

ANNEX 10

GIS DATABASE



ANNEX 10 GIS DATABASE

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Annex 10.1

*GIS Database Manual for Water Resources
in Jordan River Rift Valley*

GIS Database Manual for Water Resources in Jordan River Rift Valley

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GIS Database Manual for Water Resources in Jordan River Rift Valley

1 Introduction

1.1 Background

Geographic Information System (GIS) is utilized for organizations in PNA to monitor the progress of the land development. However, GIS data is not consolidated among its holders since these data were individually developed by different organizations under the support of donor agencies. Therefore, the data and knowledge sharing on GIS is limited, considering that said data may have been formatted differently by each organization and may consist of various topology errors.

In addition, the latest basic GIS data in Palestine was prepared based on 1997 satellite images. However, since land development has already progressed since it was prepared, actual situation especially on land use/land cover is not reflected on the GIS data. Moreover, data for planning of water resources management and development is not available.

Under the above situation, “The Feasibility Study on Water Resources Development and Management in the Jordan River Rift Valley” was conducted in March 2007, and integrated GIS database for water resources development and management was developed.

1.2 Objective

Objectives of this manual are to clarify:

- (i) Steps for the development of the GIS database;
- (ii) Structure of the GIS database; and
- (iii) Contents of the GIS database.

1.3 Work Schedule

Work schedule of the development is illustrated in the following figure:

Work Item	Year 2007												Year 2008								
	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9			
1 Data Collection	████████████████████																				
2 Clarification of Issues on GIS Data in Palestine	██																				
3 Modification of GIS Data								████									████				
4 Assistance of Land Use Survey								████████████████████													
5 Integration into GIS Database																		██			

Source: JICA Study Team

Figure 1.1 Work Schedule of Development of Integrated GIS Database

2 Steps for GIS Database Development

2.1 Data Collection

As the first step of the database development, GIS data sets were collected from MoA,

MoP and PWA to clarify the issues on GIS data in Palestine.

In parallel with this, raster data of satellite images and aerial photographs were procured by the JICA Study Team. Their specifications were as follows:

Table 2.1 Specifications of Raster Data Procured by the JICA Study Team

	Satellite Images	Aerial Photographs
Coverage Area	Whole Jordan River Rift Valley	- Along Wadi Far'a - Along Auja spring irrigation area - Jericho municipality and Dyuk and Nwai'mah spring irrigation areas
Year of Image	2005	2006
Source	Spot Image	Good Shepherd Engineering & Computing
Color	Black and White	Color
Resolution	2.5 m/pixel	0.5 m/pixel

Source: JICA Study Team

2.2 Clarification of Issues on GIS Data in Palestine

The collected GIS data was reviewed by the JICA Study Team considering aspects of uniformity, topology and ease of manageability. Findings are as follows:

(1) Coordinate System

Coordinate system is the basis of utilization of geographic information since the set of GIS data is linked with location information based on a unique coordinate system. If the coordinate system applied to GIS data is misunderstood and not properly utilized by beginners, data displayed on the screen will represent wrong locations on earth. To avoid such mistakes, MoP recommends using the 1923 Palestinian Grid as the national standard.

However, the coordinated system of the collected GIS data from MoA and PWA were undefined and are different from each other. The reason is insufficient communication among Palestinian organizations regarding the definition of coordinate system.

(2) Data Uniformity

Some of the GIS data were not unified among organizations as listed below.

Table 2.2 List of Differences Observed in the Collected GIS Data

Type of Difference	Compared GIS Data	
	MoA	PWA
Number of features is different.	Features of springs in water_data	springs
	Features of wells in water_data	wells
	Wadies	wadis
Boundary of features is not overlapped completely.	Catchment	Catchments
	District	district
	Geology	geology

Source: JICA Study Team

Such difference results from insufficient communication and unclear delineation of responsibility on data updating among the organizations.

(3) Logical Error

Contour lines and stream line of wadis must be orthogonal. Stream line however must run through points with lower elevations. However, a part of polylines of wadis were sometimes not in accordance with such usual norms. It is assumed that the reasons originated from i) misrecognition of satellite images or aerial photographs (misunderstanding of roads and wadis), ii) inappropriate geometric collection of satellite images, aerial photographs and scanned maps, iii) misunderstanding or insufficient understanding of relation between contour lines and wadis, iv) mistakes in digitizing contour lines or wadis, and etc.

(4) Field Name

Field name in the attribute tables of GIS data should be given appropriately to avoid misinterpretation by data users. Moreover, the number of fields should also be minimized to avoid misunderstanding by users unfamiliar with the data, as well as to alleviate work volume on the data management. Since some of the collected GIS data have inappropriate field names and unused fields, it is recommended that these should be consolidated under a data management guideline.

2.3 Modification of GIS Data

Based on the above findings, the collected GIS data were modified especially on the following points:

- (i) Deleting unnecessary or tentative field name of attributes;
- (ii) Correction of topology error;
- (iii) Integration of coordinate system into 1923 Palestinian Grid; and
- (iv) Integration of GIS data sets collected from different organizations.

2.4 Assistance of Land Use Survey

Latest base map in Palestine was prepared in 1997. MoP had planned to update base map by using SPOT satellite images acquired in 2003. Digitizing work based on the images was completed by 2007. However, field investigation (ground truth) required to finalize the land use GIS data still remains, which was one of the key layers of the base map. This was due to difficulty of obtaining passes at check points.

Under this situation, MoP commenced base map updating activities in December 2007, in cooperation with MoA and with the support of the JICA Study Team. Main work item was defining ground truth on land use in West Bank. All field works and updating works of digitized GIS data of land use were completed in August 2008.

The GIS data was collected and reviewed by JICA Study Team.

2.5 Integration into GIS Database

All GIS data collected by JICA Study Team were integrated into a GIS database named as GIS Database Manual for Water Resources in Jordan River Rift Valley. The contents and structure of the database were described in the following section.

3 Contents of GIS Database

3.1 GIS Database Structure

The figure below shows the structure of GIS database developed through a series of the Study. The database structure is illustrated in Figure 3.1.

The database is consisted from three main folders as follows:

(1) General:

This folder contains the basic information for map making, such as: i) administrative information; ii) topography; iii) soil and geological information; iv) road network; v) land use; vi) study area; and vii) satellite images.

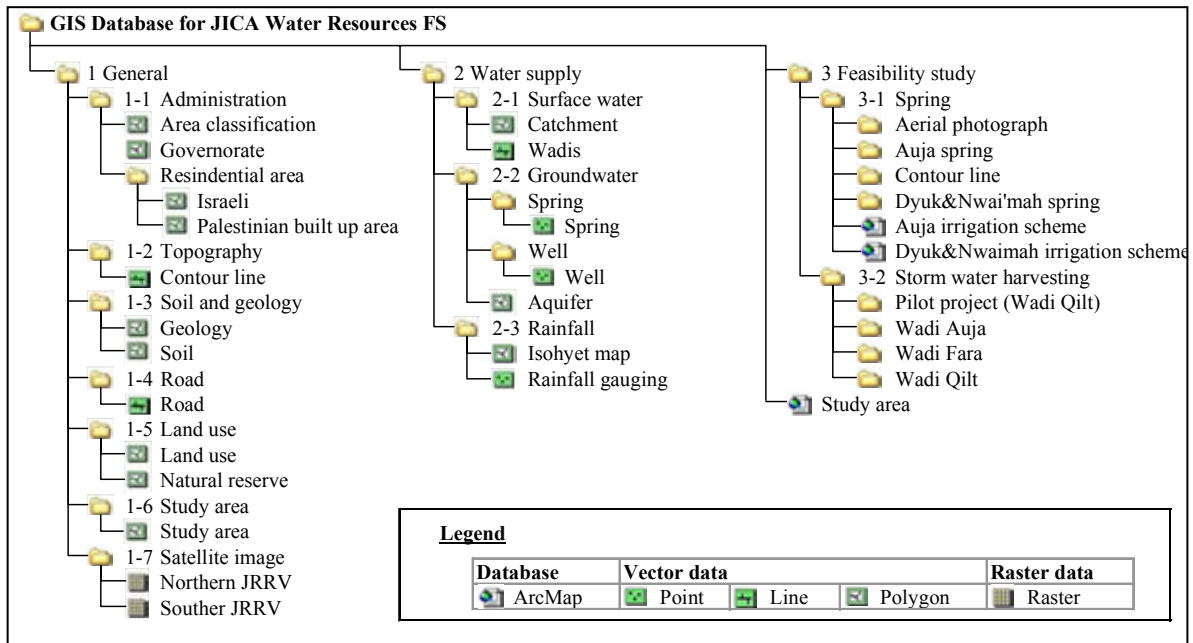
(2) Water Supply:

All data in this folder are directly related to water issues in Palestine. This folder are categorized into three sub-folders: i) surface water (wadis and their catchments); ii) groundwater (springs and wells); and iii) rainfall (gauging stations and isohyet map).

(3) Feasibility Study:

All data in this folder are collected or created by the Study, and two topics are included: i) springs (Auja, Dyuk and Nwai'mah); and ii) Storm water harvesting (Fara, Auja, Qilt including expected pilot project sites).

Detail of each data is described in the following sections.







Source: JICA Study Team


Figure 3.1 GIS Database Structure

3.2 General Information


3.2.1 Administration


File name: Area classification.shp		
	Description	Distribution of Area A, B and nature reserve areas in West Bank
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 1 General 1-1 Administration
	Data Source	Provided by Ministry of Planning
	Attribute	Class1: Category of Area A, B and nature reserve areas AREA_ha: Area in ha
File name: Governotate.shp		
	Description	Administrative boundaries of governorate in Palestine
	Coverage	Palestine
	Storage	GIS Database for JICA Water Resources FS 1 General 1-1 Administration
	Data Source	Provided by Ministry of Planning
	Attribute	GOVERNORAT: Name of governorate AREA_KM2: Area in km ²
File name: Israeli.shp		
	Description	Residential area of Israeli in West Bank
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 1 General 1-1 Administration Residential area
	Data Source	Provided by Ministry of Planning
	Attribute	COL_NAMES: Name of Israeli residential area AREA: Area in m ²
File name: Palestinian built up area.shp		
	Description	Residential area of Palestinian in Palestine
	Coverage	Palestine
	Storage	GIS Database for JICA Water Resources FS 1 General 1-1 Administration Residential area
	Data Source	Provided by Ministry of Planning
	Attribute	NAME: Name of Palestinian residential area AREA: Area in m ²

3.2.2 Topography


File name: Contour line.shp		
	Description	Contour line in West Bank with 25 m interval
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 1 General 1-2 Topography
	Data Source	Provided by Ministry of Agriculture
	Attribute	ELEV: Elevation of each line

3.2.3 Soil and Geology



File name: Geology.shp		
	Description	Geological map in West Bank
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 1 General 1-3 Soil and geology
	Data Source	Provided by Ministry of Agriculture
	Attribute	AGES: Name of formation AREA_ha: Area in ha

File name: Soil.shp		
	Description	Soil map in West Bank
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 1 General 1-3 Soil and geology
	Data Source	Provided by Ministry of Agriculture
	Attribute	LAYER: Abbreviation of soil layer MAINCLASS: Abbreviation of main class of soil layer DIS: Soil name REGIONS: Category of soil AREA_ha: Area in ha


3.2.4 Road

File name: Road.shp		
	Description	Road network in Palestine
	Coverage	Palestine
	Storage	GIS Database for JICA Water Resources FS 1 General 1-4 Road
	Data Source	Provided by Ministry of Planning
	Attribute	TYPE: Road type (Main, Regional, Local) LENGTH_m: Road length in meter


3.2.5 Land Use

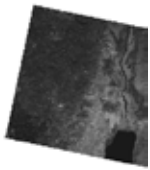
File name: Landuse.shp		
	Description	Latest land use map in West Bank (Final check of MoP has not been completed yet.)
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 1 General 1-5 Land use
	Data Source	Provided by Ministry of Planning
	Attribute	CODE_CLASS: Code number of land use CLASS_NAME: Name of land use AREA: Area in m ²
File name: Nature reserve.shp		
	Description	Nature reserve area in West Bank
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 1 General 1-5 Land use
	Data Source	Provided by Ministry of Agriculture
	Attribute	AREA_km2: Area in km ²

3.2.6 Study Area

File name: Study area.shp		
	Description	Study area of JICA Feasibility Study on Water Resources Development and Management in Jordan River Rift Valley
	Coverage	Jordan River Rift Valley
	Storage	GIS Database for JICA Water Resources FS 1 General 1-6 Study area
	Data Source	JICA Study Team
	Attribute	MEMO: Description of feature (Study Area for JICA Feasibility Study)


3.2.7 Satellite Image


File name: Northern JRRV.tif		
	Description	Northern area of Jordan River Rift Valley
	Coverage	Northern area of Jordan River Rift Valley
	Storage	GIS Database for JICA Water Resources FS 1 General 1-7 Satellite image
	Data Source	JICA Study Team procured (SPOT IMAGE)
	Attribute	

File name: Southern JRRV.tif		
	Description	Southern area of Jordan River Rift Valley
	Coverage	Southern area of Jordan River Rift Valley
	Storage	GIS Database for JICA Water Resources FS 1 General 1-7 Satellite image
	Data Source	JICA Study Team procured (SPOT IMAGE)
	Attribute	




3.3 Water Supply

3.3.1 Surface Water



File name: Catchment.shp		
	Description	Catchment area of wadis in Jordan River Rift Valley
	Coverage	Jordan River Rift Valley
	Storage	GIS Database for JICA Water Resources FS 2 Water supply 2-1 Surface water
	Data Source	Palestinian Water Authority
	Attribute	WATERSHED: Name of catchment AREA_km2: Area in km ²

File name: Wadis.shp		
	Description	Wadis in West Bank
	Coverage	West Bank
	Storage	GIS Database for JICA Water Resources FS 2 Water supply 2-1 Surface water
	Data Source	Ministry of Agriculture
	Attribute	MINOR: Name of wadis MAJOR: Region name of wadis

3.3.2 Groundwater



File name: Spring.shp			
	Description	Springs in and around the Study area	
	Coverage	Jordan River Rift Valley	
	Storage	GIS Database for JICA Water Resources FS 2 Water supply 2-2 Groundwater Spring	
	Data Source	Palestinian Water Authority	
	Attribute	PMD_CODE: Code number of spring WWU_DESCRI: Use of spring PN_NAME_E: Name of spring LOC_NAME_E: Name of locality GR_GOVERNA: Governorate name GWB_NAME_E: Name of basin	
File name: Well.shp			
	Description	Wells in and around the Study area	
	Coverage	Jordan River Rift Valley	
	Storage	GIS Database for JICA Water Resources FS 2 Water supply 2-2 Groundwater Well	
	Data Source	Palestinian Water Authority	
	Attribute	Refer to the following table	
Field name	Description	Field name	Description
PMD_CODE	Code number of well	PN_NAME_E	Name of well
GR_GOVERNA	Governorate name	LOC_NAME_E	Locality name
PMD_X	Easting in Palestinian Grid	PMD_Y	Northing in Palestinian Grid
Elevation	Elevation of well	Start_Year	Year of start operation of well
Depth	Well depth in meter	Use	Use of well
License	Annual licensed extraction volume of well in m ³	abs2003 - abs2006	extraction volume in each year
		wls2003 - wls2006	Water level in each year
* Blank column in each field means data not available.			
File name: Aquifer.shp			
	Description	Aquifer (or basin) in West Bank	
	Coverage	West Bank	
	Storage	GIS Database for JICA Water Resources FS 2 Water supply 2-2 Groundwater	
	Data Source	Palestinian Water Authority	
	Attribute	NAME: Name of aquifer AREA_km2: Area in km ²	


3.3.3 Rainfall


File name: Isohyet map.shp			
	Description	Isohyet map in West Bank	
	Coverage	West Bank	
	Storage	GIS Database for JICA Water Resources FS 2 Water supply 2-3 Rainfall	
	Data Source	Palestinian Water Authority	
	Attribute	Ave_Rain: Average rainfall in each category AREA_km2: Area in km ²	
File name: Rainfall gauging.shp			
	Description	Rainfall gauging station in West Bank	
	Coverage	West Bank	
	Storage	GIS Database for JICA Water Resources FS 2 Water supply 2-3 Rainfall	
	Data Source	Palestinian Water Authority	
	Attribute	Refer to the following table	
Field name	Description	Field name	Description
CODE	Code number of gauging station	X	Easting in Palestinian Grid
Y	Northing in Palestinian Grid	Z	Elevation of gauging station
LOCALITY	Locality name	START_DATE	Year of start observation
RMR_YEAR	Latest year of data available	STATUS	Current status(Working)
TYPE	Type of measurement	OWNERSHIP	Ownership of gauging station
NAME	Name of gauging station		


3.4 Feasibility Study


3.4.1 Spring

File name: Auja.tif		
	Description	Aerial photograph of Auja irrigation scheme
	Coverage	Auja irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Aerial photograph
	Data Source	Good Shepherd Engineering & Computing
File name: Dyuk_Nwaimah.tif		
	Description	Aerial photograph of Dyuk and Nwai'mah irrigation schemes
	Coverage	Dyuk and Nwai'mah irrigation schemes
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Aerial photograph
	Data Source	Good Shepherd Engineering & Computing


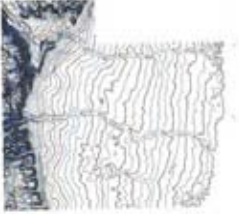



File name: Auja canal.shp		
	Description	Existing canal alignment of Auja spring
	Coverage	Auja irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Auja spring
	Data Source	JICA Study Team
	Attribute	Length: Length in meter Condition: Present condition of canal (Earth or Concrete)

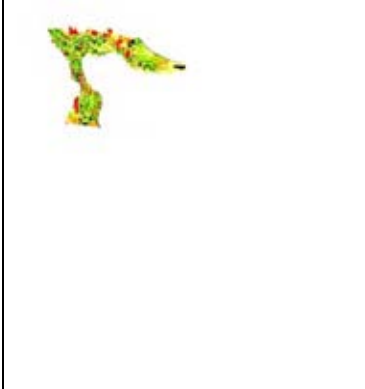



File name: Auja irrigation scheme.shp		
	Description	Boundary of Auja irrigation area
	Coverage	Auja irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Auja spring
	Data Source	JICA Study Team
	Attribute	Name: Auja irrigation scheme Area: Area in m ²


File name: Auja land use.shp		
	Description	Land use of Auja irrigation scheme based on the aerial photograph acquired in 2006
	Coverage	Auja irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Auja spring
	Data Source	JICA Study Team
	Attribute	Land_use: Land use Area: Area in m ²

File name: Auja land use.shp		
	Description	Point information of Auja irrigation scheme (Road crossing, pond, gate etc.)
	Coverage	Auja irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Auja spring
	Data Source	JICA Study Team
	Attribute	Refer to the following table

Field name	Description	Field name	Description
UTM_X	Easting in Palestinian Grid	UTM_Y	Northing in Palestinian Grid
Location	Brief description of point	Informatio	Category (Road crossing, Pond, Gate, Others)
Road_Cross	Existence of road crossing	Road_Type	Paved or non-paved
Width	Width of road crossing	Pond	Existence of pond
Pond_Type	Pond type	Pond_Area	Area of pond in m ²
Capacity	Estimated capacity of pond	Size	Size of pond
Gate	Existence of gate	Gate_Condt	Condition of gate


File name: Auja contour.shp		
	Description	Contour line of Auja irrigation scheme estimated by using aerial photographs
	Coverage	Auja irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Contour line
	Data Source	Good Shepherd Engineering & Computing
	Attribute	Elevation: Elevation of contour line in meter
File name: Dyuk and Nwaimah contour.shp		
	Description	Contour line of Dyuk and Nwai'mah irrigation schemes estimated by using aerial photographs
	Coverage	Dyuk and Nwai'mah irrigation schemes
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Contour line
	Data Source	Good Shepherd Engineering & Computing
	Attribute	Elevation: Elevation of contour line in meter
File name: Dyuk canal.shp		
	Description	Existing canal alignment of Dyuk spring
	Coverage	Dyuk irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Dyuk&Nwai'mah spring
	Data Source	JICA Study Team
	Attribute	Length: Length in meter Condition: Present condition of canal (Earth or Concrete)
File name: Nwaimah canal.shp		
	Description	Existing canal alignment of Nwai'mah spring
	Coverage	Nwai'mah irrigation scheme
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Dyuk&Nwai'mah spring
	Data Source	JICA Study Team
	Attribute	Length: Length in meter Condition: Present condition of canal (Earth or Concrete)
File name: Dyuk and Nwaimah irrigation scheme.shp		
	Description	Boundary of Dyuk and Nwaimah irrigation areas
	Coverage	Dyuk and Nwaimah irrigation schemes
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Dyuk&Nwai'mah spring
	Data Source	JICA Study Team
	Attribute	Scheme: Name of irrigation scheme Area: Area in m ²


File name: Dyuk and Nwaimah land use.shp			
	Description	Land use of Dyuk and Nwai'mah irrigation schemes based on the aerial photograph acquired in 2006	
	Coverage	Dyuk and Nwai'mah irrigation schemes	
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Dyuk&Nwai'mah spring	
	Data Source	JICA Study Team	
	Attribute	Land_use: Land use Area: Area in m ² Scheme: Name of irrigation scheme	
File name: Dyuk point.shp			
	Description	Point information of Dyuk irrigation scheme (Road crossing, pond, gate etc.)	
	Coverage	Dyuk irrigation scheme	
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Dyuk&Nwai'mah spring	
	Data Source	JICA Study Team	
	Attribute	Refer to the following table	
File name: Nwaimah point.shp			
	Description	Point information of Nwai'mah irrigation scheme (Road crossing, pond, gate etc.)	
	Coverage	Nwai'mah irrigation scheme	
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring Dyuk&Nwai'mah spring	
	Data Source	JICA Study Team	
	Attribute	Refer to the following table	
Field name	Description	Field name	Description
UTM_X	Easting in Palestinian Grid	UTM_Y	Northing in Palestinian Grid
Location	Brief description of point	Informatio	Category (Road crossing, Pond, Gate, Others)
Road_Cross	Existence of road crossing	Road_Type	Paved or non-paved
Width	Width of road crossing	Pond	Existence of pond
Pond_Type	Pond type	Pond_Area	Area of pond in m ²
Capacity	Estimated capacity of pond	Size	Size of pond
Gate	Existence of gate	Gate_Condt	Condition of gate
File name: Auja irrigation scheme.mxd			
	Description	ArcMap file for overview of Auja irrigation scheme	
	Coverage	Auja irrigation scheme	
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring	
	Data Source	JICA Study Team	


File name: Dyuk&Nwaimah irrigation scheme.mxd		
	Description	ArcMap file for overview of Dyuk and Nwai'mah irrigation schemes
	Coverage	Dyuk and Nwai'mah irrigation schemes
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-1 Spring
	Data Source	JICA Study Team


3.4.2 Storm Water Harvesting


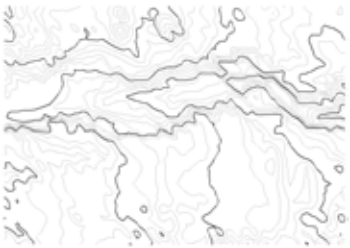



As the first step of the database development, GIS data sets were collected from MoA, MoP and PWA to clarify the issues on GIS data in Palestine.


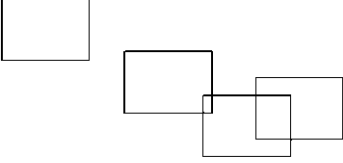
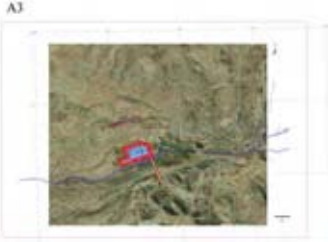
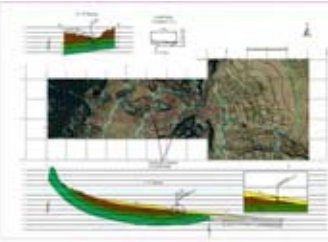
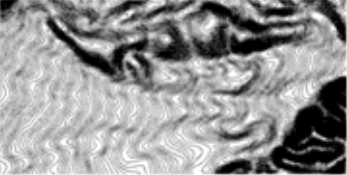
File name: Qilt PP1.dwg		
	Description	CAD drawing in potential site No.1 for pilot project on storm water harvesting
	Coverage	Pilot project potential site No.1 along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	JICA Study Team


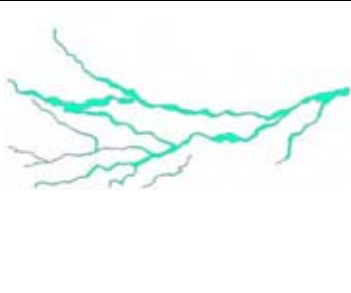
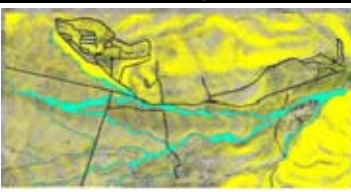


File name: Qilt PP1-PP4.dwg		
	Description	CAD drawing in whole potential sites for pilot project on storm water harvesting
	Coverage	Whole pilot project potential sites (No.1-No.4) along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	JICA Study Team


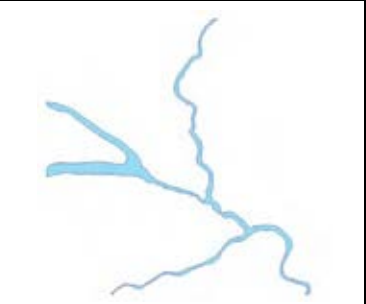

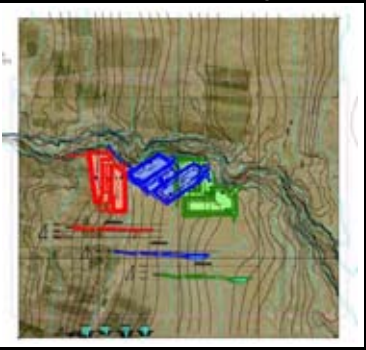
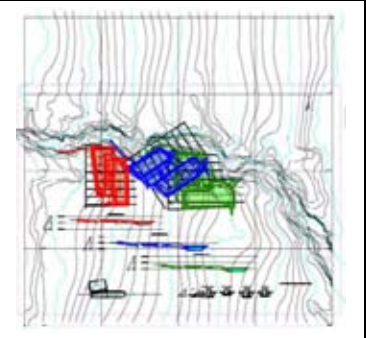
File name: Qilt PP2.dwg		
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	Coverage	Pilot project potential sites No.2 along Wadi Qilt.
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	Data Source	JICA Study Team

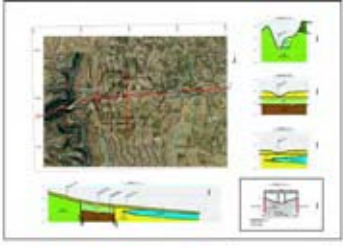
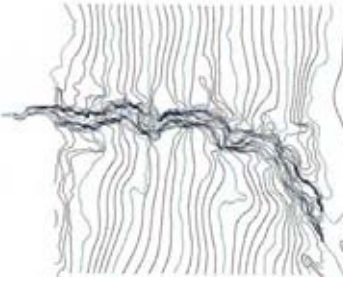
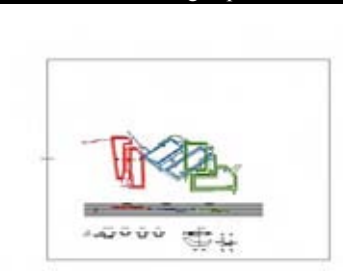


File name: Qilt PP3.dwg		
	Description	CAD drawing in potential site No.3 for pilot project on storm water harvesting
	Coverage	Pilot project potential sites No.3 along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	JICA Study Team

File name: Qilt PP4.dwg		
	Description	CAD drawing in potential site No.4 for pilot project on storm water harvesting
	Coverage	Pilot project potential sites No.4 along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	JICA Study Team
File name: Contour_PP1.shp		
	Description	Contour lines in potential site No.1 for pilot project on storm water harvesting
	Coverage	Pilot project potential sites No.1 along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	Good Shepherd Engineering & Computing
	Attribute	Contour: Elevation of contour line in meter
File name: Contour_PP2.shp		
	Description	Contour lines in potential site No.2 for pilot project on storm water harvesting
	Coverage	Pilot project potential sites No.2 along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	Good Shepherd Engineering & Computing
	Attribute	Contour: Elevation of contour line in meter
File name: Contour_PP3.shp		
	Description	Contour lines in potential site No.3 for pilot project on storm water harvesting
	Coverage	Pilot project potential sites No.3 along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	Good Shepherd Engineering & Computing
	Attribute	Contour: Elevation of contour line in meter
File name: Contour_PP4.shp		
	Description	Contour lines in potential site No.4 for pilot project on storm water harvesting
	Coverage	Pilot project potential sites No.4 along Wadi Qilt.
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	Good Shepherd Engineering & Computing
	Attribute	Contour: Elevation of contour line in meter


File name: Pilot Project for Storm Water Harvesting.mxd		
	Description	ArcMap file for overview of potentials sites for pilot project on storm water harvesting
	Coverage	Whole pilot project potential sites along Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	JICA Study Team
File name: Potential_Area.shp		
	Description	Boundary of potential sites for pilot project on storm water harvesting
	Coverage	Whole pilot project potential sites along Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Pilot project (Wadi Qilt)
	Data Source	JICA Study Team
	Attribute	Name: No. of potential site for pilot project on storm water harvesting
File name: Auja.dwg		
	Description	CAD drawing in potential site for storm water harvesting along Wadi Auja
	Coverage	Potential site for storm water harvesting along Wadi Auja
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Auja
	Data Source	JICA Study Team
File name: Auja Broad.dwg		
	Description	CAD drawing in potential site for storm water harvesting along Wadi Auja (Broad area)
	Coverage	Around potential site for storm water harvesting along Wadi Auja
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Auja
	Data Source	JICA Study Team
File name: Auja_contour.shp		
	Description	Contour lines in potential site for storm water harvesting along Wadi Auja
	Coverage	Potential site for storm water harvesting along Wadi Auja
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Auja
	Data Source	Good Shepherd Engineering & Computing
	Attribute	CONTOUR: Elevation of contour line in meter

File name: Auja_road.shp		
	Description	Road network lines in potential site for storm water harvesting along Wadi Auja
	Coverage	Potential site for storm water harvesting along Wadi Auja
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Auja
	Data Source	JICA Study Team
	Attribute	Text: Category (Major roads or others)
File name: Wadi_Auja.shp		
	Description	Flood area of Wadi Auja in potential site for storm water harvesting along Wadi Auja
	Coverage	Potential site for storm water harvesting along Wadi Auja
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Auja
	Data Source	JICA Study Team
	Attribute	Text: Category (Major roads or others)
File name: Wadi Auja.mxd		
	Description	ArcMap file for overview of potential site for storm water harvesting along Wadi Auja
	Coverage	Potential site for storm water harvesting along Wadi Auja
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Auja
	Data Source	JICA Study Team
File name: Fara.dwg		
	Description	CAD drawing in potential site for storm water harvesting along Wadi Fara
	Coverage	Potential site for storm water harvesting along Wadi Fara
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Fara
	Data Source	JICA Study Team
File name: Contour.shp		
	Description	Contour lines in potential site for storm water harvesting along Wadi Fara
	Coverage	Potential site for storm water harvesting along Wadi Fara
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Fara
	Data Source	Good Shepherd Engineering & Computing
	Attribute	CONTOUR: Elevation of contour line in meter


File name: Auja_road.shp		
	Description	Road network lines in potential site for storm water harvesting along Wadi Fara
	Coverage	Potential site for storm water harvesting along Wadi Fara
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Fara
	Data Source	JICA Study Team
	Attribute	Text: Category (Major roads or others)
File name: Wadi_Auja.shp		
	Description	Flood area of Wadi Fara in potential site for storm water harvesting along Wadi Fara
	Coverage	Potential site for storm water harvesting along Wadi Fara
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Fara
	Data Source	JICA Study Team
	Attribute	Text: Category (Major roads or others)
File name: Wadi Fara.mxd		
	Description	ArcMap file for overview of potential site for storm water harvesting along Wadi Fara
	Coverage	Potential site for storm water harvesting along Wadi Fara
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Fara
	Data Source	JICA Study Team
File name: Lower Qilt.dwg		
	Description	CAD drawing in potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team
File name: Lower Qilt for Calc BQ.dwg		
	Description	CAD drawing for calculation of BQ in potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team

File name: Upper Qilt.dwg		
	Description	CAD drawing in potential site for storm water harvesting along upper Wadi Qilt
	Coverage	Potential site for storm water harvesting along upper Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team
File name: Contour.shp		
	Description	Contour lines in potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	Good Shepherd Engineering & Computing
	Attribute	CONTOUR: Elevation of contour line in meter
File name: Drawing.shp		
	Description	GIS line data converted from CAD drawing in potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team
File name: Drawing_polygon.shp		
	Description	GIS polygon data converted from CAD drawing in potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team
File name: Qilt_road.shp		
	Description	Road network lines in potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team
	Attribute	Text: Category (Major roads or others)

File name: Wadi_Qilt.shp


	Description	Flood area of Wadi Qilt in potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team
	Attribute	Text: Category (Major roads or others)

File name: Wadi Qilt.mxd

	Description	ArcMap file for overview of potential site for storm water harvesting along lower Wadi Qilt
	Coverage	Potential site for storm water harvesting along lower Wadi Qilt
	Storage	GIS Database for JICA Water Resources FS 3 Feasibility study 3-2 Storm water harvesting Wadi Qilt
	Data Source	JICA Study Team

3.5 Others

File name: Study area.mxd

	Description	ArcMap file for overview of Palestine
	Coverage	Palestine
	Storage	GIS Database for JICA Water Resources FS
	Data Source	JICA Study Team

ANNEX 11

PROJECT EVALUATION



ANNEX 11 PROJECT EVALUATION

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Annex 11.1

Project Evaluation

Annex 1.1 Project Evaluation

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Table A.1 Standard Conversion Factor

(Unit NIS Million)

ITEM	2002	2003	2004	2005	2006	Avg.
1. Import (CIF Price)	203,244	202,024	234,435	258,439	275,363	234,701
2. Export (FOB Price)	186,892	198,058	236,028	258,328	280,339	231,929
3. Import Tax	22,662	21,575	24,996	26,674	27,351	24,652
4. Export Tax	N/A	N/A	N/A	N/A	N/A	N/A
5. Subsidies for Export	253	240	249	243	204	238
(A) =1+2	390,136	400,082	470,463	516,767	555,702	466,630
(B) =1+2+3-4+5	413,051	421,897	495,708	543,684	583,257	491,519
SCF ((A)/(B))	0.94	0.95	0.95	0.95	0.95	0.95

Source: CBS, Statistical Abstract of Israel (2007)

Table A.2 Calculation of ATP (Affordability-to-pay)

Disposable Income	2000 NIS/ HH/ month	<i>*in 2007, Estimate: based upon the socio-economic baseline survey by JICA Study Team and PCBS Population, Housing and Establishment Census - 2007</i>
Disposable Income	24,000 NIS/ HH/ year	
House Hold Size	8.1 persons	<i>*Socio-economic inventory survey</i>
Domestic Water Use	91 lpcd	<i>*in 2007, Estimate: based upon PWA database</i>
Dom. Water Use	33.215 m3/capita/ year	
Dom. Water Use	269.0415 m3/HH/ year	
ATP@4%/HHDI	960 NIS/ HH/ year	
ATP@4%/HHDI	3.6 NIS/ m3	

Reference Data

Expenditure for the Domestic Water: <i>Data from the Socio-economic Survey of "JICA, Jericho Regional Development Study, 2006"</i>		
Actual expenses for water	206 NIS/ HH/ month	<i>*in 2006 price, Mean price in JRRV</i>
	2,472 NIS/ HH/ year	
	9.2 NIS/ m3	

Source: JICA Study Team estimated based upon the Socio-economic Inventory Survey

Table A.3 Domestic Water Demand Forecast per Priority Springs

	2007 (Current Level)					2008					2009				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	4,133	93	384	140,079	0.14	4,250	95	404	147,464	0.15	4,366	97	425	155,048	0.16
Al Nuwei'ma	1,201	91	110	40,079	0.04	1,235	94	116	42,272	0.04	1,269	96	122	44,526	0.04
Al Dyuk*	1,836	91	168	84,951	0.05	1,888	94	161	88,775	0.06	1,940	96	172	92,728	0.06
<i>*For annual water demand, a 30,000m3 for Ein Sultan Camp is added.</i>															
	2010					2011					2012				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	4,484	100	446	162,843	0.16	4,602	102	468	170,845	0.17	4,720	104	491	179,050	0.18
Al Nuwei'ma	1,303	99	128	46,845	0.05	1,337	101	135	49,227	0.05	1,372	103	142	51,672	0.05
Al Dyuk*	1,992	99	196	96,814	0.07	2,044	101	206	101,034	0.07	2,097	103	216	105,385	0.08
	2013					2014					2015				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	4,839	106	514	187,473.51	0.19	4,959	108	537	196,131	0.20	5,080	111	562	205,002	0.21
Al Nuwei'ma	1,406	106	148	54,184.26	0.05	1,441	108	156	56,768	0.06	1,476	110	163	59,417	0.06
Al Dyuk*	2,150	106	227	109,874	0.08	2,203	108	238	114,508	0.08	2,256	110	249	119,280	0.09
	2016					2017					2018				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	5,200	113	586	214,063.30	0.21	5,320	115	612	223,286	0.22	5,438	120	653	238,190	0.24
Al Nuwei'ma	1,511	113	170	62,125.43	0.06	1,546	115	178	64,884	0.06	1,580	120	190	69,215	0.07
Al Dyuk*	2,310	113	260	124,178	0.09	2,363	115	272	129,190	0.10	2,416	120	290	135,811	0.11
	2019					2020					2021				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	5,556	125	695	253,499	0.25	5,673	130	737	269,175	0.27	5,790	135	782	285,286	0.29
Al Nuwei'ma	1,615	125	202	73,664	0.07	1,648	130	214	78,219	0.08	1,682	135	227	82,901	0.08
Al Dyuk*	2,468	125	309	142,612	0.11	2,520	130	328	149,575	0.12	2,572	135	347	156,732	0.13
	2022					2023					2024				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	5,907	140	827	301,828	0.30	6,024	145	873	318,798	0.32	6,140	150	921	336,189	0.34
Al Nuwei'ma	1,716	140	240	87,708	0.09	1,750	145	254	92,639	0.09	1,784	150	268	97,692	0.10
Al Dyuk*	2,624	140	367	164,081	0.13	2,676	145	388	171,619	0.14	2,728	150	409	179,345	0.15
	2025					2026					2027				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	6,257	155	970	353,995	0.35	6,375	160	1,020	372,284	0.37	6,493	165	1,071	391,059	0.39
Al Nuwei'ma	1,818	155	282	102,867	0.10	1,852	160	296	108,181	0.11	1,887	165	311	113,637	0.11
Al Dyuk*	2,780	155	431	187,255	0.16	2,832	160	453	195,380	0.17	2,885	165	476	203,720	0.17
	2028					2029					2030				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	6,613	165	1,091	398,255	0.40	6,733	165	1,111	405,503	0.41	6,854	165	1,131	412,802	0.41
Al Nuwei'ma	1,922	165	317	115,728	0.12	1,957	165	323	117,834	0.12	1,992	165	329	119,955	0.12
Al Dyuk*	2,938	165	485	206,916	0.18	2,991	165	494	210,136	0.18	3,045	165	502	213,379	0.18
	2031					2032					2033				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	6,978	165	1,151	420,232	0.42	7,103	165	1,172	427,797	0.43	7,231	165	1,193	435,497	0.44
Al Nuwei'ma	2,028	165	335	122,114	0.12	2,064	165	341	124,313	0.12	2,101	165	347	126,550	0.13
Al Dyuk*	3,100	165	511	216,680	0.19	3,155	165	521	220,040	0.19	3,212	165	530	223,461	0.19
	2034					2035					2036				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	7,361	165	1,215	443,336	0.44	7,494	165	1,236	451,316	0.45	7,629	165	1,259	459,440	0.46
Al Nuwei'ma	2,139	165	353	128,828	0.13	2,178	165	359	131,147	0.13	2,217	165	366	133,508	0.13
Al Dyuk*	3,270	165	540	226,943	0.20	3,329	165	549	230,488	0.20	3,389	165	559	234,097	0.20
	2037					2038					2039				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	7,766	165	1,281	467,710	0.47	7,906	165	1,304	476,128	0.48	8,048	165	1,328	484,699	0.48
Al Nuwei'ma	2,257	165	372	135,911	0.14	2,297	165	379	138,357	0.14	2,339	165	386	140,848	0.14
Al Dyuk*	3,450	165	569	237,770	0.21	3,512	165	579	241,510	0.21	3,575	165	590	215,317	0.22
	2040					2041					2042				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	8,193	165	1,352	493,423	0.49	8,340	165	1,376	502,305	0.50	8,491	165	1,401	511,346	0.51
Al Nuwei'ma	2,381	165	393	143,383	0.14	2,424	165	400	145,964	0.15	2,467	165	407	148,591	0.15
Al Dyuk*	3,640	165	601	249,193	0.22	3,705	165	611	253,139	0.22	3,772	165	622	227,155	0.23
	2043					2044					2045				
	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr	Pop	Lpcd	m3/day	m3/year	MCM/yr
Al'Auja	8,643	165	1,426	520,551	0.52	8,799	165	1,452	529,920	0.53	8,957	165	1,478	539,459	0.54
Al Nuwei'ma	2,512	165	414	151,266	0.15	2,557	165	422	153,988	0.15	2,603	165	429	156,760	0.16
Al Dyuk*	3,840	165	634	261,244	0.23	3,909	165	645	265,406	0.24	3,979	165	657	239,644	0.24

Note: *Population projection until 2015 is following to the JICA MP Study.

**After 2015, the following population growth pattern has been adopted:

2020 2.10%
 2025 1.90%
 2030 1.80%

after 2030 Constant at 1.80%

***The target rate for domestic water consumption for the project are has been set at 100lpcd by 2017, 150lpcd by 2027, in accordance with water development plan by PWA.
 A technical loss of 10% is added to the target lpcd. (Therefore, 115 lpcd and 165 lpcd for each.) Current lpcd is estimated based upon the 2003 PWA data.

Source: Estimated by JICA Study Team based on PWA's database and JICA Jericho Regional Development Master Plan Study (2006)

Table A.4 Domestic Water Demand Forecast: Al 'Auja Spring

Al' Auja							
Water Demand (m ³)				With	Without	With-Without	
target lpcd	No. of Population	Total Dom. Water	Supplied by Spring	Supplied by Spring	Incremental Water Supply (m ³)	Economic Benefit (USD)	
2009	97	4,366	155,034	0	0	0	0
2010	100	4,484	162,848	0	0	0	0
2011	102	4,602	170,853	0	0	0	0
2012	104	4,720	179,048	0	0	0	0
2013	106	4,839	187,474	0	0	0	0
2014	108	4,959	196,131	0	0	0	0
2015	111	5,080	205,002	0	0	0	0
2016	113	5,200	214,063	0	0	0	0
2017	115	5,320	223,286	0	0	0	0
2018	120	5,438	238,190	0	0	0	0
2019	125	5,556	253,499	0	0	0	0
2020	130	5,673	269,175	0	0	0	0
2021	135	5,790	285,286	0	0	0	0
2022	140	5,907	301,828	0	0	0	0
2023	145	6,024	318,798	0	0	0	0
2024	150	6,140	336,189	0	0	0	0
2025	155	6,257	353,995	0	0	0	0
2026	160	6,375	372,284	0	0	0	0
2027	165	6,493	391,059	0	0	0	0
2028	165	6,613	398,255	0	0	0	0
2029	165	6,733	405,503	0	0	0	0
2030	165	6,854	412,802	0	0	0	0
2031	165	6,978	420,232	0	0	0	0
2032	165	7,103	427,797	0	0	0	0
2033	165	7,231	435,497	0	0	0	0
2034	165	7,361	443,336	0	0	0	0
2035	165	7,494	451,316	0	0	0	0
2036	165	7,629	459,440	0	0	0	0
2037	165	7,766	467,710	0	0	0	0
2038	165	7,906	476,128	0	0	0	0
2039	165	8,048	484,699	0	0	0	0
2040	165	8,193	493,423	0	0	0	0
2041	165	8,340	502,305	0	0	0	0
2042	165	8,491	511,346	0	0	0	0
						0	0

Source: JICA Study Team

Table A.5 Domestic Water Demand Forecast: Al Dyuk Spring

Al Dyuk							
Water Demand (m ³)			With	Without	With-Without		
target lpcd	No. of Population	Total Dom. Water*	Supplied by Spring	Supplied by Spring	Incremental Water Supply (m ³)	Economic Benefit (USD)	
2009	96	1,940	98,068	122,500	122,500	0	0
2010	99	1,992	101,613	122,500	122,500	0	0
2011	101	2,044	105,255	122,500	122,500	0	0
2012	103	2,097	108,993	122,500	122,500	0	0
2013	106	2,150	112,833	122,500	122,500	0	0
2014	108	2,203	116,782	122,500	122,500	0	0
2015	110	2,256	120,833	122,500	122,500	0	0
2016	113	2,310	124,973	124,973	122,500	2,473	2,544
2017	115	2,363	129,190	129,190	122,500	6,690	6,881
2018	120	2,416	135,811	135,811	122,500	13,311	13,691
2019	125	2,468	142,612	142,612	122,500	20,112	20,687
2020	130	2,520	149,575	149,575	122,500	27,075	27,849
2021	135	2,572	156,732	156,732	122,500	34,232	35,210
2022	140	2,624	164,081	164,081	122,500	41,581	42,769
2023	145	2,676	171,619	171,619	122,500	49,119	50,522
2024	150	2,728	179,345	179,345	122,500	56,845	58,469
2025	155	2,780	187,255	187,255	122,500	64,755	66,605
2026	160	2,832	195,380	195,380	122,500	72,880	74,962
2027	165	2,885	203,720	203,720	122,500	81,220	83,541
2028	165	2,938	206,916	206,916	122,500	84,416	86,828
2029	165	2,991	210,136	210,136	122,500	87,636	90,140
2030	165	3,045	213,379	213,379	122,500	90,879	93,476
2031	165	3,100	216,680	216,680	122,500	94,180	96,871
2032	165	3,155	220,040	220,040	122,500	97,540	100,327
2033	165	3,212	223,461	223,461	122,500	100,961	103,846
2034	165	3,270	226,943	226,943	122,500	104,443	107,427
2035	165	3,329	230,488	230,488	122,500	107,988	111,073
2036	165	3,389	234,097	234,097	122,500	111,597	114,785
2037	165	3,450	237,770	237,770	122,500	115,270	118,563
2038	165	3,512	241,510	241,510	122,500	119,010	122,410
2039	165	3,575	245,317	245,317	122,500	122,817	126,326
2040	165	3,640	249,193	249,193	122,500	126,693	130,313
2041	165	3,705	253,139	253,139	122,500	130,639	134,372
2042	165	3,772	257,155	257,155	122,500	134,655	138,502
2043	165	3,840	261,244	261,244	122,500	138,744	142,708
2044	165	3,909	265,406	265,406	122,500	142,906	146,989
2045	165	3,979	269,644	269,644	122,500	147,144	151,348
						<u>2,013,007</u>	<u>2,070,521</u>

*Including Ein Sultan Camp

Source: JICA Study Team

Table A.6 Domestic Demand Forecast: Al Nwai'mah Spring

Al Nwai'mah									
target lpcd	No. of Population	Water Demand (m ³)			With	Without	With-Without		Economic Benefit (USD)
		Total Dom. Water	Total Ind. Water	Total Water Demand	Supplied by Spring	Incremental Water Supply (m ³)	Incremental Water Supply (m ³)		
2009	96	1,269	44,532	62,963	107,495	68,000	68,000	39,495	0
2010	99	1,303	46,846	65,244	112,090	68,000	68,000	44,090	0
2011	101	1,337	49,219	67,525	116,744	68,000	68,000	48,744	0
2012	103	1,372	51,688	69,806	121,494	68,000	68,000	53,494	0
2013	106	1,406	54,178	72,088	126,266	68,000	68,000	58,266	0
2014	108	1,441	56,767	74,369	131,136	68,000	68,000	63,136	0
2015	110	1,476	59,415	76,650	136,065	68,000	68,000	68,065	0
2016	113	1,511	62,125	78,950	141,075	141,075	68,000	73,075	75,162
2017	115	1,546	64,884	81,318	146,202	146,202	68,000	78,202	80,436
2018	120	1,580	69,215	83,758	152,973	152,973	68,000	84,973	87,400
2019	125	1,615	73,664	86,270	159,934	159,934	68,000	91,934	94,561
2020	130	1,648	78,219	88,858	167,077	167,077	68,000	99,077	101,908
2021	135	1,682	82,901	91,524	174,425	174,425	68,000	106,425	109,466
2022	140	1,716	87,708	94,270	181,978	181,978	68,000	113,978	117,234
2023	145	1,750	92,639	97,098	189,737	189,737	68,000	121,737	125,215
2024	150	1,784	97,692	100,011	197,703	197,703	68,000	129,703	133,409
2025	155	1,818	102,867	103,011	205,878	205,878	68,000	137,878	141,818
2026	160	1,852	108,181	104,556	212,737	212,737	68,000	144,737	148,873
2027	165	1,887	113,637	106,125	219,762	219,762	68,000	151,762	156,098
2028	165	1,922	115,728	107,717	223,445	223,445	68,000	155,445	159,886
2029	165	1,957	117,834	109,332	227,166	227,166	68,000	159,166	163,714
2030	165	1,992	119,955	110,972	230,927	230,927	68,000	162,927	167,582
2031	165	2,028	122,114	112,637	234,751	234,751	68,000	166,751	171,515
2032	165	2,064	124,313	114,326	238,639	238,639	68,000	170,639	175,515
2033	165	2,101	126,550	116,041	242,591	242,591	68,000	174,591	179,580
2034	165	2,139	128,828	117,782	246,610	246,610	68,000	178,610	183,713
2035	165	2,178	131,147	119,549	250,696	250,696	68,000	182,696	187,916
2036	165	2,217	133,508	121,342	254,850	254,850	68,000	186,850	192,188
2037	165	2,257	135,911	123,162	259,073	259,073	68,000	191,073	196,532
2038	165	2,297	138,357	125,009	263,366	263,366	68,000	195,366	200,948
2039	165	2,339	140,848	126,885	267,733	267,733	68,000	199,733	205,439
2040	165	2,381	143,383	128,788	272,171	272,171	68,000	204,171	210,004
2041	165	2,424	145,964	130,720	276,684	276,684	68,000	208,684	214,646
2042	165	2,467	148,591	132,681	281,272	281,272	68,000	213,272	219,365
2043	165	2,512	151,266	134,671	285,937	285,937	68,000	217,937	224,163
2044	165	2,557	153,988	136,691	290,679	290,679	68,000	222,679	229,041
2045	165	2,603	156,760	138,741	295,501	295,501	68,000	227,501	234,001
								4,301,001	4,423,887

Source: JICA Study Team

Table A.7 Additional Agricultural Water Supply and Agricultural Land Increase: Priority Springs

	Al 'Auja				Al Dyuk				Al Nwai'mah			
	Incremental W m3/Yr	Add. Dom. Use m3/Yr	Add. Agr. Use m3/Yr	Add. Irrgtd Land DNM/ Yr	Incremental W m3/Yr	Add. Dom. Use m3/Yr	Add. Agr. Use m3/Yr	Add. Irrgtd Land DNM	Incremental W m3/Yr	Add. Dom. Use m3/Yr	Add. Agr. Use m3/Yr	Add. Irrgtd Land DNM
2009	0	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0	0
2013	3,247,000	0	3,247,000	6,023	0	0	0	0	0	0	0	0
2014	3,247,000	0	3,247,000	6,023	0	0	0	0	0	0	0	0
2015	3,247,000	0	3,247,000	6,023	0	0	0	0	0	0	0	0
2016	3,247,000	0	3,247,000	6,023	1,790,000	125,000	1,665,000	1,429	605,000	141,100	463,900	729
2017	3,247,000	0	3,247,000	6,023	1,790,000	129,200	1,660,800	1,425	605,000	146,200	458,800	721
2018	3,247,000	0	3,247,000	6,023	1,790,000	135,800	1,654,200	1,420	605,000	153,000	452,000	710
2019	3,247,000	0	3,247,000	6,023	1,790,000	142,600	1,647,400	1,414	605,000	159,900	445,100	700
2020	3,247,000	0	3,247,000	6,023	1,790,000	149,600	1,640,400	1,408	605,000	167,100	437,900	688
2021	3,247,000	0	3,247,000	6,023	1,790,000	156,700	1,633,300	1,402	605,000	174,400	430,600	677
2022	3,247,000	0	3,247,000	6,023	1,790,000	164,100	1,625,900	1,395	605,000	182,000	423,000	665
2023	3,247,000	0	3,247,000	6,023	1,790,000	171,600	1,618,400	1,389	605,000	189,700	415,300	653
2024	3,247,000	0	3,247,000	6,023	1,790,000	179,300	1,610,700	1,382	605,000	197,700	407,300	640
2025	3,247,000	0	3,247,000	6,023	1,790,000	187,300	1,602,700	1,376	605,000	205,900	399,100	627
2026	3,247,000	0	3,247,000	6,023	1,790,000	195,400	1,594,600	1,369	605,000	212,700	392,300	617
2027	3,247,000	0	3,247,000	6,023	1,790,000	203,700	1,586,300	1,361	605,000	219,800	385,200	605
2028	3,247,000	0	3,247,000	6,023	1,790,000	206,900	1,583,100	1,359	605,000	223,400	381,600	600
2029	3,247,000	0	3,247,000	6,023	1,790,000	210,100	1,579,900	1,356	605,000	227,200	377,800	594
2030	3,247,000	0	3,247,000	6,023	1,790,000	213,400	1,576,600	1,353	605,000	230,900	374,100	588
2031	3,247,000	0	3,247,000	6,023	1,790,000	216,700	1,573,300	1,350	605,000	234,800	370,200	582
2032	3,247,000	0	3,247,000	6,023	1,790,000	220,000	1,570,000	1,348	605,000	238,600	366,400	576
2033	3,247,000	0	3,247,000	6,023	1,790,000	223,500	1,566,500	1,344	605,000	242,600	362,400	570
2034	3,247,000	0	3,247,000	6,023	1,790,000	226,900	1,563,100	1,342	605,000	246,600	358,400	563
2035	3,247,000	0	3,247,000	6,023	1,790,000	230,500	1,559,500	1,338	605,000	250,700	354,300	557
2036	3,247,000	0	3,247,000	6,023	1,790,000	234,100	1,555,900	1,335	605,000	254,800	350,200	550
2037	3,247,000	0	3,247,000	6,023	1,790,000	237,800	1,552,200	1,332	605,000	259,100	345,900	544
2038	3,247,000	0	3,247,000	6,023	1,790,000	241,500	1,548,500	1,329	605,000	263,400	341,600	537
2039	3,247,000	0	3,247,000	6,023	1,790,000	245,300	1,544,700	1,326	605,000	267,700	337,300	530
2040	3,247,000	0	3,247,000	6,023	1,790,000	249,200	1,540,800	1,322	605,000	272,200	332,800	523
2041	3,247,000	0	3,247,000	6,023	1,790,000	253,100	1,536,900	1,319	605,000	276,700	328,300	516
2042	3,247,000	0	3,247,000	6,023	1,790,000	257,200	1,532,800	1,316	605,000	281,300	323,700	509
2043			97,410,000	180,704	1,790,000	261,200	1,528,800	1,312	605,000	285,900	319,100	502
2044					1,790,000	265,400	1,524,600	1,309	605,000	290,700	314,300	494
2045					1,790,000	269,600	1,520,400	1,305	605,000	295,500	309,500	486
							47,497,300	40,766			11,358,400	17,851

Source: JICA Study Team

Table A.8 Additional Agricultural Water Supply and Agricultural Land: Priority Wells

No.	Well Code	Location	Current Status	Well Type	Working Month	Pumping Capacity (000m ³ /yr (Current))	Pumping Hour per day	Fuel(Electricity) Cost NIS/yr	Maintenance Cost NIS/yr	Managing Cost NIS/yr	Total O&M Cost NIS/yr	Needs for rehabilitation	Estimated Pumping Volume after rehabilitation* (000m ³ /yr)	Incremental Water by Rehabilitation (000m ³ /yr)	Incremental Agricultural Land by Rehabilitation (Dm ² /yr)
1	19-17/054	Faresht Beit Dagan	Pumping	Diesel	12	200	9	9,000	600	-	102,900	Pump, Electricity	200	0	0
2	19-17/055	Jilnik	Pumping	Diesel	12	337	12	97,200	14,600	3,200	133,600	Motor, Pump, Electricity	400	83	166
3	19-17/033	Jilnik	Not pumping	Diesel	-	0	N/A	-	-	-	-	Deepening down to 50m, motor, pump, electric	50	50	99
4	19-17/007	Faresht Beit Dagan	Pumping	Diesel	10	21	4	12,800	600	-	18,400	Deepening more than 25m, Electrical cable	40	19	19
5	18-18/027A	Fara	Not pumping	Diesel	-	0	N/A	-	-	-	-	Deepening down to 100m, motor, pump, electric	27	27	54
6	19-17/064	Jilnik	Pumping	Electricity	11	184	14	11,000	1,800	1,900	148,800	Submersible	184	0	0
7	19-17/027	Jilnik	Pumping	Diesel	11	277	8	14,800	-	-	148,800	Motor	277	0	0
8	19-15/008	Auja	Not pumping	Diesel	-	0	N/A	-	-	-	-	Cleaning salinity water, Electricity, pump, all	240	240	240
9	19-18/054A	Fara Et Beita	Pumping	Electricity	10	179	4	156,000	30,000	-	186,000	Transmission, Motor	179	0	0
10	18-18/036	Fara	Pumping	Diesel	12	168	7	288,000	12,000	64,000	364,000	Main, Electricity	168	0	0
11	18-18/016	Fara	Pumping	Electricity	12	280	10	450,000	90,000	19,200	559,200	Submersible pump, Distribution network, Electrical board	420	140	277
12	19-20/001A	Bardalla	Not pumping	Diesel	-	2	N/A	-	-	-	-	Motor, Gear head	14.4	13	25
13	20-17/022	Marji Najja	Not pumping	Diesel	-	66	N/A	-	-	-	-	Motor, Pump, Gear head	73	7	14
14	19-14/062	Jericho	Pumping	Electricity	12	445	16	156,000	9,600	42,000	207,600	Pump network	147	0	0
15	19-16/005	Jilnik	Pumping	Diesel	9	53	4	21,600	1,800	0	23,400	Motor	89	36	72
16	19-14/058	Jericho	Not pumping	Diesel	-	68	N/A	-	-	-	-	Deepening down to 120m, motor, pump, electric	53	0	0
17	19-17/012	Marji Ghazal	Not pumping	Diesel	-	0	N/A	-	-	-	-	motor	100	100	198
18	19-15/028A	Auja	Not pumping	Diesel	-	0	N/A	-	-	-	-	Substitute well, Generator, pump	100	100	128
19	18-18/019	Fara	Pumping	Diesel	8	132	10	16,000	120,000	84,000	220,000	motor	117	0	0
		Total (Overall 19 Priority Wells)				2,342		1,540,650	300,800	231,000	2,072,450		2,829	815	1,032
		Total (11 Wells, except Pilot Project Wells)				1,046		643,600	221,400	145,200	1,010,200		1,191	473	867

Note: *PWA database; and agricultural well baseline survey conducted by HWE under the supervision of JICA S/T in 2007.
 **Extraction License: data is obtained from PWA database and well baseline survey done by HWE under the supervision of JICA S/T.
 ***Some of the wells that have no license data, the pumping volume is estimated on the basis of discussion with MOA.

Table A.9 Additional Water Loss in “Without Case” per Priority Spring

	Al 'Auja				Al Dyuk				Al Nwailmah			
	Discharge m ³ /Yr	Add. Water Loss m ³ /Yr	Add. Ingrtd Land Loss DNM/Yr	Add. Water Loss Ratio* %	Discharge m ³ /Yr	Add. Water Loss m ³ /Yr	Add. Ingrtd Land Loss DNM/Yr	Add. Water Loss Ratio* %	Discharge m ³ /Yr	Add. Water Loss m ³ /Yr	Add. Ingrtd Land Loss DNM/Yr	Add. Water Loss Ratio* %
2009	9,550,000	0	0	0%	4,710,000	0	0	0%	2,520,000	0	0	0%
2010	9,550,000	0	0	0%	4,710,000	0	0	0%	2,520,000	0	0	0%
2011	9,550,000	0	0	0%	4,710,000	0	0	0%	2,520,000	0	0	0%
2012	9,550,000	0	0	0%	4,710,000	0	0	0%	2,520,000	0	0	0%
2013	9,550,000	95,500	177	1%	4,710,000	177	177	4%	2,520,000	95,500	177	4%
2014	9,550,000	191,000	354	2%	4,710,000	354	354	8%	2,520,000	191,000	354	8%
2015	9,550,000	286,500	531	3%	4,710,000	531	531	11%	2,520,000	286,500	531	11%
2016	9,550,000	382,000	709	4%	4,710,000	709	709	15%	2,520,000	382,000	709	15%
2017	9,550,000	477,500	866	5%	4,710,000	866	866	18%	2,520,000	477,500	866	18%
2018	9,550,000	573,000	1,063	6%	4,710,000	1,063	1,063	23%	2,520,000	573,000	1,063	23%
2019	9,550,000	668,500	1,240	7%	4,710,000	1,240	1,240	27%	2,520,000	668,500	1,240	27%
2020	9,550,000	764,000	1,417	8%	4,710,000	1,417	1,417	30%	2,520,000	764,000	1,417	30%
2021	9,550,000	859,500	1,594	9%	4,710,000	1,594	1,594	34%	2,520,000	859,500	1,594	34%
2022	9,550,000	955,000	1,772	10%	4,710,000	1,772	1,772	38%	2,520,000	955,000	1,772	38%
2023	9,550,000	1,050,500	1,949	11%	4,710,000	1,949	1,949	42%	2,520,000	1,050,500	1,949	42%
2024	9,550,000	1,146,000	2,126	12%	4,710,000	2,126	2,126	46%	2,520,000	1,146,000	2,126	46%
2025	9,550,000	1,241,500	2,303	13%	4,710,000	2,303	2,303	49%	2,520,000	1,241,500	2,303	49%
2026	9,550,000	1,337,000	2,480	14%	4,710,000	2,480	2,480	53%	2,520,000	1,337,000	2,480	53%
2027	9,550,000	1,432,500	2,657	15%	4,710,000	2,657	2,657	57%	2,520,000	1,432,500	2,657	57%
2028	9,550,000	1,528,000	2,835	16%	4,710,000	2,835	2,835	61%	2,520,000	1,528,000	2,835	61%
2029	9,550,000	1,623,500	3,012	17%	4,710,000	3,012	3,012	64%	2,520,000	1,623,500	3,012	64%
2030	9,550,000	1,719,000	3,189	18%	4,710,000	3,189	3,189	68%	2,520,000	1,719,000	3,189	68%
2031	9,550,000	1,814,500	3,366	19%	4,710,000	3,366	3,366	72%	2,520,000	1,814,500	3,366	72%
2032	9,550,000	1,910,000	3,543	20%	4,710,000	3,543	3,543	75%	2,520,000	1,910,000	3,543	75%
2033	9,550,000	2,005,500	3,720	21%	4,710,000	3,720	3,720	79%	2,520,000	2,005,500	3,720	79%
2034	9,550,000	2,101,000	3,898	22%	4,710,000	3,898	3,898	83%	2,520,000	2,101,000	3,898	83%
2035	9,550,000	2,196,500	4,075	23%	4,710,000	4,075	4,075	87%	2,520,000	2,196,500	4,075	87%
2036	9,550,000	2,292,000	4,252	24%	4,710,000	4,252	4,252	91%	2,520,000	2,292,000	4,252	91%
2037	9,550,000	2,387,500	4,429	25%	4,710,000	4,429	4,429	95%	2,520,000	2,387,500	4,429	95%
2038	9,550,000	2,483,000	4,606	26%	4,710,000	4,606	4,606	99%	2,520,000	2,483,000	4,606	99%
2039	9,550,000	2,578,500	4,783	27%	4,710,000	4,783	4,783	103%	2,520,000	2,578,500	4,783	103%
2040	9,550,000	2,674,000	4,961	28%	4,710,000	4,961	4,961	107%	2,520,000	2,674,000	4,961	107%
2041	9,550,000	2,769,500	5,138	29%	4,710,000	5,138	5,138	111%	2,520,000	2,769,500	5,138	111%
2042	9,550,000	2,865,000	5,315	30%	4,710,000	5,315	5,315	115%	2,520,000	2,865,000	5,315	115%
2043		44,407,500	82,380		4,710,000	82,380	82,380		2,520,000	44,407,500	82,380	
2044					4,710,000				2,520,000			
2045					4,710,000				2,520,000			
						21,901,500	40,629			11,718,000	21,738	

Source: JICA Study Team (Based upon Spring Baseline Survey)

Table A.10 Overview of the Agricultural Data by Locality

Locality	Farmer (no. of HH)	Irrigated Area* dunumm	Irrigated Area per Farmer DNM/HH	Irrigable Area dunumm	Irrigable Area per Farmer DNM/HH	Annual Water Supply by Spring MCM/yr	Agri. Wat Use MCM/yr	Actual Agricultural Water Use 000m ³ /yr	Agricultural Water Use Efficiency m ³ /DNM Yr	Incremental Water for Agricultural Use 000m ³ /yr	Additional Irrigation, Land DNM	Additional Irrg. Land DNM/HH	Current Value Added NIS/DNM/yr	Extra Value Added NIS/yr
Bandala	115	2,882	25	10,000	87								3,290	
Ein el Beida	81	5,982	74	10,000	123								3,290	
Kardala	24	823	34	850	35								3,290	
Wadi al Far'a	0	N/A	N/A	N/A	N/A								3,290	
Ras al Far'a	0	N/A	N/A	N/A	N/A	5.31	5.10	3,588.3	504				3,290	
Al Badhan	197													
An Nassaniya & Ein Shibli	102	10,258	27	N/A	N/A	7.29	7.20	5,173.6	504		4,029	8.3	2,776	11,184,140
Al Agrabaniya	75													
Funush Beit Dajan	113	2,005	18	4,335	38									
Marj Naja	60	2,081	35	6,000	100								1,580	
Az Zubeidat	96	2,127	22	6,000	63								1,580	
Marj al Ghazal	36	1,031	29	3,000	83								1,580	
Al Jiflik	284	13,419	47	50,000	176								1,580	
Fasayil	72	559	8	80,000	1,111								1,580	
Al' Aujja	256	9,921	39	15,775	62	9.55	9.55	5,348.0	539	3,247	6,023	23.5	1,580	9,517,074
An Nuweima	30	2,506	84	4,467	149	2.60	2.52	1,594.5	636	464	729	24.3	1,580	1,151,962
Ein ad Duyuk al Fauqa	37	764	21	1,479	40	4.86	4.71	2,326.7	1,165	1,665	1,429	15.7	1,580	2,257,864
Ein ad Duyuk al Taha	54	1,233	23	2,132	39									
Jericho City	582	18,291	31	50,000	86	6.15	3.82	2,798.2	209		2,842	4.5	1,580	4,173,806
Total Mean	2,214	73,882	38	244,038	83	36	33	17,241	760	5,376	14,852	15.3	1,972	5,656,973

Source: JICA Study Team (Estimate based upon MoA Database, PWA Database and aerial photographs)

Table A.11 Financial and Economic Value of the Agricultural Land

Fruit Cropping Pattern

	Conditions of Product Cycle			Establishment			Unbearing Periods			Bearing			Total(m20yrs)		
	(Year)			Values (Per Dnm)			Values (Per Dnm)			Values (Per Dnm)			Values (Per Dnm)		
	Establishment	Unbearing	Bearing	Output	Input	VIA	Output	Input	VIA	Output	Input	VIA	Output	Input	VIA
Olive	3	3	24	0.0	324	324	342.9	149	194	600.0	349	251	15,428.6	9,784.3	5,644
Orange	3	3	24	0.0	1,193	1,193	754.3	357	397	1,571.4	686	886	39,977.1	21,107.1	18,870
Banana	1	1	4	0.0	1,357	-1,357	642.9	1,171	-529	1,800.0	1,129	671	39,214.3	35,214.3	4,000
Date	3	3	24	0.0	1,914	-1,914	3,085.7	1,320	1,766	5,028.6	2,097	2,931	129,942.9	60,034.3	69,909
Grape	1	2	7	0.0	1,191	-1,191	1,542.9	886	657	1,800.0	1,143	657	47,057.1	32,888.6	14,169
Others	3	3	24	0.0	286	-286	480.0	157	323	780.0	446	334	20,160.0	12,025.7	8,134

Fruits

	Unbearing (Establishment)				Bearing				Overall
	Land	Weighted	Value Added \$'	Value Added \$'	Land	Weighted	Value Added \$'	Value Added \$'	
Olive	0	0.00	0	0	65	0.30	16,343	16,343	
Orange	30	0.14	-17,893	5,957	75	0.35	66,429	54,493	
Banana	0	0.00	0	0	0	0.00	0	0	
Date	20	0.09	-12,762	23,543	0	0.00	0	10,781	
Grape	1	0.00	-596	329	24	0.11	16,114	15,847	
Others	0	0.00	0	0	2	0.01	669	669	
Total	51	0.23	-31,250	29,829	166	0.77	99,554	98,132	
Per Total Irrigd Land	0.01		-0.61	0.77	0.02		1.56	1.56	

Nablus area

	Unbearing (Establishment)				Bearing				Overall
	Land	Weighted	Value Added \$'	Value Added \$'	Land	Weighted	Value Added \$'	Value Added \$'	
Olive	25	0.01	-4,054	2,429	150	0.05	37,714	36,089	
Orange	68	0.02	-40,557	13,503	2,371	0.84	2,100,029	2,072,974	
Banana	0	0.00	0	0	0	0.00	0	0	
Date	22	0.01	-14,038	25,897	0	0.00	0	11,859	
Grape	36	0.01	-21,446	11,829	54	0.02	35,486	25,869	
Others	2	0.00	-86	323	83	0.03	27,746	27,788	
Total	153	0.05	-80,388	53,980	2,658	0.94	2,200,974	2,174,574	
Per Total Irrigd Land	0.02		-2.08	1.37	0.36		560.19	556.31	

Jericho area

	Unbearing (Establishment)				Bearing				Overall
	Land	Weighted	Value Added \$'	Value Added \$'	Land	Weighted	Value Added \$'	Value Added \$'	
Olive	0	0.00	0	0	80	0.01	20,114	20,114	
Orange	315	0.05	-187,875	62,550	654	0.10	579,257	453,932	
Banana	855	0.12	-580,179	-225,954	2,450	0.36	1,645,000	838,857	
Date	1,139	0.17	-726,790	1,340,766	850	0.12	2,491,714	3,105,690	
Grape	11	0.00	-6,553	3,614	417	0.06	274,029	271,900	
Others	30	0.00	-4,286	4,843	55	0.01	18,386	18,943	
Total	2,350	0.34	-1,505,683	1,185,809	4,506	0.66	5,028,500	4,708,626	
Per Total Irrigd Land	0.05		-382.58	296.83	0.10		1,251.03	1,154.63	

Vegetable

Protected(GH) Field Vegetable

Tubas area	OUTPUT		Yield	CLTVD AREA	PRODUCTION	INPUT	Value Added	TOTAL VIA
	\$ per KG	\$ per DNM	KG per DNM					
Tomato	0.57	10,260	18,000	260	4,680,000	3810	6,450	1,677,000
Cucumbers	0.43	4,300	10,000	540	5,400,000	2140	2,160	1,166,400
Eggplant	0.6	3,420	6,000	320	1,920,000	1710	1,710	547,200
Squash	1	3,000	3,000	870	2,610,000	870	2,130	1,853,100
Beans	0.86	2,580	3,000	65	195,000	1370	1,210	78,650
Others	0.36	2,700	7,500	515	3,862,500	2130	570	293,550
Total				2,570	18,667,500	14,230		5,615,900
Nablus area	\$ per KG	\$ per DNM	KG per DNM	DNM	KG	per DNM	\$ per DNM	\$
Tomato	0.57	10,260	18,000	96	1,728,000	3810	6,450	619,200
Cucumbers	0.43	4,300	10,000	373	3,730,000	2140	2,160	805,680
Eggplant	0.57	3,420	6,000	70	420,000	1710	1,710	119,700
Squash	1	3,000	3,000	150	450,000	870	2,130	319,500
Beans	0.86	2,580	3,000	65	195,000	1370	1,210	78,650
Others	0.36	2,700	7,500	24	180,000	2130	570	13,680
Total				778	6,783,000	14,230		1,956,410
Jericho area	\$ per KG	\$ per DNM	KG per DNM	DNM	KG	per DNM	\$ per DNM	\$
Tomato	0.57	10,260	18,000	303	5,454,000	3810	6,450	1,954,350
Cucumbers	0.43	4,300	10,000	462	4,620,000	2140	2,160	997,920
Eggplant	0.57	3,420	6,000	0	0	1710	1,710	0
Squash	1	3,000	3,000	0	0	870	2,130	0
Beans	0.86	2,580	3,000	316	948,000	1370	1,210	382,360
Others	0.36	2,700	7,500	133	997,500	2130	570	75,810
Total				1,214	12,019,500	14,230		3,410,440

Open Vegetable

Tubas area	OUTPUT		Yield	CLTVD AREA	PRODUCTION	INPUT	Value Added	TOTAL VIA
	\$ per KG	\$ per DNM	KG per DNM					
Tomato	0.43	1,505	3,500	850	2,975,000	1400	105	89,250
Cucumbers	0.43	860	2,000	230	460,000	540	320	73,600
Eggplant	0.29	1,450	5,000	700	3,500,000	860	590	413,000
Squash	0.57	1,140	2,000	1,380	2,760,000	960	180	248,400
Beans	0.86	860	1,000	690	690,000	460	400	276,000
Others	0.36	792	2,200	1,920	4,224,000	630	162	311,040
Total				5,770	14,609,000	4850		1,411,290
Nablus area	\$ per KG	\$ per DNM	KG per DNM	DNM	KG	per DNM	\$ per DNM	\$
Tomato	0.43	1,505	3,500	120	420,000	1400	105	12,600
Cucumbers	0.43	860	2,000	1,340	2,680,000	540	320	428,800
Eggplant	0.29	1,450	5,000	150	750,000	860	590	88,500
Squash	0.57	1,140	2,000	210	420,000	960	180	37,800
Beans	0.86	860	1,000	107	107,000	460	400	42,800
Others	0.36	792	2,200	541	1,190,200	630	162	87,642
Total				2,468	5,567,200	4850		698,142
Jericho area	\$ per KG	\$ per DNM	KG per DNM	DNM	KG	per DNM	\$ per DNM	\$
Tomato	0.43	1,505	3,500	3,705	12,967,500	1400	105	389,025
Cucumbers	0.43	860	2,000	2,484	4,968,000	540	320	794,880
Eggplant	0.29	1,450	5,000	4,962	24,810,000	860	590	2,927,580
Squash	0.57	1,140	2,000	6,917	13,834,000	960	180	1,245,060
Beans	0.86	860	1,000	3,314	3,314,000	460	400	1,325,600
Others	0.36	792	2,200	9,030	19,866,000	630	162	1,462,860
Total				30,412	79,759,500	4850		8,145,005

Open Field

Tubas	OUTPUT		Yield	CLTVD AREA	PRODUCTION	INPUT	Value Added	TOTAL VIA
	\$ per KG	\$ per DNM	KG per DNM					
Tubas	0.39	1,268	3,250	280	910,000	1,040	228	63,700
Nablus	0.39	1,268	3,250	1,550	5,037,500	1,040	228	352,625
Jericho	0.39	1,268	3,250	6,270	20,377,500	1,040	228	1,426,425
Total				8,100	26,325,000			1,842,750

Total Value Added (USD)	Value Added (USD)							Total Land Area DNM	VIA per DNM USD	VIA per DNM (USD) Economic Price
	Open Field (Total /per DNM)	Veg. (Total /per DNM)	Fruits (Total /perDNM)	Overall	Total Land Area DNM	VIA per DNM USD	VIA per DNM (USD) Economic Price			
TUBAS	63,700	228	7,027,190	843	96,132	452	7,189,022	8,772	820	779
NABLUS	352,825	228	2,654,552	405	2,174,574	774	5,181,751	7,469	694	659
JERCHO	1,426,425	228	11,355,445	365	4,788,626	687	17,690,496	44,736	395	375
Project Area	1,842,750	228	21,237,187	491	8,981,332	706	30,061,269	60,977	493	468

Exchange Rate: 3.5 NIS=USD

Source: JICA Study Team estimated based upon PCBS Agricultural Statistics 2005/2006, JICA ASAP crop budget report 2007/2008

Table A.12 EIRR, NPV, and B/C: Al 'Auja Spring

Period	30yrs* <i>After the completion of improvement works</i>
EIRR	23.2%
NPV@12%	5,663,168
B/C@12%	1.72

Year	Economic Costs (I)			Economic Benefits (II)				Net Benefits (II) - (I)
	Investment costs	Recurrent costs	Total Costs	Domestic Water	Agricultural Water	Additional Water Loss Prevention	Total Benefits	
1 2009	347,400		347,400				0	347,400-
2 2010	487,000		487,000				0	487,000-
3 2011	2,753,900		2,753,900				0	2,753,900-
4 2012	5,090,200		5,090,200				0	5,090,200-
5 2013	112,000	294,000	406,000	0	2,260,300	66,500	2,326,800	1,920,800
6 2014		294,000	294,000	0	2,260,300	133,000	2,393,300	2,099,300
7 2015		294,000	294,000	0	2,260,300	199,400	2,459,700	2,165,700
8 2016		294,000	294,000	0	2,260,300	265,900	2,526,200	2,232,200
9 2017		294,000	294,000	0	2,260,300	332,400	2,592,700	2,298,700
10 2018		294,000	294,000	0	2,260,300	398,900	2,659,200	2,365,200
11 2019		294,000	294,000	0	2,260,300	465,400	2,725,700	2,431,700
12 2020		294,000	294,000	0	2,260,300	531,800	2,792,100	2,498,100
13 2021		294,000	294,000	0	2,260,300	598,300	2,858,600	2,564,600
14 2022		294,000	294,000	0	2,260,300	664,800	2,925,100	2,631,100
15 2023		294,000	294,000	0	2,260,300	731,300	2,991,600	2,697,600
16 2024		294,000	294,000	0	2,260,300	797,800	3,058,100	2,764,100
17 2025		294,000	294,000	0	2,260,300	864,200	3,124,500	2,830,500
18 2026		294,000	294,000	0	2,260,300	930,700	3,191,000	2,897,000
19 2027		294,000	294,000	0	2,260,300	997,200	3,257,500	2,963,500
20 2028		294,000	294,000	0	2,260,300	1,063,700	3,324,000	3,030,000
21 2029		294,000	294,000	0	2,260,300	1,130,200	3,390,500	3,096,500
22 2030		294,000	294,000	0	2,260,300	1,196,600	3,456,900	3,162,900
23 2031		294,000	294,000	0	2,260,300	1,263,100	3,523,400	3,229,400
24 2032		294,000	294,000	0	2,260,300	1,329,600	3,589,900	3,295,900
25 2033		294,000	294,000	0	2,260,300	1,396,100	3,656,400	3,362,400
26 2034		294,000	294,000	0	2,260,300	1,462,600	3,722,900	3,428,900
27 2035		294,000	294,000	0	2,260,300	1,529,000	3,789,300	3,495,300
28 2036		294,000	294,000	0	2,260,300	1,595,500	3,855,800	3,561,800
29 2037		294,000	294,000	0	2,260,300	1,662,000	3,922,300	3,628,300
30 2038		294,000	294,000	0	2,260,300	1,728,500	3,988,800	3,694,800
31 2039		294,000	294,000	0	2,260,300	1,794,900	4,055,200	3,761,200
32 2040		294,000	294,000	0	2,260,300	1,861,400	4,121,700	3,827,700
33 2041		294,000	294,000	0	2,260,300	1,927,900	4,188,200	3,894,200
34 2042		294,000	294,000	0	2,260,300	1,994,400	4,254,700	3,960,700

Source: JICA Study Team

Table A.13 EIRR, NPV, and B/C: AI Dyuk & AI Nwai'mah Springs

Year	Investment Costs			Economic Costs (I)			Total Costs			Economic Benefits (II)						Net Benefits (II) - (I)	
	Dyuk Spring	Nwai'mah Spring	Total	Dyuk Spring	Nwai'mah Spring	Total	Benefits from Domestic Water		Benefits from Agricultural Water		Additional Water Loss Prevention		Total Benefits				
							Dyuk Spring	Nwai'mah Spring	Dyuk Spring	Nwai'mah Spring	Dyuk Spring	Nwai'mah Spring				Dyuk Spring	Nwai'mah Spring
1 2011	63,150		63,150			126,300										0	126,300-
2 2012	252,700	252,700	505,400			505,400										0	505,400-
3 2013	302,200	122,800	425,000			425,000										0	425,000-
4 2014	183,700	702,500	2,536,200			2,536,200										0	2,536,200-
5 2015	215,910	1,155,500	3,314,600			3,314,600										0	3,314,600-
6 2016		164,300	94,300	164,300		258,600	2,500	75,200	536,200	273,600	32,800	17,500	937,800			0	679,200
7 2017		164,300	94,300	164,300		258,600	6,900	80,400	534,900	270,600	65,600	35,100	993,500			0	734,900
8 2018		164,300	94,300	164,300		258,600	13,700	87,400	532,800	266,600	98,400	52,600	1,051,500			0	792,900
9 2019		164,300	94,300	164,300		258,600	20,700	94,600	530,600	262,500	131,100	80,200	1,109,700			0	851,100
10 2020		164,300	94,300	164,300		258,600	27,800	101,900	528,300	258,300	163,900	87,700	1,167,900			0	909,300
11 2021		164,300	94,300	164,300		258,600	35,200	109,500	526,000	254,000	196,700	105,300	1,226,700			0	968,100
12 2022		164,300	94,300	164,300		258,600	42,800	117,200	523,700	249,500	229,500	122,800	1,285,500			0	1,026,900
13 2023		164,300	94,300	164,300		258,600	50,500	125,200	521,200	244,900	262,300	140,300	1,344,400			0	1,085,800
14 2024		164,300	94,300	164,300		258,600	58,500	133,400	518,800	240,200	295,100	157,900	1,403,900			0	1,145,300
15 2025		164,300	94,300	164,300		258,600	66,600	141,800	516,200	235,400	327,900	175,400	1,463,300			0	1,204,700
16 2026		164,300	94,300	164,300		258,600	75,000	148,900	513,600	231,400	360,700	193,000	1,522,600			0	1,264,000
17 2027		164,300	94,300	164,300		258,600	83,500	156,100	510,900	227,200	393,400	210,500	1,581,600			0	1,323,000
18 2028		164,300	94,300	164,300		258,600	86,800	159,900	509,900	225,100	426,200	228,000	1,635,900			0	1,377,300
19 2029		164,300	94,300	164,300		258,600	90,100	163,700	508,800	222,800	459,000	245,600	1,690,000			0	1,431,400
20 2030		164,300	94,300	164,300		258,600	93,500	167,600	507,800	220,600	491,800	263,100	1,744,400			0	1,485,800
21 2031		164,300	94,300	164,300		258,600	96,900	171,500	506,700	218,300	524,600	280,700	1,798,700			0	1,540,100
22 2032		164,300	94,300	164,300		258,600	100,300	175,500	505,700	216,100	557,400	298,200	1,853,200			0	1,594,600
23 2033		164,300	94,300	164,300		258,600	103,800	179,600	504,500	213,700	590,200	315,800	1,907,600			0	1,649,000
24 2034		164,300	94,300	164,300		258,600	107,400	183,700	503,400	211,400	623,000	333,300	1,962,200			0	1,703,600
25 2035		164,300	94,300	164,300		258,600	111,100	187,900	502,300	209,000	655,700	350,800	2,016,800			0	1,758,200
26 2036		164,300	94,300	164,300		258,600	114,800	192,200	501,100	206,500	688,500	368,400	2,071,500			0	1,812,900
27 2037		164,300	94,300	164,300		258,600	118,600	196,500	499,900	204,000	721,300	385,900	2,126,200			0	1,867,600
28 2038		164,300	94,300	164,300		258,600	122,400	200,900	498,700	201,500	754,100	403,500	2,181,100			0	1,922,500
29 2039		164,300	94,300	164,300		258,600	126,300	205,400	497,500	198,900	786,900	421,000	2,236,000			0	1,977,400
30 2040		164,300	94,300	164,300		258,600	130,300	210,000	496,200	196,300	819,700	438,600	2,291,100			0	2,032,500
31 2041		164,300	94,300	164,300		258,600	134,400	214,600	495,000	193,600	852,500	456,100	2,346,200			0	2,087,600
32 2042		164,300	94,300	164,300		258,600	138,500	219,400	493,700	190,900	885,300	473,600	2,401,400			0	2,142,800
33 2043		164,300	94,300	164,300		258,600	142,700	224,200	492,400	188,200	918,000	491,200	2,456,700			0	2,198,100
34 2044		164,300	94,300	164,300		258,600	147,000	229,000	491,000	185,400	950,800	508,700	2,511,900			0	2,253,300
35 2045		164,300	94,300	164,300		258,600	151,300	234,000	489,700	182,500	983,600	526,300	2,567,400			0	2,308,800

30yrs*
After the completion of improvement works

EIRR

13.5%

NPV@12%

472,252

B/C@12%

1.08

Source: JICA Study Team

Table A.14 EIRR, NPV, and B/C: Al Dyuk Spring Solely

Period	30yrs*	<i>*After the completion of improvement works</i>
EIRR	12.8%	
NPV@12%	246,175-	
B/C@12%	0.93	

Year	Economic Costs (I)			Economic Benefits (II)				Net Benefits (II) - (I)
	Investment costs	Recurrent costs	Total Costs	Domestic Water	Agricultural Water	Additional Water Loss Prevention	Total Benefits	
1	2011	63,150	63,150				0	63,150-
2	2012	252,700	252,700				0	252,700-
3	2013	302,200	302,200				0	302,200-
4	2014	1,833,700	1,833,700				0	1,833,700-
5	2015	2,159,100	2,159,100				0	2,159,100-
6	2016		164,300	2,500	536,200	32,800	571,500	407,200
7	2017		164,300	6,900	534,900	65,600	607,400	443,100
8	2018		164,300	13,700	532,800	98,400	644,900	480,600
9	2019		164,300	20,700	530,600	131,100	682,400	518,100
10	2020		164,300	27,800	528,300	163,900	720,000	555,700
11	2021		164,300	35,200	526,000	196,700	757,900	593,600
12	2022		164,300	42,800	523,700	229,500	796,000	631,700
13	2023		164,300	50,500	521,200	262,300	834,000	669,700
14	2024		164,300	58,500	518,800	295,100	872,400	708,100
15	2025		164,300	66,600	516,200	327,900	910,700	746,400
16	2026		164,300	75,000	513,600	360,700	949,300	785,000
17	2027		164,300	83,500	510,900	393,400	987,800	823,500
18	2028		164,300	86,800	509,900	426,200	1,022,900	858,600
19	2029		164,300	90,100	508,800	459,000	1,057,900	893,600
20	2030		164,300	93,500	507,800	491,800	1,093,100	928,800
21	2031		164,300	96,900	506,700	524,600	1,128,200	963,900
22	2032		164,300	100,300	505,700	557,400	1,163,400	999,100
23	2033		164,300	103,800	504,500	590,200	1,198,500	1,034,200
24	2034		164,300	107,400	503,400	623,000	1,233,800	1,069,500
25	2035		164,300	111,100	502,300	655,700	1,269,100	1,104,800
26	2036		164,300	114,800	501,100	688,500	1,304,400	1,140,100
27	2037		164,300	118,600	499,900	721,300	1,339,800	1,175,500
28	2038		164,300	122,400	498,700	754,100	1,375,200	1,210,900
29	2039		164,300	126,300	497,500	786,900	1,410,700	1,246,400
30	2040		164,300	130,300	496,200	819,700	1,446,200	1,281,900
31	2041		164,300	134,400	495,000	852,500	1,481,900	1,317,600
32	2042		164,300	138,500	493,700	885,300	1,517,500	1,353,200
33	2043		164,300	142,700	492,400	918,000	1,553,100	1,388,800
34	2044		164,300	147,000	491,000	950,800	1,588,800	1,424,500
35	2045		164,300	151,300	489,700	983,600	1,624,600	1,460,300

Source: JICA Study Team

Table A.15 EIRR, NPV, and B/C: Al Nwai'mah Spring Solely

Period	30yrs* <i>After the completion of improvement works</i>
EIRR	15.0%
NPV@12%	201,849
B/C@12%	1.10

Year	Economic Costs (I)			Economic Benefits (II)				Net Benefits (II) - (I)	
	Investment costs	Recurrent costs	Total Costs	Domestic Water	Agricultural Water	Additional Water Loss Prevention	Total Benefits		
1	2011	63,150		63,150				0	63,150-
2	2012	252,700		252,700				0	252,700-
3	2013	122,800		122,800				0	122,800-
4	2014	702,500		702,500				0	702,500-
5	2015	1,155,500		1,155,500				0	1,155,500-
6	2016		94,300	94,300	75,200	273,600	17,500	366,300	272,000
7	2017		94,300	94,300	80,400	270,600	35,100	386,100	291,800
8	2018		94,300	94,300	87,400	266,600	52,600	406,600	312,300
9	2019		94,300	94,300	94,600	262,500	70,200	427,300	333,000
10	2020		94,300	94,300	101,900	258,300	87,700	447,900	353,600
11	2021		94,300	94,300	109,500	254,000	105,300	468,800	374,500
12	2022		94,300	94,300	117,200	249,500	122,800	489,500	395,200
13	2023		94,300	94,300	125,200	244,900	140,300	510,400	416,100
14	2024		94,300	94,300	133,400	240,200	157,900	531,500	437,200
15	2025		94,300	94,300	141,800	235,400	175,400	552,600	458,300
16	2026		94,300	94,300	148,900	231,400	193,000	573,300	479,000
17	2027		94,300	94,300	156,100	227,200	210,500	593,800	499,500
18	2028		94,300	94,300	159,900	225,100	228,000	613,000	518,700
19	2029		94,300	94,300	163,700	222,800	245,600	632,100	537,800
20	2030		94,300	94,300	167,600	220,600	263,100	651,300	557,000
21	2031		94,300	94,300	171,500	218,300	280,700	670,500	576,200
22	2032		94,300	94,300	175,500	216,100	298,200	689,800	595,500
23	2033		94,300	94,300	179,600	213,700	315,800	709,100	614,800
24	2034		94,300	94,300	183,700	211,400	333,300	728,400	634,100
25	2035		94,300	94,300	187,900	209,000	350,800	747,700	653,400
26	2036		94,300	94,300	192,200	206,500	368,400	767,100	672,800
27	2037		94,300	94,300	196,500	204,000	385,900	786,400	692,100
28	2038		94,300	94,300	200,900	201,500	403,500	805,900	711,600
29	2039		94,300	94,300	205,400	198,900	421,000	825,300	731,000
30	2040		94,300	94,300	210,000	196,300	438,600	844,900	750,600
31	2041		94,300	94,300	214,600	193,600	456,100	864,300	770,000
32	2042		94,300	94,300	219,400	190,900	473,600	883,900	789,600
33	2043		94,300	94,300	224,200	188,200	491,200	903,600	809,300
34	2044		94,300	94,300	229,000	185,400	508,700	923,100	828,800
35	2045		94,300	94,300	234,000	182,500	526,300	942,800	848,500

Source: JICA Study Team

Table A.16

EIRR, NPV, and B/C: Priority Wells (1/4)

		18-18/027A						18-18/019						18-18/016					
	Year	Costs		Incremental Water	Irrg. Land	Unit Econ. Benefit	Economic Benefits		Net Benefits	Costs		Incremental Water	Irrg. Land	Unit Econ. Benefit	Economic Benefits		Net Benefits		
		USD					USD	USD		USD	USD				USD	USD			
1	2010	138,100		m3	DNM	USD/DNM	779	0	-138,100	66,500	0	DNM	779	0	779	0	-66,500		
2	2011	181,200	0	27,000	54	779	41,700	27,000	-181,200	175,700	0	0	779	0	779	0	-175,700		
3	2012	14,700	27,000	27,000	54	779	41,700	27,000	29,900	29,900	0	0	779	0	779	0	-29,900		
4	2013	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
5	2014	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
6	2015	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
7	2016	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
8	2017	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
9	2018	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
10	2019	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
11	2020	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
12	2021	8,500	27,000	27,000	54	779	41,700	33,200	25,000	25,000	0	0	779	0	779	0	-25,000		
13	2022	69,600	27,000	27,000	54	779	41,700	-27,900	71,000	0	0	0	779	0	779	0	-71,000		
14	2023	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
15	2024	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
16	2025	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
17	2026	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
18	2027	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
19	2028	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
20	2029	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
21	2030	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
22	2031	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
23	2032	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
24	2033	69,600	27,000	27,000	54	779	41,700	-27,900	71,000	0	0	0	779	0	779	0	-71,000		
25	2034	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
26	2035	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
27	2036	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
28	2037	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
29	2038	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
30	2039	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
31	2040	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
32	2041	6,200	27,000	27,000	54	779	41,700	35,500	15,000	0	0	0	779	0	779	0	-15,000		
										IRR				IRR		109.2%			
										NPV@12%		-82,062		NPV@12%		1,093,002			
										B/C		0.879382		B/C		3.377235			

Source: JICA Study Team

EIRR, NPV, and B/C: Priority Wells (2/4)

Table A.16

	19-17/033						19-20/001A						20-17/022						
	Costs	Incremental Water	Irrg. Land	Unit Econ. Benefit	Economic Benefits	Net Benefits	Costs	Incremental Water	Irrg. Land	Unit Econ. Benefit	Economic Benefits	Net Benefits	Costs	Incremental Water	Irrg. Land	Unit Econ. Benefit	Economic Benefits	Net Benefits	
	USD	m3	DNM	USD/DNM	USD	USD	USD	m3	DNM	USD/DNM	USD	USD	m3	DNM	USD/DNM	USD	USD	USD	
1	65,200		0	659	0	-65,200	71,000			659	-71,000	162,900			0	659	0	-57,300	
2	151,000	50,000	99	659	65,400	-151,000	9,600	12,500	25	659	16,300	6,700		7,100	14	659	9,300	-150,400	
3	16,000	50,000	99	659	65,400	49,400	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-10,700	
4	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
5	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
6	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
7	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
8	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
9	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
10	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
11	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
12	11,800	50,000	99	659	65,400	53,600	5,200	12,500	25	659	16,300	11,100		7,100	14	659	9,300	-6,900	
13	47,800	50,000	99	659	65,400	17,600	51,000	12,500	25	659	16,300	-34,700		7,100	14	659	9,300	-39,800	
14	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
15	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
16	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
17	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
18	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
19	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
20	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
21	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
22	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
23	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
24	47,800	50,000	99	659	65,400	17,600	51,000	12,500	25	659	16,300	-34,700		7,100	14	659	9,300	-39,800	
25	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
26	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
27	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
28	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
29	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
30	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
31	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
32	7,500	50,000	99	659	65,400	57,900	3,900	12,500	25	659	16,300	12,400		7,100	14	659	9,300	-600	
											IRR	0.7%						#DIV/0!	
											NPV@12%	-152,895							NPV@12%
											B/C	0.486067							B/C

Source: JICA Study Team

Table A.16

EIRR, NPV, and B/C: Priority Wells (3/4)

		19-16/005					19-17/012					19-14/062					
	Year	Costs		Incremental Water m3	Irrg. Land DNM	Unit Econ. Benefit USD/DNM	Economic Benefits		Net Benefits	Costs USD	Incremental Water m3	Irrg. Land DNM	Unit Econ. Benefit USD/DNM	Economic Benefits		Net Benefits	
		USD	USD				USD	USD						USD	USD		
1	2010	32,700	0	659	0	659	0	-32,700	22,900	0	0	375	0	-22,900			
2	2011	127,900	0	659	0	659	0	-127,900	108,900	0	0	375	0	-108,900			
3	2012	21,600	36,300	72	659	47,400	25,800	19,100	19,100	0	0	375	0	-19,100			
4	2013	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
5	2014	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
6	2015	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
7	2016	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
8	2017	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
9	2018	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
10	2019	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
11	2020	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
12	2021	18,800	36,300	72	659	47,400	28,600	17,000	17,000	0	0	375	0	-17,000			
13	2022	45,400	36,300	72	659	47,400	2,000	57,600	57,600	0	0	375	0	-57,600			
14	2023	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
15	2024	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
16	2025	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
17	2026	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
18	2027	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
19	2028	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
20	2029	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
21	2030	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
22	2031	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
23	2032	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
24	2033	45,400	36,300	72	659	47,400	2,000	57,600	57,600	0	0	375	0	-57,600			
25	2034	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
26	2035	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
27	2036	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
28	2037	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
29	2038	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
30	2039	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
31	2040	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
32	2041	11,100	36,300	72	659	47,400	36,300	17,000	17,000	0	0	375	0	-17,000			
								IRR							IRR		
								NPV@12%	43.3%						NPV@12%	#DIV/0!	
								B/C	585.583						B/C	-257.489	
									2.652194							0	

Source: JICA Study Team

Table A.16 EIRR, NPV, and B/C: Priority Wells (4/4)

	19-14/058										19-15/028A										Overall 11 Wells				By region		
	Costs		Incremental Water	Irr. Land	Unit Econ. Benefit	Economic Benefits	Net Benefits	Costs		Incremental Water	Irr. Land	Unit Econ. Benefit	Economic Benefits	Net Benefits	Overall Cost	Overall Benefit	Net	Tubas	Nabulis	Jericho							
	USD	m3	DNM	USD/DNM	USD	USD	USD	USD	m3	DNM	USD/DNM	USD	USD	USD	USD	USD	USD	USD	USD	USD							
1	2010	62,100		0	375	0	-62,100				375		-112,600	726,800	0	-726,800											
2	2011	110,400	0	0	375	0	-110,400	147,000	100,000	128	375	48,100	-147,000	1,560,000	0	-1,560,000	-231,700	-297,500	-197,600								
3	2012	10,300	0	0	375	0	-10,300	26,600	100,000	128	375	48,100	-147,000	241,500	333,300	164,900	176,300	176,300	-7,900								
4	2013	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
5	2014	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
6	2015	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
7	2016	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
8	2017	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
9	2018	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
10	2019	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
11	2020	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
12	2021	7,500	0	0	375	0	-7,500	21,900	100,000	128	375	48,100	26,200	199,600	574,800	375,200	177,900	195,600	1,700								
13	2022	50,400	0	0	375	0	-50,400	54,200	100,000	128	375	48,100	-6,100	628,400	574,800	-53,600	35,800	24,700	-114,100								
14	2023	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
15	2024	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
16	2025	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
17	2026	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
18	2027	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
19	2028	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
20	2029	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
21	2030	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
22	2031	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
23	2032	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
24	2033	50,400	0	0	375	0	-50,400	54,200	100,000	128	375	48,100	-6,100	628,400	574,800	-53,600	35,800	24,700	-114,100								
25	2034	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
26	2035	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
27	2036	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
28	2037	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
29	2038	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
30	2039	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
31	2040	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
32	2041	7,500	0	0	375	0	-7,500	13,300	100,000	128	375	48,100	34,800	150,500	574,800	424,300	190,200	223,800	10,300								
																		IRR	14.9%	23.3%	17.4%						
																		NPV	492,931	606,822	428,831	-542,723					
																		B/C	1.14	1.52	1.29	0.44					
																		IRR	9.2%								
																		NPV@12%	-54,212								
																		B/C	0.968264								

Source: JICA Study Team

Table A.17 Farm Income Analysis: A Typical Vegetable Producing Farmer's Income Model

Typical Vegetable Producing Farmer Model		Benefit				Expenditure		Net Benefit NIS
		Occupancy		Unit price	Benefit	Unit cost	Cost	
		DNM	%	NIS/DNM	NIS	NIS/DNM	NIS	
Price at 2007								
Current Cropping Pattern*								
<i>*Protected Land shares 10% of Total Agricultural Land</i>								
Open Irrigated	Tomato	4.18	11.0%	5,250	21,945	4,910	20,524	1,421
	90.0% Cucumber	3.80	10.0%	3,000	11,400	1,900	7,220	4,180
	Eggplant	4.94	13.0%	5,000	24,700	3,000	14,820	9,880
	Squash	7.60	20.0%	4,000	30,400	3,350	25,460	4,940
	Beans	3.80	10.0%	3,000	11,400	1,600	6,080	5,320
	Others	9.88	26.0%	2,750	27,170	2,200	21,736	5,434
Protected(GH)	Tomato	0.76	2.0%	36,000	27,360	13,330	10,131	17,229
	10.0% Cucumber	0.95	2.5%	15,000	14,250	7,500	7,125	7,125
	Eggplant	0.38	1.0%	12,000	4,560	6,000	2,280	2,280
	Squash	0.76	2.0%	10,500	7,980	3,062	2,327	5,653
	Beans	0.38	1.0%	9,000	3,420	4,800	1,824	1,596
	Others	0.57	1.5%	9,380	5,347	7,460	4,252	1,094
Subtotal		38.00	100.0%				NIS	66,153
							USD	18,900
High Value-added Pattern*								
<i>*Protected Land shares 30% of Total Agricultural Land/ **Market Prices for the Open Vegetables Enhanced by 10%</i>								
Open Irrigated Veg.	Tomato	3.30	9%	5,775	19,058	4,910	16,203	2,855
	70% Cucumber	3.00	8%	3,300	9,900	1,900	5,700	4,200
	Eggplant	3.80	10%	5,500	20,900	3,000	11,400	9,500
	Squash	5.90	16%	4,400	25,960	3,350	19,765	6,195
	Beans	3.00	8%	3,300	9,900	1,600	4,800	5,100
	Others	7.60	20%	3,025	22,990	2,200	16,720	6,270
Protected(GH) Veg.	Tomato	2.30	6%	36,000	82,800	13,330	30,659	52,141
	30% Cucumber	3.00	8%	15,000	45,000	7,500	22,500	22,500
	Eggplant	1.00	3%	12,000	12,000	6,000	6,000	6,000
	Squash	2.30	6%	10,500	24,150	3,062	7,043	17,107
	Beans	1.20	3%	9,000	10,800	4,800	5,760	5,040
	Others	1.60	4%	9,380	15,008	7,460	11,936	3,072
Subtotal		38.00	100%				NIS	139,980
							USD	40,000

Source: JICA Study Team estimated based upon JICA ASAP's crop budget report 2007/2008