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M.Sc. Thesis

**Agricultural Reuse of Treated Effluent and Stabilized Bio-
solids from Jericho Wastewater Treatment Plant**

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Abstract

Due to the water shortage in Jericho city and extremely depending on fresh water and some private wells for irrigation, reuse of treated wastewater and bio-solids should be encouraged in order to save the main source of drinking water and to improve the quality of crops, since some farmers use private wells for irrigation which the quality is deteriorated and has a notable effects on productivity.

The main aim of this research is to assess the viability of agricultural reuse of treated wastewater and bio-solids in Jericho City. The specific objectives are to: (1) identify the characteristics and quantity of treated effluent from JWWTP, (2) generate evidence on the effects that may be associated with reuse, and (3) present the results to farmers and assess their perceptions.

The research methodology included: assessing the potential of wastewater and bio-solids quantities generated from JWWTP. In addition to the treated wastewater quality test the water quality data of two wells located near the WWTP will be compared with the treated wastewater quality. The experimental farm called the Pilot Plant will be set up inside the WWTP. The farm planted popular fruit trees in Jericho such as date palm, lemon, orange, and some kinds of fodders like alfalfa and corn to monitor and verify the yields and growth such as product color, taste and size. In order to assess the acceptance of farmers about treated wastewater/sludge reuse, a questionnaire was distributed to them.

The general findings of this research are: (1) the treated wastewater amount is very low on 2014 which is the beginning year of operation and the connection rate is very low, but the flow is expected to increase to WWTP due to ongoing projects that will connect more building until 2018, which is the target year that whole city will be connected to public sewer (2) the quality of

treated wastewater that is generated from Jericho WWTP is complying with quality A of Palestinian standards, which means it can be used for all reuse options except direct potable reuse, and comparing with the private wells that are used for agriculture irrigation, the results also showed that the treated wastewater quality is better than that wells which can promote the farmers to use this water safely (3) the visual observation of using treated wastewater in agricultural showed that there is no negative impacts of treated wastewater on the plant itself and on soil, on the contrast using treated wastewater gave results better than using fresh water, on other hand by establishing this experimental plant an evidence was created for farmers to use this water without any worry on their products (4) regarding reuse of treated water and sludge, more than half of respondents are positive for reuse of waste water, on the other hand, less than half of respondents are positive to reuse of sludge.

Using the treated wastewater in agricultural and especially in palm trees is more feasible option in Jericho city, especially all palm trees farms located near the WWTP, so no high cost is needed in infrastructure in order to distribute the treated wastewater amongst farmers.

الخلاصة

بسبب محدودية المياه في مدينة أريحا وحيث أنها تعتمد بشكل كبير على المياه العذبة وبعض الآبار الخاصة لأغراض الري، فإن فكرة استصلاح وإعادة استخدام مياه الصرف الصحي والحماة المعالجة ينبغي تشجيعها من أجل إنقاذ المصدر الرئيسي لمياه الشرب وتحسين نوعية المحاصيل، حيث أن بعض المزارعين يعتمدون بشكل كبير على استخدام آبار خاصة من أجل ري محاصيلهم وحيث أن هذه الآبار في الآونة الأخيرة تدهورت نوعيتها بسبب ملوحتها العالية مما أدى وبشكل ملحوظ التأثير على إنتاجية بعض المحاصيل.

أهداف هذا البحث هو: (1) تحديد خصائص وكمية مياه الصرف الصحي المعالجة من محطة معالجة المياه العادمة في مدينة أريحا ((2 إيجاد أدلة على الآثار التي قد تترافق مع إعادة استخدام المياه المعالجة عن طريق بناء مشروع تجريبي ومراقبة المزروعات التي تروى باستخدام المياه العذبة ومياه الصرف الصحي المعالجة (3) تقديم النتائج إلى المزارعين وتقييم تصوراتهم عن طريق إجراء ورشة عمل وتوزيع استبيان لمعرفة مدى تقبلهم لاستخدام المياه المعالجة والحماة.

أهم النتائج العامة في هذا البحث هي: (1) كمية مياه الصرف الصحي المعالجة منخفضة جدا في عام 2014 وهي السنة الأولى من عملية التشغيل لمحطة الصرف الصحي بالإضافة لقلّة عدد المباني المربوطة على شبكة الصرف الصحي، ولكن من المتوقع أن يرتفع عدد المباني التي ستربط على الشبكة مما يؤدي الى ارتفاع معدل التدفق إلى محطة معالجة مياه الصرف الصحي بسبب المشاريع الجارية التي ستربط أكبر عدد من المباني والمنشآت والتي سيزيد من معدل التدفق والتي من المتوقع الانتهاء منها حتى عام 2018، وهي السنة المستهدفة التي سيتم ربط المدينة بأكملها إلى شبكة الصرف الصحي العامة. (2) نوعية مياه الصرف الصحي المعالجة الخارجة من محطة معالجة مياه الصرف تتمثل لجودة ومعايير المياه المعالجة (أ)، مما يعني أنه يمكن استخدامها لجميع خيارات إعادة الاستخدام إلا لأغراض الشرب، ومقارنة مع الآبار الخاصة التي تستخدم للري والزراعة فإن النتائج أظهرت أيضا أن جودة مياه الصرف الصحي المعالجة أعلى من الآبار المستخدمة حالياً لأغراض الزراعة والتي يمكن أن تشجع المزارعين على استخدام هذه المياه المعالجة دون قلق. (3) أظهرت المراقبة النظرية على المزرعة التجريبية أن ليس هناك أي آثار سلبية لمياه الصرف الصحي المعالجة على المزروعات نفسها وعلى التربة وعلى النقيض من ذلك فإن النتائج باستخدام مياه الصرف الصحي المعالجة أفضل من استخدام المياه العذبة، من جهة أخرى من خلال إنشاء هذه المزرعة التجريبية أعطى دليل للمزارعين لاستخدام هذه المياه دون أي قلق على منتجاتهم. (4) بخصوص إعادة

استخدام المياه المعالجة والحمأة، فإن أكثر من نصف المستطلعين من المزارعين كانت فكرة إعادة الاستخدام في الزراعة إيجابية بينما من ناحية أخرى أقل من نصف المستطلعين كانت ردودهم إيجابية لإعادة استخدام الحمأة.

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LIST OF ABBREVIATIONS

BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
EPA	US Environmental Protection Agency
JWWTP	Jericho Waste Water Treatment Plant
JM	Jericho Municipality
L/c/d	Liters Per Capita Per Day
MENA	Middle East and North Africa
NIS	New Israeli Sheqel
PCBS	Palestinian Central Bureau of Statistics
PHG	Palestinian Hydrology Group
PSI	Palestinian Standards Institute
PWA	Palestinian Water Authority
TSS	Total Suspended Solids
WHO	World Health Organization

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Chapter One

Introduction

1.1 Background

Due to the increase of global population and limited water resources, a wide gap between demand and supply of water is existing and reached to a level that poses severe constraints on economic and social development and can threaten the existence of humans (Hussain et al, 2002). Most arid and semi-arid countries are suffering from water scarcity, in addition to low rainfall, droughts and limited resources, the water demand increased due to population growth, urbanization, industrialization and irrigated agriculture which creates a competition among the different water sectors (Phillipa, 2012). Arab countries are life evidence on growing of water stress; both the quantity and quality of water are no more available. The surface water is declining and the over pumping of ground water beyond the recharge rate resulted lowering the water table and deterioration of the water quality (AFED, 2010).

A more water stress is caused also by the way the water is consumed, in MENA's region more than 87% of water is allocated for irrigation and 13% only is allocated for domestic and industry use compared with 69% and 31% respectively around worldwide, if the amount of water allocated for agriculture is reduced to 15%, the amount of water for domestic and industry will be doubled in the region (Abu Madi, 2004).

Because of the aforementioned reasons it is necessary to find a source of water that can reduce the gap between supply and demand and eliminate the looming crisis which promotes some governments to start to seek an efficient alternative source that can satisfy their needs. Reuse of treated municipal wastewater is considered as a potential solution in developing a nonconventional water resource (EPA, 2004).

The practice of wastewater reuse can be returned back to approximately 3000 years to the Minoan Civilization in Crete which was used in irrigation of food crops. Table 1.1 shows some events that contributed to the evolution of treated wastewater reuse (Asano, 1996).

Table 1.1 Historical Development of Treated Wastewater Reuse (Asano, 1996)

Period	Location	Events
~ 3000BC	Crete, Greece	Minoan civilization: use of wastewater for Agricultural irrigation.
97 AD	Rome, Italy	The City of Rome has a water supply commissioner, Sexus Julius Frontinus.
1500 ~	Germany	Sewage farms are used for wastewater disposal.
1700 ~	United Kingdom	Sewage farms are used for wastewater disposal.
1800-1850	France, England, U.S.A.	Legal use of sewers for human waste disposal in Paris (1880), London (1815), and Boston (1833) Instituted.
1850-1875	London, England	Cholera epidemic is linked to polluted well water by Snow.
1850-1875	England	Typhoid fever prevention theory developed by Budd.
1850-1875	Germany	Anthrax connection to bacterial etiology Demonstrated by Koch.
1875-1900	France, England	Microbial pollution of water demonstrated by Pasteur. Sodium hypochlorite disinfection by Down to render Water “pure and wholesome” advocated.
1890	Mexico City, Mexico	Drainage canals are built to take untreated Wastewater to irrigate an important agricultural area north of the city, a practice that still continues today. Untreated or minimally treated wastewater from Mexico City is delivered to the Valley of Mexico where it is used to irrigate about 90,000 ha of Agricultural lands including vegetables.
1906	Jersey City, NJ	Chlorination of water supply
1913-1914	United States and England	Activated sludge process is developed at the Lawrence Experiment Station in Massachusetts and Demonstrated by Arden and Lockett in England.
1926	United States	In Grand Canyon National Park treated waste water is first used in a dual water system for toilet flushing, lawn sprinkling, cooling water and boiler Feed water.
1929	United States	The City of Pomona, CA initiated project utilizing Reclaimed water for irrigation of lawns and gardens.
1932-1985	San Francisco, CA	Treated wastewater is used for watering lawns and supplying ornamental lakes in Golden Gate Park and Continued with better quality effluent.
1955	Japan	Industrial water is supplied from Mikawajima Wastewater treatment plant by Tokyo Metropolitan Sewerage Bureau.
1968	Namibia	Direct potable reuse begun at Windhoek’s Goreangab Water Reclamation Plant.

Therefore the reuse of wastewater was practiced in many regions around the world for thousands of years and considered as renewable resource that can be used for different purposes and not a waste. So in order to utilize the treated wastewater three components should be available, first: the collection system, second: a well operated wastewater treatment plant and third: the end user that accepts this water (Abu Madi and Al-Sa'ed, 2009).

1.2 Research Problem

Water resources in Jericho city are mainly limited to groundwater that is exploited through wells and springs, and to surface water resources that include Jordan River and some temporary flood flow. Despite, its nearest location to the Jordan River, this resource is not exploited by Palestinians due to Israeli restrictions. At the same time, flood flows of main valleys crossing the area are not used. Wadi Qilt that forms the main valley crossing the area from west to east drains annually about one million cubic meter of flood water that finally drains into Jordan River without any usage. Thus, groundwater forms the main water resource in the area through wells and springs.

The main source of drinking water in Jericho city is Ein Sultan spring where the flow reaches about $650\text{m}^3/\text{hr}$ or $15,600\text{ m}^3/\text{day}$. The flow of the spring is stable and constant. At present, Ein Sultan spring forms the unique domestic as well as agricultural water supply source in the Jericho area. Almost 48% of the spring discharge goes to domestic use whereas the rest is used for irrigation purposes (PHG, 2010).

Considering the population growth, future water source capacity shortage is apparent. If some percentage of the spring water used for agriculture is replaced by the treated wastewater, the saved spring water volume can be used as potable water.

Increase in potable water volume will enhance commercial and industrial activities and reuse of the treated wastewater to irrigation purpose will increase agricultural products. In addition dried sludge can be used as fertilizer or soil improvement material for farm lands. This effect will invigorate the local economy.

1.3 Aim and Objectives

The aim of this research is to assess the viability of agricultural reuse of treated wastewater and bio-solids in Jericho City. The specific objectives are:

- To quantify the amounts of wastewater and bio-solids generated at the JWWTP.
- To study the quality of treated effluent and bio-solids.
- To study potential reuse of treated effluent and bio-solids in the study area with emphasis on the agricultural uses.
- To study the perceptions of farmers towards reuse of treated effluent and bio-solids.
- To assess the financial costs and benefits of reuse.
- To promote reuse amongst farmers and policy makers.

1.4 Thesis Outline

This research consists of six chapters. Chapter one presents an introduction of the thesis topic, aims and objectives and finally the research problems. Chapter two focuses about literature review of previous studies. Chapter three includes the study area. Chapter four presents the methodology used in order to achieve the goal of this research. Chapter five includes the main results of this research and a discussion of these results is also included in this chapter and finally the conclusion and recommendations are included in chapter six.

Chapter Two

Literature Review

2.1 Overview

Wastewater reuse is a popular practice in many countries around the world, where 4-6 million hectares of agricultural lands are irrigated by treated or partially treated wastewater (Jiménez and Asano, 2008). The sources of wastewater for reuse include storm water, grey water and municipal wastewater generated by urban setting and all of these kinds of wastewater were practiced in different parts of the world in different scales (Booker, 2000). Treated municipal wastewater is considered as a potential source of water that contributed to reduce water scarcity in Arab countries (Qadir et al., 2007).

The idea of reuse of treated wastewater was unfavorable in the past due to high cost of treatment and technical constrains which hampered the reuse, but after spreading the advanced wastewater treatment technologies that able to treat wastewater to non-potable application for reuse in many developed and developing countries, it has become an attractive solution in order to overcome the current and future shortage of water (Po et al., 2004).

Treated wastewater is widely used in agricultural in developing and developed counties, hence it considers as a non-conventional water resource and on other hand a nutrient concentrations that allow increasing crop yield without using fertilizers, which can reduce the cost and increase the farmer's income (Asano, 1998). Israel, Jordan and Tunisia provide the greatest share of treated wastewater in agricultural irrigation, with 70 percent of collected and treated wastewater in Israel which was considered a world pioneer in this field (Kanarek and Michail, 1996).

Urban water reuse is another application of treated water in many large countries, where Japan is the leader in this field where it used 8 percent of treated water in urban purposes like irrigation of (parks, golf courses, sports fields), waterfalls, fountains, lakes, road cleaning, car washing, and firefighting (EPA, 2004).

In order to utilize the treated wastewater three components should be available (i) wastewater collection system (ii) wastewater treatment facilities (iii) users who benefit from treated wastewater, on other hand it can be described as a commodity which its market can be classified as (i) supply side which consists from production, collection and treatment (ii) demand side which consists from the users (iii) market control which consists from regulations and standards (Abu Madi, 2004).

2.2 Types of Reuse Applications

According to (Metcalf and Eddy, 2003), reuse can be classified into following groups:

1. Agricultural irrigation reuse: Wastewater reuse for agricultural irrigation involves three major challenges:
 - Quality requirements, to limit all kinds of negative impact on human health and the environment/water cycle. This would necessitate appropriate treatment of water to be reused and the application of safe irrigation techniques.
 - Seasonal demand: wastewater is produced constantly, but irrigation is only needed seasonally, thus intermediate storage facilities would be required.
 - Location of production; the greatest amount of wastewater is generated in large cities, whereas agricultural areas are mostly located in rural areas. Consequently, long-distance transportation networks and pumping would be needed.

The technical and economic feasibility has to be studied for every specific location, especially when larger infrastructure such as storage reservoirs and long-distance transportation networks with pumps are involved.

2. Landscape irrigation: The term landscape irrigation means irrigation of surfaces not used for direct agricultural cultivation, such as green belts, public parks/gardens, forestry plantations and median strips in avenues and highways, together with sport facilities (e.g. golf courses) and hotel gardens.
3. Industrial reuse (cooling water, process water)
4. Groundwater recharge: Groundwater recharge intends to preserve groundwater levels, prevent land subsidence, protect coastal aquifers against saltwater intrusion, and store reclaimed wastewater and surface runoff for future use (called aquifer storage and recovery). Recharge methods commonly used include surface spreading in basins, direct injection into groundwater aquifers and riverbank infiltration.
5. Recreational uses (lake, ponds, fountains)
6. Non-potable urban uses (firefighting and toilet flushing)
7. Potable use

2.3 Environmental Benefits of Treated Wastewater Reuse

The positive effects of reuse can be summarized as follow (MEDAWARE, 2004; Carr et al., 2011):

1. It is considered as a non-conventional water source, which can increase water quantity by reducing potable water that is used in industrial and recreational projects and even in agricultural irrigation that needs less quality than potable water and also can reduce the over pumping of groundwater.

2. It is considered as a reliable source for farmers.
3. It can be a cost effective method by supplying farmers with nutrients and reducing the need for artificial fertilizers.
4. It can increase the crop production
5. It can supplement the natural sources and support the aquatic life.
6. It can be discharged to aquifers and to maintain water table level.

2.4 Driving Forces of Treated Wastewater Reuse Development

All literature reviews showed three driving forces that forced to reuse development, which can be summarized as follow (EPA, 2004; Jhansi & Mishra, 2013):

First: water scarcity and increasing the available water resources by using the treated wastewater, and also it can conserve the fresh water amount.

Second: treated wastewater is also considered a valuable source of nutrient when using it in agricultural scheme, which also has an economic impact on farmers when using it by reducing the chemical fertilizers and increasing the agricultural productivity.

Third: environmental and public health protection

2.5 Constraints and Obstacles for Reuse of Treated Wastewater

Choukr-Allah and Kampa (2007) summarized the main obstacles that can hamper reuse as follows:

1. Policy and political constraints: which include absence to policy or strategy to support the reuse or social acceptance.

2. Health impacts and environmental constraints: which related to treated wastewater quality due to lack of sufficient operation and maintenance of wastewater treatment plant.
3. Standards and regulations constraints: which include lack of guidelines and legislation for treated wastewater reuse.
4. Monitoring and evaluation of treated wastewater: which related to ignorance of continuance monitoring to treated wastewater quality.
5. Financial constraints: This related to the cost of treated wastewater comparing with the tariff of fresh water.
6. Public awareness and acceptance to use treated wastewater.

2.6 Case Studies of Reuse Practices

Treated wastewater reuse projects have increased during past decades in many countries, and this practice was not limited to countries suffering water scarcity like (Mediterranean region, Middle East, Latin America), but also has practiced in populated countries like (Japan, Australia, Canada, North China, Belgium, England, Germany) (EPA, 2004).

In the United States of America, especially in the state of Florida more than 462 of golf courses, are irrigated with treated wastewater which cover over 56,000 acres of land, and also treated wastewater is used to irrigate 201,465 residences, 572 parks, and 251 schools by using dual network (a network that provides treated wastewater separate than potable water), and since 1966, the treated wastewater was used in agricultural irrigation, hence more than 2163 acres of farm land are irrigated by treated wastewater and the main crop is corn (Crook, 2005).

In Japan which is considered a densely populated country and the water resources are very limited, the practice of reuse is not new and it could offer a good model in reuse especially in urban and agricultural applications, where in 1998 more than 130Mm³/year of treated wastewater were used in different purposes where 40% of treated wastewater was provided in dual networks for toilet flushing and urban irrigation, Kobe City, and Fukuoka City are considered the largest area of treated wastewater reuse in Japan (Ogoshiet *al*, 2000).

In Israel more than 92% of municipal wastewater is collected and treated to reuse in urban and agricultural irrigation, where 72% of treated wastewater is used for irrigation, the main incentives of high percentage of reuse are; the water crisis and the low cost of treatment (Angelakis et al., 2003). The Dan Region Treatment Plant (DRTP) is an example of treatment plant in Israel which is considered the largest plant in Israel that can treat about 100 million cubic meter of wastewater from Tel Aviv and provides the treated wastewater for unrestricted irrigation (Haruvy, 1997).

Tunisia is considered as one of the Arab countries that has long experience in treatment and reuse of treated wastewater and since 1965 Tunisia uses the treated wastewater to irrigate citrus, orchards, olive trees, fodder crops and golf courses. Tunisia had 61 operated wastewater treatment plant in 2008, which can treat more than 0.24 billion cubic meter of wastewater to secondary treatment and then offered to farmers to irrigate their fields (Bahri, 2008a).

In Jordan more than 85% of treated wastewater is used for different purposes, where wastewater forms 10% of total water supply (MEDWWRWG, 2007). In 2008 Jordan had more than 21 wastewater treatment plant which can generate more than 100 million cubic meter of treated wastewater which can be used directly for irrigation or stored to use it later for irrigation, one of

demonstration project was implemented in Wadi Musa near Petra where the reclaimed water was used to irrigate different agricultural crops like alfalfa, maize, palm trees citrus. The reclaimed water is expected to reach 223 million cubic meters by 2020 (JMWI, 2009a).

In Egypt the annual generated amount of wastewater is more than 3.5 million cubic meter while the hydraulic capacity of treatment plants is 1.6 million cubic meter annually which is the main obstacles of reuse in Egypt (Tawfic, 2008). The reuse of treated wastewater is not a new practice; the treated wastewater has been used since 1900, where it was being used to irrigate orchards, food, green belts and tree along the desert roads (Tawfic, 2008).

2.7 Reuse in Palestine

Palestine is one of the countries that is suffering from water scarcity which hampers the economic and social development in the region. The estimated water deficit will be around 271 MCM in year 2020, which forced to search other water sources even with low quality where in some cases the raw wastewater is used to irrigate fruit trees and vegetables in some areas (PWA, 2005).

Reuse of treated wastewater in Palestine is limited to agricultural irrigation option in order to minimize the sever water shortage, where the agricultural consumption is about 70% while 30% is used for domestic and industrial purposes (RAND, 2007).

Despite the intended to use the treated wastewater for irrigation in Palestine, farmers still hesitate to use it, this fears due to lack to demonstration projects for reuse and a public awareness among farmers (Zimmo et al, 2005). Al Bireh WWTP is one of the projects that planned to use the treated wastewater at Deir Debwan town for irrigation purposes, it produces 1.2 MCM/year which can cover 230 ha of agriculture land, despite a good quality of treated wastewater, the

treated wastewater is discharged to wadi due to non-acceptance of Deir Debwan farmers to use it, despite the availability of agriculture land and water scarcity in the region (Al-Sa'ed, 2007).

The West Nablus WWTP has a capacity of 12,000 m³ of water per day, which is released into Wadi Zomar without any reuse (PWA, 2014).

In Gaza there is a lack of reuse projects, the reuse is limited to small pilot projects, one of the pilot projects is through a French program called “Strategy of agricultural water management in the Middle East”, Two areas were chosen for the implementation of the project the first was Beit Lahia area where the treated wastewater coming from the Beit Lahia WWTP was available in unlimited quantities to irrigate vegetation for animal consumption cultivated on an area of 20 dounums. The drip irrigation system was used with a wastewater filtration system that consists of sand filter in order to avoid drippers clogging from time to time. Different types of fodder were selected as Alfalfa, Rye Grass and Sudan Grass which met the local market in the Bedouin Village where there is a number of sheep and cow keepers. The second area of the project is in the Gaza Eshtiwi farm to irrigate citrus, olives trees and various fruits on a land of 12 dunums by the treated wastewater generated from the Gaza wastewater treatment plant. The system of irrigation was also drip irrigation (Abu Sultan, 2015).

2.8 Standards and Regulations of Reuse

Standards and regulations are the most important element in any sustainable reuse scheme and should be realistic and enforcement otherwise it will create attitude of unconcern among polluters and administrators, on other hand they can encourage both supply and demand for treated wastewater (AHT Group AG, 2009). Standards and regulations may differ from country to country and usually they are based on other international experiences where in Middle East

and North Africa adopted either United States Environmental Protection (USEPA) or World Health Organization (WHO) guidelines, the rationale behind using of these guidelines is to develop criteria to prevent transmission diseases with optimizing resources recycling (WaDImena, 2008).

All Literatures reviews showed that all researchers can be divided into two schools of thoughts on matter of appreciate level of nematode and fecal coliform that should be exist in treated wastewater, the less strengthen school led by WHO and no risk school led by US, the last school can't be adopted in developing countries which needs high cost of treatment (Marecos do Monte et al., 1996).

Generally Arab countries have different approaches to protect public health and the environment. The high income counties have adopted high technology, high cost with high standards while the low income countries have adopted low cost technology based on WHO recommendations (AHT Group AG,2009).According to cost estimation of the two scenarios (WHO and USEPA standards), the assessment showed in order to meet USEPA standards extra expenditure of US \$ 3-30 million per case, for disease prevention, which make WHO guidelines more attractive and financially feasible than USEPA (Shuval et al.,1997).

According to final disposal of treated wastewater, Arab countries could be divided into three categories, the first category which includes Bahrain, Oman, Saudi Arabia, Qatar, Kuwait, and UAE: in this group a high percentage of treated wastewater is used in irrigation of agricultural and landscape and the rest discharge into sea after advance treatment and strict quality standards, the second category includes Egypt, Iraq, Jordan, Morocco, and Syria: this group adopted moderate standards for reuse where the treated wastewater is disposed into water bodies for later

use in agricultural, the last category includes the West Bank, Yemen, and Lebanon: where large amount of wastewater is discharged into wadis and used for irrigation without any consideration about public health (Choukrallah, 2011).

2.9 Palestinian Reuse Standards

Palestine is one of the countries that did not own standards and guidelines for long time, and all practices for reuse were according either WHO guideline or from neighboring countries like Jordan and Egypt, but recently the Palestinian Authority has established its own standards for reuse but still draft and need enforcement (MEDAWARE, 2005).

The draft of Palestinian standards Table 2.1 covers three main issues: Sanitary, Environment and Agro- technical quality requirements. The sanitary requirements focused on pathogens that may exist in treated wastewater like bacteria and intestinal nematode where the draft mentioned less than 1 intestinal nematode per liter and 200-100 fecal coliform per 100 ml of treated wastewater. The environment requirements focused on heavy metals, salts and nutrients while the agrotechnical requirements focused on anions like (Cl^- , SO_4^{--} , HCO_3^-) and cation like (Ca^{++} , Mg^{++} , Na^+) which can determines the irrigation method for reuse (MEDAWARE, 2005).

Also according to draft of Palestinian standards other quality parameters should be monitored for ground water contamination, soil structure and for crop growth, these parameters include: nitrate, total dissolved solids, sodium adsorption ratio and toxic elements (PWA, 2000).

Table 2.1 Classification of the Treated Wastewater according to Quality (MOA, 2012)

Maximum limits for chemical and biological properties (mg/L) unless otherwise stated	Quality of Treated Wastewater			
	High quality (A)	Good quality (B)	Medium quality (C)	Low quality (D)
Biochemical Oxygen Demand BOD ₅	20	20	40	60
Total Suspended Solids TSS	30	30	50	90
Fecal coliform bacteria (colony/100 mL)	200	1000	1000	1000
Chemical Oxygen Demand COD	50	50	100	150
Dissolved Oxygen DO	< 1	< 1	< 1	< 1
Total Dissolved Solids TDS	1200	1500	1500	1500
Potential of Hydrogen PH	6-9	6-9	6-9	6-9
Fat, Oil and Grease	5	5	5	5
Phenol	0.002	0.002	0.002	0.002
Detergents MBAS	15	15	15	25
Nitrate Nitrogen NO ₃ -N	20	20	30	40
Ammonium Nitrogen NH ₄ -N	5	5	10	15
Total Nitrogen T-N	30	30	45	60
Chloride Cl ⁻	400	400	400	400
Sulfate SO ₄ ⁻	300	300	300	300
Sodium Na ⁺	200	200	200	200
Magnesium Mg ⁺⁺	60	60	60	60
Calcium Ca ⁺⁺	300	300	300	300
Sodium adsorption ratio SAR	5.83	5.83	5.83	5.83
Phosphate Phosphorus PO ₄ -P	15-20	15-20	15-20	15-20
Aluminum Al	5	5	5	5
Arsenic As	0.1	0.1	0.1	0.1
Copper Cu	0.2	0.2	0.2	0.2
Iron Fe	5	5	5	5
Manganese Mn	0.2	0.2	0.2	0.2
Nickel Ni	0.2	0.2	0.2	0.2
Lead Pb	0.2	0.2	0.2	0.2
Selenium Se	0.02	0.02	0.02	0.02
Cadmium Cd	0.01	0.01	0.01	0.01
Zinc Zn	2	2	2	2
Cyanide CN	0.05	0.05	0.05	0.05
Chrome Cr	0.1	0.1	0.1	0.1
Mercury Hg	0.001	0.001	0.001	0.001
Cobalt Co	0.05	0.05	0.05	0.05
Boron B	0.7	0.7	0.7	0.7
Bacteria E. coli (Colony/100 mL)	100	1000	1000	1000
Nematodes (Eggs/L)	≤ 1	≤ 1	≤ 1	≤ 1
Maximum temperature	35	35	35	35
The degree of turbidity	5-10	5-10	5-10	5-10

2.10 Agronomic Concerns of Treated Wastewater

Treated wastewater is a valuable source for agriculture irrigation, but its quality should be considered at reusing especially some properties that have critical effects on plant, soil and environmental quality (Haering, 2009).

2.10.1 Salinity Levels

The concentration of salts (salinity) is the most important consideration when choosing the treated wastewater for reuse, which can express about it by the sum of all elements ions (e.g., sodium, calcium, chloride, boron, sulfate, nitrate) either by electrical conductivity ($EC = \text{ds/m}$) or by total dissolved solids ($TDS = \text{mg/l}$) found in water (EPA, 2004). The effect of high concentrations of salts on plants occurred by reducing the plant water uptake by reducing the osmotic potential of soil (Lazarova et al., 2004a). When applying the treated wastewater for irrigation, the concentration of salts should be measured, because plants differ in their sensitivity to salts level where it may be toxic above 2000 mg/l (Harivandi, 2004).

2.10.2 Sodium, Chloride and Boron Concentrations

High concentration of Sodium can effect on soil structure by dispersing soil aggregates and sealing of soil pores, Sodium Adsorption Ratio (SAR) which measures the ration of sodium to other ions can be used to evaluate the effect of treated wastewater on soil; in some cases the high concentration of sodium may be toxic to plants (Harivandi, 1999).

High concentration of chloride and boron dissolved ions in treated wastewater may have a toxicity problems on plants; the degree of toxicity depends on plant type and on the method of irrigation (Harivandi, 1999).

2.10.3 Nutrient Levels

Reclaimed water typically contains more nitrogen (N) and phosphorus (P) than drinking water. The amounts of N and P provided by the reclaimed water can be calculated as the product of the estimated irrigation volume and the N and P concentration in the water. To prevent N and P leaching into groundwater, the water reclamation and reuse regulation requires that a nutrient management plan be written for bulk use of reclaimed water not treated to achieve biological nutrient removal (BNR), which the regulation defines as treatment that achieves an annual average of 8.0 mg/L total N and 1.0 mg/L total P. Water that has been subjected to BNR treatment processes contains such low concentrations of N and P that the reclaimed water can be applied at rates sufficient to supply a crop's water needs without risk of surface or ground water contamination. (Haering, 2009).

2.10.4 Total Suspended Solids

High suspended solids (TSS) concentrations may clog irrigation systems, and can fill pore spaces near the soil surface resulting in reduced drainage. Acceptable TSS levels will vary depending on the type of suspended solids and type of irrigation system. Generally, TSS levels less than 50-100 mg/L are safe for drip irrigation. (Lazarova et al., 2004a).

2.11 Wastewater Characteristics

Generally municipal wastewater consists from domestic wastewater, industrial wastewater, and storm water and from ground water seeping to sewer networks. The main compositions of municipal wastewater are Organic matter, Nutrients (Nitrogen, Phosphorus, and Potassium), Inorganic matter (dissolved minerals), Toxic chemicals and Pathogens. Table 2.2 shows that the generated wastewater is concentrated. Its strength is high due to the fact that the West Bank per capita water consumption is low. Considering the limited industrial activities in the West Bank;

light industries are prevailing, which means that heavy metal contamination is not probable (Adilah, 2010).

Table 2.2 Characteristics of Raw Municipal Wastewater in West Bank (Adilah, 2010).

	Municipal Wastewater		
Parameter mg/l	Ramallah	Hebron	Al-Bireh
BOD ₅	525	1008	522
COD	1390	2886	1044
K _j -N	79	278	73
NH ₄ -N	51	113	27
NO ₃ -N	0.6	0.3	-
SO ₄ ²⁻	132	267	-
PO ₄ ³⁻	13.1	20	44
Cl ⁻	350	1155	1099
TSS	1290	1188	554

2.12 Economics of Wastewater Treatment and Reuse

Wastewater should be recognized as an economic resource, which can provide water, nutrients, biogas and other valuable materials, globally 330 km³ of wastewater is being generated which can theoretically irrigate and fertilize millions of hectares of crops and provide energy for millions of households (Mateo-Sagasta et al., 2015).

Despite the importance of wastewater treatment and reuse, some challenges can reduce this value including the diversity of wastewater types and lack of infrastructure to collect wastewater to a single point which generates small portions of treated wastewater that can be used (Mateo-Sagasta et al., 2015).

Cost benefit analysis and life cycle assessment are the common tools to evaluate the feasibility of any water and wastewater projects (Rodriguez Garcia et al., 2011). Despite the benefits wastewater treatment and reuse have on the environment, socially and on health level; some cannot be calculated because its value cannot be determined by the market (Drechsel et al., 2015b).

The economic drivers for wastewater treatment and reuse are the resources recovery, such as, energy saving (generation of biogas), nutrients recovery for plants and saving in wastewater disposal and water supply (Drechsel et al., 2015a).

Chapter Three

Study Area: Jericho City

3.1 Overview

The Study area is Jericho City. Which is one of the smallest cities in the Palestine. It is located in the far east of the West Bank with the lowest altitude (250 meters below sea level) of any city. The population is about 20,000, with a large part of the population engaged in agriculture as Jericho is considered a green oasis located in the Jordan Valley. Figure 3.1 depicts Jericho City and the surrounding communities (PCBS, 2007).

It is 35 km east of Jerusalem and about 14 km northwest of the Dead Sea and 8 km west of the Jordan River and extends over 37,481 Donums. The city has been and will continue to be developed as a regional center for trade, tourism, and agriculture as well as environmental management, particularly due to its unique historical, religious and cultural characteristics. Today Jericho City is the only international gateway for Palestinians residing in the West Bank to the outside world (PHG, 2010).

3.2 Demography and Population

According to the Palestinian Central Bureau of Statistics (PCBS), the population of Jericho City today is estimated to be 13773 with about 43% of the total population classified as refugees in both Ein alSultan and Aqbat Jabr Refugees Camps. Known as the city with the lowest population, Jericho is inhabited by 69 persons/km² which implies a potential for future expansion (PCBS, 2007).

Table 3.1 lists the households and population numbers in Jericho Governorate as of the PCBS 2007.

Table 3.1 Households and Population in Jericho Governorate (PCBS 2007)

No.	Name	Households	Population	Capita per Households
1.	Jericho	2394	13773	5.8
2.	Al Jiftlik	507	3178	6.3
3.	Az Zubeidat	85	968	11.4
4.	Al Auja	477	2891	6.0
5.	An-Nabi Musa	7	45	6.4
6.	An Nueima	133	841	6.3
7.	Ein Ad Duyuk at Tahta	113	698	6.2
8.	EinadDuyuk al Foqa	96	588	6.1
9.	Fasayil	117	650	5.6
10.	AqbatJaber Camp	765	4462	5.8
11.	Ein al Sultan Camp	274	1467	5.4
12.	Marj al Ghazal	35	278	7.9
13.	MarjNa'ja	83	554	6.7
Total		5086	30393	6.0 (average)

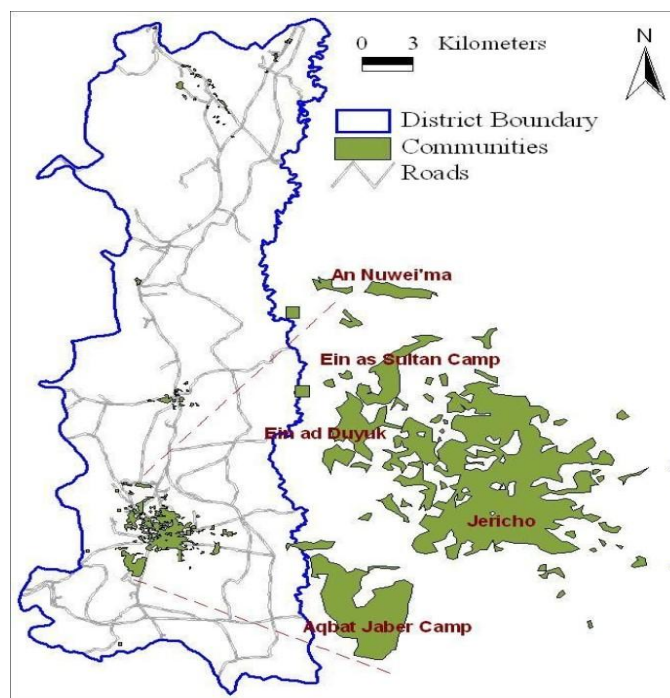


Figure 3.1 Jericho City and the surrounding community(PCBS 2007)

3.3 Climate

Palestinian climate belongs to Mediterranean Sea climate having rainy winter time and hot summertime. Annual rainfall fluctuates depend on year or area ranging from 150 mm to 1,100 mm. Average annual rainy days are 25 to 55 days. Supposing from the locality of Jericho city, surrounded by mountains with ground elevation of minus 300 m below sea level, it is hot in summertime with temperature exceeding 40°C, on the other hand it is cold and comfortable with temperature down to 15 °C. Thanks to such a favorite locality, many tourists visit the area. Annual rainfall is 50to 400 mm and most of rain falls concentrate during October to March. (PHG, 2010).

3.4 Land Use

The land use map of the City of Jericho is shown below in Figure 3.2. Despite the fact that the city has prepared a city master plan in 2004, illegal buildings and the control of illegal buildings constructions and the ability of the city to take action is limited. This explains the growing needs to construct expand and rehabilitate the roads system and water network in the city (Jericho municipality, 2011).

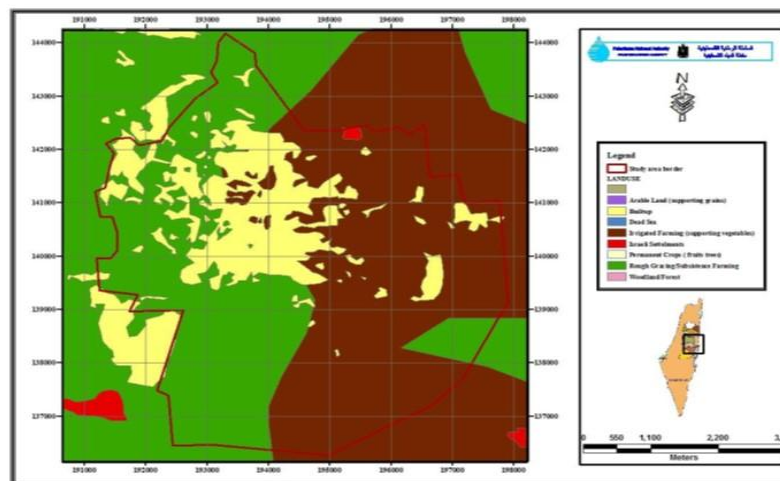


Figure 3.2 Jericho City Land Use Map(Jericho Municipality, 2011)

An indicator of the expansion of houses constructions over the past few years is Table 3.2 below, which shows the total area of construction in square meters within the City borders. As noticed from the table, the year 2005 has witnessed a sharp increase in the constructions industry due to the JICA projects. Another issue of land miss management in Jericho is the construction of buildings within agricultural areas (Jericho Municipality, 2011).

Table 3.2 Area of Construction in Jericho City

Year	Total Area of constructions (km2)
2002	17012
2003	23837
2004	23032
2005	61720
2006	22601

3.5 Geopolitical Aspects

Oslo agreement has classified the lands of the Palestinian Territories as A, B, and C. The Palestinian Authority (PA) has civil and security control only over area A and area C is totally under the control of the Israeli authorities. The civil affairs in area B, which extends outside the Palestinian cities and villages, are managed by the PA, while the security is kept in hands of Israel.

According to Article 40 of the Oslo II Agreement, Israeli Civil Administration through the Joint Water Committee (JWC) has to approve any water or wastewater project in the West Bank. However, previous experience with this approval process is not promising.

Jericho city is classified as area A, but is surrounded from all sides by areas classified as "C" Figure 3.3. This is adding to the complications of Jericho as most infrastructure facilities has to

cross the municipal boundary and thus to conflict the restrictions of Oslo agreement and classifications (PHG, 2010).

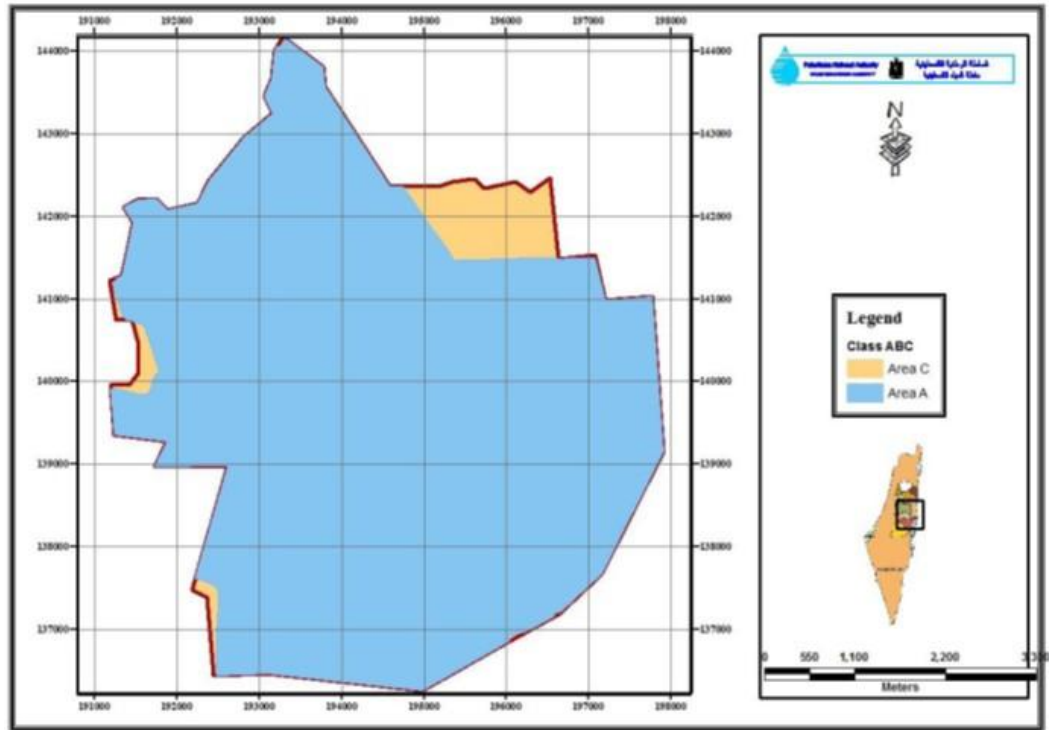


Figure 3.3 Oslo Classifications for Areas (PHG, 2010)

3.6 Water Resources

Groundwater is used as the main source of water supply for the Palestinian in the Jericho city either by wells or springs. Water of wells is taken from the quaternary aquifers. The aquifers are recharged from seasonal rainfall through the outcropping mountainous areas in WB. The eastern basin is considered the main source of water for shallow wells through direct infiltrations from the surface runoff or by lateral flow from the mountain aquifers.

The working agricultural wells are 28 out of 93 wells. The remaining wells are non-pumping and abandoned wells. The Jericho area using Al Sultan Spring has quite high water use efficiency. The irrigation methods in this area have been originally advanced from the viewpoint of water-

saving agriculture. The new irrigation pipeline system was already installed, and it is expected that water use efficiency will become higher. However, there is friction concerning water allocation between the farmers and the municipality which has responsibility for O&M of the facilities. The agreed allocation volume was that 42% of water is for domestic purposes and 58% is for agricultural purposes. According to the farmers, however, the current allocation has a gap from the agreed rate, that is, only around 40% is allocated for agriculture. The water tariff for agricultural purposes is also one of causes of friction.

3.7 Water Supply and Use

The total water that is being supplied by network does not only used for domestic use but also for commercial and agriculture purposes also, in Figure 3.4 shows the main categories benefit from the total quantities of water that are being pumped into domestic system on 2009 which reaches to 2,228,985 m³/year and segregated to three components as figure 3.4, (PHG, 2010).

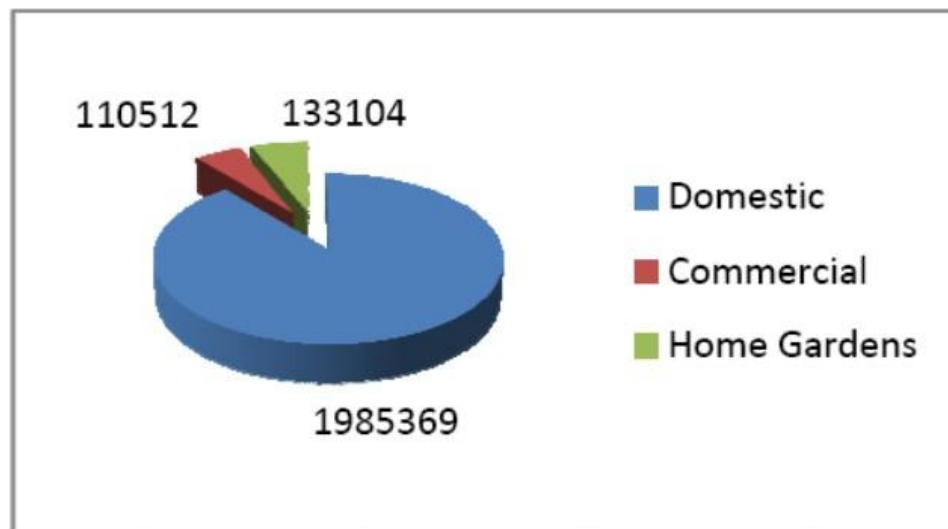


Figure 3.4 Water use categories (PHG, 2010)

According to the study of (PHG, 2010), the per capita per day of domestic use is 205 liters, which is higher than the average of per capita of water used in other places and this is due to many reasons:

1. 36.6% of domestic water is used for irrigation of gardens.
2. 0.3% of domestic water is used for swimming pools.
3. 20.3% of domestic water is used for wet air conditioning.

As a conclusion of study 57.3% is going for irrigation and cooling while 42.7% is going for actual domestic use which decreases the per capita per day to 87.6 liters.

3.8 Water Tariff

The current tariff structure of domestic water use at Jericho municipality is summarized in Table 3.3

Table 3.3 Water Tariff

Block no.	Consumption category	Price (NIS/m ³)	Tax (NIS)
1	0 - 100 m ³	1	10
2	101 - 150 m ³	2	
3	151 - 250 m ³	4	
4	> 250 m ³	5	

3.9 Agricultural Tariff

The tariff of agricultural water is very complicated, but according to municipality calculation the price of cubic meter of water for agriculture is 0.36 NIS.

3.10 Agricultural lands east of Jericho City

The total irrigable lands at the east part of Jericho city is around 6583 Donums, which mainly depends on very saline water extracted from wells for irrigation, the annual water demand for each Donums is 830 m³ (PHG, 2011).



Figure 3.5 Irrigable lands to the east of Jericho

3.11 Sanitation Condition

Until June 2014, Jericho had neither wastewater collection networks nor wastewater treatment facilities. There are some wastewater treatment units at the household or complex building scale; examples include some security forces camps, Jericho hospital and two hotels. The main wastewater disposal system currently used is cesspits and percolation pits. The average size of the cesspits ranges between 10 to 40 cubic meters. As most of the geological formation of Jericho is Quaternary rocks and Jericho falls mainly over the Loessial Serozem soil type of relatively high infiltration rates, the frequency of cesspit emptying depends on water consumption and wastewater generation rates, disposal practices and methods of construction of the cesspits.

Evacuation of the cesspits is being performed using vacuum tankers. Usually the septage is disposed in the nearby Wadis and agricultural lands. These are causing social and environmental problems as to the frequent emptying and/or direct infiltration of the sewage into the ground.

Therefore there was an urgent need to solve the problem and provide Jericho with a wastewater collection system and treatment plant.

Based on these circumstances, the Palestinian Government requested Jericho Wastewater Collection, Treatment System Project under the Japanese Grant Aid Assistance in Jericho Municipality in August 2008. In response to the request, the Government of Japan decided to conduct the Preparatory Survey to study the feasibility of the Project. JICA conducted the Preparatory Survey to examine the target facility construction sites and wastewater treatment methods. The outline of the request is as follows:

- Construction of a wastewater treatment plant (WWTP) that serves Jericho Municipality and the surrounding areas; namely, Nwaeima District, Duyuk District, Ain Sultan Camp and Aqbet Jaber Camp.
- Installation of trunk and branch sewer lines.

The survey team was dispatched from 12 December 2010 to 7 January 2011 and from 31 January 2011 to 8 March 2011 for the basic design, and in July 2011 for the explanation of the draft final report of the basic design and between 2012 to 2014 for the construction.

Jericho Wastewater Collection, Treatment System project objective is to contribute to the improvement of the health conditions of the population of Jericho and more specifically to:

- Protect the groundwater aquifer and the soil from sewage percolations.
- Eliminate nuisance that results from overflow of sewage into the surroundings of the populated area.
- Reducing the health risks to the population that results from the lack of proper integrated sanitation systems.

- Protect the environment from degradation due to stagnation and/or flow of untreated sewage in surface or subsurface.

Figure 3.6 shows Jericho Wastewater Collection, Treatment System project. The location of the WWTP is at the eastern boundary of Jericho Municipality slightly south of Wadi Al-Qilt.

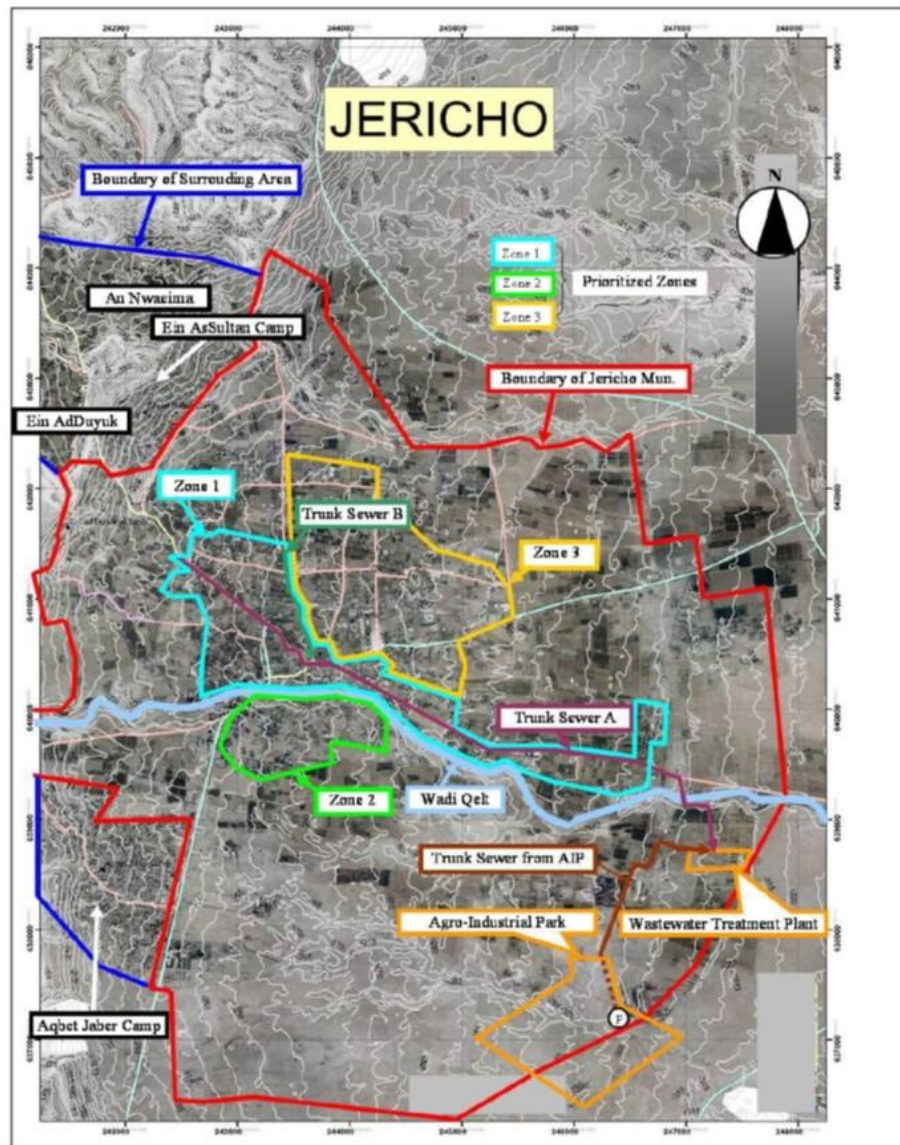


Figure 3.6 Jericho Wastewater Collection, Treatment System Project

The total length of the sewer pipes needed to serve the whole project area of Jericho is estimated at 80 km including trunk and branch pipes, which cannot be covered by this project. Therefore,

three densely populated areas were extracted as prioritized sewer development areas (Zone 1, Zone 2, and Zone 3) covering around 60% of the total population.

The construction of the wastewater collection system is to be done under the three priorities. Priority Zone 1 is to include the city center and those populated area adjacent and north of wadi Al-Qilt. Priority Zone 2 covers the populated areas adjacent and south of wadi Al-Qilt. The third priority Zone 3 extends to cover most of the populated areas in the northern parts of Jericho. Later stages include Ein Sultan camp, Ein alDuyuk, Aqbet Jaber camp and Al Nwaeima. The total lengths of the collection network of these three zones are about 32 km branch sewers and 12 km main sewers. The wastewater collection system consists of mainly PVC pipes for 8", 10", 12" and 16" diameter pipes. For larger diameters concrete pipes are used.

3.12 Treatment Process

Figure 3.7 depicts the treatment processes of Jericho WWTP and Figure 3.8 shows the layout plan of the WWTP. The primary treatment reactor is Oxidation Ditch with a retention period is 24 hours. Since the expected treatment load is high owing to high incoming wastewater concentration, the treatment method is corresponding to extended aeration method. Disinfection tank and treated wastewater storage tank for reuse purposes are among the other proposed components of the Jericho WWTP. Application of these was judged as appropriate from viewpoint of safe reuse of the treated wastewater. Further, Solar Panel with output of 100 kW and with an area of 1,000 m² is proposed from viewpoint of environmental consideration and to have O&M cost mitigation.

The first phase has been designed for 9800 m³/day and the final phase for 14400 m³/day. The mechanical-biological treatment includes the following main components:

- Fine screens
- Aerated grit and grease removal
- Extended aeration tanks
- Final sedimentation tanks (Clarifier)
- Disinfection stage
- Treated water tank

The components of sludge treatment are:

- Sludge thickener
- Sludge drying beds

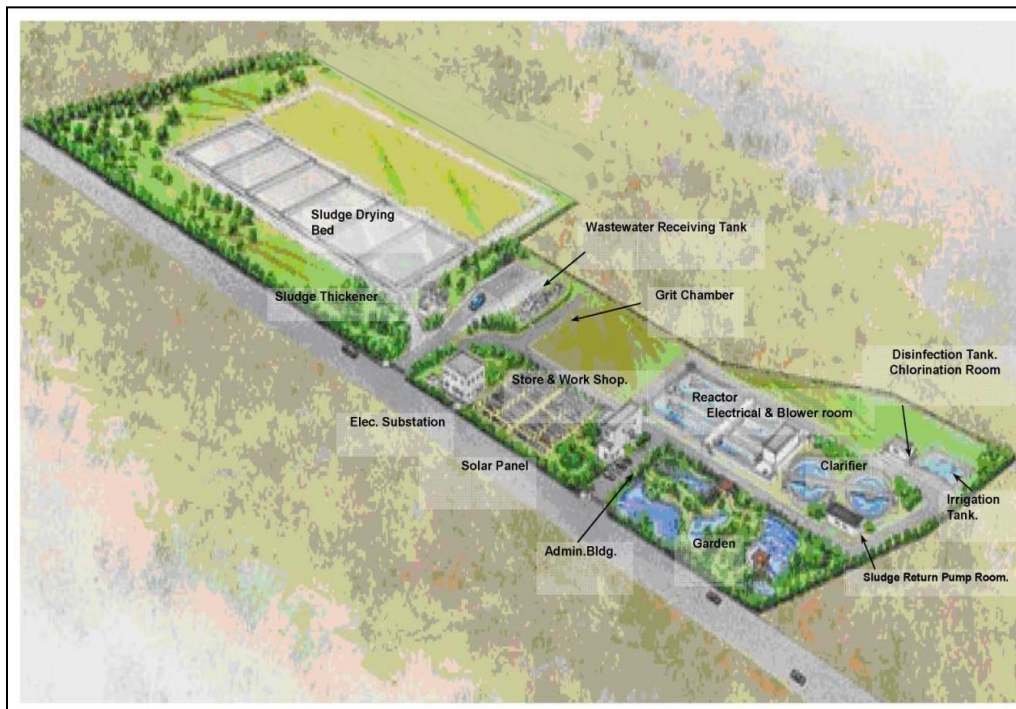


Figure 3.7 Layout of Jericho Wastewater Treatment Plant

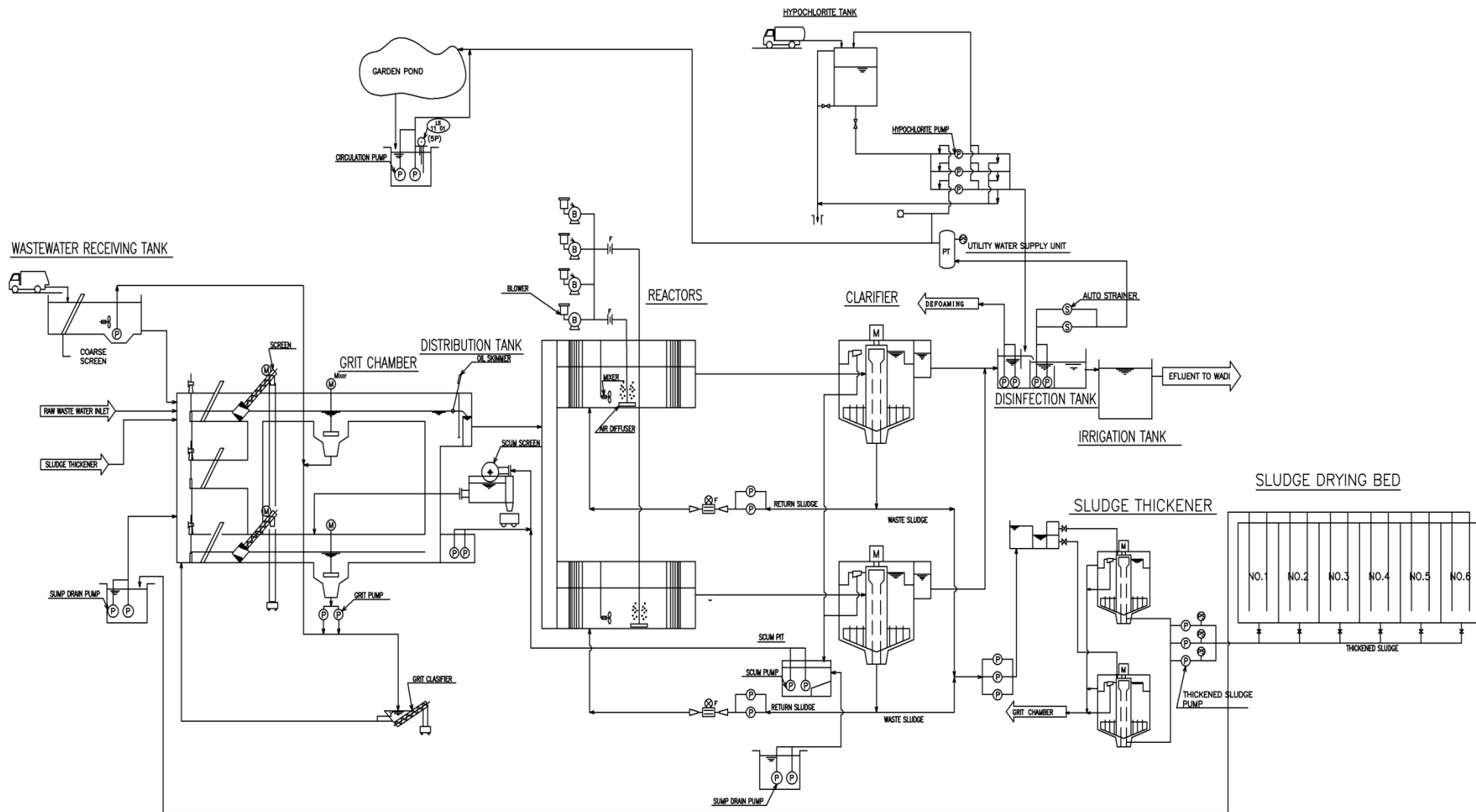


Figure 3.8 Flowchart of Jericho Wastewater Treatment Plant

3.13 WWTP Designed Capacity and Quality

Design wastewater amount and quality are planned for the target year of 2020 and for the ultimate Plan (100 % connection in 2025) as shown in Table 3.4.

Table 3.4 Design WWTP Capacity and Treated Wastewater Quality (JICA, 2011)

Item	Wastewater Amount and Quality			Effluent Quality
	Daily Average	Daily Maximum	Hourly Maximum	
Wastewater Amount (m ³ /day)	6600	9800	19100	-
BOD (mg/L)	500			20
TSS (mg/L)	500			30
T-N (mg/L)	75			25

3.14 WWTP Mass Balance

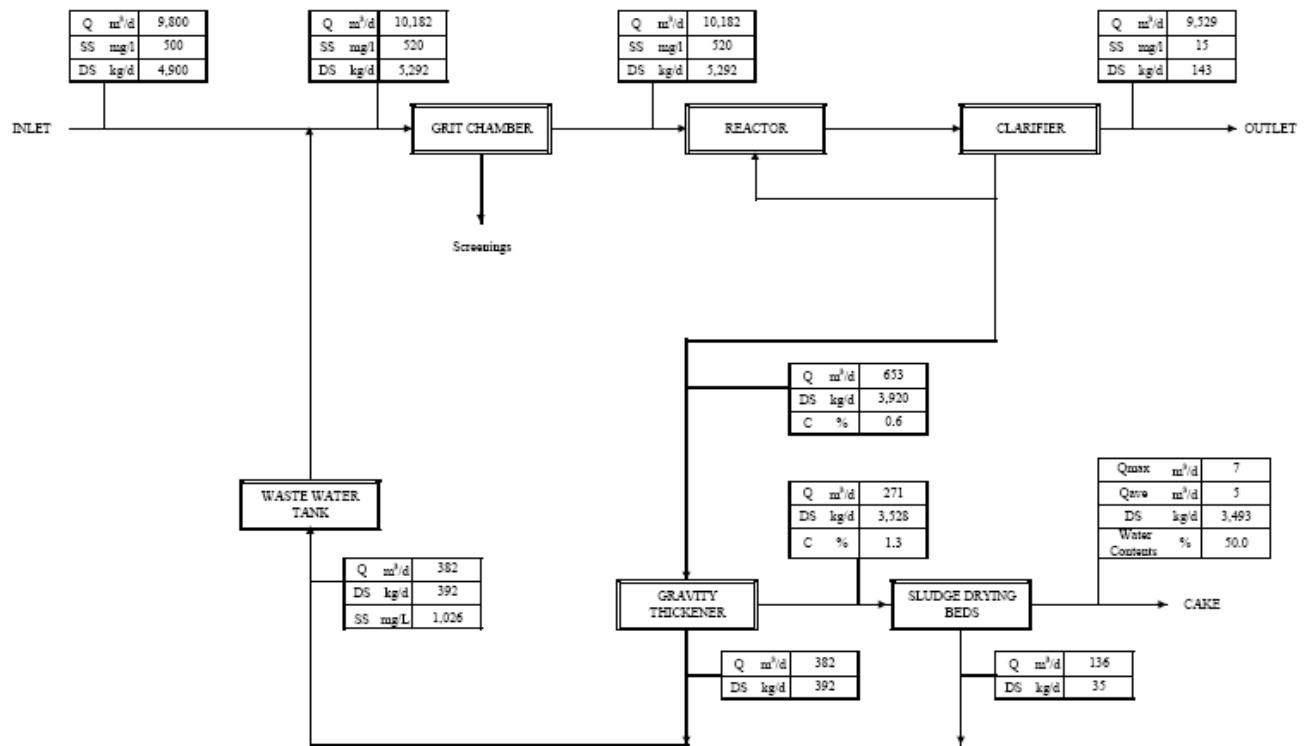


Figure 3.9 Mass Balance Diagram of WWTP (JICA, 2011)

3.15 Sewerage Fee and Connection Fee

The sewerage by-law of Jericho Municipality including sewerage fee and connection fee was approved by the Municipality Council in March 2014 and activated in April 2014. The sewerage fee and connection fee scheme is as shown in Table 3.5. Uniform volumetric tariff was adopted instead of progressive volumetric tariff, considering the unexpected behavior of customers to save water.

Table 3.5 Sewerage Fee and Connection Fee

Category	Unit Fee	Notes
Sewerage Fee	1.0 NIS/m ³	For every cubic meter of water consumption
Connection Fee	13 NIS/m ²	For every square meter of building

Chapter Four Methodology

4.1 Wastewater Generation

4.1.1 Household connections

Since the sanitary project of Jericho city was completed by June 2014, which consists of a treatment plant and main collection system as mentioned previously and since the house connections are not included in this project but on municipality responsibility, so it is valuable to study the annual potential number of connections in order to account the quantity of wastewater produced.

Potential number of household connections was counted up and grouped into neighborhood, using satellite image and site investigation, along the trunk sewer that was constructed by the Grant Aid Project and 16km of the branch sewer that will be constructed by the USAID fund.

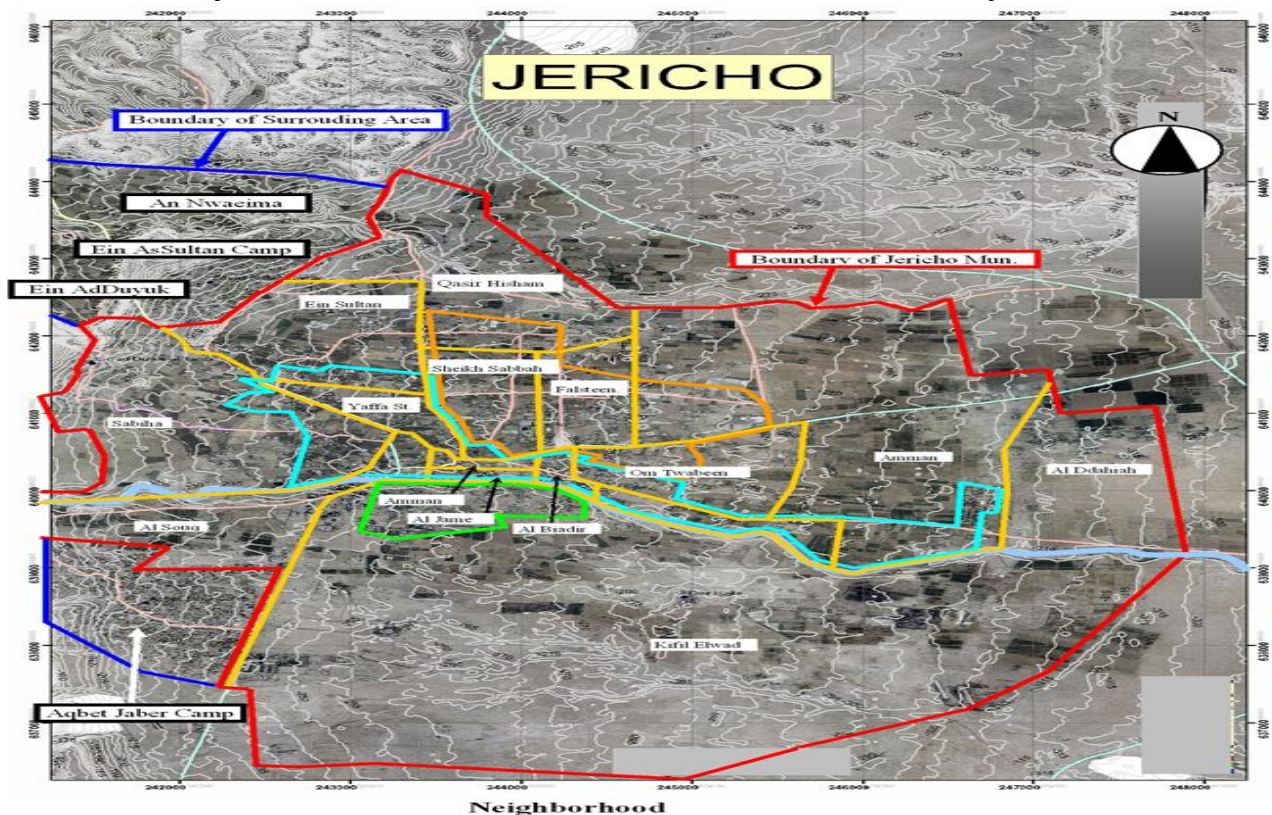


Table 4.1 Household Connections**Household Connections**

Total Water Connections in 2012	Number of Connections to Sewer							Sum 2014-2020
	2014	2015	2016	2017	2018	2019	2020	
5,195	89	409	340	340	340	340	340	2,198

Discharged Household Connections

							Discharge Rate:	1st year	50%
								2nd year	50%
Number of Discharged Connections to Sewer									
	2014	2015	2016	2017	2018	2019	2020	Sum 2014-2020	
2014	45	44						89	
2015		205	204					409	
2016			170	170				340	
2017				170	170			340	
2018					170	170		340	
2019						170	170	340	
2020							170	170	
Sum	45	249	374	340	340	340	340	2,028	

The estimation of wastewater was based on the “unit supplied water per connection” according to 18 neighborhoods; this is from past water supply data. The estimation was made by using primary regression equation prepared for each neighborhood. Unit wastewater consumption is calculated from unit water consumption multiplied by 55%.

Table 4.2 Unit Supplied Water (l/connection/day)

Neighborhood	2008	2009	2010	2011	2012
1. Al-Bayader	694.87	744.45	752.37	719.82	819.44
2. Sheikh Sabbah	835.87	855.61	905.58	864.18	913.61
3. Sheikh Sbeih	817.80	879.53	917.73	994.91	1096.28
4. Om-Tawabeen	841.77	879.34	829.27	802.40	924.68
5. Sabiha+AlDoeuk	660.52	721.86	802.73	807.34	838.30
6. Ein-Sultan	739.24	807.50	857.41	867.17	864.54
7. Qasir-Hisham	756.37	756.49	769.96	834.76	888.21
8. Kitf Al Wad	736.47	767.01	794.32	803.39	937.32
9. Al-Dahiah	1127.40	1212.12	1309.86	1442.05	1411.44

10. Al-Maghtes	999.49	984.41	1034.42	998.70	1251.28
11. Falasteen	792.44	853.13	874.44	910.39	1035.72
12. Amman	825.71	878.86	979.54	952.85	977.95
13. Al-Souq	374.93	342.51	366.91	358.75	371.40
14. Al-ma'moun	947.01	1005.94	1063.95	1013.45	1153.01
15. Al-Rasheed	454.37	418.48	483.53	484.16	468.14
16. Al-Quds	666.36	799.46	763.13	800.72	929.57
17. Yaffa	986.50	959.31	996.80	928.87	883.51
18. Al-Jame	361.67	391.52	399.42	390.73	406.72
Average	750.01	797.03	834.96	845.96	919.34

4.1.2 Large Users

Large users are comprised of 26, from “Arab Development Society” to “Palestinian Academy for Security Sciences”; each location was identified and grouped into neighborhood. The unit wastewater consumption was calculated from unit water consumption multiplied by 55%.

Table 4.3 Large Users Connections

Name of Large User	Connection Year				
	2014	2015	2016	2017	2018
1 Arab Development Society	1				
2 Ghosheh Factory	1				
3 National Security Training Center		1			
4 Military Intelligence		1			
5 Ministry of the Interior		1			
6 The Leadership of the National Security Forces		1			
7 General Administration Police College		1			
27+28+29 Palestinian Academy for Security Sciences	1				
8 Jibril Muhammad Aldmanhori/Allimona	1				
9 Suleiman KhaderGeahchan /Alrawda	1				
10 The Tourist Village	1				
11 TyseerNimer Mustafa/ Alwaha	1				
12 School girls basic minimum		1			
13 Jericho, Girls High School		1			
14 Girls Jericho Elementary School High		1			
15 Jericho Women Charitable	1				
16+17 Palestine Telecommunications	1				
18 Mehdi Alajlouni -Commercial		1			

	Investments					
19	Ziad Nusseibeh -Company Compromise	1				
20	House Grandparents to Care for the Elderly	1				
21	Agricultural Jericho Station	1				
22	Jericho Government Hospital	1				
23	Jericho Health Directorate	1				
24	And border crossings/ the rest	1				
25	And border crossings/ the rest	1				
26	And border crossings/ the rest	1				
	Sum	15	11	0	0	0

Table 4.4 Large Users: Water Supply Volume

		2012					
	Name of Large User	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec
1	Arab Development Society	8,968	7,144	8,892	8,968	5,852	6,992
2	Ghosheh Factory	432	576	637	408	593	477
3	National Security Training Center	4,537	3,743	2,400	3,116	4,380	4,711
4	Military Intelligence	656	408	600	254	192	527
5	Ministry of the Interior	1,271	936	2,879	2,591	6,312	1,814
6	The Leadership of the National Security Forces	664	1,244	32	2,595	3,290	1,899
7	General Administration Police College	55	418	440	407	1,056	1,342
27+28+29	Palestinian Academy for Security Sciences	2,886	6,782	3,670	1,689	5,249	3,496
8	Jibril Muhammad Aldmanhori/Allimona	334	440	358	195	290	281
9	Suleiman KhaderGeahchan /Alrawda	109	151	224	234	181	222
10	The Tourist Village	458	1,126	931	2,682	3,409	2,208
11	TyseerNimer Mustafa/ Alwaha	88	124	179	122	245	107
12	School girls basic minimum	386	409	228	200	731	904
13	Jericho, Girls High School	184	182	201	139	346	227
14	Girls Jericho Elementary School High	327	563	429	484	544	473
15	Jericho Women Charitable	545	601	445	122	301	428
16+17	Palestine Telecommunications	248	295	524	564	836	712
18	Mehdi Alajlouni -Commercial Investments	1,240	1,400	1,720	1,320	1,880	1,640
19	ZiadNusseibeh -Company Compromise	770	1,276	1,144	880	726	1,223
20	House Grandparents to Care for	482	607	540	787	518	342

	the Elderly						
21	Agricultural Jericho Station	174	262	231	226	221	147
22	Jericho Government Hospital	1,080	1,600	2,298	4,180	2,611	2,127
23	Jericho Health Directorate	282	329	269	96	205	357
24	And border crossings/ the rest	393	362	691	511	862	604
25	And border crossings/ the rest	2,205	2,197	2,126	1,632	2,664	2,418
26	And border crossings/ the rest	587	519	1,169	688	986	550
	Sum	29,361	33,694	33,257	35,090	44,480	36,228

4.1.3 Jericho Agro-Industrial Park (JAIP)

Wastewater from JAIP was estimated by interpolation of 638 m³/d at the end of 2014 and 2,500 m³/d in 2018; the former 638 m³/d is from questionnaire survey for tenants of JAIP conducted by JAIP developer in September 2013; the latter 2,500 m³/d is from the feasibility study of JAIP development.

4.2 Water Quality

In addition to the treated wastewater quality test the water quality data of two wells located near the WWTP will be compared with the treated wastewater quality. Adaptation to agricultural use of treated wastewater will be verified based on the reuse standard.

Water parameters for the test are the 37 items which are stipulated in the reuse standard including organic, nutritive, pathogenic, salt and heavy metal items. The locations of the target two wells are shown in Figure 4.1.

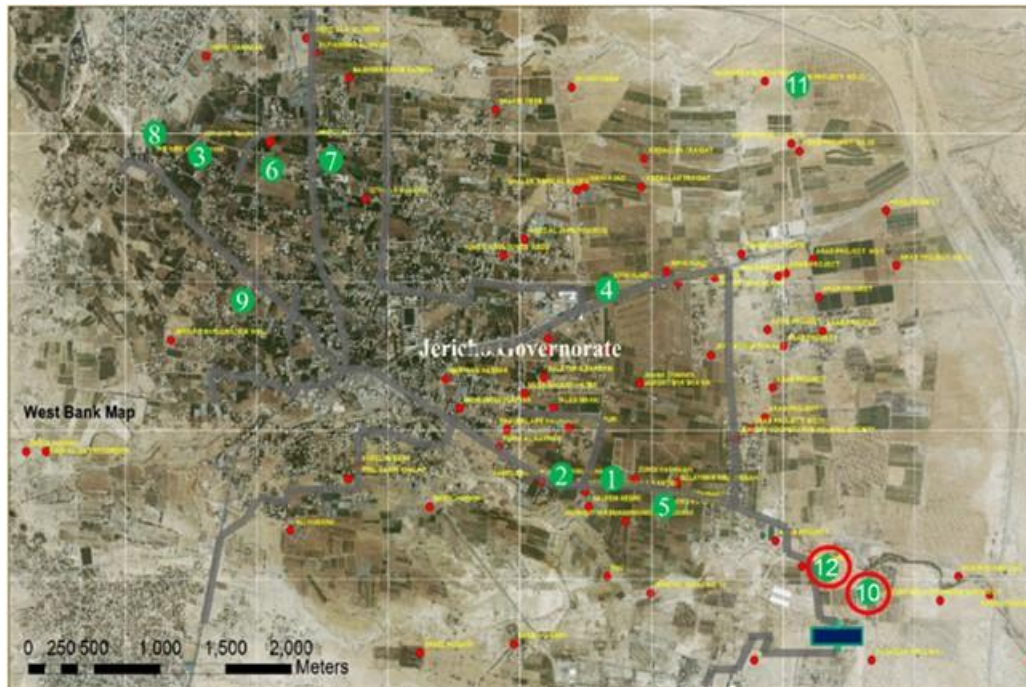


Figure 4.1 The locations of the targeted two wells.

4.3 Pilot Plant

The experimental farm called the Pilot Plant will be set up inside the WWTP. The farm planted popular fruit trees in Jericho such as date palm, lemon, orange, alfalfa and corn to monitor and verify the yields and growth such as product color, taste and size. The area of pilot plant is approximately 1,800 m² and the location of pilot plant is shown in Figure 4.2.

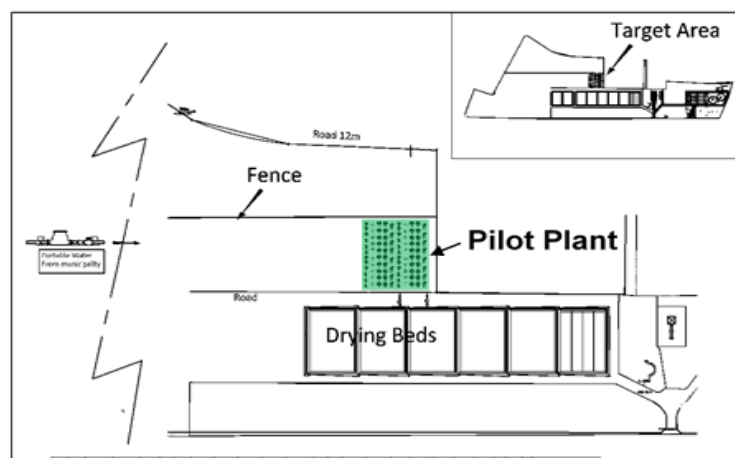


Figure 4.2 Pilot plant location

The crops will be irrigated by treated wastewater and fresh water and also a chemical fertilizer and sludge will be added, the Figure 4.3 explains the method that was used in planting and irrigation.

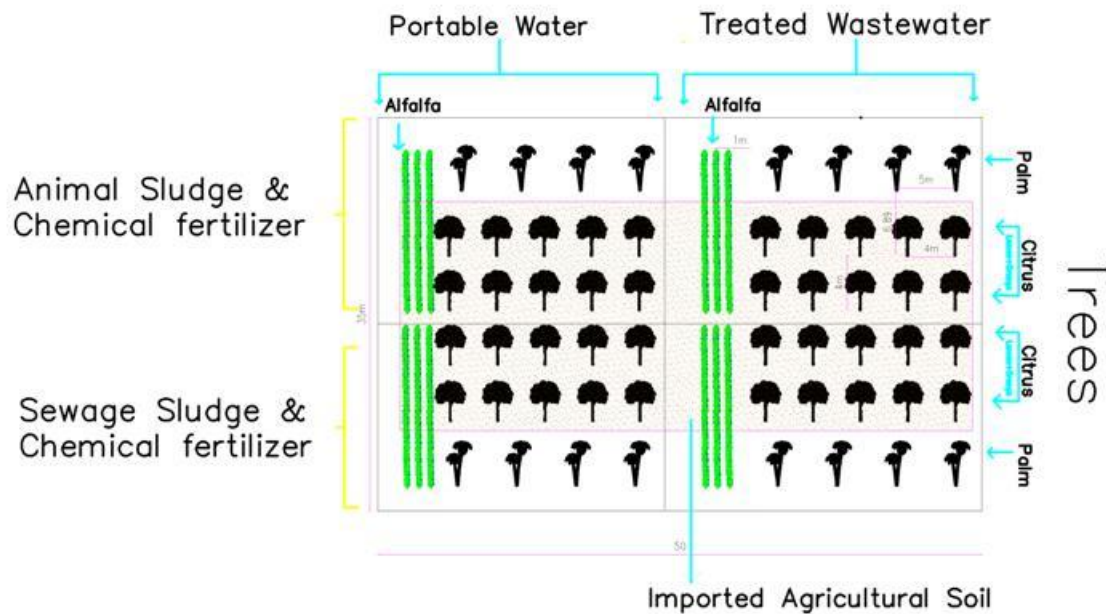


Figure 4.3 Pilot plant

The Pilot Plant Area Preparation

1) Surface Leveling and cleaning

All earth works on Site shall be completed before any fill is deposited. The pilot plant area should be clean from all rubbish, debris and any dirt .Sub-grade should be leveled before filling with any material.

2) Soil Improvement:

The soil and the work of the laboratory tests shall be studied to ensure suitability for the cultivation of tree species mentioned. And if it turns out that the soil contains a high percentage of salinity the soil for at least half a meter of good soil suitable for agriculture must be improved.

3) Soil Tilling:

The target area for planting by mechanical tilling shall be prepared to mix in organic matter, or to reduce the amount of weeds in the area.

4) Chemical and natural fertilizers:

Organic material to the soils through tilling shall be added to improve the soil's texture and workability, while increasing its nutrient content. Chemical and natural fertilizers should be added in scientific ways and amounts taking into account the divisions shown in the accompanying drawings.

5) Irrigation system :

Suitable irrigation system for each type of trees has been made, and all the necessary dripping tubes, water taps and necessary meters have been prepared. The times and amounts of water suitable for irrigation with the nature of the soil and the type of trees and climatic conditions have been taken into account.

4.4 Treated Wastewater Cost Calculation

All costs related to wastewater treatment are categorized into the following:

4.4.1 Operation and Maintenance Cost

1) Personnel Cost

- 10 personnel are assumed to be assigned from June 2014, of which 1 manager, 2 engineers and 7 technicians/workers.
- 7 working months for 2014, and 12 working months after 2015.

- Unit personnel cost is 7,000 NIS/cap/month for manager, 5,500 NIS/cap/month for engineer and 3,700 NIS/cap/month for technicians/workers as of 2012 in Jericho Municipality; annually 5% increase.

2) Electricity Cost

- Comprised of “fixed charge” and “metered charge”
- Fixed charge” is calculated by “maximum demand” multiplied by “unit fixed charge”; maximum demand is 225 kW when all equipment are in full operation; “unit fixed charge” is 6.4087 NIS/kW/month(bill) for low demand users (JDECO as of 2013); annually 5 % increase.
- Metered charge” is calculated by “total load” multiplied by “unit metered charge”; “total load” is based on 3,655 kWh/day per treated wastewater 6,600 m³/d considering operation hours; total load of a given year =3,655 kWh/day × Influent wastewater volume /6,600 m³/day×1.1; “unit metered charge” is calculated by weighted average of Rate A, B and C and their seasonal settings of JDECO tariff; annually 5 % increase.
- Solar generation is calculated by “100 kW×8 hours/day×0.7 (efficiency)”; reduction of electricity metered charge is calculated by “solar generation ”×”unit metered charge”.
- 6working months for 2014, and 12 working months after 2015.

3) Repair Cost

- Comprised of “spare parts replacement”, “shipping” and “supervisor” cost.
- Estimation was made by the contractor (Hitachi), but the annual upper limit was set as the 1% of construction cost for the mechanical and electronic works.

4) Chemicals Cost

- The cost of Hypo-chlorine solutions is calculated, to be dosed to effluent before discharging to Wadi.
- Unit dose rate is 0.18 m³/d per treated wastewater 6,600 m³/d =0.0000273 m³/m³.
- Unit cost of chemicals is 1.3 NIS/kg (as of 2013 in Jericho Municipality); annually 5% increase.

4.4.2 Capital cost

The capital costs consist of:

- (1) WWTP construction.
- (2) Sewer network
- (3) Mechanical equipment
- (4) Land and others

4.4.3 Revenue

The revenues of wastewater consist of:

- (1) Wastewater tariff which equals 1 NIS/m³.
- (2) Reuse charge which is assumed 75% of treated wastewater will be reused in 2016 with unit charge equal 0.5 NIS.

4.5 Promotion of Wastewater/Sludge Reuse

To promote treated wastewater reuse in Jericho, a visit of few Jericho farmers of the Jordanian WWTP to learn how farmers utilize the treated wastewater for farming. The visiting farmers

could then encourage wastewater reuse in Jericho by spreading their learning at farmer's workshops in Jericho.

The trip was during June 9th-11th and included six people (4 Jericho farmers+1 WWTP engineer+1 public relation staff). The criteria for selection of four Jericho farmers included their type of crop production (mostly dates, bananas and herbs), own different size of farms, geographical distribution of farms within the city (not just those close to the WWTP), residency in Jericho, both male and female farmers and age.



Figure 4.4 Some photos about farmers' tour

The purpose of the tour included:

- Visit a Jordanian WWTP with focus on treated wastewater re-use
- Visit farmers/farms currently using the treated wastewater
- Share the learning with Jericho farmers; first hand observations of re-use, crops, new potential crops for Jericho, methods, impacts, costs, water saving, etc.

- Contribute to the Project's educational workshops for wastewater re-use for farmers in Jericho and measure their Perception towards Wastewater/Sludge Re-use.

4.5.1 Workshop for Reuse

A number of 100 farmers were invited to visit the WWTP with a focus of treated wastewater reuse. The purpose was to share experience of the selected farmers who visited Jordan for wastewater re-use. After an introductory presentation by the WWTP manager who also attended the Jordan tour, an open discussion was held.

4.5.2 Questionnaire

In order to assess the acceptance of farmers about treated Wastewater/Sludge Re-use, a questionnaire was distributed at the end of the workshop. The questionnaire was made in English and each question was translated in Arabic for easiness of understanding.

Chapter Five

Results and Discussion

5.1 Forecasting of Unit Supply Water Volume and Wastewater

The annual supply water volume for the period (2008 – 2012) was drawn in order to find a relation between water supply amount and specific year; Appendix 1 shows this relation and the forecasting results were tabulated in same appendix, it is obvious that the total volume of water is increasing and this is because the increasing number of water connections.

The total amount of wastewater generation can be calculated by assuming 55% of supply water is going to sewer network as shown in Table 5.1.

As was mentioned before Wastewater from household is calculated by multiplying “discharged connections” by “unit wastewater volume” of each neighborhood.

Influent to WWTP is calculated by multiplying the sum of discharged wastewater by 1.1, of which 0.1 is the rainwater inflow due to misconnection of private sewer.

Other wastewater inflow as mentioned in the table means wastewater coming from Aqbat Jaber Camp, which was supposed to connect to the public sewers at 2015.

Since the wastewater treatment plant operated on June 2014, so the accumulated wastewater in this year is the summation of daily wastewater generation for 7 months only.

Table 5.1 The amount of wastewater generation

		Discharge rate of supplied water to sewer: r=							55%
Category	Item	Discharged Wastewater							
		2014	2015	2016	2017	2018	2019	2020	Sum 2014-2020
Wastewater Inflow from New Connections (accumulated)	Discharged New Connections (accumulated) a	45	294	668	1,008	1,348	1,688	2,028	-
	Unit Water Supply Volume (l/connection/day) b	985	1,023	1,062	1,101	1,140	1,178	1,217	-
	Unit Wastewater Volume (l/connection/day) c=b*r	541	563	584	605	627	648	669	-
	Wastewater from Newly Connected Large Users (m ³ /d) d	72	181	232	259	356	0	0	1,100
	Discharged Wastewater from New Connections (m ³ /d) e=a*c+d	96	347	622	869	1,201	1,094	1,357	5,586
Wastewater Inflow from Bulk Users (accumulated)	Jericho Agro-Industrial Park f	0	4	44	117	191	314	500	1,170
	Others g	0	0	0	65	194	322	451	1,032
	Sum h=f+g	0	4	44	182	385	636	951	2,202
Sum	Discharged Connections i=a	45	294	668	1,008	1,348	1,688	2,028	7,079
	Number of Bills for Discharged Connections	135	1,764	4,008	6,048	8,088	10,128	12,168	42,339
	Discharged Wastewater (households, m ³ /d) j=a*c	24	166	390	610	845	1,094	1,357	4,486
	Discharged Wastewater (large users, m ³ /d) k=d	72	181	232	259	356	0	0	1,100
	Discharged Wastewater (bulk users, m ³ /d) h	0	4	44	182	385	636	951	2,202
	Discharged Wastewater (sum, m ³ /d) l=e+h	96	351	666	1,051	1,586	1,730	2,308	7,788
	Discharged Wastewater (accumulated, m3/year) m	14,600	128,115	243,756	383,615	578,890	631,450	844,728	2,825,154
	Influent Wastewater to WWTP (accumulated, m3/d) n=l*1.1	106	386	733	1,156	1,745	1,903	2,539	8,568
	Influent Wastewater to WWTP (accumulated, m3/year) o	16,121	140,890	268,278	421,940	636,925	694,595	929,274	3,108,023

5.2 Water Quality

The results of water quality test for the two target wells located near the wastewater treatment plant and the treated wastewater are shown in Table 5.2.

As shown in table 5.2 some parameters were retested again on 29/11/2015 due to the wrong way of sampling on 11/11/2015, the new results are tabulated in new column.

The values highlighted with bold color in Table 5.2 show exceeded water quality levels. These items are Total Dissolved Solid (TDS), Phenol, Chloride, Sulfate, Sodium, Manganese, Sodium Adsorption Ratio (SAR) and Boron, which have an influence to human health.

It is obvious also from table 5.2 the value of TDS of private wells is almost double of the value of treated wastewater, and this is refer to the natural of aquifer in that area.

Total dissolved solids comprise inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides and sulfates) found in wastewater. Effluent with high levels of TDS is not suitable for irrigation or landscaping because many plants are intolerant of the chlorides and the TDSs may leach into the groundwater. TDSs are also not desirable for industry reuse because they will cause corrosion and incrustation.

Table 5.2 Water quality tests for treated wastewater and the two target wells

Items		Standard Quality A Sampling Date	Treated Wastewater				Well-10	Well-12
			12/1/2014	5/20/2015	11/11/2015	11/29/2015	6/22/2013	6/22/2013
Biochemical Oxygen Demand (BOD)	mg/L	20	<5	<5	24	11	<5	<5
Total Suspended Solids (TSS)	mg/L	30	1	6.7	7		1.5	1
Fecal coliform bacteris	colony/100mL	200	600-800	192	22		0	0
Chemical Oxygen Demand (COD)	mg/L	50	<10	<10	54	40	<10	<10
Dissolved Oxygen (DO)	mg/L	1<	2.1	3	2.6		3.6	3.95
Total Dissolved Solids (TDS)	mg/L	1,200	867	885	910		2,413	2,860
Potential of Hydrogen (pH)		6 - 9	7.85	7.68	7.58		7.98	7.7
Fat, Oil and Grease	mg/L	5	10.2	<1	18.4	<1	<1	<1
Phenol	mg/L	0.002	0.00581	0.018	<0.001		0.00267	0.00418
Detergents (MBAS)	mg/L	15	<0.01	<0.01	<0.01		<0.01	<0.01
Nitrate Nitrogen (NO3-N)	mg/L	20	1.23	0.35	0.42		0.97	8.39
Ammonium Nitrogen (NH4-N)	mg/L	5	<0.05	<0.05	0.36		<0.05	<0.05
Total Nitrogen (T-N)	mg/L	30	22.3	10.7	35.62		0.97	8.38
Chloride (Cl)	mg/L	400	237.9	232.9	223.36		1024.6	1007.9
Sulfate (SO4)	mg/L	300	85.7	73.5	58.84		157.5	305.2
Sodium (Na)	mg/L	200	145	107.1	153.3		491	343
Magnesium (Mg)	mg/L	60	30.4	34.67	37.24		96.3	162
Calcium (Ca)	mg/L	300	86.6	83.59	94.84		54.4	130
Sodium Adsorption Ratio (SAR)	mg/L	5.83	ND	2.47	1.36		9.26	4.74

ND: Not detected

Items		Standard Quality A Sampling Date	Treated Wastewater				Well-10	Well-12
			12/1/2014	5/20/2015	11/11/2015	11/29/2015	6/22/2013	6/22/2013
Phosphate Phosphorus (PO4-P)	mg/L	20	13.2	24.5	3.69		20.3	ND
Aluminum (Al)	mg/L	5	0.04	0.224	0.008		0.239	0.212
Arsenic (As)	mg/L	0.1	ND	ND	ND		ND	ND
Copper (Cu)	mg/L	0.2	0.035	0.011	0.015		ND	ND
Iron (Fe)	mg/L	5	0.07	0.143	0.041		0.087	0.4
Manganese (Mn)	mg/L	0.2	ND	0.041	0.04		0.011	ND
Nickel (Ni)	mg/L	0.2	ND	ND	ND		ND	ND
Lead (Pb)	mg/L	0.2	ND	ND	0.026		ND	ND
Selenium (Se)	mg/L	0.02	0.04	ND	ND		ND	ND
Cadmium (Cd)	mg/L	0.01	ND	ND	ND		ND	ND
Zinc (Zn)	mg/L	2	0.1	0.046	0.073		0.029	0.042
Cyanide (CN)	mg/L	0.05	<0.03	<0.03	<0.03		<0.03	<0.03
Chrome (Cr)	mg/L	0.1	ND	ND	ND		ND	ND
Mercury (Hg)	mg/L	0.001	ND	0.00015	0.000564		ND	ND
Cobalt (Co)	mg/L	0.05	ND	ND	ND		ND	ND
Boron (B)	mg/L	0.7	0.4	ND	0.11		2.75	2.16
Bacteria E. Coli	(colony/100mL)	100	TMTC	187	22		0	0
Nematodes	(Eggs/L)	<1	ND	ND	ND		ND	ND

ND: Not detected

5.3 Quantity and Quality of Sludge Generated

Sludge treatment was done to keep some MLSS value from September 2014 to May 2015 of 3,000mg/L and from June to August 2015 of 2,000mg/L. The treatment has been carried out every month from October 2014. The record and evaluation results of sludge treatment were shown in Table 5.3 in the table, daily generated DS (Dried Solid) was calculated and then

generated SS per inflow/outflow water was calculated. When inflow data is applied, the generated solid is vary from 830mg/l to 250mg/L, which is very large compared to ordinal WWTP and it reflects the rate of tanker wastewater. It means that the SS concentration of tanker wastewater is high.

Table 5.3 Evaluation of Sludge Treatment

Year	Treated Date	MLSS	Treated volume	Trasfmed DS	Treated DS	Duration	Treated solid	Increased solid	Generated solid	Inflow Rate			Outflow Rate		
		mg/L	m ³	kg	kg		kg/d	kg/d	kg/d	Inflow total	Tanker W rate	Generated SS	Outflow total	Tanker W rate	Generated SS
										m ³ /d	%	mg/L	m ³ /d	%	mg/L
2014	8/17	1,900	800	1,520	1,216	---	---	---	---	---	---	---	---	---	---
	10/02	3,300	1,000	3,300	2,640	35	75	102	178	213	39.4	833	175	48.0	1014
	11/05	3,500	1,000	3,500	2,800	34	82	13	96	172	39.5	556	164	41.5	584
	12/07	3,400	1,000	3,400	2,720	30	91	-6	85	221	32.1	383	224	31.7	378
2015	01/07	3,600	1,000	3,600	2,880	31	93	12	105	178	28.7	588	208	24.5	504
	02/07	3,700	1,000	3,700	2,960	31	95	6	101	160	30.6	633	155	31.6	653
	03/06	3,600	1,000	3,600	2,880	27	107	-5	102	209	23.9	486	214	23.4	474
	04/08	3,500	1,000	3,500	2,800	33	85	-6	78	244	10.2	321	239	10.5	328
	05/04	3,200	1,000	3,200	2,560	26	98	-17	82	167	9.6	489	125	12.8	654
	06/02	3,000	1,000	3,000	2,400	29	83	-13	69	192	12.5	362	127	18.9	547
	06/28	2,350	1,550	3,643	2,914	26	112	-32	80	221	14.0	363	98	31.6	818
	08/08	2,300	1,000	2,300	1,840	41	45	-6	39	153	15.7	253	126	19.0	308
	Average	3,113	1,029	3,203	2,551	31	88	4	92	194	23	479	169	27	569

The tendencies of relation for Generated solid, inflow total and tanker WW rate are shown in Figure 5.2. The relation between generated solid (SS) and tanker WW rate is clearly shown in Figure 5.3.

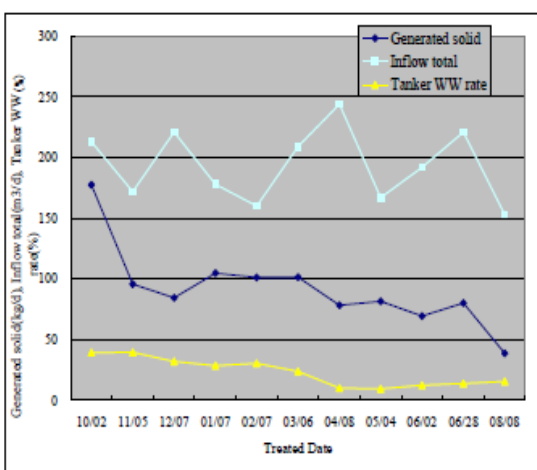


Figure 5.2 Tendencies of Sludge Treatment

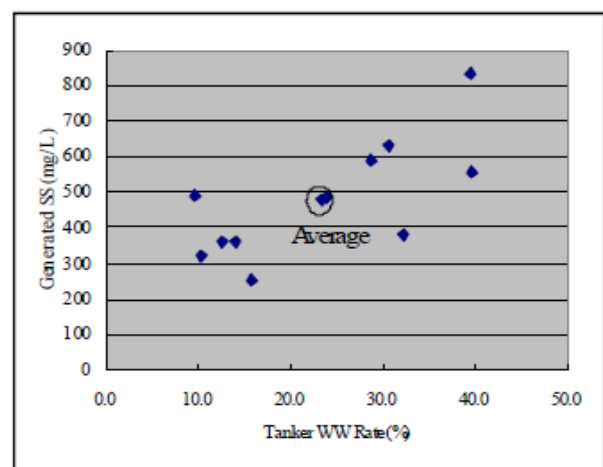


Figure 5.3 Relation between Generates SS and Tanker rate

The quality of generated sludge is shown in Table 5.4, which two tests were conducted in order to see the heavy metal concentration in sludge, it is obvious from the table all results under the limit values, which means the sludge can be used for agriculture.

Table 5.4 Maximum Limit Values for Heavy Metal Concentrations in Sludge for Use in Agriculture (mg/kg of dry matter)

Parameters	Limit Values	Sewage Sludge ¹⁾	Sewage Sludge ²⁾
Cadmium	20	3.2	1.94
Copper	1,000	279.5	153.3
Nickel	300	30.2	31.9
Lead	750	29.7	15.7
Zinc	2,500	1,258	1,029.2
Mercury	16	2.969	1.67
Chromium	400	ND ³⁾	43.45
Total Nitrogen	-	32,531	40,900
Phosphate (P ₂ O ₅)	-	23,740	23,050
Lime	-	115,620	70,550
Kalium (K ₂ O)	-	2,430	3,480

1) Sampling date: December 1, 2014. 2) Sampling date: November 4, 2015. 3) ND: Not Detected

5.4 Pilot Plant

Many issues have been observed during the experimental farm, which was categorized as following:

1. Crop Yielding: it was obvious that the plants or crops under treated wastewater yielded higher than those fresh water, where the number of fruits are more and the density of fodders are more than fresh water, and also it was noted the color of fruits and fodders are more green than fresh water and the size of products are more bigger.
2. Height of crop: the height of plants and crops are more under treated wastewater than fresh water.
3. Stem thickness: also it was obvious the diameters of plants under treated wastewater are higher than fresh water.



Figure 5.4 crops irrigated with fresh water



Figure 5.5 crops irrigated with treated wastewater



Figure 5.6 crops irrigated with fresh water



Figure 5.7 crops irrigated with treated wastewater



Figure 5.8 crops irrigated with fresh water



Figure 5.9 crops irrigated with treated waste water

5.5 Treated Wastewater Costs

5.5.1 Personnel cost

- 10 personnel are assumed to be assigned from June 2014, of which 1 manager, 2 engineers and 7 technicians/workers.
- 7 working months for 2014, and 12 working months after 2015.
- Unit personnel cost is 7,000 NIS/cap/month for manager, 5,500 NIS/cap/month for engineer and 3,700 NIS/cap/month for technicians/workers as of 2012 in Jericho Municipality; annually 5% increase. Appendix 3 shows the personnel costs of all staffs who are working in sewerage section from 2014 until 2020.

It is obvious from Appendix 2 the number of staffs are minimum at 2014, where 10 persons should be assigned in order to follow up the various works in the section but actually and because the year 2014 is the year of startup of the sewerage section and the amount of wastewater is very low, the number of staffs are around 8 this is because some engineers work part time, but it is expected to increase by year 2018 when the flow increases.

5.5.2 Electricity cost

- Comprised of “fixed charge” and “metered charge”
- Fixed charge” is calculated by “maximum demand” multiplied by “unit fixed charge”; maximum demand is 225 kW when all equipment are in full operation; “unit fixed charge” is 6.4087 NIS/kW/month(bill) for low demand users (JDECO as of 2013); annually 5 % increase.
- Metered charge” is calculated by “total load” multiplied by “unit metered charge”; “total load” is based on 3,655 kWh/day per treated wastewater 6,600 m³/d considering

operation hours; total load of a given year = $3,655 \text{ kWh/day} \times \text{Influent wastewater volume} / 6,600 \text{ m}^3/\text{day} \times 1.1$; “unit metered charge” is calculated by weighted average of Rate A, B and C and their seasonal settings of JDECO tariff; annually 5 % increase.

- Solar generation is calculated by “ $100 \text{ kW} \times 8 \text{ hours/day} \times 0.7 \text{ (efficiency)}$ ”; reduction of electricity metered charge is calculated by “solar generation” $\times$ ”unit metered charge”.
- 6 working months for 2014, and 12 working months after 2015. Table 5.5 shows the annual electricity cost.

Table 5.5 Electricity cost (Unit: NIS)

Items			2014	2015	2016	2017	2018	2019	2020	Sum	Remarks
Unit Fixed Charge	NIS/kW/month	A	6.4087	6.4087	6.4087	6.4087	6.4087	6.4087	6.4087	-	6.4087NIS/kW/month for low demand users (as of 2015, no annual increase)
Annual Fixed Charge	NIS	B	32	77	77	77	77	77	77	494	B=A*5months for 2014; B=A*12 months from 2015
Annual Metered Charge	NIS	C	49,527	37,735	64,087	96,078	143,179	155,581	209,199	755,386	Actual cost for 2014; Calculated cost considering the sales of surplus solar from 2015
Electricity Cost	NIS	D=B+C	49,559	37,812	64,164	96,155	143,256	155,658	209,276	755,880	

Table 5.5 shows that the solar panels can minimize the electricity cost, where on 2014 there is a surplus of power that can be sold to electricity company, this is due to the minimum working hours of equipment and also some equipment not under operation due to insufficient amount of flow, see Appendix 3 for detailed calculations.

5.5.3 Repair cost

- Comprised of “spare parts replacement”, “shipping” and “supervisor” cost.
- Estimation was made by the contractor (Hitachi), but the annual upper limit was set as the 1% of construction cost for the mechanical and electronic works Table 5.6 shows the annual repair cost.

Table 5.6 Repair cost

Items			2014	2015	2016	2017	2018	2019	2020	Sum 2014-2020	Remark
Influent Wastewater	m ³ /day average	A	106	386	733	1,156	1,745	1,903	2,539	-	
	m ³ /year	B	16,121	140,890	268,278	421,940	636,925	694,595	929,274		B=A*365*5months/12months for 2014 - B=A*365 for 2015,2017 and 2018 B=A*366 for 2016
Spare Parts Replacement Cost	NIS	C	0	0	0	1,561,784	0	401,622	1,302,215	3,265,621	
Shipping Cost	NIS	D	0	0	0	0	0	0	0	0	
Supervisor Cost	NIS	E	0	0	0	0	0	138,477	0	138,477	
Total	NIS	F=C+D+E	0	0	0	1,561,784	0	540,098	1,302,215	3,404,097	
Adopted	NIS		0	156,178	156,178	780,892	468,535	540,098	1,302,215	3,404,096	The original estimation of 2017 was allocated to the year 2015, 2016, 2017 and 2018 according to the ratio of 10%, 10%, 50% and 30% respectively.

All data in Table 5.6 has been taken from manufacturer, since the treatment plant is a new one and so there is no historical data for repairing but only recommendation from the manufacture about repairing and replacement, this data should be updated according to maintenance records of treatment plant.

5.5.4 Chemicals cost

- The cost of Hypo-chlorine solutions is calculated, to be dosed to effluent before discharging to Wadi.
- Unit dose rate is 0.18 m³/d per treated wastewater 6,600 m³/d =0.0000273 m³/m³.
- Unit cost of chemicals is 1.3 NIS/kg (as of 2013 in Jericho Municipality); annually 5% increase. Table 5.7 shows the annual chemicals cost which is minimum in 2014 due to the low amount of wastewater.

Table 5.7 Chemicals cost

Items			2014	2015	2016	2017	2018	2019	2020	Sum 2014-2020	Remark
Influent Wastewater	m ³ /day average	A	106	386	733	1,156	1,745	1,903	2,539	-	
	m ³ /year	B	16,121	140,890	268,278	421,940	636,925	694,595	929,274		B=A*365*5months/12months for 2014 - B=A*365 for 2015 and 2017-2019 B=A*366 for 2016 and 2020
Unit Dose of Chemicals (Hypochlorine)	m ³ /m ³	C	0.0000273	0.0000273	0.0000273	0.0000273	0.0000273	0.0000273	0.0000273	-	Dose of 0.18m ³ /d per 6,600 m ³ /d
Unit Cost of Chemicals	NIS/m ³	D	1,240	1,302	1,367	1,436	1,507	1,583	1,662	-	1.3NIS/kg=1,181NIS/m ³ as of 2013 (annually 5% increase)
Chemicals Cost	NIS	E=B*C*D	546	5,008	10,012	16,541	26,204	30,018	42,164	130,493	

5.5.5 Annual Depreciation of Sewerage Assets

Appendix 4 presents all assets as grant aids and from Jericho Municipality which consists of WWTP construction, sewer network, mechanical equipment, land and others, the useful life of each asset was allocated and the annual depreciation was calculated.

5.5.6 Annual Cost

Two cases were considered for annual cost calculation; the first one O&M cost without depreciation as shown in Table 5.8 and finally the unit cost of treated wastewater was calculated. It is obvious the unit cost is high at 2014 and this is reasonable where the flow is very low comparing with other years, so in order to recover O&M cost the unit cost of treated wastewater should be not less than 3 NIS.

Table 5.8 Annual Costs without Depreciation

Items		2014	2015	2016	2017	2018	2019	2020	Sum
O&M Cost	Personnel	178,958	481,729	561,323	589,438	700,878	735,924	772,734	4,020,984
	Managers and Engineers	100,395	151,729	159,383	167,362	257,700	270,600	284,142	1,391,311
	Technicians and Workers	78,563	330,000	401,940	422,076	443,178	465,324	488,592	2,629,673
	Electricity	49,559	37,812	64,164	96,155	143,256	155,658	209,276	755,880
	Fixed Charge	32	77	77	77	77	77	77	494
	Metered Charge	49,527	37,735	64,087	96,078	143,179	155,581	209,199	755,386
	Repair	0	156,178	156,178	780,892	468,535	540,098	1,302,215	3,404,096
	Chemicals	546	5,008	10,012	16,541	26,204	30,018	42,164	130,493
	Sum a	229,063	680,727	791,677	1,483,026	1,338,873	1,461,698	2,326,389	8,311,453
Capital Cost	Interest	0	0	0	0	0	0	0	0
	Depreciation Donors	0%	0	0	0	0	0	0	0
	JM	0%	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0
	Sum b	0	0	0	0	0	0	0	0
O&M and Capital Cost Total c=a+b		229,063	680,727	791,677	1,483,026	1,338,873	1,461,698	2,326,389	8,311,453
Discharged Wastewater (m3/year) A		14,600	128,115	243,756	383,615	578,890	631,450	844,728	2,825,154
Unit cost NIS/m3 C/A		16	5	3	4	2	2	3	3

The second case is the O&M cost with depreciation as shown in Table 5.9, where the unit cost at 2014 is high as previous case. The depreciation cost related to donors was put 0% meanwhile from Jericho Municipality was put 100%. So in order to recover O&M and capital cost the unit cost should be not less than 3 NIS.

Table 5.9 Annual Costs with Depreciation

Items		2014	2015	2016	2017	2018	2019	2020	Sum
O&M Cost	Personnel	178,958	481,729	561,323	589,438	700,878	735,924	772,734	4,020,984
	Managers and Engineers	100,395	151,729	159,383	167,362	257,700	270,600	284,142	1,391,311
	Technicians and Workers	78,563	330,000	401,940	422,076	443,178	465,324	488,592	2,629,673
	Electricity	49,559	37,812	64,164	96,155	143,256	155,658	209,276	755,880
	Fixed Charge	32	77	77	77	77	77	77	494
	Metered Charge	49,527	37,735	64,087	96,078	143,179	155,581	209,199	755,386
	Repair	0	156,178	156,178	780,892	468,535	540,098	1,302,215	3,404,096
	Chemicals	546	5,008	10,012	16,541	26,204	30,018	42,164	130,493
	Sum a	229,063	680,727	791,677	1,483,026	1,338,873	1,461,698	2,326,389	8,311,453
Capital Cost	Interest	0	0	0	0	0	0	0	0
	Depreciation Donors	0%	0	0	0	0	0	0	0
	JM	100%	0	25,600	25,600	54,320	54,320	54,320	268,480
	Total		0	25,600	25,600	54,320	54,320	54,320	268,480
	Sum b		0	25,600	25,600	54,320	54,320	54,320	268,480
O&M and Capital Cost Total c=a+b		229,063	706,327	817,277	1,537,346	1,393,193	1,516,018	2,380,709	8,579,933
Discharged Wastewater (m3/year) A		14,600	128,115	243,756	383,615	578,890	631,450	844,728	2,825,154
Unit cost NIS/m3 C/A		16	6	3	4	2	2	3	3

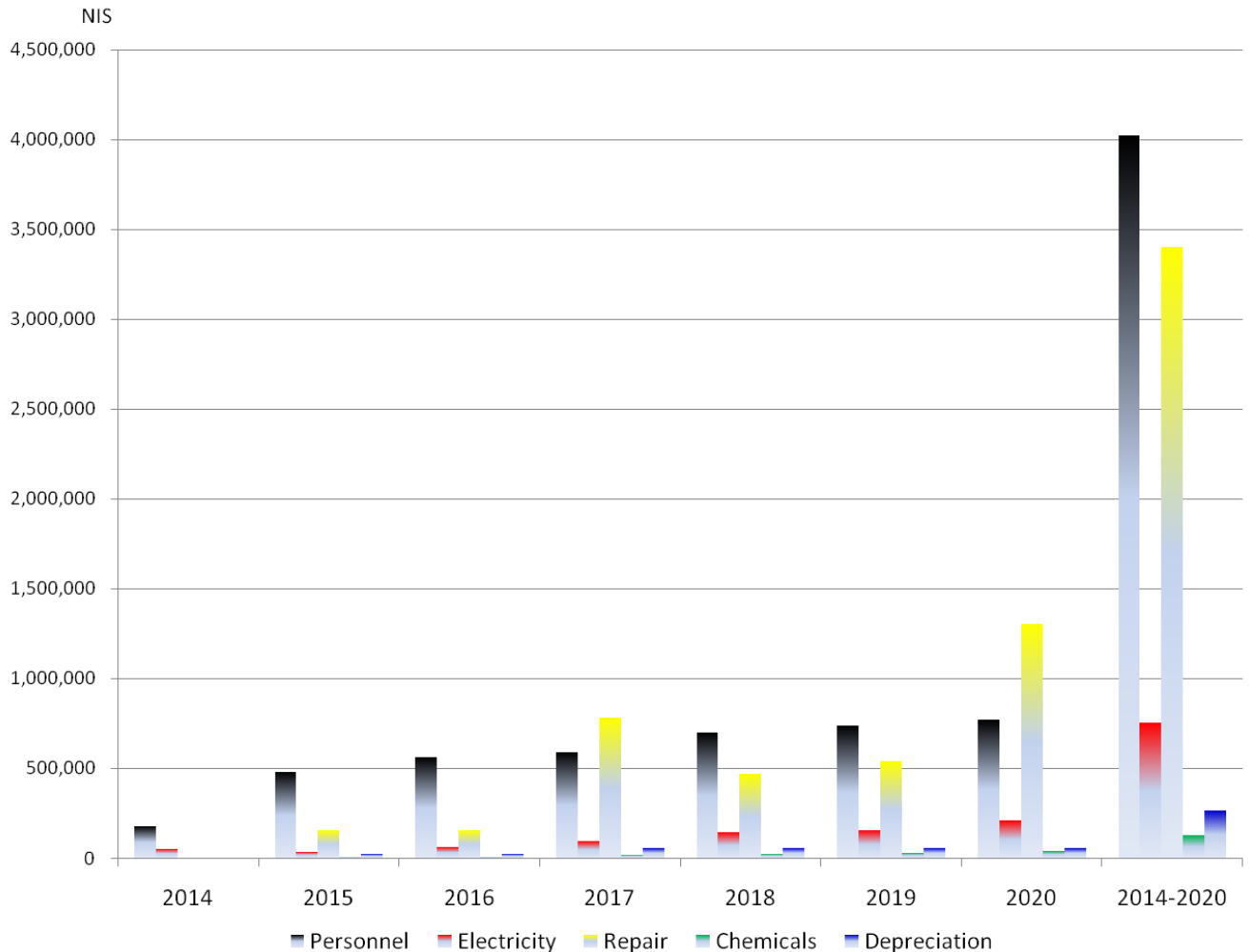


Figure 5.10 Annual Breakdowns of O&M and Capital Costs

It is obvious from figure 5.10 that the personnel cost is most important factor in wastewater treatment and then repairing cost and then the power cost.

5.5.7 Revenue and Expenditure

The revenue and expenditure schedule from 2014 to 2020 is shown in Table 5.10, which clear that there is a deficit during this period. The revenue is consisted of wastewater tariff and reuse charge, and the expenditure is consisted of the personnel, electricity, repair and chemicals cost necessary for operation and maintenance. The revenue of reuse charge was calculated assuming

that the percentage of reusing treated wastewater is 75% from 2016 and the unit charge is 0.5 NIS/m3.

Table 5.10 Annual Balance of Revenue and Expenditure (Unit: NIS)

Items			2014	2015	2016	2017	2018	2019	2020	Sum
Discharged Wastewater (m3/year) A			14,600	128,115	243,756	383,615	578,890	631,450	844,728	2,825,154
Influent Wastewater to WWTP (m3/year) B=A*1.1			16,121	140,890	268,278	421,940	636,925	694,595	929,274	3,108,023
Reuse Rate of Treated Wastewater C			0%	0%	75%	75%	75%	75%	75%	-
Wastewater Tariff (NIS/m3) D			1.0	0.8	0.5	0.5	1.0	1.0	1.0	-
Reused Wastewater Tariff (NIS/m3) E			-	-	0.5	0.5	0.5	0.5	0.5	-
Collection Rate of Wastewater Tariff F			0%	15%	40%	40%	40%	40%	40%	-
Revenue	Wastewater Tariff	G=A*D*F	0	15,374	48,751	76,723	231,556	252,580	337,891	962,875
	Reused Water Tariff	H=B*C*E	0	0	100,604	158,228	238,847	260,473	348,478	1,106,630
	Sum	I=G+H	0	15,374	149,355	234,951	470,403	513,053	686,369	2,069,505
Expenditure	Personnel	J	178,959	481,728	561,324	589,437	700,878	735,924	772,734	4,020,984
	Electricity	K	49,559	37,812	64,164	96,155	143,256	155,658	209,276	755,880
	O&M Cost	Repair	0	156,178	156,178	780,892	468,535	540,098	1,302,215	3,404,096
		Chemicals	546	5,008	10,012	16,541	26,204	30,018	42,164	130,493
	Sum	N=J+K+L+M	229,064	680,726	791,678	1,483,025	1,338,873	1,461,698	2,326,389	8,311,453
	Interest	O	0	0	0	0	0	0	0	0
	Capital Cost	Depreciation	0	25,600	25,600	54,320	54,320	54,320	54,320	268,480
	Sum	Q=O+P	0	25,600	25,600	54,320	54,320	54,320	54,320	268,480
	O&M and Capital Cost Total	R=N+Q	229,064	706,326	817,278	1,537,345	1,393,193	1,516,018	2,380,709	8,579,933
	Balance	S=R-I	229,064-	690,952-	667,923-	1,302,394-	922,790-	1,002,965-	1,694,340-	6,510,428-

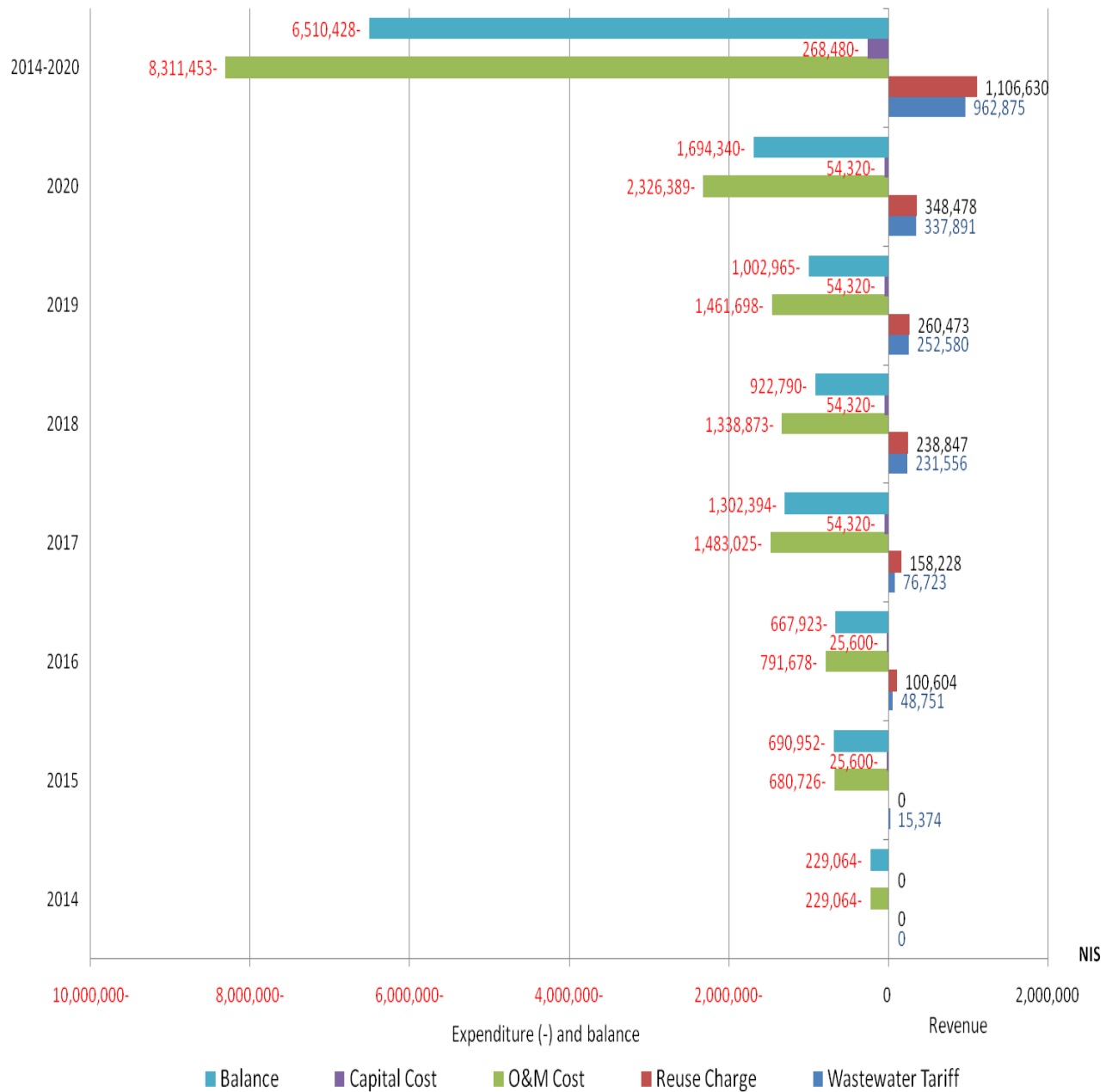


Figure 5.11 Annual Balance of Revenue and Expenditure

As shown in Figure 5.11 the deficit during the study period refers to many reasons; first: the municipality considered the wastewater tariff less than actual cost, second: the collection rate is very low and this can reflect to final balance and the third reason is the capital cost was considered in calculation.

5.6 Promotion of Wastewater/Sludge Reuse

The main outputs of Jordan visit are listed below:

- Learned about the Jordanian experience in irrigation using the treated wastewater in order to break the fear of the farmer of using the treated wastewater. The treated wastewater was sold freely at first and then the government increased the cost when there were many requests for using it.
- Observed and discussed the Jordanian farmers' experiences in the re-use and the possibility to apply this experience in Jericho. The visited Jordanian farmers agreed that it's economically beneficial to them and they need more amounts of it, this encourages the farmers to apply this experience in Jericho.
- Identified the types of crops that depend on treated wastewater quality which are not found in Palestine like the Dutch herb and can be introduced.

5.6.1 Workshop for Reuse

The selected farmers shared the following learning with their other fellow farmers:

- It is economically beneficial to them using the treated wastewater.
- Jordanian Government helps and assists farmers in reusing the treated wastewater by offering the treated water for free for the first few years. Now, the water is provided by some fees to

farms especially those near the WWTP. The treated wastewater at Jericho WWTP has higher quality than the visited Jordanian WWTP so it will be better for irrigation .

- More connections in Jericho are needed in order to increase the wastewater which can in turn reduce the cost of treated wastewater.
- It is important to properly use the treated wastewater as that water should not touch the plant.
- Most Jordanians use the treated wastewater.

The followings were also some of the recommendations by the attendees on treated wastewater reuse:

- Government should help farmers in reusing the wastewater.
- Community participation.
- Raise public awareness about the reuse of treated wastewater.
- Reduce the purchasing cost of the treated wastewater.

5.6.2 Perception of Treated Wastewater/Sludge Reuse

After analyzing 100 of respondents about treated wastewater/sludge re-use, see Appendix 5 for questionnaire format. The results showed that 69% of the respondents believe that re-use of wastewater is something useful. Within them, 52% thought it can be applied for agricultural irrigation also finds 25% of them thought treated wastewater can be applied for amenity such as fountains, waterways and pounds.

Table 5.11 Number of Respondents Who is Negative/Positive for Reuse of Wastewater

	Male	Female	Total
Positive	38	31	69
Negative	5	16	21
No idea	5	5	10

Table 5.12 The Places which Reuse Water Applied for

	Male	Female	Total
Landscape Irrigation	10	7	17
Agriculture irrigation for crops	28	24	52
Reclaimed water for amenity	13	12	25
Other	0	0	0

On the other hand, 21% of the respondents don't think the re-use of wastewater is useful because they feel it is dirty and it may not be safety for human health (20%). In addition, some answered it because it is against religious belief (17%).

Table 5.13 Reason for Negative to Reuse of Wastewater

	Male	Female	Total
Dirty	4	16	20
Dislike	4	13	17
Human health	5	15	20
Religious belief	4	13	17
Other	0	0	0

Under the situation that re-use water is controlled by regulation and meet standards, 50%of respondents want to use it, while 43% do not want to use it.

As for the re-use sludge, Table 5.14 showed that 52% of the respondents know that dry sludge generated from WWTP can be used for fertilizer of agricultural products and/or plant. On the other hand, in reality, 40% of respondents agree with usage of re-use of sludge fertilizer, and 56% of respondents mentioned that he/she does not use sludge fertilizer.

Table 5.14 Number of Respondent's Answers for Knowledge and Action for Dry Sludge Fertilizer

	Male	Female	Total
No. of respondents who knows dry sludge	29	23	52
No. of respondents who agree with re-use of sludge from Jericho WWTP	20	20	40
N. of respondents who does use sludge fertilizer by his/herself	18	18	36

The result also implies that 60% of them don't agree with re-use of sludge from WWTP. Table 5.15 shows that these respondents do not want to use the dry sludge as fertilizer because it may not be safe for human health (54%), also because of its bad smell (48%) and dirtiness (47%). Some are answered it because it's against their religious beliefs (29%).

Table 5.15 Reason of Disagree With Reuse of Sludge

	Male	Female	Total
Dirty	17	30	47
Dislike	18	27	45
Smells bad	21	27	48
Human health	24	30	54
Religious belief	8	21	29
Other	0	1	1

Chapter Six

Conclusions and Recommendations

6.1 Conclusions

1. Wastewater generation: it was obvious that the amount of wastewater generated from Jericho city had been very low on 2014 and this is due to the operation of the project in this year and also the low number of building connected to sewer network, but the generated amount then increased drastically due increasing of connection rate, on 2020 it is expected to connect all the city and the annual amount of treated wastewater will reach around 3108023 m³ and can covers most of agricultural lands at the east of Jericho city, which famous with palm trees planting.
2. The quality of treated wastewater: the results of treated wastewater showed that the quality is complying to quality A of standards, which means it can be used for all reuse option except direct potable reuse, and comparing with the private wells that used for agriculture irrigation, the results also showed that the treated wastewater quality is higher than that wells which can promote the farmers to use this water safely.
3. Pilot plant: the visual observation of using treated wastewater in agricultural showed that there is no negative impacts of treated wastewater on plant itself and on soil, on the contrast using treated wastewater gave results better than using fresh water, on other hand by establishing this experimental plant an evidence was created for farmers to use this water without any worry on their products.
4. Annual balance of revenue and expenditure: shows that there is a deficit in the study period; this is logic because the number of connection is still in progressing and the revenue does not cover O&M cost and also due to depreciation was included in the costs.

5. Perception of treated wastewater/sludge reuse: Regarding re-use of treated water and sludge, more than half of respondents are positive for re-use of waste water, on the other hand, less than half of respondents are positive to re-use of sludge. Re-use of waste water is already carried out in Al-Bireh, a neighborhood community of Jericho, but not for re-use of sludge. The result also shows that some respondents know about dry sludge fertilizer, but not all of them positive for actual usage. Some preparation needs to be carried out re-use of sludge, and awareness activities are important in this matter as well.

6.2 Recommendations

1. A long term experimental plant should be taken in consideration in future plan, in order to monitor the effects of treated wastewater on plants and soils.
2. A regular monitoring of treated wastewater quality especially when the flow of wastewater increase, and compare it with the reuse standard.
3. In order to minimize the O&M cost, first the flow should be increased by promoting people to start connecting their building to sewer line and second by promoting farmers to buy the treated wastewater. On other hand to invest on solar panels in order to minimize the power cost.
4. A regular workshops needed for farmers in order to increase their awareness in reuse and to measure their satisfaction on treated wastewater and to hear from them if there is any effect on their crops.
5. Using the treated wastewater in agricultural and especially in palm trees is more feasible option in Jericho city, especially all palm trees farms located near the WWTP, so no high cost is needed in infrastructure in order to distribute the treated wastewater amongst farmers.

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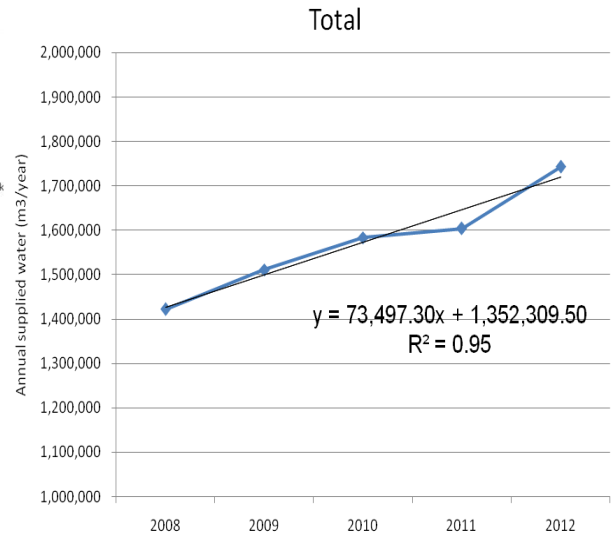
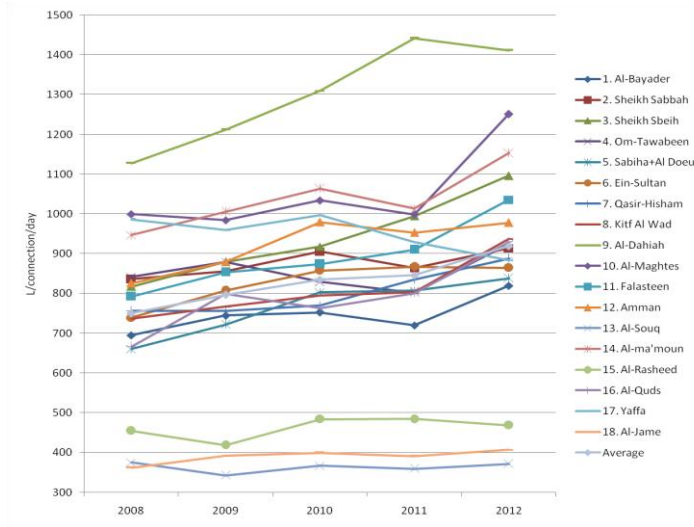
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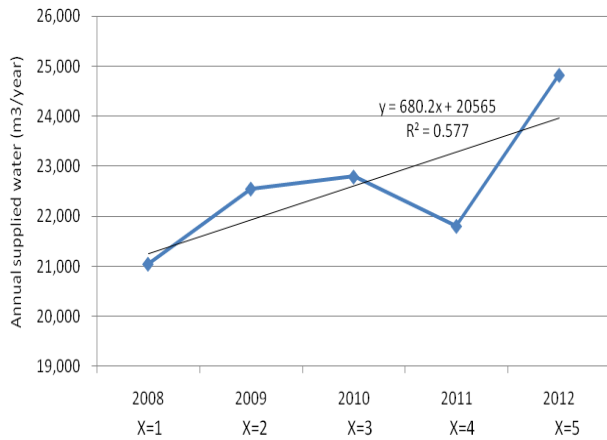
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Appendix 1

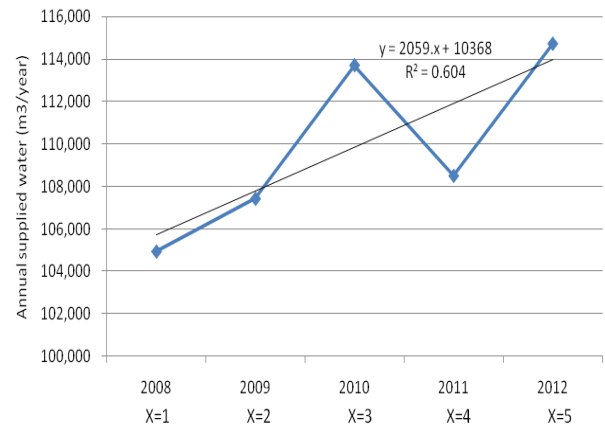
Forecast of Unit Supply Water Volume



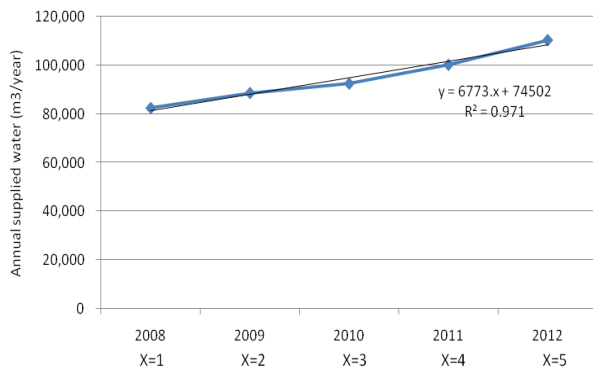
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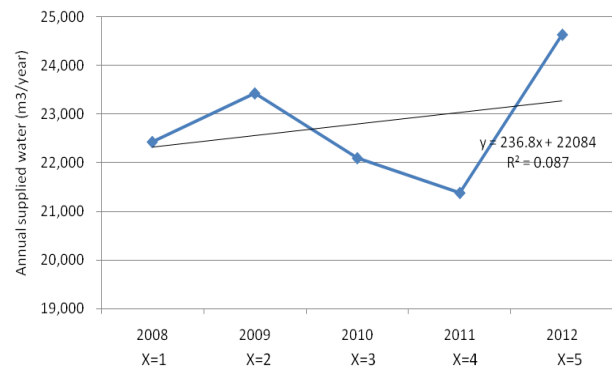
2. Sheikh Sabbah



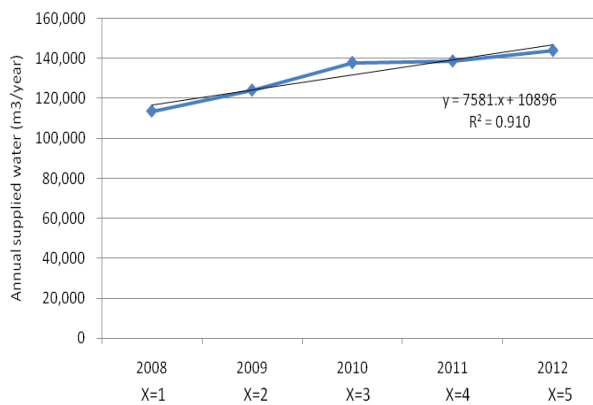
3. Sheikh Sbeih



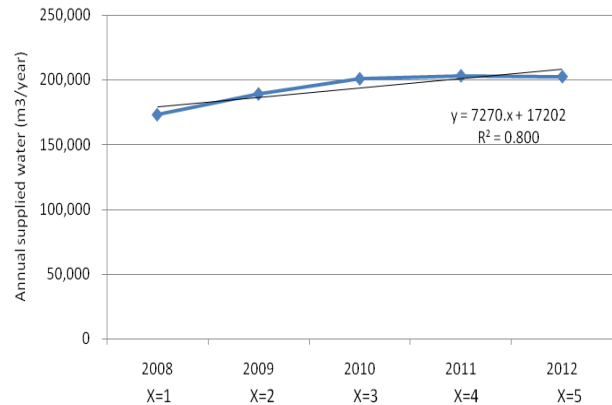
4. Om-Tawabeen



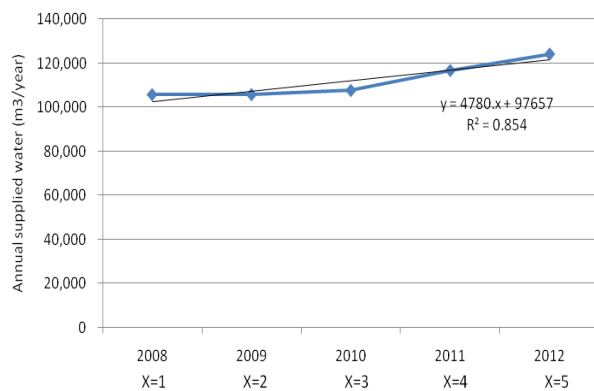
5. Sabiha+Al Doeuk



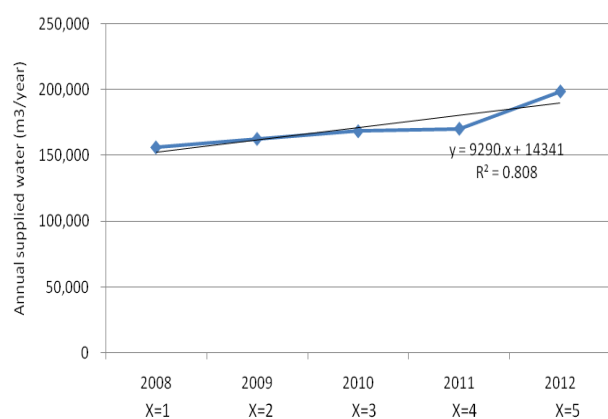
6. Ein-Sultan



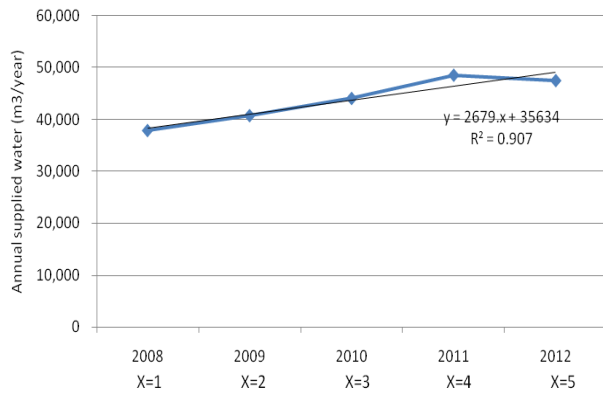
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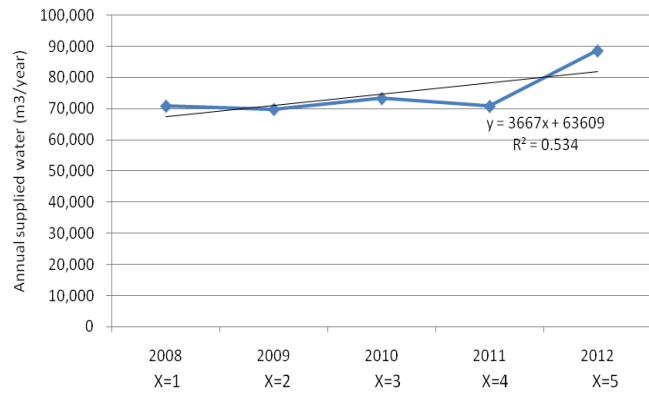
8. Kitf Al Wad



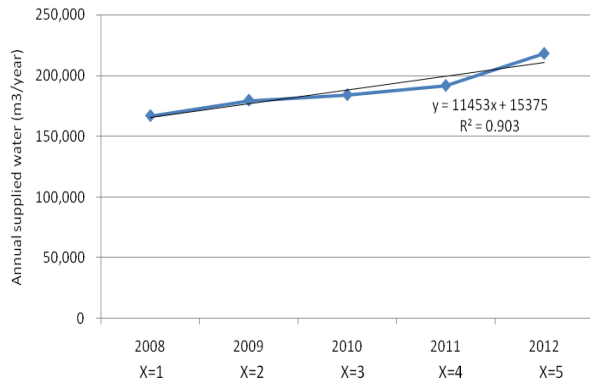
9. Al-Dahiah



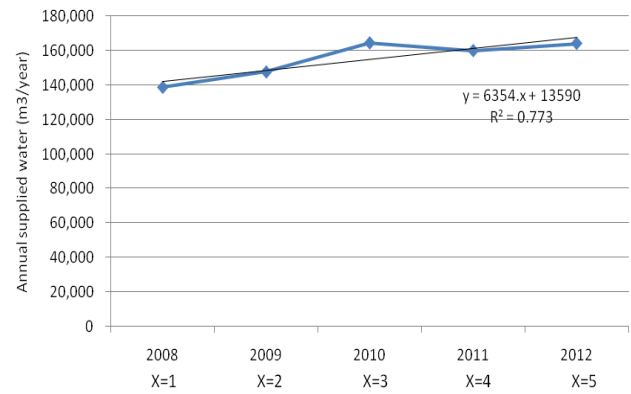
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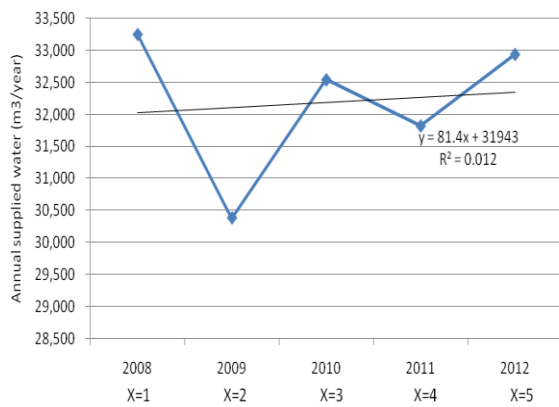
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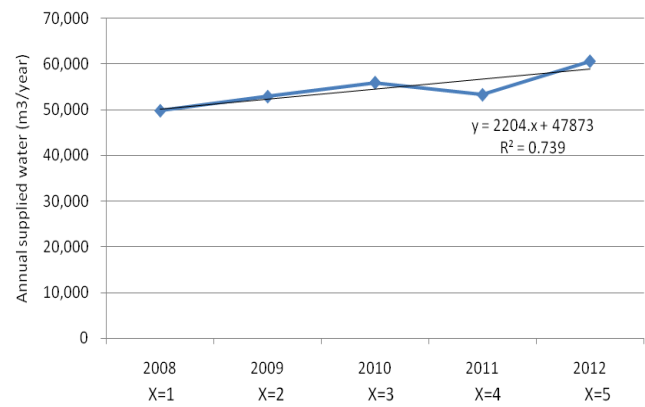
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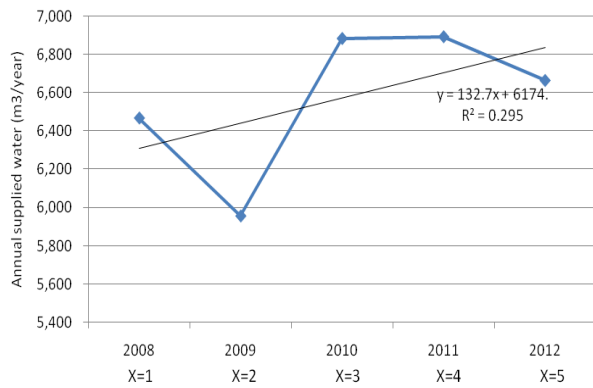
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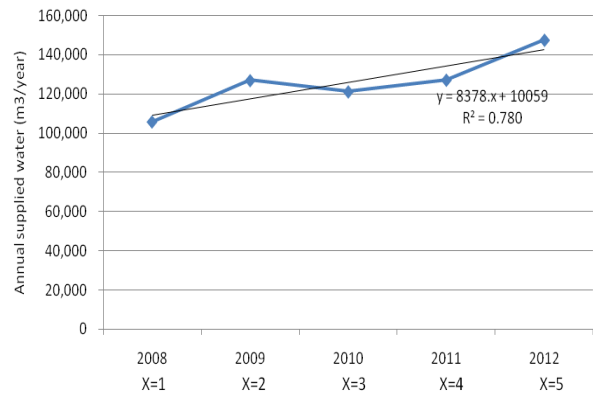
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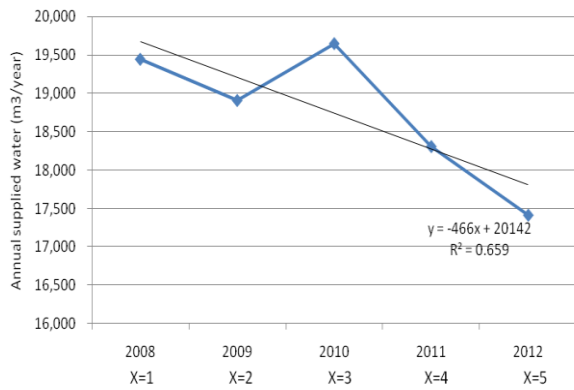
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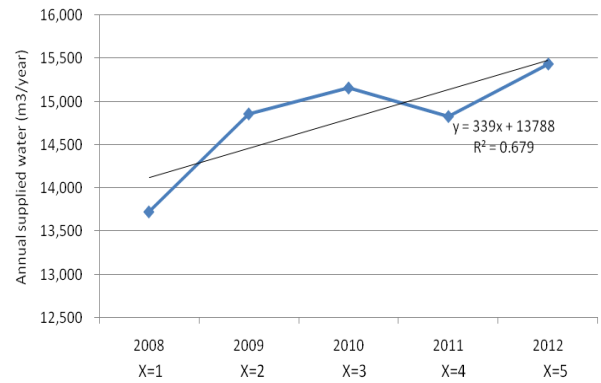
16. Al-Quds



17. Yaffa



18. Al-Jame



Household: Unit Supplied Water (l/connection/day)

Neighborhood	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	(Ref) Number of Connections
1. Al-Bayader	694.87	744.45	752.37	719.82	819.44	813.53	835.98	858.46	880.90	903.35	925.80	948.24	970.72	83
2. Sheikh Sabbah	835.87	855.61	905.58	864.18	913.61	924.19	940.59	957.00	973.41	989.81	1006.22	1022.63	1039.03	344
3. Sheikh Sbeih	817.80	879.53	917.73	994.91	1096.28	1142.95	1210.19	1277.42	1344.65	1411.88	1479.12	1546.35	1613.58	276
4. Om-Tawabeen	841.77	879.34	829.27	802.40	924.68	882.15	891.05	899.91	908.80	917.70	926.59	935.49	944.34	73
5. Sabiha+Al Doeuk	660.52	721.86	802.73	807.34	838.30	898.46	942.56	986.66	1030.77	1074.87	1118.97	1163.08	1207.18	471
6. Ein-Sultan	739.24	807.50	857.41	867.17	864.54	920.25	951.27	982.30	1013.33	1044.35	1075.38	1106.40	1137.43	642
7. Qasir-Hisham	756.37	756.49	769.96	834.76	888.21	903.75	937.95	972.14	1006.34	1040.53	1074.72	1108.92	1143.12	383
8. Kitf Al Wad	736.47	767.01	794.32	803.39	937.32	939.13	982.93	1026.75	1070.55	1114.36	1158.17	1201.98	1245.79	581
9. Al-Dahiah	1127.40	1212.12	1309.86	1442.05	1411.44	1539.96	1619.77	1699.58	1779.36	1859.17	1938.98	2018.76	2098.57	92
10. Al-Maghtes	999.49	984.41	1034.42	998.70	1251.28	1209.02	1260.81	1312.60	1364.38	1416.17	1467.96	1519.74	1571.53	194
11. Falasteen	792.44	853.13	874.44	910.39	1035.72	1056.37	1110.75	1165.13	1219.51	1273.89	1328.27	1382.66	1437.04	577
12. Amman	825.71	878.86	979.54	952.85	977.95	1036.52	1074.37	1112.22	1150.07	1187.91	1225.76	1263.60	1301.45	460
13. Al-Souq	374.93	342.51	366.91	358.75	371.40	365.65	366.57	367.48	368.41	369.32	370.24	371.16	372.07	243
14. Al-ma'moun	947.01	1005.94	1063.95	1013.45	1153.01	1162.52	1204.47	1246.42	1288.38	1330.33	1372.28	1414.23	1456.18	144
15. Al-Rasheed	454.37	418.48	483.53	484.16	468.14	489.71	499.05	508.33	517.67	527.01	536.28	545.63	554.97	39
16. Al-Quds	666.36	799.46	763.13	800.72	929.57	950.16	1002.92	1055.69	1108.46	1161.23	1214.00	1266.77	1319.53	435
17. Yaffa	986.50	959.31	996.80	928.87	883.51	880.06	856.42	832.78	809.13	785.49	761.85	738.20	714.56	54
18. Al-Jame	361.67	391.52	399.42	390.73	406.72	416.81	425.74	434.67	443.60	452.53	461.46	470.39	479.32	104
Average	750.01	797.03	834.96	845.96	919.34	945.74	984.50	1023.26	1062.03	1100.79	1139.55	1178.31	1217.07	5,195

Household: Supply Water Volume

Neighborhood	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Regression Equation (primary)
1. Al-Bayader	21,051	22,553	22,793	21,807	24,825	24,646	25,326	26,007	26,687	27,367	28,047	28,727	29,408	680.2(X-2007)+20565
2. Sheikh Sabbah	104,952	107,430	113,705	108,507	114,713	116,041	118,101	120,161	122,221	124,281	126,341	128,401	130,461	2059.9(X-2007)+103682
3. Sheikh Sbeih	82,385	88,604	92,452	100,227	110,439	115,141	121,914	128,687	135,460	142,233	149,006	155,779	162,552	6773.1(X-2007)+74502
4. Om-Tawabeen	22,429	23,430	22,096	21,380	24,638	23,505	23,742	23,978	24,215	24,452	24,689	24,926	25,162	236.8(X-2007)+22084
5. Sabiha+Al Doeuk	113,554	124,099	138,002	138,794	144,116	154,458	162,040	169,622	177,204	184,786	192,368	199,950	207,532	7581.9(X-2007)+108967
6. Ein-Sultan	173,227	189,221	200,918	203,203	202,587	215,642	222,912	230,183	237,453	244,723	251,993	259,263	266,534	7270.2(X-2007)+172021
7. Qasir-Hisham	105,737	105,753	107,636	116,695	124,168	126,339	131,120	135,900	140,681	145,461	150,241	155,022	159,802	4780.4(X-2007)+97657
8. Kitf Al Wad	156,179	162,657	168,448	170,371	198,773	199,156	208,446	217,737	227,027	236,317	245,607	254,897	264,188	9290.2(X-2007)+143415
9. Al-Dahiah	37,858	40,703	43,985	48,424	47,396	51,712	54,392	57,072	59,751	62,431	65,111	67,790	70,470	2679.7(X-2007)+35634
10. Al-Maghtes	70,774	69,706	73,247	70,718	88,603	85,611	89,278	92,945	96,612	100,279	103,946	107,613	111,280	3667(X-2007)+63609
11. Falasteen	166,891	179,673	184,162	191,732	218,127	222,476	233,929	245,382	256,835	268,288	279,741	291,194	302,647	11453(X-2007)+153758
12. Amman	138,637	147,561	164,464	159,984	164,198	174,032	180,387	186,741	193,096	199,450	205,805	212,159	218,514	6354.5(X-2007)+135905
13. Al-Souq	33,254	30,379	32,543	31,819	32,941	32,431	32,513	32,594	32,676	32,757	32,838	32,920	33,001	81.4(X-2007)+31943
14. Al-ma'moun	49,775	52,872	55,921	53,267	60,602	61,102	63,307	65,512	67,717	69,922	72,127	74,332	76,537	2204.9(X-2007)+47873
15. Al-Rasheed	6,468	5,957	6,883	6,892	6,664	6,971	7,104	7,236	7,369	7,502	7,634	7,767	7,900	132.7(X-2007)+6174.7
16. Al-Quds	105,801	126,934	121,166	127,135	147,592	150,861	159,239	167,617	175,996	184,374	192,752	201,131	209,509	8378.3(X-2007)+100591
17. Yaffa	19,444	18,908	19,647	18,308	17,414	17,346	16,880	16,414	15,948	15,482	15,016	14,550	14,084	-466(X-2007)+20142
18. Al-Jame	13,729	14,862	15,162	14,832	15,439	15,822	16,161	16,500	16,839	17,178	17,517	17,856	18,195	339(X-2007)+13788
Sum	1,422,145	1,511,302	1,583,230	1,604,095	1,743,235	1,793,293	1,866,791	1,940,288	2,013,785	2,087,283	2,160,780	2,234,277	2,307,774	73497.3(X-2007)+1352309.5

Large Users: Water Supply Volume

Name of Large User	2012						2013				Neighborhood #	Water Supply Volume Projection (m³/day)						
	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug	Sep-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May-Jun	Jul-Aug		2012	2013	2014	2015	2016	2017	2018
1 Arab Development Society	8,968	7,144	8,892	8,968	5,852	6,992	6,878	5,206	3,762	3,686	12	128	135	142	149	157	165	174
2 Ghosheh Factory	432	576	637	408	593	477	449	456	463	660	12	9	9	10	10	11	12	12
3 National Security Training Center	4,537	3,743	2,400	3,116	4,380	4,711	2,400	3,742	6,239	6,364	12	63	66	70	73	77	81	86
4 Military Intelligence	656	408	600	254	192	527	580	543	500	292	16	7	7	8	8	9	9	10
5 Ministry of the Interior	1,271	936	2,879	2,591	6,312	1,814	2,391	2,036	3,121	4,820	16	43	45	48	50	53	56	58
6 The Leadership of the National Security Forces	664	1,244	32	2,595	3,290	1,899	648	1,736	4,429	3,058	6	27	28	30	31	33	35	37
7 General Administration Police College	55	418	440	407	1,056	1,342	594	1,320	748	187	6	10	11	11	12	12	13	14
27+28+29 Palestinian Academy for Security Sciences	2,886	6,782	3,670	1,689	5,249	3,496	882	1,932	1,021	819	6	65	68	72	76	80	84	88
8 Jibril Muhammad Aldmanhori/Allimona	334	440	358	195	290	281	246	215	0	352	5	5	5	6	6	6	6	7
9 Suleiman Khader Geahchan /Alrawda	109	151	224	234	181	222	265	372	113	234	8	3	3	3	3	4	4	4
10 The Tourist Village	458	1,126	931	2,682	3,409	2,208	1,265	2,744	4,200	4,890	6	30	32	33	35	37	39	41
11 Tyseer Nimer Mustafa/ Alwaha	88	124	179	122	245	107	115	168	133	145	13	2	2	2	2	2	3	3
12 School girls basic minimum	386	409	228	200	731	904	823	589	300	135	2	8	8	9	9	10	10	11
13 Jericho, Girls High School	184	182	201	139	346	227	115	319	526	516	2	3	3	3	3	4	4	4
14 Girls Jericho Elementary School High	327	563	429	484	544	473	574	644	429	547	2	8	8	9	9	10	10	11
15 Jericho Women Charitable	545	601	445	122	301	428	262	364	289	0	1	7	7	8	8	9	9	10
16+17 Palestine Telecommunications	248	295	524	564	836	712	536	945	798	671	10	9	9	10	10	11	12	12
18 Mehdi Alajlouni -Commercial Investments	1,240	1,400	1,720	1,320	1,880	1,640	1,760	1,680	1,680	1,800	8	25	26	28	29	31	32	34
19 Ziad Nusseibeh -Company Compromise	770	1,276	1,144	880	726	1,223	2,376	1,826	1,320	1,254	6	16	17	18	19	20	21	22
20 House Grandparents to Care for the Elderly	482	607	540	787	518	342	392	344	776	459	7	9	9	10	10	11	12	12
21 Agricultural Jericho Station	174	262	231	226	221	147	210	232	164	119	2	3	3	3	3	4	4	4
22 Jericho Government Hospital	1,080	1,600	2,298	4,180	2,611	2,127	1,106	1,185	2,383	1,921	16	38	40	42	44	47	49	52
23 Jericho Health Directorate	282	329	269	96	205	357	2,528	336	138	173	15	4	4	4	5	5	5	5
24 And border crossings/ the rest	393	362	691	511	862	604	316	981	750	593	11	9	9	10	10	11	12	12
25 And border crossings/ the rest	2,205	2,197	2,126	1,632	2,664	2,418	2,249	2,091	2,030	1,946	11	36	38	40	42	44	47	49
26 And border crossings/ the rest	587	519	1,169	688	986	550	129	206	196	309	11	12	13	13	14	15	16	16
Sum	29,361	33,694	33,257	35,090	44,480	36,228	30,089	32,212	36,508	35,950	-	579	605	642	670	713	750	788

Appendix 2

Personnel cost (Unit: NIS)

Position	Rank	2014				2015				2016			
		Full-time /Part-time	Share of Working Hours	Number		Full-time /Part-time	Share of Working Hours	Number		Full-time /Part-time	Share of Working Hours	Number	
				Assigned	Real	Assigned		Real	Assigned	Real			
a1	b1	c1=a1*b1	a2	b2	c2=a2*b2	a3	b3	c3=a3*b3					
Manager, Water Supply and Sewerage Dep.	Manager	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5
Manager, Sewerage Section	Manager	Full-time	100%	1	1	Duplication	33%	1	0.33	Duplication	33%	1	0.33
Sewer Network and House Connection Div.	Manager	-				Duplication	33%	1	0.33	Duplication	33%	1	0.33
	Engineer	Concurrent	33%	1	0.33	-				-			
	Engineer	Concurrent	33%	1	0.33	-				-			
	Worker/Technician	-				Full-time	100%	1	1	Full-time	100%	1	1
	Worker/Technician	-				Concurrent	50%	1	0.5	Full-time	100%	1	1
	Worker/Technician	-				Concurrent	50%	1	0.5	Full-time	100%	1	1
WWTP Manager	Manager	Full-time	100%	1	1	Duplication	33%	1	0.33	Duplication	33%	1	0.33
WWTP Operator	Engineer	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
WWTP Worker/Guard (Shift)	Worker/Technician	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
	Worker/Technician	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
	Worker/Technician	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
	Worker/Technician	-				Full-time	100%	1	1	Full-time	100%	1	1
WWTP Maintenance (M)	Worker/Technician	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Full-time	100%	1	1
WWTP Maintenance (E)	Worker/Technician	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Full-time	100%	1	1
WWTP Laboratory	Worker/Technician	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5
	Worker/Technician	-				Full-time	100%	1	1	Full-time	100%	1	1
Total	Manager	-	-	3	2.5	-	-	4	1.5	-	-	4	1.5
	Engineer	-	-	3	1.67	-	-	1	1	-	-	1	1
	Worker/Technician	-	-	3	1.5	-	-	7	5	-	-	7	7
	Worker/Technician (shift)	-	-	3	3	-	-	4	4	-	-	4	4
	Sum	-	-	12	8.67	-	-	16	11.0	-	-	16	13.0
	Full-Time+Duplication	-	-	6	6	-	-	10	8.0	-	-	14	12.0
	Concurrent	-	-	6	2.7	-	-	6	3	-	-	2	1

2017				2018				2019				2020			
Full-time /Part-time	Share of Working Hours	Number		Full-time /Part-time	Share of Working Hours	Number		Full-time /Part-time	Share of Working Hours	Number		Full-time /Part-time	Share of Working Hours	Number	
		Assigned	Real			Assigned	Real			Assigned	Real			Assigned	Real
a4	b4	c4=a4*b4		a5	b5	c5=a5*b5		a6	b6	c6=a6*b6		a7	b7	c7=a7*b7	
Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5
Duplication	33%	1	0.33	Duplication	50%	1	0.50	Duplication	50%	1	0.50	Duplication	50%	1	0.50
Duplication	33%	1	0.33	Full-time	100%	1	1.00	Full-time	100%	1	1.00	Full-time	100%	1	1.00
-				-				-				-			
-				-				-				-			
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Duplication	33%	1	0.33	Duplication	50%	1	0.50	Duplication	50%	1	0.50	Duplication	50%	1	0.50
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5	Concurrent	50%	1	0.5
Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1	Full-time	100%	1	1
-	-	4	1.5	-	-	4	2.5	-	-	4	2.5	-	-	4	2.5
-	-	1	1	-	-	1	1	-	-	1	1	-	-	1	1
-	-	7	7	-	-	7	7	-	-	7	7	-	-	7	7
-	-	4	4	-	-	4	4	-	-	4	4	-	-	4	4
-	-	16	13.0	-	-	16	14.0	-	-	16	14.0	-	-	16	14.0
-	-	14	12.0	-	-	14	13.0	-	-	14	13.0	-	-	14	13.0
-	-	2	1	-	-	2	1	-	-	2	1	-	-	2	1

Monthly Salary (Full-time)							Annual Cost							
2014	2015	2016	2017	2018	2019	2020	2014	2015	2016	2017	2018	2019	2020	Sum
d1	d2	d3	d4	d5	d6	d7	e1=c1* d1*5 months	e2=c2* d2*12 months	e3=c3* d3*12 months	e4=c4* d4*12 months	e5=c5* d5*12 months	e6=c6* d6*12 months	e7=c7* d7*12 months	
5,619	5,900	6,195	6,505	6,830	7,172	7,531	14,048	35,400	37,170	39,030	40,980	43,032	45,186	254,846
5,619	5,900	6,195	6,505	6,830	7,172	7,531	28,095	23,576	24,778	26,017	40,980	43,032	45,186	231,664
5,619	5,900	6,195	6,505	6,830	7,172	7,531	0	23,576	24,778	26,017	81,960	86,064	90,372	332,767
3,619	3,800	3,990	4,190	4,400	4,620	4,851	6,031	0	0	0	0	0	0	6,031
3,619	3,800	3,990	4,190	4,400	4,620	4,851	6,031	0	0	0	0	0	0	6,031
2,095	2,200	2,310	2,426	2,547	2,674	2,808	0	26,400	27,720	29,112	30,564	32,088	33,696	179,580
2,095	2,200	2,310	2,426	2,547	2,674	2,808	0	13,200	27,720	29,112	30,564	32,088	33,696	166,380
2,095	2,200	2,310	2,426	2,547	2,674	2,808	0	13,200	27,720	29,112	30,564	32,088	33,696	166,380
5,619	5,900	6,195	6,505	6,830	7,172	7,531	28,095	23,576	24,778	26,017	40,980	43,032	45,186	231,664
3,619	3,800	3,990	4,190	4,400	4,620	4,851	18,095	45,600	47,880	50,280	52,800	55,440	58,212	328,307
4,190	4,400	4,620	4,851	5,094	5,349	5,616	20,950	52,800	55,440	58,212	61,128	64,188	67,392	380,110
4,190	4,400	4,620	4,851	5,094	5,349	5,616	20,950	52,800	55,440	58,212	61,128	64,188	67,392	380,110
4,190	4,400	4,620	4,851	5,094	5,349	5,616	20,950	52,800	55,440	58,212	61,128	64,188	67,392	380,110
4,190	4,400	4,620	4,851	5,094	5,349	5,616	0	52,800	55,440	58,212	61,128	64,188	67,392	359,160
2,095	2,200	2,310	2,426	2,547	2,674	2,808	5,238	13,200	27,720	29,112	30,564	32,088	33,696	171,618
2,095	2,200	2,310	2,426	2,547	2,674	2,808	5,238	13,200	27,720	29,112	30,564	32,088	33,696	171,618
2,095	2,200	2,310	2,426	2,547	2,674	2,808	5,238	13,200	13,860	14,556	15,282	16,044	16,848	95,028
2,095	2,200	2,310	2,426	2,547	2,674	2,808	0	26,400	27,720	29,112	30,564	32,088	33,696	179,580
5,619	5,900	6,195	6,505	6,830	7,172	7,531	70,238	106,129	111,503	117,082	204,900	215,160	225,930	1,050,942
3,619	3,800	3,990	4,190	4,400	4,620	4,851	30,157	45,600	47,880	50,280	52,800	55,440	58,212	340,369
2,095	2,200	2,310	2,426	2,547	2,674	2,808	15,713	118,800	180,180	189,228	198,666	208,572	219,024	1,130,183
4,190	4,400	4,620	4,851	5,094	5,349	5,616	62,850	211,200	221,760	232,848	244,512	256,752	269,568	1,499,490
-	-	-	-	-	-	-	178,959	481,728	561,324	589,437	700,878	735,924	772,734	4,020,984
-	-	-	-	-	-	-	137,135	380,328	510,294	535,851	644,616	676,848	710,700	3,671,110
-	-	-	-	-	-	-	41,824	101,400	51,030	53,586	56,262	59,076	62,034	349,874

Appendix 3

Electricity Bill Assumption Sheet

Winter, January 2015

				Data Input	Data Output	AM																PM							
						0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Load	Consumption	kWh	A	564		23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	
Solar	Maximum Output	kW	B	45																									
	Output Rate for Solar	%	C			0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	
	Solar Generation	kWh	D=B*C	330.8		0.0	0.0	0.0	0.0	0.0	0.0	2.3	9.0	18.0	27.0	36.0	42.8	45.0	45.0	36.0	31.5	22.5	13.5	2.3	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			23.5	23.5	23.5	23.5	23.5	23.5	21.3	14.5	5.5	0	0	0	0	0	0	0	1	10	21.3	23.5	23.5	23.5	23.5	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	0	3.5	12.5	19.3	21.5	21.5	12.5	8	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	B	B	A	A	A	A	A	A	A	C	C	C	C	C	C	C	A	
Tariff for consumption		NIS/kWh	H			0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	1.286	1.286	1.286	1.286	0.436	
Tariff for surplus		NIS/kWh	I=H-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	1.166	1.166	1.166	1.166	0.316	
Cost for consumption		NIS	J=E*H	Sub Total	263.7	10.3	10.3	10.3	10.3	10.3	10.3	16	10.9	2.4	0	0	0	0	0	0	0	1.3	12.9	27.3	30.2	30.2	30.2	10.3	
Cost for surplus		NIS	K=F*I	Sub Total	31.3	0	0	0	0	0	0	0	0	0	0	1.1	4	6.1	6.8	6.8	4	2.5	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	232.4																								
<u>Time Zone for Fridav&Feast Evening</u>			M			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N			0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.754	0.754	0.436	0.436	0.436		
Tariff for surplus		NIS/kWh	O=N-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.634	0.634	0.316	0.316	0.316		
Cost for consumption		NIS	P=E*N	Sub Total	163	10.3	10.3	10.3	10.3	10.3	10.3	9.3	6.3	2.4	0	0	0	0	0	0	0	0.8	7.5	16	17.7	10.3	10.3	10.3	
Cost for surplus		NIS	Q=F*O	Sub Total	31.3	0	0	0	0	0	0	0	0	0	0	1.1	4	6.1	6.8	6.8	4	2.5	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	131.7																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	C	B	B	A	A	A	
Tariff for consumption		NIS/kWh	T			0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	0.754	0.754	0.436	0.436		
Tariff for surplus		NIS/kWh	U=T-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	0.634	0.634	0.316	0.316		
Cost for consumption		NIS	V=E*T	Sub Total	186.7	10.3	10.3	10.3	10.3	10.3	10.3	9.3	6.3	2.4	0	0	0	0	0	0	0	0.4	12.9	27.3	17.7	17.7	10.3	10.3	
Cost for surplus		NIS	W=F*U	Sub Total	31.3	0	0	0	0	0	0	0	0	0	0	1.1	4	6.1	6.8	6.8	4	2.5	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	155.4																								

Spring&Autumn 2015

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	644	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	
Solar	Maximum Output	kW	B	65																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0	
	Solar Generation	kWh	D=B*C	477.8	0.0	0.0	0.0	0.0	0.0	0.0	3.3	13.0	26.0	39.0	52.0	61.8	65.0	65.0	52.0	45.5	32.5	19.5	3.3	0.0	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)		26.8	26.8	26.8	26.8	26.8	26.8	23.6	13.8	0.8	0	0	0	0	0	0	0	0	7.3	23.6	26.8	26.8	26.8	26.8	26.8	
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	12.2	25.2	35	38.2	38.2	25.2	18.7	5.7	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	C	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	A	A	
Tariff for consumption		NIS/kWh	H		0.383	0.383	0.383	0.383	0.383	0.383	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.478	0.478	0.383	0.383	
Tariff for surplus		NIS/kWh	I=H-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.358	0.358	0.263	0.263	
Cost for consumption		NIS	J=E*H	Sub Total	164.6	10.3	10.3	10.3	10.3	10.3	13.9	8.2	0.5	0	0	0	0	0	0	0	0	4.3	13.9	15.8	12.8	12.8	10.3	10.3	
Cost for surplus		NIS	K=F*I	Sub Total	93.6	0	0	0	0	0	0	0	0	0	5.8	11.9	16.5	18	18	11.9	8.8	2.7	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	71.0																								
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N		0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	O=N-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263	
Cost for consumption		NIS	P=E*N	Sub Total	148.7	10.3	10.3	10.3	10.3	10.3	11.2	6.6	0.4	0	0	0	0	0	0	0	0	3.5	11.2	12.8	10.3	10.3	10.3	10.3	
Cost for surplus		NIS	Q=F*O	Sub Total	71	0	0	0	0	0	0	0	0	0	4.4	9	12.5	13.7	13.7	9	6.7	2	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	77.7																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	T		0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	U=T-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263	
Cost for consumption		NIS	V=E*T	Sub Total	147.6	10.3	10.3	10.3	10.3	10.3	9	5.3	0.3	0	0	0	0	0	0	0	0	3.5	11.2	12.8	12.8	10.3	10.3	10.3	
Cost for surplus		NIS	W=F*U	Sub Total	52	0	0	0	0	0	0	0	0	0	3.2	6.6	9.2	10	10	6.6	4.9	1.5	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	95.6																								

Summer 2015

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	712	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	
Solar	Maximum Output	kW	B	75																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0	
	Solar Generation	kWh	D=B*C	551.3	0.0	0.0	0.0	0.0	0.0	0.0	3.8	15.0	30.0	45.0	60.0	71.3	75.0	75.0	60.0	52.5	37.5	22.5	3.8	0.0	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)		29.7	29.7	29.7	29.7	29.7	29.7	26	14.7	0	0	0	0	0	0	0	0	0	7.2	26	29.7	29.7	29.7	29.7	29.7	
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0.3	15.3	30.3	41.6	45.3	45.3	30.3	22.8	7.8	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	A	B	B	B	C	C	C	C	C	C	C	B	B	B	B	A	A	A	
Tariff for consumption		NIS/kWh	H		0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.603	0.603	0.603	1.411	1.411	1.411	1.411	1.411	1.411	1.411	0.603	0.603	0.603	0.603	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	I=H-0.12		0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.483	0.483	0.483	1.291	1.291	1.291	1.291	1.291	1.291	1.291	0.483	0.483	0.483	0.483	0.276	0.276	0.276	
Cost for consumption		NIS	J=E*H	Sub Total	180.2	11.7	11.7	11.7	11.7	11.7	10.3	8.9	0	0	0	0	0	0	0	0	0	4.3	15.6	17.9	17.9	11.7	11.7	11.7	
Cost for surplus		NIS	K=F*I	Sub Total	295.8	0	0	0	0	0	0	0	0	0.1	7.4	39.1	53.6	58.5	58.5	39.1	29.4	10.1	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	-115.6																								
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Tariff for consumption		NIS/kWh	N		0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396		
Tariff for surplus		NIS/kWh	O=N-0.12		0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276		
Cost for consumption		NIS	P=E*N	Sub Total	157.9	11.7	11.7	11.7	11.7	11.7	10.3	5.8	0	0	0	0	0	0	0	0	0	2.8	10.3	11.7	11.7	11.7	11.7	11.7	
Cost for surplus		NIS	Q=F*O	Sub Total	65.7	0	0	0	0	0	0	0	0	0.1	4.2	8.3	11.4	12.5	12.5	8.3	6.3	2.1	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	92.2																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		
Tariff for consumption		NIS/kWh	T		0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396		
Tariff for surplus		NIS/kWh	U=T-0.12		0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276		
Cost for consumption		NIS	V=E*T	Sub Total	157.9	11.7	11.7	11.7	11.7	11.7	10.3	5.8	0	0	0	0	0	0	0	0	0	2.8	10.3	11.7	11.7	11.7	11.7	11.7	
Cost for surplus		NIS	W=F*U	Sub Total	65.7	0	0	0	0	0	0	0	0	0.1	4.2	8.3	11.4	12.5	12.5	8.3	6.3	2.1	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	92.2																								

Winter, January 2016

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	676	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	
Solar	Maximum Output	kW	B	45																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0	
	Solar Generation	kWh	D=B*C	330.8	0.0	0.0	0.0	0.0	0.0	0.0	2.3	9.0	18.0	27.0	36.0	42.8	45.0	45.0	36.0	31.5	22.5	13.5	2.3	0.0	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)		28.2	28.2	28.2	28.2	28.2	28.2	26	19.2	10.2	1.2	0	0	0	0	0	0	5.7	14.7	26	28.2	28.2	28.2	28.2	28.2	
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	0	7.8	14.6	16.8	16.8	7.8	3.3	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	B	B	A	A	A	A	A	A	A	A	C	C	C	C	C	C	C	A	
Tariff for consumption		NIS/kWh	H		0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	1.286	1.286	1.286	1.286	1.286	0.436	
Tariff for surplus		NIS/kWh	I=H-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	1.166	1.166	1.166	1.166	1.166	0.316	
Cost for consumption		NIS	J=E*H	Sub Total	330	12.3	12.3	12.3	12.3	12.3	19.6	14.5	4.5	0.5	0	0	0	0	0	0	7.3	18.9	33.4	36.3	36.3	36.3	36.3	12.3	
Cost for surplus		NIS	K=F*I	Sub Total	21.2	0	0	0	0	0	0	0	0	0	2.5	4.6	5.3	5.3	2.5	1	0	0	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	308.8																								
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N		0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.754	0.754	0.436	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	O=N-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.634	0.634	0.316	0.316	0.316	0.316	
Cost for consumption		NIS	P=E*N	Sub Total	204	12.3	12.3	12.3	12.3	12.3	11.3	8.4	4.5	0.5	0	0	0	0	0	0	4.3	11.1	19.6	21.3	12.3	12.3	12.3	12.3	
Cost for surplus		NIS	Q=F*O	Sub Total	21.2	0	0	0	0	0	0	0	0	0	2.5	4.6	5.3	5.3	2.5	1	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	182.8																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	C	B	B	A	A	A	
Tariff for consumption		NIS/kWh	T		0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	0.754	0.754	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	U=T-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	0.634	0.634	0.316	0.316	0.316	
Cost for consumption		NIS	V=E*T	Sub Total	232.8	12.3	12.3	12.3	12.3	12.3	11.3	8.4	4.5	0.5	0	0	0	0	0	0	2.5	18.9	33.4	21.3	21.3	12.3	12.3	12.3	
Cost for surplus		NIS	W=F*U	Sub Total	21.2	0	0	0	0	0	0	0	0	0	2.5	4.6	5.3	5.3	2.5	1	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	211.6																								

Spring&Autumn 2016

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	771	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1		
Solar	Maximum Output	kW	B	65																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0		
	Solar Generation	kWh	D=B*C	477.8	0.0	0.0	0.0	0.0	0.0	0.0	3.3	13.0	26.0	39.0	52.0	61.8	65.0	65.0	52.0	45.5	32.5	19.5	3.3	0.0	0.0	0.0	0.0		
JDECO Consumption		kWh	E=A-D (NLT 0)		32.1	32.1	32.1	32.1	32.1	32.1	28.9	19.1	6.1	0	0	0	0	0	0	0	0	12.6	28.9	32.1	32.1	32.1	32.1		
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	6.9	19.9	29.7	32.9	32.9	19.9	13.4	0.4	0	0	0	0	0	0		
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	C	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	A	A	
Tariff for consumption		NIS/kWh	H		0.383	0.383	0.383	0.383	0.383	0.383	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.478	0.478	0.383	0.383	
Tariff for surplus		NIS/kWh	I=H-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.358	0.358	0.263	0.263	
Cost for consumption		NIS	J=E*H	Sub Total	204.6	12.3	12.3	12.3	12.3	12.3	17.1	11.3	3.6	0	0	0	0	0	0	0	0	7.5	17.1	19	15.3	15.3	12.3	12.3	
Cost for surplus		NIS	K=F*I	Sub Total	73.6	0	0	0	0	0	0	0	0	0	3.3	9.4	14	15.5	15.5	9.4	6.3	0.2	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	131.0																								
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N		0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	O=N-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263	
Cost for consumption		NIS	P=E*N	Sub Total	183.9	12.3	12.3	12.3	12.3	12.3	13.8	9.1	2.9	0	0	0	0	0	0	0	0	6	13.8	15.3	12.3	12.3	12.3	12.3	
Cost for surplus		NIS	Q=F*O	Sub Total	55.8	0	0	0	0	0	0	0	0	2.5	7.1	10.6	11.8	11.8	7.1	4.8	0.1	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	128.1																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	T		0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	U=T-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263	
Cost for consumption		NIS	V=E*T	Sub Total	181.7	12.3	12.3	12.3	12.3	12.3	11	7.3	2.3	0	0	0	0	0	0	0	0	6	13.8	15.3	15.3	12.3	12.3	12.3	
Cost for surplus		NIS	W=F*U	Sub Total	40.8	0	0	0	0	0	0	0	0	1.8	5.2	7.8	8.6	8.6	5.2	3.5	0.1	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	140.9																								

Summer 2016

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	853		35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	
Solar	Maximum Output	kW	B	75																									
	Output Rate for Solar	%	C			0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0	
	Solar Generation	kWh	D=B*C	551.3		0.0	0.0	0.0	0.0	0.0	3.8	15.0	30.0	45.0	60.0	71.3	75.0	75.0	60.0	52.5	37.5	22.5	3.8	0.0	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			35.5	35.5	35.5	35.5	35.5	31.8	20.5	5.5	0	0	0	0	0	0	0	0	13	31.8	35.5	35.5	35.5	35.5	35.5	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	9.5	24.5	35.8	39.5	39.5	24.5	17	2	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	B	B	B	C	C	C	C	C	C	C	B	B	B	B	A	A	A	
Tariff for consumption		NIS/kWh	H			0.396	0.396	0.396	0.396	0.396	0.396	0.603	0.603	0.603	1.411	1.411	1.411	1.411	1.411	1.411	1.411	0.603	0.603	0.603	0.603	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	I=H-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.483	0.483	0.483	1.291	1.291	1.291	1.291	1.291	1.291	1.291	0.483	0.483	0.483	0.483	0.276	0.276	0.276	
Cost for consumption		NIS	J=E*H	Sub Total	224	14	14	14	14	14	14	12.6	12.4	3.3	0	0	0	0	0	0	0	7.8	19.1	21.4	21.4	14	14	14	
Cost for surplus		NIS	K=F*I	Sub Total	240.4	0	0	0	0	0	0	0	0	0	4.6	31.6	46.1	51	51	31.6	21.9	2.6	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	-16.4																								
<u>Time Zone for Friday&Feast Evening</u>			M			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Tariff for consumption		NIS/kWh	N			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	O=N-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	
Cost for consumption		NIS	P=E*N	Sub Total	194.6	14	14	14	14	14	14	12.6	8.1	2.2	0	0	0	0	0	0	0	5.1	12.6	14	14	14	14	14	
Cost for surplus		NIS	Q=F*O	Sub Total	52.9	0	0	0	0	0	0	0	0	0	2.6	6.7	9.8	10.9	10.9	6.7	4.7	0.6	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	141.7																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Tariff for consumption		NIS/kWh	T			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	U=T-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	
Cost for consumption		NIS	V=E*T	Sub Total	194.6	14	14	14	14	14	14	12.6	8.1	2.2	0	0	0	0	0	0	0	5.1	12.6	14	14	14	14	14	
Cost for surplus		NIS	W=F*U	Sub Total	52.9	0	0	0	0	0	0	0	0	0	2.6	6.7	9.8	10.9	10.9	6.7	4.7	0.6	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	141.7																								

Winter, January 2017

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	811	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8		
Solar	Maximum Output	kW	B	45																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0		
	Solar Generation	kWh	D=B*C	330.8	0.0	0.0	0.0	0.0	0.0	0.0	2.3	9.0	18.0	27.0	36.0	42.8	45.0	45.0	36.0	31.5	22.5	13.5	2.3	0.0	0.0	0.0	0.0		
JDECO Consumption		kWh	E=A-D (NLT 0)		33.8	33.8	33.8	33.8	33.8	33.8	31.6	24.8	15.8	6.8	0	0	0	0	0	2.3	11.3	20.3	31.6	33.8	33.8	33.8	33.8		
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	0	2.2	8.95	11.2	11.2	2.2	0	0	0	0	0	0	0	0		
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	B	B	A	A	A	A	A	A	A	C	C	C	C	C	C	C	A		
Tariff for consumption		NIS/kWh	H		0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	1.286	1.286	1.286	1.286	1.286	0.436		
Tariff for surplus		NIS/kWh	I=H-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	1.166	1.166	1.166	1.166	1.166	0.316		
Cost for consumption		NIS	J=E*H	Sub Total	412.2	14.8	14.8	14.8	14.8	14.8	23.8	18.7	6.9	3	0	0	0	0	0	1	14.5	26.1	40.6	43.5	43.5	43.5	14.8		
Cost for surplus		NIS	K=F*I	Sub Total	11.2	0	0	0	0	0	0	0	0	0	0.7	2.8	3.5	3.5	0.7	0	0	0	0	0	0	0	0		
Bill for Working Days		NIS/day	L=J-K	Total	401.0																								
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A		
Tariff for consumption		NIS/kWh	N		0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.754	0.754	0.436	0.436	0.436	0.436		
Tariff for surplus		NIS/kWh	O=N-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.634	0.634	0.316	0.316	0.316	0.316		
Cost for consumption		NIS	P=E*N	Sub Total	256.6	14.8	14.8	14.8	14.8	14.8	13.8	10.8	6.9	3	0	0	0	0	0	1	8.5	15.3	23.8	25.5	14.8	14.8	14.8		
Cost for surplus		NIS	Q=F*O	Sub Total	11.2	0	0	0	0	0	0	0	0	0	0.7	2.8	3.5	3.5	0.7	0	0	0	0	0	0	0	0		
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	245.4																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	C	B	B	A	A	A	A		
Tariff for consumption		NIS/kWh	T		0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	0.754	0.754	0.436	0.436	0.436			
Tariff for surplus		NIS/kWh	U=T-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	0.634	0.634	0.316	0.316	0.316			
Cost for consumption		NIS	V=E*T	Sub Total	291.3	14.8	14.8	14.8	14.8	14.8	13.8	10.8	6.9	3	0	0	0	0	0	1	4.9	26.1	40.6	25.5	25.5	14.8	14.8		
Cost for surplus		NIS	W=F*U	Sub Total	11.2	0	0	0	0	0	0	0	0	0	0.7	2.8	3.5	3.5	0.7	0	0	0	0	0	0	0	0		
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	280.1																								

Spring&Autumn 2017

				Data Input	Data Output	AM												PM											
						0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Load	Consumption	kWh	A	925		38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	38.5	
Solar	Maximum Output	kW	B	65																									
	Output Rate for Solar	%	C			0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	
	Solar Generation	kWh	D=B*C	477.8		0.0	0.0	0.0	0.0	0.0	0.0	3.3	13.0	26.0	39.0	52.0	61.8	65.0	65.0	52.0	45.5	32.5	19.5	3.3	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			38.5	38.5	38.5	38.5	38.5	38.5	35.3	25.5	12.5	0	0	0	0	0	0	0	6	19	35.3	38.5	38.5	38.5	38.5	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	0	0.5	13.5	23.3	26.5	26.5	13.5	7	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	C	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	A	A
Tariff for consumption		NIS/kWh	H			0.383	0.383	0.383	0.383	0.383	0.383	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.478	0.478	0.383	0.383	
Tariff for surplus		NIS/kWh	I=H-0.12			0.263	0.263	0.263	0.263	0.263	0.263	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.358	0.358	0.263	0.263	
Cost for consumption		NIS	J=E*H	Sub Total	256	14.7	14.7	14.7	14.7	14.7	14.7	20.8	15.1	7.4	0	0	0	0	0	0	0	3.5	11.2	20.8	22.8	18.4	18.4	14.7	14.7
Cost for surplus		NIS	K=F*I	Sub Total	52.3	0	0	0	0	0	0	0	0	0	0	0.2	6.4	11	12.5	12.5	6.4	3.3	0	0	0	0	0	0	0
Bill for Working Days		NIS/day	L=J-K	Total	203.7																								
<u>Time Zone for Friday&Feast Evening</u>			M			A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A
Tariff for consumption		NIS/kWh	N			0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	O=N-0.12			0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263	
Cost for consumption		NIS	P=E*N	Sub Total	229.2	14.7	14.7	14.7	14.7	14.7	14.7	16.8	12.2	6	0	0	0	0	0	0	0	2.9	9.1	16.8	18.4	14.7	14.7	14.7	14.7
Cost for surplus		NIS	Q=F*O	Sub Total	39.6	0	0	0	0	0	0	0	0	0	0	0.2	4.8	8.3	9.5	9.5	4.8	2.5	0	0	0	0	0	0	0
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	189.6																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	A	A	A
Tariff for consumption		NIS/kWh	T			0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	U=T-0.12			0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.263	0.263	0.263	
Cost for consumption		NIS	V=E*T	Sub Total	225.4	14.7	14.7	14.7	14.7	14.7	14.7	13.5	9.8	4.8	0	0	0	0	0	0	0	2.3	9.1	16.8	18.4	18.4	14.7	14.7	14.7
Cost for surplus		NIS	W=F*U	Sub Total	29	0	0	0	0	0	0	0	0	0	0	0.1	3.5	6.1	7	7	3.5	1.8	0	0	0	0	0	0	0
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	196.4																								

Summer 2017

				Data Input	Data Output	AM																PM							
						0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Load	Consumption	kWh	A	1024		42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	
Solar	Maximum Output	kW	B	75																									
	Output Rate for Solar	%	C			0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	
	Solar Generation	kWh	D=B*C	551.3		0.0	0.0	0.0	0.0	0.0	0.0	3.8	15.0	30.0	45.0	60.0	71.3	75.0	75.0	60.0	52.5	37.5	22.5	3.8	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			42.7	42.7	42.7	42.7	42.7	42.7	39	27.7	12.7	0	0	0	0	0	0	0	5.2	20.2	39	42.7	42.7	42.7	42.7	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	0	2.3	17.3	28.6	32.3	32.3	17.3	9.8	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	A	B	B	B	C	C	C	C	C	C	C	B	B	B	B	A	A	A
Tariff for consumption		NIS/kWh	H			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.603	0.603	0.603	1.411	1.411	1.411	1.411	1.411	1.411	1.411	0.603	0.603	0.603	0.603	0.396	0.396	0.396
Tariff for surplus		NIS/kWh	I=H-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.483	0.483	0.483	1.291	1.291	1.291	1.291	1.291	1.291	1.291	0.483	0.483	0.483	0.483	0.276	0.276	0.276
Cost for consumption		NIS	J=E*H	Sub Total	286.3	16.9	16.9	16.9	16.9	16.9	16.9	15.4	16.7	7.7	0	0	0	0	0	0	0	7.3	12.2	23.5	25.7	25.7	16.9	16.9	16.9
Cost for surplus		NIS	K=F*I	Sub Total	178.5	0	0	0	0	0	0	0	0	0	0	1.1	22.3	36.8	41.7	41.7	22.3	12.6	0	0	0	0	0	0	0
Bill for Working Days		NIS/day	L=J-K	Total	107.8																								
<u>Time Zone for Friday&Feast Evening</u>			M			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Tariff for consumption		NIS/kWh	N			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	O=N-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	
Cost for consumption		NIS	P=E*N	Sub Total	242.8	16.9	16.9	16.9	16.9	16.9	16.9	15.4	11	5	0	0	0	0	0	0	0	2.1	8	15.4	16.9	16.9	16.9	16.9	16.9
Cost for surplus		NIS	Q=F*O	Sub Total	38.6	0	0	0	0	0	0	0	0	0	0	0.6	4.8	7.9	8.9	8.9	4.8	2.7	0	0	0	0	0	0	0
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	204.2																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Tariff for consumption		NIS/kWh	T			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	U=T-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	
Cost for consumption		NIS	V=E*T	Sub Total	242.8	16.9	16.9	16.9	16.9	16.9	16.9	15.4	11	5	0	0	0	0	0	0	0	2.1	8	15.4	16.9	16.9	16.9	16.9	16.9
Cost for surplus		NIS	W=F*U	Sub Total	38.6	0	0	0	0	0	0	0	0	0	0	0.6	4.8	7.9	8.9	8.9	4.8	2.7	0	0	0	0	0	0	0
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	204.2																								

Winter, January 2018

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	1002		41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	
Solar	Maximum Output	kW	B	45																									
	Output Rate for Solar	%	C			0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	
	Solar Generation	kWh	D=B*C	330.8		0.0	0.0	0.0	0.0	0.0	0.0	2.3	9.0	18.0	27.0	36.0	42.8	45.0	45.0	36.0	31.5	22.5	13.5	2.3	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			41.8	41.8	41.8	41.8	41.8	41.8	39.6	32.8	23.8	14.8	5.8	0	0	0	5.8	10.3	19.3	28.3	39.6	41.8	41.8	41.8	41.8	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	0	0	0	0.95	3.2	3.2	0	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	B	B	A	A	A	A	A	A	A	A	C	C	C	C	C	C	A	
Tariff for consumption		NIS/kWh	H			0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	1.286	1.286	1.286	1.286	1.286	0.436	
Tariff for surplus		NIS/kWh	I=H-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	1.166	1.166	1.166	1.166	1.166	0.316	
Cost for consumption		NIS	J=E*H	Sub Total	535.6	18.2	18.2	18.2	18.2	18.2	18.2	29.8	24.7	10.4	6.5	2.5	0	0	0	2.5	4.5	24.8	36.4	50.9	53.8	53.8	53.8	18.2	
Cost for surplus		NIS	K=F*I	Sub Total	2.3	0	0	0	0	0	0	0	0	0	0	0	0.3	1	1	0	0	0	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	533.3																								
<u>Time Zone for Friday&Feast Evening</u>			M			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N			0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.754	0.754	0.436	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	O=N-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.634	0.634	0.316	0.316	0.316	0.316	
Cost for consumption		NIS	P=E*N	Sub Total	337.2	18.2	18.2	18.2	18.2	18.2	18.2	17.3	14.3	10.4	6.5	2.5	0	0	0	2.5	4.5	14.6	21.3	29.8	31.5	18.2	18.2	18.2	
Cost for surplus		NIS	Q=F*O	Sub Total	2.3	0	0	0	0	0	0	0	0	0	0	0	0.3	1	1	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	334.9																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	C	B	B	A	A	A	
Tariff for consumption		NIS/kWh	T			0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	0.754	0.754	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	U=T-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	0.634	0.634	0.316	0.316	0.316	
Cost for consumption		NIS	V=E*T	Sub Total	380.5	18.2	18.2	18.2	18.2	18.2	18.2	17.3	14.3	10.4	6.5	2.5	0	0	0	2.5	4.5	8.4	36.4	50.9	31.5	31.5	18.2	18.2	18.2
Cost for surplus		NIS	W=F*U	Sub Total	2.3	0	0	0	0	0	0	0	0	0	0	0	0.3	1	1	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	378.2																								

Spring&Autumn 2018

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	1143	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	
Solar	Maximum Output	kW	B	65																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0	
	Solar Generation	kWh	D=B*C	477.8	0.0	0.0	0.0	0.0	0.0	0.0	3.3	13.0	26.0	39.0	52.0	61.8	65.0	65.0	52.0	45.5	32.5	19.5	3.3	0.0	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)		47.6	47.6	47.6	47.6	47.6	47.6	44.4	34.6	21.6	8.6	0	0	0	0	0	2.1	15.1	28.1	44.4	47.6	47.6	47.6	47.6	47.6	
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	0	4.4	14.2	17.4	17.4	4.4	0	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	C	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	A	A	
Tariff for consumption		NIS/kWh	H		0.383	0.383	0.383	0.383	0.383	0.383	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.478	0.478	0.383	0.383		
Tariff for surplus		NIS/kWh	I=H-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.358	0.358	0.263	0.263		
Cost for consumption		NIS	J=E*H	Sub Total	336.7	18.2	18.2	18.2	18.2	18.2	18.2	26.2	20.5	12.8	5.1	0	0	0	0	0	1.2	8.9	16.6	26.2	28.2	22.7	22.7	18.2	18.2
Cost for surplus		NIS	K=F*I	Sub Total	27.3	0	0	0	0	0	0	0	0	0	0	2.1	6.7	8.2	8.2	2.1	0	0	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	309.4																								
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N		0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383		
Tariff for surplus		NIS/kWh	O=N-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263		
Cost for consumption		NIS	P=E*N	Sub Total	299.6	18.2	18.2	18.2	18.2	18.2	18.2	21.2	16.5	10.3	4.1	0	0	0	0	0	1	7.2	13.4	21.2	22.7	18.2	18.2	18.2	
Cost for surplus		NIS	Q=F*O	Sub Total	20.7	0	0	0	0	0	0	0	0	0	0	1.6	5.1	6.2	6.2	1.6	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	278.9																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	T		0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.383	0.383	0.383		
Tariff for surplus		NIS/kWh	U=T-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.263	0.263	0.263		
Cost for consumption		NIS	V=E*T	Sub Total	292.2	18.2	18.2	18.2	18.2	18.2	17	13.2	8.3	3.3	0	0	0	0	0	0.8	5.8	13.4	21.2	22.7	22.7	18.2	18.2	18.2	
Cost for surplus		NIS	W=F*U	Sub Total	15.3	0	0	0	0	0	0	0	0	0	0	1.2	3.7	4.6	4.6	1.2	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	276.9																								

Summer 2018

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	1265	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	52.7	
Solar	Maximum Output	kW	B	75																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0	
	Solar Generation	kWh	D=B*C	551.3	0.0	0.0	0.0	0.0	0.0	0.0	3.8	15.0	30.0	45.0	60.0	71.3	75.0	75.0	60.0	52.5	37.5	22.5	3.8	0.0	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)		52.7	52.7	52.7	52.7	52.7	52.7	49	37.7	22.7	7.7	0	0	0	0	0	0.2	15.2	30.2	49	52.7	52.7	52.7	52.7	52.7	
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	0	7.3	18.6	22.3	22.3	7.3	0	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	A	B	B	B	C	C	C	C	C	C	C	B	B	B	B	A	A	A	
Tariff for consumption		NIS/kWh	H		0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.603	0.603	0.603	1.411	1.411	1.411	1.411	1.411	1.411	1.411	0.603	0.603	0.603	0.603	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	I=H-0.12		0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.483	0.483	0.483	1.291	1.291	1.291	1.291	1.291	1.291	1.291	0.483	0.483	0.483	0.483	0.276	0.276	0.276	
Cost for consumption		NIS	J=E*H	Sub Total	380.6	20.8	20.8	20.8	20.8	20.8	20.8	19.4	22.7	13.7	4.6	0	0	0	0	0	0.3	21.4	18.2	29.5	31.8	31.8	20.8	20.8	20.8
Cost for surplus		NIS	K=F*I	Sub Total	100.3	0	0	0	0	0	0	0	0	0	0	9.4	23.9	28.8	28.8	9.4	0	0	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	280.3																								
<u>Time Zone for Fridav&Feast Evening</u>			M		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Tariff for consumption		NIS/kWh	N		0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	O=N-0.12		0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	
Cost for consumption		NIS	P=E*N	Sub Total	312.5	20.8	20.8	20.8	20.8	20.8	20.8	19.4	14.9	9	3	0	0	0	0	0	0.1	6	11.9	19.4	20.8	20.8	20.8	20.8	
Cost for surplus		NIS	Q=F*O	Sub Total	21.3	0	0	0	0	0	0	0	0	0	0	2	5.1	6.1	6.1	2	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	291.2																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
Tariff for consumption		NIS/kWh	T		0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396		
Tariff for surplus		NIS/kWh	U=T-0.12		0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276		
Cost for consumption		NIS	V=E*T	Sub Total	312.5	20.8	20.8	20.8	20.8	20.8	20.8	19.4	14.9	9	3	0	0	0	0	0	0.1	6	11.9	19.4	20.8	20.8	20.8	20.8	
Cost for surplus		NIS	W=F*U	Sub Total	21.3	0	0	0	0	0	0	0	0	0	0	2	5.1	6.1	6.1	2	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	291.2																								

Winter, January 2019

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	1052		43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	
Solar	Maximum Output	kW	B	45																									
	Output Rate for Solar	%	C			0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	
	Solar Generation	kWh	D=B*C	330.8		0.0	0.0	0.0	0.0	0.0	0.0	2.3	9.0	18.0	27.0	36.0	42.8	45.0	45.0	36.0	31.5	22.5	13.5	2.3	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			43.8	43.8	43.8	43.8	43.8	43.8	41.6	34.8	25.8	16.8	7.8	1.05	0	0	7.8	12.3	21.3	30.3	41.6	43.8	43.8	43.8	43.8	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	0	0	0	0	1.2	1.2	0	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	B	B	A	A	A	A	A	A	A	A	C	C	C	C	C	C	A	
Tariff for consumption		NIS/kWh	H			0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	1.286	1.286	1.286	1.286	0.436	
Tariff for surplus		NIS/kWh	I=H-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	1.166	1.166	1.166	1.166	0.316	
Cost for consumption		NIS	J=E*H	Sub Total	567.5	19.1	19.1	19.1	19.1	19.1	19.1	31.3	26.2	11.3	7.3	3.4	0.5	0	0	3.4	5.4	27.4	39	53.4	56.3	56.3	56.3	19.1	
Cost for surplus		NIS	K=F*I	Sub Total	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.4	0	0	0	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	566.7																								
<u>Time Zone for Friday&Feast Evening</u>			M			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N			0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.754	0.754	0.436	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	O=N-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.634	0.634	0.316	0.316	0.316	0.316	
Cost for consumption		NIS	P=E*N	Sub Total	358.8	19.1	19.1	19.1	19.1	19.1	19.1	18.1	15.2	11.3	7.3	3.4	0.5	0	0	3.4	5.4	16.1	22.8	31.3	33	19.1	19.1	19.1	
Cost for surplus		NIS	Q=F*O	Sub Total	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.4	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	358.0																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	C	B	B	A	A	A	
Tariff for consumption		NIS/kWh	T			0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	0.754	0.754	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	U=T-0.12			0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	0.634	0.634	0.316	0.316	0.316	
Cost for consumption		NIS	V=E*T	Sub Total	404.2	19.1	19.1	19.1	19.1	19.1	19.1	18.1	15.2	11.3	7.3	3.4	0.5	0	0	3.4	5.4	9.3	39	53.4	33	33	19.1	19.1	19.1
Cost for surplus		NIS	W=F*U	Sub Total	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0.4	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	403.4																								

Spring&Autumn 2019

				Data Input	Data Output	AM																PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23					
Load	Consumption	kWh	A	1200	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50					
Solar	Maximum Output	kW	B	65																													
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0					
	Solar Generation	kWh	D=B*C	477.8	0.0	0.0	0.0	0.0	0.0	0.0	3.3	13.0	26.0	39.0	52.0	61.8	65.0	65.0	52.0	45.5	32.5	19.5	3.3	0.0	0.0	0.0	0.0	0.0					
JDECO Consumption		kWh	E=A-D (NLT 0)		50	50	50	50	50	50	46.8	37	24	11	0	0	0	0	0	4.5	17.5	30.5	46.8	50	50	50	50	50					
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	0	2	11.8	15	15	2	0	0	0	0	0	0	0	0	0					
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	C	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	A	A					
Tariff for consumption		NIS/kWh	H		0.383	0.383	0.383	0.383	0.383	0.383	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.478	0.478	0.383	0.383					
Tariff for surplus		NIS/kWh	I=H-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.358	0.358	0.263	0.263					
Cost for consumption		NIS	J=E*H	Sub Total	359	19.1	19.1	19.1	19.1	19.1	19.1	27.6	21.9	14.2	6.5	0	0	0	0	0	2.7	10.3	18	27.6	29.6	23.9	23.9	19.1	19.1				
Cost for surplus		NIS	K=F*I	Sub Total	21.5	0	0	0	0	0	0	0	0	0	0	0.9	5.5	7.1	7.1	0.9	0	0	0	0	0	0	0	0					
Bill for Working Days		NIS/day	L=J-K	Total	337.5																												
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A					
Tariff for consumption		NIS/kWh	N		0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383					
Tariff for surplus		NIS/kWh	O=N-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263						
Cost for consumption		NIS	P=E*N	Sub Total	319.1	19.1	19.1	19.1	19.1	19.1	19.1	22.3	17.7	11.5	5.3	0	0	0	0	0	2.1	8.4	14.6	22.3	23.9	19.1	19.1	19.1					
Cost for surplus		NIS	Q=F*O	Sub Total	16.4	0	0	0	0	0	0	0	0	0	0	0.7	4.2	5.4	5.4	0.7	0	0	0	0	0	0	0	0					
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	302.7																												
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A					
Tariff for consumption		NIS/kWh	T		0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.383	0.383	0.383						
Tariff for surplus		NIS/kWh	U=T-0.12		0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.263	0.263	0.263						
Cost for consumption		NIS	V=E*T	Sub Total	310.5	19.1	19.1	19.1	19.1	19.1	19.1	17.9	14.2	9.2	4.2	0	0	0	0	0	1.7	6.7	14.6	22.3	23.9	23.9	19.1	19.1					
Cost for surplus		NIS	W=F*U	Sub Total	11.9	0	0	0	0	0	0	0	0	0	0	0.5	3.1	3.9	3.9	0.5	0	0	0	0	0	0	0	0					
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	298.6																												

Summer 2019

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	1328		55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	55.3	
Solar	Maximum Output	kW	B	75																									
	Output Rate for Solar	%	C			0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	
	Solar Generation	kWh	D=B*C	551.3		0.0	0.0	0.0	0.0	0.0	0.0	3.8	15.0	30.0	45.0	60.0	71.3	75.0	75.0	60.0	52.5	37.5	22.5	3.8	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			55.3	55.3	55.3	55.3	55.3	55.3	51.6	40.3	25.3	10.3	0	0	0	0	0	2.8	17.8	32.8	51.6	55.3	55.3	55.3	55.3	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	0	0	4.7	16	19.7	19.7	4.7	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	A	B	B	B	C	C	C	C	C	C	C	B	B	B	B	A	A	A
Tariff for consumption		NIS/kWh	H			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.603	0.603	0.603	1.411	1.411	1.411	1.411	1.411	1.411	1.411	0.603	0.603	0.603	0.603	0.396	0.396	0.396
Tariff for surplus		NIS/kWh	I=H-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.483	0.483	0.483	1.291	1.291	1.291	1.291	1.291	1.291	1.291	0.483	0.483	0.483	0.483	0.276	0.276	0.276
Cost for consumption		NIS	J=E*H	Sub Total	409.7	21.9	21.9	21.9	21.9	21.9	21.9	20.4	24.3	15.2	6.2	0	0	0	0	0	3.9	25.1	19.8	31.1	33.3	33.3	21.9	21.9	21.9
Cost for surplus		NIS	K=F*I	Sub Total	83.6	0	0	0	0	0	0	0	0	0	0	6.1	20.6	25.4	25.4	6.1	0	0	0	0	0	0	0	0	0
Bill for Working Days		NIS/day	L=J-K	Total	326.1																								
<u>Time Zone for Friday&Feast Evening</u>			M			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Tariff for consumption		NIS/kWh	N			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	O=N-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	
Cost for consumption		NIS	P=E*N	Sub Total	332.8	21.9	21.9	21.9	21.9	21.9	21.9	20.4	15.9	10	4.1	0	0	0	0	0	1.1	7	13	20.4	21.9	21.9	21.9	21.9	
Cost for surplus		NIS	Q=F*O	Sub Total	17.8	0	0	0	0	0	0	0	0	0	0	1.3	4.4	5.4	5.4	1.3	0	0	0	0	0	0	0	0	0
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	315.0																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Tariff for consumption		NIS/kWh	T			0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	0.396	
Tariff for surplus		NIS/kWh	U=T-0.12			0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	0.276	
Cost for consumption		NIS	V=E*T	Sub Total	332.8	21.9	21.9	21.9	21.9	21.9	21.9	20.4	15.9	10	4.1	0	0	0	0	0	1.1	7	13	20.4	21.9	21.9	21.9	21.9	
Cost for surplus		NIS	W=F*U	Sub Total	17.8	0	0	0	0	0	0	0	0	0	0	1.3	4.4	5.4	5.4	1.3	0	0	0	0	0	0	0	0	0
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	315.0																								

Winter, January 2020

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	1260	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	
Solar	Maximum Output	kW	B	45																									
	Output Rate for Solar	%	C		0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	0	
	Solar Generation	kWh	D=B*C	330.8	0.0	0.0	0.0	0.0	0.0	0.0	2.3	9.0	18.0	27.0	36.0	42.8	45.0	45.0	36.0	31.5	22.5	13.5	2.3	0.0	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)		52.5	52.5	52.5	52.5	52.5	52.5	50.3	43.5	34.5	25.5	16.5	9.75	7.5	7.5	16.5	21	30	39	50.3	52.5	52.5	52.5	52.5	52.5	
Surplus Power		kWh	F=D-A (NLT 0)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G		A	A	A	A	A	A	B	B	A	A	A	A	A	A	A	A	C	C	C	C	C	C	C	A	
Tariff for consumption		NIS/kWh	H		0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	1.286	1.286	1.286	1.286	1.286	0.436	
Tariff for surplus		NIS/kWh	I=H-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	1.166	1.166	1.166	1.166	1.166	0.316	
Cost for consumption		NIS	J=E*H	Sub Total	715.1	22.9	22.9	22.9	22.9	22.9	37.9	32.8	15.1	11.1	7.2	4.3	3.3	3.3	7.2	9.2	38.6	50.2	64.6	67.5	67.5	67.5	67.5	22.9	
Cost for surplus		NIS	K=F*I	Sub Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	715.1																								
<u>Time Zone for Friday&Feast Evening</u>			M		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N		0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.754	0.754	0.754	0.754	0.436	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	O=N-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.634	0.634	0.634	0.634	0.316	0.316	0.316	0.316	
Cost for consumption		NIS	P=E*N	Sub Total	460.1	22.9	22.9	22.9	22.9	22.9	21.9	19	15.1	11.1	7.2	4.3	3.3	3.3	7.2	9.2	22.6	29.4	37.9	39.6	22.9	22.9	22.9	22.9	
Cost for surplus		NIS	Q=F*O	Sub Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	460.1																								
<u>Time Zone for Saturday&Feast Days</u>			S		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	C	C	B	B	A	A	A	
Tariff for consumption		NIS/kWh	T		0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	0.436	1.286	1.286	0.754	0.754	0.436	0.436	0.436	
Tariff for surplus		NIS/kWh	U=T-0.12		0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	0.316	1.166	1.166	0.634	0.634	0.316	0.316	0.316	
Cost for consumption		NIS	V=E*T	Sub Total	514.8	22.9	22.9	22.9	22.9	22.9	21.9	19	15.1	11.1	7.2	4.3	3.3	3.3	7.2	9.2	13.1	50.2	64.6	39.6	39.6	22.9	22.9	22.9	
Cost for surplus		NIS	W=F*U	Sub Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	514.8																								

Spring&Autumn 2020

				Data Input	Data Output	AM												PM											
					0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Load	Consumption	kWh	A	1438		59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	59.9	
Solar	Maximum Output	kW	B	65																									
	Output Rate for Solar	%	C			0	0	0	0	0	0	5	20	40	60	80	95	100	100	80	70	50	30	5	0	0	0	0	
	Solar Generation	kWh	D=B*C	477.8		0.0	0.0	0.0	0.0	0.0	0.0	3.3	13.0	26.0	39.0	52.0	61.8	65.0	65.0	52.0	45.5	32.5	19.5	3.3	0.0	0.0	0.0	0.0	
JDECO Consumption		kWh	E=A-D (NLT 0)			59.9	59.9	59.9	59.9	59.9	59.9	56.7	46.9	33.9	20.9	7.9	0	0	0	7.9	14.4	27.4	40.4	56.7	59.9	59.9	59.9	59.9	
Surplus Power		kWh	F=D-A (NLT 0)			0	0	0	0	0	0	0	0	0	0	0	1.85	5.1	5.1	0	0	0	0	0	0	0	0	0	
<u>Time Zone for Working Days</u>			G			A	A	A	A	A	A	C	C	C	C	C	C	C	C	C	C	C	C	C	C	B	B	A	A
Tariff for consumption		NIS/kWh	H			0.383	0.383	0.383	0.383	0.383	0.383	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.591	0.478	0.478	0.383	0.383	
Tariff for surplus		NIS/kWh	I=H-0.12			0.263	0.263	0.263	0.263	0.263	0.263	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.471	0.358	0.358	0.263	0.263	
Cost for consumption		NIS	J=E*H	Sub Total	460.9	22.9	22.9	22.9	22.9	22.9	22.9	33.5	27.7	20	12.4	4.7	0	0	0	4.7	8.5	16.2	23.9	33.5	35.4	28.6	28.6	22.9	22.9
Cost for surplus		NIS	K=F*I	Sub Total	5.7	0	0	0	0	0	0	0	0	0	0	0	0.9	2.4	2.4	0	0	0	0	0	0	0	0	0	
Bill for Working Days		NIS/day	L=J-K	Total	455.2																								
<u>Time Zone for Friday&Feast Evening</u>			M			A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	A	A	A	A	
Tariff for consumption		NIS/kWh	N			0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.478	0.383	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	O=N-0.12			0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.358	0.263	0.263	0.263	0.263	
Cost for consumption		NIS	P=E*N	Sub Total	407.3	22.9	22.9	22.9	22.9	22.9	22.9	27.1	22.4	16.2	10	3.8	0	0	0	3.8	6.9	13.1	19.3	27.1	28.6	22.9	22.9	22.9	
Cost for surplus		NIS	Q=F*O	Sub Total	4.3	0	0	0	0	0	0	0	0	0	0	0	0.7	1.8	1.8	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	R=P-Q	Total	403.0																								
<u>Time Zone for Saturday&Feast Days</u>			S			A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	A	A	A	
Tariff for consumption		NIS/kWh	T			0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.478	0.478	0.478	0.478	0.383	0.383	0.383	
Tariff for surplus		NIS/kWh	U=T-0.12			0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.263	0.358	0.358	0.358	0.358	0.263	0.263	0.263	
Cost for consumption		NIS	V=E*T	Sub Total	392.3	22.9	22.9	22.9	22.9	22.9	22.9	21.7	17.9	13	8	3	0	0	0	3	5.5	10.5	19.3	27.1	28.6	28.6	22.9	22.9	22.9
Cost for surplus		NIS	W=F*U	Sub Total	3.1	0	0	0	0	0	0	0	0	0	0	0	0.5	1.3	1.3	0	0	0	0	0	0	0	0	0	
Bill for Friday&Feast Evening		NIS/day	X=V-W	Total	389.2																								

Appendix 4

Annual Depreciation of Sewerage Assets (Unit: NIS)

Items	Grant Aid			Jericho Municipality		Useful life	Annual Depreciation															
	Taken over in 2014 (JICA)	Taken over in 2015 (USAID)	Taken over in 2018 (JICA+ USAID)	Taken over in 2014	Taken over in 2016		Grant Aid			Jericho Municipality		Total	Grant Aid: Total Annual					JM: Total Annual				
							From 2015	From 2016	From 2019	From 2015	From 2017		From 2015	From 2016	From 2017	From 2018	From 2019	From 2015	From 2016	From 2017	From 2018	From 2019
A	B	C	D	E	F	G=A/F	H=B/F	I=C/F	J=D/F	K=E/F	L=Sum(G:K)	M=G	N=M+H	O=N	P=O	Q=P+I	R=J	S=R	T=S+K	U=T	V=U	
Civil and Architectural Structures	43,694,535	17,132,469	38,470,000	0	1,436,000	50	873,889	342,649	769,400	0	28,720	2,014,658	873,889	1,216,538	1,216,538	1,216,538	1,985,938	0	0	28,720	28,720	28,720
- WWTP	20,450,388	0	0	0	1,436,000		409,007	0	0	0	28,720	437,727	409,007	409,007	409,007	409,007	409,007	0	0	28,720	28,720	28,720
- Trunk Sewer (25.4km)	23,244,147	0	0	0	0		464,882	0	0	0	0	464,882	464,882	464,882	464,882	464,882	464,882	0	0	0	0	0
- Branch Sewer (12.5km)	0	17,132,469	0	0	0		0	342,649	0	0	0	342,649	0	342,649	342,649	342,649	342,649	0	0	0	0	0
- Trunk+Branch Sewer (Remaining)	0	0	38,470,000	0	0		0	0	769,400	0	0	769,400	0	0	0	0	769,400	0	0	0	0	0
Machineries and equipment	37,482,722	0	0	384,000	0	15	2,498,848	0	0	25,600	0	2,524,448	2,498,848	2,498,848	2,498,848	2,498,848	2,498,848	25,600	25,600	25,600	25,600	25,600
Others	227,425	0	0	0	0	5	45,485	0	0	0	0	45,485	45,485	45,485	45,485	45,485	45,485	0	0	0	0	0
Sum	81,404,682	17,132,469	38,470,000	384,000	1,436,000	-	3,418,222	342,649	769,400	25,600	28,720	4,584,591	3,418,222	3,760,871	3,760,871	3,760,871	4,530,271	25,600	25,600	54,320	54,320	54,320

Appendix 5

Questionnaire

On

Reuse of Treated Wastewater and Sewage Sludge

1. Basic Information (Attendee Information)

Attendee	Organization	Name	Gender
			☐ M ☐ F
	Position		
E-mail address			
Mobile Number			

2. Perception of Treated Wastewater Reuse

2-1	As an experimental farm, reuse of wastewater for agriculture is already started in Jericho wastewater treatment plant. From a viewpoint of effective utilization of water resources, do you think that reuse of wastewater is something useful?	(1) Yes, I think re-use of wastewater is useful... go to Q₂₋₂. (2) No, I don't think... go to Q₂₋₃. (3) No idea... go to Q₂₋₄
2-2	In case you choose (1) on Q ₂₋₁ : What kind of reuse is acceptable in Jericho city.	☐ Agricultural irrigation such as palm dates ☐ Landscape irrigation such as watering of parks, roadside planting and greenbelts

		☐ Reclaimed water for amenity such as fountains, waterways and pounds ☐ Other ()
2-3	In case you choose (2) on Q ₂₋₁	☐ Because I don't know whether treated wastewater quality meets the standard for agriculture use ☐ Because it may not be safety for human health ☐ Because I feel it is dirty and/or lack of hygienic care ☐ Because I feel I dislike it ☐ Because it is against my religious belief ☐ Other ()
2-4	If treated wastewater quality is disclosed periodically and the tested water quality meets the reuse standard, Do you think that treated wastewater is usable?	☐ Yes, I want to use it ☐ No, I don't want to use it ☐ Other ()
2-5	When the Jericho Municipality sells treated wastewater, Do you want to buy/use it?	☐ Yes, I want to buy/use it ☐ No, I don't want to buy/use it ☐ No idea, it depends on price (tariff)
2-6	How much do you want for treated wastewater?	NIS/m ³

3. Perception of Treated Sewage Sludge Reuse

3-1	Do you think that dry sludge generated from wastewater treatment plant (WWTP) can be used for fertilizer of agricultural products and /or plant?	☐ Yes ☐ No
3-2	Do you agree with reuse of dry sludge from wastewater treatment plant (WWTP)?	☐ Yes ☐ No
3-3	In case you choose "No" on Q ₃₋₂ : Why do you feel rejection for reuse of dry sludge for agriculture?	☐ Because I don't know whether contents of dry sludge such as heavy metals meet the standard for agriculture use ☐ Because I feel it is dirty and/or lack of hygienic care ☐ Because I feel I dislike it ☐ Because I feel it smells bad ☐ Because it may not be safety for human health ☐ Because it is against my religious belief ☐ Other ()
3-4	If dry sludge meets the reuse standard for agriculture purpose, Do you use the dry sludge as fertilizer?	☐ Yes, I want to use it ☐ No, I don't want to use it ☐ Reasons ()
3-5	When Jericho Municipality sells dry	☐ Yes, I want to buy/use it

	sludge, do you want to buy/use it?	☐ No, I don't want to buy/use it ☐ Other ()
3-6	How much do you want for dry sewage sludge?	NIS/Kg