HIGHER TECHNICAL INSTITUTE

CIVIL ENGINEERING DEPARTEMENT

DIPLOMA PROJECT

ENVIRONMENTAL STUDY WASTEWATER TREATMENT AND REUSE

C/ 947

BYS

PARIS A. CONSTANTINOU



HIGHER TECHNICAL INSTITUTE

NICOSIA - CYPRUS

CIVIL ENGINEERING COURSE

DIPLOMA PROJECT

ENVIROMENTAL STUDY WASTEWATER TREATMENT AND REUSE

BY

PARIS A. CONSTANTINOU

JUNE 2001

HIGHER TECHNICAL

INSTITUTE

PROJECT NO.

321

HIGHER TECHNICAL INSTITUTE CIVIL ENGINEERING DEPARTEMENT

DIPLOMA PROJECT

ENVIRONMENTAL STUDY WASTEWATER TREATMENT AND REUSE

C/947

BY:

PARIS A. CONSTANTINOU

JUNE 2001



ENVIRONMENTAL STUDY-WASTEWATER TREATMENT AND REUSE

By

PARIS A. CONSTANTINOU

Project Report Submitted to The Department of Civil Engineering Of the Higher Technical Institute Nicosia-Cyprus In partial fulfillment of the requirements For the diploma of

TECHNICIAN ENGINEER

In

CIVIL ENGINEERING

Project Supervisor:

Mr. N. Kathijotes Lecturer at C.E.D at HTI

External Assessor: Mrs

Mrs. Lia Georgiou

Type of project: Individual

JUNE 2001



<u>HIGHER TECHNICAL INSTITUTE</u> <u>NICOSIA – CYPRUS</u>

CIVIL ENGINEERING DEPARTEMENT

Academic Year 2000 / 2001

Diploma Project Number: C / 947

Title : Environmental study - wastewater treatment and reuse.

Objectives:

- 1) State the characteristics of wastewater and problems resulting from wastewater disposal.
- 2) To carry out an environmental analysis study.
- 3) To design the sewerage system of an establishment.
- 4) To design a secondary treatment plant.
- 5) To design the wastewater reuse facilities.

Terms and conditions

1) The establishment under consideration will be assigned by the project supervisor.

Student : Paris A. Constantinou Supervisor : Mr. N. Kathijotes External Assessor : Mrs. L. Georgiou

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1Historical overview of water and wastewater treatment

1.2Water cycle and effects of impurities to humanity

1.3Water pollution

1.4Prevention of pollution

1.5Wastewater engineering

1.6Wastewater

1.7Domestic wastewater

CHAPTER 2

LOCATION OF PLANT / GENERAL INFORMATION

2.0 Location of plant & general information

CHAPTER 3

WASTEWATER CHARACTERISTICS

3.1 Wastewater characteristics

3.2 Physical characteristics of wastewater

3.2.1 Suspended solids

3.2.2 Dissolved solids

3.2.3 Turbidity

3.2.4 Color

3.2.5 Taste and Odor

3.2.6 Temperature

3.3 Chemical characteristics of wastewater

- 3.3.1 Total dissolved solids
- 3.3.2 Alkalinity
- 3.3.3 Hardness
- 3.3.4 Fluoride
- 3.3.5 Metals
- 3.3.6 Organics
- 3.3.7 Nutrients

3.4 Biological wastewater characteristics

- 3.4.1 Pathogenic organisms
- 3.4.1.1 Bacteria
- 3.4.2 Viruses
- 3.4.3 Protozoa
- 3.4.4 Helmnths
- 3.4.5 Fungi
- 3.4.6 Algae

3.5 Characteristics and evaluation of w/w quality

- 3.5.1 Biochemical oxygen demand (BOD)
- 3.5.2 Carbonaceous biochemical oxygen demand (CBOD)
- 3.5.3 Chemical oxygen demand (COD)
- 3.5.4 Total organic carbon

3.5.5 Theoretical Oxygen Demand

3.5.6 PH

CHAPTER 4

WASTEWATER TREATMENT FACILITIES

4.1 Wastewater treatment facilities

4.1.1 Collection of Wastewater

4.1.2 Treatment plants

4.1.3 Methods of treatment

4.1.3.1 Preliminary treatment

4.1.3.1.1 Screening

- 4.1.3.1.2 Grit chambers and grit channels
- 4.1.3.1.3 Flow measuring devises
- 4.1.3.2 Primary treatment
- 4.1.3.3 Secondary or Biological treatment
- 4.1.3.3.1 Underline principal operations

4.1.3.4 Stabilization ponds

4.1.3.5 Tertiary treatment

4.1.3.6 Fixed film systems

4.1.3.7 Suspended film systems

4.1.3.8 Lagoon systems

4.1.3.9 Advance treatment

4.1.3.10 Sludge

CHAPTER 5

METHODS AND STANDARDS OF SECONDARY TREATMENT

5. Methods and standards of secondary treatment

5.1 Introduction

5.2 Activated sludge

5.3 Trickling filter

5.4 Aerated lagoon

5.5 Rotating biological contractor

- 5.6 Anaerobic biological treatment
- 5.7 Oxidation pond

CHAPTER 6

ENVIROMENTAL ANALYSIS OF THE AREA

6.1 Description of the proposed action

6.1.2 Location

- 6.1.3 Design and layout
- 6.1.4 Construction and operation

6.2 Environmental setting-natural resources

- 6.2.1 Geology
- 6.2.2 Water resources
- 6.2.3 Air resources
- 6.2.4 Terrestrial and aquatic ecology

6.3 Human resources

6.3.1 Transportation

6.3.2 Community services

6.3.3 Demography

6.3.4 Cultural resources

6.4 Significant environmental impacts

CHAPTER 7

PLANT OPERATION

7.1 Introduction

7.2 Present situation

7.3 Proposed scheme

7.3.1 Mechanical treatment

7.4 Design and operating parameters

- 7.4.1 Amount of nutrients
- 7.4.2 Concentration of dissolved oxygen
- 7.4.3 Food-to-microorganisms

7.4.4 pH

- 7.4.5 Biological treatment temperature
- 7.4.6 Mean cell residence time
- 7.4.7 hydraulic loading rate
- 7.4.8 Settling time
- 7.4.9 Degree of mixing
- 7.5 Design data/process description
- 7.5.1 Design data
- 7.5.2 Air blower sizing

7.6 Summary of tank directions

CHAPTER 8

PLANT DESIGN

8.1 Technical data & specifications-design

8.2 Summary of tank dimensions

ACKNOWLEDGMENTS

I am very grateful to those who have helped me to prepare this project.

First of all, I want to thank Mr. Panikos Nikolaides from Nikolaides & Associates Civil & environmental engineers, for his great interest and response during the development of this project, which without his help this project would have never exist.

I am especially grateful to my supervisor Mr. N. Kathijotis, Senior Lecturer at the H.T.I., for trusting me and giving this project to me and also for his helpful guidance during the preparation of this work.

I want to thank the monks of the monastery for their helpful guidance.

I want to thank also my friend Mrs. Cristiana Katsabas for the support and help to prepare this project.

Finally, I must acknowledge with deep appreciation the support and encouragement of my family as well as all those unnamed who in one way or another helped in the accomplishment of this work.