



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم

Ain Shams University
Faculty of Engineering
Irrigation and Hydraulics Department

**ASSESSMENT OF THE CURRENT DRAINAGE
WATER QUALITY MONITORING NETWORK IN
HADUS DRAIN (EASTERN DELTA)**

By

Mohamed Shaban Mohamed Abu-Salama
B.Sc. of Civil Engineering 1993
Faculty of Engineering at Ain Shams University

**A Thesis Submitted for the Fulfillment of the Requirements for
The Degree of Master of Science in
Civil Engineering**

Supervised By

Prof. Dr. Abd El Mohsen El Mongy
Prof. of Irrigation and Hydraulics Engineering
Faculty of Engineering
Ain Shams University

Dr. Mohamed Abu-El-Einin El-Samnoudy
Dr. of Irrigation and Hydraulics Engineering
Faculty of Engineering
Ain Shams University

Dr. Ashraf El-Sayed Mohamed
Head of Open Drainage Department
Drainage Research Institute
National Water Research Center

Cairo, Egypt
2001

4

5

6

7

M.Sc. Thesis submitted by
Eng. Mohamed Shaban Mohamed Abu-Salama
In Civil Engineering (Irrigation and Hydraulics)

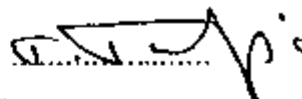
Examination Committee

Signature

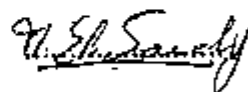
Prof. Dr. Mostafa Mohamed Soliman
Prof. of Irrigation and Hydraulics
Faculty of Engineering
Ain Shams University

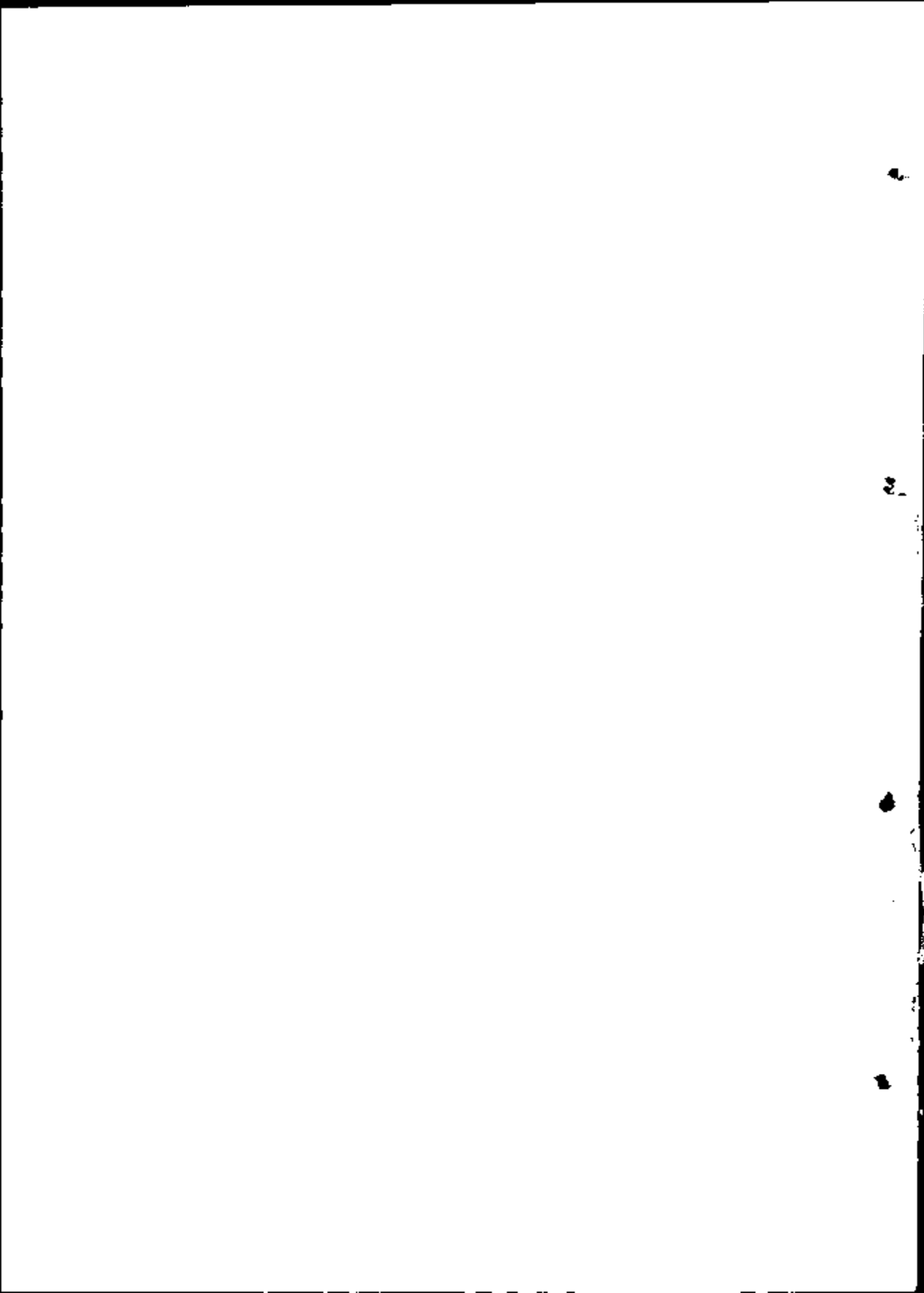


Prof. Dr. Tarek Abdel-Rahman Tawfik
Director of Central Laboratory for Environmental Quality Monitoring
Ministry of Water Resources and Irrigation



Prof. Dr. Mohamed Abu-El-Emin El-Samoudy
Prof. of Irrigation and Hydraulics
Faculty of Engineering
Ain Shams University





STATEMENT

This thesis is submitted to Ain Shams University, Faculty of Engineering for the degree of Master of Science in Civil Engineering.

The work included in this thesis was carried out by the author in the Department of Irrigation and Hydraulics, Faculty of Engineering, Ain Shams University from 1998 to 2001.

No part of this thesis has been submitted for the degree or qualification at any other university or institution.

Name: *Mohamed Shaban Abu Salama*

Date:

Signature:

CURRICULUM VITEA

Name : Mohamed Shaban Mohamed

Personal Information

- Nationality : Egyptian
- Date of Birth : 27/2/1969
- Place of Birth : Cairo

Summary of qualifications

1. Certificate of completing the International Course in designing and assessing water quality monitoring network in Brace Center for Water Resources Management, (3-month) *McGill University, Canada* (May-August 2000).
2. Certificates of completing short courses in (Access program, Advance Access program and Access programming Using Visual Basic, *NCR Egypt* 1999).
3. Land Drainage Refresher Short Course organised by International Institute for land Reclamation and Improvement *ILIRI, Netherlands* in National Water Research center.
4. Diploma of Specialised Post-Graduate Studies in Hydraulics & Irrigation, (2-years) from (*Ain Shams University, Egypt*).
5. Diploma of Specialised Post-Graduate Studies in Irrigation, (1-year) from The International Center for advanced Mediterranean Agronomic Studies (*The Mediterranean Agronomic Institute Of Bari, Italy*).
6. Certificate of completing the international course on Development & The Environment, from (*Environmental Engineering University of Southampton, England*).
7. Certificate of completing the course on Statistical Analysis of Water Quality Data using SPSS, (*National Water Quality Conservation Program*).
8. Certificate of completing the course on Statistical Analysis of Water Quality Management, (*National Water Quality Conservation Programme*).
9. Certificate of completing the course on Salinity Control, (*Drainage Training Centre, Egypt*).
10. Certificates of attending English courses in the *British Council Centre, Egypt*.
11. B.Sc. 5-years in Civil Engineering from (*Ain Shams University, Egypt*).

Profession

Civil Engineer, Open Drainage Department, Drainage Research Institute (DRI), National Water Research Center (NWRC), Ministry of water Resources and Irrigation.

ACKNOWLEDGMENTS

I would like to express my sincere gratitude and appreciation to my supervisor Prof. Dr. Abdel El-Mohsen El-Mongy, Professor of Costal Engineering, Irrigation & Hydraulic Department, Faculty of Engineering, Ain Shams University, for his continuous encouragement, support, advice and skillful guidance to make the completion of this study possible.

Grateful thanks and appreciation are due to my supervisor Dr. Mohamed Abu El-Einin El-Samneudy, Dr. of Irrigation and Hydraulics Engineering, Irrigation & Hydraulic Department, Faculty of Engineering, Ain Shams University, for his continuous assistance, comments and valuable guidance throughout the work of this study.

Particular mention must be made to Dr. Ashraf El-Sayed Ismail, Head of the Open Drainage Department, Drainage Research Institute, National Water Research Center, And Ministry of Water Resources and Irrigation, Whose sincere efforts extended more than supervising this study, his endless support and encouragement have continued since the author started his professional career.

I would like to express my gratitude to Prof. Dr. Shaden Tawfik Abdel Gawad Director of Drainage Research Institute, National Water Research Center, Ministry of Water Resources and Irrigation, for her endless assistance and motivation.

Also, I would like to extend my appreciation to the staff of the Drainage Research Institute for their encouragement and support.

ABSTRACT

Title: ASSESSMENT OF THE CURRENT DRAINAGE WATER QUALITY MONITORING NETWORK IN HADUS DRAIN (EASTERN DELTA)

Name: Muhamed Shaban Mohamed Abu-Salama

In view of the scarcity of water resources limited to a portion amounting to 55.5-milliard m³ annually from Nile water, the ministry of Water Resources and Irrigation in Egypt prepared a strategy for re-use of agricultural drained water, which is spilled in the sea, about 7.5 milliard m³ annually. The ministry started important steps to implement this strategy, by expanding in new agricultural lands, using Nile water mixed with drained agricultural water. El-Salam canal project comes beforehand of projects relying on this strategy, by using around 2.3-milliard m³ annually from agricultural drained water. The total area planned for irrigation on El-Salam canal is around 620 thousand feddans. To benefit from the re-use of some water from Lower Serw drain, Farsqr drain and Bahr Hadus drain, by mean of mixing it with fresh water from the Nile (Damielta Branch) with variable mixing proportion through the year, up to 1:1. It is important to monitor the quality of water at regular basis along the years of cultivation and modify the mixing proportion according to the variation in properties of water and soil. In 1995, the Drainage Research Institute (DRI) implemented drainage water-quality monitoring network. The primary goal of the network is to provide relevant and consistent drainage water-quality information to assist policy makers who must address water-resource management issues at the national, and local levels. The network plans to assess the drainage water quality in Nile Delta and Fayoum regions. The overall objective of this research is to assess and redesign the water quality-monitoring network for Bahr Hadus drain in Eastern Delta as one of the main feeders of El-Salam Canal. This is to provide reliable drainage water quantity and quality information about the drainage water which could be reused for El-Salam Canal Project. It is concluded that: The locations of some existing sampling sites do not correspond to the proposed sites, primarily because the former have been established as project-oriented observation sites, therefore they do not present an overall picture of the water quality conditions in the Bahr Hadus basin. Also, it was clear that the network covers most of the important water quality parameters. Sampling frequencies were also calculated for some of the water quality parameters monitored in the network. It was clear that the water quality parameters in Hadus drainage system should be monitored with different frequencies according to the data variability for each parameter.

TABLE OF CONTENTS

ACKNOWLEDGMENTS	v
ABSTRACT	vi
LIST OF FIGURES	x
LIST OF TABLES	xii
LIST OF TABLES	xii
ACRONYMS AND ABBREVIATIONS	xiv
1 CHAPTER 1	1
INTRODUCTION	1
1.1 Challenges For Egypt	1
1.2 Background	2
1.3 Problem Definition	3
1.4 Objectives	4
2 CHAPTER 2	6
CURRENT DEFINITIONS AND TYPES OF MONITORING	6
2.1 Definitions	6
2.2 Complexity Of Water Quality Monitoring	6
2.3 Significance Of Water Quality Monitoring	7
2.4 Water Quality Monitoring Networks	8
3 CHAPTER 3	9
DESIGN AND ASSESSING WATER QUALITY MONITORING NETWORK	9
3.1 Design Approach For Water Quality Monitoring Network	9
3.2 Network Assessment and Redesign	10
3.2.1 Assessment Sampling Sites	13
3.2.1.1 Sander's Approach	14
3.2.2 Assessment of Variables Selection	17
3.2.2.1 Selection of Base Variables	18
3.2.2.2 Selection of Specific Variables	19
3.2.2.3 Analysis of Data Correlations	20
3.2.3 Assessment of Temporal Frequencies	23
3.2.3.1 Sampling Frequency Based on Flow Characteristics	24
3.2.3.2 Relating Information Objectives To Sampling Frequency Statistics	25
3.2.3.3 Sampling Frequency Selection	27
3.2.3.4 Sampling Design Strategies	28
3.2.3.5 Additional Statistical Consideration	32

3.2 3.6 Additional Design Approaches - Mathematical Programming	33
4 CHAPTER 4	35
CURRENT DRAINAGE WATER QUALITY MONITORING NETWORK IN HADUS DRAIN	35
4.1 Network Description	35
4.2 Monitoring Location Selection Criteria	37
4.3 Water Quality Parameters	37
4.3.1 Status Of The Monitored Parameters	37
4.3.2 Overview Of Monitored Parameters	39
4.4 Data Collection	48
4.4.1 Water Quality Data	48
4.4.1.1 Field Work	48
4.4.1.2 Laboratory Analysis	49
4.4.2 Water Quantity Measurements	51
5 CHAPTER 5	52
ASSESSMENT OF THE CURRENT DRAINAGE WATER NETWORK IN HADUS DRAIN	52
5.1 Sampling Sites	52
5.1.1 Sampling Sites Based on No. of Tributaries	52
5.1.2 Sampling Sites Based on Indicator of Stream Use	55
5.1.2.1 Sampling Sites Based on No. of Outfalls	55
5.1.2.2 Sampling Sites Based on BOD Loadings	57
5.1.3 Sampling Sites Based On Discharge Measurements	59
5.1.3.1 Current Discharge Measurements Network For Hadus Drain	59
5.1.3.2 Water Balance For Current Discharge Measurements Network	60
5.1.3.3 Comments On The Current Discharge Measurements Network	62
5.1.3.4 Water Balance For The Proposed Discharge Measurements Network	64
5.2 Selection of Variables	66
5.2.1 Drainage Water Quality Standard	66
5.2.2 Analysis of Data Correlations	70
5.3 Selection of Temporal Frequencies	71
6 CHAPTER 6	74
RESULTS AND DISCUSSIONS	74
6.1 Sampling Sites	74
6.1.1 Water Quality Monitoring Network	74
6.1.2 Water Quantity Monitoring Network	75