration (mg/liter) in The First Layer of The Model.....	39
Figure (4.1):	The ammonia concentration (60 mg/l) at the surface before run the model.....	42
Figure (4.2):	The ammonia concentration at the surface (T=5) (2002) .....	43
Figure (4.3):	The ammonia concentration at the surface (T=15) (2012) .....	44
Figure (4.4):	The ammonia concentration at the surface (T=25) (2022) .....	44
Figure (4.5):	The ammonia concentration in the depth 25 m below the Surface (T=5) (2002).....	45
Figure (4.6):	The ammonia concentration in the depth 25 m below the Surface (T=15) (2012).....	46

Figure (4.7):	The ammonia concentration in the depth 25 m below the Surface (T=25) (2022).....	46
Figure (4.8):	Time curve of Ammonia Concentration at (25 m) below the surface.....	47
Figure (4.9):	The ammonia concentration in the depth 75 m below the Surface (T=5) (2002).....	48
Figure (4.10):	The ammonia concentration in the depth 75 m below the Surface (T=15) (2012).....	48
Figure (4.11):	The ammonia concentration in the depth 75 m below the Surface (T=25) (2022).....	49
Figure (4.12):	The ammonia concentration in the depth 150 m below the Surface (T=5) (2002).....	50
Figure (4.13):	The ammonia concentration in the depth 150 m below the Surface (T=15) (2012).....	50
Figure (4.14):	The ammonia concentration in the depth 150 m below the Surface (T=25) (2022).....	51
Figure (4.15):	Ammonia Concentrations – Time Curve at at the same area and time .....	52
Figure (A.01):	The Lithology of Well 01.....	64
Figure (A.02):	The Lithology of Well 02.....	66
Figure (A.03):	The Lithology of Well 03.....	68
Figure (A.04):	The Lithology of Well 04.....	70
Figure (A.05):	The Lithology of Well 05.....	72
Figure (A.06):	The Lithology of Well 06.....	74
Figure (A.07):	The Lithology of Well 07.....	76
Figure (A.08):	The Lithology of Well 08.....	78
Figure (A.09):	The Lithology of Well 09.....	80
Figure (A.10):	The Lithology of Well 10.....	82
Figure (A.11):	The Lithology of Well 11.....	84
Figure (A.12):	The Lithology of Well 12.....	86
Figure (A.13):	The Lithology of Well 13.....	88
Figure (A.14):	The Lithology of Well 14.....	90

Figure (A.15): The Lithology of Well 15.....	93
Figure (A.16): The Lithology of Well 16.....	95
Figure (A.17): The Lithology of Well 17.....	97

## SYMBOLS

a.m.s.l	Above Mean Sea Level
Ca	Calcium
Cl	Chloride
Co <sub>3</sub>	Carbonate.
Conc.	Concentration
C°	Degree Centigrade
Cm	Centimeter
Cm <sup>2</sup>	Square Centimeter
Cm <sup>3</sup>	Cubic Centimeter
F	Fluoride
Fe	Iron
Fig.	Figure
Figs.	Figures
H	Total Head
Km	Kilometer
Km <sup>2</sup>	Square Kilometer
l/hr	Liters Per Hour
l/s	Liters Per Second
M	Meter
M <sup>2</sup>	Square Meter
Mg/l	Milligram per Liter
Ph	Measure of the hydrogen – ion concentration in water
ppm	Part Per Million
Q	Discharge
T	Transmissivity
TDS	Total Dissolved Solids
USGS	United States Geological Survey
UTM	Universal Transverse mercator
V	Velocity
WHO	World Health Organization