DESIGN OF A WASTEWATER TREATMENT PLANT

BY

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

June 1999



HIGHER TECHNICAL INSTITUTE NICOSIA CYPRUS

CIVIL ENGINEERING DEPARTMENT

Academic Year 1998/99 Diploma Project No. C/864

TITLE: DESIGN OF A WASTEWATER TREATMENT PLANT

SUMMARY / OBJECTIVES

The objectives of this project are:

- 1. To state wastewater qualities, treatment objectives and principles.
- 2. To carry a planning study including and environmental impact study.

v

3. To design a small scale secondary treatment plant.

TABLE OF CONTENTS

		Page
Acknowledger	nent	iv
Summary / Ob	ojectives	V
INTRODUCTI	ION	vi
CHAPTER 1	- WASTEWATER CHARACTERISTICS	
1.1 Wastewa	ater Composition	2
1.2 Wastewa	ater Characteristics	3
1.3 Physical	Characteristics of Wastewater	3
1.3.1	Total Solids	3 - 4
1.3.2	Taste and Odor	4
1.3.3	Color	4
1.3.4	Temperature	5
1.3.5	Turbidity	5
1.4 Chemical Characteristics		6
1.4.1	Organic Matter – Measurement of Organic Content	6 - 7
1.4.2	Alkalinity	8
1.4.3	Hardness	8-9
1.4.4	Nutrients	9
1.4.5	Metals	9 – 10
1.5 Biologi	cal Characteristics of Wastewater	10
1.0 5.000	Microorganisms and their role	10 – 13
1.5.7	Pathogenic Organisms	14
1.5.3	Pathogen Indicators	15
CHAPTER	2 – WASTEWATER TREATMENT PROCESSES	
0.4. \\/==+=	water Treatment Methods	17

2.1 Wastewater Treatment Methods182.2 Effluent Standards18

Page

2.3	Primary ⁻	Treatment	19
	2.3.1	Screening	19 – 20
	2.3.2	Comminuting	21
	2.3.3	Grit Removal	21 – 22
	2.3.4	Flow Measurement	24
	2.3.5	Primary Sedimentation	24 – 25
2.4	Seconda	ary Treatment	26
	2.4.1	Trickling Filters	26 – 27
	2.4.2	Rotating Biological Contactors	27 – 28
	2.4.3	Activated Sludge	30
	2.4.4	Waste Stabilization Ponds	30 – 34
	2.4.5.	Desinfection of Effluents	34 – 35
2.5	Advanced Wastewater Treatment		35
	2.5.1	Nutrient Removal	36 – 39
2.6	Wastew	ater Disposal	39 – 40
	2.6.1	Irrigation	40 – 41
	2.6.2	Rapid Infiltration	41
2.7	Wastewater Reuse		41 – 42
	2.7.1	Agriculture Reuse	42
	2.7.2	Industrial Reuse	42 – 43
	2.7.3	Recreational Use	43
	2.7.4	Groundwater Recharge	43

CHAPTER 3 – THE ACTIVATED-SLUDGE PROCESS

3.1	Activated Sludge Process		45 - 40
	3.1.1	Modifications of the activated-sludge processes	46 – 48
	3.1.2	Methods of Aeration	49
	3.1.3	Secondary Clarifier	49 – 50
3.2	Sludge Characteristics		50 – 51
3.3	Thickening		51 – 52
3.4.1 Anaerobic Digestion			52 – 53

a 4.0 A prohip Digostion			53
3.4.2 Aerobic Digestion			55
3.5	Dewater	ing	55 – 56
3.6	Sludge I	Jisposai	
сци	PTFR 4	- BASIC DESIGN CONSIDERATIONS	
<u>011</u>	Introduc	tion	58
4.1	A 1 1	Initial and design vears	58 – 59 🔺
	442	Site selection	59 – 60
	4.1.2	Process Selection	60
	4.1.0 A 1 A	Degree of Treatment	60
	4.1.5	Environmentally Impact Assessment	61
<u>CH</u>	APTER 5	5 - DESIGN OF AN ACTIVATED-SLUDGE TEAN	63
5.1	Locatio	on of Plant	63 – 64
5.2	5.2 Physical Environment		64
5.3	B Descri	ption of the Proposed Project	64 - 65
	5.3.1	Sludge Thickening	65
	5.3.2	Odour/Noise Control	65 - 66
5.4	5.4 Effluent Reuse/Disposal		67
5.	5 Desig	n Procedures	67
	5.5.1	Technical Data and Specifications	69
	5.5.2	Wastewater Characteristics	69 70
	5.5.3	Primary Settling Tank	70 73
	5.5.4	Aeration Tank	70 - 75
	5.5.5	Final Settling Tank	75 - 75
	5.5.6	Desinfection Tank	75-70
	5.5.7	Calculation of Sludge Volume (Ves)	76-70
	5.5.8	Thickening	78
Conclusions			79 – 80
	,		0.4

References

81

Page