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سلطة الميـــاه الفلسطينية
PALESTINIAN WATER AUTHORITY

THE WORLD BANK

AGENCE FRANÇAISE DE DÉVELOPPEMENT

Environmental, Social, and Cultural Heritage Impact Assessment to Support Additional Financing for the Hebron Wastewater Management Project

ESCHIA/ESCHMP REPORT

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UNIVERSAL GROUP
for Engineering & Consulting

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Sajdi & Partners
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Table of Contents

List of Figures

List of Tables

List of Abbreviations

ARIJ	Applied Research Institute Jerusalem
dB	Dimension Decibel
EA	Environmental Assessment
EIA	Environmental Impact Assessment
CEC	Consulting Engineering Center
CHIA	Cultural Heritage Impact Assessment
ESCHIA	Environmental, Social, and Cultural Heritage Impact Assessment
ESCHMP	Environmental, Social and Cultural Heritage Management Plan
SMP	Social Management Plan
HWWMP	Hebron Waste Water Management Project
HWWTP	Hebron Wastewater Treatment Plant
IEE	Initial Environmental Evaluation
MEnA	Ministry of Environment Affairs
MoA	Ministry of Agriculture
MoH	Ministry of Health
MoL	Ministry of Labor
MoLG	Ministry of Local Government
MoP	Ministry of Planning
MoPWH	Ministry of Public Works and Housing
MoT	Ministry of Transportation
MoTA	Ministry of Tourism and Antiquities
PNA	Palestinian National Authority
PCBS	Palestinian Central Bureau of Statistics
PEAP	Palestinian Environmental and Assessment Policy
PEL	Palestinian Environmental Law
PSI	Palestinian Standards Institute
PWA	Palestinian Water Authority
PDO	Project Development Objective
ToR	Terms of Reference
TPAT	Technical Planning and Advisory Team
UG	Universal Group for Engineering and Consulting
USAID	United States Agency for International Development
WBWD	West Bank Water Department
WHO	World Health Organization
WRC	Water Regulatory Council
WSCBP	Water Sector Capacity Building Project
WWU	Wastewater Unit

1. INTRODUCTION

1.1 Project Structure and Co-financing Details

This project will finance technical assistance, construction and contract management, capacity-building, and incremental project management costs (operational costs, institutional capacity building, monitoring, and supervision) associated with the construction of the Hebron Waste Water Treatment Plant (HWWTP).. The planned construction of HWWTP and the associated institutional capacity building required for the construction contract management the operation and maintenance of the plant by the Hebron municipality require that the reformed water sector policies and practices established under a parallel project (Water Sector Capacity Building Project (or TPAT, the acronym of one of its components, the Technical Planning and Advisory Team), are operationalized at the national and municipal. Co-financing for the HWWTP is being provided by the Swedish International Development Cooperation Agency (SIDA) through the Partnership for Infrastructure Development Multi-donor Trust Fund, the EU, and AFD.

This ESCHIA/ESCHMP has been written to support the construction of the wastewater treatment plant and all associated works. AfD and the EU are financing all civil works associated with construction of the wastewater treatment plant, whereas USAID is assisting to finance the extension of the sewer trunk line from the boundary of Hebron Municipality to the WWTP, the electrical power line to the WWTP, the upgrading of the access road, and the water supply line for the WWTP which will lie within the right-of-way of the access road.. This ESCHIA/ESCHMP serves as the collaborative environmental impact assessment and mitigation document across all financing partners. USAID and PWA have used the Disclosed ESCHIA Report of July 2013 as the base for capturing the current required safeguards specific to contracting of associated works under its financing; accordingly that document, "The Environmental Documentation and Review Report for Hebron WWTP Access Road and Utilities" concords with both World Bank and USAID relevant environmental impact assessment and management polices

The World Bank will ensure that civil works financed by AFD and the EU, and USAID through parallel co-financing arrangements will be supervised in line with World Bank safeguard policies in order to meet environmental and social compliance. Civil works financed by AfD and the EU will be supervised through the Hebron Wastewater Management Project HWWMP, which funds consulting services for supervision of civil works and contract management, project management, and special studies to inform the redesign of the second phase, whereas civil works financed by USAID will be supervised by USAID-financed technical assistance consultants.

The proposed second phase of the HWWTP, supporting operation and maintenance, capacity building for the management of wastewater services and possibly the reuse of treated effluent in irrigated agriculture, will be re-appraised and submitted for donor financing in order to be effective by commissioning of the WWTP. As a part of this second phase, more detailed treatment of environmental and social impacts and mitigations associated with the reuse of treated effluent in irrigated agriculture will be supported by a supplemental safeguards document.

1.2 Hebron Municipality Background

The City of Hebron is served by a combined sewer system with more than 70% of the current population connected to the system. Currently, most of the municipal sewage entering the system from the City and its environs is discharged directly to Wadi as-Samen just south of the City. The area served by the existing sewerage system is also characterized by the presence of many stone and marble-cutting industries which also discharge their wastewater to the sewer system. This leads to high concentrations of sawdust in the wastewater reaching the sewers and eventually the Wadi (**Figure 1.1**).

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.

Figure 1.1: Raw Wastewater Flowing Open in Wadi as-Samen South of Hebron

The proposed project measures include construction of a new wastewater treatment plant to serve the City of Hebron and facilities for conveyance and distribution of the Treated Wastewater (TWW) for use in agriculture. The project also includes training of personnel on operation and maintenance of the plant and its facilities as well as training farmers on proper use of TWW including the required monitoring and control arrangements.

This class of project is normally expected to have a significant effect on the environment. The preparation of an Environmental, Social, and Cultural Heritage Impact Assessment (ESCHIA) for HWWMP, including the HWWTP and its associated works is required by the Palestinian Water Authority (PWA), afd, EU, and the World Bank. The Environmental Assessment (EA) and Environmental Approval are also required as promulgated by the Palestinian Environmental Law (PEL), and the Palestinian Environmental Assessment Policy (PEAP).

The ESCHIA includes an overview of the key environmental, social, and cultural heritage impacts associated with the construction and operation of the HWWTP and its associated works, including trunk sewer, and access road, as well as water and electrical supply lines. It should be noted that, from this point on, the term "HWWTP" refers to the wastewater treatment plant and all associated facilities, unless otherwise specified and detailed. It provides mitigation measures to be considered in the design and proposes an environmental management and monitoring plan.

The general objective of the HWWTP is to contribute to the improvement of the existing hygienic and health conditions of the populations of Hebron city and the nearby areas and villages by improving the wastewater management and the sanitation conditions in the project area.

Prior to ESCHIA, it is important to determine the appropriate level of assessment and identify the issues and concerns. The scoping has consulted with interested and impacted agencies, stakeholders, and the public. The significant environmental and social issues that were identified during the Scoping Session are addressed in this ESCHIA report.

1.3 ESCHIA Objectives

The purpose of the ESCHIA is to ensure that environmental, social, cultural heritage impacts are identified, screened and classified (or categorized) right at the design stage of the phases and components of the HWWTP so that mitigation measures and social and environmental management plans are well developed to avoid or reduce irreversible or serious negative impacts which could affect both the population and the environment to manageable levels.

Among the specific objectives of this assignment of Consulting Services according to the Terms of Reference (TOR) which has been issued by both PWA and MEnA and approved by MEnA, are the following:

- Conduct, prepare and provide (ESCHIA) in order to fully comply with Palestinian environmental law and World Bank safeguard policies, as well as to support the sustainability of the expected project outputs and outcomes.
- Identify the possible environmental, social and cultural heritage impacts of the infrastructure component of the project;
- Identify any potential temporary or permanent land acquisition requirements associated with civil works;
- Design and prepare an environmental, social and cultural heritage management plan (ESCHMP) to manage, mitigate, and monitor any possible negative impacts during the construction and operation phases of the project
- Conduct a capacity assessment of the implementing party of the ESCHMP and provide recommendations for any capacity building needs.

1.4 Screening

The Palestinian Environmental Assessment Policy (PEAP) has listed proposed projects for which an Environmental Impact Assessment (EIA) must be conducted. Wastewater treatment and main sewers projects are listed as number 3. The proposed projects are as follows:

1. Power plants (including gas turbines, substations and super tension lines)
2. Quarries and mines
3. Waste water treatment plants, including main sewers
4. Cement plants
5. Solid waste disposal sites
6. Hazardous waste disposal sites
7. Plants producing, storing or using hazardous substances
8. Airports and landing strips
9. Seaports, jetties and harbors
10. Refineries
11. Industrial estates
12. Major dams and reservoirs
13. Major roads
14. Steel mills

Therefore and considering the above it is required to conduct a detailed assessment of the potential impacts that the HWWTP will have on the environment, on the social structure and values, and on the cultural resources of the project area. This ESCHIA has been prepared parallel to the feasibility study of the project that is currently under finalization. The ESCHIA is to define the environmental impacts of the project and the measures to mitigate the adverse impacts and/or capture potential environmental benefits.

1.5 Scoping Session

Within the context of this study, a scoping session was held in Hebron on August 08, 2012. The Scoping Session provided space for interaction between the consultancy team, the environmental professionals conducting the ESCHIA, the municipal officials, representatives of various Ministries, nongovernmental agencies, local residents, and other individuals and stakeholders who are directly involved in or affected by the proposed HWWTP. The ESCHIA scoping report has been prepared and submitted. It has presented the significant environmental and social issues that were identified during the Scoping Session. The scoping report has also addressed the concerns of the affected individuals alongside the comments of the stakeholders. The scoping report is attached in Annex VIII.

Most of the subjects and issues raised and discussed in the scoping session were addressed and have been covered by the ToR of the ESCHIA study (Annex IX). Other issues have also been raised in the meetings with the different representatives of the Environmental Assessment committee. The scoping session did achieve its public participation objectives and did inform the attendees of the project activities and tasks.

During discussions in the Environmental Scoping Session a number of issues were raised by residents and stakeholders to be considered. The concerns and comments of the participants were summarized into major categories, out of which 6 were determined to be significant. These issues are listed as follows:

- Health and hygiene conditions in Wadi as-Samen
- Odors and noise
- Reuse of treated effluent
- Feasibility and Sustainability of the project, and its future capacity

- Response to emergencies
- Connection of industrial influent

One participant stated that there are rocks and terraces in the valley that may have been ruins of an old village. Consultation with the Ministry of Tourism and Antiquities (MoTA) was done to investigate the significance of this area historically as detailed later in this ESCHIA report.

Three issues were identified as being potentially non-significant; these are:

- Biodiversity
- Treatment technology
- Impacts during construction and implementation phases

In the ESCHIA Scoping Session of the HWWTP, participants (including institutional representatives and local residents) highlighted several social issues regarding implementation of the project. These included the position and expectations of citizens in the benefiting areas towards the construction of the HWWTP, payment of fees (wastewater discharge fees), and willingness to purchase and use treated wastewater in economic activities.

The other main issue raised is related to the stone cutting industries, which are responsible for dumping the slurry and their wastewater into Wadi-as-Samen. These are main contributors to the pollution of the wadi (**Figure 1.1**). At the same time they did express the willingness to reuse the treated effluent in the stone cutting process.

There is a need to raise awareness and build the capacity of workers and officials in sanitation and wastewater issues. Limiting of the sanitation problems is considered a positive impact of the HWWTP. These impacts can be summarized by improving the hygienic conditions, enhance public health, create better social interrelations, and improving the wastewater collection and treatment.

1.6 Scoping on environmental assessment

Scoping is meant to identify the issues to be covered by the ESCHIA and to raise the concerns of the impacted societies and involved institutions. The TOR for the preparation of the ESCHIA has been issued by both PWA and MEnA and has been finally approved by MEnA. The TOR states the general requirements and the scoping of the ESCHIA; which should cover environmental, social, culture heritage, and stakeholder consultation.

1.6.1 World Bank environmental and social safeguard policies

Under the World Bank's operational policies, there are ten environmental and social policies referred to as the Bank's "safeguard policies". The Bank's environmental assessment policy and procedures in light of these ten safeguard policies are described in OP/BP (Operational Policy/Bank Procedures) 4.01.

Table 1.1 outlines the core requirements under each policy. Based on the ESCHIA and the array of information that were made available in context of this study, it has been determined that all the other safeguard policies are not encountered and need not to be covered by the study. This ESCHIA study for HWWTP covers the three policies OP 4.01 Environmental Assessment, OP 4.11 Physical Cultural Resources, and OP 4.12 Involuntary Resettlement.

The ESCHIA examined the potential negative and positive environmental performance of the HWWTP for Hebron and Wadi as-Samen. The examination and assessment were conducted in light of the World Bank's Environmental Assessment policy and procedures OP/BP 4.01. Based on the information collected of the project, the assessment was addressed through:

1. Reviewing the ten safeguard policies and examining the OP 4.01 Environmental Assessment, OP 4.11 Physical Cultural Resources, and OP 4.12 Involuntary Resettlement. Mitigating measures have been identified accordingly.
2. Describe the safeguard issues and impacts associated with the project. Identify and describe any potential large scale, significant and/or irreversible impacts.
3. Describe the potential indirect and/or long term impacts due to anticipated future activities in the project area.
4. Describe the measures taken to address safeguard policy issues. Provide an assessment of project proponent capacity to plan and implement the measures described.
5. Identify the key stakeholders and describe the mechanisms for consultation and disclosure on safeguard policies, with an emphasis on the potentially affected people.

There are other safeguards issues which were dealt with in this ESCHIA including the impact on the stone cutting industry, cultural resources, extension of services to other communities etc.

Based on the analysis of the different safeguard policies and the information collected, all the safeguard policies other than OP 4.01 Environmental Assessment, OP 4.11 Physical Cultural Resources, and OP 4.12 Involuntary Resettlement are not impacted by the project activities. The land parcels allocated for the construction of the HWWT plant are already made available for the project. The trunk sewer and electrical supply line is to be laid out along the edges of the Wadi and will consider the boundaries of the land parcels, the ownership and the agriculture activities. The proposed access road will be constructed adjacent to the Wadi along with a trunk sewer etc.

Under section 7.3.3 the OP 4.12 Involuntary Resettlement is addressed. Annex IV is the Social Management Matrix and Annex V is the Social Safeguards Matrix that summarizes the overall social impact and mitigation measures due to the construction of HWWTP. In this regards the social safeguard mission visited the site in June 2014 and confirmed that there were no OP 4.12 issues. Further information in the form of summaries of the relevant World Bank Safeguards Policies and Requirements is as follows:

Table 1.1: World Bank Safeguard Policies and Core Requirements under each Policy

Policy	Summary of Core Requirements	Public Consultation
Relevant to Hebron Wastewater Treatment Project		
OP/BP 4.01 Environmental Assessment	Screen early for potential impacts and select appropriate instrument to assess, minimize, and mitigate potentially adverse impacts.	Consult affected groups and NGOs as early as possible.
OP/BP 4.11 Physical Cultural Resources	Investigate and inventory cultural resources potentially affected, include mitigation measures when there are adverse impacts on physical cultural resources.	Consult appropriate agencies, NGOs, and University departments.
OP/BP 4.12 Involuntary Resettlement	Assist displaced persons in their effort to improve or at least restore their standards of living. Avoid resettlement where feasible or minimize. Displaced persons should share in project benefits.	Consult resettles and host communities, incorporate expressed views in resettlement plans.
Not Relevant to Hebron Wastewater Treatment Project		
OP/BP 4.04 Natural Habitats	Do not finance projects that degrade or convert critical habitats. Support projects that affect non-critical habitats only if no alternatives are available and if acceptable mitigation measures are in place.	Consult local people in planning, designing, and monitoring projects.
OP 4.09 Pest Management	Support integrated approaches to pest management Identify pesticides that may be financed under the project and develop appropriate pest management plan to address risks.	Consult local people in planning, designing, and monitoring projects.
OP/BP 4.10 Indigenous Peoples	Screen to determine presence of Indigenous Peoples in project area. Policy triggered whether potential impacts are positive or negative. Design mitigation measures and benefits that reflect Indigenous People cultural preferences.	Carry out free, prior, informed consultation and obtain broad community support.
OP/BP 4.36 Forests	Support sustainable and conservation oriented forestry. Do not finance projects that involve significant conversion or degradation of critical forest areas.	Consult local people, the private sector, and interest groups in forest area.
OP/BP 4.37 Safety of Dams	For large dams, technical review and periodic safety inspections by independent dam safety professionals.	No public consultations
OP/BP 7.50 Projects on International Waterways	Ascertain whether riparian agreements are in place, and ensure that riparian states informed of and do not object to project interventions	No public consultations. Riparian notification required.
OP/BP 7.60 Projects in Disputed Areas	Ensure that claimants to disputed areas have no objection to proposed projects	No public consultations. Claimants informed.

Detailed Description of the Relevant Policies
Environmental Assessment (OP 4.01) Objectives:
To ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts (OP 4.01, para. 1).
Environmental Assessment (OP 4.01) Triggers:
This policy is triggered if a project is likely to have potential (adverse) environmental risks and impacts in its area of influence. Note: OP 4.01 covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources; and transboundary and global environment concerns. Social aspects (involuntary resettlement, indigenous peoples) as well as natural habitats, pest management, forestry, and safety of dams are covered by separate policies with their own requirements and procedures.
Environmental Assessment (OP 4.01) Mechanisms for achieving policy objectives:
When OP 4.01 is triggered, the Bank classifies the project as category A, B, C, or FI according to the nature and magnitude of potential environmental impacts (OP 4.01, para. 8). For category A and B projects the Borrower prepares an EA report (OP 4.01, para. 8a & Annex B). For category B projects the scope of the EA may vary (OP 4.01, para. 8b) and it is narrower than category A. Depending on the project, and the nature of impacts a range of instruments can be used: EIA, environmental audit, hazard or risk assessment and environmental management plan (EMP). When the project is likely to have sectoral or regional impacts, sectoral or regional EA is required (OP 4.01, para. 7 and Annex A). The Borrower is responsible for carrying out the EA. For category A projects, the Borrower retains independent EA experts not affiliated with the project to carry out the EA. For category A projects that are highly risky or contentious or that involve serious and multidimensional environmental concerns, the Borrower normally engages an advisory panel of independent, internationally recognized environmental specialists.
OP 4.01 Consultation and Disclosure Requirements (see also BP 17.50)
For (i) A and B projects and (ii) sub-projects categorized as A and B in a programmatic loan, the borrower consults project-affected groups and local nongovernmental organizations (NGOs) about the project's environmental aspects and takes their views into account. The borrower initiates such consultations as early as possible. For Category A projects, the borrower consults these groups at least twice: (a) shortly after environmental screening and before the terms of reference for the EA are finalized; and (b) once a draft EA report is prepared. In addition, the borrower consults with such groups throughout project implementation as necessary to address EA-related issues that affect them. The Borrower provides relevant information in a timely manner prior to consultation and in a form and language accessible to the groups being consulted. The Borrower makes the draft EA (for category A projects) or any separate EA report (for category B projects) available in country in a local language and at a public place accessible to project-affected groups and local NGOs prior to appraisal. It is good practice to disclose the draft EA report at the InfoShop.

The Task Team sends the final EA to the InfoShop prior to appraisal for all category A and category B projects. For category A projects, the task team sends a summary of the EA report to the Board of Directors as soon as it is received. Separate Resettlement Plans and Indigenous Peoples Plans are disclosed with the relevant EA report. When there is no EA, it is good practice to send these reports to the InfoShop prior to appraisal.
Physical Cultural Resources (OP 4.11) Definition:
For the purposes of this policy, 'physical cultural resources' are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. Their cultural interest may be at the local, provincial or national level, or within the international community.
Physical Cultural Resources (OP 4.11) Objectives:
The Bank assists countries to avoid or mitigate adverse impacts of development projects on physical cultural resources.
Phyiscal Cultural Resources (OP 4.11) Triggers:
This policy applies to all projects requiring a Category A or B Environmental Assessment under OP 4.01, projects located in, or in the vicinity of, recognized cultural heritage sites, and projects designed to support the management or conservation of physical cultural resources.
OP 4.11 Mechanisms to achieve policy objectives:
The Borrower assesses the project's potential impacts on physical cultural resources as an integral component of the Environmental Assessment (EA). The process steps for the physical cultural resources component of the EA are the same for Category A and B projects. The physical cultural resources component of the EA provides for (a) an assessment of physical cultural resources likely to be affected by the project, (b) documentation of the characteristics and significance of the these resources, and (c) an assessment of the nature and extent of potential direct and indirect impacts on these resources. Where the EA predicts adverse impacts on physical cultural resources, the cultural resources component of the EA includes a management plan which includes: (a) actions to mitigate adverse impacts, (b) provisions for the treatment of physical cultural resources discovered during project implementation and operation (hereafter referred to as "chance finds"), (c) any necessary measures for strengthening institutional capacity to implement the management plan, and (d) a monitoring system to track progress of these activities.
Physical Cultural Resources (OP 4.11) Consultation & Disclosure:
The Borrower consults relevant stakeholders as part of the overall consultation process for the EA, including project-affected groups, in documenting the presence and significance of physical cultural resources, assessing potential impacts, and exploring mitigation options. The findings of the cultural resources component of the EA are normally disclosed to the public as per OP 4.01, except where the Borrower, in consultation with the Bank, determines that such disclosure would jeopardize the safety or integrity of the physical cultural resources involved (e.g. the location of sacred sites or movable cultural resources of value), or of the source of information about the physical cultural resources.
Involuntary Resettlement (OP 4.12) Objectives:

Avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs.

Assist displaced persons in improving their former living standards, income earning capacity, and production levels, or at least in restoring them.

Encourage community participation in planning and implementing resettlement.

Provide assistance to affected people regardless of the legality of land tenure.

Involuntary Resettlement (OP 4.12) Triggers:

The policy covers not only physical relocation, but any loss of land or other assets resulting in:

(i) relocation or loss of shelter;

(ii) loss of assets or access to assets;

(iii) loss of income sources or means of livelihood, whether or not the affected people must move to another location;

The policy also applies to the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons.

Involuntary Resettlement (OP 4.12) Mechanisms to achieve policy objectives:

When the policy is triggered, preparation of a Resettlement Action Plan is required as a condition of project appraisal. An abbreviated plan may be developed where less than 200 persons are affected by the project or where the impacts are minor (no one is physically displaced or loses more than 10 percent of their land). In situations where the precise impacts cannot be known at the time of project appraisal, a Resettlement Policy Framework is prepared as a condition of the loan and detailed plans are prepared during project implementation. In case of restrictions of access to parks and protected areas, a Process Framework is prepared as a condition of appraisal and detailed Plans Of Action are prepared during project implementation.

Based on experience from past Bank projects, task teams should pay particular attention to the following issues:

A Resettlement Action Plan should provide for payment of compensation for affected assets at their replacement cost.

Affected people, who do not have legal title to the lands occupied / used by them, also need to be provided resettlement assistance.

OP 4.12 Consultation and Disclosure Requirements (see also BP 17.50):

For projects subject to the Resettlement policy, the disclosure requirements are those required under the EA Policy (OP 4.01). Specifically, Resettlement Action Plans (RAP), prepared by the Borrower, should be submitted to the Bank prior to project appraisal. Task Teams must ensure that the Borrower has disclosed the RAP in-country and must send the RAP to the Info Shop prior to appraisal for all category A and IDA-B projects and in a timely manner once received by the Bank for IBRD projects. If a separate EA is not prepared, the disclosure of RP is not mandatory, but is recommended as a good practice.

1.6.2 Scoping on environmental impacts

Among other potential environmental impacts likely to occur during HWWTP construction phase are (i) nuisance to people due to dust /noise /smoke generated by the movement of vehicles and machinery which will be mitigated by regular air testing, vehicle noise, and smoke tests and make sure that those emissions are as to the standards; (ii) pollution due to wastewater and construction wastes from the contractor's camp which will be mitigated by providing adequate arrangement for the safe disposal of wastewater and wastes; (iii) health and safety of workers which will be mitigated by proper training of the contractor's crew about First Aid and Health and Safety procedures; (iv) risks of damaging chance-find cultural resources which will be mitigated by stopping excavations and immediate informing of the MoTA, and (iv) accidental hazards on the public, which will be mitigated by regulating the procurement of material.

During the operational phase, potential environment impacts are mainly limited to accidental problems or failures at the HWWTP site or encountering health issues with the operating staff and labor. To mitigate this impact, staff will be trained on handling/storage of material and safety requirements. The awareness of the public should be raised as to enhance social cooperation and understandings. The farmers should be aware of the reuse requirements of treated wastewater.

The ESCHIA was carried out in compliance to the requirements of the PEAP. According to this policy wastewater works are listed among those that require detailed EIA and are likely to have significant adverse environmental impacts that are sensitive and diverse. Therefore, a detailed ESCHIA study has been prepared.

The ESCHIA study covered the following components, in addition to others:

1. Provide comprehensive description of the project components including using maps at appropriate scales when necessary.
2. Generate baseline data on relevant environmental and social characteristics of the project components including description of physical environment, biological environment, and socio-economic and cultural constrains.
3. Outline and examine the pertinent regulations and standards governing environmental quality, health and safety, protection of sensitive areas and cultural heritage resources, protection of water resources and pollution control, and land use control at the national and local level.
4. Identify and determine the potential positive and negative impacts, direct and indirect impacts. The assessment of the potential impacts included pollution of groundwater aquifer, landscape impacts of excavations and construction, soil contamination impacts, noise pollution, and socio-economic and cultural resources impacts.
5. Prepare and develop Environmental and Monitoring Management Plan (Annex II), Social Management Plan (Annex IV), and Risk Management Plan (Annex VI) to mitigate the negative impacts, recommend feasible and cost effective measures to prevent or reduce significant negative impacts to acceptable national levels.
6. The Management Plans were prepared to monitor the implementation of the mitigation measures and the impacts of the project, during the construction and operation phases.

1.6.3 Scoping on social impacts

The social impacts that are associated with the construction of the HWWTP include:

1. Impact on agricultural land and private properties.
2. Allocating temporary construction camp and waste disposal sites and the impact of operating these facilities.
3. Traffic safety during construction and operation.
4. Job creation and labor safety.
5. Information disclosure to ensure maximum broad and convenient among residents
6. Public awareness and social understanding and corporation.

The ESCHIA/ESCHMP social assessment concentrated on several social aspects. These included the position and expectations of the citizens in the beneficiary areas towards construction of the WWTP, payment of fees (wastewater discharge fees), and willingness to purchase and use treated wastewater in economic activities. In this respect the ESCHIA has also considered the gender issue and did consult community members, including women and did make sure that women were adequately informed and represented.

An Environmental, Social and Cultural Heritage Impact Assessment (ESCHIA) was carried out for the HWWMP, cleared by the Bank and publicly disclosed in July 2013. The assessment determined that there are no social safeguards impacts under the project, hence OP 4.12 was not required and therefore neither were social safeguards instruments. The Bank is coordinating closely with donor partners on social and environment risks that may arise under the components that are financed by them. The USAID financed access road (which will include the electricity, water and WW lines) located in the wadi has 9 landowners of the access road who have voluntarily agreed to donate small portions of their lands for the purposes of widening the existing unpaved roads where utilities lines will be established, whereas the other 4 landowners (owners of the WWTP site) have agreed and signed official paper to transfer the ownership of the land to PWA. The USAID Environmental Documentation and Review Report confirms the nature of tractions, i.e., that it is voluntarily carried out and is based on fully and informed consent. Based on the information contained in this USAID document, the Bank's social safeguards policy on Involuntary Land Acquisition and Resettlement (OP 4.12) would not apply. Based on this updated information, the ESCHIA/ESCHMP is being publically redisclosed in September 2014.

1.6.4 Scoping on Cultural and Natural Resources

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.

The Cultural Heritage Impact Assessment (CHIA) section of the ESCHIA for HWWTP 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 HWWTPr. 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.

1.7 Monitoring Plan

The HWWTP will not require any transfer of people and/or an acquisition of private lands. Therefore monitoring for progressing of local negotiation will not be required. After commencement of construction, monitoring for various issues will be required. The necessary items, contents and time are summarized in **Table 1.2**.

Table 1.2: Necessary Items and the Implementation Time for Monitoring

Division	Items	Contents	Timing
Present Conditions	Along the Trunk Sewer and Access Road	- Facilities which require special attention;	ESCHIA*
		- Intervals of traffic density and noise	
		- Location and kinds of natural resources	
	Surrounding WWTP	- Land utilization condition	
		- Facilities surrounding the area	
		- Surrounding housings and others	
		- Dust generation situation by wind	
		- Landscape	
	Effluent	- Condition of effluent point	
		- Groundwater quality	
		- Reuse in agriculture and/or stone cutting industry	
	Solid Waste Management	- Collection and disposal of domestic solid waste	
		- Collection and disposal of industrial solid waste	
		- Reuse methods for dried sludge from WWTP	
Check for Mitigation Countermeasures	Trunk Sewer and Access Road	- Countermeasure for dust, noise and vibration	Formulation of Construction Plan
		- Traffic countermeasures including detours	
		- Countermeasures to facilities require paying attention	
		- Construction time schedule	
	WWTP	- Countermeasure for odor, noise and vibration	

		- Traffic countermeasures	
		- Countermeasures to facilities require paying attention	
		- Prevention measure for dust	
		- Consideration to landscape	
	Effluent Water	- Treated water quality, groundwater quality, reuse requirements and conditions.	ESCHIA*
	Solid Waste	- Solid Waste Management Plan (recycling, disposal of domestic waste and industrial waste)	Formulation of Construction Plan
		- Treatment and disposal/reuse of dried sludge and screenings in operation phase	
Monitoring during Construction	Trunk Sewer and Access Road	- Noise/vibration during construction (working points and nearby facilities require paying attention)	During Construction
		- Generation of traffic jam by construction and effect by countermeasures	
		- Finding and prevention methods of natural resources	
	WWTP	- Nuisance by Noise, vibration and effluence to surrounding area	
		- Generation of traffic jam by vehicles for construction	
		- Generation condition of dust and effect of mitigation method	
	Solid Waste	- Observance situation of Solid Waste Management Plan	
		- Disposal/recycle quantities of domestic/industrial waste	
Monitoring in operation phase	Trunk Sewer	- Occurrence of odor nuisance and clogging	Operation Phase
		- Generation of caving–in	
	WWTP	- Complaint from odor/noise/vibration	
		- Regular analysis of treated water	
		- Quantity/purpose of reused treated water, complaint by users	

*Items essentially included in the ESCHIA

In the table, present environmental, social and cultural heritage situation is essential and these are carried out during the implementation of ESCHIA. In addition, mitigation countermeasures for various negative impacts to environmental, social and cultural heritage condition are prepared. These shall be implemented including the Construction

Plan prepared by the Contractor. As of monitoring, the mitigations shall be checked and modified as necessary.

During construction, various items of monitoring shall be implemented according to the conditions before construction and mitigation methods. In operation stage, even though serious environmental/social problems will not be considered, the monitoring shall be continuously implemented.

Annex II and Annex IV are the Environmental, Social, and Cultural Heritage Management Plan (ESCHMP) and the Social Management Plan (SMP) in which the potential impacts against each environmental element are listed. The Plans list also the required mitigation measures and the institutional responsibilities. The frequency and execution entities of monitoring are suggested and have to be agreed with the implementation agencies.

1.8 ESCHIA Methodology

In order to carry out the ESCHIA study for HWWTP and to achieve the expected outcomes, the following methodology was considered:

1.8.1 Review and Data Collection

An iterative process of information gathering, alternative development, and impact forecasting was conducted. The available reports were reviewed. The relevant Palestinian governmental agencies were contacted and informed of the project. Their cooperation and any other information including the potential issues deemed important and other concerns or desires related to the project were obtained.

The available relevant documents and materials reviewed included the previous environmental assessment and the feasibility study of Hebron regional wastewater treatment facilities that have been prepared in 2005. Thereafter, site visits, field surveys, and interviews were carried out. This enabled the description of the existing baseline conditions of HWWTP with a depiction of the project activities.

Collected data mainly elements of cultural resources existing in the project site were represented by photos. A set of thematic maps in different scales were produced and helped in providing a good reading of the WWTP site and the proposed route of the trunk sewer and access road.

The ESCHIA study was conducted on the basis of collected data. The study includes baseline assessment, prediction of the potential environmental, social and cultural resources impacts, proposing mitigation measures and the design of an ESCHMP.

1.8.2 Cultural Heritage Impact Assessment

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 the project area.

During field visits, to the project site and the proposed Hebron wastewater treatment plant location -in particular- and the surrounding area in general, the study team has undergone a survey to collect data about the existing cultural heritage and landscape elements. Effective On-site observations helped to analyze the components of the site whether on cultural heritage or cultural and natural landscape features.

The proposed location of the HWWTP is situated to the south of Hebron city at the eastern edge of Hebron mountain range which is the last in the Palestinian highlands that ends with Annaqab hill. The area has a Mediterranean climate with long, hot and rainless summers and relatively short, cool and rainy winters.

A full cultural heritage survey was conducted within the context of preparing the ESCHIA for the project area. That process depended on the identification of these elements of cultural heritage and conducted a qualitative field survey, which was used later as a baseline document in preparing the mitigation plan. Snapping photos represented a crucial tool in the identification of cultural heritage components to illustrate the possible physical impacts and deign special mitigation measures.

The methodology of this study is based on desk research and field survey. Literature on the conservation of cultural heritage components was extensively reviewed and combined with a qualitative field survey that aimed at locating and documenting cultural heritage elements within the study area.

Photographs and direct observations helped in analyzing the project sites in order to determine the most vulnerable locations and locations with a conglomeration of cultural heritage elements. The tools of analysis also provided the needed information that helped in drawing the main outline of the potential impact and mitigation measures of the HWWTP.

Finally, accomplishing this methodology depended on the leadership of experts in the field of cultural heritage in Palestine. They were broadly involved in different Landscape Conservation and Management Plan implemented by UNESCO in terms of developing a proper methodology that contributes to the safeguarding of Palestinian heritage and in conducting a multiple-layered survey that provides a comprehensive knowledge about the site. The experts have been part of several cultural heritage projects implemented by UNESCO and other specialist institutions; the acquired experience in this field is emphasized through several projects. This assures that the standards that were used in the ESCHIA report cope with the UNESCO and international standards in conservation and cultural heritage as much as assuring meeting the MoTA requirements for dealing with archeological sites and antiquities (MoTA gives higher priority to Archeological site).

1.8.3 Socio-Economic Impact Assessment

A rapid socio-economic assessment was conducted. A series of interviews were held with respective village councils, key figures, households, women, farmers, craftsmen and managers of various economic businesses and stone cutting industries. In addition a field research was conducted by the research team, using a participatory rapid assessment approach. The focus groups included males and females.

Various civil society organizations contribute to developing and improving public service delivery in the surveyed residential localities.

Data were derived from reports and studies on Hebron city in particular, and on the Wadi as-Samen area, the valley through which the Hebron-generating wastewater stream flows, in general. It also relies on results of the field research carried out by the research team, using a participatory rapid assessment approach. A series of interviews were held with officials at the Hebron Municipality as well as with key figures in Hebron city and its environs, especially in Al Heila village. Interviews included residents of various age groups and backgrounds in Hebron and Al Heila areas, including farmers, employees, handicraftsmen, and managers of various economic activities, particularly stone processing factories.

Figure 1.2: Public consultation and discussion groups

Two focus groups, including one for males and one for females, were also organized (**Figure 1.2**). Field research focused on Hebron city (especially Khallet ad Dar area and the Industrial Zone) and Al Heila village. The project's first phase is restricted to Hebron city and the wastewater treatment plant will be constructed in the vicinity of Al Heila village, here is why these focus groups were chosen from these localities.

In addition, several organizations were consulted as part of the socioeconomic survey and assessment. Annex VII lists the local community organizations, other institutions, individuals, focus groups, and the names of those who were interviewed.

1.9 Stakeholder Consultation

Stakeholder consultation has important benefits both as means and as an end in itself. The *afd* and World Bank's main interest in consulting the stakeholders, stems from the need to ensure that supported policies and projects perform well. Evidence shows that this phase is an important "means" whereby the quality, impact and sustainability of development policies, projects or programs can be enhanced.

The consultation was mainly with a variety of relevant stakeholders likely to be affected either positively or negatively by the project. These stakeholders are expected to assist PWA and Hebron Municipality in coordinating ESCHIA-specific issues. The consultation was structured in such a way that participants conducted their own consultation and answers to specific questions after listening to a brief about the project and its objectives.

Several consultative interviews were conducted with the Palestinian Ministries and Authorities such as Ministry of Local Government (MoLG), Ministry of Tourism and Antiquities (MoTA), Palestinian Water Authority (PWA), Ministry of Labour (MoL), Ministry of Planning (MoP), Ministry of Agriculture (MoA), Ministry of Public Works and Housing (MoPWH), Ministry of Environment Affairs (MEnA), and Hebron Municipality. Other meetings have been conducted with local communities and civil institutions in context of the social survey and analysis.

In the meetings the Hebron wastewater management project was briefly described to the consulted parties, whom they were requested for any comments or concerns to be addressed in the ESCHIA.

1. Ministry of Environment Affairs (MEnA)

MEnA will conduct a preliminary review of the ESCHIA and provide comments in accordance to the ToRs which they issued for this project. MEnA is also heading the environmental assessment committee and are in charge of the environmental approvals. The environmental application for the project was prepared and was submitted to MEnA office in Hebron by Hebron Municipality, and will eventually determine whether to issue the environmental approval for the project or not.

On September 18, 2012 Mr. Mahmoud Abu Shanab (Deputy Director General - Environmental protection Section) was met alongside Mr. Amjad Al Kharraz (Head of Environmental Assessment Department)

- The most important things are the location of the HWWTP and the satisfaction and acceptance from the neighbouring residents.
- The sensitivity rose during the scoping session among the countryside and Hebron city towards the project objectives and which areas are to be served first by the HWWTP has to be addressed and solved.
- Establishing a clear vision about the operation and maintenance is important.
- Emergency plan and mitigation measures should be prepared.
- A reuse plan should be prepared.
- Actions to mitigate environmental problems during construction on the site also need to be clearly set including traffic and disposal of construction waste and excavation material.
- Conducting training courses for the farmers to increase their awareness.
- The odour issue and how it will be dealt with must be addressed. Also the used technology should be effective and easy to operate by workers on the site.
- The project must ensure the involvement of local councils and stakeholders.
- The project must achieve the Palestinian water specifications especially the nitrogen content while maintaining the agricultural pattern. It is to state here that this is a potential conflicting area between MEnA and MoA in terms of changing cropping patterns downstream the plant.

2. Ministry of Public Works and Housing (MoPWH)

On September 17, 2012 Eng. Bassam Shaalan (Director of General Housing) was interviewed and he indicated the following:

- MoPWH encourages the establishment of the HWWTP, taking in consideration the distance between the plant site and the residential areas which should be far enough.
- Treatment plant should be regularly maintained.
- Exchanging experiences between MoPWH and the PWA is very important especially in the tender evaluation. Technical consultations will be given if needed, and MoPWH is ready to provide any required instruments.
- Formation of a committee with the governorate to solve problems if there are complaints from the residents about mosquitoes, odours or any failure at the treatment plant.

3. Ministry of Agriculture (MoA)

Mr. Thaer Al-Rabi represents the MoA in the EA national committee. On September 19, 2012 Eng. Thaer Al- Rabi was interviewed and he indicated the following:

- There are mandatory instructions from the MoA about reuse of treated wastewater for all beneficiaries.
- MoA supports reusing treated wastewater to irrigate crops only if the farmers will follow the instructions of the ministry.
- A clear idea must be established about the irrigation systems and the use of the treated wastewater.
- The project is very important and beneficiary from an environmental perspective.
- MoA major interest is in the operational phase and the effluent from the treatment plant, the irrigation systems, and the set of the well being of beneficiaries as a priority.
- Farmers' interests should be considered.
- Commitment to the Palestinian specification and standards is crucial.
- The project is innovative and anticipated to contribute to the increase of the agricultural production.

4. Ministry of Local Government (MoLG)

The interview was held with Eng. Riyad Abu Zaid. He is the Water and Sanitation Engineer at MoLG. Eng. Riyad pointed out the following:

- The project is innovative and will improve the current sanitation conditions and will serve the environment, people and agriculture.
- Sustainability of the project shall be taken in consideration including issues of management, funding and maintenance.
- Location of treatment plant should be far enough from residential areas
- A plan for reuse of treated wastewater shall be established to make beneficial for the surrounding agricultural areas. Corresponding bylaws for treated wastewater

quality and types of plants that are eligible for irrigation by treated water must be considered
- Emergency plan must be in place in face of any faults occurring in the treatment plant such as power shut down or overloaded capacity during winter time.
- Considering the price per cubic meter of treated water for farmers and the financial transactions.
- Prepare training courses for farmers to increase their awareness and build their capacity in irrigation methods and types of crops which are eligible for irrigation by treated effluent.
- MoLG will cooperate with the Hebron Municipality to explore ideas on setting up a qualified body/institution for the management of the project.

5. Ministry of Labor (MoL)

Ms. Iyham Nsoor represents the MoL in the EA national committee. He normally stresses the following:

- The project will contribute to job creation at different levels through construction and later during operation.
- The project should comply with the Palestinian Labor Law No. 7 / 2000. For example, and not limited to occupational health and safety measures and protection of workers eyes, head, hands, feet and insuring a safe working environment. Life insurance, accidents insurances, working hours and workers' wages shall also comply with the Labor Law.
- Safety measures should be provided.
- Full medical and emergency services in the workplace should be provided.

6. Ministry of Transport (MoT)

Engineer Thafer Jaber represents the Ministry of Transport (MoT) in the EA national committee. The following are the concerns of the MoT:

- The study should consider the resulting air and noise pollution at the project construction phase (heavy vehicles and machines emissions) and during operation.
- The project is anticipated to scatter large quantities of dust; therefore, mitigation measures should be considered.
- Traffic signs and detours should be provided during the project construction.
- The construction works should be performed in assigned and limited times to avoid nuisance to the nearby neighborhoods.
- The project is anticipated to have a significant traffic generation during the construction phase. Therefore, measures should consider the capacity of the existing streets, the entrance and the exit ways of vehicles from or to the project site during and after construction of the WWTP and trunk sewer.

7. Land Research Center, Hebron

Mr. Makie Al-Hafez (Project Coordinator) at Land Research Centre (LRC) was interviewed, and he indicated the following:

- The project has positive implications that give through water treatment a partial solution to the environmental problems in Hebron. It also prevents soil contamination and decreases the odours.
- Provision of an alternative source of water with acceptable quality to the farmers which leads to creating jobs, increasing agricultural yield, and expanding green areas.
- The project will minimise the imposed taxes by the Israeli occupation. A conventional resource of water will become available for agriculture which lead minimize pressure on drinking water and may lead to an increase in the per capita water consumption.
- The project will contribute to jobs creation for many people. Training courses must be conducted for the farmers to increase their awareness about irrigation methods and the types of eligible crops.
- At the operational phase LRC is ready to cooperate with competent authorities to conduct research and testing to ensure that the quality of the produced effluent meets the specification.
- There are 18 residential communities in the vicinity of the plant site which are at risk of suffering pollution because the raw sewage stream passing through Wadi as-Samen. There are many farmers who irrigate their crops by using either raw or diluted wastewater.

8. Applied Research Institute Jerusalem (ARIJ)

On September 20, 2012 Ms. Inas Banoura (Research Assistant) at ARIJ was interviewed and she indicated the following:

- People who are close to the location of the treatment plant and their satisfaction are the top most priority.
- ARIJ recommends preparing a questionnaire for neighbouring residents to examine their opinion about the existing situation and if they want to have the HWWTP in the area and acceptability of the effluent reuse schemes.
- Emergency plan and mitigation measures shall be prepared.
- A plan for effluent reuse shall be prepared.
- ARIJ is interested in looking at biodiversity aspects and presence of any natural reserves in the vicinity. ARIJ is ready to help in this issue
- Conducting training courses for farmers to increase their awareness.
- ARIJ has agricultural experts who are ready to cooperate and offer their services.

9. Palestinian Water Authority (PWA)

PWA is the client and its concern is that the project be implemented. Ms. Majedah Alawneh, the Director of the Laboratories is the representative of the PWA in the EA committee and Mr. Adel Yassin (The Director of Wastewater Department in PWA) were consulted. They indicated the following:

- PWA requested the World Bank for financing the project.
- PWA discussed the need of the project in response to the current sanitation conditions in Hebron.
- The project has many benefits related to Hebron city and its countryside.

- PWA stated that the project will have no negative results, since Hebron already suffers lack of water. Therefore, it is expected that the proposed development will partially cover for the lack of water.
- PWA will support the Hebron Municipality by expertise, equipment, software, etc.
- The location of HWWTP will not affect the residential clusters since it is distant from the houses
- After the completion of the project, there will not be a problem in operating the WWTP because there is cooperation between the municipality and PWA.
- PWA and Hebron Municipality will apply safety requirements during construction phase, which will not be an easy task.
- The wastewater network will be rehabilitated and expanded at later phases of the Hebron governorate wastewater management project.

10. Hebron Municipality

Hebron Municipality is the project proponent and its concern is that the project be implemented. They are very much concerned as the project will solve the environmental, social and cultural heritage problems that are associated with the project and will stop the flow of sewage open through Wadi as-Samen.

In Annex I, the the questions asked and the answers of each of the stakeholder mentioned above in addition to two NGOs; namely Land Research Center and ARIJ.

1.10 Public and Beneficiary Consultation

In context of the social and economic assessment, a series of interviews were held with respective village councils, key figures, households, women, farmers, craftsmen and managers of various economic businesses and stone cutting industries.

During these consultation meetings the Project and associated environmental and social impacts are presented. The comments/suggestions of the consulted public were considered. The questions and the answers that were raised during these meetings are annexed as Annex I: Public and Beneficiary Consultation.

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

2.1 EIA System and Administration

2.1.1 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. 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.

The PEL of 1999 has stated in article 45, "The Ministry, in coordination with the competent agencies, shall set standards to determine which projects and fields shall be subject to the environmental impact assessment studies. It shall also prepare lists of these projects and set the rules and procedures of the environmental impact assessment".

Article 47 of the PEL states that: "The Ministry, in coordination with the competent agencies, shall determine the activities and projects that have to obtain an environmental approval before being licensed. This includes the projects that are allowed to be established in the restricted areas".

In relation to water and wastewater disposal, article 29 of the PEL (Aquatic Environment) state that: "The Ministry shall formulate, in coordination with the competent authorities, the standards and criteria of dispose of the wastewater and rain water in a sound manner which is consistent with the preservation of the environment and public health".

2.1.2 Palestinian Environmental Assessment Policy

The Palestinian Ministerial Council approves the Palestinian Environmental Assessment Policy (PEAP), through resolution No: 27-23/4/2000. 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:

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.

According to the PEAP, there are three documents that represent sequential stages in the project life cycle and the Environmental Approval (EA) review process: an Application for Environmental Approval; an Initial Environmental Evaluation (IEE); and An Environmental Impact Assessment (EIA). The MEnA shall provide guidance on the content and preparation of these documents.

The IEE is for projects where significant environmental impacts are uncertain, or where compliance with environmental regulations must be ensured; whereas EIA is required for projects, which are likely to have significant environmental impacts. An EIA may be carried out as a result of an IEE.

Based on the Application for Environmental Approval, screening criteria are used to determine whether IEE or EIA is required for a project. Waste water treatment plants including main sewers are listed as number 3 among the major development projects for which an EIA shall be conducted.

For project types that are not listed, a determination of whether or not an IEE or an EIA must be conducted will be based on a screening criterion. The IEE and/or the EIA are to define the environmental impacts of the project and the measures to mitigate the adverse impacts or capture potential environmental benefits.

The project proponent must first obtain initial approval from the appropriate Ministry or Local Planning Committee. The proponent then submits an Application for Environmental Approval to the MEnA. The MEnA will notify the appropriate permitting authorities that an Application for Environmental Approval has been received and that an EIA is required.

The proponent submits the Application for Environmental Approval to the appropriate permitting authorities as part of his overall application package for initial approval. These authorities then refer the project to the MEnA. The MEnA may ask the proponent for further information to ensure the Application is sufficient for consideration under the PEAP. In consultation with these authorities and others through the EA Committee as required, the MEnA then applies the screening guidelines and determines whether IEE or EIA is required.

The screening process will be based on requirements of relevant land use plans, and on whether the project is likely to:

1. Use a natural resource in a way that pre-empts other uses of that resource,
2. Displace people or communities,
3. Be located in or near environmentally sensitive areas such as natural reserves, wetlands, or registered archeological and cultural sites,
4. Generate unacceptable levels of environmental impact,
5. Create a state of public concern, or
6. Require further, related development activities that may cause significant environmental impacts.

If neither IEE nor EIA are required, the MEnA will determine, in coordination with the relevant permitting authorities or the EA Committee as required, whether or not Environmental Approval will be granted and, if so, under what conditions.

Once the MEnA considers that an Application for Environmental Approval is complete, it has a maximum of 14 business days to determine the need for an IEE or an EIA, or to determine whether Environmental Approval will be granted based on the Application alone. If this deadline is not met, the proponent has the right to submit a written complaint to the Head of the MEnA, who must respond in writing within a week from receipt of the complaint.

Without limiting its content, an Environmental Approval may specify:

- Required measures to mitigate adverse environmental impacts or capture potential environmental benefits, including a compliance schedule,
- Measures that the proponent must implement in order to comply with relevant standards and requirements; and
- Monitoring and reporting duties of the proponent.

2.1.3 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.

2.1.4 Laws and Regulations relating to Resettlement, Land Expropriation and Involuntary Resettlement

The Jordanian Expropriation Law No. 2 for 1953 which is applied in the West Bank/Palestine covers the process of expropriating private lands for public use and the compensation should be paid.

The process of expropriating private lands for public use is defined as follows:

1) The project proponent has to publish an announcement in the official newspapers (Gazette) for 15 days; declaring his willingness to request a resolution from the Cabinet in order to expropriate a private land, defined in the announcement, for public use.
2) After the expiry of the announcement, the project proponent has to submit an application to the Cabinet attached with a map for the land he is willing to expropriate, and a proof of his financial capacity that he is capable to implement the project.
3) When the Cabinet makes sure of the proponent's financial capacity and the public benefits of the project; the Cabinet has the right to decide:

   - The absolute expropriation of the land.
   - Dispossession of the land for a limited period of time.
   - Dispossession of any easement right, or any other rights related to the land.

4) The Cabinet's resolution should be approved by the President of Palestine, and then published in the official Gazette.
5) The Proponent, then, has to inform the Land Registrar in the area where the land exists, who subsequently informs the owners with the Cabinet Resolution.
6) After informing the land owner of the resolution, the project proponent has to negotiate the expropriation, disposition or the limited use of the land with the land owner or with anyone has a right in it.
7) If the project proponent and the land owner didn't agree upon the amount of the compensation, any of them can submit a request to the court to estimate the compensation.
8) After paying the compensation to the land owner or to the court, the Land Registrar then registers the land under the name of the proponent.

The abovementioned process applies for lands in zones A, B and C as to Oslo agreement classification. However, in zone C, approval from the Israeli side must be obtained before the expropriation.

2.1.5 Laws and Regulations relating to Community Participation to Project Formulation

The PEAP has referred to the stakeholder (any person in his natural or legal capacity with an interest in or affected by a development activity) consultation in two stages:

1) The Initial Environmental Evaluation (IEE) Report; where the policy stated that the stakeholder consultation is optional when undertaking an IEE. In consultation with the proponent and the EA Committee as required, the MENA determines

whether stakeholder consultation is required and, if so, what the minimum requirements should be. It may be required during scoping and terms-of-reference preparation, and during the conduct of the IEE.

2) The Environmental Impact Assessment (EIA) Report; where the policy stated that the stakeholder consultation is mandatory when undertaking an EIA. In consultation with the proponent and the EA Committee, the MEnA determines what the minimum requirements for stakeholder consultation should be. It may be required during scoping and terms-of-reference preparation, and during the conduct of the EIA. At the minimum, the proponent must meet with the principal stakeholders to inform them about the proposed project and to solicit their views about it. More problematic projects should involve more extensive consultations. The methods and results of these consultations must be documented in the EIA Report.

2.1.6 Laws and Regulations relating to Preservation of Cultural or Historical Assets

2.1.6.1 Jordanian Antique Law No 51 for 1966

The Jordanian Antique Law No 51 for 1966 which is applied in Palestine / West Bank has considered the antiques as states' assets. The Ministry of Antiques is responsible for managing and supervision of the antiques and it is its duty to publish a report in the official gazette with the names of antique places and to add on it from time to time.

The Law has prohibited doing anything in the antique places without permission from the minister. It also has obliged anyone who finds antique places to record the place to the government within three days.

In spite of the crucial need, legislations and laws concerning the conservation of cultural and traditional heritage in Palestine are still immature; however there are some initiatives that contribute to the design of by-laws and regulations that underwent many debates on several levels but have not got the legitimate status yet.

Nevertheless, this review will shed the light on the only law that directly covers part of the cultural heritage; that is the law of Antiquities for the year 1966, besides the Bethlehem charter "Charter on the Safeguarding of Palestinian Historic Towns and Urban Landscape" signed in 2009 which addresses cultural heritage protection and by-laws that points directly to the cultural heritage such the decision no 54 of march/2006 of the higher council of planning regarding the General Rules for the Protection of Historic Areas and Historic Individual Buildings and considered as an annex to the Building and Planning Regulations for the Local Authorities of 1996, in addition to the law of Building and planning for local authorities of 2011,also the Palestinian national spatial plan that is being prepared and expected to be approved by 2012.

2.1.6.2 Law of Antiquities No. 51 for the year 1966

The law of antiquities deals with the movable and immovable antiquities which are deemed part of the cultural heritage. The second article of the law defines the antiquities as "any historical movable or immovable iniquities made, or composed or carved (inscribed) or built or explored or produced or modified by a human being before the year 1700 A.D including any part added to the antiquities or reconstructed after that date" article 2.A.

Also falls under this definition according to article 2.C "any movable or immovable antiquities that dates after the year 1700 A.D that is proclaimed by the minister through an ordinance he issues and states that it is a historical remain".

Antiquities included in the above-mentioned definition shall be listed according to article 9.A and announced in the official newspaper: "the director publishes in the official newspaper a table approved by the minister that includes historical buildings and sites. He is allowed from time to time to add to this table and modify it."

Titled as the prohibited acts, article 10 of the law of antiquities states that any person either is not allowed without permission from the minister to:

a. Excavate any historical site that is inscribed in the declared list or was mentioned in any later amendment to the list,
b. Start a process of excavation or construct a building, or open quarries, establishing irrigation actions or lime burning or a like in the historical buildings and sites or beside them or putting soil or dumping them or converting them into cemeteries,
c. Introducing transformations to any antiquities or adding to it or restoring it,
d. Destroy any antiquities, or demolish part of it or move it, or
e. Constructing buildings or walls that encroaches any artifact or being adjacent to it.

Paragraphs d and e are not applied to historical buildings designated for religious purposes or owned by a religious body.

Sanctions are determined in Article 46. In paragraph 5 everyone who distorts, or destroys, or obliterate, or remove or block any historical artifact shall be punished by imprisonment for a term not exceeding two years or a fine of 20 dinars to 200 dinars. The year of approval is this law is 1966.

2.1.6.3 General Rules for the Protection of Historic Areas

In March 2006 one an advanced step in the field of cultural heritage protection was achieved. A legal protection for historic areas and individual historic buildings was provided for the first time by the decision no 54 of the higher council of planning:

"The Higher Council of Planning decided in its meeting no 4/2006 on 11 March 2006 according to the decision no. 54 to approve the General Rules for the protection of historic areas and individual historic buildings. These rules are considered part of the Building and Planning Regulations for the Local Authorities approved with a decision of the Higher Council of Planning no. 30 on 24 August 1996". This amendment to the building and planning regulations for the local authorities was vital because it prevents demolish or remove any historic buildings or demolish or distort any element of that forming the root of the historic town (the traditional urban fabric) such as paths, alleys, open spaces, covered passages and portals.

However, the law of building and planning for the local authorities of the year 2011 has not broadly mentioned the above mentioned amendment. On the contrary, it only points

that historic towns are mandated to the special committee responsible of building and planning in local authorities.

2.1.6.4 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.

2.1.6.5 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 mankind which led to the birth of the "World Heritage List."

Efforts to protect 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 ESCHIA 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.

2.1.7 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.

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. The MEnA shall, in coordination with the competent authorities, control the various corporations, projects and activities in order to ascertain the extent of its compliance with the approved specifications, standards

and instructions for the protection of environment and vital resources formulated by them according to the provisions of this law.

For the above purposes the law entitles the MEnA inspectors and other inspectors who are appointed in the Ministries and other authorities who have the capacity of judicial police as per the law may impound the environmental violations and crimes that take place in violation with this law. The MEnA inspectors shall also have, in cooperation with the competent departments and authorities; the right of entry into the installations for the purpose of inspecting them, taking samples, carries out the measurements and ascertains the application of the standards and conditions of the environment protection and prevention of pollution.

The owners of projects and other activities should enable the MEnA inspectors and competent authorities to carry out their functions and provide them with the information and particulars which they deem necessary to obtain in implementation of the provisions of the Law. Owner of Projects should also carry out self-supervision operations according to the standards and conditions formulated by the MEnA in coordination with the competent authorities and submission of reports according to the instructions of the MEnA.

The competent authority shall have the right, with respect to every installation or project which has violated the environmental conditions necessary for granting the license, to cancel the license or withdraw same before the competent court.

The law has entitled the competent authorities to cancel or withdraw the license of any violating project. Should the project not remove the violation, the competent authority shall remove same at the project's own account.

The Minister may decide to stop the work in any project or prohibit the use of any machine or material in part or in whole if the continuation of work in the project or use of the machine or article involves a serious hazard to the environment. The stoppage or prohibition shall be for a period not exceeding two weeks and may not be extended except by a judicial order from the competent court. Whoever was harmed from the stoppage or prohibition order may take exception towards it before the competent court.

2.2 Institutional Arrangements

2.2.1 Wastewater Treatment Plant and Associated Works

The on-going project entitled "Update Feasibility Study for Hebron Governorate Regional Wastewater Management Project" includes two main components. The first component is to allow for construction of HWWTP and associated works to serve Hebron City and those surrounding areas as deemed feasible by the Update. This plant is also to include facilities for treatment of the generated sludge as to allow for reuse of treated biosolids, if considered feasible.

The second component of the project is designated for the identification of a preferred option for reuse of the treated wastewater along with development of the conceptual designs for the proposed reuse facilities, including pumping, storage and conveyance systems as deemed feasible.

PWA and Hebron Municipality are the client and the proponent of the project respectively. According to the Water Law 2002, PWA is the water regulating body, and therefore, for the time being, Hebron Municipality is the potential entity to manage the proposed Hebron WWTP and trunk sewer.

It is expected that at the end of the project, a newly established Water and Wastewater Unit (WWU) in Hebron Municipality will be established to carry out the operations and maintenance of the wastewater system and the WWTP after the completion of construction. The project also involves capacity building plans for the proposed WWU. Subsequently, technical assistance should be provided to the WWU in case it is to operate the project.

It is important here to assess the capacity and role of the environmental units involved in the project implementation to implement the ESCHMP. WWU will require capacity building in terms of increasing its knowledge about environment and the measure for environmental and cultural heritage protection. As addressed in the scoping session, a capacity building program is required for those who are to be responsible for the management of the treated effluent network.

The PWA has the capacity to manage the project and supervise its implementation. The MEnA has the capacity and experience in environmental management and in impact assessment, but they require further enforcement in terms of monitoring and environmental inspection and auditing. The MoTA is to make sure that cultural heritage assets are conserved and is required to be present during project implementation. Coordination among the different authorities and units is essential to guarantee a successful implementation of the project. The capacity building program should also include a clear agreed upon wastewater tariff policy.

2.2.2 Treated Effluent Reuse

To manage the treated effluent reuse it is to take into consideration the land ownership distribution in Palestine and the small sizes of farms around. This implies that the number of farmers who might utilize wastewater in irrigation will be high.

It is recommended to build on the Palestinian heritage of agriculture that families will stay as the primary unit in agricultural development. Families are to be encouraged in developing their land and utilizing treated wastewater to improve production. The family units will be organized in local institutions through existing village councils or through farmers' unions/associations/cooperative to deal with the distribution, storage and system maintenance for reuse facilities.

Some technical assistance should be provided to the farmers through the cooperative. This is encouraged by international donors who are usually welling to assist small farmers directly to improve their living conditions.

In addition, and as has been addressed during the ESCHIA scoping session, the Union of Stone and Marble suggested to pump the treated effluent to the Hebron industrial zone in order to utilize it for industrial purposes.

Therefore, there will be a need to form some type of institutions to deal with reuse issues. Such institute could be different than the institutional setup for wastewater treatment plant. The reuse institution could be in charge of reuse and effluent conveyance facilities including operation and maintenance

2.2.3 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.

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. Building.

2.2.4 Water Users Associations (WUA)

Currently, no Water User Association is existed in the project area. While farmer cooperative is existing for livestock and agricultural, however, there activities are abandoned.

The set-up of Water User Associations (WUA) is in the responsibility of the Ministry of labor and cooperatives in cooperation with MoA. Both ministries need to frame the legal, administrative and institutional conditions for the WUA(s) in question. Another focus should refer to the possible incentives in order to guarantee the long-term sustainability of the WUA.

The (WUA) will support the farmers in the project area by providing professional training in the field, but earlier initiatives of the MoA are required. The main tasks of WUA are summarized in the following points:

- Allocation of effluent among competing users.
- Maintenance of quality standards and system reliability.
- Investment in supporting resources, especially managerial and technical staff, required to administer each component of an effluent use scheme.
- Monitoring the farmer to insure that they will plant the recommended crops.
- Act as connector between the famers and other concerned institutions such municipalities. Ministry of agri. PWA, markets and others.

To run a wastewater re-use programmed commercially, it is necessary to form WUAs with sufficient financial resources to design, operate and fund a large irrigation system which typically contains pumping station(s), conveyor system, pipes, irrigation nozzles or sprinklers and reservoirs.

Wastewater Users Associations (WUAs) will form a consortium to purchase, distribute and monitor the effluent. In this case, the design and financing of the necessary infrastructure is a key issue to be resolved before irrigation can commence.

3. PROJECT DESCRIPTION

3.1 Project Background

The City of Hebron in the south eastern section of the West Bank is served by a combined sewer system, with more than 70% of the existing population connected to the system. Currently, there is no wastewater treatment plant at the end of the sewer system and therefore, most of the municipal sewage entering the system from the City and its environs is discharged directly to Wadi as-Samen just south of the City. The area served by the existing sewerage system is also characterized by the presence of many stone and marble-cutting industries which also discharge their wastewater into the sewer system. This leads to high concentrations of sawdust in the wastewater reaching the sewers and eventually 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.

In response to the urgent need to address this outstanding issue within the Hebron Governorate, the PWA has requested the donor community to mobilize financial and technical support for the Hebron Wastewater Management Project. The first phase of the project has an estimated cost of US$ 35 - 40 million for the construction of the WWTP and associated works and will be financed by a consortium of multilateral and bilateral partners including the *AFD*, EU, USAID and the World Bank.

The proposed HWWTP aims to achieve the following objectives:

- 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).

In order to meet these objectives, the on-going project entitled "Update Feasibility Study for Hebron Governorate Regional Wastewater Management Project" includes two main components. The first component is to allow for construction of a HWWTP to serve Hebron City and those surrounding areas as deemed feasible by the Update. This plant is also to include facilities for treatment of the generated sludge as to allow for reuse of treated biosolids, if considered feasible.

The second component of the project is designated for the identification of a preferred option for reuse of the treated wastewater in agriculture with the definition of the areas to be irrigated and potential cropping patterns along with development of the conceptual

designs for the proposed reuse facilities, including pumping, storage and conveyance systems as deemed feasible.

3.2 Status of Previous Studies

Within the framework of the Water Resources Program (WRP, 2001-2006) funded by the U.S. Agency for International Development (USAID), detailed plans for a regional solution for wastewater management in the Hebron Governorate were elaborated. The WRP developed a vision for addressing the regional wastewater management issues in phases, as part of the Storm water, Domestic Wastewater and Industrial Wastewater Master Plan for Hebron (2001). The first phase would address the immediate needs of treatment and reuse of the sewage stream coming from Hebron city, through HWWTP and a reuse scheme for reclaimed effluents and biosolids south of Hebron. In subsequent phases additional communities would be sewered and the wastewater loads are either treated in the first-phase of HWWTP, or in an adjacent plant. Total cost for implementation of these phases would be in excess of US$ 100 million.

The overall goals of the project were defined as follows:

- Treatment of the current wastewater stream now discharged in Wadi As-Samen,
- Reduction of nutrient loads to the Wadi and to the Eastern Aquifer from untreated wastewater discharges;
- Sustainably managed treatment capacity of projected additional wastewater loads in the future, with a thirty year planning period to be considered;
- Increase of water availability for irrigating farm lands;
- Reduction in the annual wastewater treatment charges levied by the Israeli Occupation Authorities;
- Increase organic matter for the lands benefiting from treated biosolids applications, if feasible, and
- Increase in Biosolids available for other uses if determined to be beneficial.

To achieve these goals it was proposed that the design, construction and operation of a WWTP for Hebron be undertaken as soon as possible with capacity building of the organizations needed to operate and maintain the HWWTP and the wastewater reuse scheme.

Within the framework of the WRP, a site for the WWTP was identified and detailed feasibility studies were completed in 2005 for implementation of the first phase of the Master Plan. This includes the WWTP with secondary treatment for around 15,000 cubic meters of wastewater per day, as well as facilities for the reuse of treated effluents and biosolids. In addition, an environmental assessment was conducted and conceptual designs were developed. Based on this documentation, the project was submitted to the Joint Water Committee, which approved the project, and subsequently, the Israeli Civil Administration of the West Bank issued the required permits. In 2005, USAID issued a Request for Proposals for the design and building of the plant, but because of high costs and a change in strategy, the project was eventually not included in the USAID portfolio.

3.3 Existing Wastewater Flows and Loads

To facilitate the design of the proposed WWTP and trunk sewer, it was first necessary to determine the existing wastewater flows and pollutant loads from the Hebron Municipality and to project future flows and loads.

Existing flows and loads were first developed using mathematical models which were then verified based on actual monitoring of the flows in the sewer system immediately before discharge to the Wadi. For this purpose, a wastewater sampling and flow monitoring campaign was conducted during the period May 6 to 13 2012. These were all done as part of the "Update Feasibility Study for Hebron Governorate Regional Wastewater Management Project".

Two sampling locations (**Figure 3.1**) 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.

Continuous flow monitoring was carried out during the period May 6 to 13 2012 at the two locations. In addition, a composite sample of the wastewater was obtained on a daily basis at Location 1 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 3.1:** 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 m^3/h or 10,660 cubic meters per day.

Table 3.1: Summaries of Combined Flows for Hebron City

	Unit	**Average Flowrate**
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]

The monitored average daily flow of 10,660 cubic meters per day is consistent with the estimated average daily flow of 10,600 cubic meters per day which is based on a current connected population to the sewer system of 155,842 persons; an average water use rate of 85 l/c/d and a wastewater contribution rate of 80% of water use.

Flow monitoring data indicates an average diurnal peaking factor of 2.3. This peaking factor compares favorably with the diurnal peaking factors obtained during previous flow monitoring exercises conducted between 1999 and 2005, which showed the diurnal peaking factors varying from 2.0 to 2.5 depending on the season of the year. Values of 2.0 were obtained during winter when water use was higher and closer to 2.5 in spring, when water use was reduced. Therefore for this design, it was recommended that the higher peaking factor of 2.5 be utilized to represent conditions throughout the year and present a more conservative design approach.

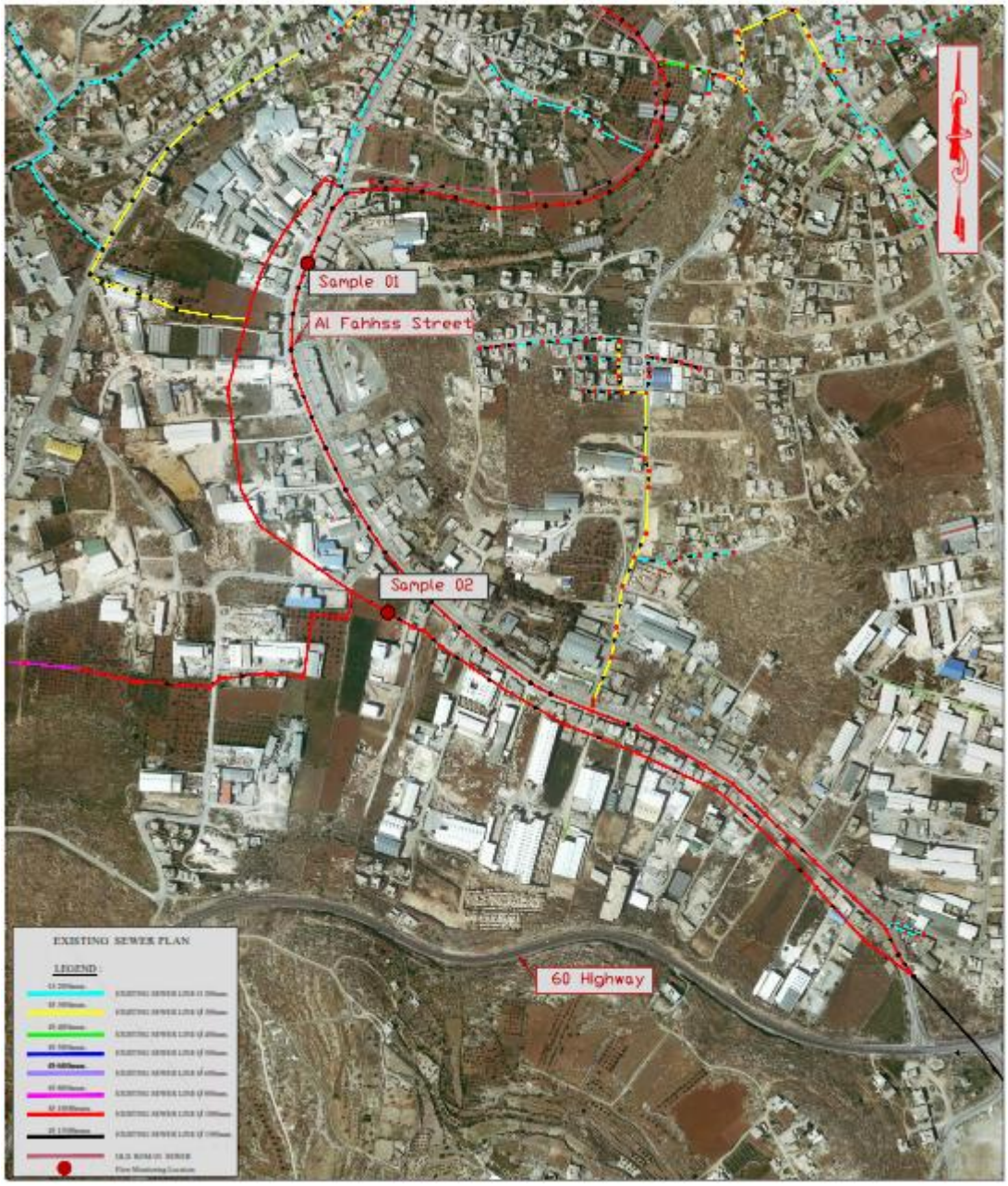

Figure 3.1: Sampling locations along existing sewer system of Hebron city

3.4 Wastewater Pollution Loads and investment Scenarios

3.4.1 Wastewater Pollution loads

A summary of the main wastewater parameters of BOD; COD; TSS; TKN; and TP which were monitored during the program are presented. **Table 3.2** shows the average loadings for these parameters.

Based on the results of the monitoring exercise, the actual per capita loading rates for the selected parameters were computed. **Table 3.3** shows the pollutant loading rates adopted for the HWWTP design.

Table 3.2: Summary of main wastewater parameters

Parameter	Average Loading (mg/l)	Peak Loading (mg/l)
BOD	698	1200
COD	1880	3475
TSS	788	2140
TKN	142	200
TP	24	43

Table 3.3: Wastewater Loads for Selected Parameters

	TSS (g/c.d)	COD (g/c.d)	BOD (g/c.d)	TN (g/c.d)	TP (g/c.d)	COD/BOD
Loading rate	60.0	140.0	60.0	10.8	1.9	2.3

Population and wastewater flows and loads for the HWWTP were developed for the base year 2012 and projected up to the year 2045. In order to identify the maximum areas for inclusion in the project, three scenarios were initially evaluated.

3.4.2 Investment Scenarios

The projected flows and loads were developed for three scenarios. These scenarios can best be described as follows:

Scenario 1 - Low Investment Scenario: This scenario reflects the status quo, in which only the City of Hebron will continue to be served by the sewer system. However, for this scenario, it was assumed that sewers will be extended to provide sewer service to the entire Hebron city by 2030 and that water use rates will gradually increase over time based on new water sources being tapped in the area (**Figure 3.2**).

Scenario 2 - Medium Investment Scenario: In this case, Hebron City will continue to be served by the sewer system and wastewater treatment plant but in addition, sewer service will be extended to Halhul and 50% of Yatta, which can be drained by gravity to the proposed wastewater treatment plant. This scenario will require medium investments for new sewers in currently unsewered areas in surrounding communities (**Figure 3.3**).

Scenario 3 - High Investment Scenario: In this case, Hebron, Halhul and Yatta will continue to be served as per Scenario 2 but sewers will also be extended to the communities of Dura, Al Fawwar Camp, Hadb Al Fawwar, Al Reihiya, and Bani Na'im. This scenario will require the highest level of investments in new sewers and is not considered very implementable at this stage because of the lack of funding (**Figure 3.4**).

Since the preliminary estimates suggested that projects designed for either of these scenarios will exceed the project budget, the above scenarios were eventually rejected and a fourth scenario developed and agreed by the PWA and donors for full development during this project phase. **Scenario 1X** was developed to define a project that may be constructed with the available budget. This scenario is similar to scenario 1 but assumes that while only Hebron City will be served, no new sewers will be constructed to extend

the sewer coverage in the 12 year planning period and indicated a design flow of 15,000 cubic meters per day.

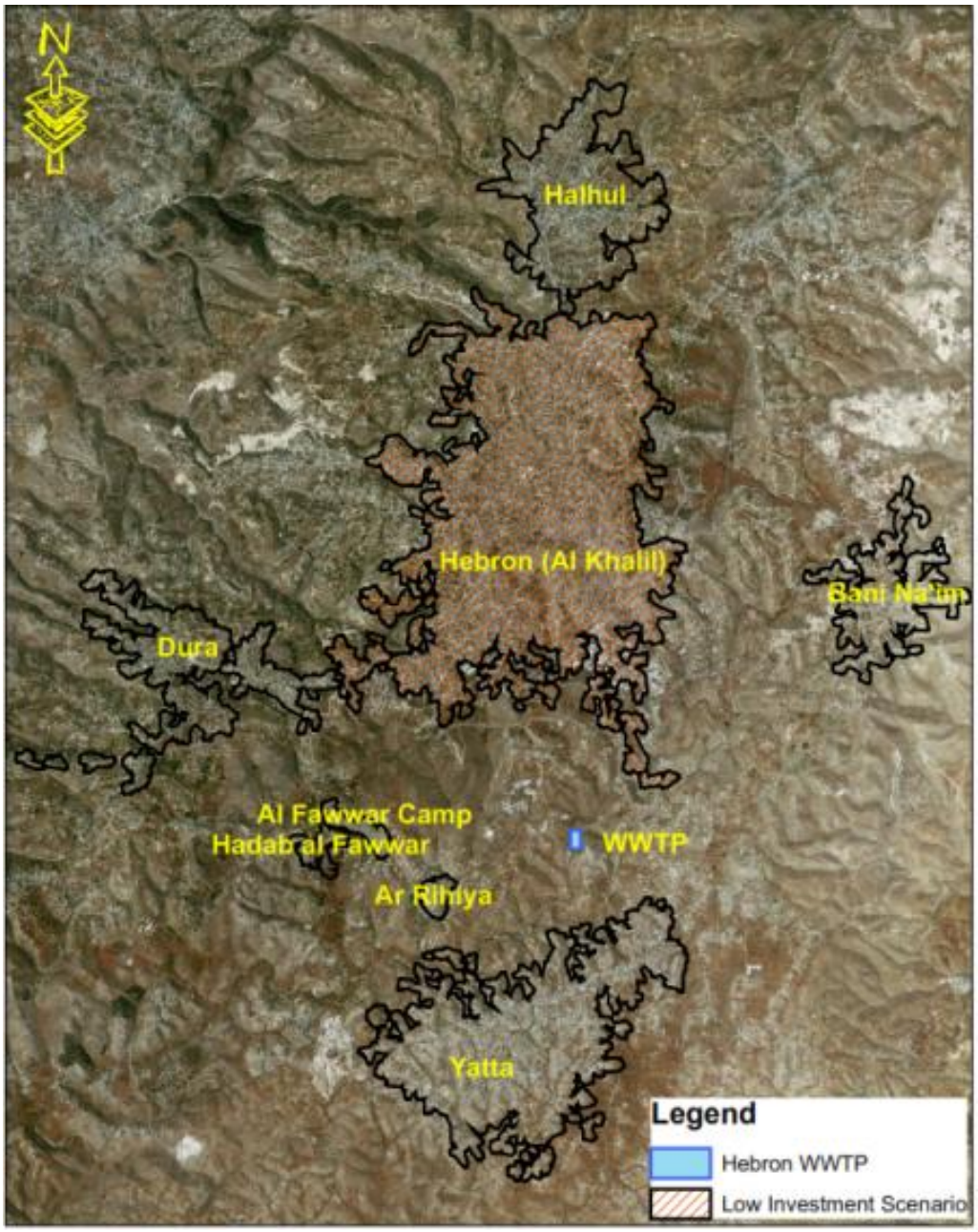

Figure 3.2: Served Communities in Low Investment Scenario

It is worth pointing out here the water scarcity response of PWA in 2011 for Hebron, which indicated that the existing water supply wells in Hebron are already depleting and that the plan is to reduce pumping gradually. All new water network plans are being stopped because of it is becoming more feasible now to serve communities by tankers rather than a network, because the pressure is low and the water loss is high. Therefore the assumption that water use rates will gradually increase over time based on new water sources being tapped in the area needs to be justified. New water resources need to be allocated to provide additional water for Hebron. The reuse of the treated wastewater will alleviate potable water uses and is positive in this sense.

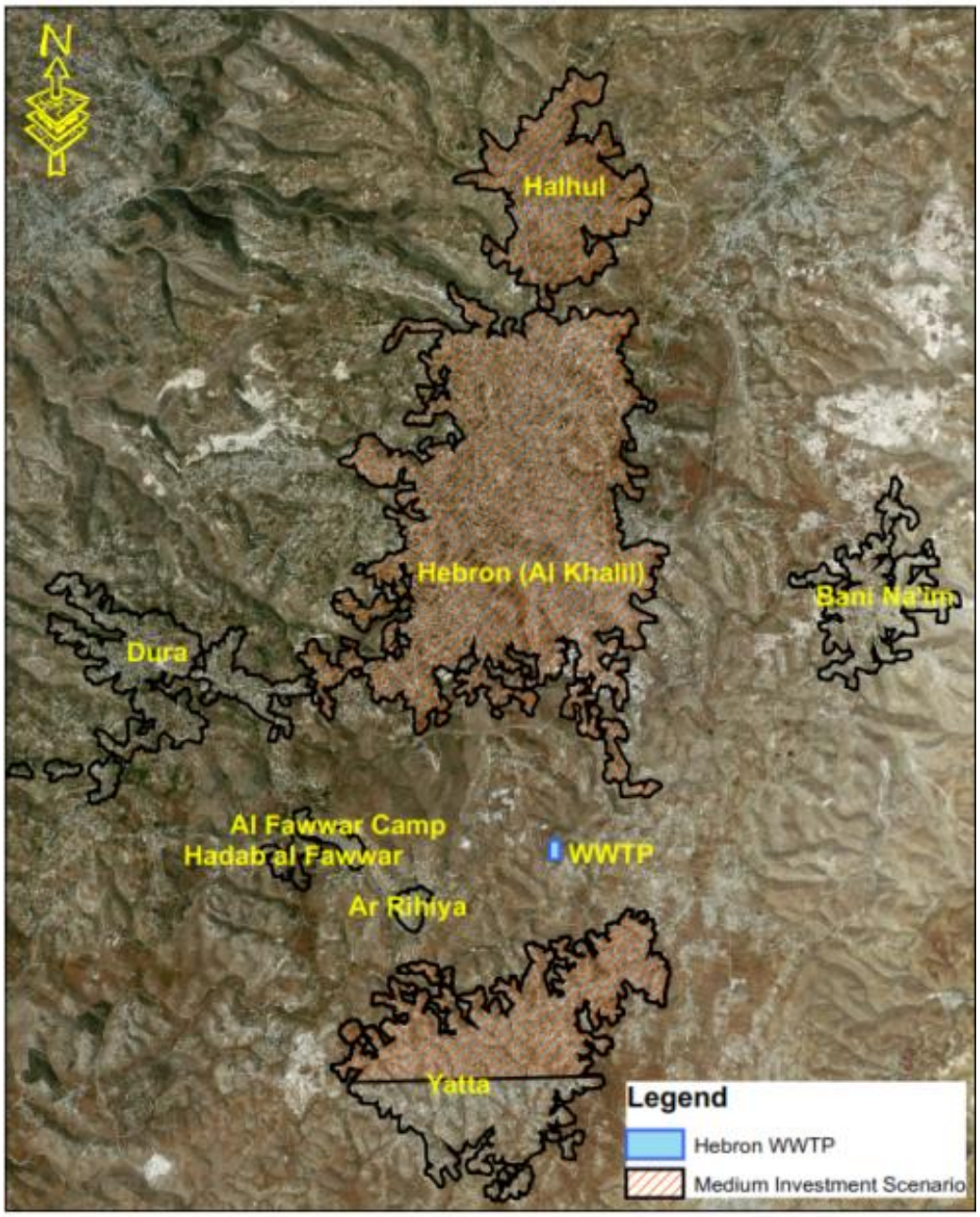

Figure 3.3: Served Communities in Medium Investment Scenario

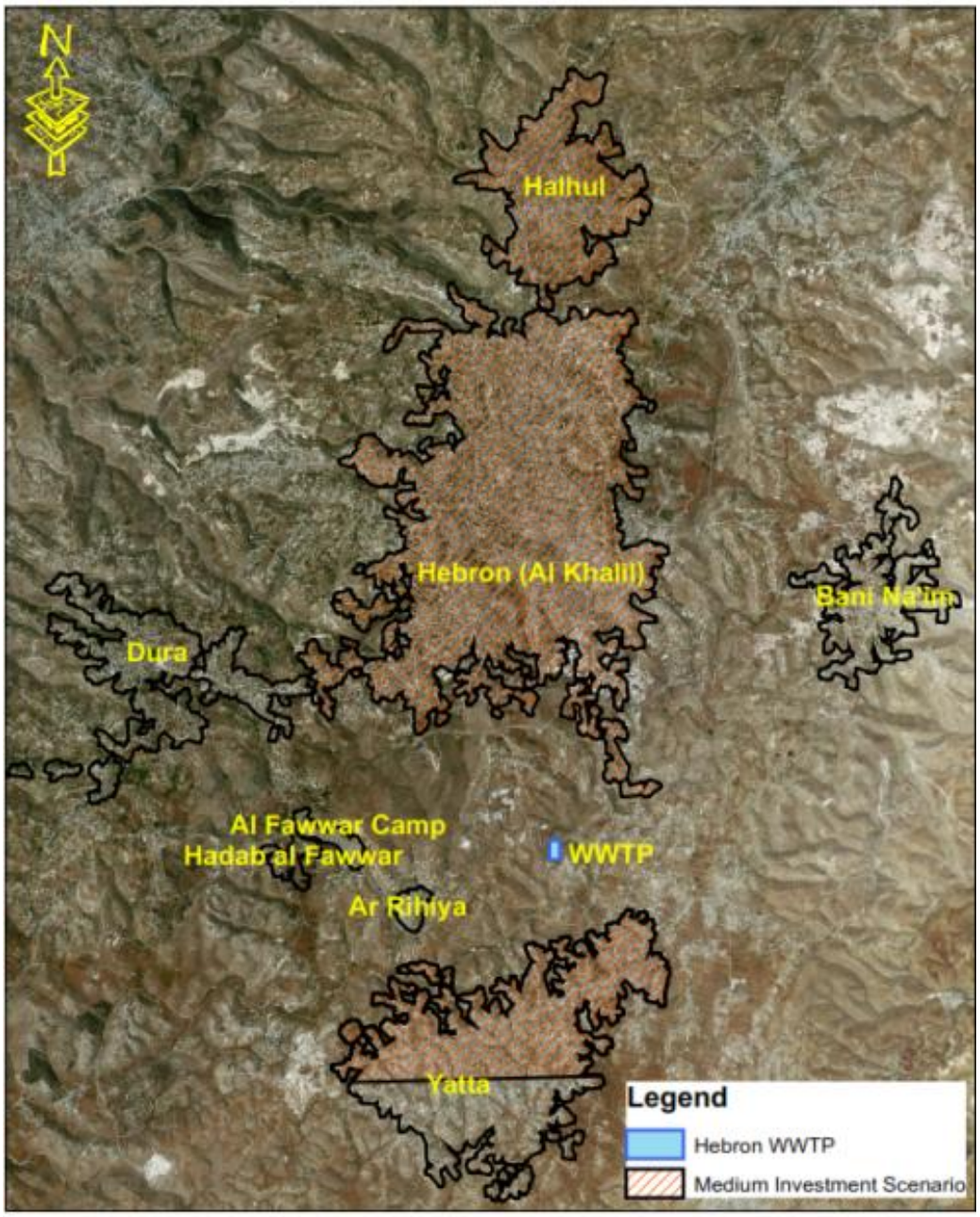

Figure 3.4: Served Communities in Medium Investment Scenario

3.4.3 Assumption and basic data used in developing projections

The baseline and projections (2015-2045) of future wastewater flows have been established using the following assumptions and basic data:

- **Current Populations** taken from the Palestinian Central Bureau of Statistics (PBCS).
- **Projected Population Growth Rates** taken from the PBCS (**Table 3.4**).
- **Household Size** was assumed to be 5.6 persons per housing unit as per data provided by the PBCS.
- **Water Production, Unaccounted water and Per Capita Water Use** was obtained from the Palestinian Water Authority and confirmed by the Water

Master Plan for the Southern West Bank[1] (**Table 3.5**), which also shows a comparison with the water use assumed in the previous Feasibility study report.

Table 3.4: Projected Population Growth Rates (PBCS)

Year		**Projected Growth rate per year -% per year**
From	To	
2007	2012	3.10
2012	2015	2.90
2015	2020	2.70
2020	2025	2.30
2025	2030	2.00
2030	2035	1.80
2035	2040	1.80
2040	2045	1.80

Table 3.5: Projected Water Production and Use (PWA)

Year	**Scenarios 1, 2 and 3**			**Scenario 1X**		
	Water Production - lpcd	**Unaccounted Water - %**	**Water Use - lpcd**	**Water Production - lpcd**	**Unaccounted Water - %**	**Water Use - lpcd**
2007	120	40	72			85
2012	130	35	85	130		85
2015	134	35	87	130	35	85
2020	143	30	100	130	35	85
2025	151	28	109	130	35	85
2030	159	25	119	130	35	85
2035	167	20	134	130	27	95
2040[2]	167	20	134	130	25	98
2045[2]	167	20	134	130	20	104

[2]The PBCS only provided projections to 2035

A wastewater production factor of 80% of the per capita water use was assumed for this analysis. This figure is assumed to include the water obtained from both cisterns and from the public water supply system. This is so, because in developing estimates of wastewater flow rates, we are not concerned about the source of the water, but consider that most people will contribute the same average amount of wastewater per day. Therefore, for

[1] Water Master Plan for the Southern West Bank, March 22, 2012. Draft Report, USAID, MWH, and Palestinian Water Authority.

estimation, all persons were assumed to be connected to the water supply system and taking similar amount of water from that system.

The detailed results of the wastewater flow monitoring exercise have confirmed that the bases for the projections and the projections themselves were reasonable as the estimated and measured flows for 2012 were quite similar.

The projected populations and wastewater production rates for the four scenarios are summarised below. **Table 3.6** details of the projections for Scenario 1x. The projected amounts for the design year 2027 are highlighted.

Table 3.6: Summary of Projected Connected Populations

Community	Connected Population								
	2012	2015	2020	2025	**2027**	2030	2035	2400	2045
Scenario 1									
Hebron city	155,842	176,009	212,917	251,808	275,770	292,649	319,953	349,804	382,440
Scenario 1X									
Hebron city	155,842	169,797	193,991	216,820	**225,580**	239,986	261,721	286,139	343,356
Scenario 2									
Hebron city	155,842	176,009	212,917	251,808	275,770	292,649	319,953	349,804	382,440
Halhul	0	0	9,626	26,963	35,533	37,708	43,396	47,445	51,872
Yatta	0	0	10,587	29,258	38,668	41,034	47,726	52,179	57,047
Total	155,842	176,009	233,130	308,030	349,971	371,392	411,075	449,428	491,360
Scenario 3									
Hebron city	155,842	176,009	212,917	251,808	275,770	292,649	319,953	349,804	382,440
Halhul	0	0	9,626	26,963	35,533	37,708	43,396	47,445	51,872
Yatta	0	0	21,173	59,308	78,158	82,942	95,453	104,358	114,095
Dura	0	0	6,149	13,778	28,669	30,424	55,438	60,610	66,265
Al Fawwar Camp	7,547	8,223	9,394	10,632	11,061	11,739	12,834	14,031	15,340
Hadb-AL Fawwar	0	0	417	935	1,945	2,064	3,761	4,112	4,496
Al Reihiya	0	0	859	1,925	4,005	4,250	7,745	8,467	9,257
Bani Na'im	0	0	4,369	9,789	20,369	21,616	39,388	43,062	47,080
Total	**163,389**	**184,232**	**264,905**	**375,138**	**455,511**	**483,392**	**577,967**	**631,891**	**690,845**

3.4.4 Projected Wastewater Loads

Based on the projected service populations and the per capita wastewater loading rates, the projected total wastewater loads for the HWWTP were computed as shown on **Table 3.7** for COD, BOD, Total suspended Solids (TSS) and Total Nitrates (TN) (**Table 3.8**), and Total Phosphates (TP) (**Table 3.9**).

Table 3.7: Summary of Pollutant Loading Rates

Year	Total COD (COD)				Total BOD (BOD_5)			
	Scenario (1)	**Scenario 1X**	**Scenario (2)**	**Scenario (3)**	**Scenario (1)**	**Scenario 1X**	**Scenario (2)**	**Scenario (3)**
2012	21,818	21,818	21,818	22,874	9,351	9,351	9,351	9,803
2015	24,641	23,772	24,641	25,792	10,561	10,188	10,561	11,054
2020	29,808	27,159	32,638	37,087	12,775	11,639	13,988	15,894
2025	35,253	30,355	43,124	52,519	15,108	13,009	18,482	22,508
2027	**38,608**	**31,581**	**48,996**	**63,772**	**16,546**	**13,535**	**20,998**	**27,331**
2030	40,971	33,514	51,995	67,675	17,559	14,363	22,284	29,004
2035	44,793	36,641	57,551	80,915	19,197	15,703	24,665	34,678
2040	48,973	40,059	62,920	88,465	20,988	17,168	26,966	37,913
2045	53,542	48,070	68,790	96,718	22,946	20,601	29,482	41,451

Table 3.8: Summary of Pollutant Loading Rates (Contd.)

Year	Total Suspended Solids (TSS)				Total Nitrates (TN)			
	Scenario (1)	**Scenario 1X**	**Scenario (2)**	**Scenario (3)**	**Scenario (1)**	**Scenario 1X**	**Scenario (2)**	**Scenario (3)**
2012	9,351	9,351	9,351	9,803	1,683	1,683	1,683	1,765
2015	10,561	10,188	10,561	11,054	1,901	1,834	1,901	1,990
2020	12,775	11,639	13,988	15,894	2,300	2,095	2,518	2,861
2025	15,108	13,009	18,482	22,508	2,720	2,342	3,327	4,051
2027	**16,546**	**13,535**	**20,998**	**27,331**	**2,978**	**2,436**	**3,780**	**4,920**
2030	17,559	14,363	22,284	29,004	3,161	2,585	4,011	5,221
2035	19,197	15,703	24,665	34,678	3,455	2,827	4,440	6,242
2040	20,988	17,168	26,966	37,913	3,778	3,090	4,854	6,824
2045	22,946	20,601	29,482	41,451	4,130	3,708	5,307	7,461

Table 3.9: Summary of Pollutant Loading Rates (Contd.)

Year	Total Phosphates (TP)			
	Scenario (1)	**Scenario 1X**	**Scenario (2)**	**Scenario (3)**
2012	296	296	296	310
2015	334	323	334	350
2020	405	369	443	503
2025	478	412	585	713
2027	**524**	**429**	**665**	**865**
2030	556	455	706	918
2035	608	497	781	1,098
2040	665	544	854	1,201
2045	727	652	934	1,313

3.4.5 Diurnal and Storm water Peak flows

The 2005 Feasibility Study indicated diurnal peaking factors varying from 2.0 to 2.5 depending on the season. Recent flow monitoring indicates a diurnal peaking factor of 2.3 in late spring. For this study, a diurnal peaking factor of 2.5 was proposed for throughout the year. It is also recommended that the HWWTP be designed to treat the first flush and a storm water peaking factor of 1.5 is proposed, which gives rise to an overall storm water peaking factor of 3.75.

The resulting peak dry weather flow and the peak wet weather flows are presented in **Table 3.10**.

Table 3.10: Wastewater flow Projections for year 2027

Parameter	Unit	Scenario 1	Scenario 1X	Scenario 2	Scenario 3
Average daily flow	m^3/d	26,308	15,249	33,387	43,456
Average hourly flow	m^3/h	1,096	635	1,391	1,810
Diurnal peaking factor	-	2.50	2.50	2.50	2.50
Diurnal peak flow	m^3/h	2,740	1,588	3,478	4,525
Storm water peaking factor	-	1.50	1.50	-	-
Stormwater flow	m^3/h	4,110	2,382	-	-

3.5 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 as proposed in the FS2005, or the Carrousel 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. Due to the effectiveness of the membranes, no filtration or disinfection is required before the treated wastewater is used in irrigation

Based on discussions with the PWA staff and after reviewing data for other wastewater treatment plants recently constructed or under construction in Palestine, it was agreed that the proposed plant must satisfy the following principal effluent design criteria and the treatment processes were evaluated based on their potential to consistently meet these standards:

- Biological Oxygen Demand (BOD_5) : 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 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

During a workshop with PWA and donors on May 3rd, 2012, the stakeholders provided weights for the listed criteria according to

Table 3.11. Given the general criteria described above and the weighting factors listed, a combined score was developed for each of the three options as summarized on **Table 3.12**.

The Conventional Activated Sludge (CAS) treatment process obtained the highest total scores (**Figure 3.5**) and was recommended as the preferred option for the HWWTP.

Table 3.11: Weighing Criteria and Categories

Category	Criterion	Criterion weight	Category weight
Costs	Low investment costs Low operation and maintenance costs	25% 75%	40%
Local suitability	High start-up and operation simplicity Low maintenance and high durability High process stability Low land use	25% 25% 25% 25%	30%
Flexibility	Towards increasing effluent requirements & loads Towards increasing flows	50% 50%	20%
Environment	Low energy and chemicals use Low odour emission	50% 50%	10%

Table 3.12: Total MCA Scores - Resulting from Workshop

Item	Weight Factor %	CAS		EA		MBR	
		Criteria Score	W. Score	Criteria Score	W. Score	Criteria Score	W. Score
Low Investment costs	10	50	5.0	40	4.0	30	3.0
Low operation and maintenance cost	30	50	15.0	30	9.0	20	6.0
Low total cost of ownership	00	50	0.0	35	0.0	25	0.0
High startup and operation simplicity	7.5	30	2.25	40	3.0	10	0.75
Low maintenance and high durability	7.5	0.0	0.0	50	3.75	0	0.0
High process stability	7.5	40	3.0	40	3.0	50	3.75
Low land use	7.5	30	2.25	10	0.75	50	3.75
Towards increasing effluent requirements and loads	10	30	3.0	40	4.0	40	4.0
Towards increasing flows	10	30	3.0	40	4.0	40	4.0
Low energy and chemicals use	5	50	2.5	30	1.5	20	1.0
Low odour emissions	5	30	1.5	40	2.0	30	1.5
Total Score	100		37.5		35.0		27.8

W. Score: Weighted Score

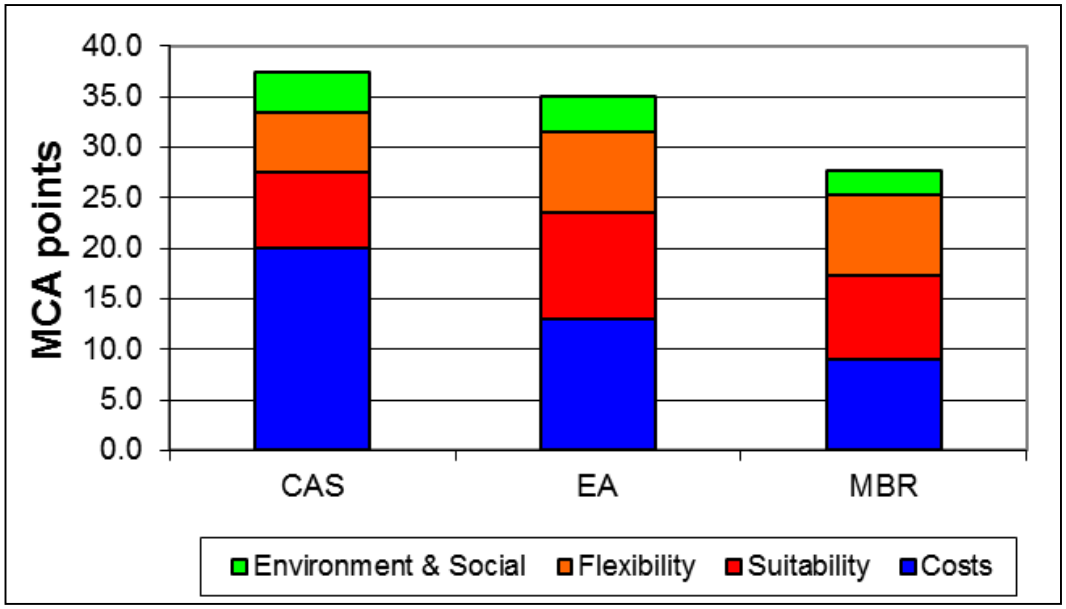

Figure 3.5: Weighted Scores for Treatment Options Evaluated

3.7 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 3.6**:

- 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.

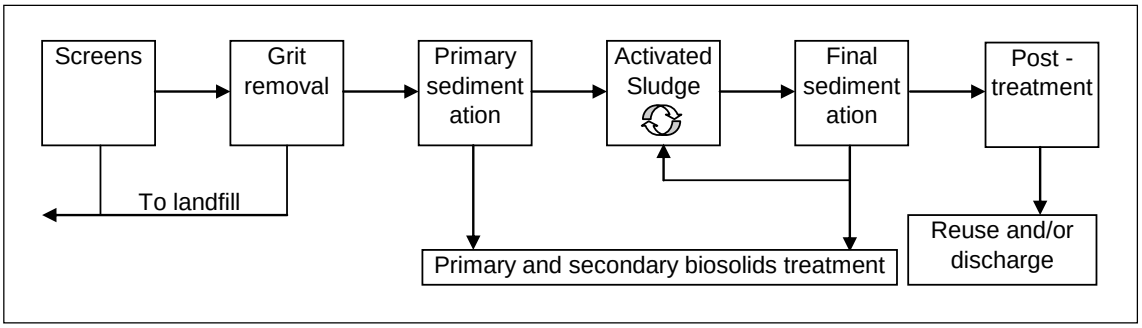

Figure 3.6: Schematic Process of Conventional Activated Sludge system

3.8 Site Selection for HWWTP

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

Ad Dahriya site
The Ad Dhahriya site is located approximately 4km southeast of the town of ad Dhahriya and 2 km north of Khirbat Zanuta (coordinates 87,500 n and 149,000 e on the Palestinian grid system). 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 at approximate coordinates 95,500 n and 155,000 e. 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 at approximate coordinates 98,500 n and 160,000 e. 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 approximate coordinates 79,500 n and 173,500 e . 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.

- ✓ The following criteria are used to evaluate and rank the sites included: Land type, area available, ownership and appropriation.
- ✓ Constructability
- ✓ Potential aquifer Impacts
- ✓ Site wastewater effluent reuse potential
- ✓ Proximity to existing and future urban areas
- ✓ Site access to utilities
- ✓ Flood proofing
- ✓ Proximity to landfill
- ✓ Potential population served and
- ✓ Site visibility and aesthetics

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 (**Figure 3.7).**

The site is located within a relatively flat area and flood plain in Wadi as-Samen. This site was selected earlier for the HWWTP and was approved by all parties including the Joint Water Committee and the Israeli Civil Administration of the West Bank back at the time of the previous feasibility studies which was completed in 2005 for the implementation of the first phase of the Hebron Master Plan. As a consequence, all attempts shall be made to utilize this site for the HWWTP.

The following points clarify the basis of Hebron site selection:

- Land acquisition as afore mentioned.
- The distance from neighbours/few neighbors.
- 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 land preparation difficulties that may occur due to the big elevation differences observed.

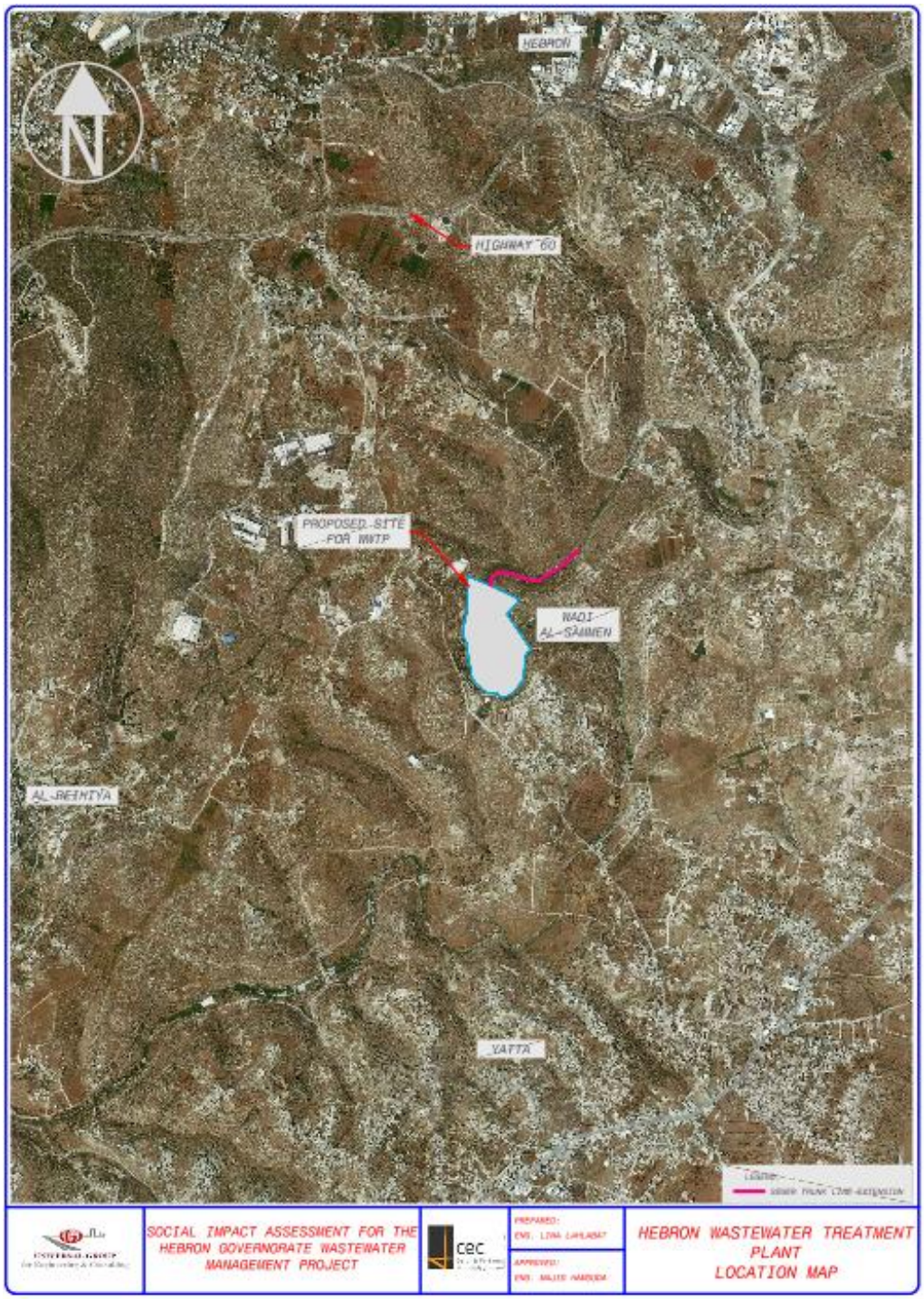

Figure 3.7: HWWTP Location Map

3.9 Design Criteria

3.9.1 Connected Population Equivalents

155,842 persons are considered already connected to the sewer system in 2012. Under the selected scenario, 1X. This is expected to increase to 225,580 by 2027 (**Table 3.6)** due to natural growth in the community alone without installation of new sewers. The connected population as proposed for design is illustrated in **Table 3.13**.

Table 3.13: 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

3.9.2 Wastewater Generation

The Q_{mean} is assumed to amount to 10,535 m³/d in 2012 and to reach 15,200 by 2027 (**Table 3.10**) considering population increases but with minimal increases in per capita water consumption rates. The projected mean daily flows are further illustrated by **Table 3.14**.

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 3.14**

Table 3.14: Projection of Mean and Diurnal Peak Wastewater Flows

Parameter	2012	2015	2020	2025	2027	2030
Daily Mean Flow to the HWWTP - m^3/d	10,535	11,480	13,110	14,660	**15,200**	16,180
Diurnal Peak Flow to the HWWTP - m^3/d	26,340	28,700	32,780	36,650	**38,000**	40,450

3.9.3 Storm Water Allowances

In case of rainwater events, an additional amount of storm water enters the sewerage networks through manholes or unexpected illegal connections that have to be taken into consideration. This ratio is very much based upon experience considering manholes with ventilated openings located at lower elevations or other facilities where rainwater can enter the sewerage system. Additional storm water inflow results from illegal storm water connections. However, the storm water access to the system in the project area is very limited due to the limited amount of rainfall in the semi-arid areas of the West Bank. In this environment, it would be imprudent to design the facilities for high storm water flow events which may only occur very infrequently.

Therefore, the design of HWWTP under the selected scenario is capable of treating the first flush (mixed waste and storm water). To achieve this, a storm water peaking factors of 1.5 on top of the diurnal peaking factor of 2.5 was proposed (**Table 3.10**).

For the selected scenario, only the City of Hebron is served and the existing sewer system in this area is considered a combined system. This is in line with international best practice and gives rise to an overall storm water peaking factor of 3.75 times average day flows. Design Peak flows recommended to be applied for the project are as shown on **Table 3.15**.

Table 3.15: Projection of Peak Wet Weather Wastewater Flow

Parameter	2012	2015	2020	2025	2027	2030
Daily Mean Flow to the HWWTP - m^3/d	10,535	11,480	13,110	14,660	**15,200**	16,180
Peak Wet Weather Flow to the HWWTP - m^3/d	39,500	43,050	49,160	55,000	**57,000**	60,675

3.9.4 Specific Wastewater Pollution Loads

The specific wastewater loads as indicated in **Table 3.16** are recommended.

Table 3.16: Specific Wastewater Loads

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

Table 3.17 lists all basic wastewater flows and loads used in design of the preferred scenario 1X of HWWTP. These serve as the bases for the hydraulic and process design of the HWWTP facilities required to treat the influent wastewater and deliver an effluent that meets the stipulated criteria such that the water may be reused in agriculture as proposed.

3.9.5 Effluent Standards

The effluent of the WWTP has to fulfill the criteria defined in the Jordanian Standard JS 893/2006 for cooked vegetables (Class A). The effluent criteria are presented below:

- Biological Oxygen Demand (BOD_5) : 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

To reach the requirements for BOD_5, COD, TSS and PO_4-P, secondary wastewater treatment with adequately designed sedimentation tanks will be necessary. To reach the requirements for TN, nitrification will be required.

The maximum effluent value for total coliforms calls for disinfection. Two options were considered: chlorination and UV disinfection. The option for chlorination was discarded, since very large (and costly) amounts of chlorine would be required for the removal of ammonia, before disinfection would take place. Furthermore large contact tanks are needed for effective chlorination. As a consequence for design purposes disinfection by means of UV radiation is proposed.

Table 3.17 lists also the proposed inflows and loads applied for the design of the HWWTP.

Table 3.17: Summary of Proposed Inflows and Loads

Parameter	Unit	2012	2015	2020	2025	2027	2030
1. Connected population							
Connected Population	P.E.	155,840	169,800	193,990	216,820	225,580	239,990
Growth Rate	%	2.9	2.7	2.3	2	1.8	1.8
2. Wastewater Flow							
Daily domestic	m^3/d	10,535	11,480	13,110	14,660	15,200	16,180
Growth rate	%	2.9	2.7	2.3	2	2	4
Hourly (diurnal) peak factor		2.5	2.5	2.5	2.5	2.5	2.5
Wet weather peak factor		3.75	3.75	3.75	3.75	3.75	3.75
Peak dry weather flow	m^3/d	26,340	28,700	32,780	36,650	38,000	40,450
	m^3/h	1,098	1,196	1,366	1,527	1,583	1,685
Peak wet weather flow	m^3/d	239,500	43,050	49,160	55,000	57,000	60,675
	m^3/h	9,979	1,794	2,048	2,292	2,375	2,528
3. Wastewater Loads							
Specific BOD – Load	g/c/d	60	60	60	60	60	60
Specific COD – Load	g/c/d	140	140	140	140	140	140
Specific TSS - Load	g/c/d	60	60	60	60	60	60
Specific TN - Load	g/c/d	11	11	11	11	11	11
Specific TP - Load	g/c/d	2	2	2	2	2	2
Total BOD - Load	kg/d	9,350	10,188	11,639	13,009	13,535	14,399
Total COD - Load	kg/d	21,818	23,772	27,159	30,355	31,581	33,599
Total TSS – Load	kg/d	9,350	10,188	11,639	13,009	13,535	14,399
Total TN – Load	kg/d	1,683	1,834	2,095	2,342	2,436	2,592
Total TP – Load	kg/d	296	323	369	412	429	456
4. Annual Flow and Load							
Annual Wastewater flow	m^3/a	3,845,275	4,190,200	4,785,150	5,350,900	5,548,000	5,905,700
Annual BOD – load (max. load x 365d)	1000 kg/a	3,413	3,719	4,248	4,748	4,940	5,256

3.10 Wastewater Treatment Plant Design

Based on the multi-criteria analysis Conventional Activated Sludge (CAS) including anaerobic sludge stabilization results in the most favourable solution for HWWTP and was recommended for this facility. A short description of the design process is provided in the following sections.

3.10.1 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 3.8.** 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.

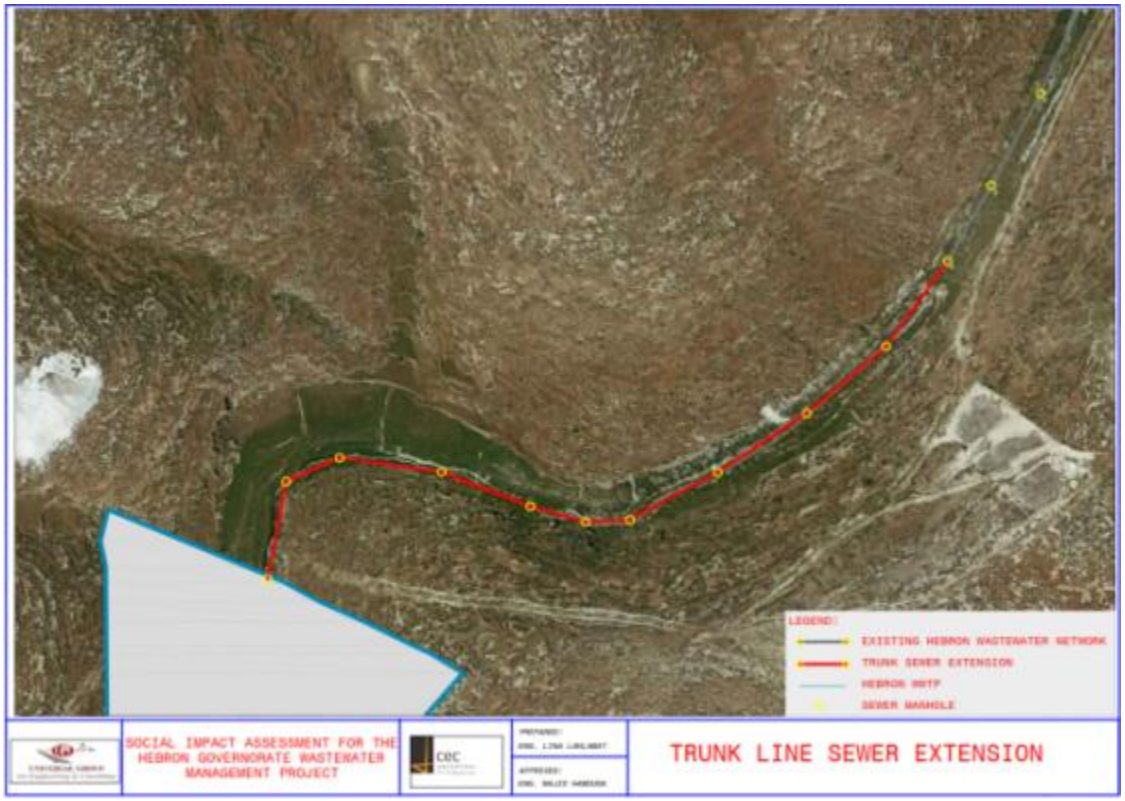

Figure 3.8: Proposed Alignment of Trunk Sewer Extension

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.

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.

The wastewater continues through a grit chamber, in which grit and sand are collected. Adequate grit and sand removal is required in order to prevent built-up of sand in the digester. **Table 3.18** lists the dimensions of the primary treatment components of HWWTP.

Table 3.18: Primary Treatment Dimensions

	Unit	**Scenario 1X**
Pumping station	m^3/h	2,375
Coarse screen	m^3/h	3,580
Fine screen	m^3/h	2,500
# of screens	#	2
Grit Chamber (total)	m^2	133
# of grit chamber	#	1
Primary sedimentation tank	m^2	1,200
Diameter per tank and #	m (#)	29 (1)

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.

The proposed sewer trunk line will be laid in the access road within the wadi right of way. The Palestinian Water Authority laws and regulations related to sewer trunk lines design were followed. The sewer trunk line has been designed to meet the peak flow with pipe diameter 1500 mm.
For the hydraulic calculations and the design of sewer trunk line, the Manning Formula and the
Continuity Equation has been applied:

$$V = \frac{1}{n} \times R\frac{2}{3} \times S\frac{1}{2}$$

$$Q = V \times A$$

Where:
V = flow velocity, (m/s)
n = coefficient of roughness, (dimension less)
R = hydraulic radius, (m)
S = slope of energy grade line, (m/m)
A = cross-sectional area of flow, (m^2)
Q = flow (m^3/sec)

A dimensionless value used in the manning formula to specify the resistant to flow of liquid in a pipe or channel of a particular surface roughness. The roughness coefficient (n) depends on the pipe internal surface conditions. The smoother the surface is, the smaller the coefficient value is. The value of n ranges between 0.01 for smooth surfaces and 0.02 for rough ones. For the purposes of design n value will be considered 0.01.

The commonly used pipe materials for sewer networks are:

- Pre-stressed reinforced concrete (R.C)
- Ductile Iron (D.I)
- Glass fiber reinforced plastic (GRP)
- Un-plasticized polyvinyl chloride (uPVC)

For sewer pipes larger than DN400 the first option should be GRP pipes, but due to the unavailability of such pipes on the local market and the long complicated Israeli customs procedures R.C pipes has been used.

Manholes shall be provided for inspection and maintenance at the following locations:-
1. Starting point (upstream Manhole)
2. Change of slope
3. Change of Diameter
4. Change of direction
5. Sewers crossings
6. Change of elevation (i.e. Drop Manholes)
7. in regular intervals to accommodate cleaning and in order to facilitate maintenance operations.

The maximum permitted distance between manholes shall not exceed 120 m.
Manholes will be cast in situ for large sewers. The internal diameters of manholes shall not be less than 1000 mm. Manholes shall be water tight, epoxy painted and shall be supplied with PE coated steps and heavy duty ductile iron covers.

3.10.2 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).

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.

It is recommended that each activated sludge basis has a final sedimentation tank associated with it. Each sedimentation tank is equipped with its own sludge return facility.

Effluent flows to the disinfection unit. **Table 3.19** lists the dimensions of the biological treatment components of HWWTP

Table 3.19: Biological Treatment Dimensions

	Unit	**Scenario 1X**
Activated sludge - total volume	m^3	15,000
- of which oxic	m^3	9,000
- of which anoxic	m^3	6,000
Final sedimentation tank area and number	m^2 (#)	3,600 (3)

3.10.3 Disinfection

In order to meet the requirements for fecal coli, effluent has to be disinfected. Two possible options for disinfection are UV-disinfection or chlorination. Preference is given to UV disinfection as it has some distinctive benefits when compared to chlorination.

UV disinfection is a well-accepted disinfection technology, amongst others in use at the Al-Bireh treatment plant. UV does not require chemicals, but electricity instead. It is assessed that for scenario 1 electricity consumption for disinfection will range around 350,000 - 400,000 kWh/year. UV disinfection uses a relatively small footprint.

3.10.4 Final System Design and Unit Sizes

The plant sizes for the revised flow rate of 15,000 m^3/d are listed in **Table 3.20.** A possible layout of facilities for the first phase project is shown on **Figure 3.9** which also shows how facilities for future project phases may be constructed on the same site. The proposed layout has taken into consideration the ultimate requirements and developed a staging plan for such facilities to ensure full site utilization. In **Figure 3.10**, the HWWTP General Site Plan is illustrated.

Table 3.20: Summary of Unit Sizes and Number of Units per Revised Flow Rate

Unit	**Size**	**No. of units for revised flow rate of 15,000 m^3/d**
Screen	5m x 1m x 1.5m	2
Grit chamber	13m Dia x 1.5m deep	1
Primary sedimentation Tank	39m dia x 4.5m deep	1
Aeration Tanks	55m x 25m x 6m	2
Final Sedimentation Tanks	39m dia x 4.5m deep	3
Anaerobic Digester	30m dia x 10m deep	1
Thickener	11m dia x 4m deep	1

3.10.5 Cost of Proposed Systems

The capital and Operation and Maintenance (O&M) costs for the HWWTP for the flow scenario of 15,000 m^3/d were developed. The capital costs of nearly US$26.48 million for the WWTP, excludes the cost of $8.74 million for the site works which include

levelling, retaining walls, construction of an access road and provision of the electrical service to the WWTP.

The annual O&M cost of US$1.59 million allows for utilization of gas generated in the anaerobic generators to produce electricity, thus reducing the annual amounts paid for electricity. This is shown as electricity production and is given a negative cost. Depreciation costs are included in the cost benefit analyses for the project.

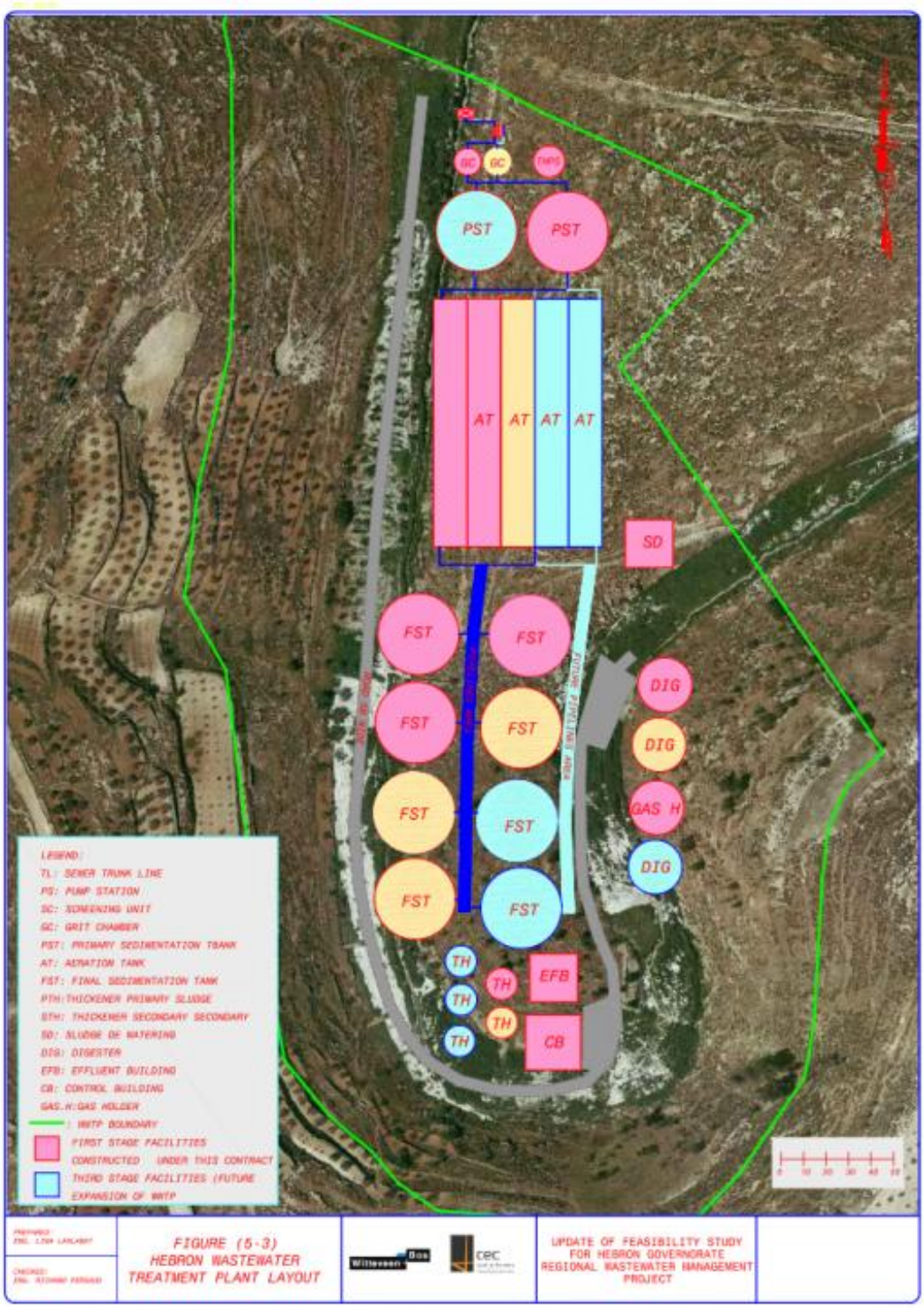

Figure 3.9: Possible Plant Layout

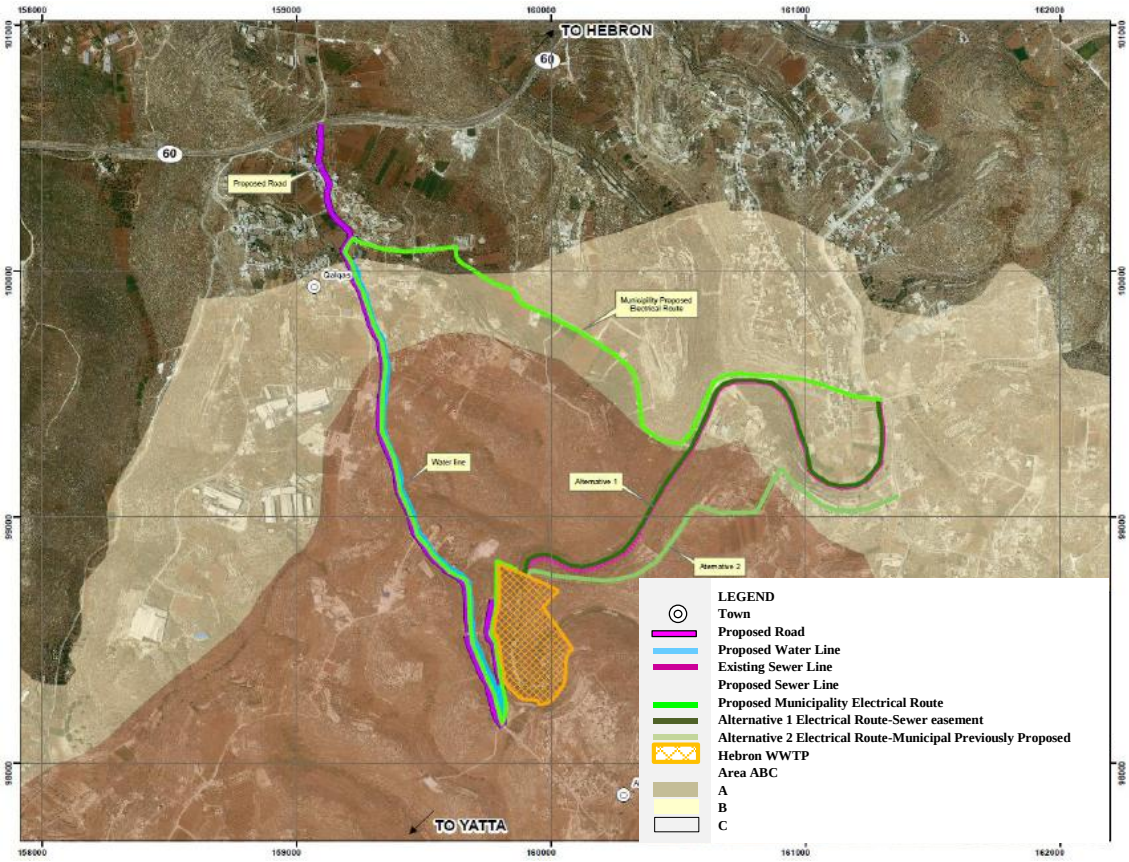

Figure 3.10: HWWTP General Site Plan

3.11 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).

The "Update Feasibility Study for Hebron Governorate Regional Wastewater Management Project" has focused on identifying lands that can be irrigated with TWW and the type of crops that may be irrigated, while satisfying current regulations. Moreover, the project also includes identification of conceptual facilities for conveying the TWW to the selected lands.

3.11.1 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-Sameen 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 3.11**).

Figure 3.11: Core Area 1 - Lands along Wadi as-Samen

The non-olive and non-grapes lands along Wadi As-Sameen, with an area of approximately 400 ha, between the HWWTP and Shokeit, are scattered along the Wadi in a parcels differing in their size and elevation. These lands were grouped to form 34 irrigation clusters, each of these clusters will be served by a separate local pumping station and irrigation line with each pump station extracting water from a pool created in the Wadi. Therefore, the parcels were classified according to their peak demand, area and required pumping head as shown in **Table 3.21** and **Figure 3.11**. Winter TWW that is not used along the Wadi will reach Al- Furejat area where it will be utilized there.

Table 3.21: Characteristics Core Area 1 - Along Wadi As-Sameen

Category	Number of separate parcels	Required pumping head (m)	required Pump capacity m^3/hr	Hp	Area covered ha
Clusters type 1	4	50	50	15	22.9
Clusters type 2	10	100	50	30	79.5
Clusters type 3	7	100	100	60	79.8
Clusters type 4	11	150	100	90	149.4
Clusters type 5	1	150	200	150	31.4
Clusters type 6	1	150	250	180	40.2
Total	34				403.4

The required conveyance system for this area includes 34 pumping stations whose costs are shown in **Table 3.22**. **Table 3.23** shows the system required pipe lengths as well as the cost of the proposed irrigation pipeline systems.

Table 3.22: Core Area 1 – Cost of pumping stations

Category	No of clusters	head	flow m^3/hr	Hp required	Unit Price US$	Total Price US$
cat 1	4	50	50	15	14,000	56,000
cat 2	10	100	50	30	32,000	320,000
cat 3	7	100	100	60	63,500	445,000
cat 4	11	150	100	90	95,500	1,050,000
cat 5	1	150	200	150	150,000	150,000
cat 6	1	150	250	180	200,000	200,000
total	34					2,221,000

- **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 3.12)**.

This potential area requires a pump station and force main to convey the TWW to the area to be irrigated in Yatta. The facilities would include a pumping station, a small reservoir (10,000 m^3), and approximately 10 km of force. **Table 3.24** shows the cost for the conveyance system including pumping stations for the Yatta area.

Table 3.23: Core Area 1 – Cost of Irrigation Pipelines

Diameter mm / Category		Unit Price US$	Total Lengths	Total Price US$
110	PE 100 6 Bar	22	2,015	44,000
110	PE 100 10 Bar	25	15,525	388,000
110	PE 100 16 Bar	30	13,250	398,000
160	PE 100 16 Bar	48	2,700	130,000
Fittings and contingencies				500,000
Total			33,490	1,460,000

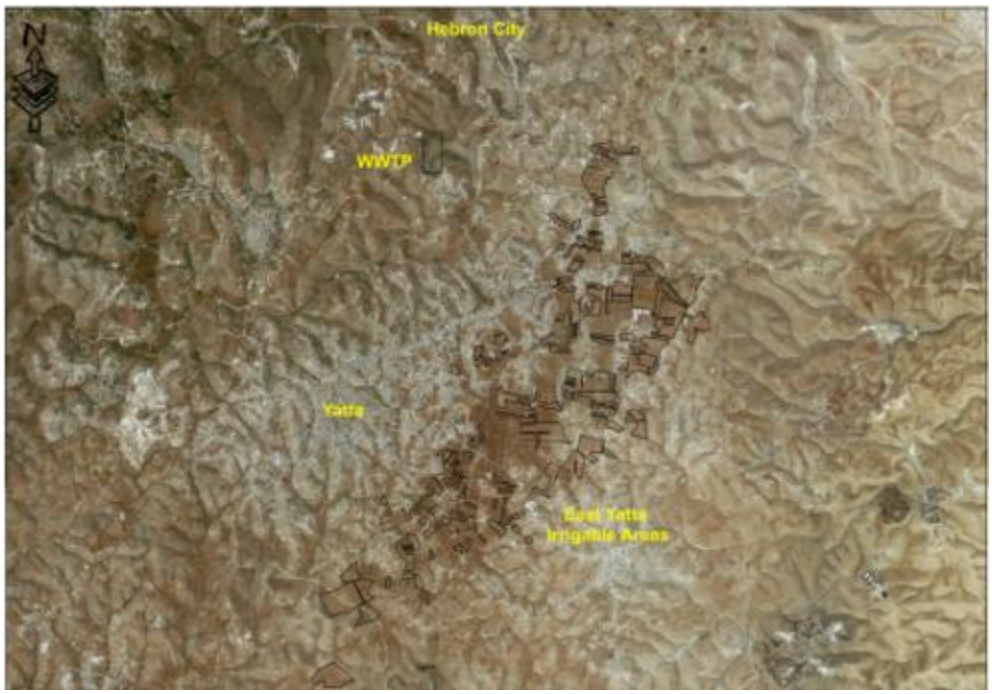

Figure 3.12: Core Area 2 - Routing of reclaimed water force main for Yatta lands

Table 3.24: Core Area 2 - Cost of Pump station and irrigation pipelines

Item	Details	Price US$
Storage	10000 m^3	850,000
Pumps	Three pumps with flow of 350l/s at a head of 150m, and motors 350 hp	1,200,000
Pipes	8", Steel 1 - 4" dia	527,000
Pipes	12", Steel 1 - 4" dia	1,201,000
Fittings		500,000
Total		4,278,000

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 3.13).**

Figure 3.13: Winter Area - Location overview of Al-Furejat Lands

To utilize the TWW in this area would require a diversion structure and force main from the Wadi to the reuse site. **Table 3.25** next shows the cost for the conveyance system including pumping stations and pipelines for the Al-Furejat area.

Table 3.25: Winter Area - Cost of the Pump station and Irrigation Pipelines

Item	Details	Price US$
Retention Structure (gravity dam)	---	850,000
Pumps	2+1, h 80, q 450, 250 hp	800,000
Pipes	4 km 18" dia	850,000
Pipes Grid	4km 10" dia Distribution	400,000
Fittings	----	200,000
Total		3,100,000

3.11.2 Crop Selection

The proposed crops to be irrigated in the select areas were identified based on responses to the farmers' survey, information provided by farmers during a workshop sessions and based on the Palestinian TWW regulations. Proposed cropping patterns also excluded irrigation of the traditional national crops i.e. olive, grapes and citrus, as requested by farmers and the MoA. Based on these criteria, the crops considered suitable for irrigated agriculture are: Barley, Green Fodders and Stone fruit tree crops.

In order to select proposed cropping patterns for detailed economic evaluation, generalized cropping patterns were first developed and evaluated. Initially, 16 different combinations of crop type and storage arrangements were developed (**Table 3.26**). These

options were first screened based on overall water utilization and the total areas irrigated and the four options selected for detailed economic evaluation (**Table 3.27**).

A Benefit-cost analysis was performed to evaluate the feasibility of each selected irrigation/cropping pattern scenario, options SC1, SC2, SC3 and SC4.

Option SC1 - Reclaimed wastewater to Wadi as-Samen in summer with residuals to Al-Furejat in winter without Storage: In the first option which included irrigating 230 hectare in summer and 410 hectare in winter, the operational costs will be US$ 1.662 million. The fixed costs will be US$ 1.004, and the total returns US$ 3.28 while the gross margin was US$ 1.59 million and the net return will be US$ 0.614 million.

Table 3.26: Cropping Patterns for Initial Screening

Core Irrigated Area	**Winter Irrigated area - Al-Furejat Lands**			
	No Storage		**Storage**	
	Crop Type		**Crop Type**	
	Barley	**Sorghum**	**Barley**	**Sorghum**
	Option Number			
The lands along Wadi as-Samen with Storage	1	2	3	4
The lands along Wadi as-Samen with No Storage	5	6	7	8
Yatta lands with Storage	9	10	11	12
Yatta lands with No Storage	13	14	15	16

Table 3.27: Options Selected for Detailed Economic Evaluation

Core Irrigated Area	**Winter Irrigated area - Al-Furejat Lands**	
	No Storage	**Storage**
	Crop Type	**Crop Type**
	Barley	**Barley**
The lands along Wadi as-Samen with No Storage	1A	3A
Yatta lands with No Storage	2A	4A

3.11.3 Cost-Benefit Analysis for the Agricultural Component

Option SC2 - Reclaimed wastewater to Yatta in summer with residuals to AlFurejat in winter without Storage: For the second option, 235 hectare in summer 410 hectare in winter, the operational costs for this option will be US$1.39 million, the fixed costs will be US$1.11, the total return will be US$ 3.28 million, the gross margins, US$ 1.89 million and the net return will be US$ 0.774 million.

Option SC3 - Reclaimed wastewater to Wadi As-Samen in summer with residuals to Al-Furejat in winter with 200,000 m^3 storage: For the third option, 590 hectare of barley and 82 hectare of sorghum will be irrigated, in addition to 62 hectare planted with alfalfa and 62 hectare planted with almonds. The operational costs in this scenario will be US$ 1.93

million, the fixed costs will be US$ 1.19, the total return will be US$ 3.78 million, and the gross margins, US$ 1.85 million and the net return will be US$ 0.663 million.

Capital costs and life time costs of the major infrastructure and farm investment components and land reclamation were estimated and amortized to annual payments, assuming a 7% interest rate. Annual operations and maintenance (O&M) costs and annual revenue were estimated from unpublished data collected by the Ministry of Agriculture as part of a comparative advantage study.

The main infrastructure requirements for using the produced reclaimed wastewater are pumps and pipelines.

The crop budgets for the selected crops in the different regions were prepared, several indicators were calculated for year 2015, they are: Total variable costs, Amortized fixed costs, gross margins, net returns (profits), return to water (i.e. return to one cubic meter of used water) and the virtual water coefficient (i.e. the quantity of water in cubic meters used to produce one kg of the product).

The results (**Table 3.28**) showed that the different the variable, fixed costs and the returns differ between the four scenarios. Since we aim at increasing the net return to the farmers, the one that has the highest net return will be chosen, which is scenario two (Planting 62 hectares with almonds, and the same with alfalfa, in addition to 590 ha of barley and 82 ha with sorghum. The chosen land is in Yatta and the rest reclaimed water is sent to Furejat without building a storing dam.

Table 3.28: Cost-Benefit Analysis for the Reuse of Reclaimed Wastewater

Scenario	Area	Water Req.	Variable Costs	Fixed Costs	Total Costs	Returns	Gross Margin	Net Return	Return to Water	Virtual Water
	HA	CM	US$	US$	US$	US$	US$	US$	US$/ CM	CM/kg
Along the Wadi Alsamen & Fraijat/SC1 No Storage/Barley										
Area of Almonds	62	757,864	454,781	191,544	646,325	912,996	458,215	266,671	0.47	3.5
Area of Barley	440	1,078,533	794,178	541,111	1,335,289	1,477,143	682,965	141,854	1.01	0.5
Area of Sorghum	82	242,275	115,703	130,168	245,870	425,974	310,271	180,104	1.40	0.1
Area of Alfalfa	62	577,215	297,709	140,694	438,402	464,045	166,337	25,643	0.42	0.3
Total	**645**	**2,655,888**	**1,662,369**	**1,003,516**	**2,665,885**	**3,280,158**	**1,617,788**	**614,272**		
Yatta & Fraijat/SC2/ No Storage/Barley										
Area of Almonds	62	757,864	454,781	191,544	646,325	912,996	458,215	266,671	0.47	3.5
Area of Barley	440	1,300,013	526,601	649,165	1,175,766	1,477,143	950,542	301,377	1.01	0.5
Area of Sorghum	82	242,275	115,703	130,168	245,870	425,974	310,271	180,104	1.40	0.1
Area of Alfalfa	62	577,215	297,709	140,694	438,402	464,045	166,337	25,643	0.42	0.3
Total	**645**	**2,877,367**	**1,394,792**	**1,111,570**	**2,506,363**	**3,280,158**	**1,885,365**	**773,795**		
Along the Wadi Alsamen & Fraijat/SC3 Storage in Fraijat/Barley										
Area of Almonds	62	757,864	454,781	191,544	646,325	912,996	458,215	266,671	0.47	3.5
Area of Barley	590	1,446,215	1,064,921	725,580	1,790,501	1,980,714	915,794	190,214	1.01	0.5
Area of Sorghum	82	242,275	115,703	130,168	245,870	425,974	11,945,454	180,104	1.40	0.1
Area of Alfalfa	62	577,215	297,709	140,694	438,402	464,045	166,337	25,643	0.42	0.3
Total	**795**	**3,023,570**	**1,933,112**	**1,187,985**	**3,121,097**	**3,783,729**	**1,850,617**	**662,632**		
Yatta & Fraijat/SC4 Storage in Fraijat/Barley										
Area of Almonds	62	757,864	454,781	191,544	646,325	912,996	458,215	266,671	0.47	3.5
Area of Barley	590	1,446,215	1,064,921	725,580	1,790,501	1,980,714	915,794	190,214	0.78	0.6
Area of Sorghum	82	242,275	212,630	168,597	381,227	425,974	213,344	44,747	0.42	0.4
Area of Alfalfa	62	577,215	297,709	140,694	438,402	464,045	166,337	25,643	0.42	0.3
Total	**795**	**3,023,570**	**2,030,039**	**1,226,415**	**3,256,454**	**3,783,729**	**1,753,690**	**527,275**		

3.12 Biosolids Handling, Treatment and disposal

The Israeli and US regulations specify 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.

3.12.1 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 3.15.**

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. Private sector involvement might be interesting to reach the required scale for feasibility. 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.

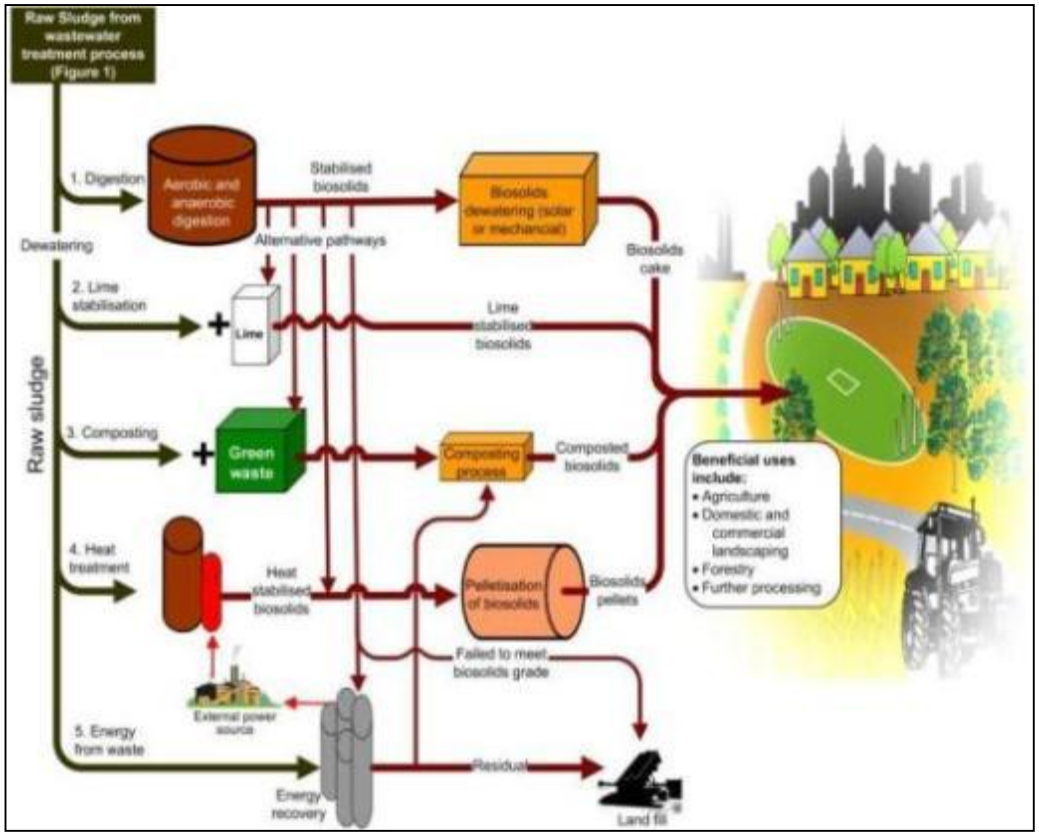

Figure 3.14: Biosolids Disposal Options

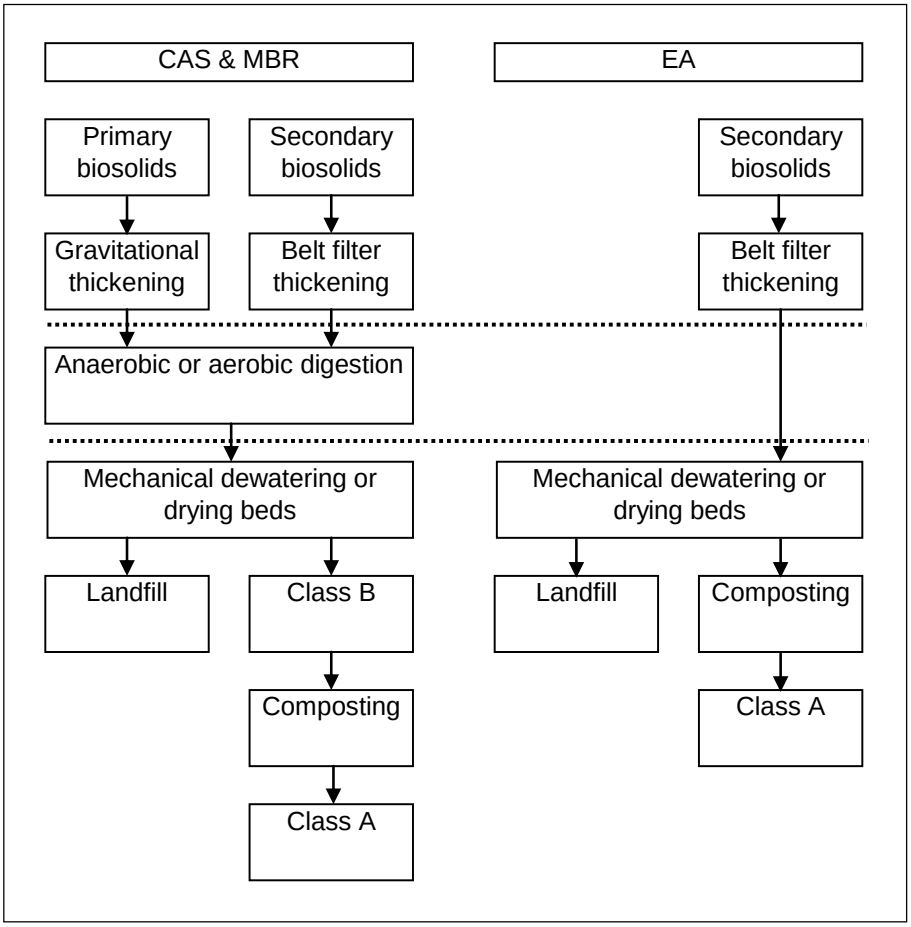

Figure 3.15: Unit Processes in Biosolids Treatment

3.12.2 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 (**Table 3.29**).

Table 3.29: Design Parameters Sludge Thickening

	Unit	**Scenario 1x**
Primary sludge	kg/d	6,700
- flow	m³/d	350
- after thickening	m³/d	125
Secondary sludge	kg/d	7,850
- flow	m³/d	1,000
- after thickening	m³/d	150
Total sludge to digester		
-load	m³/d	19,650 (optional)
- flow	m³/d	330 (optional)

3.12.3 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. **Table 3.30** lists the design parameters for the sludge digestion HWWTP.

Table 3.30: Design Parameters Sludge Digestion

	Unit	**Scenario 1**
Total flow to digester	m³/d	275
HRT digester	days	22
Volume digester	m³	7,000
VSS reduction	%	60
TSS out of digester	**kg/d**	**11.500**
Specific biogas production	m³/kgVSS digested/d	1
Caloric value of biogas	kJ/m³	22.500
Gas holder retention time	h	2
CHP electric efficiency	%	0,35
Biogas production	m³/d	7.450
Gas holder size	m³	630
Electricity production	**kWh/d**	**16.300**

3.12.4 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/m³), 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.

3.13 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 an ESCHIA 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 will be constructed in the project area.

Table 3.31 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 will enhance the environment and the cultural and social resources along Wadi as-Samen.

Table 3.31: Comparison between Project Implementation, 'No Project' Alternative and 'No Second Phase' Alternate:

Item	Project Implementation "Phase 1 + 2" Alternative	Project Implementation "Phase 1 only"	Future Conditions Under "No Project" Alternative
Land Use	WWTP is located on approximately good quality agricultural land that is potential for irrigation by reuse.	Agricultural land potential for irrigation reuse will remain as it is in the "No Project" alternative.	Existing land uses and ownership would remain unchanged.
Soil	Effluent reuse will increase the salt and sodium content of agricultural soils and underlying strata.	The salt and sodium content resulted from using the effluent reuse will not be changed. However the source that will receive the effluent (Groundwater Body) will be affected. Also the untreated resulting sludge from phase 1 could be a source of pollution if not properly handled.	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.	Dust will be emitted temporarily during construction. Potential odors may be emitted (discharge of effluent into water bodies, resulting sludge).	Odor generation will remain while raw sewage is running through the Wadi and will increase with population growth and urban expansion.
Groundwater	Effluent discharge disposal in the As-Samen Wadi may have the potential to increase levels of salinity and nitrogen content in the Wadi, especially when problems occur in the operation of the WWTP. Other alternatives is to discharge to alternative Wadi site, which is not feasible as it needs new	In case no effluent reuse will be applied the discharge of treated wastewater to the ground water will increase the nitrogen content.	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.

Item	Project Implementation "Phase 1 + 2" Alternative	Project Implementation "Phase 1 only"	Future Conditions Under "No Project" Alternative
	measures, and construction of pump line and installation of pumps and this is not justified neither environmentally nor technically.		
Surface Water	Treated wastewater will be discharged to a network to agricultural areas in future reuse schemes.	The surface water will receive the effluent from the WWTP, thus the surface water will be directly affected. Odor problems, increasing in slat and nitrogen may occur in case the of any issues in WWTP operation. Wadi As-Samen will not suffer from the availability of suitable irrigation source (In case phase 1 only was implemented), which will have direct effect on the ground and surface water.	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 into stone fruit trees and fodder.	Rain-fed agriculture will continue at present condition. If phase 1 only was implemented an acute problem will present - secondary treatment and disposal of the wastewater of Hebron Municipality. Secondary treatment has lower treatment costs, and will allow for restricted irrigation of agricultural lands adjacent to and downstream from the WWTP. However comprehensive and sound	Rain-fed agriculture will continue at present condition.

Item	Project Implementation "Phase 1 + 2" Alternative	Project Implementation "Phase 1 only"	Future Conditions Under "No Project" Alternative
		reuse practices will still be missing will further restrict agricultural activities in the adjacent lands.	
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.	Effect of construction activities will be limited to phase 1 only. Wastewater sector will still be enhanced, but without benefit from the effluent as an agricultural water source.	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.	Creation of new jobs will still be available, but will be limited to phase 1. The cost for required water for irrigation will still be hindered by the community. In addition to additional unforeseen costs to overcome the worsening of the environment (soil and groundwater) due to disposal of effluent into surface and groundwater.	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.	The elimination of future health hazards will be limited to phase 1.	Health hazard created by seepage of raw sewage from cesspits and health hazards

Item	Project Implementation "Phase 1 + 2" Alternative	Project Implementation "Phase 1 only"	Future Conditions Under "No Project" Alternative
	Exposure to WWTP chemicals and odors.		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.	Construction noise will be limited to phase 1 activities.	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.	The impacts will be limited to phase 1.	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.	The impacts will be limited to phase 1.	Damage of ecology and species by raw and industrial wastewater flowing in Wadi as-Samen

4. BASELINE ENVIRONMENTAL DATA

4.1 Location and topography

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.

Figure 4.1 and **Figure 4.2** show the topographic features of Hebron area and of the proposed WWTP site respectively. **Figure 4.1** shows also the built up areas within the project site.

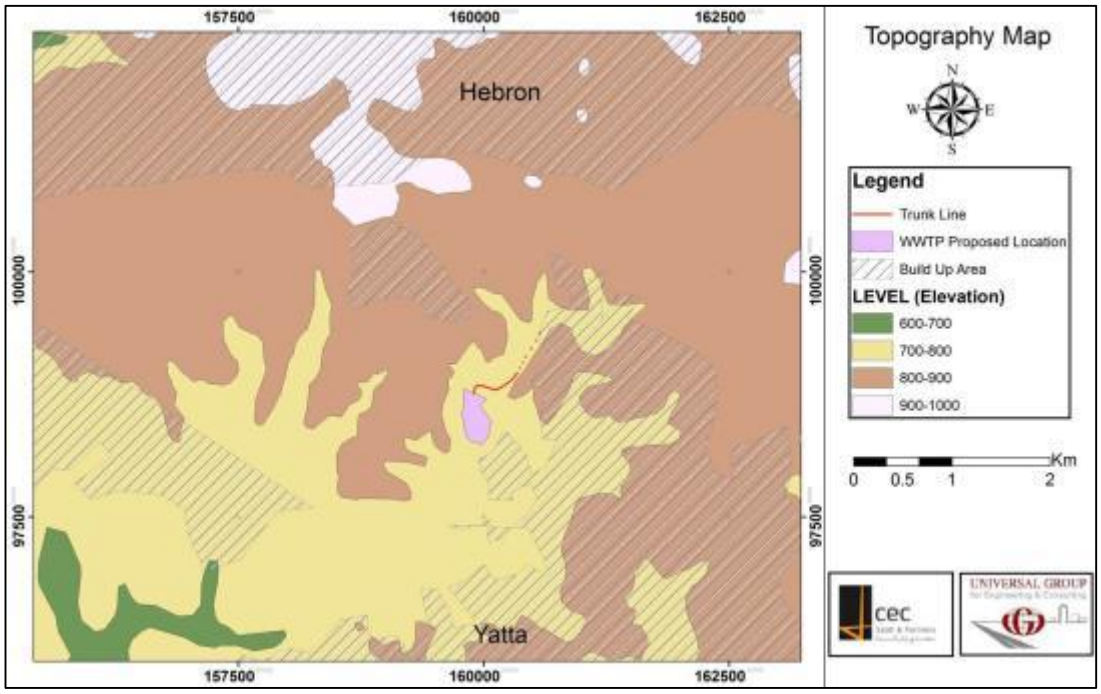

Figure 4.1: Topographic features and built up areas in the project area

The northern part of the basin is characterized by a mountainous landscape around the ancient city of Hebron, with few agricultural areas and many settlements.

4.2 Climate

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.

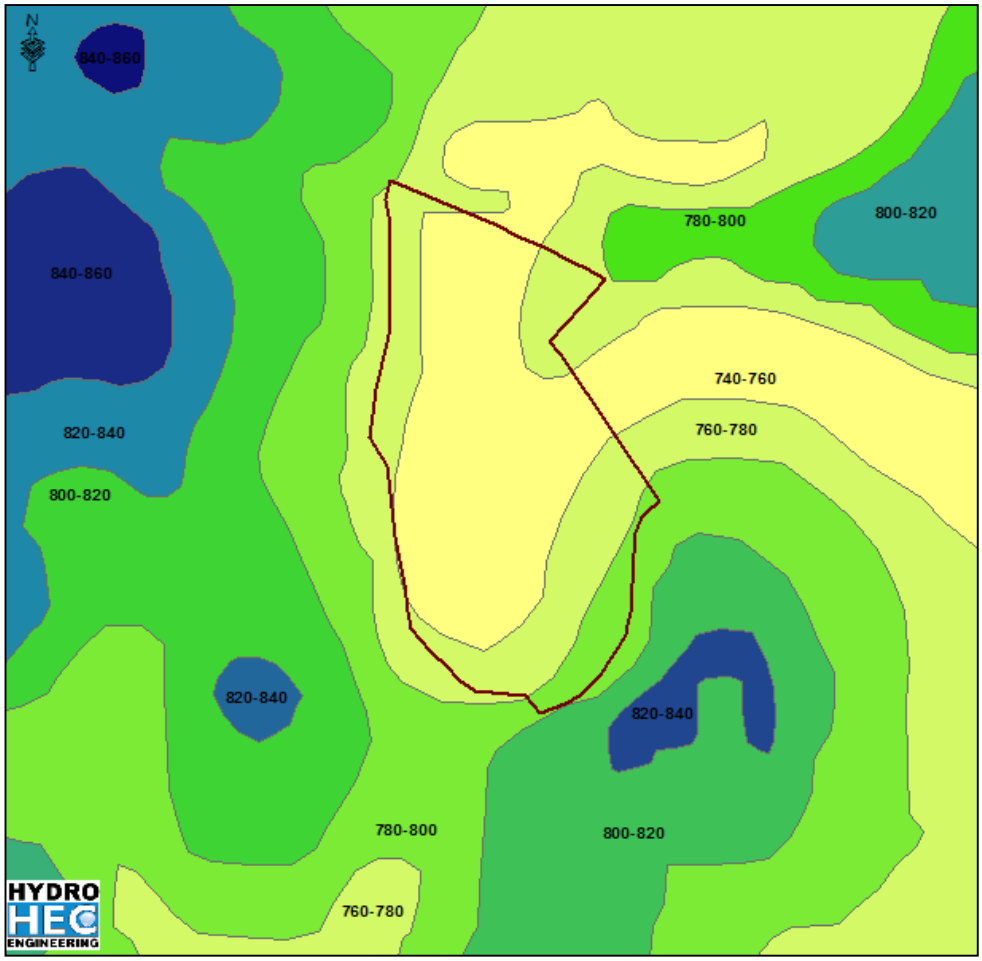

Figure 4.2: Topographic Map of the Study Area at WWTP location

4.2.1 Temperature

Generally, temperatures in the West Bank vary according to the geographical position, altitude, exposure to marine influences, etc. Throughout the West Bank, the hottest days of the year occur in August. 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. **Table 4.1** shows the average, maximum and minimum monthly temperatures recorded in Hebron station during the period 2000-2008.

Temperatures below the freezing point are registered nearly every winter in the mountains areas of the West Bank. In Hebron city the average minimum temperature during the period 2000-2008 was -2.5°C in January.

4.2.2 Humidity

Relative humidity reaches its highest in winter, when the average humidity is 73% during January. In the summer months from June to August, the relative humidity drops to 55%, **Table 4.1**. On Khamaseen days, the air moisture content may sink below 30% as an impact of this wind.

Table 4.1: Climatic data from (2000-2008), Palestine Meteorological Department

	Item	Temp			R.H	Rain	Sun Shine	Evap.	Press.
		Max.	Min.	Av.	%	(mm)	(Hour)	(mm)	(mb)
January	**Total**					**174.6**	**158.0**	**76.5**	
	Av.	12.9	2.8	7.5	73.0		5.3	2.7	837.5
	Max.	24.0	7.4	14.6	100.0	74.6	9.8	6.9	911.1
	Min.	7.0	-2.5	2.8	21.0	0.1	0.0	0.0	144.0
February	**Total**					**102.5**	**154.0**	**80.1**	
	Av.	14.3	3.4	8.3	71.6		5.7	3.0	834.3
	Max.	25.4	7.0	16.3	100.0	41.2	10.3	10.6	911.5
	Min.	8.0	-1.2	2.6	22.5	0.1	0.0	0.0	162.0
March	**Total**					**40.6**	**221.1**	**135.7**	
	Av.	25.3	5.3	13.1	62.5		7.3	4.6	829.7
	Max.	33.0	10.0	23.0	100.0	33.0	13.2	11.8	1000.7
	Min.	18.5	0.0	6.5	18.8	0.2	0.0	0.2	120.0
April	Total					23.1	227.1	163.0	
	Av.	22.9	9.3	15.3	60.0		7.9	5.8	834.3
	Max.	34.0	19.0	25.0	100.0	55.0	12.6	13.7	906.3
	Min.	13.5	3.0	7.7	15.0	0.0	0.0	0.4	204.0
May	**Total**					**35.6**	**360.1**	**217.7**	
	Av.	27.7	8.1	19.1	54.4		15.9	9.3	894.0
	Max.	34.4	19.5	58.2	100.0	74.7	272.5	149.1	9894.0
	Min.	22.0	0.8	11.8	15.0	0.0	0.0	0.7	162.0
June	**Total**					**0.0**	**339.2**	**234.3**	
	Av.	29.3	15.7	22.3	53.2		11.7	8.2	835.5
	Max.	37.6	20.0	28.5	88.0	0.0	13.9	17.0	998.6
	Min.	25.0	11.0	17.7	16.7	0.0	3.0	2.0	156.0
July	Total					0.0	358.6	255.8	
	Av.	30.4	18.6	24.2	51.8		12.3	8.4	820.0
	Max.	37.0	22.2	29.2	88.0	0.0	13.6	13.2	901.4
	Min.	26.0	14.0	20.1	20.0	0.0	9.7	2.6	180.0
August	**Total**					**0.0**	**357.5**	**199.9**	
	Av.	29.6	17.4	23.2	60.6		11.5	6.8	820.0
	Max.	39.0	20.5	27.3	87.0	0.0	13.7	11.3	901.2
	Min.	27.0	15.0	20.6	20.7	0.0	6.3	3.0	174.0
September	**Total**					**1.1**	**289.2**	**172.8**	
	Av.	28.0	16.3	21.5	64.3		9.6	6.0	812.4
	Max.	35.0	19.8	26.3	95.0	5.8	11.8	11.1	903.7
	Min.	23.0	11.5	18.1	25.0	0.0	1.9	3.4	186.0

	Item	Temp			R.H	Rain	Sun Shine	Evap.	Press.
		Max.	Min.	Av.	%	(mm)	(Hour)	(mm)	(mb)
October	**Total**					**12.7**	**350.7**	**211.6**	
	Av.	27.7	13.6	19.5	64.7		18.5	11.3	822.5
	Max.	34.0	17.5	26.4	96.0	14.0	380.7	255.2	909.1
	Min.	22.0	7.5	13.3	21.0	0.0	0.2	0.4	126.0
November	Total					49.9	207.7	117.0	
	Av.	19.3	10.1	14.6	61.6		6.9	4.1	821.9
	Max.	29.0	15.0	21.3	99.0	82.6	10.2	9.6	908.5
	Min.	13.5	2.0	8.9	16.7	0.4	0.0	0.4	132.0
December	**Total**					**126.6**	**158.7**	**94.0**	
	Av.	16.8	6.0	10.0	70.9		5.2	3.1	823.8
	Max.	27.2	10.0	16.9	100.0	86.8	10.0	12.0	910.2
	Min.	8.5	0.0	8.3	12.0	0.2	0.0	0.2	132.0
Average Annual	**Total**					**566.7**	**3181.9**	**1958.4**	
	Av.	**23.7**	**10.6**	**16.6**	**62.4**		**9.8**	**6.1**	**832.2**
	Max.	**39.0**	**22.2**	**58.2**	**100.0**	**86.8**	**380.7**	**255.2**	**9894.0**
	Min.	**7.0**	**-2.5**	**2.6**	**12.0**	**0.0**	**0.0**	**0.0**	**120.0**

4.2.3 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 transitional seasons are influenced by the Red Sea trough (convective rain) and characterized by short rainfall duration and higher intensity.

Figure 4.3 is the rainfall map of the project area, where the Hebron WWTP is proposed to be constructed. It shows that the project area enjoys considerable amount of rainfall which ranges between 400-450 mm.

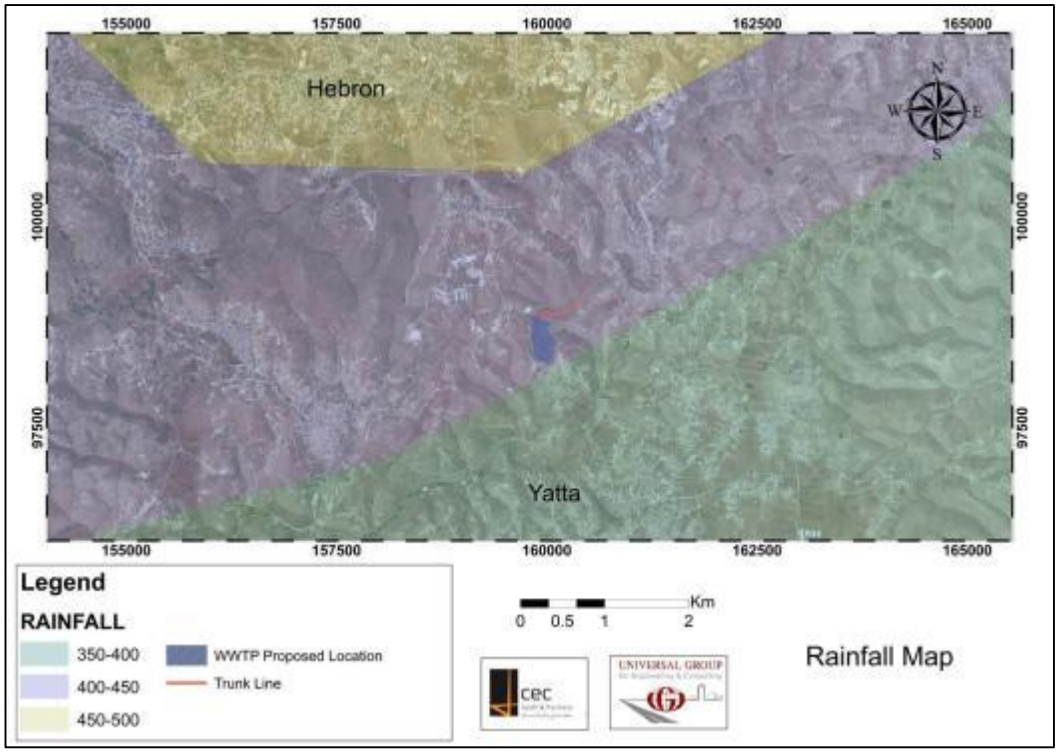

Figure 4.3: Rainfall map of the project site

The long term annual average rainfall in the watershed of the HWWTP is estimated at 492 mm where about 70% of the annual rainfall occurs between November and February. In March and April, precipitation usually decreases, while in May and September rainfall is rare. June, July and August are almost without rain. The most intensive rainfall usually occurs in December and January **Table 4.1** shows the mean monthly rainfall distribution for different stations in the West Bank.

4.2.4 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.

4.2.5 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/m^2/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.

4.2.6 Wind

The prevailing winds over the greater part of the West Bank come from the Southwest to northwest. In the summer, the high pressure belt over the Mediterranean and the continental low pressure area to the East and south creates a strong pressure gradient across the West Bank. This difference in pressure brings corresponding wind movement of relatively cooler air from the Mediterranean. The reduction of pressure gradient at night, when the land areas are cooler, causes diurnal fluctuations in wind speed. Winds are likely to blow from the land to the sea at night and reverse their direction during the day.

The mean monthly wind speed from June to August is 2.5 m/s in the proposed site area. In winter, there are depressions passing from the west to the east along the Mediterranean low pressure area. These depressions move from the Eurasian area of high pressure, centered in Russia, and the North Atlantic high pressure area, centered in North Africa to the West Bank. The incoming storms bring winds from the southwest and west saturated with moisture as a result of their passage over the Mediterranean Sea.

In mid-winter, easterly winds cause a relative warming of the pronounced cold air. Less frequent is the bitingly cold, dry winter winds blowing out from the high pressure areas of Siberia and Middle Asia, occasionally bearing large amounts of fine dust. The mean monthly wind speeds from December to February are registered 3.3 m/s in the Hebron area.

The dry, sand filled winds from the desert, Khamaseen winds, usually occur between April and June. It is a result of a low barometric pressure over Libya or Egypt, which brings winds that blow over the West Bank from the East. During these periods, the humidity decreases, the temperature rises, and the atmosphere becomes hazy with dust from the desert region. Such dry winds tend to break up the boundary layer surrounding the leaves and reduce the resistance to vapor flow through this layer around the leaf, he sweeps away any layer of water vapor accumulated around the leaf and increases the evapotranspiration. The mean monthly wind speeds during this period (April to June) is 2.8 m/s.

4.3 Soil

Figure 4.4 shows the distribution of soil types over the study area. The major soil types found in the study area are described in further detail in the following sections.

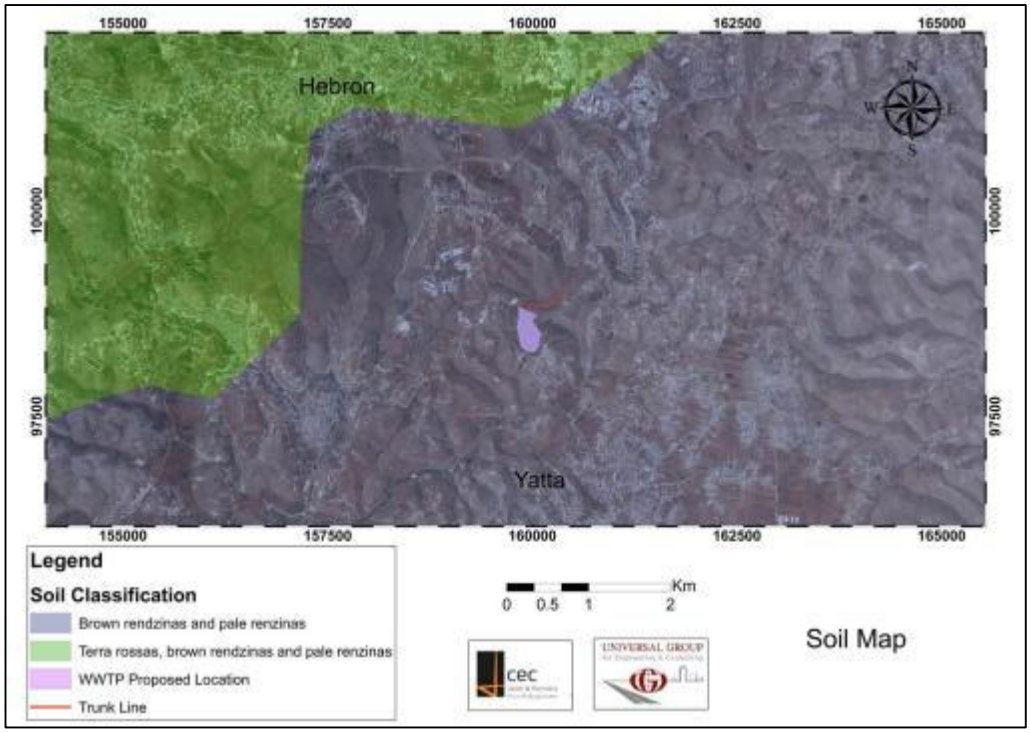

Figure 4.4: Distribution of soil types over the study area

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).

4.4 Land use

The WWTP location 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 4.5** is the land use map of the project area.

The agricultural area for potential reuse of the treated wastewater extends further downstream of the WWTP site.

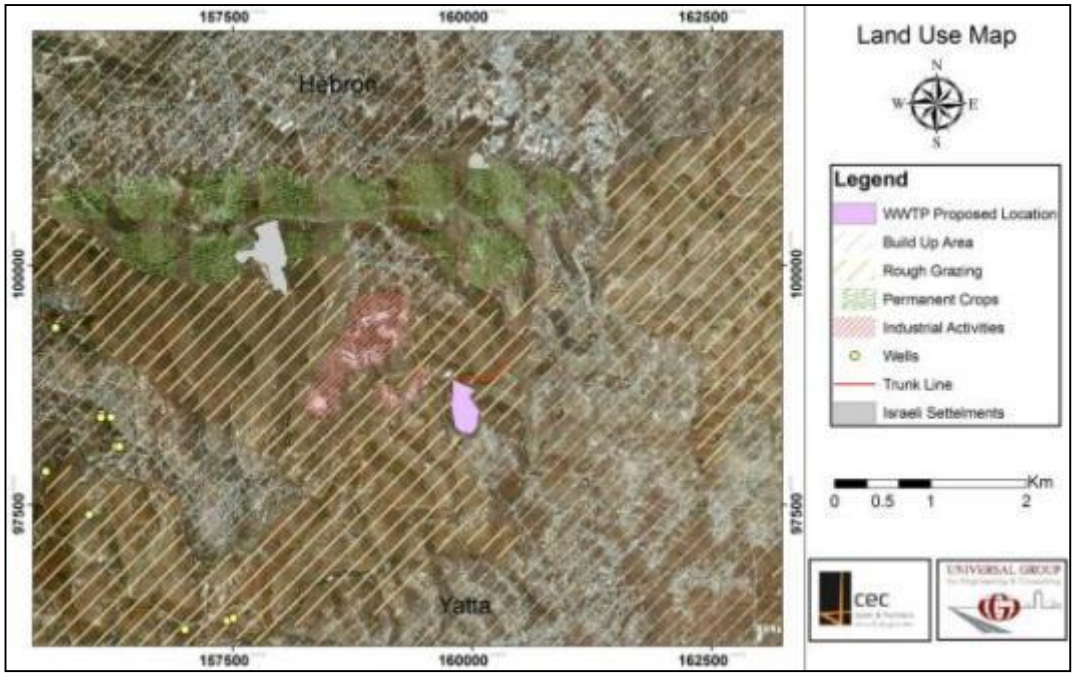

Figure 4.5: Land use map of the project area

4.5 Hydrogeology

There are two geological formations outcropping in the HWWTP area; Bethlehem and Hebron (Upper Cenomanian) and Jerusalem (Turonian) formations (**Figure 4.6**). The thickness of Bethlehem formation in the site is arranging between 20 to 30 meters and consists of dolomite, limestone, chalky marl, marly chalk, and chalky limestone. The Jerusalem formation is outcropping in the southern and western sides of the proposed plant site. Generally, the thickness of Jerusalem Formation ranges between 50 and 130 meters and consists of well bedded limestone and chalky limestone. Other outcropping formations in the area are lower Cenomanian (Yatta formation), upper Albian (Biet Kahel) and Senonian (Abu Dees) formations.

Figure 4.7 shows the outcropping formations in Wadi as-Samen and downstream of the WWTP site. It also shows the groundwater wells within the area. The nearest to the WWTP is located more than 2 km downstream.

The description of these formations is shown below:

Jerusalem Formation (Turonian): Jerusalem formation outcrops mostly at the western side of the West Bank Mountains. The typical lithology of Jerusalem is mostly a white massive limestone with stilolites, dolomite and thin bedded limestone with strong signs of karstification. The thickness of Jerusalem formation at outcrop areas ranges between 55-230m. It is clear that Jerusalem formation was subjected to surface erosion, which resulted in a reduction of its thickness to around 60-90 m. In some places Jerusalem formation was completely eroded thus overlaying the Cenomanian formations beneath directly with the Post Turonian.

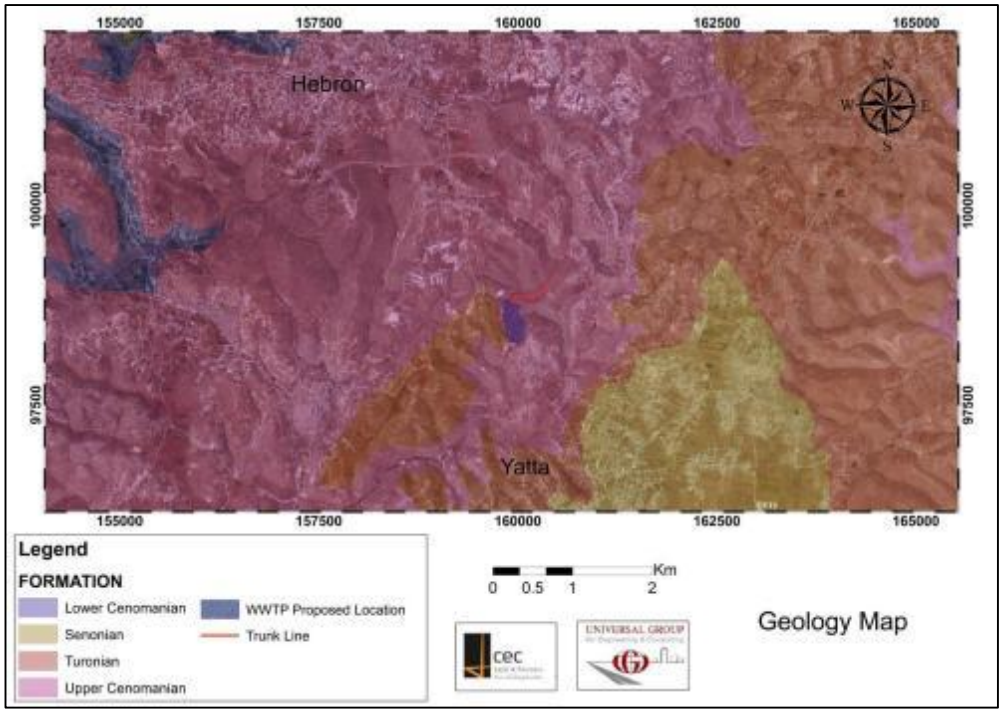

Figure 4.6: Geological map of the project area

Figure 4.7: Hydro-geological map of the WWTP site

Bethlehem Formation (Upper Cenomanian): Bethlehem formation underlies Jerusalem Fm. The lower part of Bethlehem formation crops out on the western side of the West Bank Mountains. The typical lithology of upper Bethlehem formation comprises mostly of soft, often brittle dolomite and acts as an aquifer. The thickness ranges between 5-160 m in the outcropping areas. The typical lithology of the lower part of Bethlehem formation is mostly limestone, often thin plated and with slight marl intercalations or at places as chalky limestone and thus acts as a weak to moderate aquitard. The thickness of LBL ranges between 0-100 m in the outcropping areas.

Hebron Formation (Upper Cenomanian): The typical lithology of the Hebron formation is mostly massive and karstified dolomite. Thus, this bottom part of the Upper Aquifer acts as an excellent aquifer. The thickness of the Hebron formation ranges between 35-100 m in the outcropping areas.

Yatta Formation (Lower Cenomanian): The typical lithology of upper Yatta formation (5-10 m thick) is yellow marl and thus acts as an aquiclude. The thickness of lower Yatta formation ranges between 90-100 m, with a cocktail of mostly chalky limestone, marl, dolomite and chert and in many places with a prominent bottom clay member which therefore acts as a uniform aquitard on a regional scale. The thickness of Yatta Formation ranges between 40-135 m.

Upper Beit Kahil Formation (Upper Albian): The Upper part of upper Beit Kahil formation directly underlies Yatta formation as a 30m thick, cliff-forming reefal limestone with dolomite (good but thin aquifer). In the same time the lower part shows a rhythmic alternation of dolomite to marl. Its thickness ranges between 130-150m and regionally acts as an aquitard (though giving rise to plentiful minor perched springs on a local scale).

Lower Beit Kahil Formation (Upper Albian): The Upper part of lower Beit Kahil formation mainly consists of dolomite with full thickness between 60-80m and acts as an aquifer while the lower part mainly consists of highly karstic limestone and some dolomite with a gradual transition to marl on its bottom and with a total thickness range between 150-180m It acts as an excellent aquifer.

4.6 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.

The WMAB is considered as a highly karstic aquifer; with a general thickness ranging between 600 and 1000 meters. It consists of three lithological layers; the lower (Beit Kahel formation) and the upper (Jerusalem, Bethlehem and Hebron formations) permeable layers (lower and upper sub-aquifers) are predominantly limestone and dolomite with thicknesses ranging between 250 and 400 m each. The upper and lower sub-aquifers have high signs for karstifications. The layer in between (Yatta Formation) with of thickness of 80 - 120 m functions as a semi-permeable layer which is dominated by chalky limestone, chalk and marl. This layer permits the flow to exchange between the two permeable upper and lower sub-aquifers.

The lower sub-aquifer is underlined by the Kurnub group which consists of limestone, marl, and sand. **Figure 4.8** shows a typical schematic cross section for the WMAB showing the flow mechanisms between the aquifer layers.

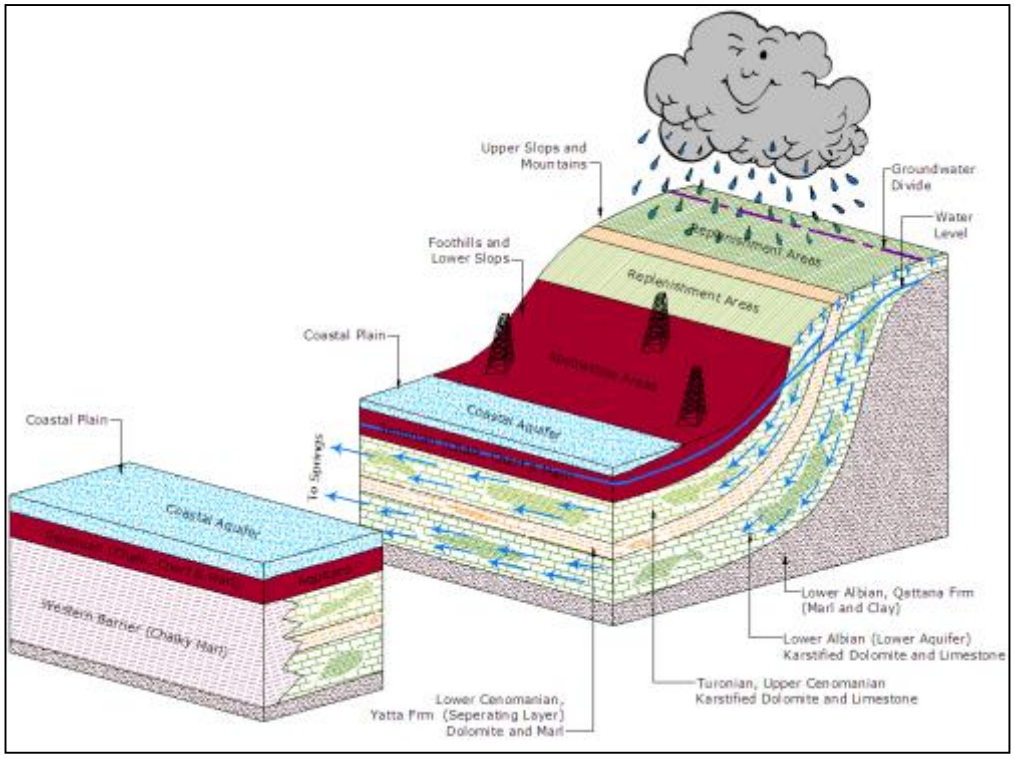

Figure 4.8: The hydrogeological setting of the WAB aquifer

However, the western part of Hebron Governorate is located in a recharge area of the WMAB which characterized by high sustainable yield (373 Mm^3/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 anticline is estimated at 40 Mm^3/yr. The average pumping rate from the 5 pumping wells is 0.5 Mm^3. **Table 4.2** and **Figure 4.9** show the baseline data and the total pumping rates for the seven wells located in the WMAB in Hebron Governorate.

Table 4.2: Baseline data for the groundwater wells in the Hebron area (WMAB)

Code	Name/Owner	Depth (m)	Use	Tapped Formation	Average Pumping (m^3/yr)
15-09/001	Al Samu' No.1	191	Domestic/WD	Turonian	71315
15-09/002	Hebron No.4	0	Abandoned	Cenomanian	0
15-09/007	Hebron 4	0	Abandoned	Cenomanian	0
15-09/010	Al Fawwar - Hebron Municipality No.1c(2)	100	Domestic	Cenomanian-Turonian	68135
15-09/012	Al Fawwar - Hebron Municipality No. 3	150	Domestic	Cenomanian-Turonian	247790
15-09/013	Al Reehiyyah	495	Domestic/WD	Turonian	91123
16-09/001	Yatta Exploration Well	308	Agricultural	Cenomanian-Turonian	45583

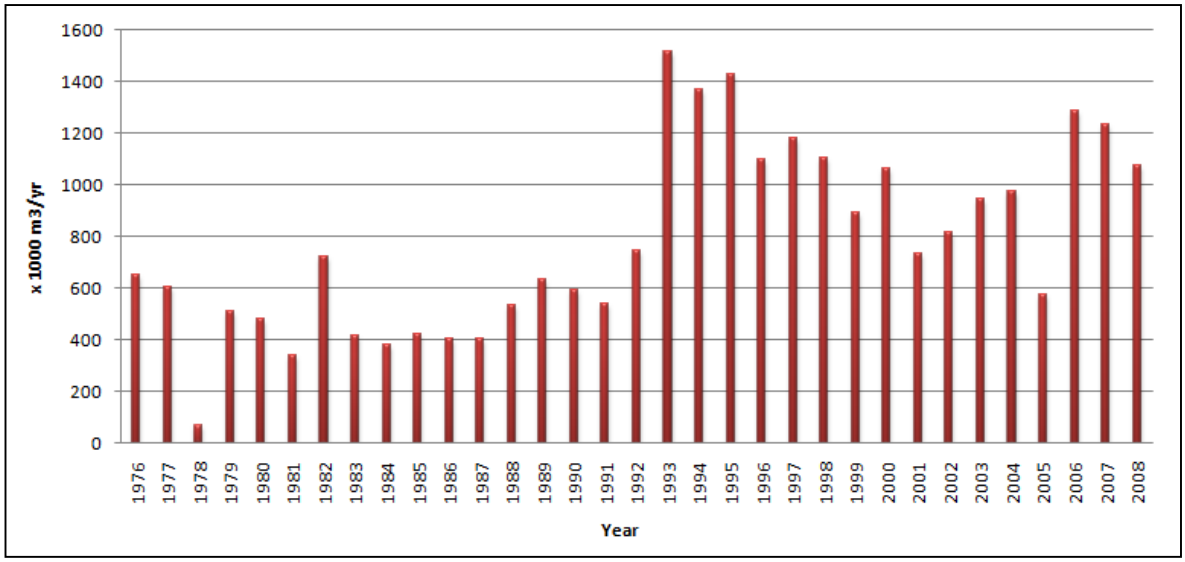

Figure 4.9: Total pumping rates for the seven wells located in the WMAB, Hebron

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

Figure 4.10 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.

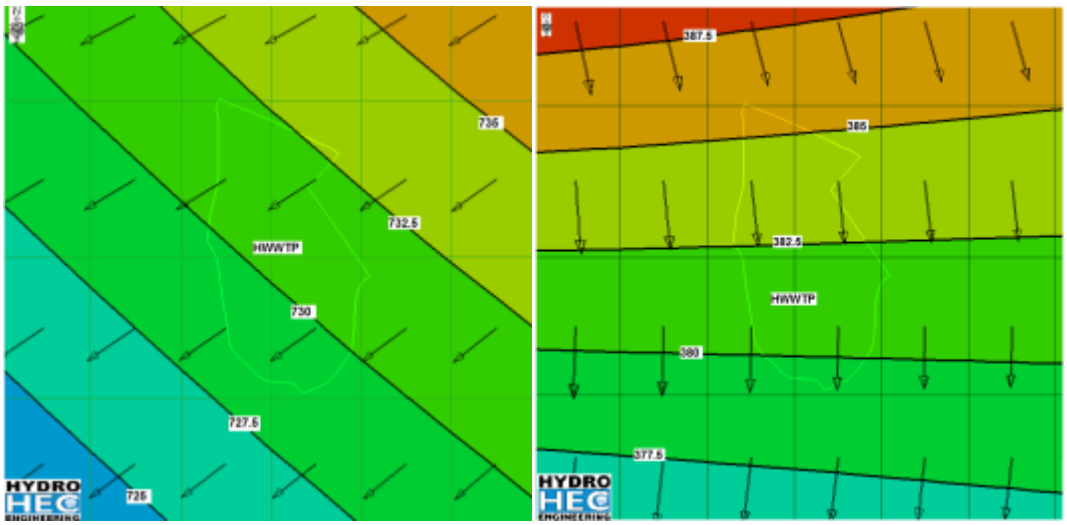

Figure 4.10: Water level distribution (a) upper sub-aquifer (b) lower sub-aquifer

4.7 Surface Water

The HWWTP site 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.

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 m^3/day (~5.5 Mm^3/yr) causing a continuing flow that reaches the Bir Al Saba' wadi.

The annual average storm water crossing (through Wadi al-Samen stream) the site of the HWWTP is estimated based on the upper part of the watershed with an area 52 km^2 and the long term annual average rainfall (492 mm/yr) **Figure 4.11**. However, the average annual storm water generated from rainfall is estimated by 2-5% 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 Mm^3/yr. in total, the sum of annual average stream flow is around 31 Mm^3/yr.

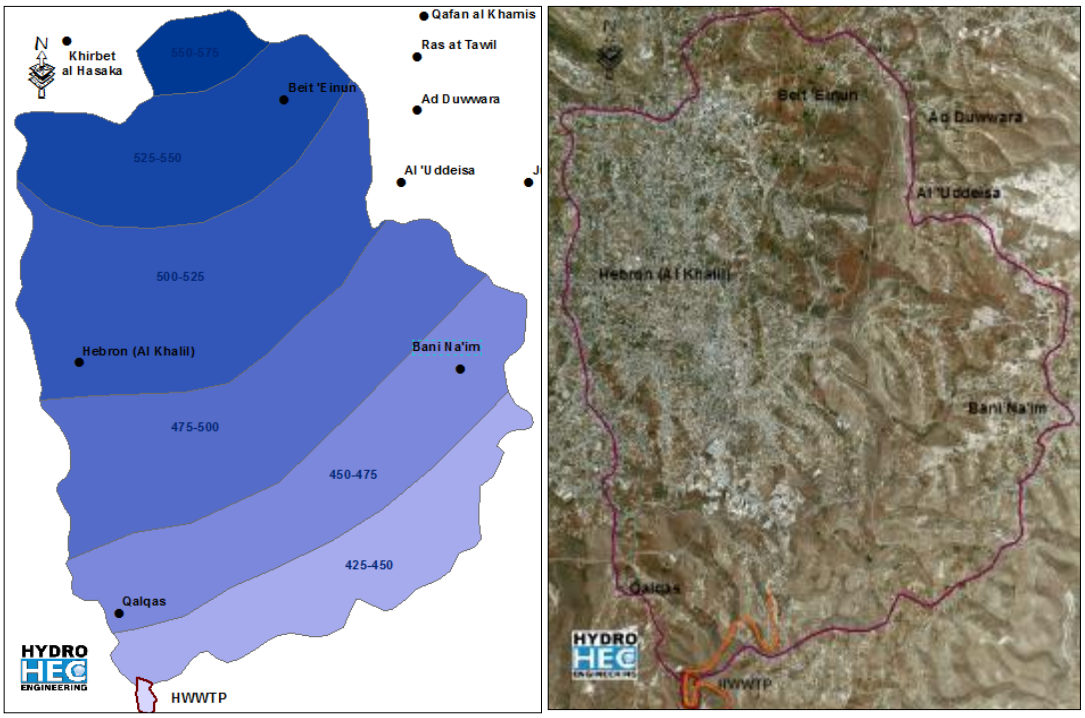

Figure 4.11: (a) Watershed map for the HWWTP (b) Aerial photo for the watershed

4.8 Water and Wastewater Services

4.8.1 Water

Official statistics indicate that the majority of houses in Hebron city have been connected to a public water supply network since 1936. More than 80% of the 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). In Hebron, water supply is provided by the Palestinian Water Authority (PWA) and Israeli Water Company (Mekorot).

Average monthly water consumption in the Hebron city is around 55-60 liters per capita per day (LCD). Though low, LCD consumption is expected to be even less in the summertime in light of severely short water supply.

Public network-supplied water is mainly used for domestic purposes as well as for irrigation of house gardens. In addition to watering livestock and providing various projects, some farmers use this water source to irrigate greenhouse crops or open-space vegetable farming in the summer. In spite of the complaint of high prices, farmers find themselves obliged to use public network-supplied water. However, they demand that water supply prices be reduced and that agricultural institutions help them operate effective, modern irrigation techniques.

4.8.2 Wastewater

In Hebron city, a public wastewater network covers the majority of the city housing units. According, the Head of Wastewater Department at Hebron Municipality, approximately 30% of the city houses are not connected to the public sewage network. 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). Work is underway to provide needed funds to expand the public wastewater network and provide appropriate pumps.

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 (**Figure 4.12**).

Figure 4.12: Raw wastewater flowing between the houses towards Wadi As-Samen

4.9 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. Most of residents in the West Bethlehem villages are served, and fees for solid waste disposal are collected by adding it to the water bills. The village councils are charged NIS 100 per ton of Solid waste by the JSC-H&B.

Al-Menya sanitary landfill, located east of Bethlehem and north-eastern of Hebron has been active since September 1, 2014, with an operational capacity of 550 tons/day. It serves the whole area of Hebron and Bethlehem Governorates. The JSC-H&B is in charge of Al-Manya landfill operations. The new solid waste management system at Al-Minya landfill is in full compliance with the Environmental and Social Management Plan. Informal dumpsites existing prior to Al-Minya, including Yatta dumpsite, are in the process of being decommissioned. The contract of the private sector site operator includes measurement of depth of leachate levels within each sub-area of the landfill, methane gas analysis, and measurement of water quality parameters (SS, COD). The Palestinian EQA is responsible for collection and review of these data.

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 Al Minya dumpsite. **Figure 4.13** shows photos of Yatta landfill site receiving SW (when operational, now closed).

Figure 4.13: Yatta dumpsite receiving SW from Hebron and Bethlehem LGUs

4.10 Seismology

The West Bank is considered, from a seismic point of view, as relatively active. Several earthquakes have been recorded during the 20th Century. Several mitigation measures, monitoring, and management activities are recommended for seismic loads in the design and the construction of the project.

West Bank is located in what is described as a moderate active seismic zone with a Peak Ground Acceleration Factor (PGA) of Z = 0.075 to Z = 0.3 on rocks.

Figure 4.14 shows the four different seismic zones in the West Bank ranging from the relatively weak Zone I in the southwest to the relatively strong zone of 6.5-7 on the Richter scale in the east. These figures have been estimated using the seismic gravitational acceleration, the Modified Mercalli Intensity (MMI) scale, and the distance to the Epicenter (E).

The project area is located within Zone 2A, which has a PGA factor of Z = 0.15 according to the Uniform Building Code (UBC), which is considered relatively low.

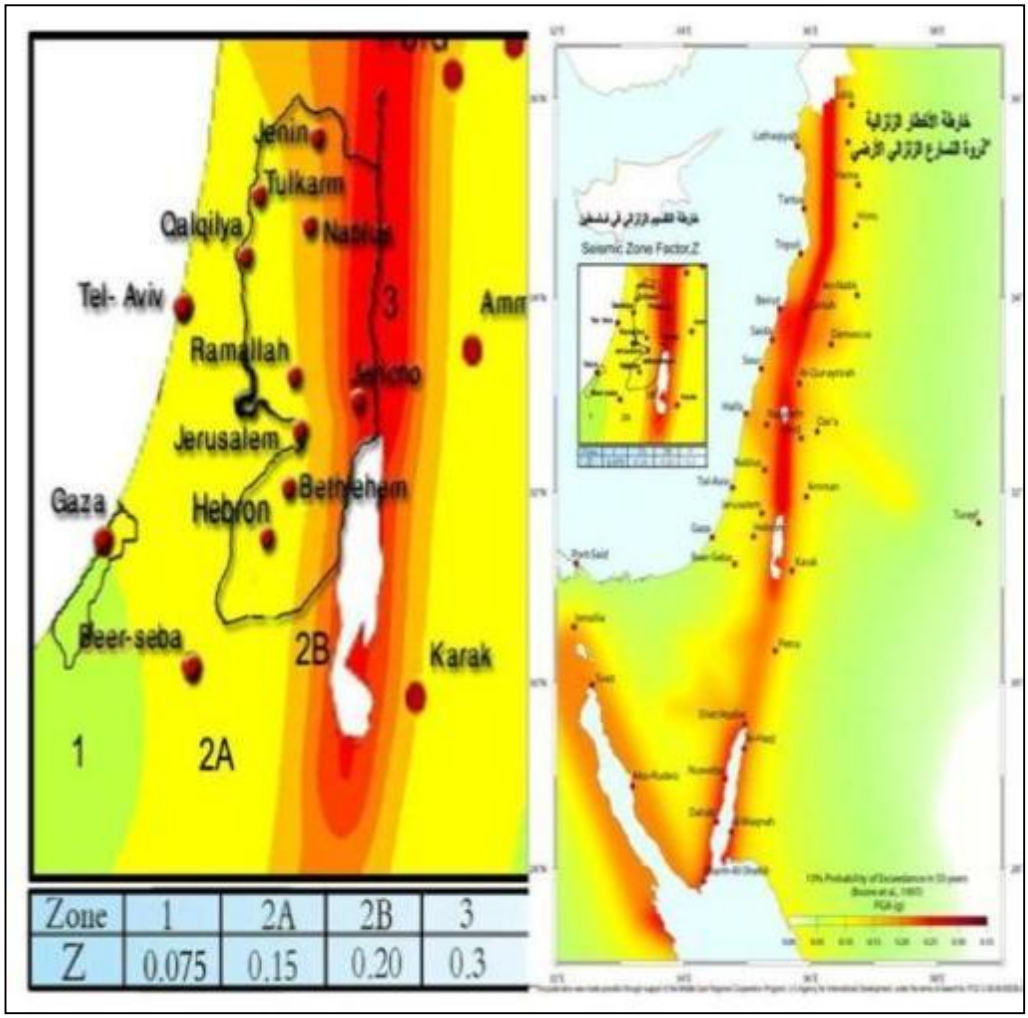

Figure 4.14: Seismic Hazard Map and Seismic Zone Factor for Building Codes in the Palestinian Territories (Earth Sciences and Seismic Engineering Center – An Najah National University)

5. BASELINE SOCIO-ECONOMIC DATA

5.1 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 6 km southeast of Hebron city.

Pursuant to the Hebron Agreement, a special arrangement governs the city. Hebron is divided into two areas. Whereas H1 area is governed by the Palestinian Authority, H2 is under control of the Israeli authorities. According to the Oslo Accords, Hebron comprises both Area A and Area C. A large number of Israeli settlements are located in the heart and on the environs of Hebron city, posing restrictions to Palestinian citizens' daily life, city planning and administration, and daily functions of government bodies and civil society actors.

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.

5.2 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 5.1**). Gender ratio shows 107.3 males to every 100 females.

Table 5.1: Population in the surveyed communities in 1997 and 2007, average annual population increase, and population estimates in 2012, 2016 and 2030

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

*1997 and 2007 data are quoted from the 1997 and 2007 PCBS *2007 Population, Housing and Establishment Census*. 2012 and 2016 estimates are derived from the PCBS *Population Estimates 2007-2016*, http://pcbs.gov.ps/Portals/_Rainbow/Documents/hebroa.htm. Population estimates in 2030 are based on a hypothetical continued population increase rates as in 2012-2016.

**Data of Qalqas and Khirbet ad Dar are included with Hebron. According to the decision on expansion of municipal borders, these are now neighborhoods in Hebron

In relation to age structure (**Table 5.2**); the population in the surveyed communities is mostly young. 45.2% of the total population is 15 years of age or below, ranging from

45.2% in Hebron and 50.1% in Al Heila. Residents in the working age (15-64 age group) comprise 52.3%, including 52.3% in Hebron and 48.1% in Al Heila. The elderly account for 2.5%, including 1.8% in Al Heila and 2.5% in Hebron.

Table 5.2: Population in the surveyed communities according to age groups

Locality	Below 15 years	15-64 years	65+ years
Hebron	74122	85765	4100
Al Heila	640	614	23
Total	74762	86379	4123
Percentage	45.2%	52.3%	2.5%

PCBS, 2008, *Census Final Results: Summary (Population, Buildings, Housing and Establishments), Hebron Governorate*, Ramallah, Palestine
ARIJ, 2009, *Hebron City Profile*, Jerusalem, Palestine

With a household size of 5.7, residents of the surveyed communities were distributed to 28,463 households in 2007. According to **Figure 5.1** below, large and medium households are dominant in the surveyed communities.

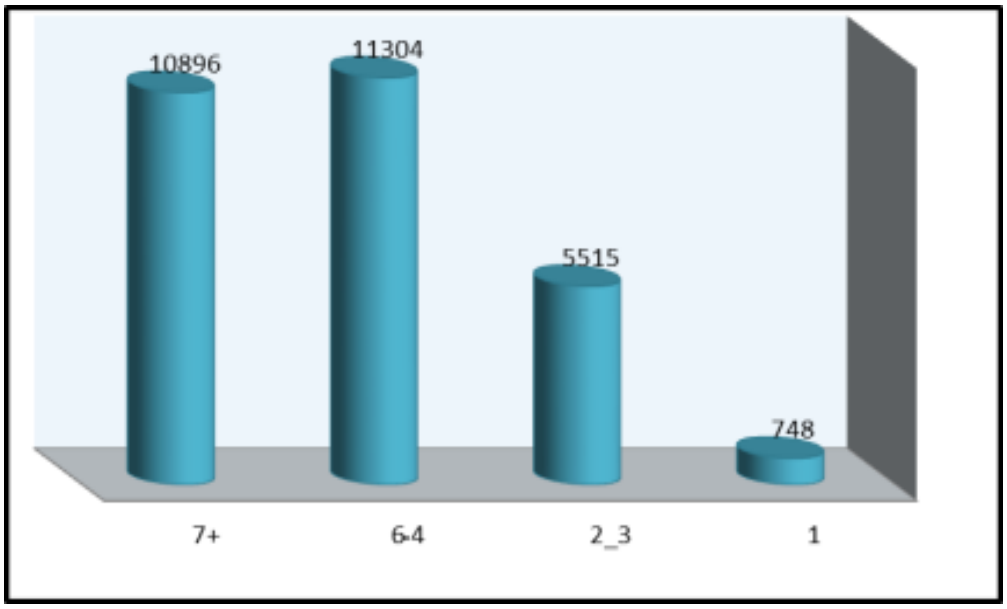

Figure 5.1: Household size categories in the surveyed communities, 2007
PCBS, 2009, *Population, Housing and Establishment Census: Census Final Results: Summary (Population, Buildings, Housing and Establishments), Bethlehem Governorate*, Ramallah, Palestine

5.3 Refugee Status

The overwhelming majority of residents in the surveyed communities are non-refugees. A total of 80.7% of the population are indigenous. Less than one fifth of the populations are refugees, including 18.7% registered and 0.6% unregistered refugees (

Table 5.3).

Table 5.3: Surveyed communities' population according to refugee status

Locality	Registered refugees	Unregistered refugees	Non-refugees	Total
Hebron	18.9	0.6	80.5	100
Al Heila	0	0	100	100
Total	18.7	0.6	80.7	100

PCBS, 2008, *Census Final Results: Summary (Population, Buildings, Housing and Establishments), Hebron Governorate*, Ramallah, Palestine

5.4 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. **Table 5.4** 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.

Table 5.4: Surveyed communities' population according to educational status

	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

ARIJ, 2009, *Hebron City Profile*, Jerusalem, Palestine
ARIJ, 2010, *Al Heila Village Profile*, Jerusalem, Palestine

5.5 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.

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.

Table 5.5: Individuals in the age of 10 years and above according to relation with the labour market, 2007

Sex	Economically Active				Not Economically Active
	Total	Employed	Unemployed Employed Ever Worked	Unemployed Never Worked	
Male	70.3	89.4	4.5	6.1	29.7
Female	10.3	83.1	4.3	12.6	89.7
Total	56.8	88.7	4.5	6.8	43.2

ARIJ, 2009, *Hebron City Profile*, Jerusalem, Palestine
ARIJ, 2010, *Al Heila Village Profile*, Jerusalem, Palestine

Establishments operating in Hebron city provide employment opportunities to more than half of the local labour force. According to the PCBS *2007 Population, Housing and Establishment Census*, 7,403 establishments were in operation in Hebron **Table 5.6**.Though mostly commercial, establishments carry out a variety of economic activities.

Table 5.6: Establishments and workers in the surveyed communities, 2007

	No. of Establishments	No. of Persons Engaged		
		Female	Male	Total
Hebron	7400	3470	20993	24463
Al Heila	3	0	5	5
Total	7403	3474	20998	24468

Source: Palestinian Central Bureau of Statistics, 2009, *Census Final Results: Summary (Population, Buildings, Housing and Establishments), Hebron Governorate*, Ramallah, Palestine

Following commercial activity, agriculture and industry sectors provide a significant source of employment in these communities. In Hebron city, over half of the labour force works in commercial activities. In contrast, 15% are employed in the agriculture sector, 15% in the industry sector, 10% in the service sector, 5% in government bodies, and 5% in Israeli workshops. In Al Heila, 60% of the labour force works in Israeli workshops, 20% in the agriculture sector, and 10% in industrial enterprises. The rest are either civil servants or service providers.

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 Hebron 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. The large quantity of water used by concrete plants

and carwash services is converted into wastewater, which mostly finds its way into the city's public sewage network.

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.

5.6 Sanitation and Public Health

5.6.1 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). On the other hand, the Al Heila village lacks a public water supply network. Though the village has only 500-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. According to the former chairman of a village council, due to water scarcity, local residents were prevented from using water for the agricultural activity in order to give priority to drinking and domestic use. Female participants in the women's focus group asserted that short and prolonged disruption of water supply, especially in elevated places, prevent them from exploiting house gardens or cultivating certain vegetables and plants.

In general, Al Heila residents suffer from high water prices (ILS 150-200 per tank, or ILS 15-20 per cubic meter at 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.

Average monthly water consumption in the Hebron city is around 55-60 liters per capita per day. Though low, water consumption is expected to be even less in the summertime in light of severely short water supply.

In this context, focus group discussants and interviewed household members indicated varied water consumption from one household to another. Especially in houses located on elevated places, water consumption declines in the summertime due to inadequate access to water. According to a female participant in the women's focus group, water was not supplied to her house for a month or more. Other participants asserted that they did not have access to the public water network-supplied water unless certain valves were closed. Therefore, households are forced to rationalize water use during the summertime and rely on cisterns.

5.6.2 Use of Various Water Sources

Public network-supplied water is mainly used for domestic purposes as well as for irrigation of house gardens. In addition to watering livestock and providing various projects, some farmers use this water source to irrigate greenhouse crops or open-space vegetable farming in the summer. In spite of the complaint of high prices, farmers find themselves obliged to use public network-supplied water. However, they demand that water supply prices be reduced and that agricultural institutions help them operate effective, modern irrigation techniques.

As mentioned above, the surveyed communities house a large number of industrial installations and service providers that consume a significant quantity of water. To meet water needs of factories and workshops, tankered water and public water network are used. Stone processing facilities rely on tanker trucks as a major source to supply water and to dispose of sludge; with up to ILS 30 and sometimes 40 NIS/m^3 during very drought periods.

5.6.3 Wastewater

In Hebron City, a public wastewater network covers the majority of the city housing units. According, the Head of Wastewater Department at Hebron Municipality, approximately 30% of the city houses are not connected to the public sewage network. 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). Work is underway to provide needed funds to expand the public wastewater network and provide appropriate pumps.

In unconnected areas, cesspits are the common method households use to dispose of produced wastewater. Interviewees described cesspits as small-sized. 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 southern Hebron suffer from the wastewater stream, which flows through the open Wadi as-Samen valley towards the Green Line. Wastewater passes through some residential areas, including the Al Heila village, where some houses are in close proximity to the wastewater stream. Even after it was covered and channeled into large sewers, residents of the Khallet ad Dar area still suffer from adverse impacts generated by the wastewater stream. Destructive consequences are still in place, including dehydration of trees and desertification of the soil. Participants in focus group sessions and interviewees in Khallet ad Dar complained of malodorous smell produced by open sanitary sewer manholes. In addition to a widespread foul smell, respondents stated that stolen sewer manholes increase hazards for residents and properties.

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.

The overwhelming majority of houses in the surveyed communities include a kitchen, bathroom and toilet connected to the water supply network. In a limited number of houses, however, these facilities are either unconnected to a water supply or not available at all, thereby increasing the quantity of wastewater produced in these communities.

With the large size of Hebron City and expanding economic activities, it is expected that wastewater flowing into the public sewage network will rise. According to the Hebron Municipality's Head of Wastewater Department, the city produces 3-4 million cubic meters of wastewater a year.

The Israeli Occupation Authorities deduct an amount of ILS 1.5 from the Palestinian Money per cubic meter of wastewater disposed of by Hebron wastewater stream into Wasi as-Samen reaching the Bir as Sabe' wastewater treatment station. To maintain the wastewater stream costs the Hebron Municipality ILS 150,000-180,000 to hire machinery (including excavation, deepening and cleaning works). The Municipality also spends ILS 10,000 a year to provide pesticides and spray areas around the wastewater stream.

5.7 Affordability to Pay Due Water Bills

In the West Bank, an overall reluctance to pay due water consumption bills has resulted in the accumulation of significant debts by local government units and service providers (especially during the past 10 years). Although the economic factor is cited as a major reason for non-payment by households (those classified as poor households), a large number of households who do not satisfy due water consumption charges have a relatively high income. Those households usually consume a considerable quantity of water. These results confirm that some consumers are not willing to pay due bills despite the fact they can afford to pay. Interviewees and participants in focus group discussions emphasized that the inadequate fees collection mechanism was the main reason of general abstention from the payment of water bills. "The fee collector is not serious; he simply leaves the water bills near to the water meter or with any person," a participant explained. In addition to weak law enforcement, a common 'culture of non-payment' entails that households have the right to not pay due water bills for various reasons, including inadequate service delivery, equality with residents of refugee camps, or rumors reporting that bills are paid by certain agencies.

With respect to wastewater, the Hebron Municipality collects a one-time fee when a house or installation is connected to the public sewage network, further debilitating public willingness to pay subscription fees. Not to mention that the public sewage network should be repaired, the wastewater treatment plant is in need of financial resources to ensure sustainable operation. In reality, residents have been accustomed to free utilization of the public sewage network. The common culture of non-payment of subscription to public services creates a serious challenge to the Hebron Municipal Council or service providers (e.g. water utilities).

For sustainability of the proposed WWTP facility and in order to meet annual Operation and Maintenance costs, the Hebron Municipality will be required to impose a new user fee for the sewer system. The average annual operating and maintenance costs for the WWTP, including depreciation, will be US $3.2M in year 1, increasing to US $4.2M in year 20. Project Economic and Feasibility studies recommend that a tariff which allows for collection of full revenues while allowing for only 65% collection rates (the 2012 rate) be implemented in the early years, until collection rates improve. It is also recommended to impose a rate based on water use, rather than based on the number of connections. Current projections for a charge of US $0.56 (NIS 2.18) per cubic meter of water to be imposed, assuming that the Municipality of Hebron can find an alternative source of funds for equipment replacement. If full depreciation rates are to be incorporated, a rate of $1.03 (NIS 40) per cubic meter is recommended.

As a complement to user tariffs, an initial free of US $.013 per cubic meter (NIS 0.5) per cubic meter of treated wastewater for agriculture is proposed. This is considered low compared to the current charges of NIS 5.0 to 10 per cubic meter of water. Lastly, there will be a savings of US $0.39 per cubic meter of water currently being paid for wastewater which reaches Israel and which is thus deducted from Palestinian VAT and customs. These three factors above enter into the financial and economic cost-benefit analysis, which is described more fully in Economic and Financial Feasibility studies for the Hebron WWTP.

5.8 Hazardous Practices

According to interviews and focus group discussions, 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, interviewees highlighted 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.
- Female participants in the women's focus group, as well as interviewed representatives of village council members and key personalities, coincided that skin diseases were widespread, particularly among children. These included skin rash and poisoning resulting from mosquitoes. Some interviewees associated the high cancer rate with the contamination resulting from the wastewater stream.

6. CULTURAL HERITAGE BASELINE DATA

6.1 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.

6.2 Historical Background and Cultural Value

Hebron Governorate Regional Wastewater Management Project 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 project value especially due to its importance in protecting cultural heritage components in Hebron which is identified as one of the holiest cities for the three monotheistic religions. The Biblical name for Hebron is "Qiriat Arba", meaning "town of the four", which refers to the number of clans who lived there, or to the number of hills surrounding the town. It was later named "Habra" or "Habron", which presumably derives from the Arabic word "Hibr," meaning "to be linked to, associated with," referring to the prophet Abraham.

Thus Hebron's History goes back to the first phase of urban human settlement of Palestine. Archaeological excavations have established the existence of several successive occupations between the Chalcolithic Period (around 4000 BC) and the Umeyyad Period (661-750 AD,) but Hebron's "Golden Age" was during the Mamluk period-despite the fact that the development of the city of Hebron in its current location dates back to the advent of Islam and to the Crusader and Ayyubid Periods- Worth to mention in this context that despite it small size the old city of Hebron is a distinguished example of an urban entity that has preserved the main characteristics of the Mamluk period, both through its morphology, and through its urban fabric including its division into "Ahwash" neighborhoods. This historical continuous urban settlement in Hebron has contributed to city's prosperity and enhanced the presence and significance of its unique morphology and architecture.

Moreover, WHC's historical towns categorization classifies Hebron's Old City as a sample of an inhabited historic town, which developed and continue to develop under influence of socio-economic and cultural change in the city while keeping its authenticity.

Hebron (al-Khalil) is one of the oldest continuously inhabited cities in the world and is sacred to Muslims, Christians and Jews as the burial place of the prophets Ibrahim, Isaac, Jacob and their wives. Also Hebron is part of the holy triangle in Palestine, which includes Al-Quds, Bethlehem and Hebron.

The historic city with well-preserved Mamluk architecture, which developed around "Harm Sharif" mosque testifies to a vibrant multi-cultural town developed throughout the centuries. This Mamluk architecture style has been protected during the different periods

by the cultures that lived in and visited the city. In the Ottoman era filling of spatial gaps left by the Mamluk era took place because of the intensified need for space, thus new floors were add to the existing buildings to compose a unique style of urban fabric developed by multi-cultural inhabitants.

In conclusion, this unique urban fabric in the city represents a unique component of cultural heritage that will be served through the proposed project, in addition to the neighboring cultural landscape components that have the same spirit of city's architectural body.

6.3 Field work Observations

During field visits to the site and the Hebron Governorate WWTP location -in particular- and the surrounding area in general, the team has undergone a site survey to collect data about the existing cultural heritage and landscape elements. Effective on-site observations helped to analyze the components of the site whether on cultural heritage or cultural and natural landscape features.

The proposed location of the WWTP is situated to the south of Hebron city at the eastern edge of Hebron mountain range which is the last in the Palestinian highlands and ends with Annaqab hill. The area has a Mediterranean climate with long, hot and rainless summers and relatively short, cool and rainy winters.

6.4 Cultural landscape elements

6.4.1 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 6.1: a) The project site and b) Agricultural Land use

6.4.2 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 6.2: a) Hawthorn tree and b) The Contour Terraces

Figure 6.3 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 6.3: The location of trunk sewer, access road along Wadi as-Samen

6.4.3 Rural dry stone vernacular elements

Dry stone vernacular elements are evidently shaping the east looking slopes of the area's terrain. The main existing typology is the dry stone agricultural terraces which displays several sub-typologies in the project area.

The first sub-typology is the contour terraces which are manmade structures made of dry stones taken from the environment. The dry stone walls follow the contour lines and divide the terrain into agricultural units where soil is better saved and rain water is retained.

The second is the cross channeled terraces which characterize the plots that come out from when two mountains meet. The cross channeled terraces are erected on the path of water channels that run from hilltops to the valleys. In the project area, cross channeled terraces are cultivated with crops while some of them are planted.

6.4.4 Cross channeled terraces

In the southern slopes of the project area, another 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.

Figure 6.4: a) Cross Channel terraces and b) Relic terraces

6.4.5 Vernacular structure

In the heart of the valley, vernacular simple structures made of dry stones were observed. The layout of the walls and some small openings in their profiles suggest a hypothesis of having a more developed human traces in the area.

6.4.6 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 6.5: a) Vernacular structure and b) Rocky and garrigue Landscape

6.4.7 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.

Figure 6.6: A cave in the project area underwent an extensive intervention

7. PROJECT BASELINE DATA, IMPACTS AND MITIGATION MEASURES

7.1 Environmental Methodology

7.1.1 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.

The field measurements were conducted based on a following:

7.1.1.1 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.

7.1.1.2 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.

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. 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.

7.1.1.3 Water Analysis

Water sampling will be taken at the effluent of HWWTP; **Table 7.1** shows the parameters that will be analyzed. The analysis will be done with the standard method of using similar equipment done for the design project. 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 7.1: Proposed sampling parameters and locations

Well No.	Tested Parameters	Date of Sampling (#of samples)
	pH TDS BOD COD NO_3 T.N &P Cl Detergent F.C	

7.1.1.4 Ambient Air and Noise Analysis

The impact on ambient air quality and noise 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 (especially for the noise and H2S 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.

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

Ambient air: SO_2, NOx, CO and SPM (and PM_{10}) will be measured to identify the current air quality

Noise: An 8 hour duration for the noise measurement will be conducted from 08.00 – 16.00 (represent the working hour duration during the construction and an hour-night represents the night condition).

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.

The international standard method will be applied for both ambient air and noise measurements whenever it is applicable and practicable. The method and equipment to be used to measure for ambient air quality and noise will be discussed in detail in the ESIA report. **Table 7.2** presents the Testing procedures and name of used instrument to measures the wastewater and soil for preparation of this ESIA study.

Table 7.2: Testing procedures & name of used instrument Ser. Parameter Procedure

Wastewater analysis	**Probe method**	**Name of instrument**
Temperature		Digital TOC meter
pH		pH meter
TDS		TDS meter
BOD	Oxitop method	Oxitop
COD	Closed reflux method	Spectrophotometer & COD reactor
TSS	2 hr Imhofe cone	Imhofe cone
Esi Coliform	Filtration technique	Incubator
Fecal Coliform	Filtration technique	Incubator
Heavy metal	Atomic method	Atomic
Cations & anions	Cl Argenometric method	Digital titration unit
NO_3	colorimetric method	Spectrophotometer
Na	Flam photometry	Flam photometer
Ca	Titration method	Digital titration unit
K	Flam photometry	Flam photometer
Mg	Titration method	Digital titration unit
CO_3	Titration method	Digital titration unit
Detergent (mg/l)	Absorption (UV-249 nm)	Spectrophotometer

7.1.1.5 Soil analysis

1. ECe (μS/cm) Soil extraction method EC meter
2. SAR By calculation method Flam photometer
3. Organic matter (%) Ignition method Furnaces
4. $CaCO_3$ (%) Titration method Digital titration unit
5. PO_4^{--} ascorbic acid Spectrophotometer

7.1.1.6 Groundwater Analyses Verification and Modeling

Perhaps the impacts on groundwater was one of the most important issues that will be associated with the project, as part of the project has been designed to prevent infiltration into the groundwater by partially treated sewage. The EA of the HWWTP estimated the water mound caused by infiltration of the partially treated sewage at 6 Groundwater.

7.2 Impacts on Water Resources

7.2.1 Background

Disposal of untreated municipal wastewater in the West Bank is considered one of the most critical environmental problems. Domestic wastewater is either collected by main sewerage networks or in cesspits. The part collected by networks is often linked with a primary treatment plant in several cities in the West Bank such as Ramallah, Jenin, Tulkarm, etc. and to the only full treatment plant in Al Bireh City. Partially or fully treated effluent from these plants as well as untreated effluent from the areas that have no treatment plants such as Hebron and Nablus is then discharged to the valley without treatment. Moreover, the part collected in cesspits is either percolates to groundwater aquifers or when evacuated is dumped into open wadies where part of it percolates again to the groundwater causing environmental, health and social problems.

In Hebron area, untreated wastewater effluent originates from Hebron City, some towns, Israeli settlements and other wastewater producers, which dispose of their wastewater in the wadi, such as vacuum tankers and quarrying industries, flows into Wadi Al Samen. This wadi is extending from Hebron City upstream and continues southward crossing the West Bank boarder at its southeastern part and reaches the Mediterranean Sea at its final destination downstream.

The Wastewater of Wadi Al Samen is a highly concentrated wastewater, where BOD, COD, TSS and TDS show very high concentrations, **Table 7.3**. In addition storm water generated during winter months are also showing high concentrations of pollutants due to the fact that most of which is generated from urban areas. Therefore, they should be partially or totally treated to become more suitable for further reuse in irrigation or aquifer recharge.

The proposed site of the HWWTP is located at the bed of Wadi as-Samen. Site placement in the flood bed field may pose a serious threat to the treatment plant structure and may wash it away. Therefore, flood control actions should be considered during the design and implementation phases. As simple calculation, the flow rate due to a high intensity rainfall storm (i.e. 100 mm/day) will generate a flow in the range of 10-15 m^3/s. This amount will call for a special flood control actions.

Table 7.3: Average and range values of Water quality in Wadi Al Samen, 2007

Parameter	Range (mg/l)	Average (mg/l)
BOD	82-1050	498
COD	240-1190	654
TSS	42-3506	713
TDS	800-2230	1200

7.2.2 Impacts on Groundwater Quantity

The sustainable yield in the groundwater system in the Hebron area is relatively high (i.e. 40 Mm^3/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 Mm^3/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.

7.2.3 Impacts on Groundwater Quality

Wadi as-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. **Figure 7.1** shows the follow directions of groundwater in the upper sub aquifer of the WMAB, the figure illustrates that the percolated water from Wadi Al Samen flows toward the existing wells in western part of Hebron Governorate.

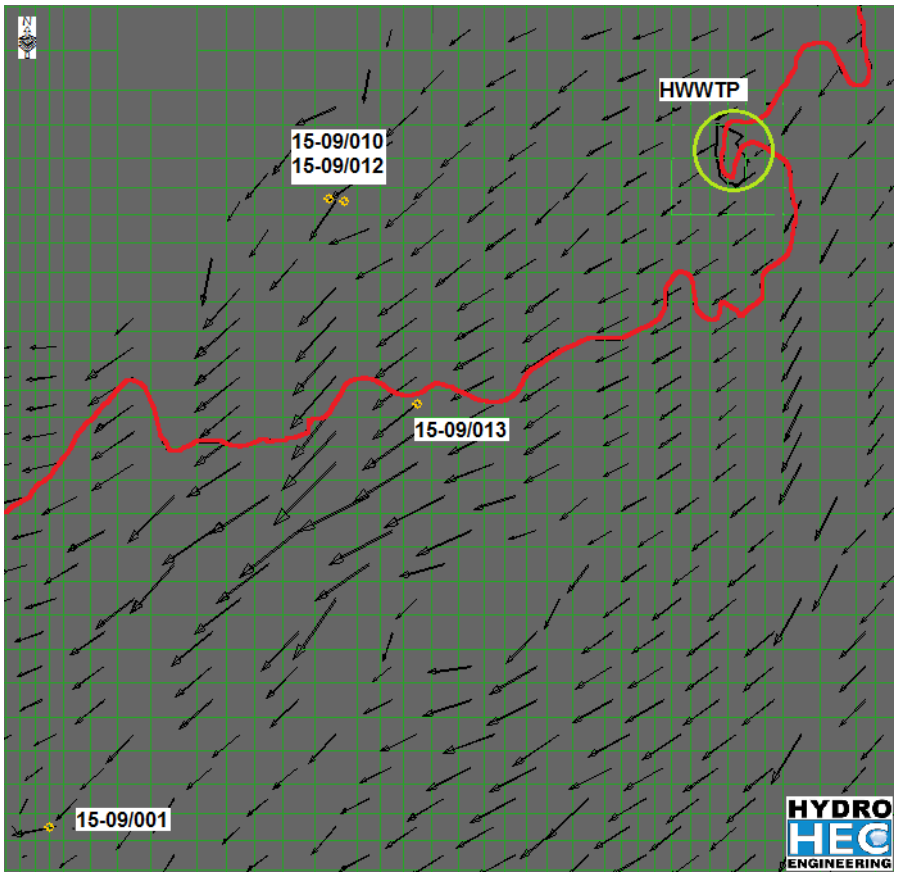

Figure 7.1: Flow directions in the upper sub-aquifer

The cross section showing the mechanisms of flow in the WMAB, **Figure 4.8**, shows that water infiltrates to the upper-sub aquifers in the mountain areas (Hebron Mountains in this case) is flowing to water the south-west the confined part of the aquifer which is connected to the lower sub-aquifer. As a result, both sub-aquifers are influenced by pollution.

To elaborate more about the potential impact of the untreated effluent on groundwater quality, we had a closer look into the water quality of two wells (15-09/010 and 15-09/12) located downstream of the proposed site location of HWWTP. A summary of major chemical parameters of the groundwater quality from the two wells are summarized in **Table 7.4**. It is noticed that Nitrate in particular shows high variation which may vary

from 140 mg/l to 40 mg/l. in Well 15-09/12. This may indicate the direct influence of the well by the effluent quality which passes nearby the well. Although on average, Nitrate concentration seems to fall within acceptable limits recommended by Palestinian Standards (i.e. 70 mg/l), yet the significant variation suggests that this well and the one adjacent to it are most likely directly affected by the pollution load in the adjacent Al Samen Valley. Moreover, **Figure 7.2** shows the time series of nitrate and chloride concentrations in the same well. The figure shows that the trend in nitrate and chloride are increasing with time as a result of wastewater contamination.

As a result, any future development of the groundwater system in the area should consider the flow path of wastewater percolated to the system.

Table 7.4: Water quality for wells 15-09/010 and 15-09/012 (PWA 2000)

Well ID	Parameter	Water-quality sample concentrations (mg/l)								
		TDS	Cl^-	NO_3^-	Na^+	Ca^{++}	Mg^{++}	K^+	HCO_3^-	SO_4^{--}
15-09/010	Max	430	75	81	42	80	44	9	285	34
	Avg	409	65	60	37	56	36	8	207	29
	Min	388	43	43	30	35	28	7	118	23
15-09/012	Max	468	79	140	51	77	44	5	307	39
	Avg	448	61	74	41	64	36	3	237	30
	Min	427	45	42	36	43	29	1	140	20

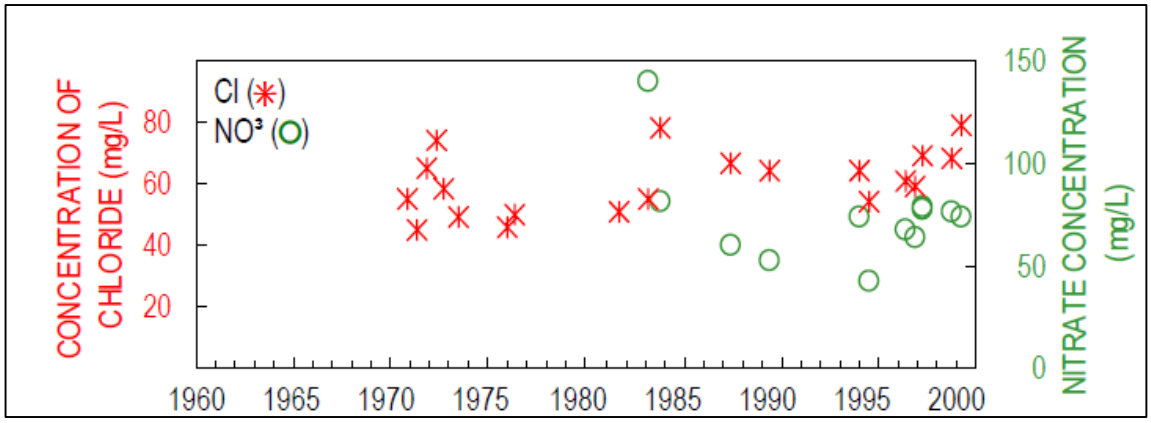

Figure 7.2: Nitrate and chloride concentrations in well 15-09/012, PWA 2000

This argument of groundwater quality pollution of the two wells is based on the fact that nitrate concentration under normal conditions in natural groundwater ranges between 15 – 20 mg/l. Since the wells located in unconfined area and shallow we may consider the concentration as 20 mg/l. Since the current NO_3 concentration in the downstream wells are ranging between 63 and 73 mg/l, it means that the difference between this concentration and the concentration in natural water under no pollution conditions is expected to be from anthropogenic sources, mainly from untreated effluent in this case. This means that on average, the Nitrate pollution load percolates to the groundwater ranges between 40 – 50 mg/l. Based on this, treating the wastewater effluent will reduce the pollution load by at least 80% or a reduction of 30 – 40 mg/l which may reflect itself to the groundwater quality and may lead to stabilizing the groundwater quality around 40 -50 mg/l in the two wells which is around acceptable WHO standards as well as Palestinian Standards of 50 mg/l and 70 mg/l respectively. Accordingly, it is expected

that HWWTP will solve this problem and will improve the water quality in the existing wells and any groundwater that could be developed in the future.

7.2.4 Impact of Total Phosphorus

Among the other pollution parameter that has to be controlled is total phosphorus (P). As to the feasibility study of HWWTP project, the phosphorus concentration in the effluent is 17mg/l. Based on the required crop water demand and assuming application efficiency of 90%, the following table shows the Phosphate balance for the cropping pattern. It shows that the applied phosphate exceeds the required amounts, but because of the calcareous nature of the project area excess applied phosphates will be fixed by the soil through surface adsorption and precipitation depressing its transportability. Thus no specific actions are necessary for phosphate management in case of effluent irrigation in the project area.

Table 7.5: Phosphates (P) Balance for Project Area

Crop/ intercropped pattern	Water demand m^3/ha	Applied P kg/ha	P requirements kg/ha	(Applied P/ Required P) %
Palm dates			60	
Alfalfa			35	
maize	6,033	92.3	40	231%
Barley	3,274	50.1	24.0	209%
Palm dates intercropped with Alfalfa	18,580	284.3	95.0	299%
Palm dates intercropped with Barley	13,433	205.5	84.0	245%

7.2.5 Groundwater Monitoring Plan

As to monitor the quality of the groundwater and the impact of the construction of the WWTP on the groundwater aquifers, it is to implement a monitoring plan. The plan is to document the changes in groundwater quality changes before and after the project.

Treatment is not needed for these nearby wells. These wells will be positively impacted during the operation phase of the project as no wastewater will be flowing into the wadi without treatment. There is no need to replace and or relocated any of those wells and their water quality is to be monitored.

The plan features are:

1. Observe the quality of the groundwater of the above listed wells (15-09/010, 15-09/012, and 15-09/013 that are located downstream of the WWTP periodically.

2. Measurements of the quality parameters (mainly Fecal Coliform, Total Coliform, and Nitrate) are to be measured every 2-3 months. These are then to be compared with the

WHO standards for drinking water. It is expected that the quality of the wells will improve after the construction and operation of the WWTP.

3. An Annual report is to be written by Hebron Municipality and the operators of the WWTP, to be delivered to PWA. The report should spcify any improvement in the groundwater quality.

4. PWA shall take any action in regard of enhancing the operation of the WWTP and the improvement of the groundwater aquifers as to bring this to the Joint Water Committee.

The analysis will be done with the standard method of using similar equipment done for the design project. Calibration sheets and detailed methods will be presented. 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.

7.2.6 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.

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 efficiency.

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. 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.

7.3 Socio-economic impacts

7.3.1 Construction Phase

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, officials in the surveyed communities showed a willingness to endure some troubles, including noise, movement of large truck, equipment, etc. during the construction phase.

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), marketing of the project needs a well-planned promotion so that the right message and information are publicly delivered. 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.

To this avail, residents of the Khallet ad Dar area, including the nearest town of Qilqis, highlighted that adverse impacts of the wastewater stream should be addressed. Like they stated, published studies indicate that these consequences are long-term. According, the local soil should be purified and treated. The Hebron Municipality should change the use of certain public land (livestock market) and convert it into, e.g., a public park with a view to help beautify the landscape and attract residents, visitors and investors. Development initiatives, including school construction and enhanced public service delivery, will also mitigate the common feeling of marginalization.

As interviewees anticipated, potential socioeconomic impacts during the construction phase might include the provision of some employment opportunities to residents of the surveyed communities. Residents expect that companies or contractors, who will implement the project, may need workers. Therefore, they will employ a number of residents of these communities to work on the project. Furthermore, external workers may improve sales of commercial premises in the surveyed locales, including restaurants, groceries, etc.

7.3.2 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.

7.3.3 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. As to the decree of the President of the Palestinian National Authority (PNA) of 2005, the lands are allocated for the purpose of construction the wastewater treatment plant for Hebron Governorate (Annex VIII). As to the officials, the decree has been announced to the public as for those who have any rights in these lands to present the official documents as to be compensated, no objections or claims have been received. The land parcel numbers are 240, 241, 242, and 243 of 8 and land parcel number 1151 of 2 of Hebron City lands. These land parcels are now owned by the PWA. The parcels mentioned as being expropriated was in 2005 under the USAID project and are now allocated for the project. No additional land will be expropriated.

This confirms that the OP 4.12 is not triggered. No lands will be acquired and there will be no involuntary resettlement. The construction of the WWTP and the trunk sewers will be on privately owned lands and there will be no impacts on private properties.

7.4 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 require a close contact with the affected communities in order to disseminate the right information. The project managers should make field visits, publish and distribute information handouts, and assure the local population that the project will not generate serious side effects. In this context, a resident of Al Heila area stated that "we do not want you to construct the station, and we pack up our things and go away." Additionally, mosques will be utilized to promote and explain benefits of the project. Although the common position of all interviewees is positive towards the project, the general sense of marginalization generates doubts that should be addressed right away. To attain this result, a permanent contact should be in place through field visits or establishment of committees in the target communities.

(ii) Local residents have showed willingness to pay public sewage network subscription fees. In this vein, a significant problem derives from public abstention from payment of public service fees, thereby threatening sustainable service delivery. To impose public sewage network subscription charges would pose a challenge in Hebron City. Therefore, a progressive tariff will be applied to the consumption of water, which generates wastewater. Mechanisms will be created with a view to alleviate or exempt the poor or communities that suffer more from Israeli practices (such as the Old City of Hebron). An incremental approach will also be in place; for example, the system can first be applied to industrial, commercial and service facilities. In parallel, a media campaign will be launched to ensure sustained and enhanced service delivery. The public sewage network is in need of continued maintenance. The wastewater treatment plant requires an operating budget to ensure sustained operation and high quality performance.

(iii) 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.

(iv) 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. 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.

7.5 Cultural Heritage Impacts

7.5.1 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. 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. Since it is not possible to predict what soil conceals beneath its surface, this study recommends a close coordination with the (MoTA) when excavations start, especially after defining the accurate borders of construction.

Knowing that archeological sites are protected by the law of antiquities for the year 1966 according to article no 10. 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.

7.5.2 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.

7.5.3 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.

7.5.4 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.

7.5.5 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. 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. This measure is essential to make sure that the proponent has the capacity to implement the provisions of OP 4.11.

Thus ESCHIA 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 elements 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 ESCHIA 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. This measure is essential to make sure that the proponent has the capacity to implement the provisions of OP 4.11.

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.

8. OTHER ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

8.1 During construction

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.

The technical construction and installation activities which will follow as soon as the proposed WWTP and associated facilities 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 areas and are of temporary character, since they will end with the finalization of the construction works.

During the construction of the WWTP, as well as the associated works of combined trunk sewer-electrical power line and access road/water supply line 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.
- **Traffic jam:** during construction the excavated soils and materials are to be transported. This is also transitory problems and can be mitigated by the proper selection and indication of the detours and assignment of the traffic warden.
- **Historical ruin:** ruins may be found. In this case, the ruins shall be preserved and the Ministry of Tourism and Antiquates (MoTA) shall be informed and consulted, then the Consultant and/or the Contractor will cope with some preserving methods including changing the pipe routes.

The construction activities for the trunk sewer- electrical power line as well as the access road and water supply line will be distributed according to those routings. . 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.

During the construction of the plant and associated works, there will be also impacts that have to be addressed. These include:

- The issues of noise and vibration will be considered limited but dust problems will be caused by running of vehicles because of the dried weather and clayish soil. In order to cope with this environmental problem, the access road is being upgraded (asphalted)and operation of vehicles can be adapted.
- Traffic jam, noise/vibration and generated dust caused by the heavy vehicles transporting huge amounts of materials and disposed soil will be considered. These

issues can be prevented by a proper selection of access route and a restriction of the time for transportation.

- Huge amounts of construction wastes, such as excavation soils and domestic wastes of the employees and labors. In order to cope with these wastes, a Solid Waste Management Plan shall be formulated and implemented. The reuse of materials, which include packages, construction waste, metals, plastic, cardboard, and timber, which are easily reused, shall be adopted. Since the problem of proper management of domestic waste that are disposed of by concentrated labor force is rather serious than above issues, these wastes shall be properly included in the waste treatment cycle of JSC-H&B.
- In addition, the landscape and aesthetics need to be reserved and improved. Replanting of trees and transport and protection of endangered species should be considered. This will enhance the view and landscape.

As a mitigation measure, the transportation trucks should be covered during transportation and should be checked and maintained from time to time to control the dust and gases emissions. The access road to the construction sites will be built in a way reducing dust emissions by asphalting it right from the beginning, or by installing a gravel layer.

The construction activities such as the excavations at the WWTP site may produce huge amounts of soils that may affect the nearby areas of the site. Protection and safety measures during construction are obligatory measures to be implemented by the contractors.

8.2 Noise connected to construction works

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.

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.

Table 8.1 lists the admissible outdoor noise levels as to the PSI (PS 840-2005), while **Table 8.2** gives the admissible time that workers should be subject to noise levels from 85dB to 115dB as to the Ministry of Labor (MoL) Instructions No. (4) Year 2005 (Occupational Health).

Noise levels should be controlled; noise barriers are recommended; occupational health measures should be enforced; Regular health tests and checks should be done for the staff. All these are among the recommended mitigation measures.

Table 8.1: Outdoor admissible noise levels as to the PSI (PS 840-2005)

Outdoor Conditions	**Maximum (dB) 7:00 am – 8:00 pm**	**Minimum (dB) 8:00 pm – 7:00 am**
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

Table 8.2: Admissible time subject to noise levels (MoL No. (4) Year 2005)

Noise level (dB)	85	90	95	100	105	110	115
Time per day (hr)	8	4	2	1	0.5	0.25	0.125

8.3 During Operation

The WWTP and associated works 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.

The diffusion of sound waves in the atmosphere is not homogenous but in contrary depends on, among others, the topography of the area (vegetation, buildings, morphology) as well as on climate conditions (wind speed, wind direction, air temperature, humidity). The character of the source of noise, too, will impact on the diffusion patterns, especially when the sound waves leave a point source in only one direction. Larger technical installations, however, are considered to be spatial sound sources generating complex sound waves mixed from various point sources.

9. MITIGATION MEASURES AND CAPACITY BUILDING

9.1 Summary of Mitigation Measures

This section summarizes the mitigation measures that are required for possible monitoring of the significant impacts as a result of the implementation of the HWWTP and associated works. It also presents information about what agency or group is responsible for implementation and continued management. Potential Contractors shall include in their Bid Documents illustrative plans that comply with these measures.

Most Impacts occurring throughout construction are primarily associated with land preparation, earth works, material transportation and movement of heavy machinery. Such impacts are mostly short term, local, and caused by the contractor's activities in the area. These concerns are usually minor and can be easily addressed using appropriate mitigation measures in the works contracts and can therefore be mitigated through proper co-ordination with the contractor and concerned governmental parties. The most important issues include:

- Construction and excavation wastes.
- Risks of damage of the surrounded environment such as the agricultural lands.

Increase in noise levels due to traffic sources in comparison to current ambient noise levels can be minimized through the use of well-serviced and maintained vehicles, in addition to the traffic reduction measures.

Mitigation of noise pollution can proceed along two possible actions, either by changing the source of noise and/or changing the path of noise from the source to the receiver. Appropriate measures should be taken to reduce the impacts of noise generated from the construction works, not allowing levels to exceed the standards. The installation instructions of the different equipment to be installed should be strictly applied as to reduce the noise emissions from the water facilities and the emissions should be controlled and minimized. Technical measures to reduce high noise levels include the use of noise insulating materials.

The following are the required measures to be implemented in order to mitigate the potential impacts expected to affect the different environmental, social, cultural, and natural resources.

- Store excess cut materials in areas that minimize environmental damage. Some of the excess aggregate materials may be used to aid in agricultural lands reclamation activities.
- Separately store all high quality soils and use them to reclaim agricultural lands under the direction of the Ministry of Agriculture (MoA). During the Design process, prior to implementation, it is to locate, design and submit final storage site plans. Compliance with this directive will be ensured during the design-build process and inspection during construction.
- Remove valuable trees in such a way that they can be transplanted in other suitable locations as guided by the MoA. The uprooted trees shall be stored in accordance with the MoA and MoPWH instructions. The trees to be transplanted will be tagged prior to clearing and grubbing activities. Compliance with this directive will be verified during continuous construction inspection.

- Comply with the Palestinian employment and wage guidelines. This measure is intended to maximize the employment benefits of construction. Compliance with this directive will be verified during random inspections and interviews throughout the construction process.
- In order to minimize potential health hazards, it is to utilize procedures that maximize worker safety and welfare. This includes exposure to heat, noise, dust, and solid and hazardous waste. These procedures will be established during negotiations with the contractors working on the site. They can be modified during the coordination meetings.
- In order to minimize the potential for loss or damage to priceless or irreplaceable cultural resources, it is necessary to alert and educate the workers about the possibility of unearthing archaeological artifacts. Workers shall be required to stop all potentially damaging activities, notify Hebron Municipality and village councils and alert the MoTA if they suspect cultural resources are being damaged. Compliance with this measure will be conducted continuously during construction.
- Consult the Ministry of Tourism and Antiquities (MoTA) to give investigation preference to the recreational sites and to plan for enhancing the recreational, picnic, and tourism activities.
- In order to minimize soil erosion, the precursor to water quality deterioration and blown dust, during and after construction, it is to progressively vegetate the exposed areas caused by construction activities with native plant species as appropriate for the location. This re-vegetation of all impacted areas shall begin as soon as possible after work at a site is completed. This program will be monitored continuously during construction and monthly until the vegetation is stable.
- In order to avoid contaminating wadis or other areas during construction, it is to discharge wastewaters into proper constructed sealed septic tanks.
- In order to avoid contaminating wadis or other areas, it is to transport the construction waste to an approved construction materials waste area. It is suggested to allocate a nearby abounded quarry and landfill it with the construction waste and demolition.
- In order to prevent the possibility of surface or groundwater contamination, it is to ensure that liquid wastes are properly collected, stored, and disposed.
- In order to minimize environmental impacts, the workers camps will be located away from environmentally sensitive areas. The potential locations of these camps will be submitted to Hebron Municipality and PWA for approval prior to camp construction. Compliance with this requirement will be monitored during camp location.
- In order to minimize pollutant emissions that could contaminate the air, surface, or groundwater, it is to use well-maintained construction vehicles and machinery.
- In order to minimize the potential for a hazardous materials spill, it is to use non-hazardous materials during construction if possible and practical.
- In order to minimize potential social, economic or environmental damage, it is to develop and utilize a spill response plan and educate appropriate staff as to the proper procedures included in the plan. This plan will be submitted to the PWA and MENA for approval prior to hazardous materials being transported for the project. Compliance to this plan will be monitored during construction.
- Establish a set of procedures for dealing with the accidental spill of hazardous materials. These procedures would include methods for cleaning fuel, battery acids or radiator fluids that leak during an accident. These procedures should ensure that the materials do not enter the environment.

- In order to minimize noise impacts, it is not to operate heavy or noisy machinery between the hours of 22:00 and 05:00. Compliance will be monitored by MoL continuously during construction and/or operation.
- Minimize the social, economic and environmental impacts associated with dust emissions; utilize a dust palative such as calcium carbonate or other suitable dust control means during earthwork activities in cleared or erodible areas. Continuous visual inspections during construction will verify compliance with/need for additional compliance measures.
- As generation of considerable amount of solid waste is anticipated, solid waste management plan shall be prepared. This has to be coordinated with the officials of JSC-H&B.
- In order to minimize air quality and health impacts, it is not to burn waste materials of any type. Compliance with this requirement will be monitored continuously during construction.
- Abide by local laws concerning maximum weight and speeds of vehicles transporting construction materials. The purpose of this measure is to minimize potential safety or environmental hazards such as traffic accidents, pavement damage, or excess dust generation. Compliance with this measure will be verified during continuous construction inspection.
- Utilize industry standard construction zone safety practices and equipment for the plant site as well as for all associated works. This includes detours, warning signs, and temporary traffic control devices. These shall be inspected daily during construction of the project.
- In order to minimize damage from seismic forces or other landslide events, it is to design and construct the water facilities, reservoirs, slopes, and any other structures to resist reasonably expected levels of activity. Compliance to this will be monitored in the design and continuously during construction.
- In order to monitor safety performance, accident reporting guidelines and an accident database for all accidents occurring is to be established.
- In order to avoid impacting the availability of transportation services, it is to provide transportation for workers to and from the construction site.

Best engineering practices shall be employed during installation of the water pipes and distribution mains under the requirements of PNA construction regulations and material standards in order to avoid possibility of underground undetectable leakage.

The construction contractors will be required to develop a Health and Safety Plan and Emergency Response Plan. These plans will include provisions to safeguard the health and safety of workers and explain procedures for response in case of workplace accidents/incidents. The locations of hospitals and clinics nearest to the construction sites will be identified. Also, first aid equipment will be provided at the construction sites.

9.2 Capacity Building on Wastewater Reuse

Successful wastewater reuse projects are designed to reflect specific local conditions, such as water demand, urban growth, climate, socio-economic characteristics, and cultural preference, as well as institutional and policy frameworks. To do so effectively, a capacity building is required. A Capacity building can improve the quality of decision-making and managerial performance in the planning and implementation of programs.

Selecting the right target group/groups will be decisive for the success of any PA programmed. The following target groups are proposed to be addressed:

- Farmers in the project area,
- Farmers downstream in Yatta. Dora and al-Thahrya towns
- Wastewater treatment plants operation personnel,
- Community service and religious institutions
- Consumers

The capacity building encompasses the following elements:

1. **Human Resource Development:** Building technical and managerial capacity for operating water and wastewater reuse programs is a critical necessity, due to the variable qualities of source water for wastewater reuse and the complexity of processes. Well-trained personnel, including engineers, accountants, mangers, scientists and technicians, are necessary for successful water and wastewater recycling projects. In some organizations, resource constraints may force staff with limited training to assume supervisory and management positions, posing a challenge to implementing effective programs. Such problems may be addressed through:

   - Carrying out internal human resource development by training courses and on-the-job training;
   - Developing human capabilities through hiring and retention of qualified personnel.

2. **Policy and Legal Framework Development:** Water reuse projects must include regulatory development and implementation to ensure the protection of human health and the environment.
3. **Institutional Development and Organizational Management:** Studies on managing water supply and sanitation services in developing communities have shown that ensuring the credibility of a responsible agency within its target community, and developing a client-oriented organizational structure are two success factors. In order to undertake wastewater reclamation projects, it is necessary to examine relevant existing institutions and strengthen them, or to create new ones and assign adequate mandates and responsibilities.
4. **Financing:** It is costly to build and maintain wastewater treatment plants, and install water distribution lines for reuse. Expanding a range of financial services and opportunities is a key component for promoting water and wastewater recycling. In countries where water and wastewater recycling programs are implemented within a comprehensive water resource development, policy makers may have flexibility in accessing financing. In other cases, technical assistance programs may provide separate funding for water reuse. Locally controlled funds or small-scale financing mechanisms (i.e. microcredit schemes) may also be established to facilitate financing.

   Here, great financing or credit intuition s should b e available since there is no irrigation system and all farmers needed to purchase irrigation infrastructure systems such as pumps, filters, irrigation pipes and laterals.

5. **Raising Public Awareness and Participation:** it is the major needs for farmers. Raising the awareness of the public about water shortages-safe use of treated wastewater-crop handling –planting, health protection measures and encouraging their participation in remedial action is crucial in the implementation of wastewater reuse. The issue is of particular importance for water reuse for indirect and direct potable use, including groundwater recharge, as many initiatives have been delayed due to public resistance and legal action. To raise the awareness of stakeholders and ensure that their voices are heard, the decision-making process needs to be participatory, with clearly outlined roles and responsibilities. Proactive public outreach initiatives, such as publications, public announcements, and site visits, are some of the main means to secure wider public acceptance and support.

Table 9.1: Institutional Strengthening and Training for Implementation

Institutional Strengthening	Contents	Scheduling	Participants	Cost Estimation ($)	Comments
Tailored training on Environmental Management Plan and Monitoring Plan	Project features. Legal aspects, environmental impacts and mitigations, monitoring and evaluation and reporting and documenting (including template and forms)	Before starting the implementation	PIU staff, HM staff	20,000 per session	Classroom, field visits and exercises
Environmental Aspects for of recovery water distributions and network	Types and treatment process, international environmental standards, national and regional standards, water quality and quantity objectives, sludge management and distributions	Once before starting the implementation	PWA, HM, HWWTP management, MENA, MoA	25,000 per session	Classroom, field visits and exercises
Environmental Auditing and Inspections	Environmental auditing technique, auditing checklist and environmental reporting	Once before starting the implementation and every two years	PWA (PIU), HM, farmer's association (Union for agriculture and PARC), MENA, MoA and MoH	25,000 per session	Classroom
Social assessment, community communications and community survey and inspection	Communication skills, mass communications, social survey, sampling, analysis and reporting	Once before implementation and once every two years	PWA (PIU), HM, Private organizations, NGO and farmer's associations (Union for Agriculture and PARC)	25,000 per session	Classroom, field visits and exercises

9.3 Health Monitoring Plan

Four groups of people can be identified as being at potential risk from the agricultural use of wastewater. These are:

- Agricultural field workers and their families;
- Crop handlers;
- Consumers (of crops, meat and milk);
- Those living near the affected fields

Agricultural field workers are at high potential risk, especially of parasitic infections. Exposure to hookworm infection can be reduced, and even eliminated, by the continuous in – field use of appropriate footwear, but persuading workers to adopt this precaution may be difficult.

A rigorous health education programmed is needed .A similar approach may be taken with crop – handlers; the risk to them is somewhat less than that to field workers, but it can be reduced by meticulous personal hygiene and the wearing of gloves.

Immunization is not feasible against helminthes infections or against most diarrheal diseases. However, for highly exposed groups, immunization against typhoid and administration of immunoglobulin to protect against hepatitis A may be worth considering.

Additional protection may be provided by the availability of adequate medical facilities to treat diarrhoeal disease, and by regular chemotherapy. This might include chemotherapeutic ontrol of intense nematode infections in children and control of anaemia. Chemotherapy must be reapplied at regular intervals to be effective.

The frequency required to keep worm burdens at a low level (for example, as low as in the rest of the population) depends on the intensity of transmission, but will not normally be less than once a year.

The drugs involved normally cost about US $ .50 for each complete treatment. One to three doses are required, depending on which drug is used.

Chemotherapy and immunization cannot normally by consider as an adequate strategy to protect farm workers and their families who are exposed to raw wastewater or excrete.

However, where such workers are organized within structured situations such as government or company farms, these could be beneficial as palliative measures, pending improvement in the quality of the wastes used.

Risks to consumers can be reduced by the thorough cooking of vegetables and meat, by boiling milk, and by maintaining high standards of personal and kitchen hygiene. Food hygiene should be included in health education campaigns, although the efficacy of such campaigns may often be quite low in poorly educated societies or outside institutional settings.

Any risk of tapeworm transmission can be controlled by meat inspection provided that animals are slaughtered only in recognized abattoirs where all carcasses are inspected and all infected carcasses are rejected.

Measures to protect human health and environment

Human health and environment could be protected through four groups of measures:

- Wastewater treatment level
- Restriction of the crops grown
- Irrigation methods and
- Control human exposure to the waste, and hygiene.

Full treatment prevents excreted pathogens from reaching the field. However, the farmers in most of the cases have to cope with wastewater of a certain quality. Because of this, for the farming crop restriction, irrigation system and human exposure control which act later in the pathway, are more important. A combination of agro-technical measures to be selected, depending on the local socio-cultural, institutional and economic conditions may provide health protection.

Crop selection for health protection

Here in Palestine and according to the local standard, vegetables are not allowed to be irrigated by treated wastewater in order to minimize health risk, which is considered the main issue for minimizing health risks.

Usually and according to WHO here are 3 groups of crops to be considered for health protection as follow:

Category A: Protection needed only for field workers according to WHO

- Crops not for human consumption (cotton, sisal)
- Crops normally processed by heat or drying before human consumption (grains, oilseeds, sugar beet)
- Vegetables and fruits grown exclusively for canning or other processing that effectively destroys pathogens
- Fodder crops sun-dried and harvested before consumption by animals
- Landscape irrigation in fenced areas without public access (nurseries, forests, and greenbelts).

Category B: Further measures may be needed

- Pasturelands, green fodder crops
- Crops for human consumption that do not come into direct contact with wastewater, on condition that none must be picked off the ground and that spray irrigation must not be used (tree crops, vineyards, etc.)
- Crops for human consumption normally eaten only after cooking (potatoes, eggplant, beetroots)
- Crops for human consumption, the peel of which is not eaten (melons, watermelons, citrus, bananas, nuts, groundnuts)
- Any crop if sprinkler irrigation is used.

Category C: Treatment to WHO "unrestricted" guidelines is essential

- Any crops often eaten uncooked and grown in close contact with wastewater effluent (fresh vegetables such as lettuce or carrots, or spray-irrigated fruit) ,this type of reuse is not allowed here in Palestine by law
- Landscape irrigation with public access (parks, lawns, golf courses)

Control of human exposure to the wastes and hygiene .Controlling the risk of public health from waterborne diseases when treated sewage wastewater is used for irrigation is of high importance. In this respect, the groups of persons running such a risk and the ways such groups are exposed to the risk should be identified and examined. The following groups may be recognized:

I. Farm workers

The probability for them of wetting their hands, clothes, or other parts of their body from leaks or otherwise is certainly the highest risk of exposure. Therefore, farmers should be aware about the risk and handle wastewater with care.

- Workers handling or packing polluted crops. If proper care was not taken at the treatment stage and proper irrigation practice were not followed by the farmers, pathogens may be present on the crops at such concentrations, as to pollute the hands, or clothes of such workers.

- Farmers: provide information through interactive learning methods on health risks associated with wastewater use, information and technical assistance on proper crop selection in relation to wastewater quality, irrigation techniques, protective clothing (boots), personal hygiene, washing crops before marketing, group organization for on field sanitation and washing facilities; preventing damage to soils and ground water.

Farmers should take the following precautions:

- It is highly recommended to prefer drip irrigation over others
- All farmers should have a standard Polio-diphtheria-tetanus vaccination.
- All farmers should wear boots and gloves, they shouldn't work barefoot.
- They should not touch their face or smoke, drink or eat during and after working with treated wastewater until they wash their hands and face with soap and water.
- All exposed wounds, however small, should be cleaned and covered with a sterile dressing.
- Farmers should contact their doctor in any case of change in their health such as persistent stomach symptoms of worm infection, a flu-like fever, chest problem and regular checkup.

II. Consumers

This group is actually the general public, comprising children, elderly people and others of low resistance to pathogens, being the most sensitive group. Farmers should feel responsible for this group and manage wastewater in such a way to avoid crop contamination. Crops polluted with pathogens, particularly those consumed raw, allow the chance for consumers to be infected by pathogens, if not properly washed and

cleaned. Risks to consumers can be reduced by thorough cooking and by high standards of hygiene. Local residents should be kept fully informed about the location of all fields where wastewater is used. In this way, they may avoid entering them and also prevent their children from doing so. Programs should be conducted to inform them on proper washing; cooking or blanching of vegetables; and sufficient cooking time for fish raised with wastewater; necessity of paying for treatment of household wastewater as they are the generators.

Protection of consumers can be avoided by:

- Selecting the most appropriate crop to be irrigated by TWW.
- Using drip irrigation and plastic mulch
- Pesticides should not be diluted or mixed with wastewater
- Avoiding contact between crops and wastewater after harvesting.
- Processing of crops.
- A strict state monitoring system for crops irrigated with wastewater

Other general measures include:

- The irrigation system should be checked regularly for spraying or broken emitters and pipes leaks
- Produce that has fallen on the ground or the black mulch should not be marked.
- Produce hanging on the ground should not be marketed
- Irrigation should be stopped two weeks before harvesting if possible

III. Surrounding residences

In order to protect them and minimize their health risks, signs should be available to all of them in order to inform them of the presence of wastewater; in addition to they should be informed about the project, site, and impact, as well as their children. This can be done by campaigns in schools, mosques, markets and health clinic. Fencing around the reuse projects is a useful tool to minimize the health risks of the people surrounding the reuse area and the treatment plant, usually safe distance such as 100 m should be from the reuse project and the nearby residence. In addition, animals should not be allowed to graze from these fields or drink for this water. **Table 9.2** summarizes the health monitoring plan.

Table 9.2: Safety and Occupational Health monitoring program

Responsible	Caretaker	Activity	Frequency
Hebron Municipality	**Doctors, Hospitals, Health Authorities**	- Monitor the occurrence of wastewater related diseases: Ascariasis, Trichuriasis, Typhoid, Fever, Cholera, Ancylostomiasis (hookworm), and Tapeworm.	All the time
	Infrastructure Authority	- Monitor the connection of industrial	All the time
		- Issue permits for connection and charge fines for illegal connections	Every time
	Drinking Water Authority and	- Monitor the abstraction wells in Wadi Matwi on: 1. E. Coli, 2. Nematode/helminth eggs, 3. Nitrate	2 times a year, April, (after the rains) and

	certified Laboratory		October (after irrigation
		- Monitor the 100 meters distance between the irrigated area and the abstraction wells.	2 times a year during irrigation; May and August
		- Monitor the required distances between The drinking water conveyance system and the Wastewater conveyance system	All the time
Treatment Plant Management	**Certified Laboratory**	- Monitor the treatment plant effluent on BOD_5, and E. Coli and	Every month
		- Monitor the treatment plant effluent on Nematode/helminth eggs	April and October
Water Users Association	**Water Users Association**	- Monitor if the irrigated crops are allowed to be irrigated with wastewater - Monitor the visibility and state of warning Signs at the irrigated area - Monitor the distance of 300 meter between the irrigated area and houses - Monitor the occurrence of main pipe system leakages - Monitor the state of drinking water Fountains in the irrigated area	All the time
	Certified laboratory	- Monitor contamination of different kinds of crops	All the time
Farmers	**Farmers**	- Only cultivate the allowed crops, do not pick fallen fruits - Monitor access of the public to the irrigated areas - Monitor splashing of crops by wastewater - Monitor leakages of the system and irrigation water run-off - Monitor the occurrence of wastewater related diseases with family or workers	All the time

9.4 Public Awareness

Following the various discussions held with farmers and other target groups, it can be expected that the current acceptance rate can be raised substantially by implementing adequate information campaigns explaining in detail the related benefits and risks and providing adequate training to ensure the safe use of effluent in irrigated agriculture.

This could be achieved by farmers' education and training measures, the dissemination of adequate extension messages and by providing other support services to farmers. In the canon of measures to increase the awareness of the selected target groups, special

attention is required to provide farmers with practical experience in irrigation agriculture, but also the formation of Water User Associations. Here the proposed irrigation pilot project at Hebron WWTP is an essential tool. Therefore, its implementation in parallel with agricultural extension services is proposed. **Table 9.3** depicts the main subjects and target groups for awareness campaigns.

Table 9.3: Main Subjects and target groups

Target Group	Subjects
Farmers	Treated effluents are reliable, economically attractive environmentally sustainable and safe.
	Health protection.
	Benefits of effluent in irrigated agriculture.
	Appropriate irrigation methods for effluent.
	Selection of appropriate crops (under restricted irrigation).
WWTP Operators	
Directors	Treated effluents are reliable, economically attractive, environmentally sustainable and safe.
	Stakeholders' responsibilities, needs and tasks.
	Palestinian Standards need to be considered with regard to treated effluents and possible usage (limitations at farm level).
	Water quality requirements of end users in irrigated agriculture.
Engineers / Administrators	Palestinian Standards need to be considered with regard to treated effluents and possible usage (limitations at farm level).
	Water quality requirements of end users in irrigated agriculture.
Operators / technicians and mechanics	Palestinian Standards need to be considered with regard to treated effluents and possible usage (limitations at farm level).
	Water quality requirements of end users in irrigated agriculture.
	Work safety measures.
Community Service Societies and Religious Associations	Treated effluents are reliable, economically attractive, environmentally sustainable and safe.
	Health protection.
	Religious acceptance of the use of treated effluents for irrigation purposes.
Consumers	Safety of products.
	Public health measures.
	International acceptance of the concept of using effluent for restricted irrigation.

9.5 Proposed Grievance Redress Mechanism

All grievances received verbally or in written shall be documented in a grievance register, handled by the PMU in PWA. It is of importance to react as quickly as possible to the grievance of the citizens. A best practice standard is to acknowledge all complaints within 10 days. Due to the different character of the complaints, some of them cannot be resolved immediately. In this case medium or long-term corrective actions are required, which need a formal procedure recommended to be implemented within 30 days:

1. The petitioner has to be informed of the proposed corrective measure.

2. In case if a corrective action is not required, the petitioner has also to be informed accordingly.
3. Implementation of the corrective measure and its follow up has to be communicated to the complainant and recorded in the grievance register

In order to enable the PWA to implement the grievances mechanism appropriately, these grievance redress functions should be integrated in the PMU. The priority responsibilities of the PMU staff member whose responsibilities include grievance redress are the following:

(i) Document all grievances received (verbally or written), and
(ii) Transfer the grievance to the responsible entity to solve i.e. the contractor, PWA, Ministry of Agriculture, MENA, etc.
(iii) ensure that each legitimate complaint and grievance is satisfactorily resolved by the responsible entity, and
(iv) Identify specific community leaders, organizations and citizen groups for enhanced dialogue and communication by public liaison office to avoid or lessen resentments and respond effectively to general concerns and issues.

All grievances and communications received by the PWA will be registered and the actions taken / responses given will be tracked and recorded for each. Proper administration and internal records of stakeholder complaints and communications are essential for transparency and quality of PWA responsiveness and reporting to stakeholders on the resolution of grievances.

This partnership between PWA and one or more NGOs, citizen groups or associations would continue from start to finish of construction in these priority communities. By supporting this partnership, PWA is communicating its clear commitment to maintaining effective communications with local communities and stakeholders and responding effectively to the problems and impacts of construction. Finally, a capable partner organization or local citizen group would be able to advise PWA on the specific content of its communications to enhance their effectiveness and favorable reception by local stakeholders.

10. ENVIRONMENTAL, SOCIAL, AND CULTURAL HERITAGE MANAGEMENT PLAN

The Environmental, Social, and Cultural Heritage Management Plan (ESCHMP) identifies feasible and cost-effective measures required for the environmental monitoring of key environmental aspects of the project during project implementation. The ESCHMP also identifies monitoring objectives, specifies the type of monitoring, and stipulates mitigation measures to address impacts as identified by the ESCHIA study. The ESCHMP is designed to monitor the effectiveness of the management actions. A component of the plan is to establish monitoring programs to evaluate the performance of the project against the goals of sustainable development: economic growth, social equity, and ecological integrity. Appropriate, measurable, defined, and valid indicators shall be identified, developed, and agreed upon by stakeholders. The ESCHMP will include regular auditing and reporting, and lead to the refinement of targets and indicators. Monitoring results will be made publicly available.

The main objectives of the ESCHMP are to:

1. Implement all recommendations and mitigation measures shown in the ESCHIA report, and any future needs that might arise.
2. Implement and enhance all laws and regulations related to labor affairs and benefits.
3. Inform workers regarding onsite job risks.
4. Enforce equal opportunity employment for equal qualifications.
5. Implement all environmental laws and regulations of the Palestinian Authority.
6. Supervise all activities that might affect the environment aspects of the community.
7. Establish a monitoring policy and an inspection program to cover environmental contaminants or those that might adversely affect the environment of the area.
8. Implement immediate mitigation measures wherever appropriate. Emphasis should be on the protection and conserving valued environmental components. Workshops and training sessions should be held regularly on various fields related to project activities.
9. Inspect and supervise environmental conditions at the project area.
10. Take corrective steps to mitigate environmental impacts.

In addition, the ESCHMP will:

1. Assess effectiveness of the proposed mitigation measures in the ESCHIA.
2. Detect environmental contamination as early as possible, to ensure the implementation of the management plan by the project operators.
3. Ensure compliance with this ESCHIA and regulatory authorities.
4. Prepare periodic reports on the environmental status of the project and the community, including activities or actions taken during the year and analysis and evaluation of results and present recommendations, to improve or develop better approach.

The ESCHMP in Annex IA provides expected impacts of the proposed project. Mitigations measures to be implemented during the construction and operational phases are also listed. Environmental mitigation and monitoring actions are presented in a matrix format. The matrix includes an identification of the issues, mitigation measures, and responsibility for executing the mitigation measures. The ESCHMP is a tool for environmental auditing and compliance, and if properly applied, will ensure the success and sustainability of the project.

In Palestine, the USAID projects are followed by the supervision and consultants have their own safeguard engineer who follows the studies, the report and all documentation in this regards. For this project the consultant is Black & Viche.

11. CONCLUSIONS AND OVERALL ASSESSMENT

This ESCHIA report summarizes the results of the impact assessment for the construction of the HWWTP and associated works. 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.

The ESCHIA has investigated and assessed the significance of the predicted positive and negative impacts associated with the proposed HWWTP. These impacts, along with the wider environmental issues will need to be weighed up in the decision-making process. No negative impacts of high significance were identified, provided that all mitigation measures are applied effectively.

No significant negative cumulative impact is expected to be caused by the development of the HWWTP. The construction of the wastewater treatment plantis by itself a positive cumulative impact as it will improve the environment and protect the groundwater aquifer. It will also enhance the social practice of wastewater disposal and will develop a focused and properly operated system.

The ESCHIA concluded that providing the recommended mitigation measures are incorporated and the environmental, social, health and safety management of the facilities are addressed in the ways described within this report, then associated environmental, social and health impacts can be maintained within acceptable levels.

In order to ensure effective application of the management actions and monitoring proposed in this ESCHIA, a comprehensive ESCHMP is prepared and annexed to this report. 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 HWWTPt.

It is recommended that this ESCHIA is approved and that the environmental approval for the construction of the proposed HWWTO and trunk sewer is issued. The PWA, Hebron Municipality and the nearby communities and stone cutting industries are committed to the standards and requirements for the protection of the environment and declare that they are committed to the required mitigation measures addressed in this ESCHIA.

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13. ANNEXES

Annex I: Public and Beneficiaries Consultation

Annex II: Summary of Potential Impacts and Proposed Mitigation Measures

Annex III: Environmental, Social, and Cultural Heritage Management Plan

Annex IV: Expected Impacts during Construction and Operational Phases

Annex V: Environmental Monitoring Plan

Annex VI: Social Management Plan

Annex VII: Social Safeguards Matrix

Annex VIII: Risk Management Plan

Annex IX: Land Acquisition Decree

Annex X: ENVIRONMENTAL DOCUMENTATION AND REVIEW REPORT – HEBRON WWTP ACCESS ROAD & UTILITIES - USAID

Annex I: Public and Beneficiaries Consultation

The Study team used focus groups and interviews as main tools to consult beneficiary local communities. The results of consultations were as the following:

1. Women's Focus Group

Time and date: 10:00 am – 12:00 pm, 9 September 2012

Eight women participated in the focus group, including teachers, farmers, housewives and employees.

Results of consultations with participants in the focus group discussions according to certain major questions:

Question: What do you think about the project?

Results: Participants in the women's focus group reviewed hazards and damages caused by the wastewater stream, including widespread illnesses, such as amoeba and skin diseases. In addition to widespread snakes and insects, discussants highlighted malodorous smell to the extent that local residents cannot open their house windows for ventilation.

Female participants stressed adverse impacts on farmland, dehydrated trees, and damaged soil, rendering invalid the agricultural land in areas adjacent to the wastewater stream.

Women explained that the wastewater stream posed an immediate risk to children. Accordingly, participants in the focus group discussions assessed that the project would be of paramount significance. Firstly, it will stop the wastewater stream and channel flowing wastewater through a closed sewer pipeline. In addition to reducing risks posed to affected local communities, the project will enable treatment, disposal and use of wastewater for agricultural and other purposes.

Question: In your opinion, what are the expected results of the project?

Results: Female participants stressed that the most prominent impact would to dispose of the wastewater stream which flows near to houses and agricultural land. It will also eliminate hazards posed to children; reduce insects and relevant diseases, and help reclaim farmland adjacent to the wastewater stream. The land will be reused for cultivation and crop production, thereby improving income of households that own this land.

Participants expected that the project would provide some employment opportunities to local residents, who are already unemployed. They anticipated that treated wastewater could be used for agricultural purposes, especially on house gardens.

Participants further demanded that residents of the target area have the right to use treated wastewater because they had suffered a great deal from the flowing wastewater stream. Women believed that that the project would change the landscape in the affected local communities.

Question: Are you willing to pay for disposal of wastewater? Are you willing to buy treated wastewater, and at what prices?

Results: Female participants in the focus group coincided that their households were willing to pay subscription fees for disposal of wastewater, taking account of affected households' economic conditions, particularly poor ones. On the other hand, participants suggested that they use treated wastewater free of charge as a compensation for the damage caused to the target area. Still, discussants did not object to paying reduced prices for the use of treated wastewater.

Question: What do you advise the project managers to do?

Results: Female participants in the focus group discussions confirmed that their first advice was to expedite construction of the project. However, they advised that the project be implemented on a phase-by-phase basis to avoid adverse impacts on the daily life of local residents. Participants demanded that employment priority should be given to members of the local communities. They also requested that waste left over behind the project should be disposed of immediately in light of the damage it would potentially cause to local residents and agricultural land.

2. Men's Focus Group

Time and date: 12:30 pm – 3:30 pm, 10 September 2012

Eight men took part in the focus group discussions, including farmers, school teachers, workers, an employee, and a former chairman of a local council.

Results of consultations with participants in the focus group discussions according to certain major questions:

Question: What do you think about the project?

Results: Participants in the focus group discussions emphasized that the project would generate major benefits, which would positively reflect on the affected area. Participants reported that the Khallet ad Dar area had been a fertile agricultural land before it was destroyed by the wastewater stream. To get rid of the stream will allow processing of negative consequences that caused damage of this farmland. Overtime, the land will be arable and usable as it previously was.

Participants highlighted that the project would relieve local communities of public health hazards, which the open stream generates. It will alleviate risks posed to the life of local residents, especially children and livestock. The problem is worse in wintertime when the wastewater stream rises up to three meters.

Discussants stated that the wastewater stream and foul smell negatively impacted on local communities' social relations with other areas. Some participants in the focus group discussions confirmed that they faced serious problems because some families had refused to marry their daughters to residents living in the affected communities because of hazards generated by the wastewater stream. From the perspective of participants, the project provides many benefits, which will positively reflect on local residents in relation to health conditions, social relations and economic situation.

Question: In your opinion, what are the expected results of the project?

Results: Participants in the focus group discussions expected that the project would enhance the living environment in the target area. It will put an end to widespread insects and diseases and promote social relations with other communities. Participants said that the project would enhance the economic situation of households in local communities.

Besides reusing agricultural land, local residents will have the opportunity to better market their agricultural produce. Currently, customers are reluctant to buy crops cultivated in the area, fearing that it is contaminated with the wastewater stream. Additionally, the project will provide employment opportunities to local residents during the construction phase and operation period.

Question: Are you willing to pay for disposal of wastewater? Are you willing to buy treated wastewater, and at what prices?

Results: Participants in the focus group discussions coincided that they were willing to pay subscription fees for wastewater disposal, provided that prices are affordable and compatible to households' economic situation. Discussants highlighted that countless problems are posed by the wastewater stream and cesspits. Therefore, to pay for elimination of these problems is widely admissible and no one can possibly oppose it. To materialize economic benefits from the agriculture activity, participants further confirmed that they are willing to purchase treated wastewater at reduced prices. They even said they were more entitled to use the treated wastewater in light of the extensive damage they had sustained over an extended period of time.

Question: What do you advise the project managers to do?

Results: Participants in the focus group discussions stressed that local communities should be introduced to details and expected side effects of the project. In particular, local residents should be freed of concerns regarding the wastewater treatment plant.

Participants recommended that their communities be connected to the public wastewater network in order to dispose of cesspits, eliminate relevant destructive impacts on the environment and agricultural land, and put an end to frequent disputes between households.

Participants highlighted that local residents should be given the priority for employment opportunities and use of treated wastewater. Although they demanded for an expedited construction, discussants asserted that operation be phased out to avoid negative reflections on local communities' daily life.

Should damage be caused to their properties by the project construction, participants recommended that the restitution be provided in a timely fashion. They confirmed they were willing to endure these temporary impacts for the sake of finalizing the project and disposing of significant adverse consequences, which they currently suffer from as a result of the flowing wastewater stream.

Discussants recommended that the public sewage network be closely monitored and overseen to avoid damage or sabotage. In this context, participants in the focus group

discussions reported that covers of some sanitary sewer manholes had been stolen, posing hazards for residents and producing malodorous smell.

3. Results of individual and group interviews with some residents of areas adjacent to the wastewater stream

Interviews Date: 5-15 September 2012

A total of 11 persons were interviewed, including workers, farmers, employees and local public figures

Results of interviews according to certain major questions:

Question: What do you think about the project?

Results: As was commonly indicated, the project will alleviate damage caused to local communities, agriculture activity and livestock. This is an important and vital project. It will rid local residents of a significant, chronic problem that adversely reflects on all aspects of their lives. Many interviewees, particularly those who lived in areas adjacent to the wastewater stream, considered the project as their number one priority.

Question: In your opinion, what are the expected results of the project?

Results: All interviewees asserted that the project would significantly contribute to eliminating adverse impacts on local communities and agricultural land. They believed that the project was duly important because it would relieve them from the wastewater stream, which causes the spread of insects and malodorous smell, and poses danger to children.

The wastewater stream prevents local residents from tending their agricultural land. Interviewees expected that the project would contribute to enhancing their income as they would be enabled to reuse their land. Additionally, some local residents would be employed in the project construction and operation phases.

Question: Are you willing to pay for disposal of wastewater? Are you willing to buy treated wastewater, and at what prices?

Results: In case they were connected to the public sewage network, all interviewed persons agreed that they were willing to pay subscription fees for disposal of wastewater. They further confirmed that they were willing to pay reasonable prices for the use of treated wastewater on their farmland.

Question: What do you advise the project managers to do?

Results: According to interviewed persons, the project should be fully explained to local communities, particularly potential malodorous smell produced by the wastewater treatment plant. Interviewees stressed that construction of the project should be expedited.

Any potential damage caused during the construction phase should be repaired. Priority should be given to residents of the target area in relation to employment and use of treated wastewater.

4. Results of interviews with individuals and owners of stone processing facilities in Hebron City

Interviews Date: 5-15 September 2012

Six owners of stone processing factories were interviewed in Hebron city

Results of interviews according to certain major questions:

Question: What do you think about the project?

Results: Interviewed owners of stone processing facilities highlighted that the project was vital and important to the Hebron area in general. It will mitigate adverse impacts on the environment and public health.

Question: In your opinion, what are the expected results of the project?

Results: In addition to positive effects on the environment and public health, interviewed managers of stone processing facilities believed that the project would provide treated wastewater, which they could use if it is fit for stone processing. In particular, they stressed that treated wastewater should not cause damage to workers and equipment.

They believe that this water source is all the more important because it reduces overall production cost. Currently, managers of stone processing factories pay as much as NIS 10 per cubic meter of water. With this project, they can purchase treated wastewater at half or less the price.

Question: Are you willing to pay for disposal of wastewater? Are you willing to buy treated wastewater, and at what prices?

Results: All owners of stone processing factories expressed their willingness to pay subscription fees for wastewater disposal. At the same time, they stressed that they were willing to purchase and use treated wastewater in their factories at a price that would not exceed ILS 5 per cubic meter (deliverable to the stone processing installation).

As mentioned above, managers stressed that treated wastewater should be valid for stone processing.

Question: What do you advise the project managers to do?

Results: To enable efficient use of treated wastewater, interviewed managers of stone processing factories mainly stressed that a network should be installed to transport treated wastewater from the wastewater treatment plant to the Industrial Zone, where their installations are located.

List of participants and interviewees:

Name	Occupation
Focus group – Women	
Kifayah Ya'qoub Abu Turki	Teacher
Fatima Ali Abu Turki	Housewife
Arij Ashour	Housewife
Samaher Abu Madhi	Housewife
Sabrin Mohammed Abu Madhi	Housewife
Zahiyyah Khaled Abu Turki	Social worker
Sana' Husni Ashour	Housewife
Eman Robeen Abu Isneinah	Janitor at the Khallet ad Dar Healthcare Centre
Focus group – Men	
Suleiman Abdul Aziz Abu Isneinah	Driver
Salman Abu Isneinah	Farmer
Abdul Shakour Abu Isneinah	Teacher
Murad Sa'id ar Rajabi	Teacher
Yaqin Mohammed Abu Madhi	Plumber
Mustafa Abu Rammouz	Employee
Mohammed Isma'il Abu Turki	Former Chairman of the Khallet ad Dar Village Council, Chairman of the Sa'd Sayel Forum
Interviewed persons in Al Heila	
Isa Jaber Awadh	Farmer
Mohammed Salem Jibrini	Farmer
Mahmoud Odeh Awadh	Farmer
Isa Zein Awadh	Farmer
Mohammed Isa Awadh	Farmer
Khalil Mousa Awadh	Farmer
Ayesh Mousa Awadh	Farmer
Mohammed Jaber Awadh	Farmer
Yasser Ahmed Awadh	Worker
Yousef Ahmed Awadh	Worker
Juridical persons and managers of stone processing factories	
Mohammed Isma'il Abu Turki	Owner of the Al Anwar Stone and Marble Company
Mohammed Jamal Banat	Ajnadin Stone Company
Hajj Abdul Shakour al Atrash	Al Ma'mal al Fanni [Technical Workshop] for Marble
Hajj Sidqi al Atrash	An Naseem Company

Rawhi al Atrash	Al Atrash Company
Fawwaz Gheith	Al Wuroud Company
Hebron Municipality	
Engineer Marwan al Akhdar	Head of Wastewater Department, Hebron Municipality
Hatem an Natshah	Technical Controller, Wastewater Department, Hebron Municipality
Abdul Fattah Abu Isneinah	Worker, Wastewater Department, Hebron Municipality
Bassam Abdul Fattah Qasrawi	Public Services, Hebron Municipality
Jamal D'eis	Inspector, Hebron Municipality

Annex II: Summary of Potential Impacts and Proposed Mitigation Measures

Category		Potential Impacts	Impact Significance	Mitigation Measures
Impacts During Construction				
Physical Environment				
Land Use and Planning	0	Land use where associated works will be laid/upgraded will only be affected temporarily.	Not Significant	Application of proper engineering practices during associated works construction.
	–	WWTP is located in agricultural areas. The land is already allocated and owned by PWA. It will be converted into a public facility.	Low Significance	PWA and Hebron Municipality shall secure land and obtain change of land use permits or easements from agencies having jurisdiction over the facility locations.
				Sludge drying beds technology may be replaced by compacting technology.
				Landscape design inside the WWTP should preserve the general characteristic of the lost green area.
Geology and Seismicity	0	Geology must be suitable to support desired construction elements.	Not Significant	A detailed geological and foundation analysis has been conducted. No unique geologic or physical features will be altered.
	–	Potential damages from earthquakes to project facilities could only cause hazardous conditions locally (WWTP process failure, storage facility damage, etc.).	Low Significance as mitigated	Facilities have generally been sited far from habitation and will be designed and constructed in accordance with Palestinian and International building codes and regulations.
				Damage will be repaired by the regional utility or any other responsible party soon after the possible seismic event occurs.

				A detailed geological and foundation analysis will be prepared and incorporated into project plans.
Soil	–	Soil will be disturbed during construction of the project facilities and will potentially increased erosion.	Low Significance	Standard measures to minimize soil erosion during construction will be included in the plans and specifications for project elements.
Air Quality and Odors	–	Air pollutants (mainly dust) will be emitted temporarily during construction. Dust generated during installation of pipelines, in town is a nuisance for residents, and dust generated during construction on WWTP site will cause dust to accumulate on adjacent vegetation.	Low Significance, localized. Well reduced by mitigation.	Spoil piles shall be transported daily in covered trucks. Mechanical excavation should be used where possible. Best construction practices will be employed; water spray and proper fencing will be applied to minimize dust spread out.
	–	Limited odors maybe generated during construction out of construction vehicles.	Low Significance, localized and temporary.	Assure the use of well maintained construction equipment.
Surface Water Systems	–	Stagnant water bodies may be formed as a result of accumulation of excavation material on storm water courses and surface water drainage areas	Medium Significance, minimized.	Continuous clearance of wadis and storm water courses.
		These stagnant water bodies resulting from blocked drainage paths produce algal blooms, anoxic sediments and bad odors which will become a nuisance for the surrounding area.		Avoid forming stagnant water bodies during construction by keeping drainage and storm water paths clean and clear.
Solid Waste	–	Poor management and compilation of construction waste may cause pooling	Medium Significance,	Unusable construction waste should be moved, removed and disposed at an

		and flooding, as well as an unpleasant visual impact	minimized by mitigation.	approved dumpsite in coordination with Hebron Municipality.
				Reusable piles produced from excavation should be properly stored for refilling after pipelines are installed.
Built Environment				
Infrastructure and Public Services	–	Construction will temporarily disrupt traffic patterns in the vicinity of project facilities, most notably at the WWTP site as well as along the access road. Most roads are lightly traveled.	Medium Significance, minimized as mitigated.	Potential access restrictions during construction will be localized and temporary, but the Contractor will notify receptors at least one week in advance of the schedule and duration of construction. The Contractor will also coordinate with providers of fire and police protection and hospitals to ensure continued access during construction.
	0	Workers' commuting to site during construction is minimal. Impact will be negligible on traffic.	Not Significant	No mitigation needed.
	+	Wastewater will be pumped to the WWTP instead of open disposal in wadis.	Highly Beneficial	No mitigation needed.
	–	Temporary impacts to services and utilities (e.g. water, electricity) during construction and during installation of associated facilities.	Medium Significance	Citizens, businesses and public facilities will be informed of the cutting schedule. Emergency service providers shall be provided with contact names, locations.
Socio-Economic	+	Construction will create a significant number of new jobs in the area.	Medium Significance, beneficial	
	+	Purchase of construction material and rent of construction equipment. Also purchase of services and commodity in	Beneficial	Assure purchase of high quality material; improve local economy by involvement of local contractors.

		the area by contractors and workers is possible.		
	–	Nearby villages may not be accustomed to large infrastructure project of this type that may cause nuisance to the community.	Low Significance	Proper engineering practices and proper monitoring of construction works.
Public & Occupational Health	–	Average level of hazard to construction workers.	Low Significance as mitigated	Contractor will adhere to health and safety regulations. Contractor is required to develop proper emergency responses in advance. First aid equipment must be available on site.
	–	Potential health hazards to residents during construction, i.e. along associated works routings..	Low Significance as mitigated	Provision of awareness and instruction signs by contractor is required.
Noise	–	Construction noise will be localized at the WWTP site and temporary on sensitive receptors of residences and businesses will be affected during installation of associated works..	Low Significance as mitigated	Include noise mitigation requirements in project bid documents. Schedule construction activities to avoid sensitive seasons, days, or hours (limit to Saturday - Thursday, 06:00 to 18:00 or daylight hours), inform residents and businesses near alignment of construction duration and schedule. Provide noise protection gear for construction workers and operators.
Historical and Cultural Heritage	–	No sites were found on the proposed project sites in literature searches. Archeological sites are not expected, but may be potentially revealed during construction activity.	Potential High Significant	Contractor will have to continuously monitor any archaeological evidence revealed during construction and is required to immediately inform the MoTA for appropriate protection procedures.
Ecology	0	From literature review and on-foot reconnaissance no sensitive terrestrial species or habitats exist on sites.	Not Significant	None required.
Category	**Impact (+,0,-)**	**Impact Discussion**	**Impact Significance**	**Mitigation Measures**

	0	No established nature reserves, protected areas, or national forests would be affected.	Not Significant	None required.
Impacts During Operation				
Physical Environment				
Land Use and Planning	0	WWTP is very far from residences, schools, hospitals, police and fire stations, and mosques.	Not Significant	None required.
	+	Irrigated agriculture will be expanded through reuse. Reuse of treated wastewater will increase agricultural rate and may change agricultural pattern into trees and fodder.	Beneficial, Highly Significant	Binding to the Palestinian standards of treated wastewater reuse.
	–	Treatment and storage facilities disrupt natural landscape.	Low Significance if mitigated	Operators used to maintain structures, observe good housekeeping procedures, keep facilities and sites clean and well cared for. Activities will be described in the O&M manual.
Soil	–	Effluent reuse will increase the salt and chloride content of agricultural soils and underlying strata.	Highly significant	Reuse system requires change of agricultural patterns in the area to fodder and trees that are tolerant to high nitrate levels. Irrigation by treated effluent must follow the Palestinian standard 742 in order to protect the nutrient levels in soil.
Generated Solid Waste and Sludge	–	Sludge will be generated from treatment process as dewatered in drying beds	Low significance as mitigated	Sludge shall be transferred to Al-Menya landfill, if not reused.
		Discharge of treated wastewater to the soil surface for irrigation purposes will increase soil salinity. Salt built-up dispersion in soil, reduced infiltration, and hydraulic conductivity that reduced soil productivity.	Medium significance	Applying greater volume of irrigation water than crop requirement can prevent salt built-up in shallow soils.

	–	Leachate from sludge may impact water quality and the environment.	Less than significant as mitigated	Sludge will be transferred to Al-Menya landfill after being dried. Environmental mitigation elements in Al-Menya landfill (lining, leachate disposal, and consideration of environmental issues) have been incorporated and O&M requirements, project plans and specifications. O&M training will be provided.
Noise	–	WWTP is in a relatively low area that would limit noise pollution. The only affected personnel are workers on the site. Potential impact may be caused if construction permissions are given near the WWTP.	Low Significance	Workers on site will wear earmuffs or ear plugs as needed.
				Construction permissions should not be given within 500 m radius from WWTP.
Air Quality and Odors	+	Odors already exist from discharge of raw sewage in public grounds and agricultural land.	Highly Significant	
	+	Conveyance of raw sewage to WWTP will be through buried pipes.	Highly Significant	Buried pipes will follow Palestinian Standards, and will be placed below fresh water network pipes to avoid leakage.
	–	Aeration basins and sludge drying beds may create odors as algae blooms decay.	Not significant with mitigation	A management plan shall be elaborated by the construction designer to control odors. Natural barriers of trees and consideration of wind direction should be included in the design.
	–	Screening/grit units will be at the WWTP plant.	Low significance with mitigations	Use of liquid chlorine to avoid gas release.
				Standardized handling of operations and procedures.
				Operations equipment (including pumps and motors) will be selected upon energy efficiency and low-emission factors.
				The screening/grit station will be equipped with odor controls; WWTP grit and

				screenings will be transferred away to Al-Menya sanitary landfill.
Groundwater Aquifer System	+	In the absence of the project, groundwater quality has the potential to become significantly degraded. The project aims to reduce or eliminate the infiltration of raw domestic sewage towards the groundwater.	Beneficial, Highly Significant	The treatment facilities should be constructed to the standards and should be sealed and not allow any seepage or overflow of the untreated sewage to the nearby areas. Regular testing of groundwater quality.
	–	Discharge of treated wastewater to the ground surface either for irrigation purposes or disposal in the nearby valley may have the potential to increase level of salinity, nitrogen.	Highly Significant, minimized by mitigation.	Application of greater volume of water than that of crops requirement. Access amount of water will bypass the root zone and percolate to reach the saturated zone.
Built Environment				
Impact in Agricultural Activities	–	Use of treated wastewater presents potential risk to farmers by direct contact.	Highly Significant Minimized by mitigation.	Irrigation activities will be conducted in accordance with all applicable standards covering worker safety, public health, environmental health and irrigation methods. Compliance with Palestinian Standard 742 will be assured. An agribusiness investment will be encouraged to help local farmers gain experience with wastewater irrigation.
Infrastructure and Public Services	0	Sludge will be reduced in volume by drying, so that hauled sludge from WWTP will be minimized, thus minimize the frequency of transporting to the landfill.	Not Significant	Sludge transporting vehicles will be covered and will follow.
	–	Possible leakage of wastewater trunk sewer that cannot be directly indicated.	Low Significance	Accidents of leakage will be minimal and could only occur over sever seismic activity or with old worn out pipes. Best

				engineering practices will be employed during installation of trunk sewer under the requirements of PA construction regulations and material standards.
	+	The access road will be designed and aligned to provide improved access from existing roads to the treatment plant site. Theis access roadwill be paved by asphalt.	Highly significant	Improve access to surrounding agricultural land.
	0	Transporting produced sludge (2-3 ton/day) by trucks to the landfill for disposal has a negligible impact on traffic.	Not Significant	Trucks are maintained and covered. Adhere to the speed limits and traffic regulations.
	0	There will be no overload from the collection system and the WWTP on public services, and therefore the impact on those utilities will be negligible.	Not Significant	No mitigation needed.
	+	Increased local water supplies for irrigation.	Beneficial	No mitigation needed.
	−	Energy needs increase compared to existing conditions for plant operation and pumping reuse water.	Low Significance	Use energy efficient technology in treatment and pumping. An alternative source of energy should be provided in case of emergencies such as generators.
Socio-Economic Public and Occupational Health	0	Population is growing in the absence of waste management The Project will not induce or alter population size, distribution or density nor affect housing.	Not Significant	None required. No relocation would be required due to land acquisition for facilities.
	+	If project is implemented and operated as designed, it would improve the existing and future quality of life in the	Beneficial, Highly significant	

		project area with respect to public health and income generation.		
	+	Treated wastewater can be used by stone cutting factories, increasing feasibility of the business.	Beneficial, Highly significant	
	+	The collection and treatment system fees will be cheaper than the costs of traditional discharge means of cesspits.	Highly Beneficial	
	+	Providing treated water for agriculture will save on water purchasing; encourage investment in land reclamation in agriculture and job creation.	Highly Beneficial	
	+	5-10 permanent jobs will be created on site of the WWTP when operated.	Low Significance	
	+	The project will significantly reduce an existing and future health hazard created by seepage of raw sewage.	Highly significant	
	–	Mechanical dangers and use of hazardous chemicals in WWTP imposed on operating workers.	Low significance as mitigated	Operation and Management (O&M) manual contains industry standards tor chemical handling. Worker require appropriate training program.
	–	New mosquito habitat created in open basins, danger of vector-transferred diseases.	Highly Significant	Construct large sludge drying. Keep bank slopes free of vegetation.
	–	Health effects may occur to farm workers and their families could include exposure to pathogens that may remain in water after inappropriate treatment and disinfection.	Medium Significance	The proposed reuse demonstration project will include training for farmers, workers and others of the safe use of reuse water.
	–	Miss-use of WWTP facilities and stored water.	Medium Significance	Signage will be provided in Arabic and English to indicate that the stored water is not potable or safe for swimming, and all

				hose bibs with reclaimed water will be similarly tagged to indicate the water is no safe for drinking.
Ecology	+	The open basins may attract and create habitat for birds flying over the region.	Medium significance Need protection measures	The O&M Manual of the WWTP will need to include security measures to protect birds. Hunting is highly restricted and all birds are protected. Therefore the WWTP requires proper fencing.
Emergencies	–	Illegal connection of connection of stone cutting and other industrial facilities to the network overloads the WWTP, clogging the system and increase the organic load in the system causing environmental damages.	Medium Significance	Legislative measures and continuous controlled monitoring should be enforced.
	–	Discharge raw wastewater towards the nearest valley and agricultural land at times of technical treatment faults or emergency cut of electricity, etc.	Potential High Significance	The provision of a storage basin that would allow the insufficiently treated water to be stored to prevent its escape into the environment. This water could be chlorinated with hypochlorite in the reservoir in emergency circumstances to reduce public health risk.
	–	Spillages of fuel during use of electrical generators in emergencies.	Medium Significance minimized by mitigation	Careful handling and prompt cleaning of spillages. Secondary catchment and impervious surfaces under fuel storage tanks can contain spills and reduce or eliminate potential leakages to soil and groundwater.

Annex III: Environmental, Social, and Cultural Heritage Management Plan

The ESCHMP is designed to monitor the effectiveness of the management actions. A component of the ESCHMP is to establish monitoring programs to evaluate the performance of the project against the goals of sustainable development: economic growth, and ecological integrity. For this purpose, appropriate, measurable, defined, and valid indicators will be identified, developed, and agreed upon by stakeholders. The ESCHMP will include regular auditing and reporting, and lead to the refinement of targets and indicators. Monitoring results will be made publicly available.

The Main Objectives of the Environmental, Social, and Cultural Heritage Management Plan (ESCHMP) are:

1. Implement all recommendations and mitigation measures shown in the ESIA report, and any future needs that might arise.
2. Implement all environmental laws and regulations of the Palestine Authority.
3. Supervise all activities that might affect the environment.
4. Establish a monitoring policy and an inspection program to cover environmental contaminants or those that might adversely affect the environment of the area.
5. Implement immediate mitigation measures wherever appropriate. Emphasis should be on the protection and conserving valued environmental components. Workshops and training sessions should be held regularly on various fields related to project activities.
6. Inspect and supervise environmental conditions at the WWTP.
7. Take corrective steps to mitigate environmental impacts.
8. Attend workshops or seminars on topics related to the wastewater collection and treatment system.
9. Adopt waste minimization and recycling strategies.
10. Prepare emergency plans to protect the public, the workers, and biodiversity.

In addition, the ESCHMP will:

- Assess effectiveness of the proposed mitigation measures in the ESCHIA. Detect environmental contamination as early as possible, to ensure the implementation of an environmental management plan by the project operators.
- Ensure compliance with this EA and regulatory authorities. Prepare periodic reports on the environmental status of the project, including activities or actions taken during the period and analysis and evaluation of results and present recommendations, to improve or develop better approach.

The implement of the ESCHMP measures involved in many units, thus the sources of funding are different and most environment protection activities are engineering measures. Therefore, the fund should be included into engineering cost and offered by project contractors and operators. The costs should be nailed down and listed in their tendering documents. The fund of ESCHMP is mainly used in the environment management during construction period including environment monitoring, environment supervision, personnel training and operation of environment management organizations, as well as some the risk prevention cost.

Annex IV: Expected Impacts during Construction and Operational Phases

During Construction Phase					
Environmental Element	**Potential Environmental Impacts**	**Proposed Mitigation Measures**	**Monitoring**	**Institutional Responsibilities**	**Monitoring Frequency**
Air Quality and Odors	Air pollution caused by emissions and exhaust from vehicles and construction machinery. Also, the dust plumes from the excavation and finishing activities. Limited odors maybe generated during construction out of construction vehicles	• Vehicles and construction machinery should be required to be properly maintained and to comply with relevant emission standards. • Spoil piles shall be transported daily in covered trucks • The vehicles, in particular, the trucks should not be over loaded to minimize exhausts emissions • Water spray of the construction site and the stockpiles of the excess cut materials to minimize dust • Controlling the speed of the transporting vehicles, selecting transportation routes to minimize dust impact on sensitive receivers, and washing trucks tires before leaving the construction site. • Proper scheduling and monitor of any risky activities such as excavation and backfilling. • Mechanical excavation should be used where possible and best construction practices will be employed. • Cease earth-moving activities on days when wind gusts exceed 40 km per hour • Assure the use of well maintained construction equipment	• Ensure that mitigation measures are incorporated into bid documents. • Contractor shall implement air quality mitigation measures	Contractor, Hebron Municipality, PWA, MoT, MoPWH, Police.	Weekly
Soil	Soil will be disturbed during construction of the project facilities and	• Soil erosion (and dust) should be minimized at construction sites by covering spoil and fill piles, in addition to applying other mitigation measures.	• Review of bid documents to ensure that applicable codes	Contractor, MoA, Hebron Municipality, PWA.	Once during the construction phase and

	will potentially increased erosion.	This requirement should be incorporated into project plans and specifications. • Suitable disposal sites should be identified for excess material from excavating pipeline benches for conveyance pipelines, from site grading and from excavation of WWTP.	and regulations are incorporated, inspection during construction to ensure that measures are implemented. • Contractor shall present written description of proposed debris and soil disposal site for review and approval.		annually during operations
Surface Water	Stagnant water bodies may be formed as a result of accumulation of excavation material on storm water courses and surface water drainage areas.	• Continuous clearance of wadis and storm water courses.	• Ensure that mitigation measures are incorporated into bid documents.	PWA, MEnA, Hebron Municipality.	• Monthly
Ground Water	Spillage of raw sewage and oil from construction equipment to the ground water systems either in the saturated or unsaturated zones	• Continuous cleaning of the construction site. • Construction of temporary septic tanks when needed.	• Ensure that mitigation measures are incorporated into bid documents.	PWA, MEnA, Hebron Municipality.	Monthly
Cleanness of the Construction Site and the	The construction camps could be sources of solid waste, debris, and waste oil from machinery.	• Disposal of the generated solid waste should be timely cleaned up and stored in closed containers. • Disposed materials should be properly compacted and stabilized.	• Ensure that mitigation measures are incorporated into bid documents.	Contractor, Hebron Municipality, PWA, MEnA.	• Daily Weekly or monthly depending

Generated Wastes	Wastewater from the camps could create new pollution sources. Construction spoils and rocky materials will be generated. Excavated materials generated by construction and demolition activities.	• Construction spoils and rocky materials could be used by local people on a 'take for free' basis. • Sewage and other wastewater from construction camps should be collected and treated using septic tanks before being discharged. • Burning of construction waste should be prohibited. • Construction waste should be promptly removed from the construction sites. • The waste transportation vehicles should not be overloaded and should be covered.			on the volume of the work
Ecology	Affecting trees, rare or endangered species living within the construction area.	• Implementing the resettlement plan for the flora at site. • Uprooting and replanting the trees. • The O&M Manual will include security measures to protect the birds and potential encounter with wolves and foxes. Bird, wolf, and fox presence should be monitored. Hunting is highly restricted and all migratory birds, wolves and foxes are protected.	• Ensure that mitigation measures are incorporated into bid documents.	Contractor, Consultant, Hebron Municipality, PWA, MEnA, MoA.	• weekly dutingactive flora resettlement and monthly otherwise
Land Use and Planning	Trunk sewers and water supply line will be buried; land use where sewer and water supply line will be laid will only be affected temporarily. Access road will be upgraded. WWTP is located in bare land owned by PWA.	• Application of proper engineering practices during collection system construction • The PWA and Hebron Municipality shall secure land acquisition and obtain change of land use permits or easements from agencies having jurisdiction over the facility locations. • Landscape design inside the WWTP should preserve the general characteristic of the lost green area.	• PWA negotiates easements and acquisitions • Contractor must provide written documentation of permissions from all affected agencies • Contractor must present written documentation of permissions from	PWA, Hebron Municipality.	Once during the preparation and once prior to the start of construction phases

			all affected property owners.		
Aesthetic	Change in landscape character from site construction	• Leveling and site preparation should be monitored; no old waste should be spilled. • Conduct further survey to include local geology. • Planting trees and improving the landscape. • The design should be environmentally friend, by considering green areas. • Maintain structures, observe good housekeeping procedures keep facilities and sites clean and well cared for; incorporate in O&M Manual.	• Periodic inspections by MEnA	Consultant, Contractor (in accordance with contractual obligation).	Weekly during the active construction phase and monthly otherwise

Post Development Phase					
Environmental Element	**Environmental Impacts**	**Proposed Mitigation Measures**	**Monitoring**	**Institutional Responsibilities**	**Monitoring Frequency**
Water Resources, Water supply	Increase in water demand. Impact on the water resources.	• The design and the implementation should comply with the local and international codes. • Water storage reservoir to meet the demand for several days. • Supply the project with water. • Monitoring of GW quality and the impact of the improved WW treatment	• Ensure that mitigation measures are incorporated into bid documents. • Monitoring program applied	Hebron Municipality, PWA, Consultant.	• semiannually
Wastewater (effluent) and Reuse	Impact on public health (specifically farmers by direct contact) Impact on soil Impact on water resources	• Treatment should comply with the required standards for reuse in agriculture. • Irrigation activities will be conducted in accordance with all applicable standards covering worker safety, public health, environmental health and irrigation methods. Compliance with Palestinian Standard 742 will be assured. An agribusiness investment will be encouraged to help local farmers gain experience with wastewater irrigation. • Reuse in cocked-eaten agriculture and landscaping. • Raise the awareness of the farmers towards reuse. • Reuse sludge during winter time (storage and loading station). • Include an in-line filtration system to remove algae pre-distribution or provide irrigation application system suitable for higher TSS. • Educate the farmers of public health. • Regular health checks. • Regular water and soil testing.	• Annual soil testing • Periodic inspections and laboratory analysis of effluent quality and crops.	Hebron Municipality, PWA MEnA, MoH.	• Bi-mnthly

Soil	Effluent reuse will increase the salt and chloride content of agricultural soils and underlying strata. Impact of increased Nitrate level	• Reuse system requires change of agricultural patterns in the area to fodder and trees that are tolerant to high nitrate levels. Irrigation by treated effluent must follow the Palestinian standard 742 in order to protect the nutrient levels in soil • Leaching as part of reuse system to maintain soil productivity	• Annual soil testing • Periodic inspections and laboratory analysis of crops	PWA, MoA, farmers	annually
Wastewater	Bad odor emissions, groundwater aquifers pollution and several health disease outbreaks may occur.	• The design and the implementation of the sewer lines should comply with the local and international codes. • Conduct regular preventive maintenance. • Regular spraying of insects, flies and mosquitoes, especially during summer.	• Ensure that mitigation measures are incorporated into bid documents.	Hebron Municipality	• Monthly
Solid waste generation and service	Leachate from sludge may impact water quality and the environment. The generated solid waste quantities are a new load to the solid waste management system of Hebron.	• Efficient solid waste management system. • Sludge will be transferred to landfill after being dried. Environmental mitigation elements in Al Menya landfill (lining, leachate disposal, and consideration of environmental issues in sitting) have been incorporated in design and O&M requirements, project plans and specifications. • Daily disposal of the wet solid waste. • Dumping the solid waste at approved sanitary landfill. • Cover the solid waste containers.	• Ensure that mitigation measures are incorporated into bid documents.	Hebron Municipality, JSC H&B, PWA, MEnA.	Bi-monthly • Every time • Every time
Air quality	Exhaust from vehicles movements from and to the WWTP site and gas emissions from the WWTP are the main source of air pollution at post development phase.	• Strict enforcement of speed limits, • Use of well-serviced and maintained vehicles, • Comply with exhaust limits and gas emissions. • A management plan shall be elaborated by the construction contractor to control odors. • Standardized handling of operations and procedures. Use of liquid sodium hypochlorite and ferric chloride. Using liquids avoids gas release	• Establish recording and reporting protocol for chemical handling.	Police, MoT Hebron Municipality, PWA, MEnA	weekly

		• Operations equipment (including pumps and motors) will be selected upon energy efficiency and low-emission factors and • The screening/grit station will be equipped with odor controls; WWTP grit and screenings will be transferred away to Al Menya sanitary landfill			
Aesthetic	Change in the landscape, degrade the aesthetic of the project area and cause odors attract insects and rodents.	• Maintain the green areas • Prohibiting any waste disposal • Effective Solid Waste Management Plan. • Maintain structures, observe good housekeeping procedures, keep facilities and sites clean and well cared for, and incorporate in O&M Manual.	• Periodic inspections by MEnA	Hebron Municipality, PWA.	• Semi-annually
Electricity	- The electric shocks may cause health risks. The electricity breaks would affect the project operation and success. - Energy and fuel consumption impact. -Energy needs increase compared to existing conditions for plant operation and pumping reuse water.	• Comply with the local and international codes of the electricity supply. • Underground cables should be considered for high voltage. • Closed feeder pillars in safe closet accessible only to authorized personnel, • Post clear warning signs to instruct the workers and to avoid risks and health hazards. • Emergency electricity generators • Use energy efficient technology in treatment and pumping.		Hebron Municipality, PWA.	• Consistently as a part of the worker health and safety plan
Land Use and Planning	Irrigated agriculture will be expanded through reuse. Existing agricultural land is mainly rain	• Binding to the Palestinian standards of treated wastewater reuse. • Operators used to maintain structures, observe good housekeeping procedures, keep facilities and sites clean and well cared for. Activities will be		MoA, MEnA, MoLG	As part of design and operations phases

	fed. Reuse of treated wastewater will increase agricultural rate. Treatment and storage facilities disrupt natural landscape.	described in the O&M manual. Pipelines will be buried.			
Ecology	The WWTP basins may attract and create habitat for migratory birds flying over the region during their semi-annual migrations.	• The Operation and Maintenance Manual of the WWTP will need to include security measures to protect the bird. Hunting is highly restricted and all migratory birds are protected. Therefore the WWTP requires proper fencing. • Since the WWTP will be an attraction for educational trips, it may also include birds-watch station if it proved to attract migratory birds. Therefore, a plan for such a station shall be developed in coordination with relevant authorities and expertise and NGOs	• Coordinate with Palestine Wildlife Society for bird monitoring and security measures to insert in O&M Manual. Have PWS review the manual	MEnA, PWA	Once, to be considered as part of the design or post-construction phase

ANNEX V: ENVIRONMENTAL MONITORING PLAN

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
Air Quality and Dust	Vehicles and construction machinery should be properly maintained and to comply with relevant emission standards.	Contractor; for transportation routes consult Hebron Municipality	Tender documents Site Inspection	Supervision	Construction machinery inspection	These measures are full responsibility of the contractor during construction. He has to allocate budget for the maintenance of his vehicles and pear all the costs as part of the project budget. An inspection and environment officer should be assigned by him to follow up and control these. The salaries and other inspection costs are estimated at US$ 110,000.
	Spoil piles shall be transported daily in covered trucks.		Tender documents Site Inspection	Supervision Police	Daily submittals	
	The vehicles, in particular, the trucks should not be over loaded to minimize exhausts emissions.		Tender documents Inspection	Supervision Police	Daily submittals	
	Water spray of the construction site and the stockpiles of the excess cut materials to minimize dust.		Tender documents Site Inspection	Supervision	Progress reports	
	Controlling the speed of the transporting vehicles, selecting transportation routes to minimize dust impact on sensitive receivers, and washing trucks tires before leaving the construction site.		Tender documents Inspection	Supervision Hebron Municipality Police	Daily Submittals; Transportation plan	
	Proper scheduling and monitor of any risky activities such as excavation and backfilling.		Tender documents	Supervision	Progress reports	
	Mechanical excavation should be used where possible and best construction practices will be employed.		Tender documents	Supervision	Progress reports	
	Cease earth-moving activities on days when wind gusts exceed 40 km per hour		Tender documents	Supervision	Progress report	
	Assure the use of well maintained mechanical construction equipment**.**		Tender documents	Supervision	Progress Reports	

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
				Hebron Municipality		
Noise (construction and traffic noise)	Construction activities should be scheduled carefully to minimize the impact of noise from construction machinery.	Consultant; Contractor	Tender documents Shop drawings	Hebron Municipality	Design report Work plan	The scheduling of the activities should be clear and agreed as to be implemented during construction. The contractor is full responsibility for the control of the works. He has to allocate budget for the maintenance of his vehicles and pear all the costs as part of the project budget.
	Night-time construction using heavy machinery such as pile drivers and concrete vibrators should be prohibited all night hours.	Contractor	Tender documents	Supervision Hebron Municipality MoPWH	Progress report	
	Good maintenance and proper operation of construction machinery to minimize noise generation.	Contractor	Tender documents	Supervision	Daily submittals	
	Selection of transport routes for large vehicles to avoid residential areas.	Contractor; Hebron Municipality	Tender documents	Supervision; Police	Transportation plan	
	Scheduling of the working hours and days.	Contractor	Work plan	Supervision; MoL	work plan; daily submittals	
	Complying with the noise limits during construction activities.	Contractor	Tender documents Inspection	Supervision; MoL; MENA	Inspection Reports	
Soil	Soil erosion (and dust) should be minimized at construction sites by covering spoil and fill piles, in addition to applying other mitigation measures. This requirement should be incorporated into project plans and specifications.	Contractor; Consultant	Tender documents Site Inspection	Supervision; Hebron Municipality	Project plans; Progress reports; Daily submittals	These measures are full responsibility of the contractor during construction. Costs are part of the project budget.

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
	Suitable disposal sites should be identified for excess material from excavating water pipelines and site grading of the water reservoirs.	Contractor; Hebron Municipality	Tender documents Excavation plan	Supervision; MoPWH	Excavation plan report; Daily submittals	
Surface Water	Continuous clearance of wadis and storm water courses.	Contractor	Tender documents	Supervision; Hebron Municipality; MoPWH	Progress report	US$ 12,000 is to cover clearance works in the wadi.
Groundwater	Continuous cleaning of the construction site.	Contractor	Tender documents	Supervision; Hebron Municipality	Progress report	US $12,000 is for the construction of the septic tank and frequent emptying of the tank.
	Construction of temporary septic tank when needed.		Tender documents	Supervision	Mobilization report	
	Emptying of septic tank when full and dumping it at an official nearby treatment facility.		Tender documents and site instructions	Supervision	Progress report	
Construction Site and Solid Wastes	Disposal of the generated solid waste should be timely cleaned up and stored in closed containers.	Contractor	Tender documents and site instructions	Supervision; Hebron Municipality	Daily submittals	These measures are full responsibility of the contractor during construction. He has to manage the construction and solid wastes as to maintain the site clean. The inspection and
	Disposed materials should be properly compacted and stabilized.		Tender documents and site instructions	Supervision; Hebron Municipality	Progress report	
	Construction spoils and rocky materials could be used by local people on a 'take for free' basis.		Announce to the public; Announcements	Hebron Municipality	Progress report	

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
	Sewage and other wastewater from construction camps should be collected by septic tank or closed container.		Tender documents	Supervision	Waste Management Plan	environment officer should be responsible for that. Additional US$ 60,000 is estimated to be allocated for solid waste management.
	Burning of wastes should be prohibited.		Site instructions	Supervision; Hebron Municipality; MEnA	-	
	Construction waste should be promptly removed from the construction sites.		Tender documents	Supervision; Hebron Municipality	Daily submittals	
	The waste transportation vehicles should not be overloaded and should be covered.		Tender documents Instructions	Hebron Municipality; Police	Waste Management Plan	
Natural Ecology and Resources	Implementing a resettlement plan for the trees.	Contractor; Hebron Municipality	Special Plan	MoA	Resettlement Plan	US$ 20,000 is estimated as the budget for the trees resettlement plan and compensation.
	Uprooting and replanting the trees.	Contractor	Consultant; Hebron Municipality	MoA	Resettlement Plan	
	Bird, wolf, and fox presence should be monitored. Hunting is highly restricted and all migratory birds, wolves and foxes are protected.	Hebron Municipality	Tender documents Special Plan	MoTA	Special Report	
Roads and	Traffic plans should be prepared before construction in conjunction with relevant authority.	Contractor	Tender documents	MoT; Police	Traffic Plan	US$ 20,000 is the estimated budget for

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
	Regulating traffic at the road crossings and improve existing roads to accommodate increased heavy traffic.	Contractor	Tender documents Traffic Plan	HEBRON MUNICIPALITY; MoPWH	Traffic Plan	the implementation of the traffic plan.
	Select transport routes to reduce disturbance to regular traffic.	Contractor, Hebron Municipality	Traffic Plan	MoPWH, MoT; Police	Traffic Plan	
Land Use and	The PWA and Hebron Municipality shall obtain change of land use permits or easements from agencies having jurisdiction over the facility locations.	PWA, Hebron Municipality	Project documents and land use plan	Higher planning council; MoP; MoPWH	Special Report	This has to be secured by Hebron Municipality prior to construction activities.
Public and Workers Safety and protection	Contractors should be required to take safety measures at the construction sites, and warning signs should be provided to alert of potential safety hazards at and around the construction sites.	Contractor	Tender documents	Supervision; Hebron Municipality; MoPWH; MoL	Progress Report	US$ 2,000 is to cover the cost of the traffic and warning signs.
	Contractors and construction supervision should be introduced to the environmental protection measures.	Hebron Municipality	ESCHIA report	MEnA; PWA	Environmental Auditing	
	Environmental protection measures in connection with construction operations are required as integral parts of the engineering contracts.	Contractor JSCDP	ESCHIA report	MENA; PWA	Environmental Auditing	
	Provide traffic regulation signs.	Contractor	Tender documents	Hebron Municipality	Progress report	
	Complying with seismic loads in design, exit, and emergency.	Consultant; Contractor	Tender documents	PWA; Hebron Municipality	Design report	

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
Heritage and cultural properties	Construction should be immediately suspended if any archaeological or other cultural properties are found.	Contractor; Consultant	Tender documents	Hebron Municipality; MoTA	Progress report	US$ 10,000 is estimated as the fees for the archaeological expert to conduct the investigation. The contractor is to take the risk of any damages to cultural properties.
	MoTA and other relevant cultural authority and the project management office should be notified promptly if any archaeological or other cultural properties are found and only after a thorough investigation will construction resume.	Contractor	Tender documents	Hebron Municipality; MoTA	Progress report	
	Reinstate any damages whatsoever that may occur (should be avoided as possible) to the cultural properties.	Contractor	Tender documents	Hebron Municipality; MoTA	Progress report	
Occupational Health	Commitment with the Palestinian Law of Labor.	Contractor	Tender documents	MoPWH; MoL	Progress report	The contractor is responsible for the occupational and workers health at site. These costs are covered by the contractor budget. The salaries of an environment and safety officer are estimated at US$60,000 per year.
	Occupational health and safety measures should be taken at the construction sites.	Contractor		Consultant MoPWH; MoL	Progress report	
	First aid kits and units should be available at the site.	Contractor		Consultant MoPWH; MoL	Progress report	
	Appoint an environmental and safety officer.	Contractor; Hebron Municipality		PWA; MEnA	Project documents	
	Workers should consult the appointed safety officer of the site regularly.	Workers; contractor		Consultant; MoL	Progress report	
Agriculture	Control machinery and vehicle access.	Contractor	Tender documents	Consultant; Hebron Municipality	Progress report	US$ 36,000 is estimated as the budget for

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
	Reinstate all affected areas**.**			Consultant; Hebron Municipality; MoA	Progress report	reinstatement and compensation. This is normally covered by the BoQ.
Socio-economic	Efficient sanitation must be maintained and monitored, with provision of health services.	Contractor	Tender documents	Consultant; MoL	Progress report	US$ 24,000 is to be allocated for efficient sanitation and health services during construction.
	The contractor should afford save and healthy environment for the workforce.	Contractor	Tender documents	Consultant; MoL	Progress report	
	Provide recreational and social activities at construction camp during non-working hours.	Contractor	Tender documents	Consultant; MoL; MoPWH	Progress report	
	Conduct Safety awareness campaign, focusing on schools and children.	Hebron Municipality	Project Agreement Announcements	PWA, MoLG	Awareness report	US$ 10,000 is the budget for the awareness campaign.
Tourism and recreation	Effective Solid Waste Management Plan.	Contractor; Hebron Municipality	Tender documents	MEnA; MoTA	Waste Management Plan	The keeping of the site post construction is the responsibility of Hebron municipalities and the costs for these should be part of the municipality budget.
	Commitment to noise, dust and emissions standards**.**	Consultant; Contractor		Hebron Municipality; MEnA	Design and progress report	
	Traffic management and maintain water and electricity supply.	Contractor		Hebron Municipality; MoPWH	Progress report	
Aesthetic	Leveling and site preparation should be monitored; no wastes should be spilled.	Contractor	Tender documents	Hebron Municipality; MoPWH	Progress report	US$ 10,000 is additional budget for

ESCH	During Construction					
	Proposed Mitigation Measures	**Implementation Responsibility**	**Means of Monitoring**	**Monitoring Responsibility**	**Means of Reporting Monitoring Results**	**Implementation and budget (US$)**
	Maintain the green areas.			Hebron Municipality; MEnA		site improvement and landscaping.
	Planting trees and improving the landscape.			Hebron Municipality; MoA		
	Maintain structures, observe good housekeeping procedures keep facilities and sites clean and well cared for.			Hebron Municipality; MoPWH		

Annex VI: Social Management Plan

The Social Management Plan is designed to identify the additional measures required to further reduce and/or manage the potential social impacts during project implementation, particularly the social, economic, health, and cultural impacts of the project and the effectiveness of mitigation measures. The plan identifies monitoring objectives and specifies the type of monitoring, and stipulates mitigation measures.

The main objectives of the social management plan are:

1. Describe the approach and procedures that will be used to ensure that the social impact avoidance and mitigation measures are successfully applied during the construction and operation of the project.
2. Prepare periodic reports on the socio-economic status of the project and the community, including activities or actions taken during the period and analysis and evaluation of results and present recommendations, to improve or develop better approach.
3. Implement and enhance all laws and regulations related to labor affairs and benefits.
4. Provide local awareness for the need of the WWTP and the nature of its service. A detailed record of public awareness activities should be properly documented.
5. Inform workers regarding onsite job risks.
6. Enforce equal opportunity employment for equal qualifications.

Operators should be aware of the actual situation, existing standard operating and maintenance procedures, and safety measures for the operators and employees. The operators should be educated not only on operational- related matters but also on potential hazards and environmental, health and safety matters. In general, the operators should be aware of the following:

- Issues related to the environment;
- Reason and purpose for the environmental regulations;
- Handling, storing, and labeling of chemicals and hazardous materials (including separate packing of hazardous waste in secure containers for separate collection);
- Proper collection and intermediate storage of wastes at the WWTP;
- Protection against health hazards;
- Safety programs and prevention of accidents; and
- Procedures for emergency care of injured personnel, and Control and maintenance of facilities.

During Construction Phase					
Environmental Element	**Potential Environmental Impacts**	**Proposed Mitigation Measures**	**Monitoring**	**Institutional Responsibilities**	**Frequency**
Socio-economic	Construction will create a significant number of new jobs. Purchase of construction material and rent of construction equipment. Workforce might be from outside the immediate neighborhood and thus living in temporary quarters subject to disease, noise and dust.	• Efficient sanitation must be maintained and monitored, with provision of health services. • The contractor should afford save and healthy environment for the workforce. • Provide recreational and social activities at construction camp during non-working hours. • Assure purchase of high quality material; improve local economy by involvement of local contractors.	• Ensure that mitigation measures are incorporated into bid documents. • Periodic visits by PWA, MoH and MoL	Contractor, PWA, MoH, MoL	• All the time • All the time • All the time • All the time
Noise (construction and traffic noise)	Noise due to heavy construction machinery and vehicular movement, potentially affecting the residents. Generally, construction noise exceeding a noise level of 70 dB has significant impacts on surrounding sensitive receptors within 50 meters of the construction sites.	• Construction activities should be scheduled carefully to minimize the impact of noise from construction machinery. • Night-time construction using heavy machinery such as pile drivers and concrete vibrators should be prohibited all night hours. • Good maintenance and proper operation of construction machinery to minimize noise generation. • Selection of transport routes for large vehicles to avoid residential areas. • Scheduling of the working hours and days to avoid sensitive seasons, days, or hours (limit to Saturday -Thursday, 07:00 to 18:00 hrs or daylight hours) • Complying with the noise limits during construction activities.	• Review of plans and specifications to ensure incorporation of noise mitigation measures. • Contractor to map locations of sensitive noise receptors in sitting pumping stations(s) and present for approval.	Contractor, Hebron Municipality, PWA, MoT, MoPWH.	• Per activity • Every night • Monthly • All the time • All the time • Every time

		• Include noise mitigation requirements in project bid documents. • Inform residents and businesses near alignment of construction duration and schedule. • Provide noise protection wears for construction workers and operators			• Every time • During Construction • During Construction
Infrastructure and services	Traffic congestion caused by increased construction traffic in the areas, altering public safety. Construction will temporarily disrupt traffic patterns in the vicinity of project facilities. Temporary impacts to services and utilities during construction such as cutting water supply service during installation of sewer pipelines	• Traffic plans should be prepared before construction in conjunction with relevant authority. • Regulating traffic at the road crossings and improve existing roads to accommodate increased heavy traffic. • Select transport routes to reduce disturbance to regular traffic. • Divert traffic at peak traffic hours. • Potential access restrictions during construction will be localized and temporary, but the Contractor will notify receptors at least one week in advance of the schedule and duration of construction. The Contractor will also coordinate with providers of fire and police protection and hospitals to ensure continued access during construction • As applicable, conduct underground utility searches prior to construction Citizens, businesses and public facilities will be informed of the water supply cutting schedule. • Emergency service providers shall be provided with contact names, locations.	• Contractor will document neighborhood meeting, notification materials, and other communications. • Contractor will provide contact reports with affected parties. • Ensure that mitigation measures are incorporated into bid documents. • Contractor shall implement required mitigation measures	Contractor, MoT, Hebron Municipality, PWA, Police.	• Once • Annual • Every time • Daily • Monthly • Once • Once

Public Safety and protection **(Geology and seismicity included)**	Problems related to public and workers safety due to the works in the project Traffic accidents Risks and seismic activities.	• Contractors should be required to take safety measures at the construction sites, and warning signs should be provided to alert of potential safety hazards at and around the construction sites. • Contractors and construction supervision should be introduced to the environmental protection measures. • Environmental protection measures in connection with construction operations are required as integral parts of the engineering contracts. • Provide traffic regulation signs. • Facilities have generally been sited far from habitation and will be designed in compliance with seismic loads in design, exit, and emergency. • Contractor will adhere to health and safety regulations. • A detailed geological and foundation analysis has been conducted. No unique geologic or physical features will be altered	• Review of geotechnical analysis and compare to bid documents to ensure recommendations are incorporated • Review of bid documents to ensure that applicable codes and regulations are incorporated.	Contractor, Consultant, Hebron Municipality, PWA, MEnA.	• All the time • Monthly • Once • Monthly • Once • Once • All the time
Heritage and cultural properties	Damaging of heritage and archaeological sites within the construction area	• Contractor will have to continuously monitor any archaeological evidence revealed during construction • Construction should be immediately suspended if any archaeological or other cultural properties are found. • MoTA and the project management office should be notified promptly and only after a thorough investigation will construction resume.	• Contractor shall immediately report any material to the Inspector. The Contractor shall document the time and date of the materials discovery and the time and	Contactor, PWA, MoTA	• Every time • Every time • Every time

			date of his contact with MoTA • MoTA shall visit the site and approve the site boundary designated. The project inspector shall monitor activities near the established boundary		
Occupational Health	Construction workers might be exposed to or injured by different occupational hazards	• Occupational health and safety measures should be taken at the construction sites. • First aid kits and units should be available at the site. • Workers should consult the appointed safety officer of the site in regularly. • Prepare WWTP safety manual and emergency response plan. • Adhere to health and safety regulations on construction site(s).	• Contractor will provide safety training and inspection. • All accidents will be reported. • Unsafe conditions will be corrected. • Agency review of manual and emergency response plan • Develop and implement training program, overseen by owner	Contractor, PWA, MoL, MoH	• All the time • Every time • All the time • Every time • Every time

Post Development Phase					
Environmental Element	**Potential Environmental Impacts**	**Proposed Mitigation Measures**	**Monitoring**	**Institutional Responsibility**	**Frequency**
Noise	Noise generated from vehicles movements, noise generated from pumps, WWTP activities	• Monitoring and enforcement programs should be applied to the noise generated. The noise should not exceed the local or international limits for WWTP and industrial areas. • The pumps, machines, activities should also comply with the noise limits and installation requirements.	• Include in O&M Manual; check WWTP inventory	Hebron Municipality, PWA.	• All the time • All the time
Public Occupational Health and Safety	Traffic accidents, noise waves, accidents and injuries during work, gas emissions from the vehicles movements from and to the project and the gas emissions from the WWTP. Use of hazardous chemicals in wastewater treatment. The large, deep reservoir may attract swimmers, livestock, and perhaps bird hunters. Damage due to seismic event	• Comply with the Palestinian Labor Law • Constructing effective fire fighting system • Comply with the national and international gas emissions standards for both, vehicles and treatment systems • Constricting ventilation systems to maintain the healthy air. • Implementing warning signs, and traffic control devices. • Maintain fire alarm and warning systems • Maintain emergency exists for fire and seismic situations • Adhere to all applicable standards for wastewater reuse in irrigation. Develop agribusiness partnership. • Operation and Management manual contains industry standards tor chemical handling. Worker require appropriate training program.	• Report damage to MEnA and PWA; MEnA and PWA oversee repairs. • Periodic inspections and laboratory analysis of crops and soil.	Hebron Municipality, PWA, Civil defense	• Every time • Once • All the time • Yearly • All the time • Yearly • All the time • All the time • All the time • All the time • Once

		• Construct steep bank slopes as soil stability allows. Post signage in Arabic and Hebrew around the reservoir to warn that the water stored is not potable and dangerous tor swimming. Hunting will be prohibited. The reservoir shall be included In the WWTP security rounds. A fence shall be constructed around the reservoir to restrict access • Repair damage as soon as possible after a seismic event.			• Every Time
Institutional	The project will affect several entities such as municipalities, authorities and ministries. It will also affect farmers who are to reuse wastewater and sludge.	• Coordinate training and public awareness for new workers • Implement regular environmental checks; public awareness campaigns; regular checks of vehicles; reuse and recycling options; maintenance activities; etc. • Coordinate with PWA for the implementation and operation of the WWTP. • Support farmers cooperative and farmers' family businesses.		Hebron Municipality, PWA, MoLG, MEnA.	• Once • Bi-monthly • All the time • All the time
Neighborhood residential area	The Neighbourhood area may be affected by noise and dust from to the WWTP.	• Commitment in the exhaust, emissions and noise limits. • Control and management to avoid congestions		Hebron Municipality, PWA.	• All the time • Monthly
Tourism and Recreation	Loss of tourism and recreational value if the aesthetic, noise, air pollution and services not well maintained.	• Effective Solid Waste Management Plan. • Commitment in noise, dust and emissions standards • Traffic management and maintain water and electricity supply • Maintain the green areas		Hebron Municipality	• All the time • All the time • Every time • All the time

ANNEX VII: SOCIAL SAFEGUARDS MATRIX

Detailed list of impacts		Permanent Land Acquisition				Temporary Land Acquisition (during construction)			
		Total amount of land	Total HH affected	Total HH/persons displaced	# of businesses affected	Total amount of land	Total HH affected	Total HH displaced	# of businesses affected
Component 4: Civil Works									
Civil Works During the Construction of the WWTP									
Construction of the WWTP	Improve living conditions for around 230,000 inhabitants in Hebron and local communities in Wadi as-Samen area, improve public health through the treatment of wastewater, and increase available water quantity through reducing the use of fresh water in Agriculture and Industry and using the treated water for such purposes.	None; The WWTP would be constructed on an area of 110 donums of lands owned by PWA.	None	None	None	None	None	None	None
Civil Works During the Construction of the Trunk Sewer									
Construction of Trunk Sewer	Improve public health through the extension of the sewage trunk line with length around 1 km from the current outfall to the WWTP, decrees social and institutional disputes on wastewater flow impacts in Wadi as-Samen, reduce the damage of agriculture lands that resulted from wastewater	The extension of the sewage trunk will be in the Wadi as-Samen itself with no change to the current	None	None	None	None	None	None	None

Detailed list of impacts		Permanent Land Acquisition				Temporary Land Acquisition (during construction)			
		Total amount of land	Total HH affected	Total HH/persons displaced	# of businesses affected	Total amount of land	Total HH affected	Total HH displaced	# of businesses affected
	flow in Wadi as-Samen.	wastewater flow course							
Enterprises									
Market	During the construction phase of both the WWTP and the Trunk Sewer, market activities might be impacted by the dust, noise and by the traffic congestion. This is only temporary. After the project implementation those impacts will vanish.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Schools	During Construction, traffic congestion, dust and noise will impact the school activities, but temporarily.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other enterprises	Same as above.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Private Shops	Same as above	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A: Not applicable

Annex VIII: 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 management is a program management tool to define and mitigate events that might adversely impact the project. Successful implementation of risk management will increase the program's likelihood of success.

Risk is defined as an event that has a probability of occurring, and could have negative impact to a project if that risk occurs. A risk may have one or more causes and, if it occurs, one or more impacts.

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 identification of risk normally starts before the project is initiated, and the number of risks increase as the project matures through the lifecycle. When a risk is identified, it is assessed to ascertain the probability of occurring, the degree of impact. The probability of occurrence and the impact of the event on the project is the basis for assigning the risk degree (high, medium, low).

As part of documenting a risk, two other important items need to be addressed. The first is mitigation steps that can be taken to lessen the probability of the event occurring. The second is a contingency plan, or a series of activities that should take place either prior to, or when the event occurs. Contingency plans implemented prior to the risk occurring are pre-emptive actions intended to reduce the impact or remove the risk in its entirety. Contingency plans implemented after a risk occurs can usually only lessen the impact.

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.

Risk mitigation involves two steps:

- Identifying the various activities, or steps, to reduce the probability and/or impact of an adverse risk.
- Creation of a Contingency Plan to deal with the risk if it occurs.

Risk Events	Main Potential Impacts	Degree of Risk	Required Mitigation Measures			Actions if the Event Occurs
			Action	Responsibility	Time	
Seismic Event	- Broken pipes - Damage structures	High	- Following the Israeli and Palestinian seismic design criteria - Following the PA construction regulations	Consultant, Contractor	During Design and Construction Phase	- Stop all mechanical equipment. - Inspect all installations immediately after earthquake and report any structure failure. - Anticipate follow-up tremors. - Identify intact basin(s) within the WWTP where raw sewage or treated effluent can be diverted. - Stop discharge for agricultural reuse. - Prepare a damage control report
Flash Flood	- Stop of mechanical part - Increase the wet flow	Medium	- Install the WWTP elements at a suitable elevation. - Protect the WWTP from flooding. - Install equalization tank.	Consultant & Contractor.	During Design and Construction Phase	- Monitor all installations and water bodies. - Conduct complete site inspection when flood subsides. - Stop discharge for agricultural reuse.
Discharge of Industrial Wastewater into the System	- Clogging in the wastewater system - Increase the organic load	Medium	- Monitoring of illegal connections. - Proper legislations.	Municipality & Councils in the project area, PWA, Security Forces.	During Operational Phase.	- Legal and judicial accountability. - Cleaning the clogging parts. - Stop discharge for agricultural reuse.
Power Failure	- Stop the treatment process	Medium	Provide standby power.	Consultant & Contractor.	During Design and Construction Phase	- Activate standby system - Investigate source of power failure.

Release of Toxic Chemicals	- Health impact	High	- Prevention program that includes safety precautions and maintenance, monitoring, and employee training is required. - The incorporation of absorption systems	Consultant & Contractor, Ministry of Health, PWA.	During Design, Construction and Operational Phase.	- Operate the absorption system. - Inspect and identify the reason of releases.
Operational Mistakes & Mechanical Malfunctions	- Discharge of untreated wastewater	Medium	- Adequate training for the system operators. - Regular maintenance and monitoring program. - Supply of spare parts.	Municipality and Councils in the project area, PWA, MoA.	During Operational Phase.	- Stop discharge for agricultural reuse. - Re-circulate treated effluent. - Inspect and identify the reason of malfunctions. - Repair the mechanical defects. - Provide more capacity building programs.

ANNEX IX: LAND ACQUISITION DECREE

Palestinian National Authority
Palestinian Water Authority

السلطة الوطنية الفلسطينية
سلطة المياه الفلسطينية

Date 22/11/2012

معالي الأخ/ د. نبيل قسيس حفظه الله
وزير المالية
تحية البناء والدولة

الموضوع: وثائق تعويضات اصحاب الاراضي المستملكة لصالح مشروع انشاء محطة تنقية مياه عادمة لمحافظة الخليل

بخصوص الموضوع اعلاه، وبناءعلى قرار فخامة الرئيس محمود عباس الموقع بتاريخ 22/7/2005 استنادا الى قرار مجلس الوزراء رقم (05\18\9م.و.ا.ق) لسنة 2005 في جلسته المنعقدة بتاريخ 22/6/2005بخصوص نزع ملكية قطع الاراضي رقم 240،241،242،243 من الحوض رقم 8 في واد الدر والقطعة رقم 1151 من حوض رقم 2 في خلة المغربي والتي تم تعويض اصحابها من وزارة المالية. برجاء تزويدنا بوثائق تنازل اصحاب الاراضي السابقين عن ملكية الارض، لاهمية هذه الوثائق كشرط اساسي لموافقة الدول المانحة (البنك الدولي ووكالة التنمية الفرنسية والاتحاد الاوربي) لتمويل تنفيذ المشروع الذي تصل تكلفته 45 مليون دولار امريكي

المرفقات : صورة من قرار فخامة الرئيس
: صورة من قرار مجلس الوزراء
: صورة من قرار لجنة التخمين
: قائمة باسماء اصحاب الاراضي الذين تم تعويضهم

وتفضلو بقبول الاحترام،،،

د.شداد العتيلي
رئيس سلطة المياه

سلطة المياه الفلسطينية
الرقم:
التاريخ 22-11-2012
صادر

Ramallah Tel 02 242 9022, Fax 02 242 9341 Gaza Tel 08 282 7520, Fax 08 282 2697

PALESTINE LIBERATION ORGANIZATION
Palestine National Authority
The President

منظمة التحرير الفلسطينية
السلطة الوطنية الفلسطينية
الرئيس

الأستاذة هالة أبو طوى

قرار رقم ( ) لسنة 2005

بشأن استملاك قطع أراضي للمنفعة العامة

رئيس اللجنة التنفيذية لمنظمة التحرير الفلسطينية
رئيس السلطة الوطنية الفلسطينية

بعد الإطلاع على المادة (21) من القانون الأساسي لسنة2002 وتعديلاته،
وعلى المادة(4) من قانون الاستملاك رقم(2) لسنة 1953م المعمول به في المحافظات الشمالية،
وبعد الإطلاع على قرار مجلس الوزراء رقم (9/18/05/م.و/أ.ق) لسنة 2005،
وبناء على الصلاحيات المخولة لنا،
وتحقيقا للمصلحة العامة،

قررنا ما يلي:

مادة (1)

تنزع مطلقا ملكية قطع الأرض ذات الأرقام (240،241،242،243) من الحوض رقم (8) الموقع واد الدر والقطعة رقم (1151) من الحوض رقم (2) الموقع خلة المغربي من أراضي مدينة الخليل لصالح سلطة المياه الفلسطينية لغاية إنشاء محطة تنقية مياه عادمة لمحافظة الخليل على أن يتم وضع يد سلطة المياه عليها فوراً.

مادة (2)

على كل من يدعي بأي حق أو منفعة على قطع الأرض المشار إليها في المادة الأولى ويرغب في الحصول على تعويض أن يتقدم بطلب خلال شهر من تاريخ هذا القرار إلى سلطة المياه الفلسطينية للحصول على التعويض مبينا فيه الحقوق المدعى بها مرفقا بالمستندات المؤيدة لذلك.

PALESTINE LIBERATION ORGANIZATION
Palestine National Authority
The President

منظمة التحرير الفلسطينية
السلطة الوطنية الفلسطينية
الرئيس

مادة (3)

على أصحاب قطع الأراضي المذكورة في المادة الأولى أو المنتفعين بها أن يمتنعوا عن التصرف بها بأي نوع من أنواع التصرف وأن يبادروا برفع أيديهم عنها.

مادة (4)

على جميع الجهات المختصة، كل فيما يخصه، تنفيذ هذا القرار، ويعمل به من تاريخ صدوره ، وينشر في الجريدة الرسمية.

صدر في مدينة رام الله بتاريخ: 22/7/2005م

محمود عباس
رئيس اللجنة التنفيذية لمنظمة التحرير الفلسطينية
رئيس السلطة الوطنية الفلسطينية

بسم الله الرحمن الرحيم

السلطة الوطنية الفلسطينية

رئيس مجلس الوزراء

قرار مجلس الوزراء رقم (ر/09/18/م.و/أ.ق) لسنة 2005

بشأن استملاك قطع أراضي من أراضي الخليل لصالح سلطة المياه الفلسطينية لإنشاء محطة تنقية مياه عادمة لمحافظة الخليل

بناء على الصلاحيات المخولة لنا قانونا

وتنسيب وزير الزراعة/ سلطة المياه الفلسطينية

وبناء على مقتضيات المصلحة العامة

وبعد الاطلاع على قانون الاستملاك رقم (02) لسنة 1953 المعمول به في المحافظات الشمالية وتعديلاته

فقد قرر مجلس الوزراء في جلسته المنعقدة بمدينة نابلس بتاريخ (2005/06/22) ما يلي:

مادة (1)

تنـزع مطلقـاً ملكـية قطـع الأراضي المبينة في الجدول أدناه من أراضي الخليل لصالح سلطة المياه الفلسطينية لغاية إنشاء محطة تنقية مياه عادمة لمحافظة الخليل:

رقم القطعة	رقم الحوض	الموقع	المساحة المستملكة بالمتر المربع	اسم المـالك
242	8	واد الدر	22377	يوسف محمد إبراهيم أبو اسنينة
240	8	واد الدر	44826	حسن صبري عباس رجب صبري حسن موسى
241	8	واد الدر	7495	إبراهيم عباس إبراهيم أبو اسنينة
241	8	واد الدر	4845	عباس يعقوب عباس أبو اسنينة اسحق يعقوب عباس أبو اسنينة أيوب يعقوب عباس أبو استينة ياسين يعقوب عباس أبو سنينية
243	8	واد الدر	35895	محمد عيسى إبراهيم حسن موسى

بسم الله الرحمن الرحيم

السلطة الوطنية الفلسطينية

رئيس مجلس الوزراء

مادة (2)

على كل من يدعي بأي حق أو منفعة على المساحة المشار إليها في المادة الأولى ويرغب في الحصول على تعويض أن يتقدم بطلب خلال شهر من تاريخ هذا القرار إلى سلطة المياه الفلسطينية للحصول على التعويض مبيناً فيه الحقوق المدعى بها مرفقاً بالمستندات المؤيدة لذلك.

مادة (3)

على أصحاب الأراضي المذكورة أو المنتفعين بها أن يمتنعوا عن التصرف بها بأي نوع من أنواع التصرف وأن يبادروا برفع أيديهم عنها.

مادة (4)

يعرض القرار على رئيس السلطة الوطنية الفلسطينية للمصادقة عليه.

مادة (5)

على جميع الجهات المختصة تنفيذ هذا القرار كل فيما يخصه، ويعمل به اعتبارا من تاريخ صدوره.

صدر في مدينة رام الله بتاريخ 2005/06/22

أحمد قريع (أبو علاء)

رئيس مجلس الوزراء

Palestinian National Authority

The Land Authority

بسم الله الرحمن الرحيم

السلطة الوطنية الفلسطينية

سلطة الأراضي

No ...

Date : ...

الرقم : ٢٠٠٥/٢٧٥/٢/٩٥

التاريخ : ٢٠٠٥/١٩/١٧

الأخ فضل كعوش ... حفظه الله

رئيس سلطة المياه الفلسطينية

تحية الوطن وبعد

إشارة إلى كتابكم رقم WE/171/2005 بتاريخ 29 حزيران 2005 وبناء عليه فقد تم تشكيل لجنة لتخمين الأراضي المنوي استملاكها لغايات مشروع إنشاء محطات المعالجة لمياه المجاري / محافظة الخليل وبعد الكشف الحسي على الموقع الواردة بكتاب أمين عام مجلس الوزراء الصادرة رقم 2005/أ.ج.ب د/3984 بتاريخ 2005/6/26 وبكتابكم الوارد ذكره أعلاه قررت اللجنة وبالإجماع أن يكون سعر المتر المربع للقطعة المستملكة مايلي:

أ- القطع أرقام 240، 241، 242، 243 من الحوض رقم 8 المسمى واد الدار سعر المتر المربع الواحد خمسة دنانير أردنية.

ب- القطعة رقم 1151 من الحوض رقم 2 المسمى خلة المغربي سعر المتر المربع الواحد أربعة عشر دينار أردني.

وبناء على طلبكم نزودكم بهذا التقرير لاستكمال الإجراءات القانونية اللازمة وذلك حسب الأصول ووفقاً للقانون.

مع الاحترام

مدير عام سلطة الأراضي

صاحب ناظرات

نسخة / دائرة أملاك الدولة

نسخة / الملف.

السلطة الوطنية الفلسطينية
سلطة المياه الفلسطينية

Palestinian National Authority
Palestinian Water Authority

Date 22/11/2012

معالي الأخ/ د. نبيل قسيس حفظه الله
وزير المالية
تحية الدناء والدولة

الموضوع: وثائق تعويضات اصحاب الاراضي المستملكة لصالح مشروع انشاء محطة تنقية مياه عادمة لمحافظة الخليل

بخصوص الموضوع اعلاه، وبناءعلى قرار فخامة الرئيس محمود عباس الموقع بتاريخ 22/7/2005 استنادا الى قرار مجلس الوزراء رقم (05\18\19م.و.ا.ق) لسنة 2005 في جلسته المنعقدة بتاريخ 22/6/2005بخصوص نزع ملكية قطع الاراضي رقم 240،241،242،243 من الحوض رقم 8 في واد الدر والقطعة رقم 1151 من حوض رقم 2 في خلة المغربي والتي تم تعويض اصحابها من وزارة المالية. برجاء تزويدنا بوثائق تنازل اصحاب الاراضي السابقين عن ملكية الارض، لاهمية هذه الوثائق كشرط اساسي لموافقة الدول المانحة (البنك الدولي ووكالة التنمية الفرنسية والاتحاد الاوربي) لتمويل تنفيذ المشروع الذي تصل تكلفته 45 مليون دولار امريكي

المرفقات : صورة من قرار فخامة الرئيس
: صورة من قرار مجلس الوزراء
: صورة من قرار لجنة التثمين
: قائمة باسماء اصحاب الاراضي الذين تم تعويضهم

وتفضلو بقبول الاحترام،،،

د.شداد العتيلي
رئيس سلطة المياه

ANNEX X: ENVIRONMENTAL DOCUMENTATION AND REVIEW REPORT – HEBRON WWTP ACCESS ROAD & UTILITIES - USAID

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FROM THE AMERICAN PEOPLE

ENVIRONMENTAL DOCUMENTATION AND REVIEW REPORT

HEBRON WWTP ACCESS ROAD & UTILITIES

21 MAY 2014

This publication was produced for review by the United States Agency for International Development. It was prepared by Black & Veatch.

ENVIRONMENTAL DOCUMNETATION AND REVIEW RPORT

HEBRON WWTP ACCESS ROAD & UTILITIES

USAID | WEST BANK/GAZA
FROM THE AMERICAN PEOPLE

Environmental Documentation

A. Applicant information

Contractor/grantee(organization) Black & Veatch	Parent grant or project **Infrastructure Needs Program II (INP II)**
Individual contact and title **Christian Decker** **Chief of Party**	Address, phone & email (if available) **Black & Veatch** **West Bank / Gaza INP II Program Office** **Louis Building, Ras Al Tahuna Street,** **Al Bireh, West Bank** **Tel: 02 2947800** **Fax: 02 2402288**
Activity (brief description) ***The City of Hebron (City) is served by a combined sewer system with majority of the population connected to the system. Currently, most of the municipal sewage entering the system from the City and surrounding area is discharged directly to the Wadi as-Samen, south of the City.*** ***Activities of this project will be divided into phases, as appropriate for sustainability of the project works, and are limited to:*** • ***Road work: Rehabilitation of the approach to the wadi route (existing local road off the Hebron – Yatta Road) to the WWTP fence-line.*** • ***Water supply pipe: Installation of 4-inch water pipe within existing local road (for future PWA pipeline expansion) to a 2-inch pipeline at the wadi junction to the WWTP fence-line.*** • ***Electrical supply: Installation of electrical line from the nearest high voltage tower to the WWTP fence-line with transformer according to WWTP's required power needs.*** • ***Main sewer pipeline: Extension of the existing main sewer pipeline from the last manhole to reach the WWTP proposed site.***	Amount **US $**

Location of activity	Start and end date of activity
Hebron Governorate	**2014**

B. Activities, screening results, and recommended determination

TABLE 1		**Screening result** (Step 3 of instructions)			**Recommended Determinations** (Step 6 of instructions. Complete for all moderate and high-risk activities)		
Project	**Activity**	**Very Low Risk**	**Moderate Risk**	**High Risk**	**No significant adverse impact**	**mitigation, no significant adverse**	**Significant Adverse impact**
Hebron WWTP Access Road & Utilities	1. Planning and design phase	X			X		
	2. Site preparation		X			X	
	3. Excavation		X			X	
	4. Rehabilitation of road access		X			X	
	5. Installation of water pipeline		X			X	
	6. Installation of electrical supply		X			X	
	7. Extension of sewer pipeline		X			X	

C. Summary of recommended determinations (check all that apply)

	The activity contains. . .	*(equivalent regulation 216 terminology)*
★	Very low risk sub-activities	*categorical exclusion(s)*
★	After environmental review, sub-activities determined to have **no significant adverse impacts**	*negative determination(s)*
★	After environmental review, sub-activities determined to have **no significant adverse impacts, given appropriate mitigation and monitoring**	*negative determination(s) with conditions*
☐	After environmental review, sub-activities determined to have **significant adverse impacts**	*positive determination(s)*

D. Certification:

I, the undersigned, certify that:

1. The information on this form is correct and complete
2. The following actions have been and will be taken to assure that the activity complies with environmental requirements established for the Infrastructure Needs Program under the Code of Federal Regulations 22 CFR 216:
   - These design elements and best practices will be followed in implementing this activity, except with the approval of USAID.
   - Any specific mitigation or monitoring measures described in the attached information will be implemented in their entirety.
   - Compliance with these conditions will be regularly confirmed and documented by on-site inspections during the activity and at its completion.

Nimya Santiago — (Signature)

28 May 2014 — (Date)

BELOW THIS LINE FOR USAID USE ONLY

Approval

USAID Project Officer ☑ Approved ☐ Rejected	(print name) Sophie Tainter	(signature)	August 1, 2014
USAID MEO ☒ Approved ☐ Rejected	(print name)	(signature)	Aug. 1, 2014

USAID comments: (if documentation is rejected, comments must be provided to applicant)

Contents

ENVIRONMENTAL REVIEW

Hebron WWTP Access Road & Utilities

The City of Hebron (Hebron) is served by a combined sewer system with the majority of the population connected to the system. Currently, most of the municipal sewage entering the system from Hebron and surrounding area is discharged directly to the Wadi as-Samen, south of Hebron.

Hebron wastewater management project is one of the major projects funded by the World Bank and Agence Francaise de Developpement (afd). USAID has agreed to assist in the construction of the access road, including utilities.

A major benefit of this project is the separation of the raw sewer water from the storm water and the potential treatment of the municipal sewage, minimizing the impact of the eastern aquifer and communities along the wadi.[1]

1. SUMMARY OF ACTIVITY AND ENVIRONMENTAL DETERMINATION

The proposed Hebron wastewater treatment plant (WWTP) access road and utilities project will start south of the Hebron Industrial Zone and Road 60, on the Hebron – Yatta Road, then west through the village of Halit Addar on the existing local road that leads to the village of Qelqes, and connecting at Wadi as-Samen at approximately 700 meters from the start of the local road (see Annex 1 for the project Key Map).

The WWTP access road will continue along Wadi as-Samen (wadi alignment), ending at the fence-line of the proposed WWTP. In addition, the wadi alignment will also act as the utility corridor and will accommodate the WWTP project utilities: water, sewer, and electric.

Activities of this project will be divided into phases, as appropriate for sustainability of the project works, and are limited to:

- Road work: Rehabilitation of the approach to the wadi route (existing local road off the Hebron – Yatta Road) and opening of the wadi alignment to accommodate future construction and operational traffic to safely access the WWTP.
- Water supply pipe: Installation of a water pipe to connect with existing water distribution network pipeline to the WWTP fence-line.
- Electrical supply: Installation of the electrical line, to be installed by the Hebron Electrical Distribution Company from the nearest high voltage tower to the WWTP fence-line.
- Main sewer pipeline: Extension of the existing main sewer pipeline from the last manhole to the WWTP fence-line.

After environmental review, the sub-activities were determined to have no significant adverse impacts, given appropriate mitigation measures and monitoring to ensure compliance.

[1] *Environmental, Social, and Cultural Heritage Impact Assessment (ESCHIA) to Support the Hebron Governate Wastewater Management Project*, the World Bank and Agence Francaise de Developpement (afd), 28 May 2013.

2. ACTIVITY DESCRIPTION

The proposed project is to provide an access road and all utilities: electricity, water supply and sewer main pipe from its existing source to the proposed Hebron wastewater treatment plant (WWTP) fence-line.

See Annex 1 for the key map of proposed project activities.

3. ENVIRONMENTAL INFORMATION AND FIELD INVESTIGATIONS

Information on potential impacts of project-work activities was gathered with a desk review and field investigation.

Desk Review

An Environmental, Social, and Cultural Heritage Impact Assessment (ESCHIA) was completed by the World Bank and Agence Francaise de Developpement (afd) on 28 May 2013 (see Annex 2). This report encompassed all areas within the proposed WWTP and sewer system.

Per the ESCHIA desk review, these items were identified as potential issues of concern for the overall WWTP project and required further on-site investigation for the proposed road access and utilities project:

- Indigenous Palestinian plants: Hawthorn, pistachio, and olive trees, and
- Relic stone terraces and caves.

In addition, an Archaeology Assessment of the proposed WWTP project area was conducted by CH2MHILL in 2005 (see Annex 3). Three sites were identified that required further on-site investigation for the proposed road access and utilities project:

- Former stone structure and cistern,
- Recent circular stone enclosure above a cave, and
- Small natural rock niches.

Field Investigation

In addition to the ESCHIA desk review, on 15 April 2014, a field survey of the system components was performed by the Black & Veatch (B&V) team and Hebron Municipality engineers to determine the existing environmental situation and evaluate the future impact of the work at the proposed project site.

The existing physical and natural environment was investigated for all project elements including, but not limited to: land use and land cover, biodiversity, hydrology and water resources, and archeology.

The following observations in Table 1 were made after conducting the necessary field investigations. Photographs from the field investigation can be found in Section 9.0 at the end of this report. And a discussion of the alternative project sites proposed by the Hebron Municipality (Municipality) is provided in Section 5.0.

Table 1: Field Observations and Potential Environmental Impacts

Potential Impact	Field Observation
Cumulative Impact	• Currently there are no known projects that coincide with the proposed WWTP access road and utilities project activities • PWA plans to upgrade the existing water supply network in the area, but the project is currently on hold due to permitting issues
Land Ownership and Land Use	• Agricultural lands (limited: vegetables, grape vines and olive trees) • Residential homes • Small businesses • Stone quarry
Existing Infrastructure	Khalit Addar village utility lines: • Aboveground: electrical and telephone • Underground: water, sewer (non-municipal)
Disturbances	• Residences and small businesses • Local vehicle traffic
Public health and Safety	• Residents of Khalit Addar • Vehicle traffic (low-volume) on local existing road connecting Khalit Addar and Qelqes villages to Hebron and Yatta
Groundwater Quality and Quantity	Potential for contamination: • WWTP proposed location is part of the unconfined Western Mountain Aquifer Basin and is considered to have fissures or sinkholes or streams within the limestone (ESCHIA 2013) • Wadi as-Samen currently receives the outflow of the municipal and surrounding villages' sewer water
Surface Water	• Wadi as-Samen – natural open wadi channel that receives approximately 15,000 cubic meters of raw sewage discharge from Hebron and Qiryat Arab and industrial stone-cutting waste (ESCHIA 2013) • Stone terraces act to contain storm water for agricultural use • Functional water cistern (not within proposed alignment - see Archaeological and Cultural Heritage)
Soil Quality and Quantity	• Soil excavations shall be investigated for suitability for reuse or refill • Soil excavations within the wadi alignment shall remain in the same vicinity in case of contamination from the untreated raw sewer water

Flora and Fauna	• No Hawthorne or pistachio trees were observed • White Stork[2], commonly referred to as Abu-Laban (non-endangered, common, migratory species), were seen flying above and landing within Wadi as-Samen
Archaeological and Cultural Heritage	• Stone structures and functional water cistern were identified opposite side of the proposed wadi access road and utilities alignment, approximately 700 meters from the wadi road junction • Stone niches or caves within the hillside west of the proposed access road were identified
Landscape and Aesthetic View	• Agricultural open lands and stone terraces • Stone-faced hillsides • Abu-Laban birds (see Flora and Fuana)

[2] BirdLife International (2012). "*Ciconia ciconia*". *IUCN Red List of Threatened Species. Version 2013.2.* International Union for Conservation of Nature. Retrieved 26 November 2013.

For the potential concerns observed and anticipated, it is foreseen that short-term impacts will occur during the project-work activities as identified in Section 4.0; these and other potential pre-, construction, and post-construction impacts are manageable and can be mitigated with the proper measures listed in Section 8.0.

However, the long-term beneficial impact shall be with the separation of the sewage from the storm-water outflow into the wadi, and potentially treated, for the overall health of humans and the environment.

A summary of the potential impacts and their significance after proper mitigation measures and actions are performed can be found in Annex 4. A complete table of the Mitigation and Monitoring Plan (MMP) can be found in Annex 5.

4. EVALUATION OF POTENTIAL ENVIRONMENTAL IMPACT

The impacts summarised hereinafter include those that would potentially occur during the construction phase and contracting activities, and may extend to some impacts that need to be considered when put into operation (see Annex 4 for Potential Impact Significance table).

Land Ownership

The PWA provided a letter to the World Bank stating ownership of the land for the WWTP (Annex 6). In addition, the Municipality has acquired signatures from the landowners within the wadi alignment for its use as a WWTP access road and utility corridor (Annex 7).

Impacts from these project activities will be long-term for changes in land ownership and of low significance after proper mitigation measures and actions are performed. However, project activities will have a long-term, beneficial impact on a regional level with the operation of the WWTP.

Current Land Use Conditions

The proposed access road will start south from the Hebron Industrial Zone and Road 60 on the Hebron – Yatta Road, then west through the village of Khalit Addar on the existing local road (local road) that leads to the village of Qelqes, and connecting at the wadi at approximately 700 meters from the start of the local road.

The village of Khalit Addar is a small rural community with residential homes, concrete walls and metal barriers, small businesses, and open agricultural areas on both sides of the local road for approximately 200 meters from the turn-off of the Hebron – Yatta Road. It then opens up to rocky and agricultural lands with mainly vegetables, grape vines, and olive trees dispersed along the landscape, in addition to stone quarry cuts within the hillsides and residential homes.

Approximately 700 meters from the Hebron – Yatta Road turn-off, a dirt road crosses over to the wadi. The wadi is dirt-filled, for agricultural use, until the first manhole of the existing main sewer line, then the storm water and sewage flows openly into the wadi channel. There is evidence of stone-cutting slurry from past overflow along its banks.

This then reaches to the proposed WWTP site fence-line, which is marked by the start of a patch of olive trees.

Impacts from these project activities will be short-term, during pre- and construction activities and of low significance after proper mitigation measures and actions are performed. However, project activities will have a long-term, beneficial impact on a regional level with the operation of the WWTP.

Existing Utilities and Proposed Utility Project Works

The proposed water and electrical line will extend from existing sources in Khalit Addar to the fence-line of the proposed WWTP site (see Annex 1). The proposed water line will be a 4-inch pipe from the village to the wadi access road junction to anticipate for PWA's future pipeline extension plans. At the wadi access junction, the pipe will be a 2-inch line to accommodate the potable water needs of the WWTP.

The village of Khalit Addar has non-municipal sewer lines that connect to the main municipal sewer line. Since these sewer lines are non-municipal, it is assumed that cesspits may be associated with some of the residential homes in the village (see Groundwater Quality).

The main sewer line will connect from the last manhole within the wadi, also to the fence-line of the proposed WWTP site (see Surface Water for description of Wadi as-Samen).

Impacts from these project activities will be short-term, during pre- and construction activities and of medium significance after proper mitigation measures and actions are performed. However, project activities will have a long-term, beneficial impact on a regional level with the operation of the WWTP.

Groundwater Quality and Quantity

Groundwater Quality

Per the 2013 ESCHIA, it is reported that:

> …7 groundwater wells [are] located 3.5 to 4.5 km south and south-west of the proposed site, [4] of which are used for pumping water for domestic use…The HWWTP site is located in the Western Mountain Aquifer Basin (WMAB)…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...The WMAB is considered as a highly karstic aquifer; with a general thickness ranging between 600 and 1000 meters.

Since the WMAB is considered to be "karstic" or with fissures or sinkholes or streams within the limestone, and the proposed site location is part of an unconfined aquifer basin that contains raw sewage flow, it is important that water quality testing be performed on the domestic water supply prior to discharge into the network system. In addition to the complete water quality suite of tests, fecal coliform and arsenic needs to be tested.

To ensure that the groundwater quality provided is within PWA's and World Health Organization's standards, the PWA informed B&V that the PWA, with its associated partners: WBWD and Ministry of Health (MoH), has a monitoring program process in place to: 1) test and confirm the water quality and 2) address the community's concerns.

In addition to PWA's monitoring program, it is important that the community draft and implement a water safety plan specific for the area and address the potential project impacts during construction and operation of the system.

Spillage of raw sewage and oil from the construction site and construction equipment may impact the groundwater systems if continuous or in large quantities, during the construction phase, if not properly managed and disposed at an approved location.

Currently, there is a non-municipal sewer network within Khalit Addar village. Since this is not an official municipal line, it can be assumed that some existing residential homes may still be connected to cesspits. Therefore, prior to excavation, it needs to be identified if cesspits are within the project-site work activities. Damaging cesspits during construction is a major environmental concern, typically regarding groundwater quality and public health.

If cesspits are located, special consideration must be taken during excavations for the installation of the water pipeline and electrical line, to avoid damaging potential domestic cesspits. Cesspits do already impact the water quality due to raw sewage infiltration; however, damage maybe a cause of unpredicted accelerated infiltration rate and thereafter an expedited impact on groundwater quality, and therefore public health.

Installation of the water pipeline should be safely away and uphill from any identified cesspits or sewer lines in case of aging and corrosion of pipes and/or illegal connections damaging the water pipeline.

Groundwater Quantity

PWA, and the WBWD, states the quantities from the available water well source are sufficient for the current residents and the proposed WWTP potable use. The water source is the Bani Naim loop, which is a 20-inch trunk line that is owned by PWA and WBWD. The trunk line is supplied by the PWA ground wells and reservoir.

According to the Hebron WWTP design assumptions of 14 on-site staff utilizing 100 liters per capita per day, the minimum required demand for potable water will be approximately 1.5 m^3/day, to not exceed 7 m^3/day for future plant use.

Potable water demand for the WWTP will be low because potable water is needed only for personal use of the plant facility staff. It is anticipated that the quantity is similar to other places with no greater load than the other domestic demands anticipated along a 2-inch network.

However, the plant will be still able to function if no potable water is supplied to the plant through the installed water pipes. Potable water can be trucked and placed in water holding tanks for the plant's domestic needs.

In addition, for facility functions that do not require potable water, such as toilet water, re-circulated, treated effluent water can be used.

Temporary high water consumption during construction for soil conditioning and compaction and filling the structures for testing will be supplied by the contractor through tanker trucks and other temporary sources. Once completed, a plant water system using plant effluent will provide for all process water and plant operational needs.

It should be noted that future demand may require additional supply, along with the WBWD managing the supply and the demand. The ESCHIA identified the "western part of Hebron Governorate is located in a

recharge area of the WMAB which characterized by high sustainable yield" (see Groundwater Quality above), but "the groundwater wells in the area are very limited due to Israeli constraints on the Palestinian water resources."

Impacts to the groundwater are to be short-term during construction activities with regional, low significance after proper mitigation measure and actions are taken, but long-term, regional, benefit once wastewater is properly treated.

Surface Water

The main surface water within the proposed project location is Wadi as-Samen.

A preliminary drainage study was conducted by B&V for a 100-year storm. The preliminary results indicate that the 100-year flood elevation is approximately 1 to 2.5 meters above the lowest surveyed data, which is the top of the narrow channel and outwards from that point up the hillside. The potential impacts to the road will primarily be near the existing roadway (to the north) because it might be close to the flood elevation. Downstream towards the WWTP proposed site, it will be above the flood elevation as the proposed wadi access road alignment runs up the side of the hillside on the east side of the wadi.

Currently, 15,000 cubic meters of the municipal sewage from the city of Hebron and the surrounding area, in addition to industrial stone-cutting waste, is estimated to be discharged directly to the wadi (ESCHIA 2013).

The flow can be seen after the last sewer manhole within the wadi. Where the main sewer pipeline is laid, the land dries up and becomes available for agricultural use. Since the Abu-Laban are migratory, they will move to the next shallow water source.

It is anticipated that water resources should improve or not further deteriorate with the implementation of this project in coordination with the WWTP and sewer system. Therefore, providing a healthier environmental for all that are impacted by the wastewater and storm water streams.

In addition, stone terraces in the surrounding area are acting as retaining structures to capture the storm water for agricultural use.

Impacts are short-term, during construction work activities, and medium significance, especially working within and around open wastewater after mitigation and monitoring actions are performed. With proper design, drainage to anticipate for a 100-year flood elevation can be implemented. Long-term benefit will be once the storm water is separated from the wastewater. Agricultural land will become available, and the Abu-Laban should have a clean, downstream, shallow water source.

Soil Quantity and Quality

Since Wadi as-Samen receives raw sewage discharge from Hebron and Qiryat Arab (see Surface Water), the soils within, and in close proximity to, the wadi are potentially contaminated from untreated raw sewer water. Therefore, excavated soil from the wadi access road alignment shall remain in the same vicinity. However, excavation performed outside the wadi access road alignment shall be investigated for suitability for reuse or refill.

Potential impacts are short-term, during construction work activities. Low significance for soils outside the vicinity of the wadi and medium significance for soils within the wadi vicinity, after mitigation and monitoring actions are taken.

Flora or Fauna

It is anticipated that no flora will be affected during construction of the proposed facilities in this project. No Hawthorn or pistachio trees were observed during the field investigation. Local community member mentioned that these trees may be at higher elevations than the proposed project site.

No other biological resources were identified in the ESCHIA; however, during the site visit, white storks, or commonly called Abu-Laban were seen flying and landing within Wadi as-Samen. These birds may use the wadi as a nesting area.

Building the sewer line may potentially dry out the wadi channel, potentially causing the Abu-Laban to migrate further down the wadi or to another location that will provide shallow water for its nesting needs.

However, the development of the proposed project site should not disturb or interfere substantially with the movement of other native resident wildlife species, when mitigation measures have been included if potential issues arise during construction work activities.

Therefore, impacts are to be short-term, during construction work activities and of low significance after mitigation and monitoring actions are performed. And a long-term benefit, especially for the Abu-Laban, and all species that interact or use the wadi, when the sewage water is separated from the storm water.

Historical and Cultural Heritage

As noted in the CH2MHILL 2005 Feasibility Study (see Annex 3), former stone structures and a functional cistern were identified on the opposite side of the proposed wadi access road and utilities alignment, approximately 700 meters from the wadi road junction. In addition to small natural rock niches or caves on the hillside, northwest of the proposed WWTP site location. The recent circular stone enclosure above the cave was not identified within the proposed access road and utilities project site vicinity, but described by the Municipality to be on the hillside southeast of the proposed WWTP site location, and away from the proposed wadi access road.

With the proposed wadi access road and utilities alignment on the opposite side of the sites identified and outside the vicinity of the circular stone enclosure, impacts will be of low significance after proper mitigation and monitoring actions are performed.

It was stated in the ESCHIA that are potentially historical or cultural stone relics. Agricultural-terraces can be seen throughout the landscape; however, these were noted by the Hebron Archeological Department to be agricultural and not historical or cultural relics (see Annex 8).

No other special considerations were identified in the Feasibility Study and ESCHIA, or during the site visit.

However, mitigation measures have been included if potential issues arise during construction work activities. If archaeological sites are uncovered, construction shall cease immediately in the area until the Hebron Archeological Department and Ministry of Tourism and Antiquities is contacted and the site is evaluated.

Therefore, impacts are to be short-term, during construction work activities and of low significance after mitigation and monitoring actions are performed.

5. PROJECT SITE ALTERNATIVES

Technically-Viable Road-Access Route and Alternatives

Throughout the scoping of the project, the B&V team considered technically-viable alternatives provided by the Municipality for the road access route. Finalizing the access road then allowed for the utilities route to be identified by the Municipality.

Below is a summary of the road access route and alternatives:

Road Access Route and Alternatives Summary

Three access routes to the WWTP was assessed: 1) municipal-planned road that goes through a village and open agricultural lands, with some residential homes; 2) Wadi as-Samen alignment, which goes through open land from an existing road south of the Hebron Industrial Zone and Road 60; and 3) main Qelqes road from Road 60, southwest from the proposed WWTP site.

All three options faced land ownership approval issues. However, the access road that was chosen by the Municipality, with land ownership agreement, was Option #2: Wadi as-Samen.

Reasons remaining routes were not chosen:

- Municipal-planned agricultural road was met with disapproval from the local residents on 14 November 2013; therefore, this option was removed at USAID and Municipality's decision.
- Approximately 500 meters from Road 60 on the main Qelqes road is within Area C. On 30 March 2014 a meeting was held with the Israeli Civil Administration (ICA) for approval of the road design within Area C. The ICA stated that since the section of the road is not within a master plan, it will not consider any design until a master plan is completed.

6. MONITORING

The ENGINEER responsible for managing this program (construction management contractor) will be responsible for periodic monitoring of the environmental aspects and compliance with the mitigation measures of this program.

7. RESPONSIBLE PARTIES

It is the CONTRACTOR's responsibility to take into account all the construction-related mitigation measures listed in this report: pre-construction and during construction. And it is the ENGINEER's responsibility to monitor and document any departure changes in scope of this project from any of the terms and conditions stated in this report. Both CONTRACTOR and ENGINEER are the primary responsible parties for the mitigation and monitoring tasks; however, both shall adhere to informing and coordinating with all applicable stakeholders with relevance to their corresponding mandates.

8. MITIGATION MEASURES AND MONITORING PLAN (MMP)

The CONTRACTOR shall read, consider, and comply with the Mitigation and Monitoring Plan (MMP) for this project. The CONTRACTOR shall act responsibly to provide notification of CONTRACTOR'S schedule to enable the ENGINEER to carry out his responsibilities.

The CONTRACTOR shall designate an environmental coordinator. This individual(s) shall have knowledge of environmental issues that include, but not limited to: biology, cultural resources, soil erosion, dust control, topsoil preservation, topsoil restoration, biological and cultural sensitivity training.

This individual(s) shall be responsible to:

- Coordinate the CONTRACTOR'S work related to compliance with environmental mitigation measures.
- Work closely with the ENGINEER to ensure that the CONTRACTOR thoroughly understands the mitigation and monitoring requirements for implementation.
- Work closely with the ENGINEER to ensure that the CONTRACTOR modifies or incorporates necessary mitigation actions and monitoring plans to reflect on-site field conditions.

The mitigation measures, monitoring plan, frequency and responsible party is identified in the sections below and summarized in an MMP table (see Annex 8).

8.1 PRE-CONSTRUCTION PHASE

8.1.1 Land Ownership

Potential Impact: Construction works could potentially be on private land

Mitigation Measures:

- Conduct village meetings informing right-of-way activities
- Use planning maps and protected zones to mark right-of-way
- Address and resolve village concerns before physically widening the road
- Locate or obtain land ownership and approvals to land acquisition

Monitoring Action:

- Record comments or issues provided by the community and resolution
- Document and record land ownership and approvals

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER, in coordination with local authority

Monitoring Frequency: As needed

8.1.2 Current Land Use Conditions

Potential Impact: Agricultural and residential lands; small businesses and start of stone quarry

Mitigation Measures:

- Conduct meeting with Municipality to ensure compliance with local plans and land categories
- Delineate and preserve land use categories to avoid a major shift in land use patterns
- Conduct meeting and walk-through with village residents and landowners to ensure they are informed of the project
- Identify right-of-way with municipality, residents, and landowners and address and resolve village concerns
- Inform landowners if private property is within right-of-way or obstructs project-site construction activities and Municipality to open the road to designated right-of-way
- Preserve original site characteristics, agricultural patterns and practices, whether irrigated or rain fed, in the areas where they are practiced
- Protect trees and plants (including root system). However, if it is necessary to uproot any plant or tree, then it should be replanted in a location that is agreed upon by the appropriate authorities and landowners and that would not be affected by the projects at any stage (construction, operation and maintenance).
- Filling, excavating, trenching, or stockpiling of materials shall not be permitted in the private vegetation areas, except as approved by the landowner
- Minimize excess dust to avoid damage to property, cultivated vegetation, or domestic animals, or cause a nuisance to persons living in or occupying buildings in the vicinity of the site.
- Utilize truck covers over loads to prevent dust migration from loads in transit
- Dust control measures, such as wetting, should only be used if it becomes a nuisance to persons or a thick film of dust covers private property
- Restore to original site characteristics after the projects are completed as much as practical

Monitoring Action:

- Document consultation with landowners and/or local council prior to removal of any object and its resolution
- Verify and document land for construction activities using land use and planning maps, as well as design alignments
- Monitor and document dust generation and actions taken when dust begins to cover private property – include photographs before and after clean up
- Take same-point vantage photographs to ensure site restoration back to original characteristics as much as practical

Monitoring Responsibility:

- Monitoring – Municipality Contractor
- Oversight – Municipality Engineer, in coordination with local authority

Monitoring Frequency: Daily

8.1.3 Cumulative Effect of the Proposed Action

Potential Impact: Continuous public and worker health and safety and environmental impacts, along with destruction to completed project(s)

Mitigation Measures:

- Conduct meetings with local authorities to understand the strategic developmental vision of the area
- Collect information about projects that may coincide with the proposed project in hand
- Prepare integrated development plans so that projects integrate seamlessly and contribute to one another. This would eliminate redundant facilities and provide mechanisms to avoid or mitigate impacts
- Coordinate all development actions and construction efforts with local authorities in order to minimize the impacts of each project and create synergistic benefits
- Coordinate amongst the various construction crews if two or more projects involve excavation in the same area to minimize environmental disturbances. This also applies to activities of multiple projects that may require the use of similar local resources or use of energy

Monitoring Action:

- Conduct project scope review and report on type, location, time, duration, and overlaps of project activities
- Meet and document stakeholders proposed or current project activities

Monitoring Responsibility:

- Monitoring and Oversight – ENGINEER, in coordination with local authority

Monitoring Frequency:

- One-Time – Pre Construction
- As-needed – Coordination activities through life of the project

8.2 CONSTRUCTION PHASE

8.2.1 General Health and Safety

Potential Impact: Health and safety of residents, public and construction workers

Mitigation Measures:

- Prepare and submit a safety plan for Engineer's approval – submit plans as part of the bid proposal
- Provide measures to define and isolate construction zones by using warning signs, pylons, fencing, and ribbon barriers
- Take appropriate measures to prevent unauthorized persons from entering the work area
- Implement safety measures to protect people from injury and adjacent property from damage
- Provide temporary bridges, safe pathways, handrails and any other safety measure during the road construction to protect the road users from injuries as appropriate and needed
- Provide temporary shoring as appropriate and needed.
- Inform residents of work schedules as well as with the management plans prepared by the contractor
- Identify locations of the hospitals and clinics nearest to the construction site, in case of illness or a construction accident.
- Provide adequate hearing protection, hard hats, safety goggles, brightly colored vests, and other appropriate safety equipment to protect workers and visitors from injury
- Maintain portable toilet, with hand washing area, to avoid leaks or spills to the surrounding area
- Dispose of waste and refuse properly

Wadi as-Samen and open raw sewer water

- Avoid or minimize physical contact and/or construction
- Ensure workers have proper vaccinations required when working in raw sewer (consult health professional)
- Provide workers with appropriate "water-proof" personal protective safety equipment (PPE) that at a minimum covers: eyes, mouth, hands, feet, and body that potentially will be in contact with the raw sewer water
- Instruct and train all workers to safely remove equipment and to securely wrap and properly dispose prior to leaving the construction site
- Clean carefully machinery and/or tools used within the open raw sewer water prior to leaving the construction site
- Follow these activities to not spread the raw sewer water and/or contaminate soil

Monitoring Action:

- Record when the public was informed of work schedules and management plans
- Document any concerns and its resolution with work schedules and management plans
- Conduct and document with checklists site inspections
- Document and report potential health and safety concerns

8.2.1 General Health and Safety (Continued)

Wadi as-Samen and open raw sewer water

- Record vaccinations taken by workers
- Conduct site visits and document that workers are properly wearing their PPE
- Document the removal of PPE and its disposal
- Document any complaints and resolutions working near or within Wadi as-Samen

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER, MoL, MoH, EQA, and MoPWH

Monitoring Frequency: Daily

8.2.2 Private Property

Potential Impact: Agricultural lands: vegetable, grape vines, olive tree; residential homes, small business and start of stone quarry

Mitigation Measures:

- Utilize Municipality designated right-of-way identified and opened in pre-construction phase
- Protect trees and plants (including root system). However, if it is necessary to uproot any plant or tree, then it should be replanted in a location that is agreed upon by the appropriate authorities and landowners and that would not be affected by the projects at any stage (construction, operation and maintenance).
- Filling, excavating, trenching, or stockpiling of materials shall not be permitted in the private vegetation areas, except as approved by the landowner. Whenever possible, excavated materials should be reused as fill, re-shaping, or restoration purposes within the same vicinity
- Minimize excess dust to avoid damage to property, cultivated vegetation, or domestic animals, or cause a nuisance to persons living in or occupying buildings in the vicinity of the site
- Cover over loads in haul trucks to prevent dust migration from loads in transit
- Use dust control measures, such as wetting, only if dust becomes a nuisance to persons or a thick film covers private property
- Maintain portable toilet to ensure no leaks or spills to the surrounding area
- Dispose of waste and refuse needs to be properly disposed
- Store construction materials, equipment, and waste in approved and designated area
- Restore original site characteristics after the project activities are completed as much as practical

8.2.2 Private Property (Continued)

Monitoring Action:

- Document consultation with landowners and/or local council prior to removal of any object
- Monitor dust generation and actions taken when dust begins to cover private property –include photographs prior to and after clean-up
- Take same-point vantage photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical

Monitoring Responsibility:

- Monitoring - CONTRACTOR
- Oversight – ENGINEER, in coordination with local authority

Monitoring Frequency:

- Daily – Work activities in close proximity to private property
- Periodically – Same-point vantage photographs

8.2.3 Soil Quantity and Quality

Potential Impact: Soil will be disturbed, potentially causing erosion and contamination during construction work activities, especially while working within Wadi as-Samen

Mitigation Measures:

- Take pictures before excavation to restore the original site characteristics, as much as practical
- Install and maintain soil erosion and sediment control measures, such as swales, grade stabilization structures, dikes, waterways, filter fabric fences, and sediment basins, until erosion concerns are eliminated
- Use of topsoil for compaction during or after replacement over the retaining walls and any graded areas, except where necessary to prevent erosion, is not allowed
- Store and replace, in its original locations, topsoil from all graded or excavated areas that support or could support vegetation
- Prevent fuel and oil leaks by continuous check of their sources
- Provide well-maintained construction vehicles and machinery, in order to minimize pollutant emissions
- Control the movement of machinery within the project boundaries
- Abide by the local laws concerning weights and speeds of vehicles that transport construction materials to and from construction and storage sites, in order to minimize environmental hazards or excess dust generation
- Ensure no sanitary, oil, hazardous materials, and any other possible contaminants will be spilled or buried in the sites areas in order to protect from soil contamination.
- Ensure staging areas used in this project are fenced and clearly marked by the contractor prior to construction activities.
- Clean the storage and staging areas and restore them to the original conditions.

8.2.3 Soil Quantity and Quality (Continued)

Mitigation Measures (c0ntinued):

- Replace excavated materials for back filling would be conducted in a manner that restores the ground surface to its original elevation and that the top 0.6 meter of any excavated trench is filled with original materials. In addition, no new soil should be brought to the site which may change the characteristics of the top soil, hence influencing the flora and fauna
- Moving or using soil for construction activities taken from Wadi as-Samen exposed to open raw sewer water is prohibited

Monitoring Action:

- Take same-point vantage photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical
- Document soil placement if moved from original site

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER

Monitoring Frequency:

- Daily – Work activities
- Periodically – Same-point vantage photographs

8.2.4 Existing Infrastructure

Potential Impact: Damage to aboveground and underground utilities

Mitigation Measures:

- Conform to site survey results, predicted and plotted utilities structures as provided in the design. Where unpredicted utility structures emerge during the course of work, proper mitigation measures shall be applied to avoid damage as practical as it can be. If not possible, suggest new locations or routes in coordination with the design team and local authorities
- Abide by the local laws concerning weight and speed of vehicles that perform the construction and transport of materials to and from the construction, storage and quarry sites.
- Work efficiently and within an expedited schedule for implementation and rehabilitation. In addition, coordinate with the relevant authorities and local residents
- Damage done to existing facilities (especially cesspits) during construction would be the responsibility of the contractor for repair or replacement to previous conditions
- Coordinate with the relevant authorities and local residents if damage to existing utilities occur
- Provide emergency services for the residents in association with local municipalities/councils if any accidental damaged in public utilities and services occurs

8.2.4 Existing Infrastructure (Continued)

Monitoring Action:

- Consult site survey results and design layout for existing utilities
- Document on-site checks on potential hazards where fragile infrastructure utilities exist
- Document accidents and their resolutions

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER, in coordination with local authority

Monitoring Frequency:

- Daily – Work activities
- Periodically – Consult survey results and design layout
- As-needed – Repair or replacement of damage facilities

8.2.5 Surface Water and Water Bodies

Potential Impact: Project work activities, storage close to the wadi, or improper disposal of construction materials may block natural flow of Wadi as-Samen

Mitigation Measures:

- Provide approved designated protected areas for storage of spoil and excavated materials
- Remove and transport waste materials that are not suitable for reuse to designated and approved disposal sites in an environmentally safe manner
- Identify all agricultural wells and protect from project work activity, storage, and materials
- Do not burn waste materials of any type
- Minimize project work activities that will create stagnant water bodies. Address stagnant water bodies if created
- Ensure no sanitary, oil, hazardous materials, and any other possible contaminants will be spilled or buried in the sites areas in order to protect the ground water or surface water

Monitoring Action:

- Document any potential concerns for spills and stagnant water body creation and its resolution
- Take photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical.

Monitoring Responsibility:

- Monitoring – Contractor
- Oversight – ENGINEER

8.2.5 Surface Water and Water Bodies (Continued)

Monitoring Frequency:

- Daily – Work activities
- Periodically – Same-point vantage photographs

8.2.6 Ground Water Quality and Quantity

Potential Impact: Construction spills or leaks and potential population and industrial growth

Mitigation Measures:

- Ensure all necessary equipment is available and in good working condition, along with back-up power
- Ensure that a qualified operator is available at all times of the project activities
- Store construction materials properly and clean site areas
- Construct temporary septic tank when needed
- Empty septic tank when full and dumping it at an official nearby treatment site

Mitigation Actions:

- Maintain a log of all equipment and its condition
- Maintain licenses of all operators
- Document safe storage of any toxic materials

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER, in coordination with local authority and PWA

Monitoring Frequency:

Daily – Work activities

8.2.7 Use of Toxic and Hazardous Materials

Potential Impact: Workers and residents exposed to toxic and hazardous materials such as: asphalt and paint

Mitigation Measures:

- Submit Material Safety Data Sheets (MSDS) and chemical mixture data sheets to the engineer for approval
- Provide a copy of licenses and insurance of any toxic and hazardous transport company and its driver
- Storage and disposal of residual hazardous material must be conducted by an experienced professional, in coordination with local and competent authorities to identify appropriate disposal site

8.2.7 Use of Toxic and Hazardous Materials (Continued)

Monitoring Action:

- Document and maintain chemical transport and storage log sheets, including MSDS and chemical mixture data sheets
- Document actual practices by checking and signing log sheets

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER, in coordination with local authority and EQA

Monitoring Frequency: As needed–work activities involving hazardous chemical material

8.2.8 Vehicle Traffic

Potential Impact: Health and safety of residents, public and construction workers

Mitigation Measures:

- Prepare and submit a traffic plan for the Engineer's approval
- Organize and manage construction activities, so that traffic disruption and delays within construction zones are minimized
- Provide temporary alternative lanes and routes shall be managed to allow traffic to pass through or around construction zones with minimal disruption
- Use flagmen and other appropriate means shall be used to direct traffic safely through and around construction zones, and to minimize conflicts between local traffic and construction vehicles
- Inform rresidents and the public of work schedules as well as with the management plans prepared by the Contractor

Monitoring Action:

- Document when the public was informed of work schedules and management plans
- Review and sign engineer approved Traffic plan and document compliance and on-site changes
- Document potential health and safety concerns and resolutions

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER

Monitoring Frequency:

- Daily – Work activities
- Periodically – Review of traffic plan

8.2.9 Nose, Air, and Light Pollution

Potential Impact: Health and safety of residents, public and construction workers

Mitigation Measures:

- Provide well-maintained construction vehicles and machinery, in order to minimize noise and air pollution
- Maintain noise levels below 70 dB surrounding sensitive receptors within 50 meters of noise source
- Install and maintain mufflers on construction equipments
- Provide the workers with protective hearing devices and face mask.
- Control the movement of machinery within the project boundaries
- Use of heavy or noisy machinery shall be prohibited between the hours of 6:00 pm (18.00) and 6:00 am during working days and all day during Fridays or designated local holidays (unless the public and workers will be best served during these hours and approval has been provided by local government and surrounding residents)

Monitoring Action:

- Document baseline noise and air emission during the start and end of the work
- Log noise and air emission
- Document complaints and how it was resolved

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER

Monitoring Frequency:

- Daily – Maintenance of vehicles and worker and public safety
- Start of project – Baseline noise and air emission
- Weekly – Log noise and air emission
- As needed – Work complaints and resolution

8.2.10 Heavy Equipment

Potential Impact: Health and safety of residents, public and construction workers

Mitigation Measures:

- Minimize the use of heavy machinery in residential areas and close proximity to the open raw sewer water within Wadi as-Samen
- Control the movement of machinery within the project boundaries
- Use of heavy machinery shall be prohibited when working near residential area between the hours of 6:00 pm (18.00) and 6:00 am during working days and all day during Fridays or designated local holidays (unless the public and workers will be best served during these hours and approval has been provided by local government and surrounding residents)
- Abide by the local laws concerning weights and speeds of vehicles that transport construction materials to and from construction and storage sites, in order to minimize safety hazards, such as traffic accidents

Monitoring Action:

- Document complaints and how it was resolved.

Monitoring Responsibility:

- Monitoring – CONTRACTOR, in coordination with local authority
- Oversight – ENGINEER, in coordination with local authority and MoPWH

Monitoring Frequency:

- Daily – Heavy equipment use
- As needed – Work complaints and resolution

8.2.11 Flora or Fauna

Potential Impact: Disruption or interference of biological resources may occur during construction work activities

Mitigation Measures:

- Minimize amount of dust generated through construction works activity
- Work within the existing road and proposed road alignment as practical as possible
- Limit working hours to daytime hours only (if work is scheduled during the night, confirm with EQA or Ministry of Agriculture (MoA) no biological species will be affected)
- Install proper fencing or other suitable protection during project activities to prevent the exposure of wild and domestic animals to construction hazards
- Restore original site characteristics after the project activities are completed, as much as practical, including maintaining the storm water open channel

8.2.11 Flora or Fauna (Continued)

Monitoring Action:

- Log any presence of wild or domestic animals within the project site and action taken
- Take photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER, in coordination with EQA and MoA

Monitoring Frequency:

- Daily – Work activities
- Periodically – Same-point vantage photographs
- As needed – Wild or domestic animals entry

8.2.12 Archaeological and Cultural Heritage

Potential Impact: Damage of archaeological and/or cultural sites

Mitigation Measures:

- Keep access road alignment east of the proposed WWTP site to avoid the former stone structures and a functional cistern identified on the opposite side of the wadi
- Avoid large excavation activities northwest of the proposed WWTP site that might disturb the small natural rock niches or caves identified on the hillside
- Stop all work if archaeological sites are uncovered, contact the Hebron Archaeological Department and (HAD) Ministry of Tourism and Antiquities (MoTA) and evaluate the site

Monitoring Action:

- Utilize survey results, design drawings, and identified archaeological site locations to document construction activities does not impact the sites
- Keep documentation of HAD and MoTA official correspondences
- Document any archaeological findings and actions taken

Monitoring Responsibility:

- Monitoring – CONTRACTOR
- Oversight – ENGINEER, in coordination with HAD and MoTA

Monitoring Frequency:

- Daily – Work activities
- Periodically – Consultation of archaeological site locations to construction activities
- As needed – Findings and actions taken

8.3 POST- CONSTRUCTION PHASE

8.3.1 Sustainability of Project

Potential Impact: Failure to sustain or monitor constructed road and installation of associated infrastructure due to technical faults or damaged, misused, or unmaintained system

Mitigation Measures:

- Comply the design and implementation activities with the local and international codes
- Ensure that resources management plans and emergency provision schemes for the service area are being prepared and implemented by competent authorities
- Ensure technical sustainability by proper training and capacity building of relevant institutions
- Train operators to comply with operation and maintenance procedures
- Ensure financial sustainability by commitment of citizens to pay necessary fees
- Ensure industries have up-to-date approvals and permits in place
- Conduct awareness campaigns
- Enforce violations on infrastructure abuses
- Perform continuous check up maintenance for the system elements

Monitoring Action:

- Use facilitating checklists and monitoring tools for application of appropriate design, construction and operational best practices
- Document training and record attendees
- Identify capacity building needs for institutions and resource provision operators and document resolutions
- Conduct frequent checks on system conditions

Monitoring Responsibility:

- Monitoring and Oversight – local authority, PWA, WBWD, EQA, MoLG, MoPWH, MoE, MoH

Monitoring Frequency:

- Daily – During operation
- Periodically – System conditions check up
- As needed – System failure

9. SITE PHOTOGRAPHS

Hebron WWTP Access Road & Utilities

Plate 1: Hebron – Yatta Road junction to existing local road (see red arrow pointing towards local road)

Plate 2: Power source for the WWTP at Hebron – Yatta Road junction

Plate 3: Local road and Khalit Addar village from Hebron – Yatta Road (red arrow points to sewer manhole)

Plate 4: Close-up of the sewer manhole from Plate 3 with land use being changed to agricultural

Plate 5: Exposed 2" water pipeline (see red arrow)

Plate 6: Khalit Addar village: steep slope, residential homes, stone walls, underground (non-municipal) sewer line, cesspits (assumed if not connected to sewer line), aboveground utility lines

Plate 7: Khalit Addar stone walls, agricultural lands adjacent to the local road

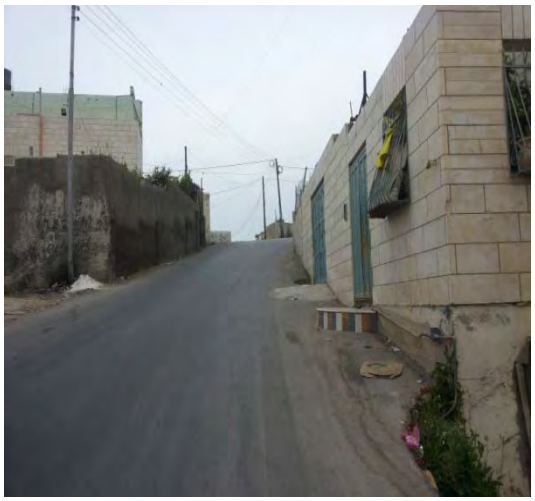

Plate 8: Local road going through Khalit Addar: residential homes and concrete walls

Plate 9: Local road through Khalit Addar: residential homes, concrete walls, small businesses

Plate 10: Leaving Khalit Addar: metal barriers, agricultural land, and aboveground utilities

Plate 11: Local road from Khalit Addar towards the wadi junction

Plate 12: Local road: single-lane paved road, rock-face terrain, open agricultural land, and stone quarry (see red arrow)

Plate 13: Local road looking towards Khalit Addar and stone quarry (see red arrow and Plate 12)

Plate 14: Local road with rock shelters potentially used by animal herders (see red arrow)

Plate 15: Residential homes uphill from the local road to the wadi junction

Plate 16: Agricultural stone walls

Plate 17: Agricultural land, grape vines, and stone-face terrain (rock shelter from Plate 14) adjacent to local road

Plate 18: Agricultural land, olive trees adjacent to local road

Plate 19: Local road and stone barrier within the Wadi as-Samen for agricultural purposes

Plate 20: Wadi junction from local road (see red arrow) – start of proposed wadi access road

Plate 21: Proposed wadi access road coming from local road passing through Wadi as-Samen – wadi has been sectioned for agricultural use

Plate 22: Close-up of agricultural use of the wadi from Plate 21

Plate 23: Proposed wadi access road

Plate 24: Open wadi channel after the last manhole (proposed wadi access road will not cross-over the wadi)

Plate 25: Former stone structures and functional cistern approximately 700 meters from wadi and on opposite side of proposed wadi access road (see red arrows and Plates 26 and 27)

Plate 26: Close-up of former stone structures

Plate 27: Close-up of functional cistern (see red arrow for wadi)

Plate 28: Rock-face with natural niches or caves northwest of the proposed WWTP site location (see red arrow and Plate 28)

Plate 29: Close-up of rock niche or caves from Plate 28

Plate 30: Abu-Laban (stork family) observed flying above and landing within wadi

ANNEX 1: Project Key Map

158000 159000 160000 161000 162000

101000 100000 99000 98000

HEBRON INDUSTRIAL ZONE

TO HEBRON

60

Qalqas

Existing Local Road

Proposed Water Line 2.0 Km

Proposed Electrical Route 2.0 Km

WWTP Access Road (Wadi) 1.0 Km

Existing Sewer Line 1.9Km

Proposed Sewer Line 560 m

TO YATTA

Al Heila

Legend

- Town
- Existing Sewer Line
- Proposed Sewer Line
- Proposed Water Line
- Proposed Electrical Line
- WWTP Access Road (Wadi)
- Existing Local Road
- Hebron WWTP

Area ABC

- A
- B
- C

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سلطة المياه الفلسطينية
PALESTINIAN WATER AUTHORITY

USAID من الشعب الأمريكي

PALESTINIAN WATER AUTHORITY
PROGRAM FUNDED BY THE U.S. AGENCY FOR INTERNATIONAL DEVELPMENT (USAID)
INFRASTRUCTURE NEEDS PROGRAM PHASE II

KEY MAP

HEBRON WWTP ACCESS ROAD & UTILITIES

N

0 87.5 175 350
Meters

PROJECT NO.
42230

FIGURE 1

ANNEX 2: ESCHIA, 28 May 2013 - CD

Environmental, Social, and Cultural Heritage Impact Assessment (ESCHIA), World Bank and Agence Francaise de Developpement (afd)

PDF Environmental Review version - ESCHIA complete report at end of Annexes

ANNEX 3: Archaeology Assessment, CH2MHILL, 2005

9.0 Archeological Assessment

Following the selection of the Hebron Regional Wastewater Treatment Facilities (HRWWTF) site in Wadi Es-Sammen northeast of Yatta and south of Hebron, an archeological (cultural heritage) study was authorized by CH2M HILL under the USAID WRP3 program. Additional regional information is documented in the April 2002 and May 2003 documents both entitled "Environmental Assessment for Storm Water and Domestic Wastewater Master Plan for Hebron".

The conclusion of the archeological assessment is that no archeological sites are directly impacted by the proposed construction or operation of the HRWWTF.

Figure 9-1 is a map of the areas assessed. Figures 9-2 to 9-5 are photographs of the sites. The area was visited and investigated on 4, 5, and 6 November 2004 and 8 April 2005. The areas investigated include:

- The proposed Hebron Wastewater Treatment Plant Site
- The wadi upstream of the site to the Qilqis-Khallit Ad Dar junction
- The wadi downstream to the Heela junction
- The effluent storage reservoir site

The wadi was and is still partially cultivated by terracing. There are numerous stonewalls along and across the wadi. These stonewalls are normal agricultural stonewalls of the type found throughout the West Bank.

The primary archeological findings are stated below.

1. There are no archeological sites within the boundaries proposed plant site.

2. There are no archeological sites within the wadi bed in the investigated areas both upstream and downstream the plant site.

3. Three archeological sites were found upstream the proposed Wastewater Treatment Plant site. The Storage Reservoir site was also visited.

   Archeological Site No. 1: This site is a small complex of three stone enclosures and a cistern on the gentle rocky slope about 15 to 20 meters distance from the edge of the wadi bed at coordinates 209,920 E and 598,900 N.

   Two enclosures are rectangular stone structures 5 meters by 4 meters and 4 meters by 4 meters. A third smaller enclosure is 1.5 meters by 2 meters.

   The cistern is about 10 m to the north of the enclosures; it is currently being rehabilitated by the land owners there.

   The three structures have 2 to 3 lines of stones still standing (about 1 meter high). The structures may be originated from the Byzantine era.

   Archeological Site No. 2: This site is a recent circular stone enclosure of about 10 meters diameter and of heights up to 70 cm in the west side. The entrance is about 2 meters wide in the southern side. This enclosure encircles a natural cave of about 9 meters length (east-west) and 5 meters wide (north-south) and about 2 meters high in its center. The entrance to the cave is about 1.2 meters by 1.5 meters. Inside the

west part of the cave is a raised area 3 meters by 4.5 meters, 70 cm above the lower eastern part of the cave. This raised part may have been used for human use.

The cave is natural but appears modified for human use and for animal keeping as well. The use of the cave may extend back to the Canaanite era.

Archeological Site No. 3: This site is a set of six small natural rock niches with dimensions of about 1.0 meters height, 70-80 cm deep called Khuzuq Al Ghouleh. No archeological significance was observed at these niches.

Storage Reservoir Site: The site was visited on 8 April 2005. The site is a typical degraded slope with broken stone agricultural terraces. The site is free of any archaeological remains; no structures, raised areas or pottery shards were detected.

209

210

211

599

598

N

PROPOSED EFFLUENT STORAGE

PROPOSED NEW WWTP SITE

1

2

3

LEGEND

1 SITE NO.1 :
A SMALL COMPLEX OF THREE STONE ENCLOSURES AND A CISTERN.

2 SITE NO.2 :
A RECENT CIRCULAR STONE ENCLOSURE ABOVE A CAVE.

3 SITE NO.3 :
SMALL NATURAL ROCK NICHES.

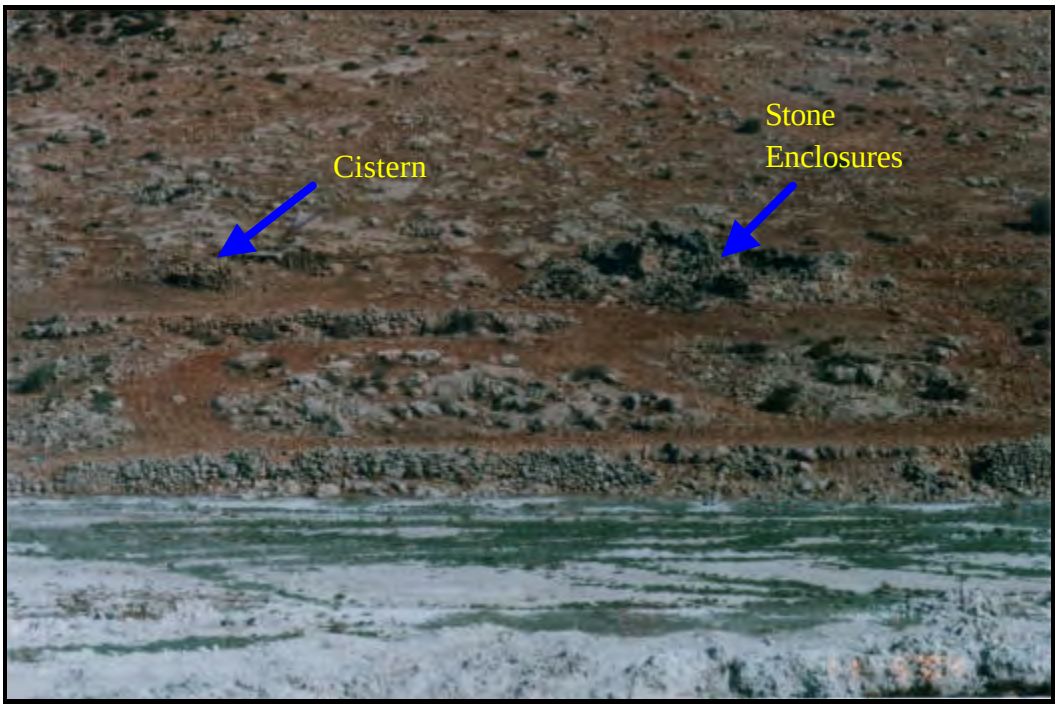
EXISTING UNPAVED ROAD

WADI AD-DOR

FIGURE 9-1
HEBRON REGIONAL WWTP
SOUTH HEBRON AREA
ARCHEOLOGICAL ASSESSMENT
OF PROJECT AREA

CH2MHILL
AND ASSOCIATES

F:\Phase III\Task 12A\Archeological study\Fig 9-1Archeological Sites.dwg, 5/25/2005 3:39:15 PM



ARCHEOLOGICAL SITE NO. 1:
A small Complex of Three Stone Enclosures and a Cistern

ARCHEOLOGICAL SITE NO. 2:
A recent Circular Stone Enclosure

ARCHEOLOGICAL SITE NO. 3:
Small Natural Rock Niches

RECLAIMED WASTEWATER STORAGE RESERVOIR SITE

ANNEX 4: Potential Impacts Significance Table

POTENTIAL IMPACT SIGNIFICANCE [1]

Potential Impact	Affected	Timescale	Magnitude	Impact Significance after Mitigation [2]
Land ownership	Landowners	Long term; change in ownership Long term; change in land use (benefit)	Local	Low
Cumulative Effect of the Proposed Action	Public; workers and local environment	Short term; construction phase	Local	Low
Land Use and Agriculture	Public; workers and local environment	Short term; pre and construction phase	Local	Low
Existing Infrastructure (Water, Wastewater, Roads and Electricity)				
Damage to existing infrastructure and supporting services	Public; workers and local environment	Short term; construction phase Long term; operational phase	Regional	Medium
Operation and maintenance of new and improved services	Public and local environment	Long term; operational phase	Regional	Medium
Disturbances (Noise and Light)	Public; workers	Short term; construction phase	Local	Medium; congested areas Low; open areas
Air Quality	Public; workers	Short term; construction phase Long term; operational phase	Local	Low
Public Health and Safety	Workers; public	Short term; construction phase	Local	Medium
Use of Toxic and Hazardous Materials	Workers	Short term; construction phase	Local; may extend to final disposal destination	Medium

POTENTIAL IMPACT SIGNIFICANCE [1]

Potential Impact	Affected	Timescale	Magnitude	Impact Significance after Mitigation [2]
Soil Quantity and Quality	Workers; public; local environment	Short term; construction phase	Local; may extend to final disposal destination	Low; not near wadi Medium; near the wadi
Flora and Fauna	Local environment	Short term; construction phase Long term; operational phase (benefit)	Local	Low
Solid Waste Management	Public; workers	Short term; construction phase Long term; operational phase	Local	Low
Groundwater Quality and Quantity				
Spills from construction vehicle motor oils and portable sanitary buildings and damage to cesspits	Public; local environment	Short term; construction phase	Regional	Low
Water provision services – improvement	Public	Long term	Regional	Not applicable (beneficial)
Surface Water	Workers; public	Short term; construction phase Long term; operational phase (benefit)	Local	Low; non-open wastewater Medium; open wastewater

POTENTIAL IMPACT SIGNIFICANCE [1]

Potential Impact	Affected	Timescale	Magnitude	Impact Significance after Mitigation [2]
Piped Water Quality				
Aging and corrosion of pipelines	Public; local environment	Long term; operational phase	Regional	Low
Corroded pipelines placed near cesspits	Public; local environment	Long term; operational phase	Regional	Low
Historical and Cultural Heritage	Local environment	Short term; construction phase	Local	Low
Sustainability of the Project	Public; local environment	Long term; operational phase	Regional	Low

Notes:

1. See Section 4.0: Evaluation of Environmental Impact Potential of report for detail analysis of impacts.
2. See Section 8.0 and Annex 5 for Mitigation Measures and Monitoring Plan (MMP) required to minimize the potential impacts.

ANNEX 5: Mitigation and Monitoring Plan

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
PRE-CONSTRUCTION PHASE				
Land Ownership Construction works could potentially be on private land	• Conduct village meetings informing right-of-way activities • Use planning maps and protected zones to mark right-of-way • Locate or obtain land ownership and approvals to land acquisition • Address and resolve village concerns before physically widening the road	• Record comments or issues provided by the community and resolution • Document and record land ownership and approvals	• Monitoring – CONTRACTOR • Oversight – ENGINEER, in coordination with local authority	As needed
Current Land-Use Conditions Agricultural lands, small businesses and start of stone quarry	• Conduct meeting with Municipality to ensure compliance with local plans and get informed of land categories • Delineate and preserve land use categories to avoid a major shift in land use patterns- comply with local plans, laws and local regulations • Conduct meeting and walk-through with village residents and landowners to ensure they are informed of the project -address and resolve village concerns • Identify right-of-way with municipality, residents, and landowners and address and resolve village concerns	• Document consultation with landowners and/or local council prior to removal of any object and its resolution • Verify and document land for construction activities using land use and planning maps, as well as design alignments • Monitor and document dust generation and actions taken when dust begins to cover private property – include photographs before and after clean up	• Monitoring – Municipality Contractor • Oversight - Municipality Engineer, in coordination with local authority	Daily

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Current Land-Use Conditions</u> Agricultural lands, small businesses and start of stone quarry (Continued)	• Inform landowners if private property is within right-of-way or obstructs project-site construction activities • Preserve original site characteristics, agricultural patterns and practices, whether irrigated or rain fed, in the areas where they are practiced • Open road through the Municipality to designated right-of-way • Protect trees and plants (including root system). However, if it is necessary to uproot any plant or tree, then it should be replanted in a location that is agreed upon by the appropriate authorities and landowners and that would not be affected by the projects at any stage (construction, operation and maintenance). • Filling, excavating, trenching, or stockpiling of materials shall not be permitted in the private vegetation areas, except as approved by the landowner • Minimize excess dust to avoid damage to property, cultivated vegetation, or domestic animals, or cause a nuisance to persons living in or occupying buildings in the vicinity of the site. • Haul trucks shall utilize covers over loads to prevent dust migration from loads in transit	• Take same-point vantage photographs to ensure site restoration back to original characteristics as much as practical		

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Current Land-Use Conditions</u> Agricultural lands, small businesses and start of stone quarry (CONTINUED)	• Dust control measures, such as wetting, should only be used if it becomes a nuisance to persons or a thick film of dust covers private property • Restore to original site characteristics after the projects are completed as much as practical			
<u>Cumulative Effect of the Proposed Action</u> Continuous public and worker health and safety and environmental impacts, along with destruction to completed project(s)	• Conduct meetings with local authorities to understand the strategic developmental vision of the area • Collect information about projects that may coincide with the proposed project in hand • Prepare integrated development plans so that projects integrate seamlessly and contribute to one another. This would eliminate redundant facilities and provide mechanisms to avoid or mitigate impacts • Review or prepare integrated development plans if not existing, so that projects integrate seamlessly and contribute to one another • Coordinate all development actions and construction efforts to minimize the impacts of each project and create synergistic benefits	• Conduct project scope review and report on type, location, time, duration, and overlaps of project activities • Meet and document stakeholders proposed or current project activities	• Monitoring and Oversight – ENGINEER, in coordination with local authority	• One-Time – Pre Construction • As needed - Coordination activities, through life of the project

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Cumulative Effect of the Proposed Action</u> Continuous public and worker health and safety and environmental impacts, along with destruction to completed project(s) (CONTINUED)	• Coordinate amongst the various construction crews if two or more projects involve excavation in the same area to minimize environmental disturbances. This also applies to activities of multiple projects that may require the use of similar local resources or use of energy			

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
CONSTRUCTION PHASE				
<u>General Health and Safety</u> Health and safety of residents, public and construction workers	• Prepare and submit a safety plan for Engineer's approval – submit plans as part of the bid proposal • Provide measures to define and isolate construction zones by using warning signs, pylons, fencing, and ribbon barriers • Take appropriate measures to prevent unauthorized persons from entering the work area • Implement safety measures to protect people from injury and adjacent property from damage • Provide temporary bridges, safe pathways, handrails and any other safety measure during the road construction to protect the road users from injuries as appropriate and needed • Provide temporary shoring as appropriate and needed • Inform residents of work schedules as well as with the management plans prepared by the contractor • Identify locations of the hospitals and clinics nearest to the construction site, in case of illness or a construction accident	• Record when the public was informed of work schedules and management plans • Document any concerns and its resolution with work schedules and management plans • Conduct and document with checklists site inspections • Document and report potential health and safety concerns	• Monitoring – CONTRACTOR • Oversight – ENGINEER, MoL and MoPWH	Daily – All activities

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
General Health and Safety Health and safety of residents, public and construction workers (CONTINUED)	• Provide adequate hearing protection, hard hats, safety goggles, brightly colored vests, and other appropriate safety equipment to protect workers and visitors from injury • Maintain portable toilet, with hand washing area, to avoid leaks or spills to the surrounding area • Dispose of waste and refuse properly			
General Health and Safety Work near or within Wadi as-Samen raw sewer water	• Avoid or minimize physical contact and/or construction • Ensure workers have proper vaccinations required when working in raw sewer (consult health professional) • Provide workers with appropriate "water-proof" personal protective safety equipment (PPE) that at a minimum covers: eyes, mouth, hands, feet, and body that potentially will be in contact with the raw sewer water • Instruct and train all workers to safely remove equipment and to securely wrap and properly dispose prior to leaving the construction site • Clean carefully machinery and/or tools used within the open raw sewer water prior to leaving the construction site	• Record vaccinations taken by workers • Conduct site visits and document that workers are properly wearing their PPE • Document the removal of PPE and its disposal • Document any complaints and resolutions working near or within Wadi es-Samen	• Monitoring – CONTRACTOR • Oversight – ENGINEER, MoL, MoH, and EQA	Daily

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>General Health and Safety</u> Work near or within Wadi es-Samen containing raw sewer water (CONTINUED)	• Follow these activities to not spread the raw sewer water and/or contaminate soil			
<u>Private Property</u> Right-of-way may potentially contain private property Agricultural lands: vegetable, grape vines, and olive tree Residential and businesses: small stores and stone quarry	• Utilize Municipality designated right-of-way identified and opened in pre-construction activities • Protect trees and plants (including root system). However, if it is necessary to uproot any plant or tree, then it should be replanted in a location that is agreed upon by the appropriate authorities and landowners and that would not be affected by the projects at any stage (construction, operation and maintenance) • Filling, excavating, trenching, or stockpiling of materials would not be permitted in the private vegetation areas, except as approved by the landowner. Whenever possible, excavated materials should be reused as fill, re-shaping, or restoration purposes within the same vicinity	• Document consultation with landowners and/or local council prior to removal of any object • Monitor dust generation and actions taken when dust begins to cover private property –include photographs prior to and after clean-up • Take same-point vantage photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical	• Monitoring - CONTRACTOR • Oversight – ENGINEER, in coordination with local authority	• Daily – Work activities in close proximity to private property • Periodically – Same-point vantage photographs

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Private Property</u> Right-of-way may potentially contain private property Agricultural lands: vegetable, grape vines, and olive tree Residential and businesses: small stores and stone quarry (CONTINUED)	• Minimize excess dust to avoid damage to property, cultivated vegetation, or domestic animals, or cause a nuisance to persons living in or occupying buildings in the vicinity of the site • Cover overloads haulage trucks to prevent dust migration from loads in transit • Use dust control measures, such as wetting, only if dust becomes a nuisance to persons or a thick film covers private property • Maintain portable toilet to avoid leaks or spills to the surrounding area • Dispose of waste and refuse properly • Store construction materials, equipment, and waste in approved and designated area • Restore original site characteristics after the projects are completed as much as practical			
<u>Soil Quantity and Quality</u> Soil will be disturbed, potentially causing erosion and contamination during construction work activities, especially while working within Wadi as-Samen	• Take pictures before excavation to restore the original site characteristics • Install and maintain soil erosion and sediment control measures, such as swales, grade stabilization structures, dikes, waterways, filter fabric fences, and sediment basins, until erosion concerns are eliminated	• Take photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical • Document soil placement if moved from original site	• Monitoring – CONTRACTOR • Oversight – ENGINEER	• Daily – Work activities • Periodically – Same-point vantage photographs

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Soil Quantity and Quality</u> Soil will be disturbed, potentially causing erosion and contamination during construction work activities (CONTINUED)	• Control the movement of machinery within the project boundaries • Use of topsoil for compaction during or after replacement over the retaining walls and any graded areas, except where necessary to prevent erosion, is not allowed • Store and replace, in its original locations, topsoil from all graded or excavated areas that support or could support vegetation • Prevent fuel and oil leaks by continuous checks and maintenance • Provide well-maintained construction vehicles and machinery, in order to minimize pollutant emissions • Abide by the local laws concerning weights and speeds of vehicles that transport construction materials to and from construction, storage and quarry sites, in order to minimize environmental hazards or excess dust generation • Ensure that no sanitary, oil, hazardous materials, and any other possible contaminants will be spilled or buried in the sites areas in order to protect from soil contamination • Ensure staging areas used in this project are fenced and clearly marked by the contractor prior to construction activities			

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Soil Quantity and Quality</u> Soil will be disturbed, potentially causing erosion and contamination during construction work activities (CONTINUED)	• Clean the storage and staging areas and restore them to the original conditions • Backfilling and replacement of the excavated materials would be conducted in a manner that restores the ground surface to its original elevation and that the top 0.6 meter of any excavated trench is filled with original materials • Changes to characteristics of the top soil, hence influencing the flora and fauna, by bringing new soil to the site is prohibited • Moving or using soil for construction activities taken from Wadi es-Samen exposed to open raw sewer water is prohibited			
<u>Existing Infrastructure</u> Damage of existing above and underground utilities	• Conform to site survey results, predicted and plotted utilities structures as provided in the design. Where unpredicted utility structures emerge during the course of work, proper mitigation measures shall be applied to avoid damage as practical as it can be	• Consult site survey results and design layout for existing utilities • Document on-site checks on potential hazards where fragile infrastructure utilities exist • Document accidents and their resolutions	• Monitoring – CONTRACTOR • Oversight – ENGINEER, in coordination with local authority	• Daily – Work activities • Periodically – Consult survey results and design layout • As-needed – Repair or replacement of damage facilities

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Existing Infrastructure</u> Damage of existing above and underground utilities (CONTINUED)	• Suggest new locations or routes in coordination with the design team and local authorities if unpredicted utility structures are identified • Abide by the local laws concerning weight and speed of vehicles that perform the construction and transport of materials • Work efficiently and within an expedited schedule for implementation and rehabilitation. In addition, coordinate with the relevant authorities and local residents • Damage done to existing facilities (especially cesspits) during construction would be the responsibility of the contractor for repair or replacement to previous conditions • Coordinate with the relevant authorities and local residents if damage to existing utilities occur • Provide emergency services for the residents in association with local municipalities/councils if any accidental damaged in public utilities and services occurs			

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Surface Water and Water Bodies</u> Project work activities, storage close to the wadi, or improper disposal of construction materials may block natural flow of Wadi as-Samen	• Provide approved designated protected areas for storage of spoil and excavated materials • Remove and transport waste materials that are unable to be used for fill to a designated and approved disposal sites in an environmentally safe manner • Identify all water-harvesting wells and surface water catchment systems and be clear of any project work activity, storage, and materials • Do not burn waste materials of any type • Modify project work activities to minimize stagnant water bodies to be formed • Enusre that no sanitary, oil, hazardous materials, and any other possible contaminants will be spilled or buried in the sites areas in order to protect the ground water or surface water	• Document any potential concerns for spills and stagnant water body creation and its resolution • Take photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical.	• Monitoring – CONTRACTOR • Oversight – ENGINEER	• Daily – Work activities • Periodically – Same-point vantage photographs

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Ground Water Quality and Quantity</u> Construction spills or leaks and potential population and industrial growth	• Ensure all necessary equipment is available and in good working condition, along with back-up power • Ensure that a qualified operator is available at all times of the project activities • Store construction materials properly and clean site areas • Construct temporary septic tank when needed • Empty septic tank when full and dumping it at an official nearby treatment site	• Maintain a log of all equipment and its condition • Maintain licenses of all operators • Document safe storage of any toxic materials	• Monitoring – CONTRACTOR • Oversight – ENGINEER, in coordination with local authority and PWA	Daily – Work activities
<u>Use of Toxic and Hazardous Materials</u> Workers and residents exposed to toxic and hazardous materials such as: asphalt and paint	• Submit Material Safety Data Sheets (MSDS) and chemical mixture data sheets to the engineer for approval • Provide a copy of licenses and insurance of any toxic and hazardous transport company and its driver • Storage and disposal of residual hazardous material must be conducted by an experienced professional, in coordination with local and competent authorities to identify appropriate disposal site	• Document and maintain chemical transport and storage log sheets, including MSDS and chemical mixture data sheets • Document actual practice by checking and signing log sheets	• Monitoring – CONTRACTOR • Oversight – ENGINEER, in coordination with local authority and EQA	• As needed–work activities involving hazardous chemical material

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Vehicle Traffic</u> Health and safety of residents, public and construction workers	• Prepare and submit a traffic plan for the engineer's approval for each road, especially within the villages and heavy-traffic areas • Organize and manage construction activities, so that traffic disruption and delays within construction zones are minimized • Provide temporary alternative lanes and routes shall be managed to allow traffic to pass through or around construction zones with minimal disruption • Use flagmen and other appropriate means to direct traffic safely through and around construction zones, and to minimize conflicts between local traffic and construction vehicles • Inform residents and public of work schedules as well as with the management plans prepared by the contractor	• Document when the public was informed of work schedules and management plans • Review and sign engineer approved Traffic plan and document compliance and on-site changes • Document potential health and safety concerns and resolutions	• Monitoring – CONTRACTOR • Oversight – ENGINEER	• Daily – Work activities • Periodically – Review of traffic plan
<u>Nose, Air, and Light Pollution</u> Health and safety of residents, public and construction workers	• Provide well-maintained construction vehicles and machinery, in order to minimize noise and air pollution • Maintain noise levels below 70 dB surrounding sensitive receptors within 50 meters of noise source • Install and maintain mufflers on construction equipments	• Document baseline noise and air emission during the start and end of the work • Log noise and air emission • Document complaints and how it was resolved	• Monitoring – CONTRACTOR • Oversight – ENGINEER	• Daily – Maintenance of vehicles and worker and public safety • Start of project – Baseline noise and air emission • Weekly – Log noise and air emission

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Nose, Air, and Light Pollution</u> Health and safety of residents, public and construction workers (CONTINUED)	• Provide the workers with protective hearing devices and face masks • Control the movement of machinery within the project boundaries • Use of heavy or noisy machinery shall be prohibited between the hours of 6:00 pm (18.00) and 6:00 am during working days and all day during Fridays or designated local holidays (unless the public and workers will be best served during these hours and approval has been provided by local government and surrounding residents)			• As needed – Work complaints and resolution
<u>Heavy Equipment</u> Health and safety of residents, public and construction workers	• Minimize the use of heavy machinery • Control the movement of machinery within the project boundaries and conform with the geotechnical survey for structural and stability of current site conditions • Use of heavy machinery is prohibited between the hours of 6:00 pm (18.00) and 6:00 am during working days and all day during Fridays or designated local holidays (unless the public and workers will be best served during these hours and approval has been provided by local government and surrounding residents)	• Document complaints and how it was resolved	• Monitoring – CONTRACTOR, in coordination with local authority • Oversight – ENGINEER, in coordination with local authority and MoPWH	• Daily – Heavy equipment use • As needed – Work complaints and resolution

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
<u>Heavy Equipment</u> Health and safety of residents, public and construction workers (CONTINUED)	• Abide by the local laws concerning weights and speeds of vehicles that transport construction materials to and from construction, storage and quarry sites, in order to minimize safety hazards, such as traffic accidents			
<u>Flora or Fauna</u> Disruption or interference of biological resources may occur during construction work activities	• Minimize amount of dust generated through construction works activity • Work within the existing road corridors as practical as possible • Limit working hours to daytime hours only (if work is scheduled during the night, confirm with EQA or Ministry of Agriculture no biological species will be affected) • Install proper fencing or other suitable protection during project construction to prevent the exposure of wild and domestic animals to construction hazards • Restore original site characteristics after project completion, as much as practical	• Log any presence of wild or domestic animals within the project site and action taken • Take photographs prior, during, and post-construction to ensure site restoration back to original characteristics as much as practical	• Monitoring – CONTRACTOR • Oversight – ENGINEER, in coordination with EQA and MoA	• Daily – Work activities • Periodically – Same-point vantage photographs • As needed – Wild or domestic animals entry

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
Archaeological and Cultural Heritage Damage of archaeological and/or cultural sites	• Keep access road alignment east of the proposed WWTP site to avoid the former stone structures and a functional cistern identified on the opposite side of the wadi • Avoid large excavation activities northwest of the proposed WWTP site that might disturb the small natural rock niches or caves identified on the hillside • Stop all work if archaeological sites are uncovered, contact the Hebron Archaeological Department and (HAD) Ministry of Tourism and Antiquities (MoTA) and evaluate the site	• Utilize survey results, design drawings, and identified archaeological site locations to document construction activities does not impact the sites • Keep documentation of HAD and MoTA official correspondences • Document any archaeological findings and actions taken	• Monitoring – CONTRACTOR • Oversight – ENGINEER, in coordination with HAD and MoTA	• Daily – Work activities • Periodically – Consultation of archaeological site locations to construction activities • As needed – Findings and actions taken

MITIGATION AND MONITORING PLAN

Potential Impact	Mitigation Measures	Monitoring Activity	Responsible Party	Frequency
POST-CONSTRUCTION PHASE				
<u>Sustainability of the Project</u> Failure to sustain or monitor water provision due to technical faults or damaged, misused, or unmaintained system	• Comply design and implementation activities with local and international codes • Ensure that resources management plans and emergency resource provision schemes for the service area are prepared and implemented by competent authorities • Ensure technical sustainability by proper training and capacity building of relevant institutions • Train operators to comply with operation and maintenance procedures • Ensure financial sustainability by commitment of citizens to pay their utility bill fees • Ensure industries have up-to-date approvals and permits in place • Conduct awareness campaigns • Enforce violations on infrastructure abuses • Perform continuous check up maintenance for the system elements	• Use facilitating checklists and monitoring tools for application of appropriate design, construction and operational best practices • Document training and record attendees • Identify capacity building needs for institutions and resource provision operators and document resolutions • Conduct frequent checks on system conditions	Monitoring and Oversight - local authority, PWA, WBWD, EQA, MoLG, MoPWH, MoE, MoH	• Daily – During operation • Periodically – System conditions check up • As needed – System failure

ANNEX 6: WWTP Landownership Document

State of Palestine
Palestinian Water Authority

دولـــــة فلسطيـن
سلطة المياه الفلسطينية

Date: 23/10/2013

Att: Richard W. Pollard
Senior Water Supply and Sanitation Specialist
Water Unit, Sustainable Development Department
Middle East & North Africa Region
The World Bank

Project: West Bank Wastewater Management Project

Subject: Land Ownership of Hebron Regional Treatment plant Site

Dear Mr. Pollard,

In reference to subject mentioned above, The PWA here confirms that all land within parcels no. 240, 241, 242, and 243 located in basin no. 8 named Wadi Ad-Dor ,and parcel no. 1151 located in basin no.2 named Khallet Al-Moghrabi is completely owned by the Palestinian Government and under PWA control for the benefit of constructing Hebron Regional Wastewater Treatment Plant in Hebron Governorate.

PWA also assures that all the land currently not used by other and only will be kept for this project, and will not be used for any other purposes.

Best regards,

Dr. Shaddad Al-Attili
Minister
Palestinian Water Authority

Cc: Eng. Adel Yasin

Ramallah Tel: 02 242 9022, Fax: 02 242 9341
Gaza Tel: 08 282 7520, Fax: 08 282 2697
Website: www.pwa.ps Email: pwa@pwa.ps

ANNEX 7: Wadi Alignment Landowners' Approval

محطة معالجة المياه العادمه المقترحه لمدينة الخليل

الموضوع : **قطعة الارض المخصصة لمشروع محطة معالجة المياه العادمه والشارع الواصل من طريق قلقس الى ارض محطة المعالجه.**

نحن مالكوا قطع الاراضي في منطقة الحيله من الاراضي التي تقع ضمن حدود مدينة الخليل، لقد قمنا باستكمال اجراءات نقل ملكية قطع الاراضي الخاصه بنا والتنازل الى سلطة المياه الفلسطينيه عن قطع الاراضي بالمساحات والحدود الموصوفه في وثائق التنازل و مخططات المساحه التي تم اعدادها لهدف استكمال اجراءات التنازل ونقل الملكيه.

لقد قامت بلدية الخليل من خلال طواقم المساحه وبمرافقة احد المالكين لقطع الاراضي المخصصه لمحطة معالجة المياه العادمه بتثبيت العلامات المساحيه لحدود قطع الاراض المخصصة لمحطة معالجة المياه العادمة، ومن خلال هذا الاجراء تبين بان هناك اختلاف في حدود قطع الاراضي ونقص في المساحه الاجماليه المتنازل عليها لمشروع محطة معالجة المياه العادمة.

ان توقيعنا المذيل ادناه هو بمثابة اقرار وموافقه لا رجعة فيه بان يتم اعادة تثبيت حدود قطعة الارض المخصصه لمحطة معالجة المياه العادمه واستكمال المساحه الاجماليه المتنازل بها الى سلطة المياه والبالغه (115,377 م.مربع) استكمال النقص في المساحه الاجماليه لكل قطعه من القطع الاربعه المتنازل بها.

وان توقيعنا المذيل ادناه هو اقرار وموافقه على مشروع محطة معالجة المياه العادمه المقترح لمدينة الخليل.

كما واننا نقر بموافقتنا على التنازل عن الملكيه لبلدية الخليل او لسلطة المياه عن اية مساحات اضافيه سيتم اقتطاعها وتخصيصها لشارع الربط لمحطة معالجة المياه العادمة مع شارع قلقس الرئيسي وان نقوم بالتنازل عن هذه المساحات المخصصه لشارع الربط لدى الدوائر الرسميه المختصه وان يتم الاتفاق على اثمان المساحات المطلوبه لشارع الربط وصرف الاثمان للمالكين، وان يكون المسار والمساحه لشارع الربط حسب ما تقتضيه المصلحه لمحطة المعالجه ووفق قرار الطاقم المساحي لبلدية الخليل ووفق الاعتبارات الفنيه الهندسيه لتصميم الشوارع.

البند	الاسم	رقم الهويه	التاريخ	التوقيع
1		959666322	24-12-2013	
2		944867969	24-12-2013	
3		974985574	24-12-2013	
4		911288967	24-12-2013	
5				
6				

ANNEX 8: Hebron Archeological Department

State OF Palestine
Ministry of Tourism & Antiquities
Sector of Antiquities and Cultural Heritage

دولة فلسطين
وزارة السياحة والآثار
قطاع الآثار والتراث الثقافي

الادارة العامة للحماية/ الخليل

2014/2/16

سعادة الأخ / رئيس بلدية الخليل المحترم
تحية طيبة ،،

الموضوع : كشف معاينة

نعلم حضرتكم لا مانع لدينا من استكمال أعمال الترخيص بعد إجراء الكشف الأثري على قطعة رقم 240 ،241 ،242 ،243 حوض رقم 8 موقع وادي الدور الخليل .علما أن السلاسل الحجرية القائمة هي زراعية وليست شواهد أثرية .

مع الاحترام

محمد صبارنه
مدير آثار محافظة الخليل

State of Palestine

Ministry of Tourism & Antiques

Sector of Antiquities and Cultural

Heritage

16/02/2014

Dear / Mayor of Hebron

Subject: Inspection Results

We would like to inform you that we have no objection on continuing the licensing after the archaeological inspection on land no. 240, 241, 242, 243 parcel no. 8 in Wadi Al Dour Hebron. Knowing that, the existing terraces are agricultural and not archaeological.

With Respect,

Mohammed Sabarneh

Hebron Archaeology Manager

For more information, please visit
http:// www.usaid.gov/west-bank-and-gaza