College of Engineering

Civil and Architectural Engineering Department

Hebron_ Palestine

Environmental Social, and Cultural Heritage Impact Assessment for a Wastewater Treatment Plant to be built in Wadi Al Samen

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ABSTRACT

This project aims to assess the environmental impact of the wastewater treatment plant to be built in Wadi al-Samen, south of Hebron, as this report provides a comprehensive view of the environmental, social, health and cultural heritage in the region and its potentials, in addition to anticipating the impacts resulting from the establishment and operation of this plant on the environmental, social and economic system And the culture as a whole within the environmental impact assessment methodology that depends on field studies and collecting information about the treatment plant site, as well as the treatment stages of the plant, its units, treatment methods and its analysis, and developing a comprehensive environmental management plan to monitor the positive and negative effects and work to mitigate the negative effects of them according to what is recommended in this study.

Through this study, it is expected to obtain the required results from the EIA process, including improving wastewater management in the Wadi Al Samen area and thus improving the environment and health conditions of the area, and increasing the area of agricultural land through the use of treated water to irrigate crops and protect water. Underground and surface areas, reduce pollution, increase food security for societies, reduce unemployment, create new job opportunities, adopt economical and environmentally friendly technology and reduce the cost of wastewater management, in addition to raising awareness among individuals of the importance of such projects in all aspects of life.

الملخص

يهدف هذا المشروع إلى تقييم الأثر البيئي لمحطة معالجة مياه الصرف الصحي المراد بناؤها في وادي السمن جنوب الخليل حيث يقدم هذا التقرير نظرة شاملة للوضع البيئي والاجتماعي والصحي والموروث الثقافي في المنطقة والإمكانيات .بالإضافة الى توقع الآثار الناتجة عن إنشاء وتشغيل هذا المحطة على النظام البيئي والاجتماعي والاقتصادي والثقافي ككل ضمن منهجية تقييم الاثر البيئي التي تعتمد على الدراسات الميدانية وجمع المعلومات حول موقع محطة المعالجة ، وكذلك مراحل معالجة المحطة ووحداته وطرق علاجه وتحليلها ووضع خطة ادارة بيئية شاملة لرصد التأثيرات الايجابية والسلبية والعمل على تخفيف الاثار السلبية منها حسب ما هو موصى به في هذه الدراسة.

من خلال هذه الدراسة ، من المتوقع الحصول على النتائج المطلوبة من عملية تقييم الأثر البيئي ، بما في ذلك تحسين ادارة المياه العادمة ادارة في منطقة وادي السمن وبالتالي تحسين البيئة والصحة ظروف المنطقة ، وزيادة مساحة الأراضي الزراعية من خلال الانتفاع من المياه المعالجة لري المحاصيل وحماية المياه الجوفية والسطحية منها والحد من التلوث وزيادة الأمن الغذائي للمجتمعات ، والحد من البطالة ، خلق فرص عمل جديدة ، واعتماد اقتصادي وصديق للبيئة التكنولوجيا وتقليل تكلفة إدارة المياه العادمة ،بالإضافة الى رفع الوعي لدى الافراد بالأهمية لمثل هذه المشاريع على جميع نواحي الحياة.

DEDICATION

All praise to Allah, today we fold the days' tiredness and the errand summing up between the cover of this humble work.
To the utmost knowledge lighthouse, to our greatest and most honored prophet Mohamed - May peace and grace from Allah be upon him.
To the Spring that never stops giving, to my mother who weaves my happiness with strings from her merciful heart ... to my mother.
To whom he strives to bless comfort and welfare and never stints what he owns to push me in the success way who taught me to promote life stairs wisely and patiently, to my dearest father
To whose love flows in my veins, and my heart always remembers them, to my brothers and sisters.
To those who taught us letters of gold and words of jewel of the utmost and sweetest sentences in the whole knowledge. Who reworded to us their knowledge simply and from their thoughts made a lighthouse guides us through the knowledge and success path, To Dr. Itissam Abuiziah.

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List of Abbreviations

ARIJ : Applied Research Institute Jerusalem

AFD : Agence Francaise Developpement

BOD : Biological Oxygen Demand

CAS : Conventional Activated Sludge

COD : Chemical Oxygen Demand

CHG : Corporate Health Group

dB : dimension Decibel

EIA : Environmental Impact Assessment

EPA : United States Environmental Protection Agency

ESIA : Environmental and social Impact Assessment

ESMP : Environmental and social management plan

$HCO3^-$: Bicarbonate

H_2S : Hydrogen sulfide

HWWTP : Hebron Wastewater Treatment Plant

MEnA : Ministry of Environment Affairs

MoA : Ministry of Agriculture

MoH : Ministry of Health

MoL : Ministry of Labor

MoP : Ministry of Planning

MoTA : Ministry of Tourism and Antiquities

NOx : Nitrogen Oxides

PA : Palestinian Authority

PCBS :Palestinian Central Bureau of Statistics

PEL : Palestinian Environment Law

PES : Palestinian Environmental Strategy

PIU : Project Implementation Unit

PM : Particulate matter

PSI : Palestinian Standards Institute

PWA : The Palestinian Water Authority

RMP : Risk Management Plan

SO_2 : Sulfur dioxide

SPM : Social Management Plan

TN :Total Nitrogen

TP :Total Phosphates

TWW : Treated Wastewater

TSS : Total Suspended Solids

WHO : World Health Organization

WMAB : Western Mountain Aquifer Basin

Chapter 1

Introduction

1.1. Introduction

Water is the most prominent natural factor affecting life on the surface of the earth in its various forms, including humans, animals, and plants ,as without the existence of water, there would have been no chance of life. This is a scientific fact fixed stipulated by the Quran to confirm that the origin of life is water . Because of human behavior and daily activities, large quantities of water are released as Unusable water in so-called wastewater, and to get rid of this water, sewage networks are created to collect and treat them and to get rid of the components of this water from impurities and microbes so that no degradation of the organic materials that contain them occurs.

The Hebron Governorate suffers from a lack of adequate infrastructure, according to the results of the Palestinian Population Survey conducted by the Palestinian Statistics Department. There are 6 housing communities connected to a sewage network in the Hebron Governorate, and these communities represent 7.3% of the population in the Governorate[1].

This means that only 36% of the Palestinian families in the governorate use the sewage network as a means to dispose of wastewater[2].

As for the rest of the governorate's gatherings, including the city of Yatta, it lacks a sewage network and wastewater is disposed of through potholes or through open channels, and these pits are emptied by tanks designated for that and then discharged into neighboring valleys without any consideration for the environment.

Consequently, the wastewater generated by the residential communities flows in the surrounding valleys without any treatment, which leads to soil pollution and the degradation of natural resources, especially water, since sewage flows from the city of Hebron and its environs towards the city of Yatta through this valley (Wadi Al Samen).

This valley starts from Al-Haila, north of Yatta, and runs through Wadi Al-Sada and Wadi Abu Al-Foul to Dhahria, then the Negev. About 2,300,00 cubic meters of wastewater is discharged annually across the Hebron main line in Wadi Al-Samin.[2].

The environmental impacts of dumping wastewater on the environment across Wadi Samen are not limited to the borders of the city of Yatta, south of Hebron, but also affect the entire Hebron Governorate. The negative effects resulting from the flow of wastewater through Wadi Samin are the emission of bad smells and the spread of harmful insects, as well as the expected effects on the soil and its ecosystem through the accumulation of salts and solid materials in the soil[3]. Wastewater affects soil fertility by damaging its components.

In addition to what was mentioned above, Wadi Al-Samen is located above an exit area that works to feed the eastern subterranean basin, and this matter is of great importance and danger as the flow of wastewater into this area leads to pollution and deterioration of the quality of groundwater in this basin.

The purpose of applying the environmental impact assessment process is to ensure that any proposed activities, programs or development plans are environmentally valid and ensure sustainability.

This process is one of the planning tools used to expect, analyze and the development of environmental impacts of any proposal and to provide data and information that are of importance in the stage of taking the decision.

In addition to the project environmental impact assessment process, which can reduce the negative impacts on the environment, it helps in the exploitation of resources in an effective and sustainable way .

Environmental and social impact assessment is a prerequisite for the implementation of development projects. The study aims to provide a detailed analysis of the expected environmental and social impacts associated with the sanitation project and to develop an environmental and social management plan for its implementation during the period of project establishment and operation.

This report has been done to assess the environmental and social impact of the wastewater treatment plant located in the Hebron Governorate (Wadi ALSamen area) which is currently under construction. The report includes the identification and evaluation of potential environmental and social impacts that can result from the establishment and operation of the various components of the project. It also includes the proposed mitigation and monitoring measures to control or limit the impacts from the identified negative impacts.

92.7% of the population depend on sewage disposal on cesspits and open channels.The main wastewater stream in the city of Hebron flows in wadi Al samen , as sewage flows from the city of Hebron and its environs towards the city of Yatta through this wadi[1].

The environmental impacts resulting from dumping wastewater into the environment through Wadi Al Samen do not stop at the borders of the city of Yatta, south of the city of Hebron, but also extend to the entire Hebron Governorate.

1.2. Problem Statement

The problem of the study includes anticipating the presence of environmental pollution resulting from the wastewater treatment plant that will be built on the lands of Yatta city, where these pollutants include air, water, noise, solid waste and radioactive pollutants, as well as the presence of the phenomenon of pollution on natural plants and wildlife.

1.3. Research Question

This research project responds to the following main and sub-main questions;

1.3.1. Main question:

What are the environmental, social, economic and cultural impacts of the wastewater treatment plant that will be built on the lands of Yatta city?

1.3.2. Sub-main questions:

1) What is the current environmental situation?

2) What is the current social and cultural situation in the study area?

3) What are the laws and legislations related to policy, environmental impact assessment in Palestine?

4) What are the expected positive effects when operating the wastewater treatment plant?

5) What is the effect of the treatment plant on natural resources?

6) What is the awareness of the project beneficiaries of the importance of building the project?

1.4. Project Justification.

1) It provides a framework for identifying general impacts to assist project implementers in their study and developing measures and procedures to address expected negative environmental, social and economic impacts.

2) Preserving the groundwater basins from pollution, which is the main source of drinking water in Palestine.

3) Proper disposal of solid and liquid waste resulting from the construction and operation of the treatment plant.

4) Reducing the impact of different construction processes on human societies and communities, as well as limiting the impact of different construction processes on the vital system in or around the project area.

5) Protecting and improving public health and raising awareness among the population.

1.5. Goals and Objectives

1. Improving wastewater management in Wadi AL Samen area.

2. Improving the environmental and health conditions in the Wadi Al Samen area.

3. Increasing knowledge and building human capacities for targeted groups.

4. Adopting environmentally friendly and economical technology.

5. Identify the multiple elements that can affect human health and safety as well as those that affect different ecosystems.

6. Describe the current environmental and social conditions of the communities hosting the project in order to measure the severity of the impacts associated with it.

7. Shed light and review the legislation under which the project will be implemented.

8. Define social and environmental impacts in a quantitative manner whenever this is allowed taking into account the activities of the various projects in multiple stages (planning, construction, and operation) and their impact on environmental and social issues.

9. Preparing a monitoring and follow-up program to determine:

_ Unexpected situations that could arise during project implementation.

_ The effectiveness of the mitigation measures identified.

The results included in this study provide decision-makers in assessing environmental and social impacts with the information necessary to reduce negative impacts, and develop the best compensation strategy if necessary.

1.6. Literature Review

Hebron wastewater management projectis one of the major projects funded by the World Bank and the Agence Francaise Developpement (afd) which includes development of a feasibility study and preliminary design for a wastewater treatment plantand trunk sewer for Hebron, Hebron Governorate. This untreated wastewater eventually flows along Wadi as-Samen south towards the green line, causing adverse environmental impacts to the eastern aquifer and to the communities along the Wadi. This was identified as a serious issue as far back as the 1970's and plans for a regional solution for the wastewater for Hebron city and the surrounding communities were developed but not implemented because of lack of funding[3].

Wastewater flow into Wadi Samen without treatment. It is drained into a large area of more than twenty kilometers. Its flow is penetrated along the valley and affects groundwater in the Wadi Samen catchments. Furthermore it, the social, economic and environmental impact of this flow on groundwater recharge Be determined. The flow of wastewater in Wadi Al Samen affects the cultivated crops and the soil quality. In addition, the flow of wastewater in Wadi Al Samen affects many towns.Villages in the Hebron Governorate by creating health and environmental problems For local residents and surrounding areas. Affects sewage overflow environmental quality of the surrounding farmland. Affected Agricultural land in the study area is about 5,000

km^2 which is mainly cultivated with fruit trees and cultivated crops. Protecting water sources from pollution, especially in Palestine, which is facing a scarcity of water resources, is a major concern[4].

Environmental Impact Assessment (EIA) is a process in which the environmental effects of development projects are studied so as to integrate the interest of the environment in the decision making process. An EIA system consists of the followed assessment procedure itself, the enabling and supporting legislations, the administrative arrangements and the institutional capabilities available within the country in terms of both technical and financial resources . Concerning the Palestinian EIA system, no comprehensive review have been undertaken before for the different system components and how they relate to the effectiveness of the EIA process in actual implementation[5].

proper application of the stated Environmental and Management Plan is a major issue for project success. In the other hand an ESIA on sludge management and safe usage is highly recommended to mitigate the current environmental degradation .

In addition, public outreach to sensitize communities, water user associations and agricultural committees on good practices and benefits of the project, and to support to address regulatory weaknesses, promote a safe re-use of effluent, undertake studies to identify and design agricultural interventions for the benefit of the existing communities[6].

The purpose of the environmental impact assessment process is to ensure that any proposed activities, programs or development plans that are environmentally valid and ensure sustainability This process is one of the planning tools used to anticipate, analyze and crystallize the important environmental impacts of any proposal and to provide data and information that are of great importance in the decision-making stage in addition to until the process of assessing the environmental impact of projects that reduce the negative and adverse impacts on the environment helps in the employment and exploitation of resources in an effective and sustainable way and maximizing the benefits of established development projects[7].

1.7. Project Focus

This project focuses on the importance of employing an environmental ,social and cultural impact assessment on a project to build a wastewater treatment plant in Yatta and its implications during the implementation and operation phase in environmental, social, cultural and health aspects.

1.8. About The Project

1.8.1. Project Location

Hebron city is located within the Hebron Mountains which extend from south of Jerusalem to the Negeb. The Hebron Mountains form the southern rim of the West Bank Mountains. On average, they are 850 meters high with the highest point at 1,020 meters above mean sea level near Kherbit Khellan, to the north of Hebron city. The proposed location of the WWTP is crossing Wadi al-Samen with an elevation ranging between 740 to 760 meter above sea level while the elevation is rising up in all sides of the site and reaches up to 840 meters[3].

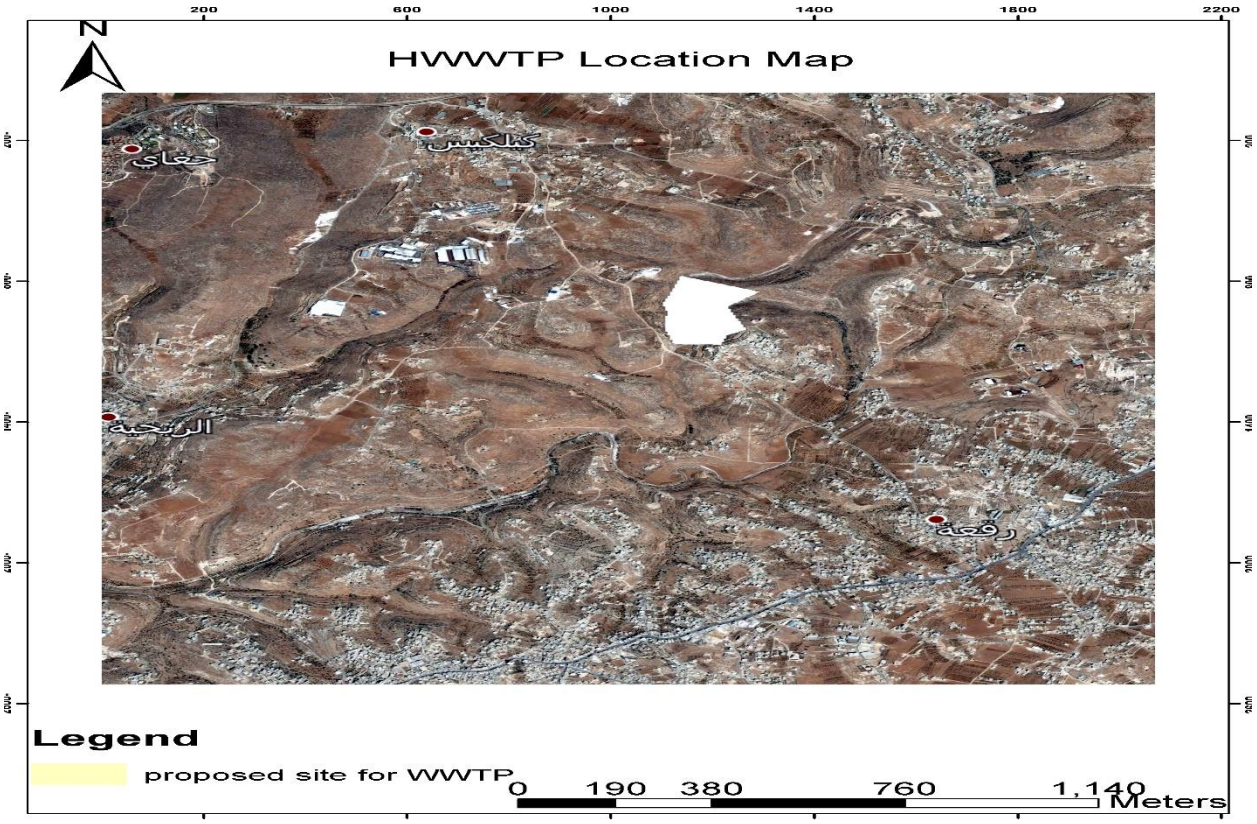


Figure 1.1: Location of the study area (Wadi-Samen) in Hebron/Palestine[4].

1.8.2. Project Duration

Started in Febreuary 7th , 2020

ended in _____

1.8.3. Implementation Phases Of The Project

1) Initial Environmental Examination (IEE).

2) The full scale Environmental Impact assessment (EIA).

1.9. Research Methodology

Environmental and Social Impact Assessment is an organized process in which the expected negative and positive impacts of the project are determined on the physical, vital, and social environment and are evaluated and measures taken to mitigate in the event of unavoidable.

The following parts include the methodologies that we will adopt during the different stages of the environmental and social impact assessment process.

The following sections include the methodologies that the consultant adopted during the different stages of the environmental and social impact assessment process:

1.9.1. Environmental Impact Assessment Methodology

1.9.1.1. General Methodology

The methodology that we will use depends on a semi-quantitative method that depends on points, where the total sum of points indicates the degree of importance of the effect and takes into account the following four factors:

A. Possibility of occurrence

B. Spatial scale

C. Timescale

D. Intensity of impact

A. Possibility Of Occurrence: Table (1.1) shows three levels used to measure the probability of an impact[8]:

Table 1.1: The probability criterion is used to evaluate the impact

Points	The standard
1	The probability of the impact is high or very high, ranging between 75 to 100%.
0.5	The probability of occurrence of medium effects, and the occurrence rate ranges between 25 to 75%.
0.25	The probability of occurrence is low, less than25%

B. Spatial Scale:

The table (1.2) shows the different points and criteria that we will adopt to measure impact taking into account the spatial scale[8]:

Table 1.2: Spatial scale for Impact evaluation

Points	**The standard**
1	The impact area extends for a distance of 1 km2_ within the boundaries of the project site.
2	The impact area extends for a distance of 10 km2 - limited impact area.
3	The impact area extends for a distance of 100 km2 - the impact area extends to the surrounding area.
4	The impact area exceeds 100 km2 - the regional impact area.

C. Time Scale :

The table (1.3) shows the different points and criteria that we will adopt to measure the impact in terms of the expected duration of the impact[8]:

Table 1.3: time scale for impact evaluation

Points	**The standard**
1 (Short term)	The duration of the effect is up to 3 months.
2 (Medium)	The duration of the effect ranges from 3 months to a year.
3 (long term)	The duration of the effect ranges from 3 months to 3 years.
4 (Continuous)	The duration of the effect is more than 3 years.

D. Intensity Of Impact:

Table (1.4) shows the different categories to measure the intensity of the impact exposed and titrated points taking into account the sensitivity of the future[8].

Table 1.4: Intensity of impact

Points	The standard
1 (Neglected)	Environmental changes within the permissible limits of natural changes.
2 (Low)	Environmental changes that exceed the permissible limits for natural changes (the environment is able to fully restore its condition).
3 (Medium)	Environmental changes that exceed the permissible limits of natural changes and result in damage to separate environmental components (the environment remains able to restore its state).
4 (High)	It results from environmental disturbances in components and ecosystems(Some environmental components lose their ability to restore its state).

E. Integrated Evaluation Of Impact: The general evaluation or the total score for the impact studied is calculated as a result of the process of multiplying the spatial scale, the temporal scale, and the impact strength scale. The total points will determine the degree of severity of the effect. The table(1.5) shows the maximum and minimum importance of the effect, assuming 100% probability of occurrence[8]. .

Table 1.5: the maximum and minimum importance of the effect.

Impact scale				Total		
Spatial scale	**Timescale**	**Impact strength**	**Possibility of occurrence**	**Points**	**Points range**	**The importance of impact**
Region [1]	Short term [1]	Countless [1]	1	1	8-1	Little importance
Limited[2]	Medium range[2]	Low[2]	1	8		
Region [3]	long term [3]	Medium [3]	1	27	27-9	Medium importance
Region [4]	Continuous [4]	High [4]	1	64	64-28	big importance

1.9.2. Social Impact Assessment methodology

A methodology was implemented to assess the social impact of the proposed project through the application of rapid research mechanisms in partnership and cooperation with project oversight bodies as well as target groups in the project area As the figure 1.2 shows. A study evaluating the social impact concerned with the representation of the various societal groups targeted from the wastewater treatment plant project, using a number of quantitative and qualitative research tools to collect data and review previous studies and reports related to the project as well as conducting field visits to the project site to assess the basic conditions**.**

1.9.2.1 Data collection

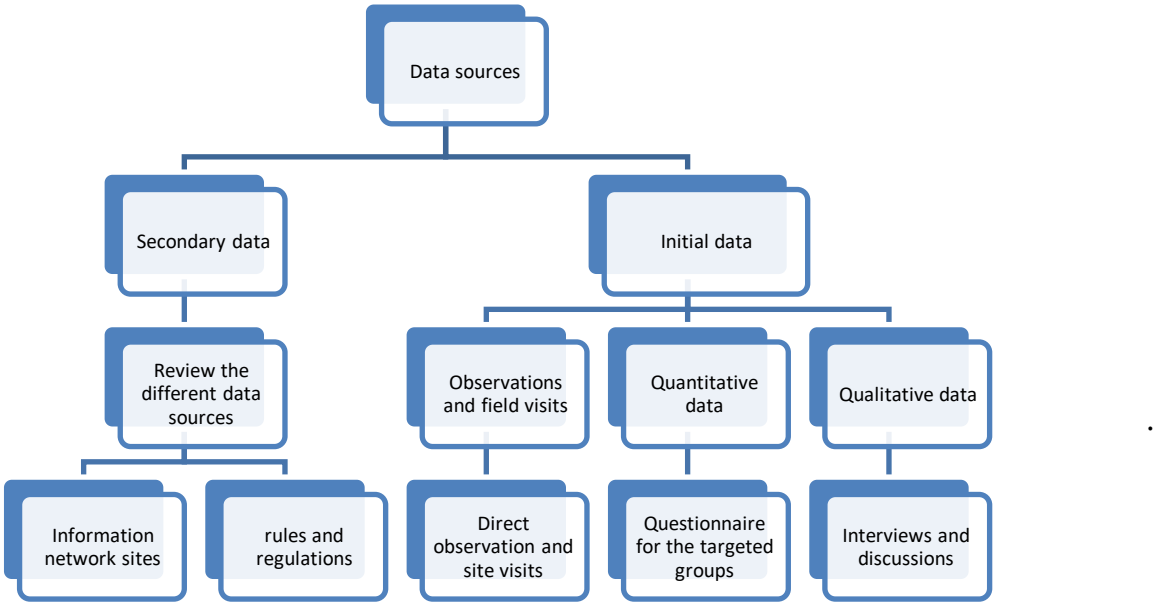


Figure 1.2: shows the methodology of data collection

1.9.3. Cultural and Natural Resources Assessment methodology

Hebron city is rich in cultural, archeological, heritage and natural resources, especially the old city. The project area is far away from the old city and is located mainly in Wadi as-Samen area, which extends south of Hebron. The existing wastewater collection network serves most of Hebron old city whose profile is being nominated to UNESCO's world heritage sites for its archeological, cultural, religious, spiritual and historical values.

This nomination represents a real addition to the project value and addresses the importance of protecting cultural heritage components in Hebron [3].

The Cultural Heritage Impact Assessment (CHIA) for Hebron wastewater management project aims at demonstrating the components of cultural heritage in project area, and illustrating measures of treatment and mediation for those elements before, during and after the implementation of the Hebron WWTP and trunk sewer. The impacts of the project on these are considered and included:

1. Impact on natural resources.

2. Allocating construction camps and project facilities away from natural and archeological resources.

3. Protection and enhancement of the archeological resources as valuable assets.

1.10. Structure of this study

The table 1.6: shows structure of this study

Title	Contents
Chapter one: Introduction and methodology of the study	It contains a brief description of the proposed activities, a summary of the report's structure, and specifies the study methodology.
Chapter Two: The Legal Framework	Determines the legislative, political and administrative requirements that apply to the project.
Chapter Three: Project Description	Includes a detailed description of the project requirements.
Chapter Four: The current environmental and social situation	Describes the current environmental and social conditions in the project area.
Chapter Five: assesses the environmental impact	It describes the potential environmental and social impacts of the proposed project, describes the process and outcome of the evaluation, and describes mitigation and monitoring measures and actions.
Chapter Six: Analyzing Alternatives	Describes and evaluates project alternatives.
Chapter Seven: Environmental and Social Management and Monitoring Plan	Describes the environmental and social management and monitoring plan.

1.11. Action plan

The table 1.7: shows Action plan for the project in the first semester &second semester

TASKS	1st Month				2nd Month				3rd Month				4th Month				5th Month			6th Month				7th Month		
	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 2	W 3	W 4	W 1	W 2	W 3	W 4	W 1	W 2	W 3
Identification of Project Idea																										
Literature Review																										
Field visits																										
Documentation																										
Discussion in the Semester																										

Chapter 2

LAWS AND REGULATIONS RELATING ENVIRONMENTAL, ,SOCIAL AND CULTURAL HERITAGE CONSIDERATIONS

2.1. introduction:

The first Palestinian environmental law came into existence in the year 1999 after being approved by the late PA president Mr. Yasser Arafat after passing in the "Palestinian Legislative Council (PLC) and is called "Law No. 7 on the Environment.

It is actually a general legal framework for environmental protection, comes in five sections, includes eighty two articles, and covers environmental protection and management aspects[5].

In addition, a set of laws with relevance to environment matters have been enacted by the PLC, As shown in the table 2.1: which are basically sector based laws but covers environmental protection matters in their scope of relevance in that specific sector.

Table2.1: Sectoral laws with environmental implications and relevance (PLC, 1997 – 2004).

Law	Year of Enactment
Law no. 20 of Public Health	2004
Law no. 3 of Agriculture	2003
Law no. 3 of Water	2002
Law no. 1 of Natural Resources	1999
Law no. 8 of Livestock Protection	1998
Law no. 15 of Industrial Estates and Free Industrial Zones	1998
Law no. 1 of Local Bodies Councils	1997

Concerning the specific context of environmental impact assessment, Palestine has what is considered as a framework enabling law for the EIA system which is the Palestinian Environmental Law of the year 1999, and a more detailed specific law or regulation, which is the Palestinian EIA Policy of the year 2000[5].

In addition to these two legislative provisions, Palestine has a commitment to what have been agreed upon in the Oslo II accords with Israel in relation to environmental protection and specifically adopting EIA as an effective environmental protection management tool.

Yet, an earlier emergency natural resource protection plan was formulated that linked land use zoning with a set of classified requirements for using EIA to obtain environmental approvals for development projects.

2.2. EIA System and Administration:

2.2.1. Palestinian Environmental Law

The Palestinian environmental legal and administrative framework has taken major strides towards protecting environmental resources and institutionalizing their sustainable management. The Palestinian Environment Law (PEL) is comprehensive covering the main issues relevant to environmental protection and law enforcement[3].

Among the objectives of the PEL are:

_ Protecting the environment from all sorts and types of pollution.

_ Protecting public health and social welfare.

_ Incorporating environmental resources protection in all social and economic development plans and promote sustainable development to protect the rights of future generations.

_ Conserving ecologically sensitive areas, protecting biodiversity, and rehabilitating environmentally damaged areas.

_ Setting inter-ministerial cooperation regulations and standards various environmental protection areas and jurisdictions.

_ Promoting environmental information collection and publication, public awareness_ education and training.

The PEL addresses various environmental issues including:

_ Management and protection of various resources. Issues covered are related to land environment, air environment, water resources and aquatic environment, and natural, archeological, and historical heritage protection.

_ Environmental Impact Assessment (EIA) and auditing, permitting of development projects, monitoring of environmental resources and their parameters.

Penalties to be applied in case of violation of any article presented under the law._

_ Other issues addressed by the legislation include emergency preparedness, public participation, research training and public education.

2.2.2. Palestinian Environmental Assessment Policy

The policy was granted approval from the Palestinian cabinet on 23rd of April under decree no. 27-23/4/2000 as the first detailed legislation on EIA 2000. This Policy shall be interpreted and implemented to support the sustainable economic and social development of the Palestinian people through assisting in meeting the following goals[5]:

1. Ensuring an adequate standard of life in all its aspects, and not negatively affecting the basic needs, and the social, cultural and historical values of people as a result of development activities.

2. Preserving the capacity of the natural environment to clean and sustain it.

3. Conserving biodiversity, landscapes and the sustainable use of natural resources.

4. Avoiding irreversible environmental damage, and minimizing reversible environmental damage, from development activities.

2.2.3. Palestinian Environmental Strategy

In 1999 MEnA developed the Palestinian Environmental Strategy (PES) as a basis for environmental action at that time over a ten-year period. The objective of the strategy was to identify and analyze the main environmental problems and their causes in Palestine and define environmental targets and to present a series of prioritized measures that will help to reach these targets. The strategy identified environmental issues, strategic objectives, and priorities at the national level. In addition, the PES included a work plan that translates the needs and gaps to projects and interventions, as well as monitoring indicators to measure the progress.

The environment sector strategy of March 2010 constitutes one of 18 sectoral strategies and five cross-sectoral strategies as an essential entry point towards the development of the overall Palestinian national plan for 2011-2013. The environment sector strategy covers 6 strategic goals and its implementation would require, among other things, the monitoring of the environmental conditions in Palestine and the enhancement of public awareness of the people regarding environmental protection and conservation[3].

2.3. Laws and Regulations relating to Preservation of Cultural or Historical Assets:

2.3.1. The Inventory of Cultural and Natural Heritage Sites of Potential Outstanding Universal Value in Palestine.

This Inventory was published in 2005 and was prepared by the MoTA with a technical assistance of UNESCO world heritage center and UNESCO Ramallah-Office.It contains 20 sites of cultural and natural potential universal value. The cultural heritage components of Hebron are classified under the site: “Palestine, the Lands of Olives and Vines”. The sites incorporated in this inventory can be nominated to be inscribed on the world heritage list.

2.3.2. The World Heritage Convention

The decisive step towards cultural and natural heritage protection at an international level was taken during the 17th UNESCO general conference held in Paris 1972, during which the "The Convention Concerning the Protection of the World Cultural and Natural Heritage" was approved. The preoccupation of this convention was that human heritage is increasingly and visibly threatened by destruction, not only due to conventional decay, but also because of the change in social and economic circumstances. Therefore, at least the cultural and natural heritage sites of special and universal significance should be listed and preserved as the world heritage of all of Efforts to protect[3].

mankind which led to the birth of the "World Heritage List cultural heritage in the Palestinian context are continuously increasing. The vulnerability of cultural heritage assets entails preparing an assessment of adverse effects before the inception of any development project undertaken for the enhancement of the quality of life. This project is an example were measures to evaluate impact of large projects on environmental, cultural and social aspects are being implemented in the light of lacking Palestinian laws that may require such measures.

2.4. Laws and Regulations relating to Environmental Management:

The Public Health Law No 20 for 2004 has articulated that it is part of the Ministry of Health's tasks and authorities is to license the establishments specialized in waste collections, method of waste treatment, and disposal. It also states that it is under the ministry of health's authority in cooperation with the competent authorities to specify the rules and conditions of transferring, saving treatment or disposal of the hazardous waste. No one is allowed to do what is stated here above unless it is in accordance with the conditions and rules[3].

The PEL No. 7 for 1999, under the third chapter, required from the MEnA to follow up the implementation of decisions which are issued concerning the environmental impact through cooperation with the competent authorities.

2.5. Institutional Arrangements

2.5.1. Ministries and Organizations

There are a considerable number of Ministries and Organizations involved in the reuse of treated wastewater for agricultural use. A set of standards has been produced to provide the basis for the treated wastewater standards for various crops. These standards are comprehensive and imply that a high standard quality control of the effluent will be essential in the management of effluent irrigation. The MoA will be the primary ministry involved but the PWA, the MoH and the WWTP operator will all have a significant input.

In addition, due to the fragmented nature of farming in the area.Water User Associations will be necessary in order to co-ordinate the efficient use of the effluent and to facilitate the implementation of an appropriate irrigation structure[3].

The specific involvement of different actors is as follows:

The Ministry of Agriculture (MoA): has the primary responsibility to license and to monitor the use of effluent for irrigation. Quality standards for reuse to be imposed. The MoA will also have the primary role in setting up irrigation systems and coordinating groups of farmers.

The Palestinian Water Authority (PWA): has wide ranging power to influence the design, operation, monitoring and control of WWTPs. It should establish appropriate departments to ensure compliance with the licensed performance of the WWTP.

The Ministry of Health (MoH): will have over-riding power to monitor irrigation programmes to ensure that the health of the community is safeguarded Close liaison with the farming community will be necessary to ensure any produce irrigated with effluent is safe for human consumption.

Hebron Municipality: the anticipated WWTP operator has the primary responsibility to ensure that the effluent quality meets the strict quality standards required and to take corrective action if problems arise.

The Ministry of Labor: (MoL) and cooperatives ,since registration of the WUA is within the frame work of ministry of labor and cooperative.

Ministry of/Planning: (MoP) and finance economic and financial appraisal of projects; and cost/benefit analysis, financing, criteria for subsidizing, etc.

CHAPTER THREE

PROJECT DESCRIPTION

3.1. Project Background

The number of residential communities connected to a sewage system in the Hebron Governorate is only 6, About 7.3% of the total population of the governorate, and it is worth noting that about 92.7% of the population depend on sewage disposal on cesspits and open channels [1]. The main wastewater stream in the Hebron Governorate flows in Wadi Al Samen, as sewage flows from the city of Hebron and its environs towards the city of Yatta through this valley. At present, there is no wastewater treatment plant at the end of the sewage network, the area served by the current sewage system is characterized by the presence of several stone and marble cutting industries that also discharge their wastewater into the sewage system. This leads to high concentrations of sawdust in wastewater reaching sewers and ultimately the wadi.

This untreated wastewater eventually flows along Wadi as-Samen south towards the green line, causing environmental damage to the eastern aquifer and to the communities along the Wadi. This was identified as a serious issue as far back as the 1970's, and plans for a regional solution for the wastewater for Hebron city and the surrounding communities were developed but were not implemented due to lack of funding.

The proposed HWWTP aims to achieve the following objective:

- To provide treatment to wastewater collected in the City of Hebron sewer system so that discharges meet current effluent discharge criteria.
- To protect the environment downstream of the plant including the eastern aquifer, from the discharge of untreated wastewater as currently exists.
- To generally improve the health and well-being of the residents along the Wadi as-Samen.
- To provide treated wastewater capable for use in irrigation so as to supplement the current water resources in the area.
- To reduce the annual wastewater treatment charges by the Israeli occupation to the Palestinian Authority (PA).

3.2. Project Data

3.2.1.Site Description

Wadi Al-Samen is located above an outlet area that works to feed the eastern subterranean basin. This valley starts from the Al-Haila region in the north of Yatta and runs through Wadi Al-Sada and Wadi Abu Al-Foul to Al-Dhahirah and then the Negev. About 2,300,00 cubic meters per year of wastewater [2] is discharged through the main line of Hebron in Wadi Al-Samen . The environmental impacts of dumping wastewater into the environment through Wadi Samen do not stop at the borders of the city of Yatta, south of the city of Hebron, but also affect the entire Hebron Governorate. Wastewater affects soil fertility by damaging its components. It is estimated that the area affected by wastewater flowing in Wadi Al-Samen is 500 dunums. The olive trees constitute 90% of the affected crops, while the tonsils and vegetables constitute 10% of these crops[2] .The negative effects resulting from the flow of wastewater through Wadi Samen are the emission of bad smells and the spread of harmful insects, as well as the expected effects on the soil and its ecosystem through the accumulation of salts and solid materials In the soil.

3.2.2. Site Selection For HWWTP

Four sites were evaluated as potential locations for wastewater treatment and reuse facilities in the Governorate, which are:

Al Dahriya Site:
The Ad Dhahriya site is located approximately 4km southeast of the town of ad Dhahriya and 2 km north of Khirbat Zanuta . Its located in abroad curve of the Wadi al Nar (Al Khalil). The Wadi opens into a flat valley that is potentially suitable for construction works. The site area is relatively unpopulated, and natural vegetation is degraded and sparse.

Yatta Site:
The Yatta site is located 5 to 6 km west of the town of Yatta . the area is relatively flat and is classified as high to moderate value agricultural land . Various residences, businesses and agricultural activities occupy the area. Natural vegetation in this area is moderately dense and diverse, including trees as well as grasses and shrubs.

Hebron Site:
The Hebron site is located 2 to 3 km south of Hebron city . the area has fairly flat topography and is classified as high to moderate value agricultural land. Residences, businesses and intensive agricultural activities occupy the area. The purchase price of the land is therefore high. Natural vegetation in the area is dense and diverse with trees in addition to grasses and shrubs and agriculture.

Bani Na'im Site:
Located southeast of the town of Bani na'im outside the boundary line of the Hebron natural basin , the site is 9 to 10 km southeast of Hebron city . The site is located in a remote unpopulated area and is classified as low value agricultural land. The site is approximately 1.5 km from the Hebron municipal solid waste dumpsite .the landscape has dramatic character, from pronounced topographical and geological variation.

3.2.3.Reasons For Choosing The Site

The recommended site for HWWTP is Hebron site which is located 4 km south of Hebron city and 700 m from the nearest residence. The site coordinates are 98,500 North, 160,000 East (Figure3.1)[3].

The following points clarify the basis of Hebron site selection:

-Land acquisition as afore mentioned.
-The distance from neighbours/ few neighbours.
-Natural landscape of the wadi.
-Institutional capacity, Hebron Municipality has the ability to manage and operate HWWTP after construction.
-The proposed site is near to the existing sewer collection system.
-The proposed site will contribute to solve pollution problem of the wadi caused by stone cutting industries, mainly the slurry.
-The industrial wastes generated from the industrial area in Hebron city will be separated from the municipal wastes.

- The readiness of stone cutting industries to reuse treated wastewater in their industries.

In conclusion, the site as acquired for the HWWTP is suitable for construction of the facility notwithstanding the land preparation difficulties that may occur due to the big elevation differences observed.

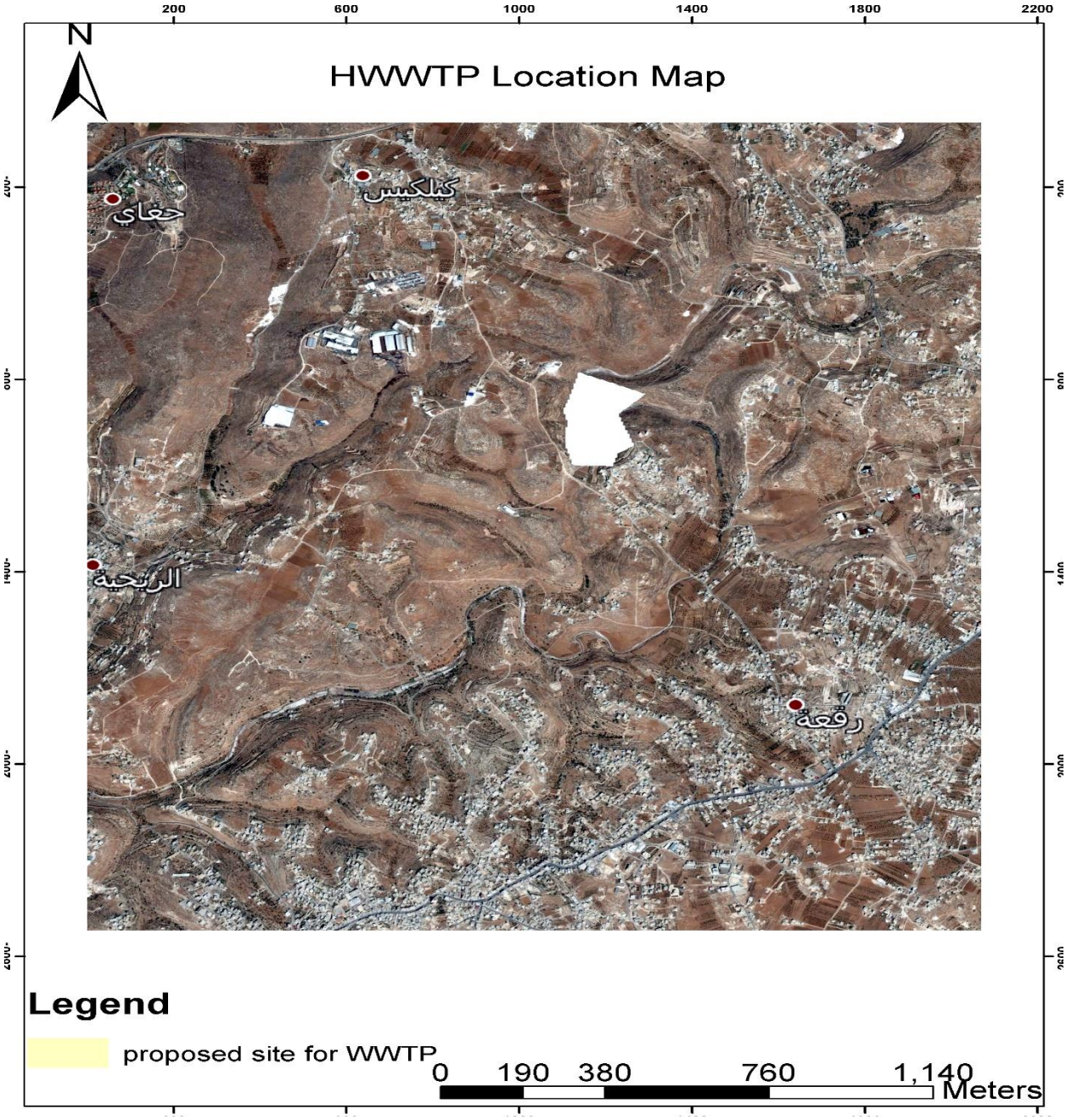


Figure 3.1 : HWWTP Location Map

3.2.4. Project Activities

- Establishing a wastewater transport channel about 2 km long to mitigate the impact of the current flow on the surrounding communities.
- Establishing 3 wastewater treatment units with daily production capacity (treatment) of 100 cubic meters.
- Providing the local community with pipes for transporting treated water in order to distribute it on agricultural lands and use them to irrigate crops.
- Holding training sessions for local authorities on wastewater management.
- Create an association to follow up and manage the treatment units intended.

3.3. Design Criteria

3.3.1. Connected Population Equivalents

155,842 persons are considered already connected to the sewer system in 2012. This is expected to increase to 225,580 by 2027 due to natural growth in the community alone without installation of new sewers. The connected population as proposed for design is illustrated in Table (3.1) .

Table3.1 Projection of Connected Population

Parameter	2012	2015	2020	2025	2027	2030
Connected Population based on growth rates from the PBCS	155,840	169,800	193,990	216,820	225,580	239,990

3.3.2. Wastewater Generation

The Q mean is assumed to amount to 10,535 m^3/d in 2012 and to reach 15,200 considering population increases but with minimal increases in per capita water consumption rates. The projected mean daily flows are further illustrated by Table (3.2).

Wastewater flow varies according to the season of the year, weather conditions, day of the week, and time of the day. Diurnal peak factors describe the ratio between daily maximum and average flow. Given these actual measurements and considering the relatively large service population in Hebron, a peak factor of 2.5 which is consistent with the published figures and the monitored flows, was proposed for the HWWTP. This diurnal peaking factor gives rise to the diurnal peak flows as shown by Table (3.2).

Table 3.2 : Projection of Mean and Diurnal Peak Wastewater Flows

Parameter	2012	2015	2020	2025	2027	2030
Daily Mean Flow to the HWWTP - m3/d	10,535	11,480	13,110	14,660	15,200	16,180
Diurnal Peak Flow to the HWWTP - m3/d	26,340	28,700	32,780	36,650	38,000	40,450

3.3.3. Specific Wastewater Pollution Loads

The specific wastewater loads as indicated in (Table 3.3) are recommended.

Table 3.3 : Specific Wastewater Loads

Parameter	Value (g pcd)
Specific BOD load	40
Specific COD load	140
Specific TSS Load	60
Specific TN load	10.8
Specific TP load	1.9

3.4. Project Stages

The proposed Hebron wastewater management project constitutes of three phases:

• Phase I: Design and implementation of a wastewater treatment plan, and the design and implementation of a major 1 km long sewer trunk line, to transport wastewater from the sewage network in the city of Hebron down to the location of the proposed WWTP.

• Phase II: reclamation of infrastructure in agricultural land, through re-use of treated effluent and solid waste for agricultural purposes. A reservoir will be built to collect treated effluent to be used for irrigation in the summer season. Approximately, 4,000 acres of agricultural land will be irrigated in the region, which include the plains of Yatta, Wadi as-Samen, in addition to Al Frejat area in winter season. The second phase also includes the design and construction of water transmission lines from the treatment plant to nearby reclaimed agricultural land.

• Phase III: building the necessary capacity for management, coordination and evaluation of the project by the establishment of a Project Implementation Unit (PIU). By time a full financial support is secured, only the first phase of the project will be implemented.

3.5. Project Components

Phase I of the proposed project includes the design of a WWTP for the city of Hebron, in addition to a major sewer trunk line (about 1 km and 1.5 meters in diameter) [9] for the transfer of sewage from the network in the city of Hebron down to the proposed treatment plant site. It is agreed that the access road and the sewer line and the entire required infrastructure will be constructed alongside the Wadi. And the local community (that their lands will be affected) voluntarily provided their lands for this purpose.

The proposed site of the WWTP is located around 4 kilometers to the south from the city of Hebron within its municipal boundaries in Al- Haila area. The proposed site is relatively flat and is subject to flooding in winter (Flood Plain).The location is not directly surrounded by residential areas, where the nearest residential community is about 400 m areal from the proposed site for the treatment plant [9] . The proposed site includes about 110 dunums of agricultural land owned by the PWA[9].

The proposed WWTP will consist of the following main parts:
• Screw Pump.
• First Screening.
• Grit Chamber.
• Primary Sedimentation Tanks.
• Basins Ventilation Aeration Tanks.
• Secondary Sedimentation Tanks.
• Secondary treatment sludge Thickener Secondary Sludge Thickener.
• Anaerobic Digester.
• Sludge Dewatering.
• Effluent Building.
• Gas Complex.
• Maintenance and Administration Buildings.

The sewer trunk line will be designed to flow by gravity where possible, and will be lined along the course of the valley until the proposed site for the WWTP. The design will be based on the amount of wastewater flowing from the sewage network of the city of Hebron, and will take into account the storm water that flows directly into the network.

The WWTP will be designed to serve the residents of Hebron initially by the population projections for year 2027, which is about 260,000 beneficiaries equivalent to 15,000 m3 in the first phase [9]. In the future, the project aims at serving the neighboring communities of Yatta, Al Fawwar Camp, Hadb Al Fawwar, Halhoul, Bani Na'im, Al Rihiyyeh. in addition that the industrial activities in the southern region of the city of Hebron, such as stone cutting facilities, slaughterhouses and tanneries will not be connected to the proposed treatment plant .

3.6. Treatment Alternatives

Wastewater treatment options evaluated included:

• Conventional Activated Sludge (CAS) : which refers to a system with primary and final sedimentation in which the activated sludge volume can be developed for various activated sludge processes such as the Modified Lubzack Ettinger (MLE) approach.

• Extended Aeration (EA) **:** which refers to an activated sludge system without primary sedimentation and designed for nitrogen removal by simultaneous nitrification and denitrification.

• Membrane Bioreactor (MBR): which refers to an activated sludge system with nitrification and denitrification in combination with a membrane filtration process instead of final clarifiers.

the treatment processes were evaluated based on their potential to consistently meet these standards:

 Biological Oxigen Demand (BOD5) : 20 mg/l
 Total Suspended Solids (TSS) : 30 mg/l
 Total Nitrogen (TN, as nitrogen) : 30 mg/l later increased to 50 mg/l
 Faecal E-coli bacteria : 200 MPN/100 ml .

3.6.1.Multi Criteria Evaluation

A Multi Criteria Evaluation (MCA) of the three treatment alternatives was conducted to identify a preferred treatment approach. For the MCA, the following steps were applied:

• Identification of Criteria to be used for comparing alternatives.
• Rating the alternatives for each selected criterion from 0 to 50 points.
• Providing Weighting Factors for the Criteria since not all criteria in a MCA have the same importance. For this task, the weight factors were established during a workshop with stakeholders at the Consultants office in Ramallah.
• Developing a weighted score by multiplying the ratings by the weight factors.
• Comparing the weighted scores.
• Identifying the recommended alternative.

The following criteria were used in the evaluation:

• Costs
  - Investment costs.
  - Operation and maintenance costs.
• Suitability of Process for use in Hebron
  - Start-up and operation.
  - Maintenance and durability.
  - Process stability.
  - Land use.

- Flexibility for modification and expansion in the future
  - Flexibility to expand plant for future increasing loads and effluent requirements.
  - Flexibility to expand plant for future increasing flows.
- Environmental Issues
  - Energy and chemical use.
  - Odor emissions.

The Conventional Activated Sludge (CAS) treatment process obtained the highest total scores (Figure3.2) and was recommended as the preferred option for the HWWTP

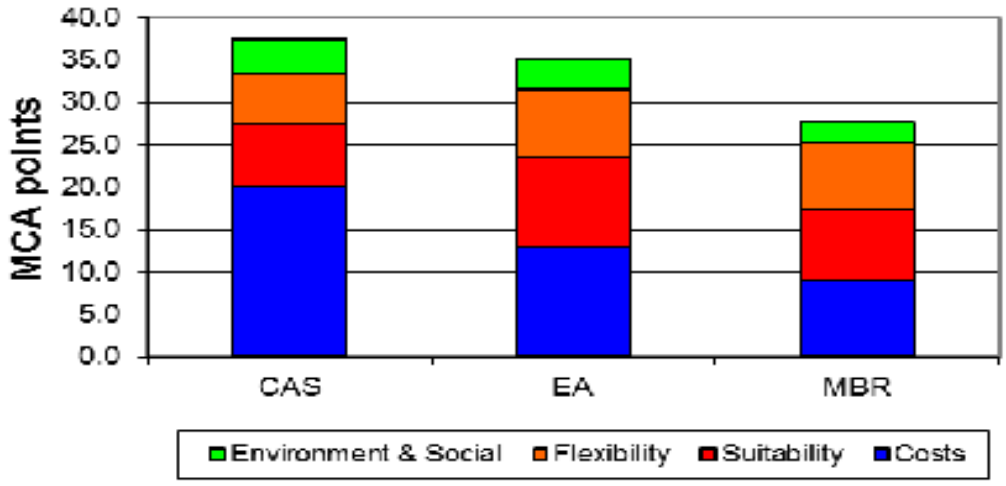


Figure3.2 : Weighted Scores for Treatment Options Evaluated [3].

3.6.2. Recommended Option - Conventional Activated Sludge

The type of activated sludge system recommended for the HWWTP is a proven technology. Nitrification and denitrification is achieved by internal recirculation of mixed activated sludge and wastewater through aerobic and anoxic zones in the activated sludge basin. Sludge stabilization for both primary and secondary sludge is achieved by external aerobic or anaerobic sludge stabilization.
The conventional activated sludge system consists of the following main elements as shown in Figure(3.3):

- screening of the incoming wastewater (coarse screen followed by 6 mm screens) and grit removal to remove coarse material and grit.
- primary sedimentation of wastewater to remove a significant fraction of the organic material.
- biological treatment of wastewater in an activated sludge system with defined aerobic and anoxic zones, designed to remove organic matter and nitrogen.
- treated wastewater and sludge are separated in a final sedimentation tank.
- effluent is disinfected.

- Primary and secondary sludge are thickened, stabilized separately by aerobic or anaerobic technology, dewatered and then disposed of .

- The purpose of primary sedimentation in conventional activated sludge systems is to:

  • reduce the load of organics to the biological reactor to decrease the footprint and save energy for aeration.

  • produce primary sludge that can be anaerobically digested for biogas production.

  • Chemicals other than polymer for dewatering of sludge are not required for this treatment alternative.

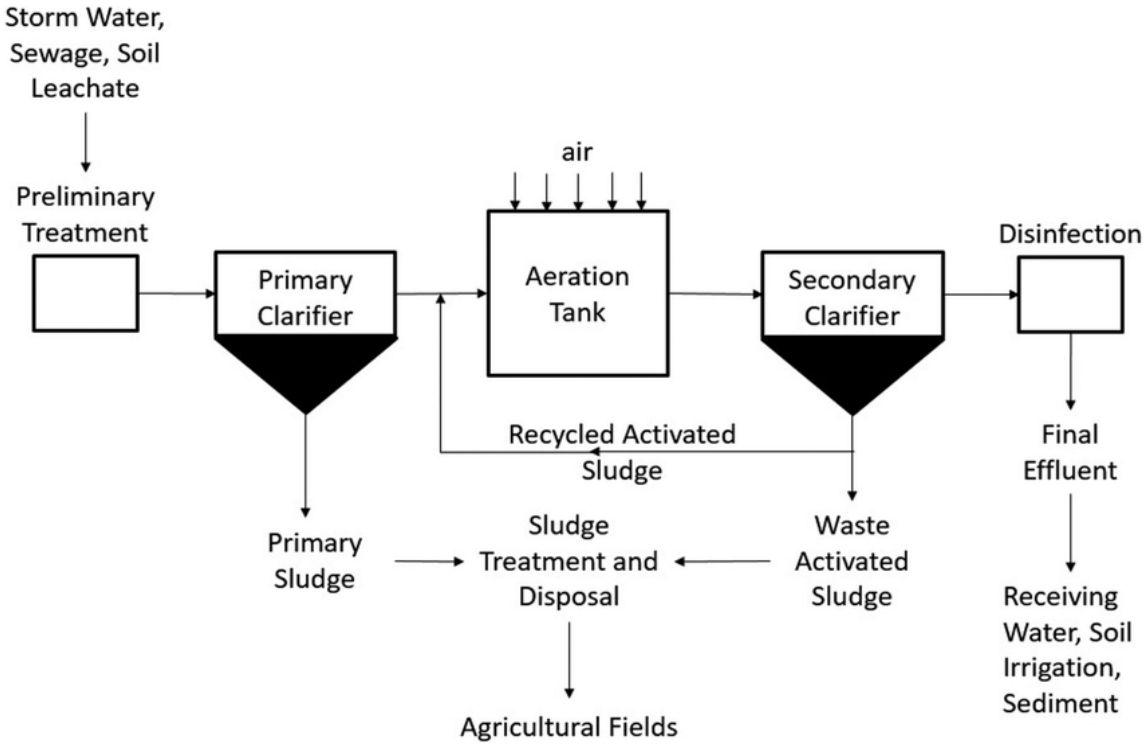


Figure 3.3: Schematic Process of Conventional Activated Sludge system[10].

3.7. Wastewater Treatment Plant Design

Based on the multi-criteria analysis Conventional Activated Sludge (CAS) including anaerobic sludge stabilization results A short description of the design process is provided in the following sections:

3.7.1. Intake and Primary Mechanical Treatment Design

Given the specific setting on the proposed site, it is concluded that the existing sewer will have to be extended as shown on Figure . Given the proposed alignment of the main trunk sewer alongside Wadi as-Samen, the outfall at the end of the pipe will be at an elevation lower than the

proposed plant. Therefore, it will be necessary to construct a pump station to lift the incoming wastewater to the head of the treatment works.

Facilities will then be so located that flow through the plant will be by gravity with no need for additional pumping of the wastewater flow stream during treatment. The actual pump head will vary depending on the final elevation of the proposed treatment works, but at this time the pumping head is estimated at about 25m.

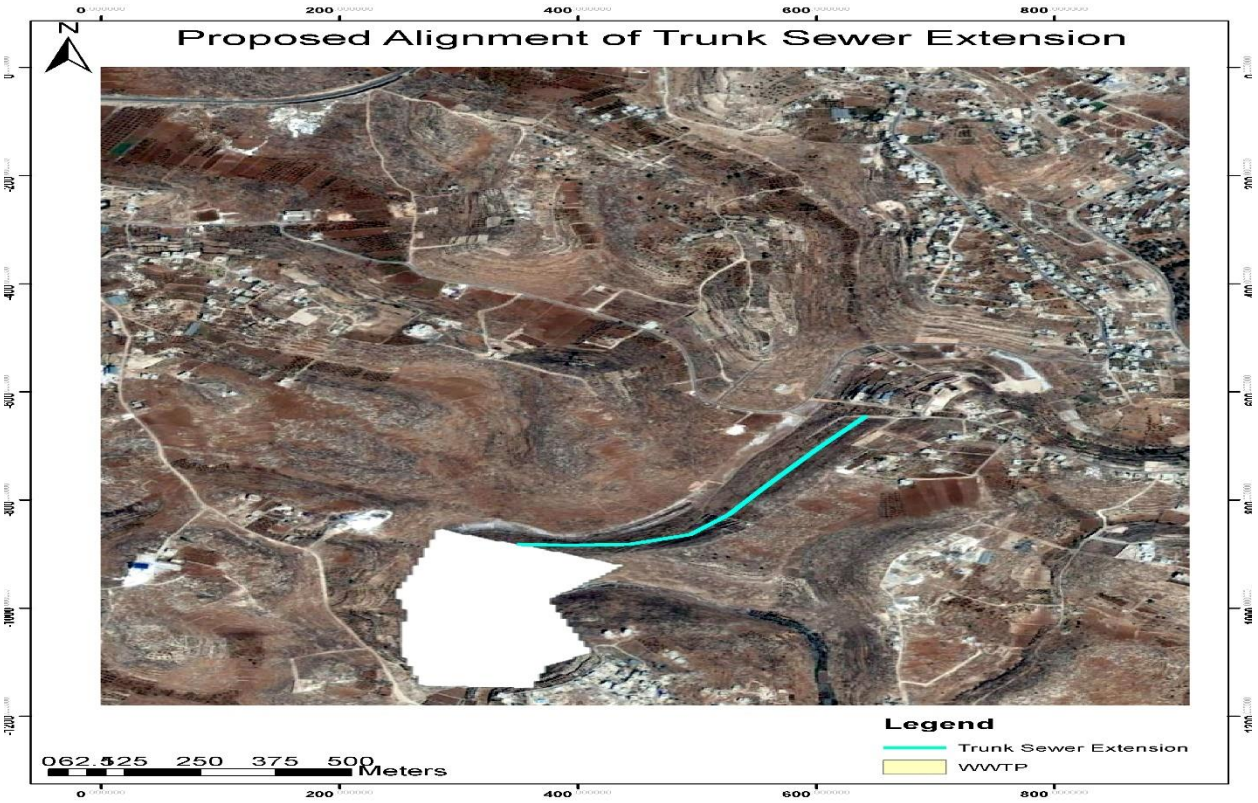


Figure 3.4: Proposed Alignment of Trunk Sewer Extension .

Only the maximum flow (diurnal peak flow) to be treated will be lifted. Excess flows (mainly excess rainwater and diluted wastewater) overflow to the Wadi. It is recommended to design the sump and the lifting main for the future final situation.

To prevent the pumping station from damage, a coarse screen will be located in the pump sump. The screen has to be cleaned manually.

The lifted wastewater passes through fine screens; with a bar spacing of 6 mm. Screens will be automatically cleaned. Screenings will be dewatered and collected in containers, for disposal in Al-Menya landfill.

Finally the water flow is delivered to the primary sedimentation tank, designed for the removal of solids and organic matter. This completes first stage treatment, with removal of about 50% of solids and 40% of organics. Nitrogen is hardly removed.

Settled primary sludge will be conveyed to the primary sludge thickener, and subsequently pumped into the digester. Overflow water from the thickener will be returned to the screens .

3.7.2. Biological Treatment

Biological treatment will use the activated sludge system. In order to achieve sufficient level of nitrogen removal, anoxic and oxic zones are to be included, and wastewater has to pass both zones repeatedly. This can be achieved by either introducing an internal recirculation system using pumps, or by configuring the activated sludge basins as carrousel type and make use of propellers.

Oxygen will be provided through compressors and fine-bubble aeration. This type of aeration is most energy-efficient, in particular now the activated sludge basins will be quite deep (5.5 meters effective water depth).
Oxygen will be provided through compressors and fine-bubble aeration. This type of aeration is most energy-efficient, in particular now the activated sludge basins will be quite deep (5.5 meters effective water depth).

Activated sludge is separated from the effluent in final sedimentation tanks. Most settled sludge will be returned to the activated sludge basins. Excess sludge is pumped to the secondary sludge thickeners. Thickened sludge will be pumped into the digesters, while the overflow water is returned to the activated sludge basins.

3.8. Wastewater Reuse Scheme

It is proposed that most of the treated wastewater from the HWWTP be reused in agriculture with the long term objective of zero discharge of treated flows to the Wadi. Currently, there are limited irrigation systems within Hebron and the adjacent communities. Therefore, reuse of the treated wastewater will require installation of new irrigation systems and training of farmers in the reuse of treated wastewater (TWW).

3.8.1. Potential TWW Reuse locations

Two-tier irrigation system in which different irrigated areas and cropping patterns were developed for a ”core” area that is irrigated throughout the year and an additional area for winter irrigation, when irrigation demands are less. The following lands were identified:

- CORE AREA 1 – The lands along Wadi as-Samen, Currently, the raw waste water in Wadi As-Samen is used for irrigating lands along the Wadi although this is prohibited by law and current regulations. This suggests that farmers in the area are looking for water and the treated effluent will be highly demanded and utilized in this area. Therefore this area was identified as a potential core area for irrigation (Figure 3.5).

- CORE AREA 2 – The “Yatta Lands” southeast of Yatta: the Yatta Lands, which were identified as a potential core area and also by area farmers as a suitable area for irrigated agriculture, were selected as the second core area for irrigation and with about 400 hectare available for irrigated agriculture as per the Wadi as-Samen lands (Figure 3.6).

Figure 3.5: Core Area 1 - Lands along Wadi as-Samen[3].

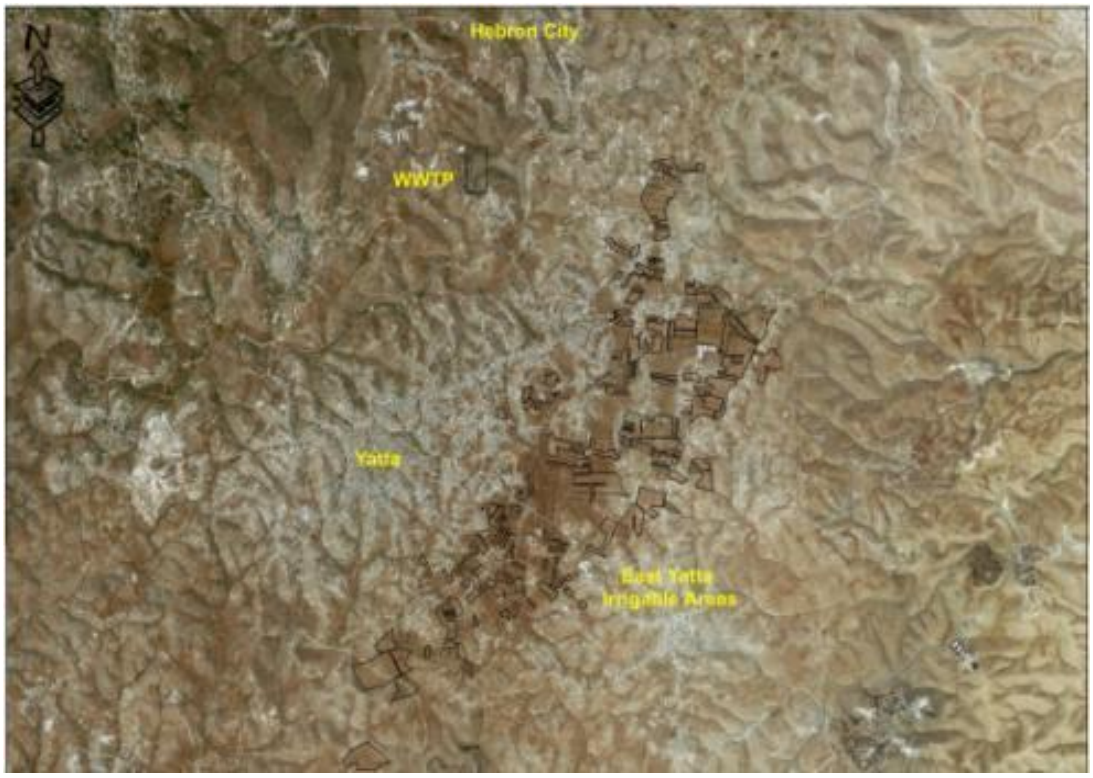


Figure 3.6: Core Area 2 - Routing of reclaimed water force main for Yatta lands[3].

• WINTER AREA– The Al-Furejat Lands: there are available large plains at the bottom of Wadi as-Samen in the Al-Furejat area about 40 km from the HWWTP, which are considered potential TWW irrigated areas during the winter months. These lands were therefore identified as the potential winter reuse area (Figure 3.7).

Figure 3.7: Winter Area - Location overview of Al-Furejat Lands

3.9. Biosolids Handling, Treatment and disposal

Is determined the requirements for two different classes of biosolids that can be applied to land: Class A and Class B. Class A biosolids are suitable for application on agricultural lands, Class B biosolids can be applied in forestry area or used for fertilization of fodder production and industrial crops.

The difference between the two classes is defined by three parameters:

- The concentration of pollutants like heavy metals;
- The concentration of pathogens (bacteria, parasites, viruses);
- The attractiveness of the biosolids to disease transmitting vector organisms, like rats, rodents, mosquitoes and other insects.

Based on information available, it appears as though the MoA will not allow the use of Class B Biosolids on agricultural land and only composted biosolids will be permitted. In general, composting leads to development of Class A Biosolids.

Pollutants like heavy metals are generally incorporated in biosolids and cannot be removed by economically feasible technologies. The pathogens can be removed by a combination of temperature and residence time. Vector attraction reduction can be met using sludge stabilization methods and irrespective as to whether the biosolids are reused as Class A or Class B, stabilization is required.

3.9.1. Biosolids and Sludge Treatment Options

Prior to disposal, biosolids must undergo a number of additional treatment processes as shown on Figure 3.14. In general, all biosolids must be stabilized before further processing even though lime stabilization and some forms of composting may be carried out with unstabilized sludge as shown on the figure. Note that stabilized sludge may also be used in these processes.

The US EPA recommends a number of methods for sludge stabilization to meet Class B requirements which include aerobic stabilization for 40 days at 20°C and anaerobic digestion at 30-40 °C for approximately 15 days. Biosolids from an extended aeration plant which are considered to be stabilized due to the long aeration times, do not meet Class B requirements and need additional treatment to satisfy this criterion. Class A biosolids can be obtained by anaerobic or aerobic technologies that combine high temperature (> 55°C) and adequate residence time .

The unit processes which may be used for biosolids treatment prior to disposal are shown on Figure(3.8) .

In this stage of the project biosolids are stabilized through thickening and anaerobic digestion and then land filled, as use of biosolids is still not permitted. Also at a later stage the option of co-composting of biosolids from sewage is further investigated. The Biosolids wastes will be transfer to Menya Landfill where is located around 32 km away from the WWTP location. The cost of transporting Biosolids wastes to the landfill is estimated 40 US $/ton. This is equivalent to 140,000 US $/year.

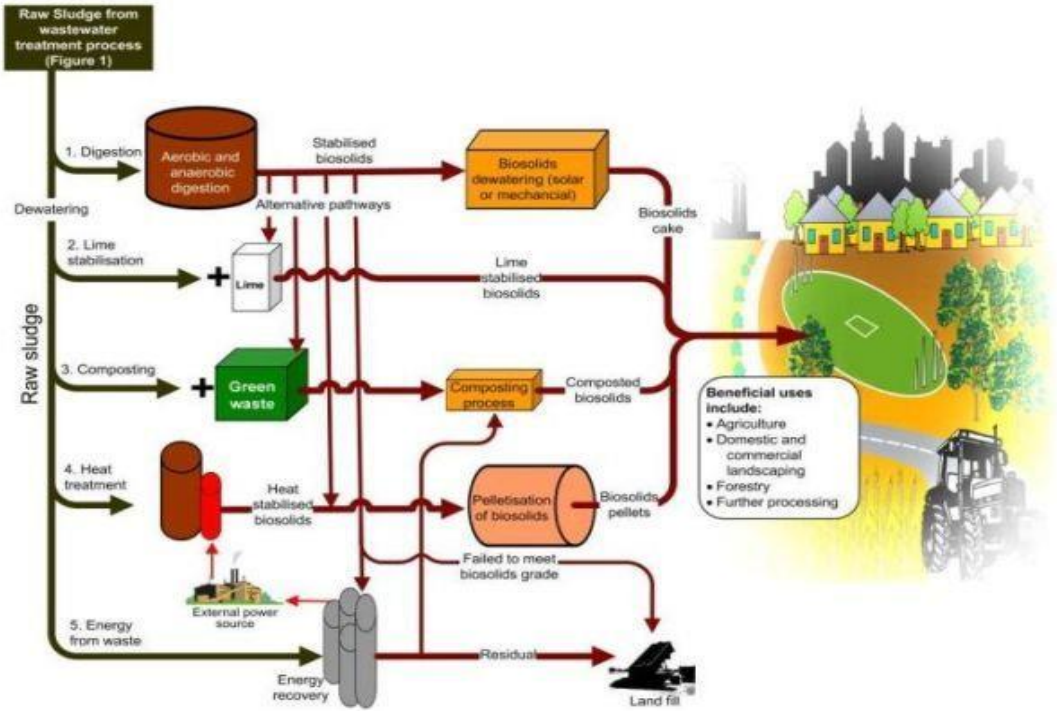


Figure 3.8: Biosolids Disposal Options[11].

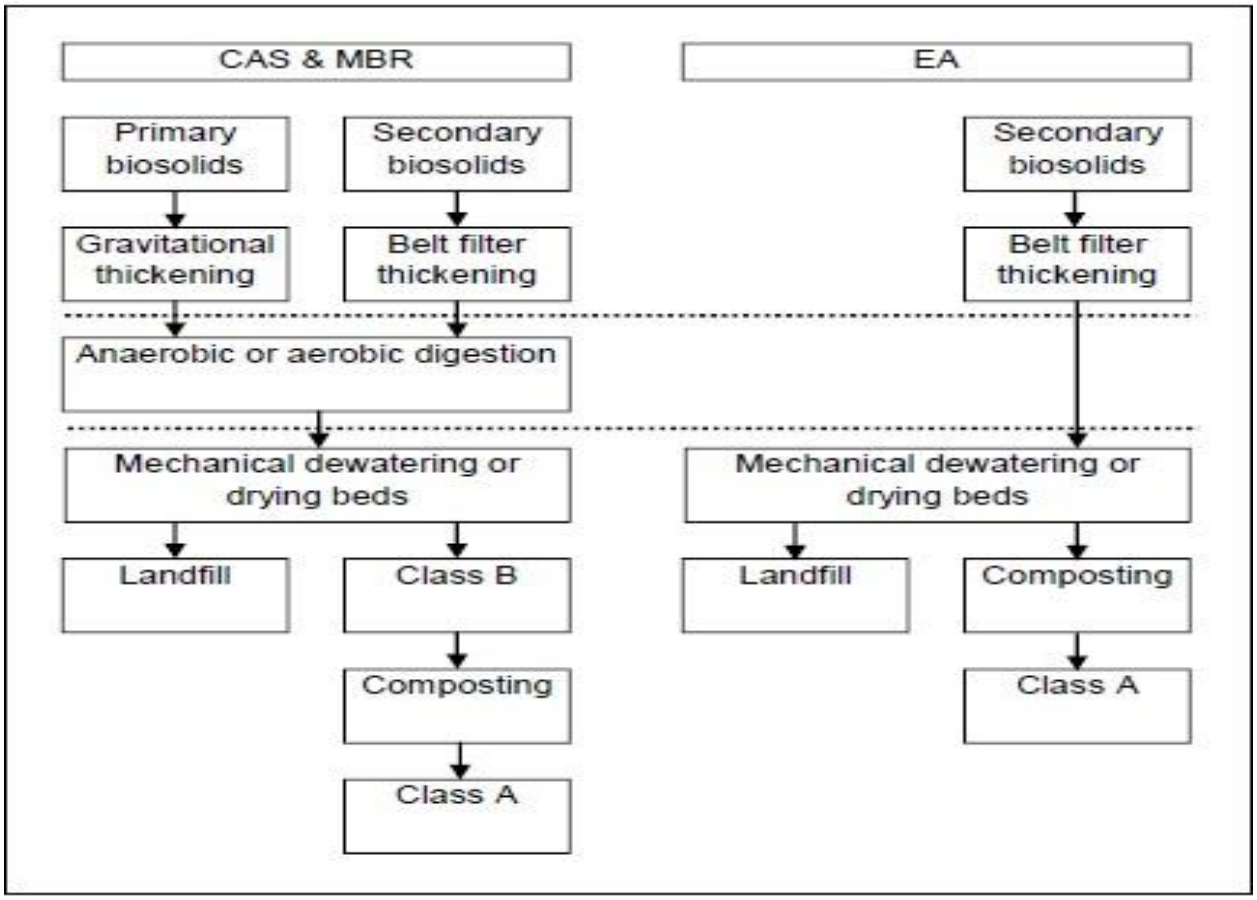


Figure 3.9: Unit Processes in Biosolids Treatment[3].

3.9.2. Sludge Thickening

Sludge from primary sedimentation tanks and excess activated sludge will be thickened in gravity thickeners. Objective is to increase the dry-solid content and by doing so reducing the total flow to the digesters. One thickener is used for primary sludge, and two thickeners for secondary sludge.

3.9.3. Sludge Digestion

Sludge is digested in anaerobic digesters under mesophilic conditions (temperature of 32oC). The hydraulic retention time of the digester is 22 days, which is sufficient to achieve substantial degradation of sludge. Furthermore after digestion sludge is stabilized and easy to handle. Under these conditions organic matter is converted into biogas that can be collected and used as fuel in a CHG-set that produces electricity.
Furthermore the heat generated by the plant is to be used for keeping the temperature in the digesters on the appropriate level.

For emergency situation and disruption of the CHG a flare is to be installed to be able to burn excess gas if needed. The electricity can partly cover the electricity consumption of the HWWTP.

3.9.4. Sludge Dewatering

After digestion sludge will be thickened and dewatered using mechanical equipment, like a belt-filter press or a decanter centrifuge. Belt filter presses use less energy and polymers, but require a larger footprint.

Sludge thickening and dewatering aims at increasing the dry solids content to above 20% (=200 kg solids/m^3), which makes it easy to handle the sludge and furthermore significantly reduces the total volume of sludge to be trucked away.

Sludge thickening and dewatering requires:

- Polymere preparation and dosing equipment
- Belt filter thickeners and belt filter presses
- Conveyor belt
- Containers to collect the dewatered sludge and transport facilities.

Sludge will be trucked away for land-fill. Once options for composting are developed, e.g. by private parties, sludge may be trucked away to co-composting facilities as well.

3.10. Potential Impacts

The Table(3.4) represents an example of project activities that identify potential impacts on important environmental and social issues during the construction period, while the table (3.5) shows project activities and potential impacts during during the operational phase .

Table(3.4) Project activities and potential impacts during the construction phase.

Project activities	Important environmental and social issues				
	Social and economic conditions	Cultural and historical resources	Air quality	Water Resources	Agricultural resources
Demolitions		X	X		
Remove existing infrastructure	X	X			
Heavy machinery operation	X	X	X	X	
Infrastructure building	X	X	X	X	
Excavations	X	X	X	X	X
Construction of buildings and facilities	X	X	X		
Purchase materials	X				
Waste disposal (solid, liquid, hazardous, etc.)	X		X	X	X
Waste water disposal	X		X	X	X
Transport	X	X	X	X	X
Unplanned accidents and events		X	X	X	X

Table (3.5): Project activities and potential impacts during the operational phase .

Project activities	Important environmental and social issues				
	Social and economic conditions	Cultural and historical resources	Air quality	Water Resources	Agricultural resources
Transport	X		X	X	
Power generation	X		X	X	
Water supply				X	
Solid waste collection and disposal	X		X	X	X
Sewage collection and disposal	X		X	X	X
Educational training		X			X
Unplanned accidents and events	X	X	X	X	X

Chapter 4

Baseline Environmental , Socioeconomic and cultural Data

4.1. Base Line Environmental Data

4.1.1 Location and topography

Hebron: al-Khalīl or al-Khalil al-Rahman, city in the southern West Bank, 30 km (19 mi) south of Jerusalem. it lies 930 meters (3,050 ft) above sea level. The largest city in the West Bank.

4.1.1.1 Yatta Town Profile

Yatta is a Town in the Hebron Governorate, located 9 km south of Hebron city, in the southern part of the West Bank. It is bordered by Zif and Khallet al Maiyya to the East, Al Rihiya, Al Fawwar Camp and Wadi as Sada to the North, Beit 'Amra to the West, and As Samu' to the South (See Figure 4.1).

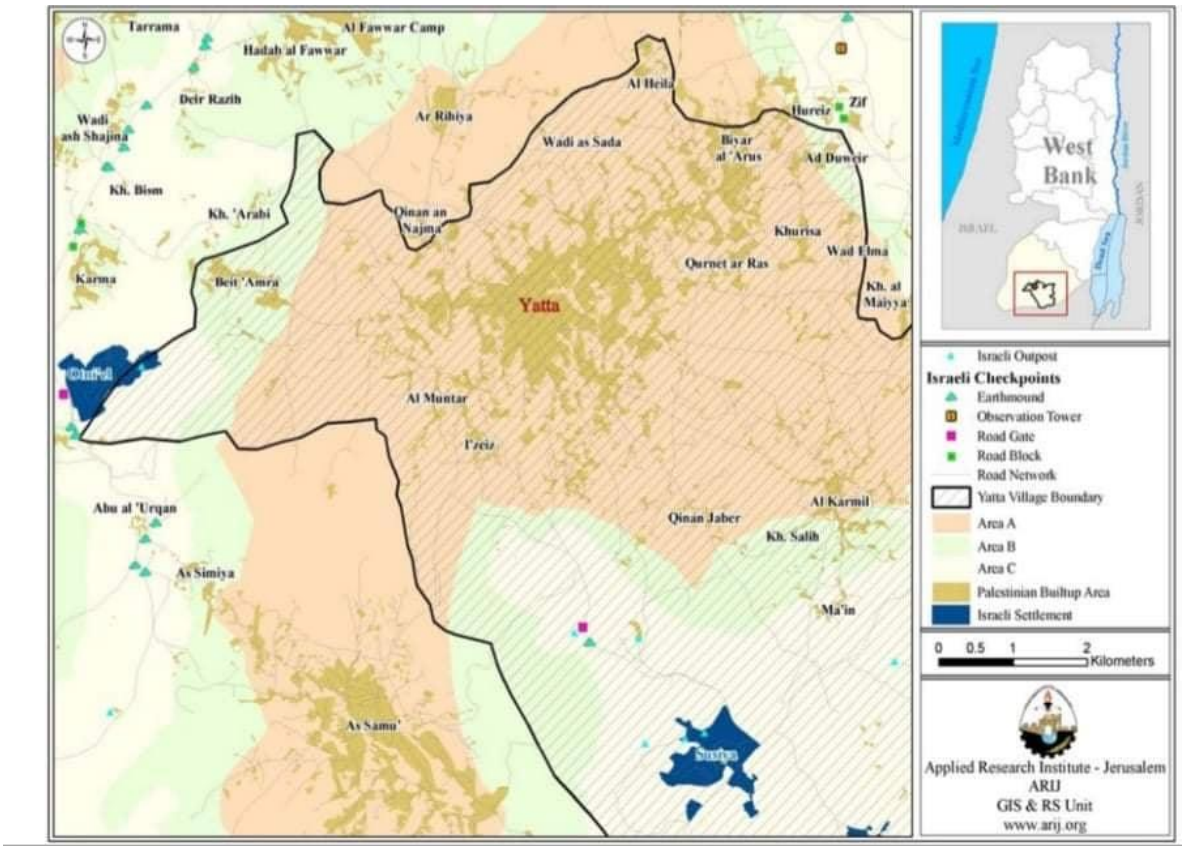


Figure 4.1: Yatta Town Profile[12].

The total area of Yatta town estimated to be 270,000 dunums, of which 14,000 dunums are classified as 'built up' area; whilst 115,000 dunums are agricultural area, 141,000 is forests uncultivated, or public land. Yatta municipality has a master plan for 24,500 dunums of town lands[12].

Yatta town is located on the mountainous area south of Hebron city at an elevation of 793 m above the sea level.

4.1.1.2. proposed location of the WWTP.

The proposed location of the WWTP is crossing Wadial-Samen with an elevation ranging between 740 to 760 meter above sea level while the elevation is rising up in all sides of the site and reaches up to840 meters.

4.1.2. Climate

4.1.2.1. Overview

Weather and climate Palestine has a temperate, Mediterranean climate. The rainy season in Palestine is between November and April. Winter can get rather cold and wet. Southern areas can get uncomfortably hot during the summer months.

The prevailing climate in West Bank is considered Mediterranean, characterized by long, hot, dry summers and short, cool, and rainy winters. This climate is influenced by different features in each region such as its elevation and proximity to the Mediterranean Sea .Hebron Governorate is located in the southern part of the West Bank mountainous range ,which has lower temperatures than in other places of the West Bank.

4.1.2.2. Temperature

The average monthly maximum temperature in the area of the proposed location of HWWTP is 23.7°C while mean monthly minimum is 10.6°C.

The figure (4.2) shows The average temperatures during 30 years past, (1985_2015,) are shown in Yatta city[13].

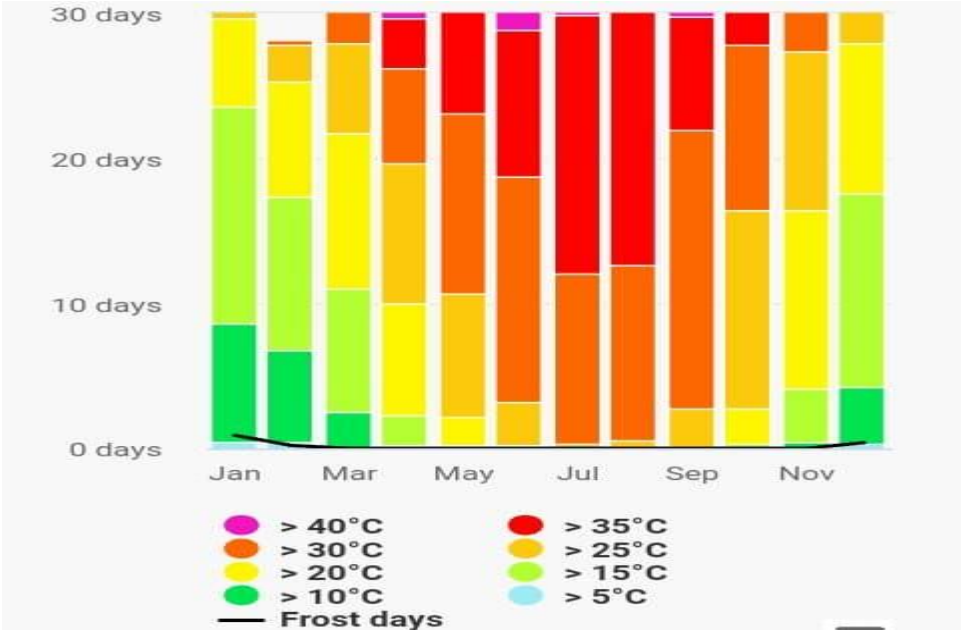


Figure 4.2: The average temperatures during 30 years past[13].

4.1.2.3.Rainfall

The climate in the Hebron governorate is classified as semi-arid and Mediterranean (dry sub-humid), characterized by a long dry season, a short wet season and two short transitional seasons (spring and fall).

The winter serves as the wet season, typically influenced by the Mediterranean front. Generally, precipitation is characterized by long rainfall duration and low rainfall intensity.

The figure (4. 3) shows Precipitation how many days per month certain amounts of precipitation are reached, during 30 years past, (1985_2015) are shown in Yatta city[13].

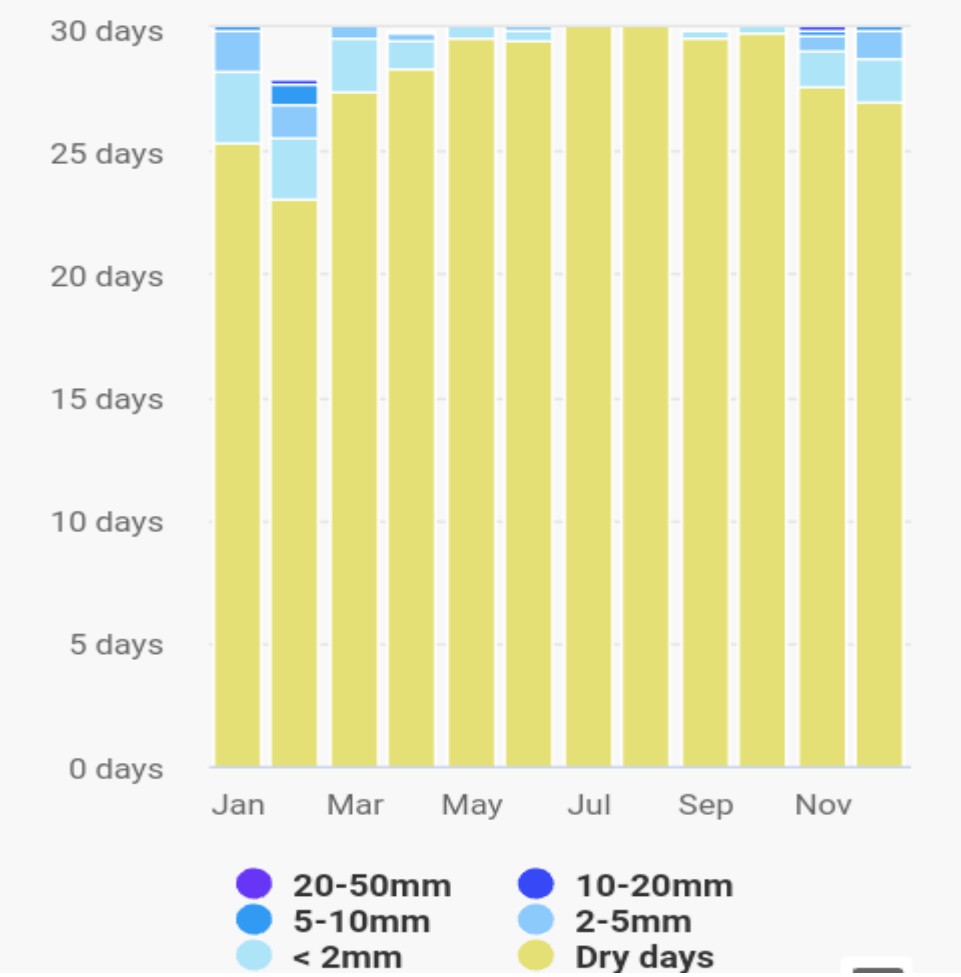


figure 4. 3 :many days per month certain amounts of precipitation are reached, during 30 years past[13]

4.1.2.4.Wind

The mean monthly wind speed from June to August is 2.5 m/s in the proposed site area, strong winds from December to April, and calm winds from June to October. The figure (4.4) shows the days per month, during which the wind reaches a certain speed during 30 years past, (1985_2015) are shown in Yatta city[13].

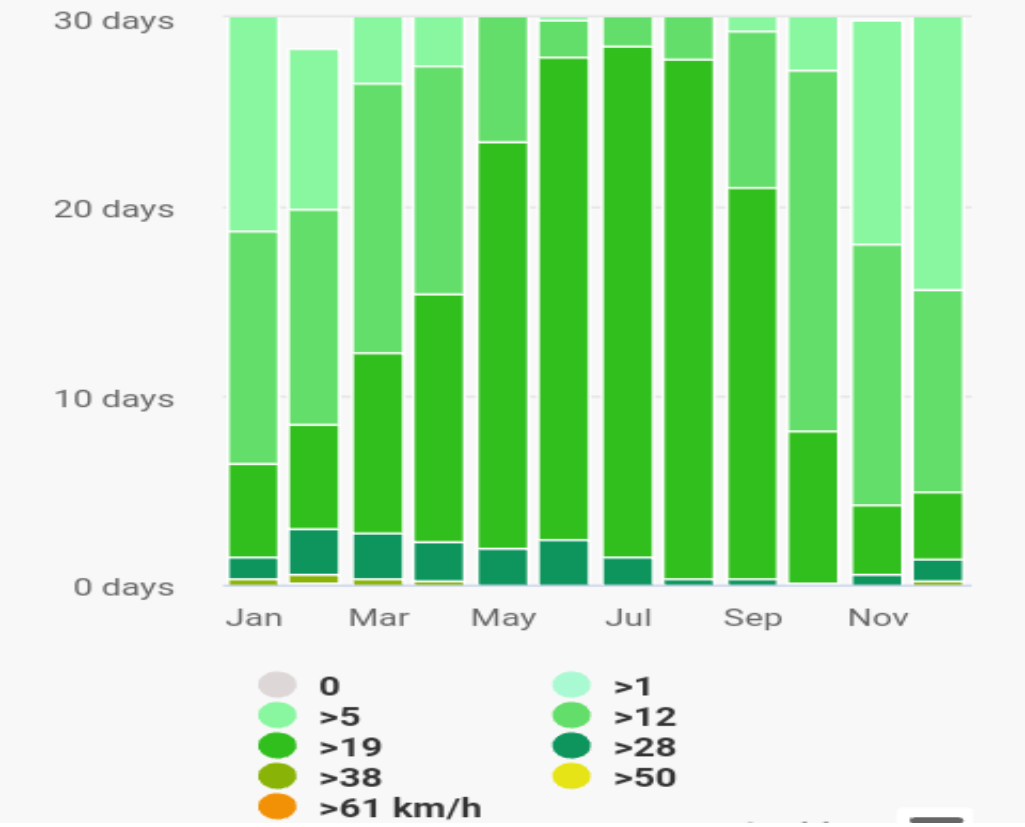


Figure 4.4 : the days per month, during which the wind reaches a certain speed during 30 years past.[13]

4.1.2.4.1. Wind rose

The figure (4.5) shows wind rose for Yuta shows how many hours per year the wind blows from the indicated direction. Example SW: Wind is blowing from South-West (SW) to North-East (NE)[13].

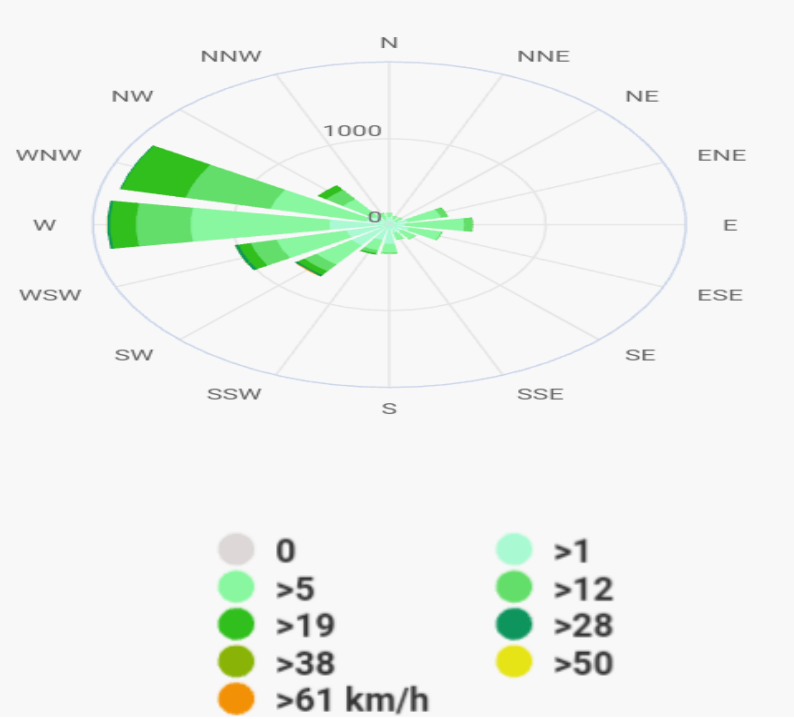


Figure 4.5:wind rose for Yatta and how many hours per year the wind blows from the indicated direction[13]

4.1.2.5. Evaporation

Evaporation is particularly strong in summer, due to the high temperatures, intensive sunshine and the low humidity. The mean monthly evaporation rates from June to August are 230 mm/month, while the evaporation rate is relatively low during the winter months when the solar radiation is lowest. The mean monthly evaporation rates from December to February are 83 mm/month. The annual total evaporation rates reach 1958 mm/year at Hebron station north to the HWWTP site.

It must be remembered, however, that only water surfaces which are in contact with the air are fully affected by evaporation. Water that has seeped into the ground is, for the most part, protected. In the West Bank, the rainfall is concentrated in the winter season, when evaporation is at its lowest[3].

4.1.2.6 .Sunshine Radiation

The West Bank has a sunny climate. Solar radiant energy provides the 2260 joules (540 calories) needed to evaporate each gram of water whether from the soil (evaporation) or from leaf surfaces (transpiration).

The amount of radiation arrives at the West Bank differs from place to another. In the proposed site area, the mean annual solar radiation is 17.9 MJ/m2/day (9.8 hours/day). In summer (June–

August), solar radiation is strengthened by the almost completely clear sky with an average sunshine 11.9 hr/day while during winter, the solar radiation occurs due to cloud cover, this cause reduction in the evaporative potential. The average sunshine from December to February is 5.4 hr/day.

The figure (4. 6) shows the monthly number of sunny, partly cloudy, overcast and precipitation days during 30 years past, (1985_2015) are shown in Yatta city[13].

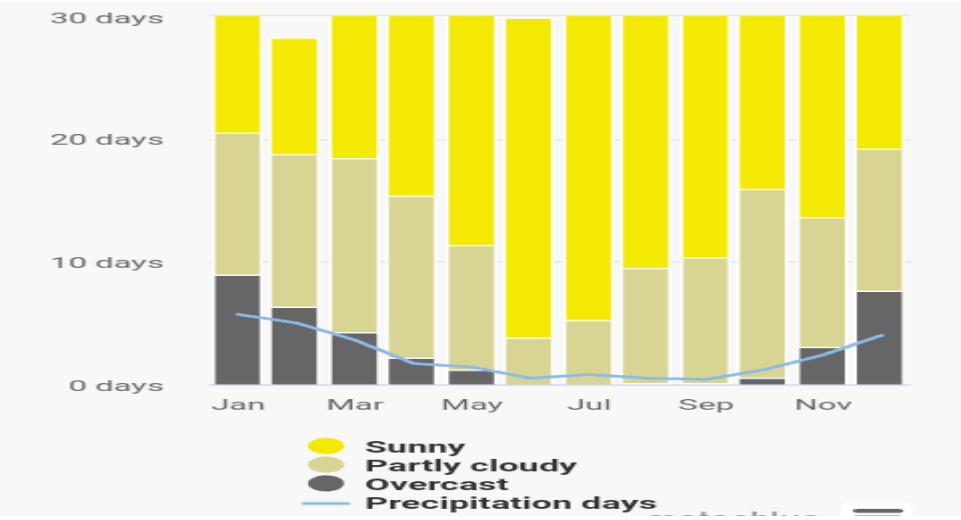


Figure 4. 6 : the monthly number of sunny, partly cloudy, overcast and precipitation[13].

4.1.3. Soil

4.1.3.1. Land use/land cover in Yatta town .

Yatta town lies on a total area of 270,000 dunums. 115,000 dunums are considered arable land; however, only 37,578 dunums are cultivated area and 77,422 dunums are uncultivated area.[12]

Table 4.1 : Land Use in Yatta Town (dunum)

Total Area	Arable Land		Built up Area	Forests Area	Open Spaces and Rangelands
	Cultivated Area	Uncultivated Area			
270000	37578	77422	14000	500	140500

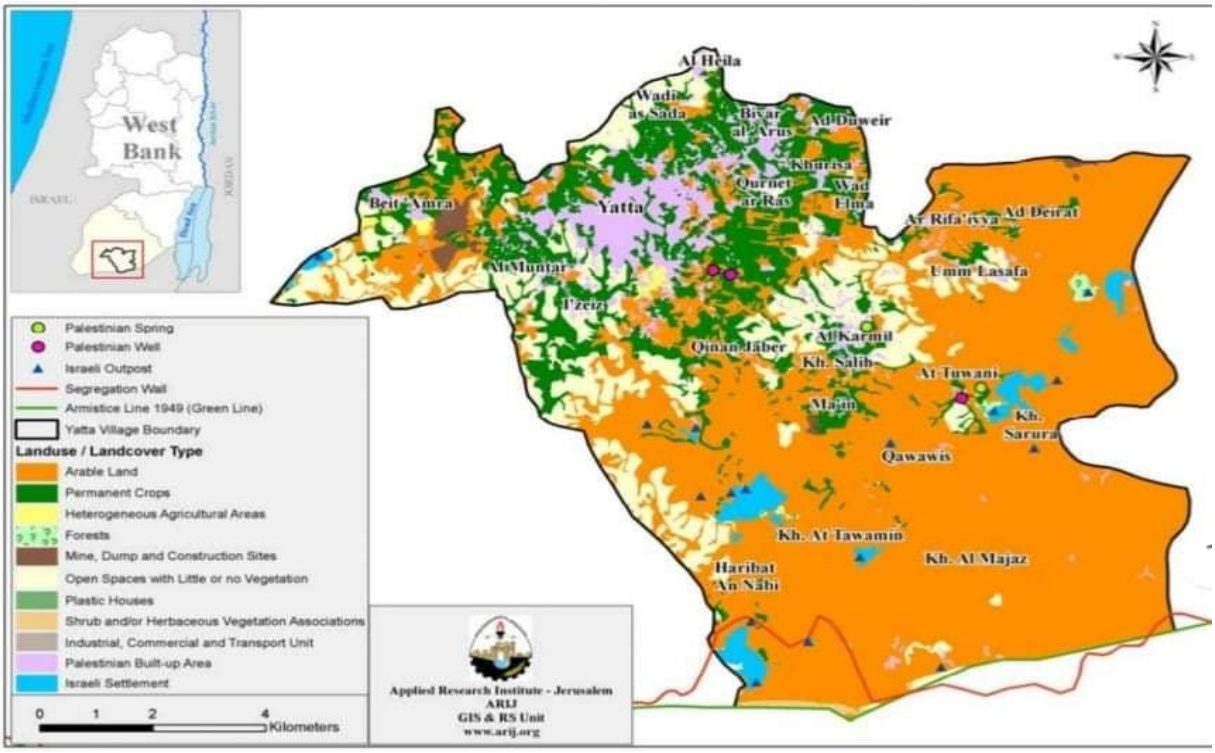


Figure 4.7: shows the Land use/land cover and segregation wall in Yatta town[12].

4.1.3.2 . Soil types at the proposed location of the HWWTP.

The major soil types found in the study area are described in further detail in the following sections.

The soil type at the proposed location of the HWWTP is Brown Rendzinas and Pale Rendzinas. This soil association dominates the hilly and mountainous areas of the central part of the West Bank. The Brown Rendzinas are dark to very dark brown, fine textured soils. The upper horizon is relatively rich in organic matter and darker colored than the underlying layer. While the deeper layer it becomes sub angular blocky. Major vegetation is on such areas, cultivation of grapes and olives, field crops (wheat and barley), and grazing are the main land use.

30_50% of Brown Rendzinas and Pale Rendzinas soil type is rock outcrops and its depths vary accordingly, starting from 0.5 m at the mountainous areas up to 2 m at the hilltops. Parent materials are mostly hard and soft chalk. The pH of this soil is mainly neutral to slightly basic (7.5-8)[3].

4.1.3.3.Land use at the proposed location of the HWWTP.

The WWTP is majorly surrounded by rough grazing land. From the Northern side some permanent cropping activities are present on the hill tops of the Wadi which will not be affected

by the project. Urban areas make the vast majority of land use in the project area but far from the vicinity of the WWTP .

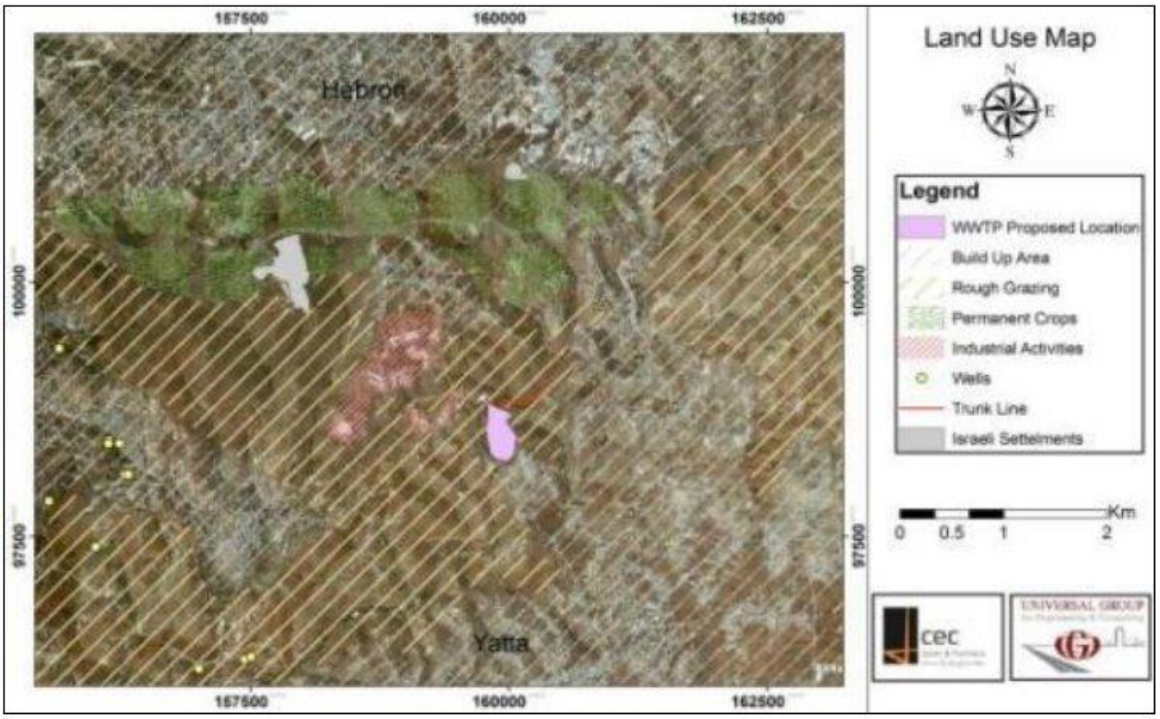


Figure 4.8 :Land use map of the project area[3].

4.1.4. Surface Water.

The HWWTP is located in the upper part of the Hebron. The main stream is Wadi al-Samen which is an ephemeral stream like other streams in the West Bank. However, it is characterized by a maximum of six to seven major flood events in a very rainy year with only a few days of flow. On average, there are two to three major flood events per year.

Although the Hebron watershed is considered to be ephemeral, due to anthropogenic activities, for several decades, part of its stream has continual flow all year long. Discharge of raw sewage from the city of Hebron, Qiryat Arba and from marble quarries in the southern Hebron Mountains (which give the water a whitish-grayish color) is estimated at 15,000 m3/day (~5.5 Mm3/yr) causing a continuing flow that reaches the Bir Al Saba' wadi.

The annual average storm water crossing (throughWadial-Samen stream) the site of the HWWTP is estimated based on the upper part of the watershed with an area 52 km2 and the long term annual average rainfall (492 mm/yr). However, the average annual storm water generated from rainfall is estimated by2-5% from the rainfall, 15%rainfall-runoff coefficient is used to estimate the storm water amount. .

This high percentage of coefficient is assumed due to the fact that most of watershed is urban areas (e.g. Hebron City) where most of land is impervious which generate a large amount of

runoff. Accordingly, the annual average runoff is estimated by 25.6 Mm3/yr. in total, the sum of annual average stream flow is around 31 Mm3/yr. .

4.1.5 Groundwater Aquifers

The HWWTP site is located in the Western Mountain Aquifer Basin (WMAB). Its recharge area is limited to the outcrops of its major formations in the West Bank Mountains. HWWTP is located within the south-eastern unconfined part of the WMAB. The formations that are outcropping in the plant site are classified as recharge areas for the aquifer.

However ,the western part of Hebron Governorate is located in a recharge area of the WMAB which characterized by high sustainable yield (373 Mm3/yr). The groundwater wells in the area are very limited due to Israeli constraints on the Palestinian water resources. There are 7 groundwater wells located 3.5 to 4.5 km south and south-west of the proposed site, 5 of which are used for pumping water for domestic uses .The sustainable yield in the area between the Green Line (1967 boundary) and Hebron anticlineis estimated at 40 Mm3/yr. The average pumping rate from the 5 pumping wells is 0.5 Mm.

The water level distributions if the proposed site in both upper and lower sub-aquifers area obtained from the regional ground water model of the WAB.

Figure (4.9) shows that water level in the upper sub-aquifer is ranging between 725 to 735 m above sea level and the flow direction is to the south-west, while the water level in the lower sub-aquifer is confined with elevation ranging between 377 and 387 m above sea level and directed to the south of the proposed site. Accordingly, water table is shallow in the area of the HWWTP.

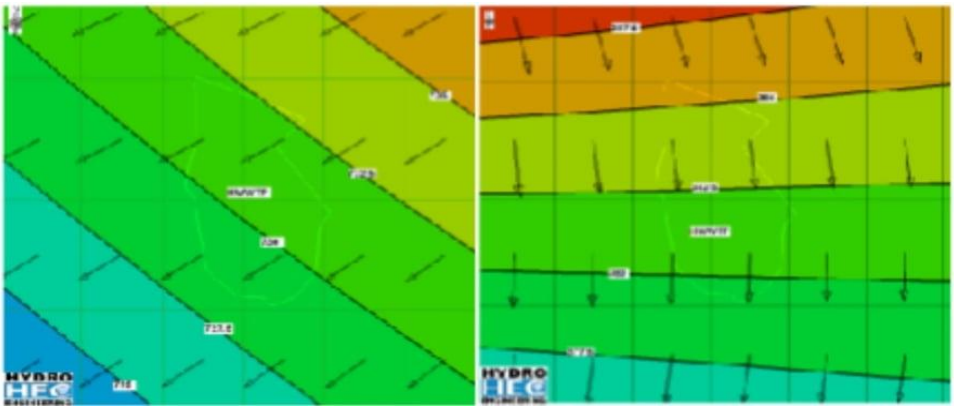


Figure4.9:Water level distribution (a) upper sub-aquifer (b) lower sub-aquifer[3].

4.1.6 Wat er and Wastewater Services

4.1.6.1 Water Services

Yatta has been connected with a water network since 1974. Almost 85% of the households are connected. The Israeli Water Company (MECOROT) is the main provider for water coming from Toque wells. The water network supplies water three days in a week. The town also has three water reservoirs with a capatown of total 2,700 m3 . These are primarily used to provide water for the town in the summer time and are available only on a once a weekly basis. The alternative sources of water network is cisterns There are six springs and wells in the town the two mains ones being Al Hano spring, Tawani spring, Furthermore, the water of springs and wells are not used. The main obstacles facing Yatta are: general reduction in water supply; insufficiency of the water network in meeting demand, water pollution, and an increase in water losses through the phenomenon of stealing and an unavailability of technicians [12].

4.1.6.2 Sewage Disposal Facilities

There is no sewage network in Yatta town. All households must therefore dispose of their wastewater in cesspits. This is considered one of the main sources of pollution to the groundwater rather the waste water is collected in cesspits[12].

In unconnected areas, cesspits are the common method households use to dispose of produced wastewater.Wastewater discharged as such gravely impacts on adjacent farmland and contaminates springs, groundwater and the environment in general As shown in the figure shown (Figure4.10)[3].

Figure4.10:Raw wastewater flowing between the houses towards Wadi As-Samen[3].

4.1.7 Solid Waste Management

The Hebron Joint Service Council is responsible for the collection of solid waste in the study area. Collected waste is transferred currently to the dumpsite east of Yatta. The Yatta dumpsite is owned by the Hebron Municipality and is managed by the Joint Service Council for Solid Waste Management for Hebron & Bethlehem Governorates (JSC-H&B)and is operated by private contractors.

The study area generates approximately 225 tons of solid waste per month. The solid waste is collected from the containers two days a week and transported to Yatta dumpsite. Yatta dumpsite is located south of Hebron near Yatta town. The site is used since 1994 for dumping solid waste by Hebron and Yatta municipalities and other villages in the south. After that, Yatta dumpsite started gradually to receive SW from other LGUs in Hebron governorate and later from Bethlehem governorate. Yatta is now receiving about 80% of the SW from the two governorates.Figure4.13shows photos of Yatta landfill site receiving SW[3].

In Yatta town, there is a solid waste management system operated by the Yatta Municipality. The solid waste collected by special vehicles in cooperation with neighbour villages (Joint Services Council) and transported from the residential areas to special dumping site (Al Dyirat Mahraqa) which far 8 km from the built-up area, where the wastes are buried. Nevertheless, about 40 tons of solid waste is generated in Yatta town daily (about 14,600 yearly)[12].

Figure 4.11:Yatta dumpsite receiving SW from Hebron and Bethlehem LGUs[12].

4.2. Base Line Socio-Economic Data

4.2.1 General

Hebron is the largest city in the West Bank, with a total area of approximately 74,100 dunums, including 30,000 dunums covered by housing units according to a study by the Applied Research Institute (ARIJ).The village of Al Heila comprises around 6,000 dunums, including 2,500 dunums occupied by houses. According to the Palestinian Central Bureau of Statistics (PCBS), Al Heila is a rural community located a distance of 6kmsoutheast of Hebron city[3].

In Hebron, various institutions contribute to developing and enhancing public service delivery. A municipal council administers the city, manages planning and development projects, issues construction licenses, provides public infrastructure services, etc. A significant number of official bodies and civil society organizations work in various fields. These include, inter alia, ministry directorate district offices, sports clubs, and charitable associations.

According to Ministry of Local Authority classification, Yatta is compromises the following localities: Yatta, Al Muntar, Khurisa, Raq'a, Qfair, Al Shawamreh, Sweidan, Qat'et As Shaikh, Al Farhaniyeh, Wadi Musalah, Al Farash, Al Dair, Fattooh, Al Marmlea', Khallet Saleam, Khallet Yerhas, Qurnet ar Ras, Wad I'zeiz, Al Heila, Khallet Tabeash, Khallet Mazaher, Al Mqthea' and Al Goweata villages[12]. Yatta town has been governed by a municipal council since 1971, which today consists of 13 elected members with 60 paid employees. In addition to drafting and implementing development programs, the council provides a number of services to the residents of Yatta, including:

_ Infrastructure Services such as water and solid waste disposal.

_ Health Services.

_ Social development services.

_ Road construction and repair, and construction of public buildings, particularly schools.

4.2.2 Demography and Population

4.2.2.1.Population

According to the PCBS 2007 Population Census, Hebron city and Al Heila village housed 165,264 residents, marking an annual rise of 3.5% in comparison to the 1997 Census results. In line with the PCBS estimates, the number of population in these communities stood at 190,927 in 2012. It is anticipated that the population will increase to around 320,000 in 2030(Table 4.2). Gender ratio shows 107.3 males to every 100 females[3].

Table 4.2:Population in the surveyed communities in 1997 and 2007, average annual population increase, and population estimates in 2012, 2016 and 2030[3].

Community	Population					
	1997	2007	Annual increase 1997 2007	2012 estimates	2016 estimates	2030 estimates
Hebron	121610	163987	3.5	189444	215452	318977
Al Heila	947	1277	3.5	1483	1686	2493
Total	122557	165264		190927	217138	321470

4.2.2.2 Age Groups And Gender

The population of Yatta town is classified by age groups. The data of the 2007 census reveals that 47.3% of the population is less than 15 years, 49.5% are in the age group 15-64 years and 2.3% are 65 year and above . The sex ratio in the town was 102 males for every 100 females. Males constitute 50.6% of the population and females constitute 49.4%. (This data includes population figures from the villages of Yatta, Al Muntar, Khurisa, Qurnet ar Ras, Ad Duweir, I'zeiz, Wadi as Sada , Hureiz and Khallet ‘Arabi.)[12].

4.2.2.3 Families

The population of Yatta predominantly from the following families: Al Da'ajnha , Harizat , Hoshchiya , Makhmera Allaya , And Makhmera Tahtta .

4.2.3 Education

6% of the populations in the surveyed communities, who are 10 years of age or above, have completed a BA degree or a higher degree of education. This category ranges between 6.1% in Hebron and 1.7% in Al Heila.Table4.3 below shows a large discrepancy in terms of the educational status between the surveyed locales. Hebron indicates a proportionately high number of educated persons (persons with an educational level above high school–Tawjihi).

On the other hand, Al Heila shows a lower percentage of educated persons. Educated individuals may provide a significant human and social capital, enhancing the quality of life in the surveyed communities[3].

Table 4.3:Surveyed communities’ population according to educational status[3].

	Illiterate	Can read and write	Elementary	Preparatory	Secondary	Associate Diploma	BA and more	Total
Hebron	3.9	14.1	27.5	30.1	14.5	3.9	6.1	100
Al Heila	18.8	16.0	36.0	16.4	10.6	0.4	1.7	100
Total	4.0	14.1	27.6	30.0	14.5	3.9	6.0	100

4.2.4. Labour Force and Economic Activities

Available data shows that participation of women in the labour force is very limited. Only 10.3% of women in the age of 10 years and above participate in the labour force. In contrast, males in the same age group comprise 70.3% of the labour force (Table 5.5). 11.3% of the population in the surveyed communities, including 10.6% males and 16.9% females, are unemployed[3].

In this context, focus groups and interviewed key personalities in the surveyed communities highlighted a correlation between rising unemployment and policies of the Israeli occupying authorities. According to respondents, unemployment rate is significantly high in Khallet ad Dar and Al Heila due to historical reliance on work inside Israel and agriculture sector.

Data collected from Yatta municipality indicated that Yatta's population is mainly dependent on the Israeli labor market for its livelihood; nearly 75% of the total labor force in the town is engaged in Israeli labor market. Employment in governmental and private sector forms the second sector which the residents depend on, whereas 8% of the labor force engaged in these sectors. Dependence on the agricultural sector decreased in Yatta town in recent years, just about 7% of the labor force working in agriculture sector. The trade and commercial sector comprises about 8% of Yatta workers and a smaller percentage depend on the industrial sector within the town[12].

The survey also indicated that the share of the population working in the various sectors of the economy is listed below by percentage ,the following figure(4.12) shows the proportions:

- The agriculture sector 7%.
- The Employee sector 8%.
- Israeli labor market 75%.
- The industrial sector 2%.
- The trade sector 8%.

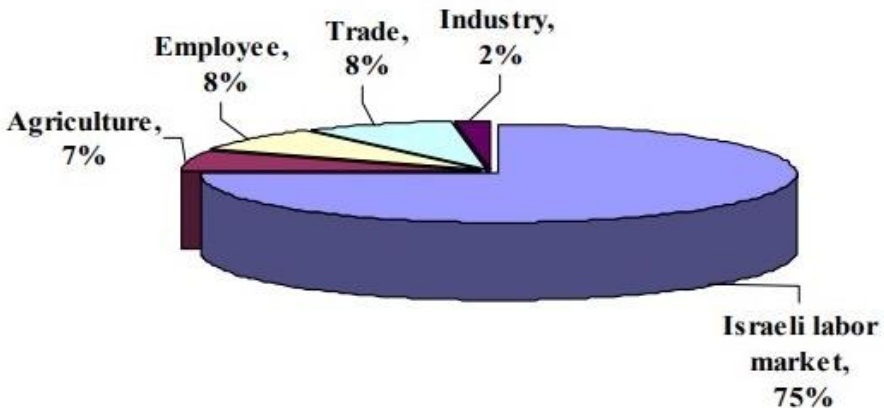


Figure 4.12: Percentage of economic activity in Yatta town[12].

In Hebron, the economic activity comprises factories that consume a large quantity of water. For example, the Hebron Industrial Zone houses 118 stone processing workshops, including 35 that operate compressed air dryers and 58 silos (reservoirs). 25 facilities still use settling ponds for sludge treatment (Data from Hebron Municipality). According to interviews conducted by the research team in the Industrial Zone, stone processing factories use an average of 10 cubic meters per factory a day. In the Workshop on Environmental, Social, Historical and Cultural Impact Assessment of the Wastewater Treatment Plant Project, held at the Hebron Municipality hall on 8 August 2012,Hebron-based representative of the Palestinian Union of Stone and Marble Industry confirmed that stone processing factories in the Hebron Industrial Zone consume over 1,000 cubic meters of water per day[3].

Irrigated agriculture covers more than 400 dunums of land, mostly relying on public network-supplied water. Representatives of local government units, focus groups, key personalities and household members emphasized the significance of agricultural activities in the life of their communities. A considerable number of the households in Khallet ad Dar and Al Heila largely depend on the agricultural activity as a source of income. Despite the destructive impact of the Hebron wastewater stream on their land, causing desertification of vast areas and increasing water salinity, respondents highlighted that irrigation water, once available, means a resumption of the agricultural activity in the affected areas.

A significant number of households in the surveyed communities breed livestock. Official statistics indicate that these localities accommodate more than 14,000 sheep and goats, 1,400 mules and horses, around 1.2 million chickens, and 1,200 beehives. Most livestock units are raised in modern farms.

These activities, particularly large-scale industrial enterprises that use and produce large quantities of water and wastewater, pinpoint the importance of water in the life of households in the surveyed areas. Unpolluted water should be provided to agricultural activity (including vegetable cultivation) and to industrial activities.

4.2.5 Sanitation and Public Health

4.2.5.1 Health Status

The health sector in the town is served by governmental, private and society sectors. The main health institutions in Yatta town are Abu Hasan Al Qasam governmental Hospital, Nasser Hospital maternity and general surgery private hospital, Hospital accreditation medical specialist private hospital, and two Yatta clinic and Maternity & Pediatric Centres. The town is also served by a governmental health centre which provides doctors, as well as, for example, vaccination services for children. Yatta Municipality officials cite several obstacles facing the health sector in the town. These include the lack of financial possibilities, insufficient supplies of medicine, insufficiency of specialist doctors, and lack buildings suitable for use as a health centre[12].

4.2.5.2 Water

More than 80% of Hebron city houses are linked to the public water supply network.

Other households rely on rainwater collection, springs, or artesian wells (There are 3 artesian wells in Hebron)[3]. On the other hand, the Al Heila village lacks a public water supply network. Though the village hasonly500-cubic-meter well, residents depend on cisterns and tankered water.

Water supply is a major problem in Hebron city and its environs. Many areas suffer from an acutely short water supply in the summertime .

In general, Al Heila residents suffer from high water prices (ILS 150-200 per tank, or ILS 15-20 per cubic meterat best) as well as from contaminated water wells. In addition to scarce water sources, Hebron city is debilitated by inadequate water supply services, especially in the summer.

4.2.5.3 Use of Various Water Sources

Water supplied from the public network is mainly used for household purposes as well as for home garden irrigation. In addition to watering livestock and providing various projects, some farmers use this water source to irrigate greenhouse crops or grow vegetables in open spaces in the summer. Despite the complaint of high prices, farmers find themselves forced to use the water provided by the public network. However, they are demanding a reduction in the price of water supplies and that agricultural institutions help them to operate modern and effective irrigation techniques.

Also a large number of industrial establishments and service providers that consume a large amount of water. To meet the water needs of factories and workshops, tank water and the public water network are used.

4.2.5.4 Wastewater

In Hebron city, a public wastewater network covers the majority of the city housing units. According to the Head of Wastewater Department at Hebron Municipality, approximately 30% of the city houses are not connected to the public sewage network[3]. These are mostly located in areas that have recently been annexed to the city's municipal borders. Others are in areas that need special techniques to connect to the public network (low areas) .

In unconnected areas, cesspits are the common method households use to dispose of produced wastewater. Sometimes, cesspits are not emptied because the soil absorbs produced wastewater. When it is not emptied, especially in the summertime, wastewater in cesspits drilled in rocky mountain regions leaks out to the streets or to land surrounding houses.

Cesspits are emptied by septic trucks at high prices (ILS 70-100) per tank. Some households are forced to pay a higher price to empty their cesspits, which are drilled in rocky mountain regions, because they are forced to empty them more than once a month (Some households empty theirs

once a week). Other households afford ILS 500 a month to empty their cesspits. Septic trucks discharge emptied wastewater in open areas near to residential communities, producing foul smell and creating swamps of wastewater in several spots around residential localities. Wastewater discharged as such gravely impacts on adjacent farmland and contaminates springs, groundwater and the environment in general.

A large number of communities in the south of Hebron suffer from wastewater streams that flow through Wadi Wadi Samen open towards the Green Line. Wastewater passes through some residential areas, including the village of Al- Haila, where some homes are located close to wastewater streams. Even after covering it and turning it into large sewers, the residents of Khallet Al-Dar still suffer from the negative effects of the flow of wastewater. Destructive consequences remain, including tree drying and soil desertification. People complained about the unpleasant smell of the open sanitary sewer manholes. In addition to the widespread unpleasant smell, they also mentioned that stolen sewer holes increase the risks to residents and property.

In areas with uncovered wastewater streams, adverse impacts pose a number of dangers:

- Dehydrated trees, damaged soil, and increasing soil salinity and intoxication.

- Spreading malodorous smell. A female participant in the women's focus group stated that she did not open her house windows.

- Widespread mosquitoes, causing skin diseases and adding a further financial burden on households for medical attention. Interviewees asserted they needed a separate budget line item to fight mosquitos or mitigate resultant maladies

- Widespread insects and snakes.

- Widespread skin diseases (including itchy skin and allergy), asthma and amoeba. Many interviewees associated the high cancer rate with the wastewater stream.

- Difficult access to farmland, driving farmers out of their land.

- The wastewater stream poses an immediate hazard to individuals, especially children. According to surveyed persons, despite the reduced risk of flooding in the wintertime, deepening of the wastewater steam has rendered it more dangerous. In the past, the stream used to flood low farmland and adjacent houses.

- The wastewater stream also negatively reflects on social relations between local residents. Despite the fact that the affected communities used to lie over a green area in the past, the wastewater stream is a repellent factor that drives out residents, investors and visitors. Some participants in focus group discussions confirmed that they faced serious problems because certain families had refused to marry their daughters to residents living in the affected community because of hazards generated by the wastewater stream.

4.2.6 Hazardous Practices

the uncovered wastewater stream has generated several hazardous patterns of behaviour:

- In disregard of negative reflections on public health, some farmers use the wastewater stream to irrigate crops. However, that clients refuse to purchase crops once they realise that they originate from affected areas. Despite declining use, some farmers have continued to use the wastewater stream in the irrigation activity.

- Cesspits are emptied in an unhealthy manner (they are either discharged on adjacent streets or wastewater overflow is neglected). Also, cesspits are emptied by septic trucks, which discharge wastewater in undesignated areas. As such, wastewater is increasingly disposed of overnight and in the wintertime. Rainwater overfills cesspits, causing groundwater contamination in areas with highly-absorbent soil.

- The simultaneous spread of skin diseases, especially among children. These included rashes and mosquito-related poisoning .The high incidence of cancer has also been associated with pollution from wastewater stream.

4.2.7 Infrastructure In Yatta Town

• **Telecommunication Services:** Yatta town is connected to the telecommunication network. Approximately 60% of the households have a telephone connection.

• **Electritown Services:** Yatta has been connected to electritown network since 1987. Approximately 90% of households in the town are connected to the electritown network[12].Yatta municipality manages the distribution of electritown which is supplied by Southern Electritown Company.

• **Solid Waste Collection:** In Yatta town, there is a solid waste management system operated by the Yatta Municipality. The solid waste collected by special vehicles in cooperation with neighbour villages (Joint Services Council) and transported from the residential areas to special dumping site (Al Dyirat Mahraqa) which far 8 km from the built-up area, where the wastes are buried.

• **Transportation Services:** There are about 80 km roads in Yatta town, 50 km are paved and in a good condition, 18 km are paved yet not in good condition and 12 km are not paved at all. The only means of transportation in Yatta compromises two office taxis[12].There are obstacles in front of transportation of passengers is the deterioration of the roads.

4.3. Cultural Heritage Baseline Data

4.3.1. General

The Cultural Heritage Impact Assessment section of the ESCHIA for Hebron Governorate aims at demonstrating the components of cultural heritage in project area, and illustrating measures of

treatment and mitigation for those elements before, during and after the implementation of the HWWTP and associated works.

Methodology of implementing the CHIA for the project area depends on conducting field surveys and professional site investigations, in addition to coordinating to collect the repository of data and maps related to the cultural heritage entity in project area.

4.3.2.Cultural landscape elements

4.3.2.1. Topography

The topography and geomorphology of the site are important landscape characteristics which had a fundamental influence on the processes of adaptation and transformation of the territories into specific typologies of historical landscapes. The topography of the site is quite rough with deep valley surrounded by steep gradients of its slopes. This morphology of this topography paved the road for human activities to intervene and produce distinctive landscape.

Figure 4.13 : a) The project site and b) Agricultural Land use

4.3.2.2. Agricultural land use

Agricultural land use is a core constituent element of the site's landscape. The eastern looking slopes are extensively cultivated by a variety of cultivations and trees. Some are organized in agricultural terraces while others grew naturally.

Rows of olive trees dominate the slopes while other types of cultivation such as prunes and vines are scattered over the agricultural terraces. On the other hand, indigenous Palestinian plantations are spread over including hawthorn and Pistacia trees.

Figure 4.14 : a) Hawthorn tree and b) The Contour Terraces

Figure (4.15) is a photo snapped for the Wadi as-Samen, where the combined trunk sewer and electrical power lines are to be laid and the HWWTP is to be constructed. It shows that the site is bare land.

Figure 4.15: The location of trunk sewer, access road along Wadi as-Samen[3].

4.3.2.3 Cross channeled terraces.

In the southern slopes of the project area, sub-typology of terraces appears. The relic terraces which used to be full vernacular structures are fading but some traces are still remaining. The remains of these terraces are undergoing a re-naturalization process providing a suitable environment for biodiversity to grow. Around the relic terraces, some spots of conifers can be observed which proves the lack of agricultural activities in that area [3].

Figure 4.16: a) Cross Channel terraces and b) Relic terraces[3].

4.3.2.4 Rocky and garrigue landscape

The majority of the site's landscape setting is classified as rocky garrigue landscape The west and south looking slopes are covered with rocks and small bushes.

Figure 4.17: Rocky and garrigue Landscape[3].

4.3.2.5. Caves and cavities

Caves are an element of cultural landscape. In the project area, there are many caves that are scattered over the slopes and the valley. Some of them seem to be looted, other underwent extensive demolishing. However, some other caves and cavities in the valley are still keeping their structures[3].

Figure 4.18: A cave in the project area underwent an extensive intervention[3].

Chapter Five

Assesses The Environmental & Social Impact

5.1. Introduction:

This chapter includes assessing the environmental & social impacts of building components of a wastewater treatment plant in the Hebron Governorate, whether during the construction or operation stages.

The proposed WWTP will consist of the following main parts which is included in the environmental impact assessment:

- Screw Pump.
- First Screening.
- Grit Chamber.
- Primary Sedimentation Tanks.
- Basins Ventilation Aeration Tanks.
- Secondary Sedimentation Tanks.
- Secondary treatment sludge Thickener Secondary Sludge Thickener.
- Anaerobic Digester.
- Sludge Dewatering.
- Effluent Building.
- Gas Complex.
- Maintenance and Administration Building.

In addition to evaluating the impact of the main project components. There are additional activities as follows:

1. Solid waste generation.
2. Liquid waste generation.
3. Workshops development.
4. On site staff, offices, and condominiums.

The main receivers considered include the following:

1) Air (Air Quality and Ambient Noise).
2) Biological Environment (Plants and animals).
3) Water (Water Quality and Resource Consumption).
4) Soil (Soil Quality, Corrosion and Landscape).

5) Human Environment (Occupational Safety and Health Community Safety, Visual Effects).
6) impacts on cultural heritage and social impacts.

The EIA methodology we used was detailed in Chapter 1. This includes conducting a quantitative impact assessment, which takes into account the following:

A. Possibility of occurrence.
B. Spatial scale.
C. temporal scale.
D. Effects of intensity (which includes sensitivity of receptors, the course of influence and the reflexive nature of the effect).

5.2. Environmental Impacts And Mitigation Measures:

Field measurements for ambient air quality and noise are important in order to assess the current environmental conditions at the project's site. In addition, to run the groundwater modeling, water quality has to be conducted, besides assessing current water quality and quantity at the recovery system.

To identify the contamination level of the effluent due to the remaining sludge generated from the wastewater (in this case, most of the sludge has been stabilized for a long period due to the climate and dryness), the sludge and soil sample is also important to be assessed. In addition, to predict the sludge generated from the HWWTP, wet sludge has to be collected and assessed to identify the heavy metals contain. This sludge assessment provides an important indication to determine the future sludge generated from HWWTP was suitable for irrigation reuse or has to be dumped to the sanitary landfill.

5.2.1. During construction:

5.2.1.1. Air (Air Quality and Ambient Noise).

For further considerations regarding possible adverse environmental effects during construction and during operation of the HWWTP, it is necessary to define a geographical reference point from which the spatial preconditions and the combined effects (i.e. emissions of dust and noise to adjacent areas) will be calculated.

During the construction of the HWWTP, a set of negative, although temporary, impacts have to be expected. However, they do not exceed the normal range of impacts accompanied with construction activities.

5.2.1.1.1. Ambient Noise:

Noise is unwanted and undesirable sound that has an adverse effect on human beings and their environment, noise can disturb natural wildlife and ecological systems. Two types of noise emissions are of concern; Impulse noise that is, noise of short duration and high density such as explosions and sonic booms; and Continuous noise such as the compressors at the streets and pumps during operation[14].

Factors which are important in determining noise levels that will potentially impact the population include; distance from the noise source; natural or man-made barriers between the source and the impacted population, weather conditions which could potentially absorb, reflect; and the type of construction phase. For general calculations and measurement of noise level, the dimension Decibel (dB) is taken.

Table5.1:Outdooradmissible noise levels as to the PSI[3].

Outdoor Conditions	Maximum (dB) 7:00 am–8:00pm	Minimum (dB) 8:00 pm–7:00a
Rural Residential, Recreational ,Schools, Hospitals	40	30
Residential Areas in Urban Centers	50	40
Residential in Commercial Centers and Public Roads	55	45
Commercial Areas	65	50
Industrial Areas	75	65
Public Parties and Conventions	85	75

Noise: An 8 hour duration for the noise measurement will be conducted from08.00– 16.00 (represent the working hour duration during the construction and an hour-night represents the night condition).

An overview of expected noise generation activities:

- Ground preparation and leveling.
- Excavation works with the required depth, as well as for some components of the wastewater treatment plant.

- Post-site preparation, including leveling, pipeline construction, welding, and fixing.
- Building concrete and other civil works.
- Installing cranes, bridges, pumps and other electrical equipment.
- Various mechanical / electrical equipment will be required, during construction activities. It includes bulldozers, trucks, pagodas and other equipment. Operation of this equipment is the main source of potential noise emissions and audio pollution during the construction stages.
- There are no sensitive areas near the wastewater treatment, the nearest residential communities more than 700 meters.

The technical construction and installation activities which will follow as soon as the proposed WWTP and trunk sewer are completed do not encompass any extraordinary negative impact, which needs to be explicitly addressed. In contrary the accompanied negative impacts are restricted to the site area and are of temporary character, since they will end with the finalization of the construction works.

During the construction of the trunk sewer, there will be impacts that have to be addressed, among these are:

_ Noise/vibration and dust generation:

will cause nuisances to surrounding areas by excavation and excavated soil transportation for pipe installation. These are transitory problems and can be mitigated by the proper selection of construction ways and restriction of working time. The construction activities for the trunk sewer will be widespread. These activities will be of temporary character and the related negative impacts connected are of inferior importance.

These construction activities will mainly generate noise on a low level and will possibly trigger traffic jams, which will then just lead to the nuisance of people living nearby or those passing by in cars. Mitigation measures should take into account the safety and comfort of the inhabitants.

_ Mitigation measures:

Construction noise on the site should be mitigated to ensure a safe working environment and an occupational health and safety plan to do this, which takes into account national and international requirements, at the site and the plan must include the following measures:

- ✓ Must provide earplugs / hearing aids for all personnel in critical audio pollution areas.
- ✓ Training is conducted on how and when to use preventive hearing aids that guide workers.
- ✓ Put clear instructions visible in areas where noise emissions are critical.

Other mitigation measures include to minimize the effects of off-site noise - at the nearest sensitive receivers below:

- ✓ Optimizing the use of construction equipment that causes a loud noise level and stopping any equipment when not in use.
- ✓ Regular maintenance of all equipment and vehicles.
- ✓ Stopping all construction activities during the night.

5.2.1.1.2. Ambient air:

The impact on ambient air quality disturbance associated to this project will be determined during the construction of project components, during operation of the project and at the reuse schemes, As the site characteristics of the project components vary, therefore the parameters and the sampling duration will be defined according to the specific site characteristics and condition and based on scientific explanation[3].

Ambient air quality and their parameters and durations are as follows:

Ambient air: SO2, NOx, CO and SPM (and PM10) will be measured to identify the current air quality.

The 8 working hours are selected to represent the activities during the construction. During the operation phase, the management and monitoring will be prepared in accordance to their sensitivity as the project components will run for 24 hours. In addition, the ambient air management and monitoring plan during construction and the operation phase of the project components will be determined in accordance to the specific nature of the site, i.e. the prevailing wind direction, during summer and winter season, day and night as well dry or humid conditions[3].

Air quality at the construction site as well as at the closest receivers can be affected for the following reasons:

- Dust emissions.
- Exhaust from generators and vehicles that transport raw materials / or that dispose of soil pits and construction waste.

- Construction equipment exhaust.

The following air pollutants are expected for most construction activities:

- (PM2.5, PM10) dust emissions.
- Nitrogen Oxides.
- And sulfur oxides.
- Carbon monoxide in the case of old engines.

_ Mitigation measures:

Implementation of the site management plan, including the following procedures:

- ✓ Store building materials in pre-defined storage areas.
- ✓ Covering volatile substances during storage.
- ✓ Moisturizing the road network on site and the use of water should be limited to the most active areas.
- ✓ Speed regulation to a suitable speed (20 km / h) for all vehicles entering the village boundaries.
- ✓ Implementation of a preventive maintenance program for vehicles and equipment operating on site and immediate repair of vehicles with visible exhaust smoke.

5.2.1.2. Biological Environment (Plants and animals).

5.2.1.2.1. Plants:

The WWTP is majorly surrounded by rough grazing land. From the Northern side some permanent cropping activities are present on the hill tops of the Wadi which will not be affected by the project. Urban areas make the vast majority of land use in the project area but far from the vicinity of the WWTP[3].

The plants in the proposed sites of the WWTP do not belong to the threatened species category. Therefore, the impact of project construction on plant species should be considered of minor importance. Table 5.1: below shows the results of the evaluation of the expected impact on plants at the project site during the construction phase.

Table5.2: the expected environmental impact assessment on plants at the project construction stage.

		Degree of impacts				
Impact due to construction	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
Impact on plants	0.5	1	2	3	3	Little importance

5.2.1.2.2. Animals:

Although some types of animals are mammals, birds, reptiles, and insects in the project area, it is unlikely that the effects on the animal will be important for the project, given the similar habitats surrounding the area that they can take refuge in. The evaluation of animal effects is evident in the table 5.2: below, considering that their consideration is of minor importance.

Table 5.3: the expected environmental impact assessment on animals at the project construction stage.

		Degree of impacts				
Impact due to constructi on	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
Impact on animals	1	2	3	2	12	Medium importance

_ Mitigation measures:

Transferring plants and animals to the surrounding environment.

5.2.1.3. Water (Water Quality and Resource Consumption).

Conventional building activities can pollute groundwater due to the following:

- Random disposal of dangerous liquids such as used oils, paints or any other chemical additives / additives used in concrete and finishing works.
- Random disposal, without performing the necessary analysis of water from excavation work.
- Solid waste leaks which are randomly disposed.

water level in the upper sub-aquifer is ranging between 725 to 735 m above sea level and the flow direction is to the south-west, while the water level in the lower sub-aquifer is confined with elevation ranging between 377 and 387 m above sea level and directed to the south of the proposed site. Accordingly, water table is shallow in the area of the HWWTP[3].

Wadias-Samen is located in a highly vulnerable areas to pollutions where it located on a highly recharge areas to the WMAB, the depth to the water table is relatively shallow.

The high fractured rocks in the area can easily allow the pollutant to percolate to groundwater.

In general, impacts on groundwater during construction of a wastewater treatment plant should be considered of medium importance and will be mitigated through the application of mitigation measures related to waste management.

5.2.1.4. Soil (Soil Quality, Corrosion and Landscape).

Conventional building activities on the soil on site can affect the following:

- Solid waste leaks which are randomly disposed.
- Soil erosion.
- Loss of resources if the extracted soil is not separated and reused as an alternative to transporting and using additional materials from outside the site.
- Random disposal of construction waste used in the soil without treatment.

_ Mitigation measures:

✓ Create base protective layer is implemented under the areas where the use or design or storage of potentially hazardous liquids.

✓ Use appropriate procedures to deal with chemicals and petroleum products during the construction of the plant. This includes proper storage, use and cleaning of these materials.

✓ Implementation of the on-site construction management plan.

✓ Use new methods to protect the soil from erosion.

✓ Backfill the excavated parts with the extracted soil again, thus reducing the level of soil losses as waste.

Table 5.4: the expected environmental impact assessment on groundwater & Soil at the project construction stage.

		Degree of impacts				
Impact due to construction	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
Ground water&soil	0.25	2	3	2	3	Little importance

5.2.2. During operation:

5.2.2.1. Field Measurements:

Field measurements for ambient air quality and noise are important in order to assess the current environmental conditions at the project's site. In addition, to run the groundwater modeling, water quality has to be conducted, besides assessing current water quality and quantity at the recovery system. To identify the contamination level of the effluent due to the remaining sludge generated from the wastewater (in this case, most of the sludge has been stabilized for a long period due to the climate and dryness), the sludge and soil sample is also important to be assessed. In addition, to predict the sludge generated from the HWWTP, wet sludge has to be collected and assessed to identify the heavy metals contain.

This sludge assessment provides an important indication to determine the future sludge generated from HWWTP was suitable for irrigation reuse or has to be dumped to the sanitary landfill[3].

5.2.2.2. Physical Impacts

_ Noise/Vibration impacts.

The trunk sewer will not cause serious environmental and social impacts during operation other than the routine operation and maintenance activities. During the operation of the WWTP, issues of noise/vibration, nuisance by vehicles transporting materials are of concern. On the other hand traffic and noise/vibration impacts will not be a serious problem because the number of vehicles carrying in and out is limited.

Table 5.5 : the expected environmental impact assessment of Noise/Vibration at the project operation stage.

		Degree of impacts				
Impact due to operation	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
Noise/Vibration impacts	1	2	3	4	24	Medium importance

_ Air Quality.

When operating the treatment plant it may result in the following:

The impact on ambient air quality this project will be determined during the construction of project components, during operation of the project and at the reuse schemes, As the site characteristics of the project components vary, therefore the parameters and the sampling duration (especially H_2S as specific characteristic of odor generated at the treatment plant only) will be defined according to the specific site characteristics and condition and based on scientific explanation.

Potential odors may be emitted. Table 5.6: showing the surrounding air quality and samples to be taken periodically during the operation of the sewage treatment plant.

Table 5.6: Proposed sampling parameters to determine the air quality.

Tested parameters	Result
SO_2	
NO_x	
CO	
SPM	
PM_{10}	
H_2S	

_ Electromagnetic radiation.

Electromagnetic radiation sources at the operational sites include all electric consumers, package transformer substations, and power mains .

The following measures will be taken to prevent their harmful impact on the HWWTP personnel :

- ✓ placing of conductive parts of process units inside metal bodies with isolation from metal structures.
- ✓ earthing of metal bodies of package equipment and their functioning as natural fixed shields from electromagnetic fields.
- ✓ safety earthing and zero grounding, equipotential bonding, protective cutout devices.
- ✓ earthing of power and lighting equipment with zero protective earth (PE) conductors.
- ✓ lightning protection system .

Basing on the above, environmental impact of electromagnetic radiation from the Project can be assessed as insignificant and weak[15].

_ Ionizing radiation.

The HWWTP does not include the installation and operation of artificial ionizing radiation sources, therefore no environmental impact of ionizing radiation from the planned processes is anticipated.

_ Thermal impact.

Operation of process equipment and traffic at the HWWTP site results in hot gas emissions to air and hence inevitable local thermal contamination of the environment. The assumption on Project-related heat losses given in the EIA was made with account for annual fuel consumption and efficiency of equipment and engines.

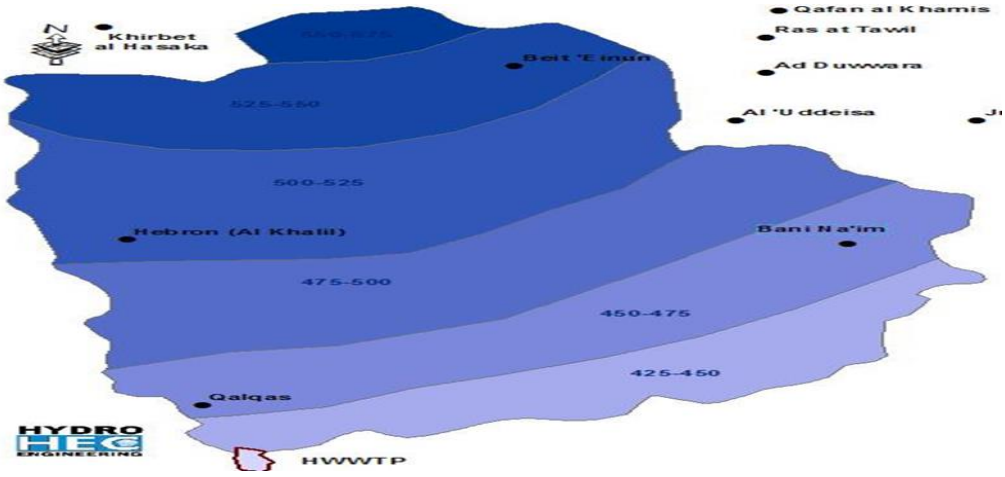
Basing on the estimate , a conclusion was made that the input of HWWTP facilities before and after the construction to the overall thermal emission in air of the Project area would be insignificant.

5.2.2.3.Surface Water Impacts.

_ Introduction.

The HWWTP is located in the upper part of the Hebron watershed (in some literature it named Bessor watershed). The main stream is Wadi al-Samen which is an ephemeral stream like other streams in the West Bank. However, it is characterized by a maximum of six to seven major flood events in a very rainy year with only a few days of flow. On average, there are two to three major flood events per year[3]. There are no lakes and marshlands in the Project area.

Although the Hebron watershed is considered to be ephemeral, due to anthropogenic activities, for several decades, part of its stream has continual flow all year long. Discharge of raw sewage from the city of Hebron, Qiryat Arba and from marble quarries in the southern Hebron Mountains (which give the water a whitish-grayish color) is estimated at 15,000 m3/day (~5.5 Mm3/yr) causing a continuing flow that reaches the Bir Al Saba' wadi[3].



Watershed map for the HWWTP[16].

Two sampling locations were identified for wastewater flow and load monitoring. The locations were primarily selected to avoid intercepting flows from the Hebron Industrial areas with its high suspended solids loadings due to the large concentration of stone cutting facilities there, while at the same time being representative of the entire remaining sewered areas [3].A composite sample of the wastewater was obtained on a daily basis at Location and analyzed for the listed parameters of BOD, COD, Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphates (TP). The concentrations of metals in the wastewater were also monitored. Table 5.7 :provides a summary of the flows from the two selected locations combined. This indicates that the average combined wastewater flow rate for the Hebron Municipality from the two locations is 444.0 m³/h or 10,660 cubic meters per day[3].

Table5.7:Summaries of Combined Flows for Hebron City.

	Unit	Average Flow rate
Sample Location 1	m^3/hr	351.8
Sample Location 2	m^3/hr	92.4
Combined Flow rate at both locations	m^3/hr	444.0
	m^3/d	10,660
Ratio of Min. to Average		0.10[1]
Ratio of Max. to Average		2.30[1]

_ Water Analysis.

Water sampling will be taken at the effluent of HWWTP ,Table 5.8: shows the parameters that will be analyzed. The analysis will be done with the standard method. Calibration sheets and detailed methods will be presented prior to construction. Groundwater assessment results provided by PWA will be verified and water samples taken at different points will be used as the baseline water quality environmental condition.

Table 5.8: shows the parameters that will be analyzed along the of Wadi al-Samen.

Tested Parameters	Date of Sampling	(#of samples)	Sample location	Result
pH				
TDS				
BOD				
COD				
NO_3				
T.N &P				
Cl				
Detergent				
F.C				

Water quality is monitored and measured before and after treatment when operating the treatment plant, as shown in the table :5.9.

Table 5.9 :Waste water quality at the inlet and outlet of HWWTP and effluent quality standards

Parameter	Influent (mg/l)	Effluent (mg/l)	Discharge limits	
			PSI standard	WHO Standard
BOD_5				
COD				
Suspended solids				
Ammonia				
Ph				
Total phosphorus				
nitrite				
nitrate				
Sulphate				

In general, water quality may be affected by potential leaks in areas intersecting with channels, The effect will be temporary until maintenance is complete, the probability of occurrence will be minimal and the effect should be considered of little importance. The main impact on surface water during the operation of the wastewater treatment plant will result from the sludge disposal that will be included in the sludge management division. There are no impacts due to the discharge of the treated flow, as it will be used for irrigation of crops, and for re-use in some industrial sectors. Effects are not expected to occur during the operation of the HWWTP. So the effect is considered to be of little significance. The effect will be fully controlled if waste mitigation measures are implemented.

Table 5.10: the expected environmental impact assessment of surface water at the project operation stage.

		Degree of impacts				
Impact due to operation	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
surface water	1	3	4	4	48	big importance

_ Mitigation measures:

- ✓ Regular maintenance of transmission lines, sewage network and treatment plant.
- ✓ Implementing waste mitigation measures.

5.2.2.4. Impacts on Groundwater Quantity.

The sustainable yield in the groundwater system in the Hebron area is relatively high (i.e. 40 Mm3/yr) which can significantly contribute to solve the shortage of water in the area. Moreover, treating the wastewater of Hebron City and its surrounding communities as well as the storm water during winter months will increase the water availability for the area by additional 20-30 Mm3/yr.

It should mentioned here that management of this potential water amounts still need future investigations including storage facilities, reuse of treated wastewater, well developments for both pumping or artificial recharge, constructing infiltration basins. As a result, the proposed HWWTP will play a major positive impact for increasing the water availability in the Hebron Governorate which leads to economical, environmental and social impacts[3].

Groundwater quality analysis should be continued in wells located at or near the plant site .As the table5.11 shows.

Table5.11:Water quality for wells

Well	Parameter	Water-quality sample concentrations (mg/l)								
		TDS	Cl-	NO3-	Na+	Ca++	Mg++	K+	HCO3-	SO4-
	Maximum									
	Average									
	Minimum									

5.2.2.5. Soil Analysis.

Soil sampling points has to be determined based on a grid pattern and should be taken in areas which are identified as “hot spots”. In addition, along the wadi and at the egress of the sewerage pipe are to be measured to indicate the contamination pattern. Analysis will be conducted in accordance with international standard methods wherever practicable and applicable. Parameter considered for soil/stabilized sludge sample will concentrate on heavy metals and in organic contaminations, if needed.

_ Soil analysis is as follows :

1. ECe (µS/cm) Soil extraction method EC meter.
2. SAR By calculation method Flam photometer.
3. Organic matter (%) Ignition method Furnaces.
4. CaCO3 (%) Titration method Digital titration unit.
5. PO4—ascorbic acid Spectrophotometer.

The risk of soil contamination as a result of irrigation with mismatched water:

In the project a sewage treatment plant, the treated effluent from the new wastewater treatment plant in Hebron will be reused in irrigation of the adjacent agricultural lands for that purpose, which, as a first step, is complied with the standards of treated wastewater, the first step to obtain approval to use wastewater In irrigation. However, wastewater may become non-compliant for any reason that could possibly be used directly on irrigated soil. This risk may depend on the area of the irrigated land and the degree of inconsistency of the treated wastewater.

Table 5.12: The risk of soil contamination due to non-compliance with operating procedures.

		Degree of impacts				
Impact due to operation	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
The risk of soil contamination due to non-compliance with operating procedures	1	1	3	3	9	Medium importance

_ Mitigation measures:

- ✓ Implementation of a preventive maintenance program for all electromechanical structures and equipment in the wastewater treatment plant. The supplier of each device must provide a preventive maintenance schedule for the supplied equipment. Whereas, the implementation of this schedule is part of the operating manual for the WWTP.
- ✓ Continuous monitoring of incoming and outgoing discharges from the wastewater treatment plant. Daily averages should be calculated and documented.

5.2.2.6. Sludge Analysis.

Sludge analysis is the basic for calculating heavy metal contamination (metal additions) when sludge is spread on farm yard. Sludge analysis from the WWTP is to be conducted to predict the metals contamination when the wastewater is transferred fully to the new WWTP. The influent wastewater flow rate is assumed to be similar as the wastewater network mainly connected to the households. The influent characteristic of the wastewater to be received at HWWTP is mainly from the household processes[3]. Although metal concentrations will vary considerably between samples, but there is general relationship between metal and sludge dry solid (but considerably not stabilized yet) content. Thus the accurate assessment of metal contamination or metal addition to land requires collection of a representative sludge sample for dry solid analysis (according to standard sludge analysis of EPA) . Sampling of liquid sludge is generally undertaken from first treatment process or first anaerobic pond [3]. Settled solid (sludge) was taken at representative depth of the pond. The normal practice to analyze sludge sample is after it

is turned to be dry solid content (reference made to the EPA standard for sludge analysis). Analyses have to be conducted in accordance with international standard methods wherever practicable and applicable. Parameters considered for wet or liquid sludge sample was concentrated on heavy metals.

Operation of the wastewater treatment plant generates sludge. The negative health and environmental impacts caused by sludge can be minimized through appropriate management. One of the following methods of sludge management can be followed:

- ❖ Dispose of sludge properly by landfill.
- ❖ Use it as fertilizer for agricultural lands.
- ❖ Used as alternative fuel in some factories.

The optimum selection depends on the results of the analysis of the sludge samples and the approval of the Ministry of Agriculture on the use of the sludge in the agricultural lands (you can not obtain this approval only after the actual production of the sludge and its analysis). Consequently, the environmental impact of all options was assessed.

Also, sludge contains nitrogen and phosphorus, which are beneficial components of the soil in agriculture. However, you must develop its use in order to prevent harmful effects on water, air, soil, plants, animals, and humans, but the sludge may also contain a large amount of heavy metals, pathogens and bacteria that can It has negative health risks and is considered (based on the result of the analysis) as a risk waste[8].

_ Determine potential environmental impacts:

- o Effects related to the storage, drying and treatment of sludge inside the wastewater treatment plant.
- o Effects associated with sludge transport.
- o Effects associated with landfill disposal.
- o Effects associated with the use of sludge on agricultural land.

_ Effects from transporting sludge to landfill / external treatment facility / farmland.

Regardless of the method used to treat sludge (reuse / disposal to the nearest burial / treatment facility or transfer to adjacent agricultural land), there will be a need to transport it. It requires the use of trucks to handle the amount of sludge produced. These trucks are a source of air emissions that contain nitrogen oxides, volatile organic compounds, carbon monoxide and carbon dioxide. And contribute to air pollution and the formation of smog, when assessing the effects of emissions from vehicles and the transportation process, it was found that the effect will be intermittent periods as the sludge will leave you and need to be transported after long periods. Spatial impacts are limited to hundreds of meters around wastewater treatment plants. In terms of its severity to the environment, these air emissions can cause environmental changes that damage individual components, but the natural environment is still self-recoverable. Therefore, air emissions from sludge transport should be considered of minor importance to the

environment[15]. Noise is also expected due to sludge transport. However, given the intermittent nature of the transport process and the expected average noise level, the effects of noise due to sludge transport should be considered of minor importance. Table 5:13 shows the expected effects of the transfer of the sludge.

Table 5.13 the expected environmental impact assessment of from transporting sludge.

		Degree of impacts				
Impact due to operation	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
transporting sludge	0.5	2	2	3	6	Little importance
Air quality	0.5	1	4	3	6	Little importance
Ambient noise	0.5	1	4	2	6	Little importance

_ Mitigation measures:

- ✓ Lime treatment. Sludge and lime should be well mixed and the pH level should not be less than 12 and the temperature should not be less than 55 ° C for at least two hours after mixing[15].
- ✓ Workers who deal with sludge or who work near sludge tanks at the wastewater treatment plant must wear appropriate gloves or shoes. Personal hygiene instructions must be published between workers before starting work. These instructions should be clearly explained in labels that are placed in offices and rest rooms for workers.
- ✓ A manual for sludge treatment will be prepared and will be modified annually based on the actual sludge quality, actual quantity, and new laws and regulations.
- ✓ A sludge removal plan will be developed that includes the following procedures:
  1. Maintenance of service roads around the ponds.
  2. A plan will be established to isolate the solids from the oxidation pools to protect the lining system.
  3. Develop a plan for measuring solids (sludge) accumulated in the oxidation ponds using appropriate equipment.
  4. Sludge is stored and transported in a closed barrel to minimize environmental impacts.

- ✓ Putting Sludge on agricultural land:
  - Sludge should not be placed on the soil where fruit and vegetable crops are grown, or less than ten months before harvesting fruits and vegetables.

- Grazing animals should not be allowed to access pastures or fodder lands less than three weeks after sludge is placed.
- Sludge should be used to meet the nutritional needs of plants and not degrade the quality of soil, surface water, and groundwater.

5.2.2.7.Effects resulting from the handling and / or disposal of non-hazardous waste.

It is expected that non-hazardous waste will be generated during operation of the sewage treatment plant. These will arise from cleaning and washing filters as well as from the daily activities of workers. The latter will consist of a mixture of leftovers, plastic packaging, and paper. The first possible effect will be contamination of soil, groundwater and / or surface water due to the random disposal of polluted solid waste. Another potential effect is the loss of natural resources if recycling is not carried out. Other impacts include negative visual effects if the waste accumulates in front of or around the lifting stations and the wastewater treatment plant.

The burning of accumulated waste affects the air quality at the sites of the lifting stations and the treatment plant, and can produce toxic emissions, especially if the plastics are between the waste. The table 5.14: below shows an assessment of the impacts due to the generation of non-hazardous wastes during the operation phase. Most of the impacts should be considered of medium importance.

It is expected that the negative impact of the generation of non-hazardous waste will be fully controlled through the implementation of the mitigation and monitoring measures listed below.

Table 5.14: Assess the expected impacts on handling and / or disposal of non-hazardous waste

		Degree of impacts				
Impact due to operation	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
Generate non-hazardous waste	1	1	4	2	8	Little importance
Loss of natural resources	0.5	1	4	2	4	Little importance
Health effects	1	2	4	4	32	big importance

Effects on soil and groundwater	1	1	4	3	12	Medium importance
Optical effect	1	2	4	4	32	big importance
Effects on air quality due to open burning	0.25	1	1	2	0.5	Little importance

_ Mitigation measures:

- ✓ Design a system to separate the different types of waste.
- ✓ Disposal of non-recyclable waste to the nearest landfill.
- ✓ Record the quantities and keep the lists as they are ready for review by the Palestinian Environmental Quality Authority.

5.2.2.8..Effects resulting from the handling and / or disposal of hazardous waste.

As mentioned in (Project Description), some of the hazardous materials needed for operations include chlorine gas, diesel fuel for generator and lubricant. Diesel fuel and lubricants will be used, which usually have some hazardous and toxic properties. However, it is expected that there will be increased awareness of the risks to workers when dealing with them. The greatest risks in this regard will be associated with the necessary disposal of empty containers. Effects on soil quality (and groundwater) can result from leakage in the fuel storage tank. Laboratory chemicals include many dangerous substances and liquids. The health risks associated with dealing with hazardous materials should be considered of great importance. Giving awareness lectures about occupational safety and health procedures, in addition to implementing normal laboratory operating procedures, including preparing control models and wearing personal protective equipment, ensuring the impact is minimized[15].

In addition, if this hazardous waste is not handled, stored and disposed of according to the best engineering practices, this will have a significant and irreversible negative impact as follows:

- ☒ Misuse and random disposal of liquid and hazardous solid waste has major health effects on site workers, residents within the project area, people who deal with waste during transportation and disposal, as well as plants and animals exposed to such waste.

- ☒ Random disposal of hazardous waste, especially in liquid form, would cause soil pollution through direct contact or leaching.
- ☒ There is a high possibility that the uncontrolled disposal of hazardous waste may affect the quality of groundwater through filtration.
- ☒ Air quality can also be greatly affected as random disposal of hazardous materials will in most cases lead to open burning and the possibility of this toxic release.

The evaluation of the effects included as shown in the table: 5.15. Most impacts should be considered of medium importance and fully controlled through implementation of mitigation actions.

Table 5.15: Assess the expected impacts on handling and / or disposal of hazardous waste

		Degree of impacts				
Impact due to operation	Possibility of occurrence (A)	Spatial scale (B)	temporal scale (C)	Effects of intensity (D)	Integrated Evaluation Of Impact (A)*(B)*(C)*(D)	The importance of impact
Generate hazardous waste	0.5	2	2	3	6	Little importance
Loss of natural resources	0.5	1	4	2	4	Little importance
Health effects	1	3	4	4	48	big importance
Effects on soil and groundwater	1	2	4	3	24	Medium importance
Optical effect	1	2	4	3	24	Medium importance
Effects on air quality due to open burning	0.5	2	3	4	12	Medium importance

_Mitigation measures :

- ✓ Different types of hazardous waste should not be mixed.
- ✓ All hazardous waste must be recycled or disposed off site at a licensed landfill to be identified by the licensed contractors identified at the beginning of the operation phase. Awareness campaigns and training in sound environmental practices for managing hazardous solid waste should be implemented as part of safety and health measures.
- ✓ The company creates a register of hazardous materials and waste, and records all data related to the management of hazardous waste and materials:
  - o Record the amount of hazardous waste generated on the site.
  - o Record the amount of hazardous waste sent for disposal and archive disposal receipts.
- ✓ Adopt a system to identify the hazardous waste generated on the site.
- ✓ Waste storage area management.

Emergency response as follows:

1. Procedures to contain emissions from a safe distance.
2. Prevent it from spreading.
3. Evacuation.

The following materials are available on site:

- o Fire extinguisher
- o Worker protection equipment, including chemically resistant gloves, glasses, etc.

5.2.2.9. Impacts On Irrigation Technologies.

The Nitrogen loading in the treated effluent depends essentially on the waste water treatment technology, the drip and sprinkler irrigation systems have no direct effect on reducing nitrogen loading of the treated waste water, but these systems have positive effect in decreasing the loading to the lands and consequently to ground water due to their high irrigation efficiency compared to surface irrigation systems[3].

Sprinkler irrigation systems are suitable for field and fodder crops and drip irrigation systems are suitable for tree crops they have almost the same high irrigation The same applies to salinity loading of the treated effluents, these efficient systems load less soluble salts to the lands compared to surface irrigation systems. The sprinkler and drip irrigation systems when used to irrigate the same crop deliver the same water quantity, sprinkler irrigation systems wet a larger surface area, thus distributing the same amount of added soluble salts to larger area leads to make the salinity affect less compared to drip systems which have smaller wetting area. It worth mentioning that the negative salinity impact for both systems is considered tolerable under good irrigation management similar to the situation of irrigating utilization fresh resources, in the water balance model of the current project the crop water demand includes additional portion

added extra to the total crop water requirements to leach added salts beyond plant root zone to prevent salinity build up negative impacts on crop productivity[3]. This extra portion termed leaching fraction depends on the crop salinity tolerance rate and the salinity of the treated effluent ,and to minimize the applied water rainfall is first used to satisfy plant requirements' effective precipitation' , but because rainfall may exceed plant water demand specially in winter time the ineffective precipitation is considered for leaching part of the applied salts and only the required water to leach the remaining added salts is added to water requirements efficiency.

5.3. Socio-Economic Impact Assessment

5.3.1. Introduction

Environmental and social impacts were evaluated at several different levels to arrive at accurate results about the impacts resulting from the project, analyze the available alternatives and identify appropriate and necessary mitigation measures to reduce negative impacts and reach the maximum possible positive impacts[17]. These effects were divided into two parts: direct and indirect effects, and short and long-term effects. The impact assessment process was completed for the construction and operation phases. Although social and economic impacts are difficult to be quantified, they have been calculated based on several determinants that can be monitored as follows:

Table 5.16: Determinants of calculating social and economic impacts

Project component	Impact time	impact type	Impact pattern	The sensitivity of the affected	Impact period	Impact range
- Lift stations and treatment - Networking	- The construction phase - The operational phase	- Negative + Positive	-Direct -Indirect	- Children - Youth -Older persons - Ladies	-Short-term - long-term	-Limited -Medium -A wide range

5.3.2. Construction Phase

It is clear that the different impacts of any project are the main determinants of the success or failure of this project. Environmental studies do not only aim to monitor these impacts, but to suggest different mechanisms to reduce or mitigate the negative impacts of different projects. The positive effects during the construction phase are often limited, because this stage often disturbs the community**.**

During the construction phase, socioeconomic impacts generated by the project will be temporary and expire with terminated implementation. To alleviate potential negative consequences during the construction phase, necessary measures should be taken in advance. To get rid of the wastewater water and consequent problems.

Implementation of the wastewater treatment station project needs a relatively long time. To reduce damage caused to residents' interests, an implementation plan needs be in place. Despite the fact that potential damage of private properties is limited, the situation should be restored in damaged areas (including restitution of demolished walls, rubble, etc.). Interviewees indicated that construction contractors had left behind project leftovers on their land after completed construction works (e.g. water network installation or repair and conversion of the wastewater stream into closed sewers). .

Although the project bears a great significance and benefits all residents, (eliminating damage caused to people, land and livestock, according to more than one interviewee). In this vein, respondents raised several questions: Is the wastewater treatment station noisy? Who will work on the station? Who will construct it? Who can benefit from treated wastewater? It should be noted that residents of the affected communities feel they are marginalized and, therefore, fear that they continue to be treated as such. This should be taken into account during the promotion phase, as well as in the course of developing implementation and communication mechanisms. Having sustained an extended damage of the wastewater stream, these residents should gain the fruits of this project.

5.3.3. Operation Period

In general, improved wastewater management services in any residential locality will exert long-term positive socioeconomic impacts. In the case of the surveyed areas, anticipated results of the project implementation can be summed up as follows:

- Eliminating a public health hazard that exerts health, economic and social predicaments to both officials and local residents. The project will also contribute to restoring farmland in the vicinity of the wastewater course.

- Providing a large quantity of treated wastewater for agricultural and industrial purposes, saving for domestic use the potable water currently used in these activities. Accordingly, the project will alleviate potable water shortage and provide a cheap water supply for various uses.

- Reducing groundwater and soil contamination and allowing expansion of irrigated farmland, thereby exerting immediate positive impacts on local residents' economic conditions, public health, and environment.

- Improved conditions of the access road, which will facilitate transportation flow and thus economic opportunities for local residents.

- The project will partly contribute to minimizing unemployment in the surveyed residential locales by creating sustainable (although limited) employment opportunities during the construction phase, or providing other opportunities in the agriculture sector. This is so significant for a considerable number of residents in these communities, who rely on the agricultural activity as a major source of income.

5.3.4. Land Acquisition and Resettlement

It has been made clear by PWA and Hebron Municipality that no lands will be acquired by private owners or communities. The lands for the WWTP are owned by the PWA. The trunk sewers are to be installed in place of the wastewater stream and wadi. The lands for the construction of the trunk sewer are public property and are within the proposed extension of Hebron municipality.

Interviewed local officials and residents declared that the project will be implemented on land already owned by the PWA. , the lands are allocated for the purpose of construction the wastewater treatment plant for Hebron Governorate . The land parcel numbers are 240, 241, 242, and 243 of 8 and land parcel number 1151 of 2 of Hebron City lands[3].

5.3.5.Risks Related to Health and Safety:

Except indirect impact (deterioration of air quality, spread of noise and electric fields, etc.) there is a direct risks of impact on health and safety (residents and staff working within the project) during the construction phase.

Direct impacts may be: Vehicle collision, power hit, falling from height, injuries while working with construction techniques and others. Strict security measures and a permanent supervision should to be protected in order to prevent direct impacts. Security measures include:

•Personnel should to be trained on safety and labor protection issues.

•Personnel working at height must be secured with ropes and special mountings.

•Warning, prohibiting and indicative signs should to be arranged throughout the construction sites and camps.

•Maximum protection of safety rules during the transportation.

•Transportation should to be limited to a minimum in populated areas.

•Risk assessment should be conducted regularly in order to determine specific risk factors for the population and for appropriate management of such risks.

•Construction personnel shall be provided with personal protective equipment (special - clothing, helmets.

Table 5.17: Summary of the impact on socio-economic environment

Description of impact and its sources	Impact receptors	Residual Impact Assessment				
		Nature	Probability of impact	Impact area	Duration	Residual impact
Construction phase						
Restriction of access to resource: • Impact on land owners - implementation of any type of activity on their lands, or damage of their property . • Limited use of water resources.	Local population	Direct, negative	Low risk	Area adjacent to the treatment plant	Duration is limited by the construction phase	Low
Positive impacts related to the employment	Local population	Direct, Positive	High probability	Population of yatta	Duration is limited by the construction phase	Medium
Negative impacts related to the employment : • Violations of workers' rights . . • Disagreement between the local residents and workers.	Construction staff and the local population	Direct, Negative	Medium risk	Construction sites and nearby populated areas	Duration is limited by the construction phase	Low

Risks related to health and safety: • Direct (e.g. Vehicle collision, power hit, falling from height, injuries while working . •Indirect(Atmospheric emissions , water and soil pollution).	Construction staff and the local population	Direct or ,Indirect Negative	Medium risk, considering mitigation measures – low risk	Construction sites and nearby populated areas	Duration is limited by the construction phase.	Low
Damage of road pavement • Movement of heavy equipment. **loaded traffic flow** • Movement of all types of vehicles and equipment. **Limitation of movement** • Closing the local roads for the security purposes.	Local infrastructure, population	Direct, Negative	Medium risk	Roads used for the project activities , as well as by the population	Duration is limited by the construction phase	Low

Operation Phase:						
Risks related to health and safety of population: • Indirect - spread of unpleasant odor; In case of maintenance works atmospheric emissions, increased acoustic background, water and soil pollution.	Plant staff and local population.	Direct, Negative	Low risk	Adjacent residential zone	Long-term	Very low
Employment: •Creation of jobs.	Employment of local population	Direct, positive	High probability	Hebron City	Long-term	Low
Improvement of local wastewater infrastructure (positive impact).	Local population and tourists	Direct, positive	High probability	Wadi Al Samen, Hebron City	Long-term	Low

5.3.6. Socio-Economic Mitigation Measures

Based on the field research, a set of problems should be carefully addressed:

i. Questions raised by residents of the target areas and public expectations of the project information. The project managers should make field visits, publish and distribute information handouts. To attain this result, a permanent contact should be in place through field visits or establishment of committees in the target communities.

ii. In principle, respondents accept the reuse of treated wastewater in various activities. In addition to maintained health standards, residents stipulated that the treated wastewater be pure; i.e. they need a fatwa to permit this water. To ensure valid use for agricultural or

industrial purposes, scientific tests should be conducted and relevant results disseminated to beneficiaries. Caution should be observed, however. A first impression affects acceptance to use treated wastewater on the long run. For instance, managers of stone processing factories need to make sure that treated wastewater will not negatively impact on their equipment, particularly salinity levels or sediments. Furthermore, farmers need to know that treated wastewater will not adversely reflect on their crops.

iii. With respect to willingness to pay subscription fees, farmers stated that they would use the public network-supplied water free of charge or in consideration of reduced prices (e.g. ILS 1 per cubic meter). On condition that treated wastewater is pure and valid, owners of stone processing facilities also indicated they were willing to pay ILS 5 per deliverable cubic meters. This is logical given that they currently purchase a cubic meter of water at ILS 15[3]. It is out of the question that they will subscribe to a cheaper water source. In the affected communities, farmers believe that they have suffered from the wastewater stream all over the past decades and that they now have the right to benefit from treated wastewater. According to the field research activity, it seemed that farmers would compete over this water, which they believed to be a right of theirs.

The following mitigation measures are required:

1- Contact residents in various areas affected by the project in order to disseminate the right information, explain potential results, and ensure full support of the project.

2- Work towards developing a progressive tariff system to collect fees of wastewater disposal through the public sewage network. This system will be based on the volume of water consumption, taking account of poor households and communities affected by Israeli measures (the Old City of Hebron). The 'culture of payment' should also be promoted by monitoring performance of fee collectors and enforcing relevant laws.

3- Whenever possible, local residents should be employed during the construction phase and operation period.

4. Prioritize localities that have been affected by the wastewater stream for extended years so that they can benefit from potential positive impacts, especially the use of treated wastewater in agricultural or industrial activities.

5. Offer, whenever possible, incentives to residents of affected areas through coordination with other government bodies or donors to support construction of healthcare centers and schools in target communities. These include conversion of the Municipality-owned livestock market into a public park and use of a portion of treated wastewater to irrigate it. Local residents highlighted significance of this project as they lack entertainment facilities in the area.

6. Following construction phase, publish and disseminate information handouts on effects of the project on the local population, highlighting optimal use of treated wastewater, specifications,

impact on public health. Fatwas will be made to permit the use of treated wastewater and sensitization sessions will be held in target communities.

7. Provide protection to sewer pipeline and ensure it is not sabotaged or robbed. Stolen sanitary sewer manholes cause foul smell and pose a serious risk to the life of children.

5.4. Cultural Heritage Impacts

5.4.1. Vernacular structures

According to the National Spatial Plan (Protection of natural and cultural resources), the area of Qilqis is classified as (inhabited Kherbeh) that means a demolished ancient Hamlet newly inhabited by people[3]. In the vicinity of this Kherbeh lies the proposed site of the HWWTP. Traces of ancient human activities are scattered over the territory, however some spots are more likely to host such traces than others. The southern part of the proposed site reveals some vernacular built elements. These elements are more developed than dry stone walls but they need further investigations and excavations from archeologists to elaborate on their characteristics.

Knowing that archeological sites are protected by the law of antiquities for the year 1966 according to article no 10[3] . The first way is Avoidance; it is crucial to avoid any adverse effects to such sites. Since the whole Kherbeh (Qilqis) is classified as archaeological, it is better to avoid places that show signs of rich human traces.

However, if constrains of topography or the feasibility of avoiding the site is of serious burden, then preemptive actions should be taken when dealing with archeological site:

• Consolidate the structure of the archeological element using means of framework.

• Great attention must be paid to all elements of the archeological site, and call for archeologists to supervise the process of consolidation.

• Prevent any attempt to dump or bury archeological elements in the process of excavation.

• Using the lightest methods and instruments in excavation and installing pipes around the site.

5.4.2. Caves

Potential impacts of water and sanitation project on caves represent in digging on top of ancient caves and remove their traces. Moreover the move of heavy machines on in areas of caves and cavities expose on human being’s life to danger on the one side and lead to the damage of caves on the other.

There is high possibility of finding caves scattered in the target area; if caves are historic they should be preserved. If not interventions are allowed.

5.4.3. Terraces

Terraces are a set of platforms marked on the lands to improve agricultural production and considered a traditional feature of Palestinian heritage. Terraces in the area around are subjected to demolish due to difficult accessibility to the project site. It is highly crucial not to undermine these cultural assets when designing roads toward the project site. Many terraces are laid out in the western slopes that surround the project site. The fragile structure of dry stone walls that form these terraces requires attention and in order to keep it intact.

Terraces represent are fundamental to the Palestinian landscape, and must thus be preserved and maintained.

• If some of them were affected, they should be repaired in accordance with compatible techniques and materials.

• It is necessary to rebuild demolished terraces and avoid heavy intervention.

• Terraces are composed of dry stone retaining walls, vegetation and soil. It is necessary that all these components are recovered when any intervention takes place.

5.4.4. Agriculture Land use and Vegetation

As introduced in previous sections, important parts of flora are the olive groves, vineyards and indigenous trees. Since the specified project site does not include organized agricultural activities, the potential impact that may affect this component during the implementation of "Hebron Wastewater treatment plant "can be summarized in ripping of olive trees and herbs from the surrounding area during the attempts to provide proper accessibility to the site. The mitigation measures for dealing with this situation can be summarized by:

• Routing excavation and utility lines at the furthest point of growth of plants, to reduce the number of effected element.

• Proper scientific transplantation of olive trees is a must when changing excavation routs is not valid, thus all watering and equipment to accomplish process should be always available.

• The propagation of any herbs and shrubs that can be effected during excavation works.

• Depend on community traditional ecological knowledge in the implementation of propagation and transplantation practices.

• Promote trees planting during before and during project implementation period.

5.4.5. Further Cultural Heritage Mitigation Measures

In order to avoid any loss in any of the cultural heritage and natural components during the implementation of the project, it is essential to avoid any conflict in coordination between related stakeholders. Providing clear orientation and information for contractors and workers helps to reduce any adverse impact that may occur. In the case of 'chance finds', the Contractor shall:

- Stop the construction activities in the area of the chance find;
- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects.

In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Ministries and Antiquities take over. it Notify the Project Environmental Officer who in turn will notify the responsible local authorities and the Ministry of Tourism and Antiquities immediately (within 24 hours or less). The Responsible local authorities and the Ministry of Tourism and Antiquities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archeologists of Ministry of Tourism and Antiquities. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values.

Decisions on how to handle the finding shall be taken by the responsible authorities and by Ministry of Tourism and Antiquities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage. All implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities according to the Environmental Management Plan Construction works could resume only after permission is granted from the responsible local authorities.

Thus this study recommends that MoTA is to be informed immediately in case of any cultural assets are found during the project implementation. It is recommended that MoTA be present during the project and to be continuously consulted. If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction.

Coordination with local authorities, MoTA office in Hebron concerning the protection of cultural heritage will also contribute to minimize potential impacts. Discovery of ele-ments of cultural heritage during project operations is possible. Thus, good management and full coordination will help to take the suitable measures to protect these sites.

To achieve the above mentioned points it is recommended to implement the monitoring and coordination in an institutional level measure, Thus this study recommends that MoTA is to be

informed immediately in case of any cultural assets are found during the project implementation. It is recommended that MoTA be present during the project and to be continuously consulted.

On the other hand, it is vital to coordinate public sessions to encourage local communities to engage in reducing or mitigating possible impact. Locals are the real experts of their environment in terms of depicting an image of what was existed and what they see is better for their quality of life[17].

Chapter Six

Analyzing Alternative

6.1. Introduction.

The wastewater treatment plant project is expected to result in tangible environmental improvement in the project areas. The current situation in which the targeted areas are denied sanitation services

Major environmental and health problems of the population. With some associated impacts and operation in the wastewater treatment plant as mentioned previously, the overall environmental impacts are expected to be positive.

The expected environmental improvements from the wastewater treatment plant project to the current situation include the following:

a) Improving the quality of surface water in the project areas.
b) Improving the quality of groundwater in most areas of the project by preventing the infiltration of wastewater into the groundwater.
c) Although there may be odor related problems when operating a wastewater treatment plant, the effects of odors and insects are expected to improve significantly as a result of good environmental management of the project.
d) The social and economic benefits of the project greatly outweigh the expected negative impacts. The sewage treatment plant project will raise the standard of living of the population by improving public health, reducing infectious diseases, water, improving psychological stress from odors, and not providing adequate sanitation in urban areas…etc.
e) It is believed that the total environmental and social benefits significantly outweigh the negative impacts expected when an environmental and social management plan is implemented. Moreover, the wastewater treatment plant construction project directly contributes to a significant improvement in the management of water resources in the project area.

The operation of the wastewater treatment plant project will be designed to achieve the maximum possible improvement, which will be continuously followed up by the M&E unit.

The environmental improvements expected from the project in light of the current situation include the following:

a) Economic use of freshwater resources, which reduces the demand for freshwater resources that are already under stress.
b) Reducing the demand for fertilizers.
c) Increase the green areas in the project area.

It is expected that the comprehensive social and environmental benefits will outweigh the damage caused, especially when implementing the Environmental and Social Management Plan. Moreover, it will directly contribute to achieving the objectives of the project it aims to, as well as it aims to improve the management of water resources in the project area.

6.2.The alternative location of the wastewater treatment plant.

Four sites were evaluated as potential locations for wastewater treatment and reuse facilities in the Governorate, which are :

1. Al Dahriya Site.
2. Yatta Site.
3. Hebron Site.
4. Bani Na'im Site.

The proposed sites were analyzed previously in the third chapter of the report.

The recommended site for HWWTP is Hebron site which is located 4 km south of Hebron city and 700 m from the nearest residence. The site coordinates are 98,500 North, 160,000 East.

The following points clarify the basis of Hebron site selection :

1. Land acquisition as afore mentioned.
2. The distance from neighbours/ few neighbours.
3. Natural landscape of the wadi.
4. Institutional capacity, Hebron Municipality has the ability to manage and operate HWWTP after construction.
5. The proposed site is near to the existing sewer collection system.
6. The proposed site will contribute to solve pollution problem of the wadi caused by stone cutting industries, mainly the slurry.
7. The industrial wastes generated from the industrial area in Hebron city will be separated from the municipal wastes.
8. The readiness of stone cutting industries to reuse treated wastewater in their industries.

In conclusion, the site as acquired for the HWWTP is suitable for construction of the facility notwithstanding the land preparation difficulties that may occur due to the big elevation differences observed. There is no other alternative to the site, because Hebron is the best site after analysis and study.

6.3. Treatment Alternatives.

Wastewater treatment options evaluated included :

1. Conventional Activated Sludge (CAS) : which refers to a system with primary and final sedimentation in which the activated sludge volume can be developed for various activated sludge processes such as the Modified Lubzack Ettinger (MLE) approach.
2. Extended Aeration (EA) : which refers to an activated sludge system without primary sedimentation and designed for nitrogen removal by simultaneous nitrification and denitrification.
3. Membrane Bioreactor (MBR): which refers to an activated sludge system with nitrification and denitrification in combination with a membrane filtration process instead of final clarifiers.

the treatment processes were evaluated based on their potential to consistently meet these standards :

- Biological Oxigen Demand (BOD5) : 20 mg/l
- Total Suspended Solids (TSS) : 30 mg/l
- Total Nitrogen (TN, as nitrogen) : 30 mg/l later increased to 50 mg/l
- Faecal E-coli bacteria : 200 MPN/100 ml .

The previously suggested treatment options were analyzed in Chapter Three of the report .The Conventional Activated Sludge (CAS) treatment process obtained the highest total scores (Figure3.2) and was recommended as the preferred option for the HWWTP.

6.4. No-Project Alternative.

In accordance with the World Bank Policy and best practice, this section basically presents the two alternatives that were considered for the project; the ‘do-nothing’ and ‘implementing the project’. One of the key objectives in this report is to analyze the environmental and social implications of each viable option and then compare the options to evaluate their environmental performance, which feeds into overall project design.

The ‘do-nothing’ alternative provides a scenario where no WWTP will be developed and no trunk sewer will be constructed in the project area. Table 6.4::is a comparison between the impact of the project and the future conditions without the project implementation; ‘do-nothing’ alternative.

From the table it is clear the worst case scenario is to do nothing and that the construction of the Hebron WWTP and trunk sewer will enhance the environment and the cultural and social resources along Wadi as-Samen.

Table 6.4:Comparison between Project Implementation and 'do-nothing' Alternative[3].

Item	Project Implementation Impacts	Future Conditions Under "No Action" Alternative
Soil	Effluent reuse will increase the salt and sodium content of agricultural soils and underlying strata.	Soil at the WWTP site is assumed to remain unchanged. Raw sewage will continue polluting soils with nutrients alongside the flow in Wadi as-Samen
Air Quality and Odor	Dust will be emitted temporarily .during construction Potential odors may be emitted.	Odor generation will remain while raw sewage is running through the Wadi and will increase with population growth and urban expansion.
Groundwater	Discharge of treated wastewater to the ground surface either for irrigational purposes or disposal in the Wadi may have the potential to increase levels of salinity and nitrogen content, especially when problems occur in the operation of the WWTP.	Groundwater quality has the potential to become significantly degraded because of the continuous flow of raw sewage in the Wadi towards the groundwater recharge areas.
Surface Water	Treated wastewater will be discharged to a network to agricultural areas in future reuse schemes.	Raw wastewater discharge in the Wadi and open areas will continue and will increase with population growth.
Agriculture	Irrigated agriculture will be expanded through reuse of treated effluent and will increase agricultural rate and may change agricultural pattern in to stone fruit trees and fodder.	Rain-fed agriculture will continue at present condition.
Infrastructure and Public Services	Construction activities will temporarily disrupt traffic patterns in the vicinity of the proposed project. Wastewater sector and service will be enhanced and regulated.	Continued reliance on the old conventional system without treatment of wastewater. Discharge to the Wadi is expected to worsen the existing infrastructure.

Socio_ Economic	Construction will create a significant number of new jobs in the area, created at the WWTP when operational. Providing treated water for agriculture will save on cost of purchasing water. Investment in land reclamation in agriculture will be encouraged. The collection and treatment system fees will be more economical than current methods of disposal.	Citizens keep paying for being connected to a wastewater service network even without treatment. Employment in the area will remain unchanged.
Public and Occupational Health	The project will significantly reduce existing and future health hazard created by seepage of raw sewage. Exposure to WWTP chemicals and odors.	Health hazard created by seepage of raw sewage from cesspits and health hazards caused by discharge of raw sewage in the open wadi will increase. Exposure to WWTP chemicals will not be an issue.
Noise	Construction noise will temporarily affect sensitive receptors during installation of conveyance pipelines. Noise during the WWTP operation.	No effect
Historical and Cultural Resources	Cultural and private resources may be subject to damages during construction. Cultural resource found during construction will be subject to the mitigation measures that will restore and enhance these resources.	Cultural and private resources will continue to be negative impacted by the sewage flowing raw in Wadi as-Samen.
Ecology	Ecology and species may be subject to damage during construction. The construction of the WWTP and the cleaning of the Wadi from the flowing raw sewage will restore the ecology and enhance the growth of species that were destroyed by the raw and industrial wastewater flowing in the Wadi.	Damage of ecology and species by raw and industrial wastewater flowing in Wadi as-Samen

Chapter seven

Environmental, Social, and Cultural Heritage Management Plan

7.1. Introduction.

Construction ESMP is a framework document with description of environmental and social management and monitoring procedures. The document will be supplemented as required by a set of environmental and social management plans and procedures for specific Project activities which are of special significance and require special attention. ESMP will identify the Project environmental and social requirements, as well as methods and approaches to ensure that such requirements are met throughout the Project development and implementation. In particular, ESMP will describe the following:

- ❖ Approach to environmental and social management, including definition and distribution of functions and responsibilities.
- ❖ Applicable environmental and social standards.
- ❖ Specific measures to be implemented for control, mitigation and monitoring of environmental and social impacts.

In view of the dynamic nature of Project development, the Environmental and Social Management Plan will allow for prompt response to changing circumstances and unforeseen events, and for revision of action plans based on monitoring and analysis of the Project activities . In view of the natural, industrial and socio-economic baseline which was described in the previous chapters, the potential environmental and social impacts and proposed measures for their prevention and mitigation, the list of management plans and procedures to be developed for the Project includes but is not limited to the following :

- ❖ Project Stakeholder Engagement Plan including comprehensive measures for meaningful disclosure of Project information to local communities and stakeholders, a consultations programme to cover various topics, provision of internal and external grievance mechanism.
- ❖ Construction Environmental and Social Management and Monitoring Plan.
- ❖ Waste Management Plan for the construction and operation phase.

The Main Objectives of the Environmental and social Management and Monitoring Plan:

- ✓ Implement all recommendations and mitigation measures shown in the ESIA report, and any future needs that might arise.
- ✓ Prepare emergency plans to protect the public, the workers, and biodiversity.
- ✓ Establish a monitoring policy and an inspection program to cover environmental contaminants or those that might adversely affect the environment of the area.
- ✓ Implementing Palestinian environmental laws.
- ✓ Adopting technology to reduce and recycle the generated waste.
- ✓ Raising environmental awareness among the public in the region.
- ✓ Emphasis should be on the protection and conserving valued environmental components.
- ✓ Preparing periodic reports on the environmental status of the project and analyzing the data and procedures necessary to mitigate the expected negative consequences of the project.

7.2. Monitoring plan.

The table 7.1: shows Environmental and social Monitoring plan during the project construction phase[17].

Stage	Monito-ring paramete-r	Place of monitoring	Method of monitoring/ type of equipment	Period of monitoring constantly or periodically	Why is this parameter monitored (optional)?	Responsibility for:	
						Construction	Operation
Construction	Noise, vibration	Near socio-sensitive objects residential) houses) during work implementation	in accordance with the current methodological developments	During construction in cases of complaints from citizens	To provide comfort for citizens, living close to place of works.	Contractor responsible for carrying out works;	MEnA , MoH, MoL , Hebron Municipality
		In the area of equipment and machinery operation, which are the sources of increased noise level	in accordance with the current methodological developments	During construction in cases of complaints from citizens	To provide comfort for citizens, living close to place of works.	Contractor responsible for carrying out works	
					To provide appropriate working conditions		
Construction	Dust	At the construction site	Visually	During construction	To prevent environmental pollution and to provide appropriate working conditions for staff	Contractor responsible for carrying out works	Not expected

		Near socio-sensitive objects	Visually	During construction	To provide comfort for citizens, living close to place of works	Contractor responsible for carrying out works	
	Soil, accumulated after excavations	At the place of works	Visually	During construction. As needed	To prevent environmental pollution In order to check the storage regulations of topsoil and preservation of fertile properties of topsoil	Contractor responsible for carrying out works	Not expected
					to provide appropriate working conditions		
	Surplus water from water pipe and elements of water treatment plant and water pumping stations	At the construction site Directly in pits /trenches	Visually	During construction. As needed	to provide appropriate working conditions for staff	Contractor responsible for carrying out works	Hebron Municipality MEnA, , PWA MoH, MoL
	Domestic waste	At the construction site	Visually	During construction As accumulated	To prevent environmental pollution	Contractor responsible for carrying	Hebron Municipality . MoH. MoL.

					to provide appropriate working conditions for staff	out works	
					In order to provide the separate waste collection		
	Construction waste	At the construction site	Visually	During construction. As accumulated	To prevent environmental pollution	Contractor responsible for carrying out works	Hebron Municipality , MoH, MoL, MEnA, PWA
					to provide appropriate working conditions for staff		
					In order to provide the separate waste collection in accordance with safety class		
Construction	Level of pollution of atmospheric air	At the work place	According to the approved methods	As needed	To prevent environmental pollution and exceeding of permissible limits of atmospheric air pollution	Contractor responsible for carrying out works	Not expected
		Near socio-sensitive objects		As needed; after receiving complaints from citizens			
					to provide appropriate working conditions for staff		

Construction	Traffic jams	At the area of construction works	Visually	During construction . As needed	To provide road safety Prevent environmental pollution to provide appropriate working conditions for staff and comfortable movement for locals	Contractor responsible for carrying out works	Not expected
Construction	Appeals and complaints of the local population	At the construction site and near territory	Verification of information indicated on the log of complaints and suggestions	During operation	To prevent accidents and injuries of citizens	To prevent accidents and injuries of citizens	Hebron Municipality, MEnA , MoL
	Water quality Indicators of quality of drinking water are set out in the State sanitary rules and norms	Water supply system in accordance with the water quality control plan	Measurement with the help of devices ,physical) ,chemical bacteriologi ,cal radiological (indicators	According to the established schedule	In order to control the quality of drinking water.	Contractor responsible for carrying out works	PWA

The table 7.2: shows Environmental and social Monitoring plan during the project operation phase[17].

Stage	Monitori-ng parameter-r	Place of monitoring	Method of monitoring/ type of equipment	Period of monitoring constantly or periodically	Why is this parameter monitored (optional)?	Responsibility for:	
						Construction	Operation
Operation	Water leakage	At the distribution network	Visually	During operation; in cases of citizens' complaints and notices.	To prevent environmental pollution and ensure public safety.	Contracting organization responsible for carrying out works;	Hebron Municipality ,PWA ,MEnA
Operation	Safety of workers, pedestrians, citizens.	On the territory of the distribution water supply network On the territory of the water treatment plant On the territory of WTP	Visually. according to the schemes of location of utility lines	During operational	To avoid emergencies and injuries to citizens	Contracting organization responsible for carrying out works, Hebron Municipality, MEnA	Contracting organization responsible for carrying out works,Hebron Municipality, MoH, MoL,MEnA

Operation	Stability of pumping equipment operation at water pumping stations	WTP(Water Treatment Site)	Instrumentally	During operational	To ensure uninterrupted operation of the equipment	Contracting organization responsible for carrying out works, Hebron Municipality, MoL	Contractor/ Equipment Supplier (Performer) in accordance with the terms of the warranty service, Hebron Municipality
Operation	Uninterrupted work of WTP	WTP elements	Visually Instrumentally	During operational	To ensure uninterrupted operation of the WTP and compliance with the technical regulations of the equipment	Not expected	Contractor/ Equipment Supplier (Performer) in accordance with ,the terms of the warranty service MoL Hebron Municipality
Operation	Wastewater (effluent) and Reuse	WWTP elements	Instrumentally, Visually, Regular water and soil testing, Regular health checks,	During operational (Bi-mnthly)	To ensure uninterrupted operation of the WWTP and compliance with the technical regulations of the equipment	Not expected	Contractor/ Equipment Supplier (Performer) in accordance with the terms of the warranty service PWA, MoA, MoH, MEnA,Hebron Municipality

Operatio	Solid waste generation and service	WWTP	Instrumentally	During operational Bi-monthly (Every time)	To prevent the leachate produced from sludge from affecting the water quality and reduce the waste generated and thus reduce the load on the Hebron municipality in the solid waste management system	Not expected	MEnA, MoH, MoP, MoL,Hebron Municipality,
Operation	Appeals and complaints of the local population	The location of the project and the surrounding population	Verification of information indicated on the log of complaints and suggestions	During operation	To prevent accidents and injuries of citizens	Hebron Municipality, MoL, MoH, ,MEnA	Hebron Municipality, MoL, MoP, MoH, PWA,MEnA
Operation	Ecology and Natural Resources	The project site and surrounding areas	Instrumentally, Visually, Environmental reports issued by specialists in the field of ecology	During operation	To save the resources and ecosystems in the project area	, MoA,MEnA ,Contractors and workers on site MoTA	Hebron Municipality, MoL, MoH, , MoA,MEnA MoTA

Operation	Agriculture	The site of the project and the surrounding agricultural lands	Instrumentally, Visually, Regular water and soil testing, Regular health checks,	During operation	Verification of the possibility of reuse of treated water in agriculture and its impact on health, soil and agricultural crops	,MoA, MoH, MoTA, MEnA Hebron Municipality	MoA, MoH, MoTA, MEnA, Hebron Municipality
Operation	Socio-economic	In the project area and on the city of Hebron	Statistics and periodic reports	During operation	Measure the impact of treatment plant operation to improve the economic situation and living standards in the region	Not expected	Hebron Municipality, MoH, MoP,MoL

7.3. Cultural Heritage Action Plan.

Table 7.3: Shows Cultural Heritage Monitoring plan.

Environmental Element	Potential Environmental Impacts	Proposed Mitigation Measures	Monitoring	Institutional Responsibilities	Frequency
Heritage and cultural properties	Damaging of heritage and archaeological sites within the construction area.	1.Contractor will have to continuously monitor any archaeological evidence revealed during construction. 2.Construction should be immediately suspended if any archaeological or other cultural properties are found. 3.MoTA and the project management office should be notified promptly and only after a thorough investigation will construction resume.	1.Contractor shall immediately report any material to the Inspector. 2.The Contractor shall document the time and date of the materials discovery and the time and date of his contact with MoTA. 3. MoTA shall visit the site and approve the site boundary designated. The project inspector shall monitor activities near the established boundary	Contactor, PWA, MoTA	Every time

7.4. Risk Management Plan.

Risk Management Plan (RMP) presents the process for implementing proactive risk management as part of the overall management of the Hebron Wastewater System. Risk is defined as an event that has a probability of occurring, and could have negative impact to a project if that risk occurs. Risk management is an ongoing process that continues through the life of a project. It includes processes for risk management planning, identification, analysis, monitoring and control. Many of these processes are updated throughout the project lifecycle as new risks can be identified at any time. It is the objective of risk management to decrease the probability and impact of events adverse to the project.

The main objectives of the RMP:

1. Identify the potential risk events and the potential impacts if risk occurs.

2. Analyzing the risk event to determine the risk degree.

3. Propose mitigations measures to reduce the probability and/or impact of an adverse risk and create a Contingency Plan.

CHAPTER Eight

Conclusions and Recommendations

8.1. Conclusions.

This section lists the key conclusions of this research:

This report summarizes the results of the impact assessment for the construction of the HWWTP and Trunk Sewer project. It includes an overview of the key environmental, social and cultural heritage impacts associated with the construction and post development of the WWTP of Hebron. No negative impacts of high significance were identified, provided that all mitigation measures are applied effectively. Recommendations are provided for the best practicable environmental option, mitigation and management actions, as well as suggested monitoring during construction and post development of the HWWTP project.

It is not expected that there will be a negative cumulative effect in the long term of the project and most of the negative effects that can be reduced through the tasks that we recommended during this research, and it is worth noting that the public interest overcomes the personal interest.

Through this study, it is expected to obtain the required results from the environmental impact assessment process, including improving wastewater management in the Wadi Al Semen area, improving the environmental and health conditions of the region, and increasing the area of agricultural land through the use of treated water for irrigation of crops, protecting ground and surface water from pollution and increasing food security for communities, reduce unemployment, create new job opportunities, Raising the level of public awareness of the importance of environmental engineering projects and the benefits they have on all practices, adopt environmentally friendly and economic technology, and reduce the cost of wastewater management.

8.2.Recommendations.

- Compliance with World Bank standards.
- Commitment to the environmental and social management plan and cultural heritage recommended in the report.
- Commitment to the legislation and laws of the Ministry of Agriculture and Labor to the Environmental Quality Authority and the introduction of local and international standards in the construction and operation of wastewater treatment plants.
- Employ the mitigation and monitoring procedures outlined in the report.
- Monitor project work mechanism during all stages.
- Attention to complaints from citizens in the project area.
- Stakeholder participation in decision making.
- Raising the awareness of the public about the importance of the project in all environmental, social, economic and health aspects, and improving the standard of living in the region.
- Attention to worker safety at the project site.
- Adopting environmentally friendly technology in all project stages, to achieve sustainability in project implementation.
- Take into account the proper disposal of solid and liquid waste during the project phases.
- Preserving the vital system components and natural resources in the region.
- Define social and environmental impacts in a quantitative manner whenever this is allowed taking into account the activities of the various projects in multiple stages (planning, construction, and operation) and their impact on environmental and social issues.
- Develop the best compensation strategy when necessary.

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