CONTENTS

Acknowledgement	ii
The summary	vi
Notations	viii
Chapter 1	
Introduction	
1.1. The groundwater systems.	2
1.2. The model building process.	5
1.3. The groundwater in Egypt.	6
1.4. The Nile Delta formation.	7
1.5. The Nile Valley aquifer.	15
1.6. The Western Desert aquifer.	17
1.7. The Eastern Desert and Sinai Peninsula aquife	ers. 19
Chapter 2	
A Safe-Yield Model Using Inventory Th	
2.1. Introductiion.	23
2.2. Inventory Theory	23
2.3. Problem formulation of inventory model.	25
2.3.1. The function of the inventory system.	25
2.3.2. Solution of the model with normal	
distribution demand	27
2.4. The results of the model.	30
2.4.1. The Nile Delta region.	30
2.4.2. The Nile Valley region.	31
2.4.3. The Eastern Dessert region.	32
2.4.4. The Western Dessert region.	33
2.5. Discussion.	38

Chapter 3

A Mathematical Model for the Optimal Dyna	amic
Utilization of the Nile Delta Aquifer.	-
3.1. Introduction.	41
3.2. Simulation model.	42
3.3. The finite difference approximation to the	
governing equation	45
3.4. Problem formulation of optimization model.	51
3.5. The case study application.	53
3.5.1. The study area	53
3.5.2. System parameters	57
3.6. The constraint matrix of the optimization model.	62
3.7. The results of the optimization model.	65
3.7.1. The deduced coefficient matrices of the	
response equations.	65
3.7.2. The numerical results of the optimization	
model.	82
Chapter 4	
A Mathematical Model For The Optimal	
Control Of The Nile Delta Aquifer.	
4.1. Introduction.	86
4.2. Simulation model.	86
4.3. Problem formulation of optimization model.	87
4.4. The study case application.	88
4.5. The results of the optimization model.	90

Chapter 5

The Optimal Control Model of the South

ALCOCAL TECTION OF THE TAME TO SELECT	Western	Region	of the	Nile	Delta
---------------------------------------	---------	--------	--------	------	-------

5.1. Introduction.	94
5.2. Simulation model.	94
5.3. The finite difference approximation to the	
govering equation	94
5.4. Problem formulation of optimization model.	97
5.5. The case study application.	98
5.6. The results of the optimization model.	101
5.6.1. The deduced coeficient matrices of the	
response equations.	102
5.6.2. The numerical results of the optimization	
model.	104
Appendix 1	109
References	116
Arabic Summary	124