

TABLE OF CONTENTS

| | <u>Page</u> |
|---------------------------|-------------|
| Acknowledgments | iv |
| Abstract | v |
| Table of Contents | viii |
| List of figures | x |
| List of Tables | xi |
| List of Maps | xii |
| Symbols and abbreviations | xiii |

CHAPTER 1:INTRODUCTION

| | |
|---------------------------------------|---|
| 1.1 Background and Problem Definition | 1 |
| 1.2 Scope of Work | 2 |

CHAPTER 2: GENERAL INFORMATION ABOUT HEBRON

| | |
|-------------------|---|
| 2.1 Introduction. | 5 |
| 2.2 Area. | 6 |
| 2.3 Topography | 6 |
| 2.4 Geology | 6 |
| 2.5 Climate | 7 |
| 2.6 Temperature | 7 |
| 2.7 Precipitation | 8 |

CHAPTER 3: WATER CONSUMPTION AND EXISTING SEWERAGE NETWORK

| | |
|---|----|
| 3.1 Introduction | 10 |
| 3.2 Current Conditions | 10 |
| 3.3 Population Forecast | 12 |
| 3.4 Water Demand | 12 |
| 3.5 Assessment of Present per Capita Demand | 13 |
| 3.6 Future per Capita Demand | 13 |

| | |
|--|----|
| 3.7 Industrial / Commercial Demand | 13 |
| 3.8 Existing Sewerage Network | 14 |
| 3.8.1 Introduction | 14 |
| 3.8.2 The Sewerage Network in the city | 15 |

CHAPTER 4: WASTEWATER SOURCES , QUANTITIES AND CHARACTERISTICS

| | |
|--|----|
| 4.1 Introduction | 20 |
| 4.2 Wastewater Sources and Quantities | 20 |
| 4.3 Industrial Wastewater Sources and Quantities | 21 |
| 4.4 Wastewater Characteristics | 28 |
| 4.4.1 Results Evaluation | 28 |
| 4.4.2 Characteristics of the Sample | 29 |
| 4.4.3 Estimation Procedure | 29 |
| 4.4.4 Data Manipulation | 31 |
| 4.4.5 Technical Notes | 31 |
| 4.5 Notes on Wastewater Quality | 36 |

CHAPTER 5: THE PROPOSED WASTEWATER TREATMENT AND REUSE SCHEME

| | |
|--|----|
| 5.1 Introduction | 37 |
| 5.2 The Reuse Scheme | 37 |
| 5.3 Types of Treatment Methods | 39 |
| 5.4 The Different Alternatives of Wastewater Treatment | 40 |
| 5.5 Characteristics of Treatment Methods | 40 |
| 5.6 Considerations for the Selection of Treatment Method | 43 |
| 5.7 Suggested Treatment Methods | 45 |

CHAPTER 6: DESIGN OF ALTERNATIVES

| | |
|--|----|
| 6.1 Introduction and Design Criteria | 47 |
| 6.2 Basic Design of Oxidation Ditch | 48 |
| 6.3 Basic Design of UASB followed by Oxidation Ditch | 52 |
| 6.4 Treatment Efficiency Predictions | 55 |
| 6.5 Design Calculation of Oxidation Ditch | 56 |

| | |
|---|-----|
| 6.6 Design Calculation of UASB followed by Oxidation Ditch | 68 |
| 6.7 Impact of UASB removal Efficiency on Main Wastewater Characters | 83 |
| 6.8 Financial Analysis | 87 |
| CHAPTER 7: RECOMMENDATIONS | 97 |
| APPENDICES | 98 |
| REFERENCES | 106 |