PALESTINIAN NATIONAL AUTHORITY

JERICHO REGIONAL DEVELOPMENT STUDY PROJECT IN PALESTINE

FINAL REPORT

JERICHO CITY URBAN DEVELOPMENT PLAN

August 2006

JAPAN INTERNATIONAL COOPERATION AGENCY

KRI International Corp.

Nippon Koei Co., Ltd.

Jericho City Urban Development Plan

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Abbreviations

GDP	Gross Domestic Product
GDPP	General Directorate for Policy and Planning
GIS	Geographical Information System
GRDP	Gross Regional Domestic Product
IFAD	International Fund for Agricultural Development
JCspd	Joint Council for services, planning and development
JICA	Japan International Cooperation Agency
LGU	Local Government Unit
lpcd	Liter per capita per day
MCM	Million Cubic Meters
MDG	Millennium Development Goal
MoA	Ministry of Agriculture
MoEHE	Ministry of Education and Higher Education
MoF	Ministry of Finance
MoFA	Ministry of Foreign Affairs
MoH	Ministry of Health
MoI	Ministry of Interior
MoL	Ministry of Labor
MoLG	Ministry of Local Government
MoNE	Ministry of National Economy
MoP	Ministry of Planning
MoPW	Ministry of Public Work
MoSA	Ministry of Social Affairs
MoTA	Ministry of Tourism and Antiquity
MoWA	Ministry of Women's Affairs
NARC	National Agriculture Research Center
NGO	Non-Governmental Organization
NIS	New Israeli Shekel
NPO	Non-Profit Organization
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation and Development
OPT	Occupied Palestinian Territory
PCBS	Palestinian Central Bureau of Statistics
PEC	Palestinian Electricity Company
PIEFZA	Palestinian Industrial Estates & Free Zones Agency
PIF	Palestine Investment Fund
PIPA	Palestinian Investment Promotion Agency
PIU	Project Implementation Unit
PLO	Palestine Liberation Organization
PNA	Palestinian National Authority
PWA	Palestinian Water Authority
PWLS	Palestinian Wild Life Society
PALTRADE	Palestine Trade Center

QIZ	Qualified Industrial Zones
SES	Socioeconomic Survey
SME	Small and Medium Enterprise
TVET	Technical and Vocational Education and Training
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNFPA	United Nations Fund for Population Activities
UNICEF	United Nations Children's Fund
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
USAID	United States Agency for International Development
USD	United State Dollars
WTO	World Tourism Organization

Currency Equivalents

USD 1 = NIS 4.5 = JPY 116
as of July 2006

1 INTRODUCTION

This report presents an urban development plan for Jericho city with the target year set for 2025. The plan has been formulated on the basis of the future development frameworks set under the master plan for Jericho Regional Development.

The purpose of the urban plan for Jericho city is to have a clear vision on future development of the city and to delineate the urban plan in harmony with the surrounding areas as well as within the city. Jericho city has a great potential for future development as an international tourism city with a great number of historical and cultural heritage sites, as well as a variety of products and the charm of the people in Jericho. Jericho city has experienced a steady growth in population and the increase in the number of visitors. Some development activities are in progress in the city without any consideration for historical sites or the environment. In order to develop Jericho city into a world renowned city utilizing the existing assets, it is necessary to guide the direction of development activities in harmony with the vulnerable resources by setting a clear future vision and share it with the surrounding areas in the Greater Jericho area.

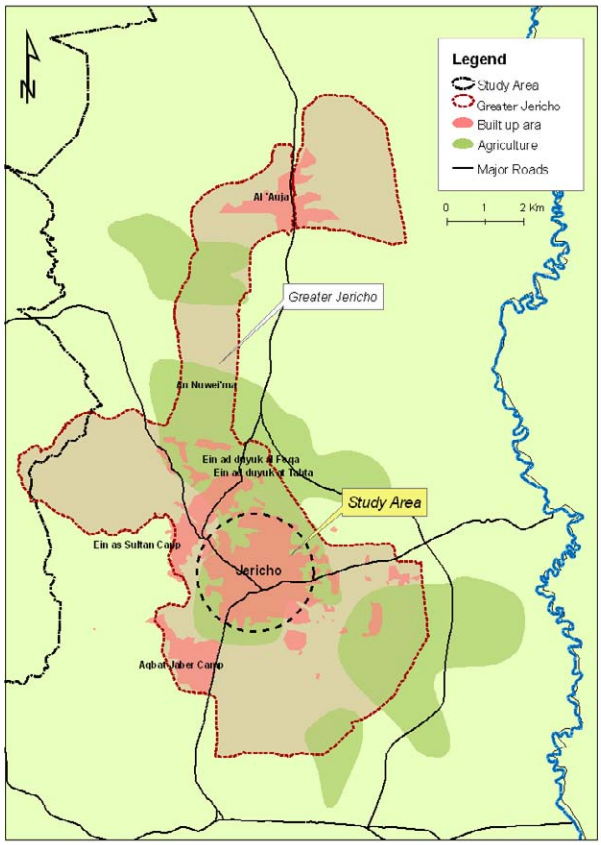


Figure 1.1 Study Area

As a strategic way to get consensus among stakeholders on the future urban plan for Jericho city, a participatory approach has been applied throughout the planning process. First, a survey was conducted in April 2006 to get input from the urban residents on their image for the future of Jericho City. The Urban Plan Working Group was established by municipal members, government officials, academic professionals, and local consultants, as shown in Annex 1. Eight working group meetings were held for discussions from March to July 2006. At the meetings, information from different sectors was presented and shared among members, to be reflected in setting the future vision for

Figure 1.2 Bird's- eye View of Jericho City

Jericho city. Outputs of all those efforts and discussions at the working group meetings have been reflected in the formulation of the urban plan of Jericho city. (Refer to Annex 1 for details of the working group meetings)

The urban development plan for Jericho city has been formulated through the following studies.

(1) Existing condition

The existing conditions of the city have been surveyed with respect to historical background, natural condition, population, housing, utility, and land use. By analyzing the current situation, the issues and potentials for future urban development have been identified (Refer to Chapters 2 and 3).

(2) Development framework

The development frameworks for population and tourism development have been set on the basis of some representative frameworks applied in the master plan for Jericho Regional Development, and are cited in this report. (Refer to Chapter 4)

(3) Future development concepts for the Greater Jericho area and Jericho city

The future development concept for the Greater Jericho area as well as for Jericho city has been formulated based upon the analysis of existing conditions and the development frameworks. (Refer to Chapters 5 and 6)

(4) Land use plan

A land use plan for Jericho city has been formulated in line with the development concept and the land use management perspective to realize the harmonized and rational land use in terms of legal and strategic approaches. (Refer to Chapter 7)

(5) Facility plan

A preliminary facility plan for transportation, water supply, wastewater treatment and solid waste management has been prepared in accordance with the master plan for Jericho Regional Development. (Refer to Chapter 8)

(6) Development plans

The development plans for tourism promotion and agro-tourism zone, as well as redevelopment of the city center for future development of the city have been worked out. (Refer to Chapter 9)

(7) Development schedule

A preliminary development schedule and programs for implementation of the proposed urban plan have been proposed. (Refer to Chapter 10)

2 HISTORY OF JERICHO CITY

2.1 Overview of History

Being endowed with spring and surface water, fertile soil, and warm climate, the city has a history extending back to the most ancient human habitations as indicated in the ancient archeological remains, Tel es-Sultan, which are located in the northwest of the city. It was built by the accumulation of remains and ruins over many years of its habitation at a location where a dependable and prolific water source is available from local springs.

Figure 2.1 Tell es-Sultan

The history of Jericho city is summarized in chronological order[1] as follows.

Human inhabitation (8000 B.C. -)

Humans started to inhabit Tel es-Sultan about 8,000 B.C., which is the oldest history of human inhabitation in the world.

The Pre-Stone Age - the Late Neolithic Age (Between 6800 - 4000 B.C.)

The ancient city was inhabited by different peoples whose lives depended on collecting wild seeds. Those inhabitants dug canals and made use of water from Ain es-Sultan to irrigate their lands. In the Late Neolithic Age (5000-4000 B.C.), people from outside immigrated and settled in the land.

The First Bronze Age (4000 - 2300 B.C.)

At the end of the Neolithic Age, a hiatus occurred in human occupation lasting until 3200 B.C. when defensive fortifications appeared in the town after people returned. These defensive walls were repaired and rebuilt sixteen times during the First Bronze Age which lasted for 600 years. Those walls were frequently destroyed by earthquakes, infiltration of water into their foundations, or enemy attacks. Continuous improvements in civilization and construction were observed in this period when people started to use copper in large quantities in order to manufacture weapons and tools.

The Middle Bronze Age (2300 - 1900 B.C.)

New inhabitants settled in the city and resided in ramshackle homes on the top of the hill. The spread of these homes extended onto the hill slopes since there was no defensive wall in that interval. It is probable that these new inhabitants were the Amorites who occupied most of the Middle Eastern countries, including Iraq and Egypt during the period.

[1] The historical ages indicated in the text are based on the research by Dr. Kenyon's excavations (Encyclopedia Britannica).

The Hyksos period (1750 - 1580 B.C.)

Jericho was one of the strong-holds of the Hyksos or Shepherd Kings (1750-1580 B.C.). Their houses were well built and covered the entire top of the hill.

The Canaanites period

Canaanites emigrated from Arabia to Syria. Jericho was one of their most important cities in 1400 B.C. The Canaanites excelled in the sculpture of statues and in pictorial sculpture. The styles of that period were exactly similar to the contemporary head dress now worn by Palestinian women. It is known by its popular name, "Al-Wiqahyah" (The protector), or "As-Samada" or "Al- 'Usabh al-kan'aniyyah "(The Canaanite Turban).

The Roman period

In the early stage of the Roman period (4th century B.C.), the city moved from Tell es-Sultan to the Al Qilt valley, which is currently known as Tell al Abu Al Oleig. The city expanded with canals, pools, castles, palaces and other structures. Jericho acquired a great importance in the time of Christ, as Jesus Christ Himself visited the city. In 325 A.D. Jericho became the center of a bishopric.

Figure 2.2 Herod's Winter Palace

The Muslim period

In the seventh century, Jericho city entered into the rule of the Arab Moslems and the city's prosperity increased due to its prominence for soldiers and the cross relationship with the Ummayed Caliphs in Damascus. The Ummayeds paid special attention to Jericho due to its location as well as its loyalty to the Ummayed family. King Hisham built a palace as a winter resort, which is located in the north of the city. Aqueducts and canals fed by Doyuk spring spanned over the valley and irrigated the palace's gardens and lands.

Figure 2.3 Hisham's Palace

At the last stage of Islamic caliph period, Jericho was ruled by the Ottoman emperor until 1917 and then the British mandate lasted until 1948. Between 1948 and 1967, the population of Jericho district grew to 80,000 persons but then more than 85% of the population became refugees just after the 1967 war. The refugees were forced to leave for Jordan and other Arab countries[2].

[2] Arij, Jericho Profile, 1997

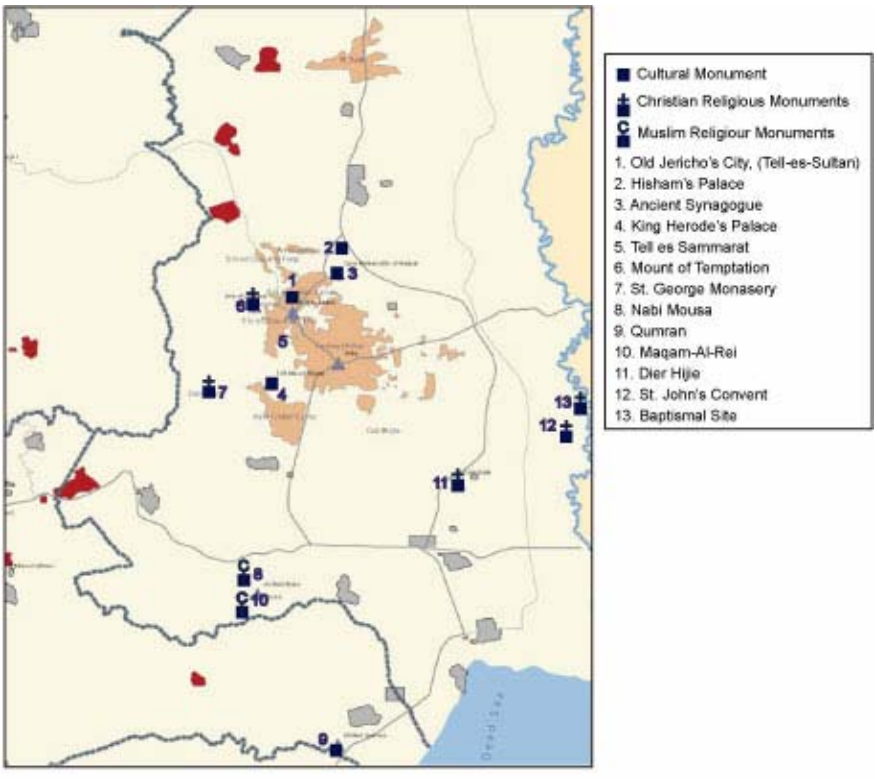
2.2 Historical and Cultural Uniqueness

As summarized in the following table, Jericho city has a significant historical and cultural uniqueness that is composed of a multi-religious and cultural background.

Table 2.1 Major Historical and Cultural Uniqueness of Jericho City

Uniqueness	Contents
Historically important sites	- Tell es-Sultan, "The oldest city in the world" - Birth place of agriculture and civilization - The center of Christianity in Roman times
Multi-religious sites	- Objects of Christian, Muslim, and Jewish religions can be observed throughout the city.
Multi-cultural sites	- Objects of Roman, Arabic, and Byzantine times can be observed throughout the city.

Source: JICA Study Team



Source: MoTA

Figure 2.4 Locations of Historical and Cultural Sites

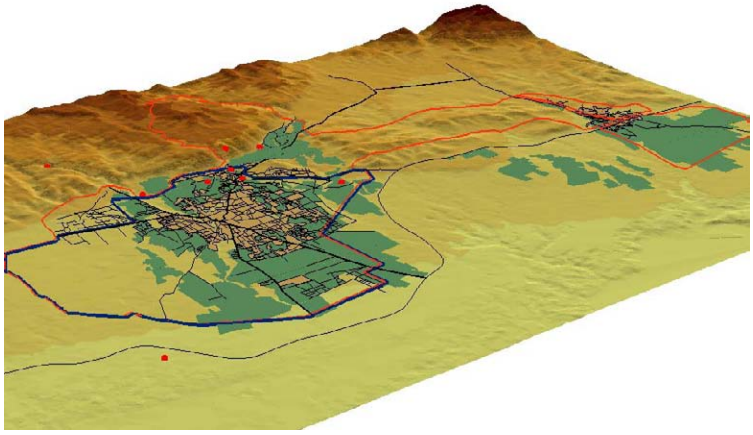
3 CURRENT JERICHO CITY

This chapter summarizes the existing condition of Jericho city and brings out issues to be addressed in the future urban development plan.

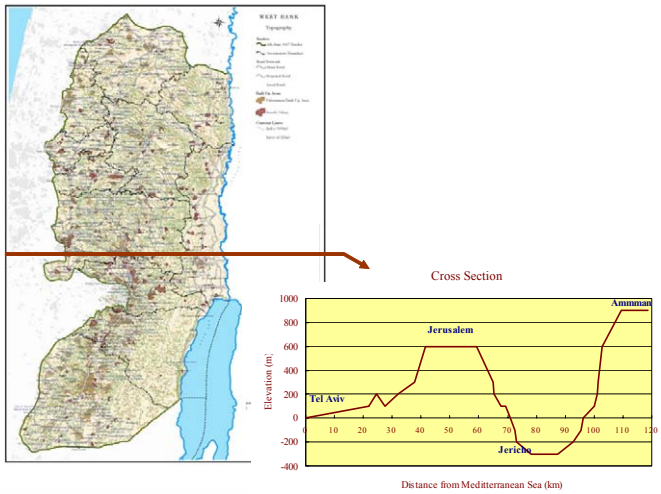
3.1 Natural Conditions

(1) Geography

Jericho city is located in the southern part of the Jordan Rift Valley and at the crossroads of the east-west corridor and north-south corridor. It is 35 km east of Jerusalem and 8 km northwest of the Dead Sea. Currently, people and products in the valley pass through the city for trade or visiting. The city has been and will continue to be developed as a regional center for trade, tourism, and agriculture, as well as environmental management. Being situated at the international border of three countries; Palestine, Jordan and Israel, the city could become an international gateway to/from neighboring countries in the future development.



Source: JICA Study Team



Source: MOP(2005)

Figure 3.1 Topographic Condition of Jericho and the West Bank

(2) Climate

The climate of the city is warm throughout the year, having four months of hot dry summer and a short winter with small rainfall from November to March. The average annual rainfall is 168 mm in the city, which is the lowest in the West Bank. The temperature is relatively high, especially in the summer seasons. The warm climate in winter gives the city an advantage as a winter resort as proved by the historical fact that in Roman times, King Herod constructed a winter palace in the west part of Jericho city.

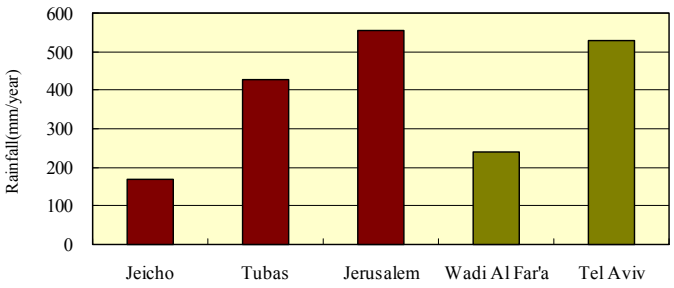


Figure 3.2 Annual Rainfall

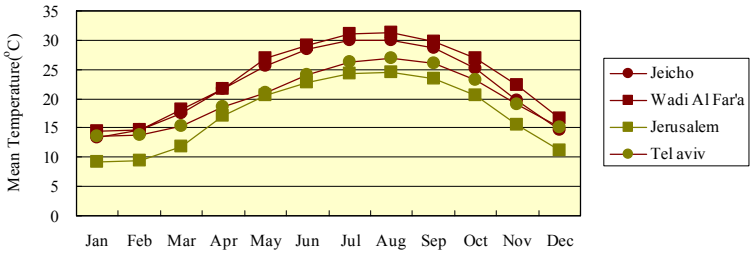


Figure 3.3 Mean Monthly Temperature

(3) Water Resources

Available water resources in the city are mainly spring water and groundwater. The following figure shows the location of spring water sources in and around Jericho city. The total volume of spring water is estimated to be about 22 MCM/year[3], which is approximately 75% of total available spring water in the Jericho and Jordan Rift Valley area. Groundwater used in this area amounts to about 6.2 MCM/year.

Water is mainly used for agriculture and domestic purposes, (37.9 MCM/year and 2.3 MCM/year; inclusive of water loss, as shown in Table 3.1). Water is not consumed at the maximum possible level of efficiency since a great deal of it is lost in the water channels from the springs as well as in the conveyance systems from wells.

The availability of water is one of the most crucial issues in formulating a future development plan for the city.

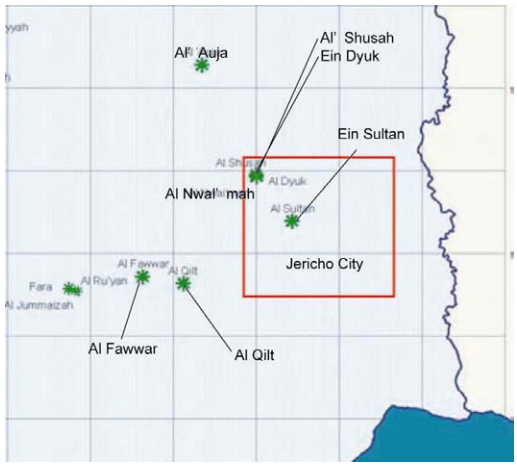


Figure 3.4 Locations of Springs

[3] MCM/year = Million cubic meter per year

Table 3.1 Water for Agriculture and Domestic Purposes

Water distriburion	Agriculture			Domestic			
	37.93 MCM/year			2.35 MCM/year			
Actual water consumption	Spring	Well	Loss	Spring	Well	Makorot	Loss
	20.8	6.16	10.97	0.89	0.03	1.04	0.39

Note: Assumed loss in conveyance system from springs is 30%.
Assumed loss in no-network system from wells is 25%.
Losses in the distribution network are not included.
Source: Water Supply for Domestic and Industrial (PWA, 2003)

3.2 Population

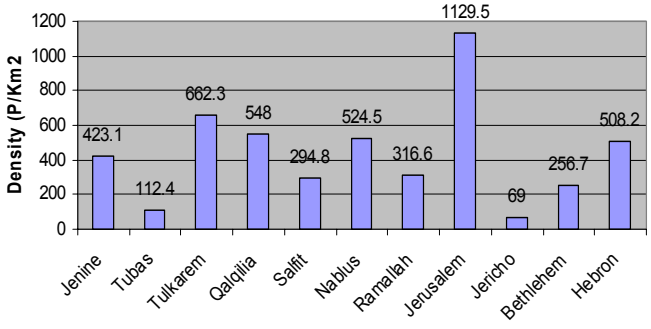
The population of Jericho city was approximately 20,000 in 2005. Including the surrounding areas, the Greater Jericho area had a total population of about 35,000 persons (2005), according to the Palestinian Central Bureau of Statistics (PCBS). The city has the lowest population density of the major cities in the West Bank at 69 persons per km^2. This implies that the city has a potential for future population expansion.

The existing built-up area is 5.4 km^2, which represents 90% of the total built-up area in the Greater Jericho area.

Table 3.2 Population in Greater Jericho

locality	Population 2005
Al 'Auja	3,886
An Nuwei'ma	1,128
'Ein ad duyuk al Foqa	789
'Ein ad Duyuk at Tahta	937
Jericho	19,783
Aqbat Jaber Camp	6,147
'Ein as sultan Camp	1,972
Total	**34,642**

Source: PCBS



Source: PCBS

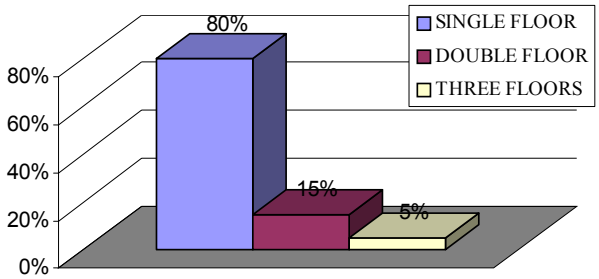
Figure 3.5 Population Density by Governorate

Figure 3.6 Major Cities in the West Bank

3.3 Housing

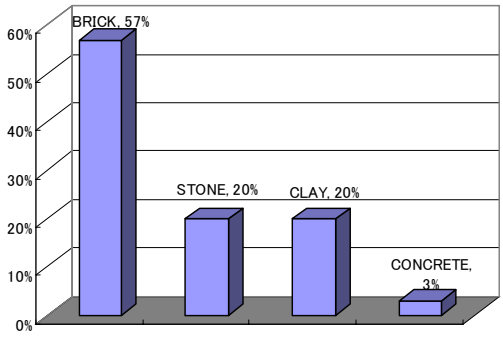
Existing buildings in the city are mainly low-rise with one or two stories which helps create the unique scenery of the city by allowing mountain views from everywhere in the city. Such a landscape is one of the valuable assets of the city and it needs to be considered in future urban development planning.

The number of buildings is about 3,000 units, counted from a GIS base map based upon the 2004 satellite image and the statistics of development permits issued in 2004 and 2005. Building material is mostly brick (57% of total buildings) which is appropriate for the hot weather. The climate is a constraint for building with concrete (3%) and stone (20%).



Source: Jericho Municipality 2005

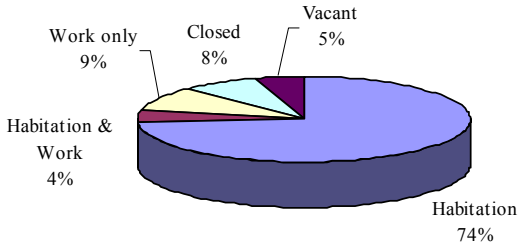
Figure 3.7 Number of Building Stories



Source: Jericho Municipality 2005

Figure 3.8 Building Materials

Buildings in Jericho are currently used for residential (74%), work or mixed use with work and residential combined (13%) and vacant buildings (13%).



Source: Jericho Municipality 2005

Figure 3.9 Utilization of Buildings

3.4 Urban Social Services

Almost all housing units have access to the water network (96% of total buildings), which is provided by the public sector. However, there is no sewage treatment system in Jericho city.

Household wastewater is directly discharged into the drainage system or collected by vacuum cars for disposal at the dumping site without treatment. The establishment of a sanitary sewerage system is therefore needed to cover the existing residential and urban centers.

Table 3.3 Wastewater Service for Major Cities in the West Bank

Major cities	% of wastewater service	Treatment Plant
Jenin	55 %	Not functioning
Tulkarem	75 %	Primary stage
Qalqilia	70 %	No
Nablus	80 %	No
Ramallah	75 %	Low efficiency
Jericho	0 %	No

Source: PWA (Working Group Meeting Presentation)

Another issue to be addressed in Jericho city is the improvement of the solid waste collection system as garbage is currently disposed of anywhere along the main roads and riverbanks. According to the data available from the Applied Research Institute (1997), the volume of solid waste is 28 ton/day in Jericho city. The existing dumping site in the eastern part of the city is not well-maintained and exceeds its capacity in the near future. It is necessary to improve the current landfill site and look for another location to install a new sanitary landfill site for the future population growth.

Table 3.4 Solid Waste in Jericho City (1994)

	Jericho
Domestic	28 ton/day
organic	67.0%
Paper	7.0%
glass	6.0%
plastic	17.0%
aluminum	2.0%
other	1.0%
Agro-industry (plastic)	250 ton/year
Medical Hazardous waste	2 ton/year
Population (1994)	21,500

Source: Applied Research Institute (1997)

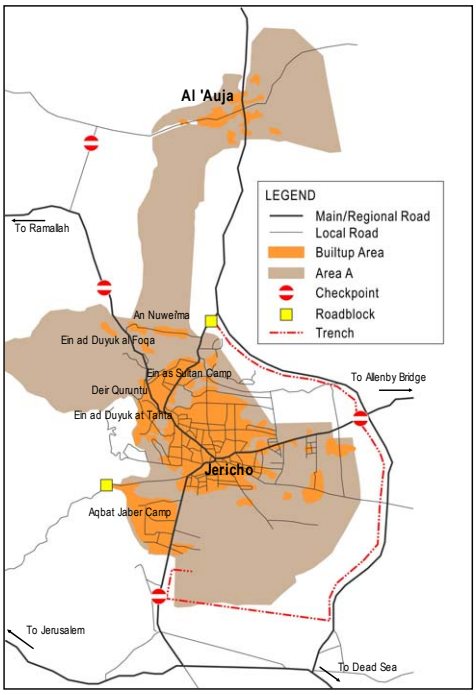
Figure 3.10 Landfill Site in Jericho City

Public facilities such as municipal buildings, the library, and post office are concentrated in the city center. The access to health care service is fair, according to the result of the socioeconomic survey conducted by the JICA Study Team. Concern of the urban population is more about the quality of such health care services, rather than the access to those facilities.

3.5 Road Network and Transportation

The road network has been developed with a radial pattern creating the existing urban structure of Jericho city. An inner ring road, which was proposed in the land use plan of 1988, is not utilized well as a trunk road under the current condition. An outer ring road was also planned but has not yet been constructed due to a lack of bridges across Wadi al Qilt. In order to mitigate traffic congestion in the city center, the outer ring road needs to be implemented in accordance with the future urban growth.

In terms of road condition, the main and regional roads are paved, while most local roads are unpaved (dirt roads). Some sections of the local roads are being paved by the Jericho Municipality, which is funded by USAID. The total length is approximately 10 km.



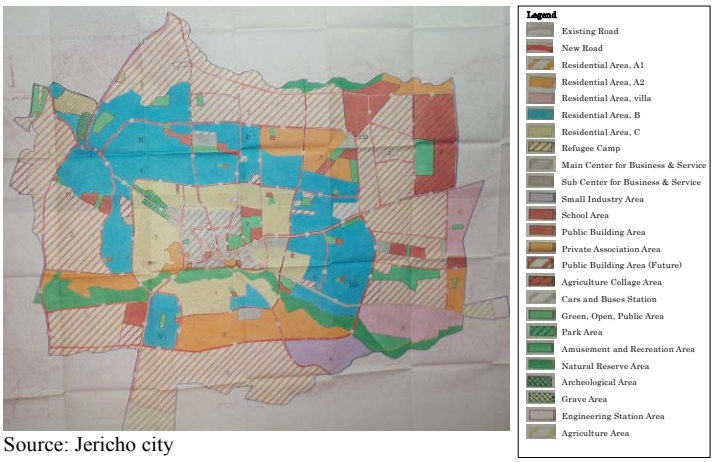
Source: JICA Study Team

Figure 3.11 Road Network in Greater Jericho

Traffic in the city center is inefficient and unsafe as is evident by the chaotic traffic conditions. Although traffic polices sometimes manage to control the traffic to provide smooth traffic flow, the problem has not been solved to an acceptable level.

3.6 Current Land Use

A land use plan for Jericho City prepared in 1988 is reproduced in the following figure. The area covers approximately 35 km^2 with an estimated population of about 25,000 including two refugee camps. The area planned for development has now been fully developed without a strategic urban development plan. Urban sprawl is in progress.



Source: Jericho city

Figure 3.12 Land Use Plan for Jericho City (Prepared in 1988)

A current land use map has been developed in the course of the study utilizing GIS technology with an IKONOS satellite image of 2004. Several layers showing roads, rivers, built-up areas, agricultural, public, commercial, industrial, vacant, archeological, and religious sites and buildings have been digitized from the satellite image and compiled into the land use map. The following analysis is based upon the GIS based land use map.

The city mainly consists of flat agricultural land (40% of total land) and unused land in the southern part of the city (35% of total land). The agricultural land adjacent to the built-up area gives an idyllic setting which is harmonized with the nature and the archeological sites.

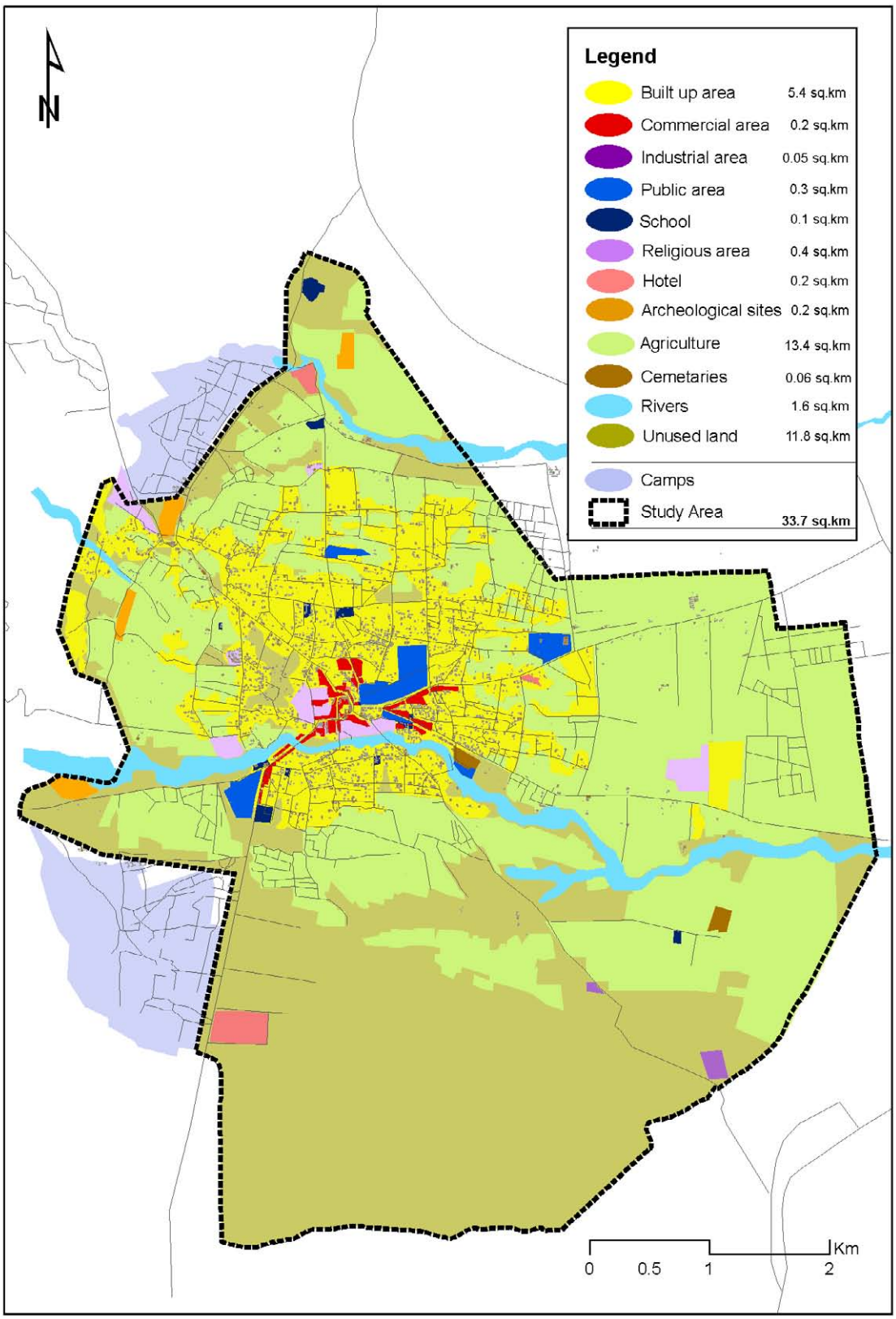
In the northwest part of the city, there are many archeological sites, which are major tourism assets of the city. The archeological sites are not maintained in good condition and subject to deterioration because of new development activities nearby or pollution and vibratory motion of cars passing alongside. Those cultural assets need to be protected by setting a clear boundary and establishing buffer zones with no development activity allowed.

The built-up area is 7.0 km^2 accounting for about 20% of the total land and spreads from the city center. The city center is extremely crowded because most urban functions are concentrated in the center, including administrative and commercial functions, wholesale markets, religious buildings, and recreational spaces. Furthermore, tourism facilities are planned to be added to the city center. It is necessary to pay attention to the city center, reducing the congestion and making the city center function much clearer.

Table 3.5 Current Land Use (2004)

Categories	Area (km^2)	Ratio
Built-up area	***7.0***	***20.7%***
Built up area	5.4	16.1%
Commercial area	0.2	0.6%
Industrial area	0.05	0.1%
Public area	0.3	1.0%
School	0.1	0.3%
Religious area	0.4	1.1%
Tourism	***0.3***	***1.0%***
Hotel	0.2	0.5%
Archeological Sites	0.2	0.5%
Agriculture	***13.4***	***39.9%***
Others	***1.8***	***5.4%***
Cemetaries	0.06	0.2%
Rivers	1.6	4.7%
Unused land	***11.6***	***34.5%***
Total	***33.7***	***100.0%***

Note: The area indicated in the table has been extracted from the Current land use map prepared on the basis of a satellite image (2004).
Source: JICA Study Team



Source: JICA Study Team

Figure 3.13 Current Land Use Map

3.7 Issues to be Addressed for Future Urban Development

Judging from the current situation of Jericho city, several issues need to be addressed, particularly for urban development in Jericho.

(1) Availability of Water

The availability of water is one of the leading factors in deciding the extent of future urban development and agricultural expansion in Jericho. The first priority of water use should be for domestic use, taking into account future tourism development as well as future population growth. It is not recommended to expand agricultural land, which consumes a great deal of water. However, in order to preserve green spaces and historical traditions, and adequate amount of agricultural land should be kept in Jericho city.

(2) Limited Public Land

The city owns very little public land available for future development. Most public lands concentrate in the city center and are mainly for administrative buildings, public parks, and sport fields. Those facilities are mixed with other uses such as tourism information centers, commercial, small retail outlets, schools, and residential buildings. Issues to be addressed in future development of administrative functions and public services are how to secure public spaces to provide sufficient public services for the growing population. Under the current condition, administrative offices are scattered in and around the city center. In view of the fact that the city center is crowded with more tourism or commercial functions and expected to become a tourism center in the near future, it is recommended that the administrative buildings be relocated to a new administrative center and the land in the city center be used more effectively.

A candidate location for the new administrative center is found in the southern part of the city where the land is currently unused and owned by a single owner.

(3) Preservation of Archeological Sites

There are about 80 archeological and potential tourism areas in and around Jericho city, and the most significant archeological sites are located in the northwestern part of the city, such as Tell es-Sultan, Hisham's Palace, and the Herod's Palace. Those sites have great potential to attract visitors, but they are not well-maintained. There is also a great concern that future development activities might deteriorate those archeological assets unless due attention is paid to preservation of the sites. The current legal system for control of development activities is not effective to protect those assets as desired, so it is necessary to establish a legal system to preserve the cultural assets under the land use management plan.

(4) Vulnerable Tourism Assets

Jericho city is rich in tourism assets and is expected to be an international tourism city in the future. In the event that more tourism related facilities are established to receive tourists and visitors, the city and tourism assets will turn out to be vulnerable to such facility development and increased number of visitors. Therefore, tourists should be properly guided to lessen such vulnerability.

The lack of a tourism center in the city is, therefore, an issue to be addressed in promoting the city as a tourism center. The city center should be the core of tourism activities where tourists start exploring the city, get tourist information, and enjoy meals.

(5) Land Availability and Land Tenure

The existing built-up area extends from the city center in a radial pattern. The density of the built-up area is not high and the built-up area has space for fill-in development to accommodate future population growth. Furthermore, in the southern part of the city, there exists a sizable area of flat and unused land owned by a single owner, i.e., the Ministry of Islamic Religious Affairs. Currently the area has a small number of buildings and this area has great potential for future development. The land tenure in this sizable flat land area, as well as the built-up area in the city center, should be duly taken into account in the land use management plan for Jericho city.

The area also has potential as an administrative zone by subdividing the unused land for infrastructure development by the public sector.

4 DEVELOPMENT FRAMEWORK

This Chapter discusses future development frameworks targeting 2025. The framework is set for population and tourism development on which to base land use planning.

4.1 Population Framework

The population framework is set based upon the population growth estimated in the Master Plan for Jericho Regional Development. The total population of Jericho city was about 20,000 persons in 2005 and the annual average growth ratio was 2.7%. The population projection made in the Master Plan for tourists in 2015 is extrapolated for the estimate of population in 2025. In addition, the number of workers in the tourism sector is estimated as tourism is expected to grow to become a major industry in 2025.

The population framework is thus set as follows.

(i) Annual average growth ratio is 2.7%

(ii) Employment in the tourism sector is estimated to be 9,000 persons in 2025, of which 80% would reside in the Greater Jericho area.

The total population of Jericho city in 2025 will be approximately 38,000 persons, which accounts for nearly 60% of the estimated total population in the Greater Jericho area. Jericho city is expected to be a major urban area to accommodate future population growth in the Greater Jericho area.

Table 4.1 Population Framework in Greater Jericho

	Actual	Target Year		
locality	2005	2015	2025	
			Population	Employment
Al 'Auja	3,886	5,080	6,631	808
An Nuwei'ma	1,128	1,476	1,927	235
'Ein ad duyuk al Foqa	789	1,031	1,346	164
'Ein ad Duyuk at Tahta	937	1,225	1,599	195
Jericho	19,783	25,863	33,759	4,112
Aqbat Jaber Camp	6,147	8,035	10,488	1,277
'Ein as sultan Camp	1,972	2,579	3,366	410
Total	**34,642**	**45,289**	**59,115**	**7,200**

Note : 2005-2006: revised mid-year population projection, Small Area Statistics 2005(website)
: The total number of workers in 2025 for the Greater Jericho is estimated to be 9,000 employees, 80% of which is assumed to reside in the Greater Jericho area.
Source : PCBS; JICA Study Team Estimation

Consequently, the future land use will be developed based upon the scenario that the city would have a total population of 38,000 persons in 2025. For the purpose of land use planning, the Jericho population is assumed to be around 40,000 in 2025.

4.2 Tourism Development Framework

Another important factor to be taken into account for future urban development is the number of tourists. Under the Master Plan for Jericho Regional Development, it is estimated that the tourists would amount to 670,000 in 2015 under the moderate growth scenario. By extrapolating the growth rate of tourists, the number of tourists is estimated to be 900,000 persons in 2025.

Table 4.2 Targeted Tourism Development Framework

	Actual		Target Year
	2004	2015	2025
Tourist Arrivals in Jericho	98,248	670,000	900,000
Overnight Tourist	33,000	402,000	540,000
Average Duration of Stay(nights	1.0	2.5	4.0
No.of Bed /night	33,000	187,500	317,647
Hotel Rooms	323	648	870
Employment	250	6700	9,000
Tourism Revenue	$12mil.	$251mil.	$324mil.

Note: The figures for 2004 and 2015 in the table above are taken from Alternative II of the tourism development scenario in the Master Plan for Jericho Regional Development.
Source: JICA Study Team

4.3 Population Density

The current population density in Jericho city is 270 m^2 per person in the built-up area of 5.4 km^2. As noted previously, the existing built-up area is sparsely developed with scattered buildings. In order to accommodate the increased population in the future, there are some spaces that could be filled in the built-up area.

The following table presents three alternative cases of population density. Case 2 is a national standard for population density in the West Bank and Gaza. In such a case, an additional 3.8 km^2 of the built-up area will be required for future development. With this case, the existing built-up area is to be developed with a moderately high population density which will not disturb the exiting landscape. About 40% of the existing total built-up area, or 3.8 km^2, will additionally be required as a new development area towards 2025.

Table 4.3 Three Cases for Future Population Density

Case	2005			2025		
	Pop.	**Pop.Density (m^2/person)**	**Built up area (km^2)**	**Pop.**	**Pop. Density (m^2/person)**	**Built up area required (km^2)**
Case 1 Keep current populatoin density	20,000	270	5.4	40,000	270	10.8 (+5.4)
Case 2 Medium density(National standard for built-up area)					230	9.2 (+3.8)
Case 3 High density					135	5.4 (0)

Note: The population figures are rounded figures.
Source: JICA Study Team

5 DEVELOPMENT CONCEPT FOR THE GREATER JERICHO AREA

This Chapter discusses a development concept for the Greater Jericho area in order to explore future development directions of this region. It also aims at making the role and local setting clear for Jericho city since future development of Jericho city should be well coordinated with the regional development directions. By drawing a development concept for the future Greater Jericho area, Jericho city and other urban centers in the Greater Jericho area can be developed in a more harmonized manner.

5.1 Development Potential and Constraints of the Greater Jericho Area

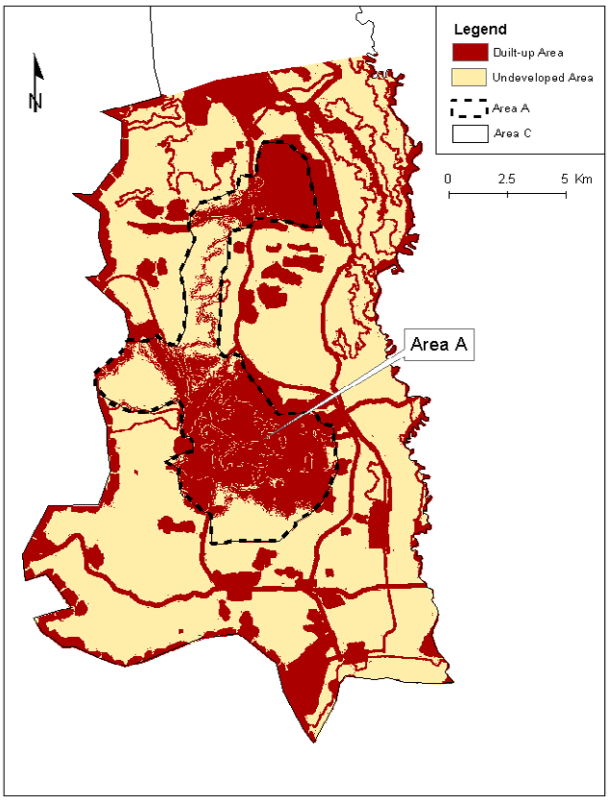
There are several constraints on future development in the Greater Jericho area in terms of land availability. The most critical constraint is the current occupational position in Area C which accounts for 80% of the total land in the Greater Jericho area as shown in the following table. Area C is not permitted for development but utilized for agriculture (mainly livestock) in some areas.

Table 5.1 Area by Land Use Categories in Greater Jericho area

1			2	3	4=2+3	5
Area(km2)			Existing Agriculture Area(km^2)	Potential Agriculture Area(km^2)	Total Area for Agriculture area (km^2)	Natural Reserve Area(km^2)
Area A&B	Area C	Total				
69	278	347	87	88	175	18
20%	80%	100%	25%	25%	50%	0.50%

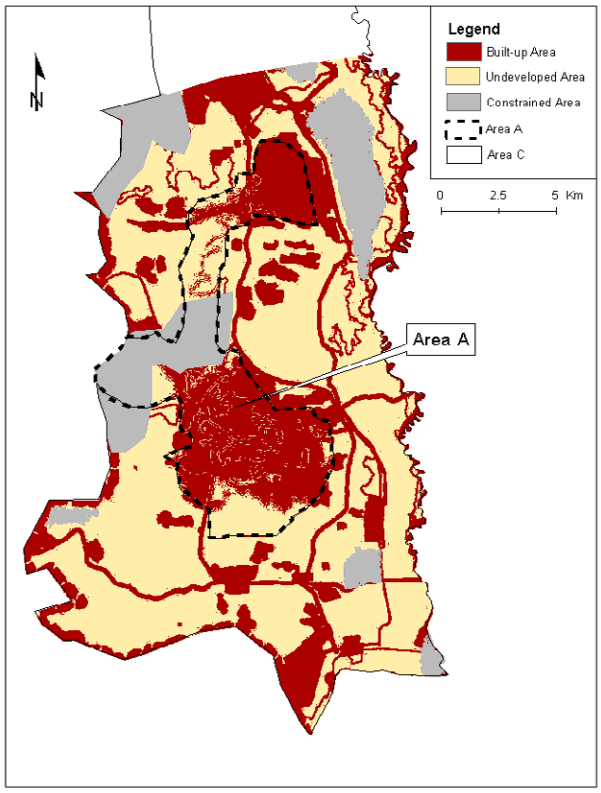
Source: JICA Study Team

Another characteristic of the Greater Jericho area is the cultivable land which accounts for half of the total land. The current agricultural land extends mainly to the north of Al' Auja and Jericho city. Agriculture, therefore, will remain as one of the major industries to support the regional economy in the future. In the Master Plan for Jericho Regional Development, it is envisaged that the current size of agriculture would remain the same with less water consumption by means of water saving agriculture. This development policy will be followed so that the land available for future development in Areas A and B would be developed in more effective ways, and development in Area C would be envisaged if and when the political situation permits in the future.



Source: JICA Study Team

Figure 5.1 Built-up Area in the Greater Jericho Area



Source: JICA Study Team

Figure 5.2 Area Constrained for Development in the Greater Jericho Area

Another important factor to be considered in future development is the limitation of water. As noted in the previous section, the Greater Jericho area has limited water supplies and the capacity of available water is one of the major factors to determine the allowable population size and agricultural activities. The allowable population size can be estimated in the following manner.

(i) Potential water available in 2025 is estimated to be 46 MCM/year.

(ii) Distribution of water use is set as indicated in the following table.

(iii) The number of tourists in 2025 is estimated to be 900,000 persons.

(iv) The current per capita agricultural output is US$1,276 and should not be substantially decreased.

The allowable population in 2025 is estimated to be 120,000 persons in the Greater Jericho area to satisfy the above noted conditions. Compared with a population framework set in the previous section, the total population at allowable level will be increased by 50,000 persons from 70,000 persons. In order to accommodate such an extraordinary population increase in the Greater Jericho area, unused lands need to be utilized for residential use. The potential

area for future residential use could be the northern part of the existing built-up areas in An Nuwei'ma and Ein ad Duyuk at Tahta and the southern part of Jericho city (currently classified into Area C).

Table 5.2 Allowable Population Size based on Water Demand

Case		Population	Potential Water Resources as of 2025	Municipal & Industrial Demand						Agriculture Water and Production		
				Domestic	Tourism	Public	Livstck	Indst.	Total	Remining Water for Agriculture	Assumed Product	Per capita Agri. Product
				160 lpcd	*200 lpc*	*3%*	*10%*	*15%*				
		(persons)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(MCM/yr)	(mil.US$)	(US$/capita)
Case-0	(Current Situation)	34,642	26	3.1					3.1	23	44.2	1,276
Case-1	(Projected)	70,000	46.0	4.1	0.2	0.2	0.6	0.9	5.9	40.1	118.1	1,687
Case-2		100,000	46.0	5.8	0.2	0.3	0.8	1.3	8.4	37.7	110.9	1,109
Case-3		120,000	46.0	7.0	0.2	0.3	1.0	1.5	10.0	36.0	106.2	885
Case-4		150,000	46.0	8.8	0.2	0.4	1.2	1.9	12.4	33.6	99.0	660
Case-5		200,000	46.0	11.7	0.2	0.5	1.6	2.5	16.5	29.5	87.0	435
Case-6		250,000	46.0	14.6	0.2	0.6	2.1	3.1	20.5	25.5	75.1	300

Source: JICA Study Team

5.2 Future Development Direction

Considering the existing conditions and future potential for development, the development concept and land use zoning for the Greater Jericho area are proposed in the following manner.

Built-up area

- Major built-up areas are Jericho city and Al' Auja, and they will be developed in accordance with the population growth utilizing the available unused lands.
- The southern part of Jericho city, currently unused land, will be newly developed to accommodate future population growth
- Nuwei'ma and Ein ad Duyuk will, potentially, be built-up areas for future development in conjunction with the possible expansion to the north (currently in Area C).

Agriculture

- Current agricultural lands will be kept as they are, with higher productivity attained through water saving agriculture.
- Agro-industries are planned to be located to the north of Al' Auja or north-east of Jericho city in order to induce higher added value in agro-based industry.
- The existing agricultural lands to the west of the Jordan Rift Valley will be developed in conjunction with development of agro-industries.

Tourism

- Jericho city will be developed as a major tourism center, attracting more international tourists, as well as local visitors.

- Resort tourism development in the Dead Sea area will be proposed to stimulate tourism in the longer term.
- The area around the Dead Sea bordering with Jordan and Israel would be proposed for a border-free eco tourism zone utilizing existing nature resources and geographical advantages.

Future utilization

- The western part of the Greater Jericho area and the southeastern part of Jericho city, currently designated as Area C, will be potential areas for future utilization in accordance with the future development needs.
- Logistic centers will be developed near by proposed agro-industries and major street network in the future utilization zone.

To develop the Grater Jericho area as a regional cluster, linkages among development centers are to be promoted. The concept of such linkages is proposed as summarized as in the following.

Al' Auja and Jericho city

- A cooperative relationship and linkage is to be enhanced under the principles of "effective usage of water resources", "environmental considerations of the Jordan Rift Valley", and "promotion of strategic agricultural products"

Jericho city and the eastern regions

- Jericho city is a gateway to/from Jordan and the Gulf countries.
- Trade in products with these countries will be provided with Jericho serving as a logistical center.

Jericho city and Dead Sea area

- Expanded tourism development will be envisaged in the Dead Sea area in cooperation with Jordan and Israel.

Jericho city and Jerusalem

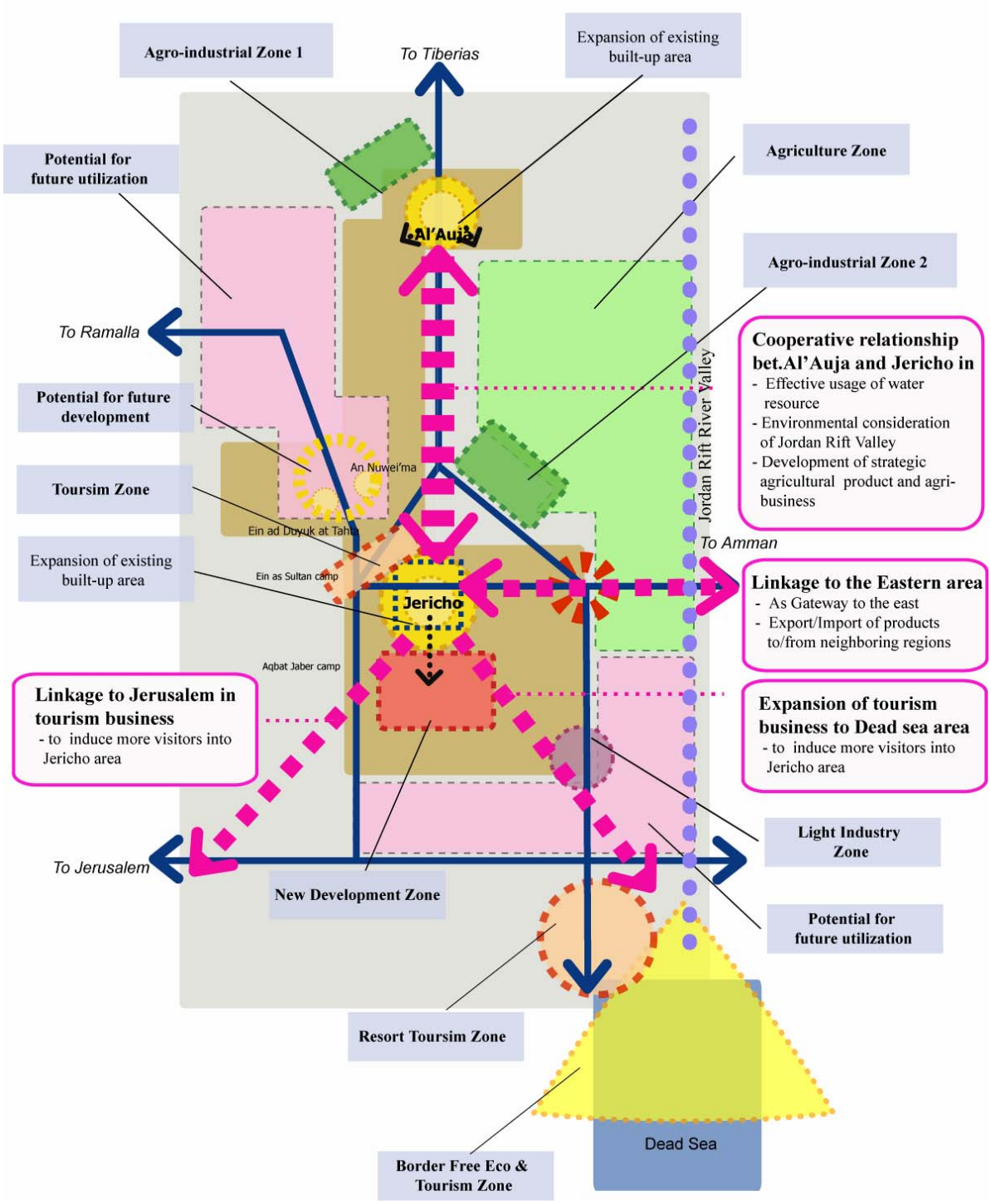
- More visitors from Jerusalem and other urban centers in the West Bank are envisaged.

A development concept for the Greater Jericho area is proposed as shown in the map on the following page that illustrates future zoning, major functions, and linkage among regions.

Under the development concept of the Greater Jericho area, the direction of future development of Jericho city would became clearer as indicated in the following.

Direction of future development for Jericho city under the Concept of the Greater Jericho area

- ✓ Tourism center targeting international regional visitors
- ✓ Gateway to/from the east in trade and logistical flow
- ✓ A center of agro-industry/agro-tourism in the region
- ✓ Cross roads of corridors connecting east to west and north to south.



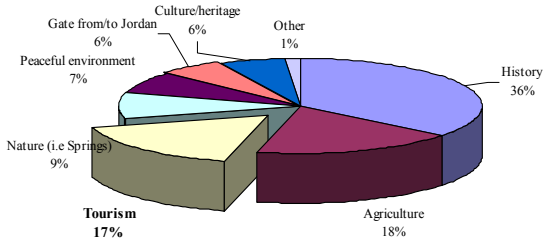
Source: JICA Study Team

Figure 5.3 Development Concept for the Greater Jericho Area

6 DEVELOPMENT CONCEPT FOR JERICHO CITY

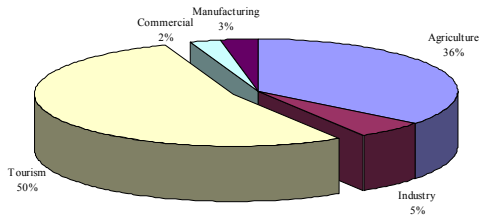
6.1 Images of Future Development

A questionnaire survey was conducted in April 2006 to residents in Jericho city and the surrounding areas in the Greater Jericho area to understand and reflect their images for future development (Refer to Annex 2). The survey revealed that the expectation for the tourism sector is remarkably high. As indicated in the following figure, about 60% of the respondents answer that they are proud of tourism related assets such as the historical and cultural heritages of Jericho. Most residents expected the tourism sector to lead the Jericho development in the future.



Source: JICA Study Team

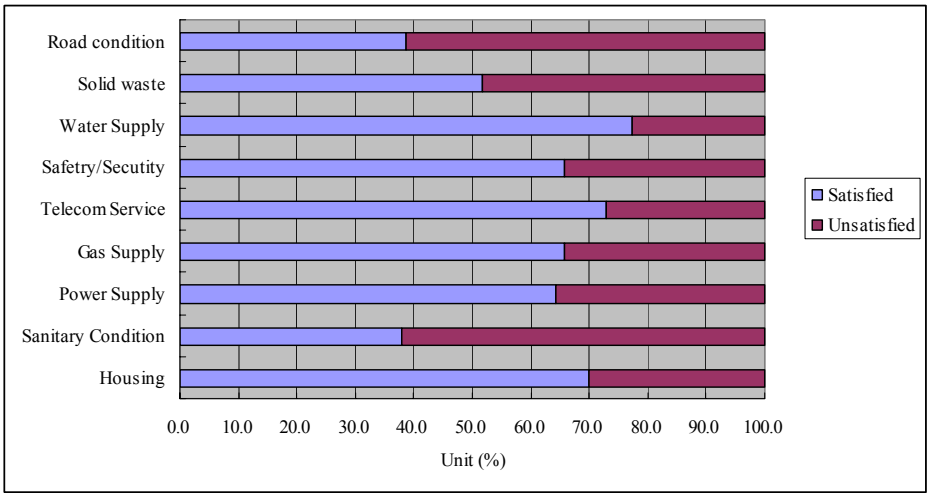
Figure 6.1 "What you are proud of in Jericho?"



Source: JICA Study Team

Figure 6.2 "What do you expect as a leading industry in Jericho"

Tourism is, indeed, a leading factor in creating a future image of Jericho as well as the Greater Jericho area. The people recognize its significance for their futures. In terms of the living environment in Jericho city, the people pointed out that the sanitary condition is the most unsatisfactory of all services, in which more than 60% of the respondents answered "not satisfied" as shown in the following.



Source: JICA Study Team

Figure 6.3 Satisfaction with the Living Environment of the Jericho People

For water supply, the people's concern is the quality of water, and about 60% of the respondents regarded the water quality as the most concerning issue in the provision of services in Jericho city. The survey result also indicates that the improvement of urban infrastructure is also required for development of Jericho city as an international tourism center.

6.2 SWOT Analysis for Jericho City Urban Development

A SWOT analysis for the urban development plan for Jericho city was conducted at the urban planning working group meeting on 27 May 2006. More than 20 participants from local government, NGOs, and the private sector discussed the Strengths, Weaknesses, Opportunities and Threats of the city in order to formulate a vision for future development. Discussion and analysis were made for 12 sectors, including tourism, water, agriculture, the environment, infrastructure, land use, industry, politics, NGO's, commerce, housing, and health care (Refer to Annex 3). Among these sectors, agriculture, tourism and water resources were selected as key factors. The results of the SWOT analysis are summarized as follows.

Table 6.1 Summary of SWOT Analysis on Tourism

Strengths	***Weaknesses***
- The value of more than 10,000 years of history - Warm climate in winter - The existence of many tourist sites and their proximity to each other	- Lack of marketing in tourism - Archeological sites are not well-utilized - Lack of infrastructure for tourist services - Lack of attractive souvenirs for tourists - Lack of tourism education for guides
Opportunities	***Threats***
- Jericho as a regional center for tourism	- Existence of factories (Pollution) - Unstable political situation

Source: JICA Study Team

Table 6.2 Summary of SWOT Analysis on Agriculture

Strengths	***Weaknesses***
- Warm climate in winter - Sufficient and fertile land for agriculture - Specialized crops in Jericho and the Jordan Rift Valley - Highly experienced laborers	- Lack of marketing - Limited water resource - Scientific technique on improvement of agricultural products
Opportunities	***Threats***
- Well-organized agricultural association - Export of agricultural products	- Situation of currently being under occupation - Soil salinity - Scarce water in summer time - Decrease in price due to competition with Israel

Source: JICA Study Team

Table 6.3 Summary of SWOT Analysis for Water resources

Strengths	***Weaknesses***
	- Insufficient water resources for future growth - No sewage network system - Lack of control of water resources due to Israeli occupation
Opportunities	***Threats***
- Exploitation of groundwater	- Unstable political situation - Pollution resulting from the untreated wastewater

Source: JICA Study Team

The SWOT analysis will lead to various implications in the urban development of Jericho city, including the following.

(1) Tourism Sector

The tourism sector is one of the leading sectors for future development of the city. It is observed, however, that there is a lack of management, presentation, and guidance in the promotion of tourism products to potential visitors. For future improvement, it is essential to develop valuable archeological sites as international tourism attractions with appropriate signage, guides, and supporting facilities to attract more tourists and visitors.

(2) Agricultural Sector

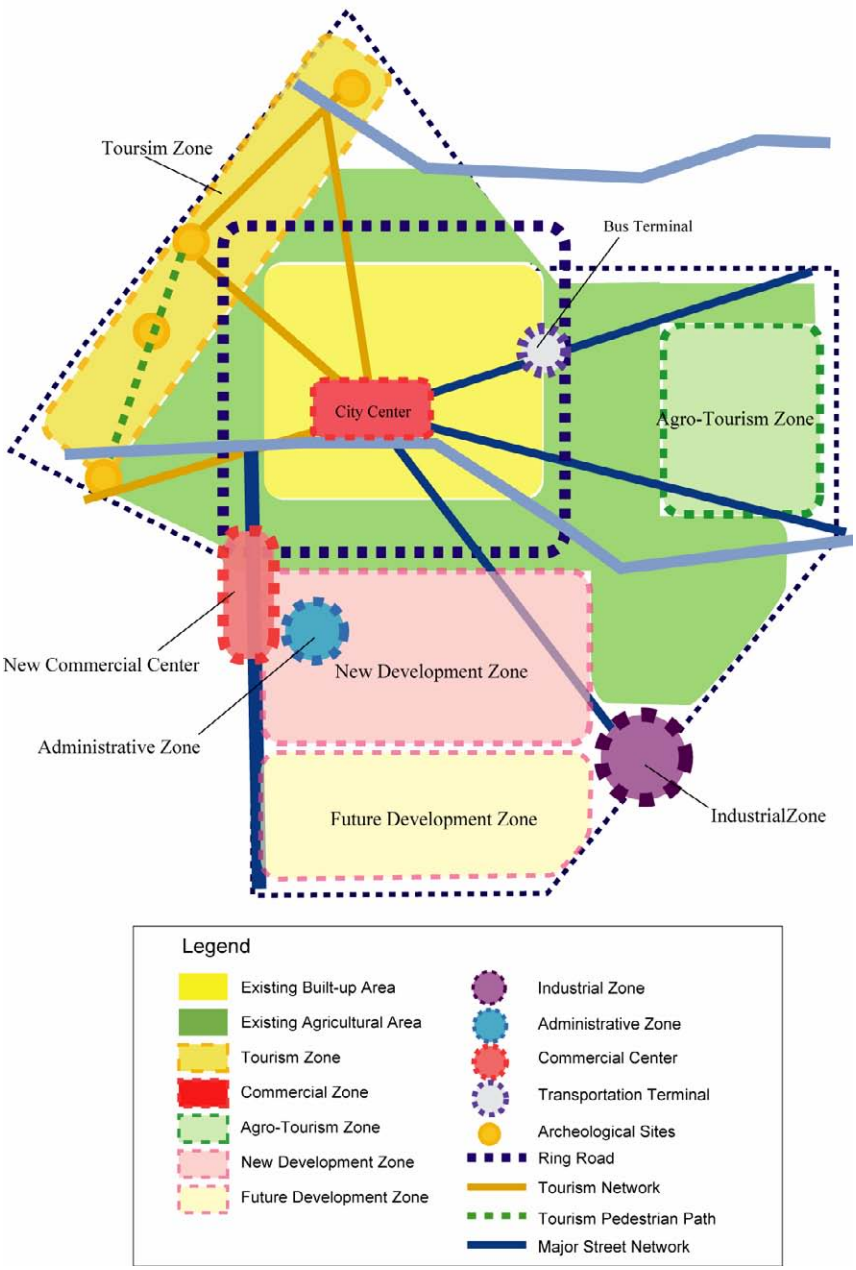
The agricultural sector is currently leading the Jericho economy and there is a potential to expand export-oriented agriculture. On the other hand, there is the limitation of water resources constraining future growth. A new type of agriculture should be developed, not only for the regional economy, but also for harmonized urban development in Jericho city.

(3) Water Resources

The above two sectors are major industries, which in turn would be dependent on water resources. It is therefore, important to make maximum use of the limited water resources for domestic and agricultural uses, properly designating the land use zones in Jericho city.

6.3 Development Concept

The development concept for Jericho city was discussed at the meetings of the urban planning working group which is composed of representatives from Jericho municipality, the departments of agriculture, tourism, water supply and wastewater management, as well as from academic circles. The working group analyzed the existing conditions, issues to be addressed and the survey results and formulated a development concept for Jericho city as presented in the following.



Source: JICA Study Team

Figure 6.4 Development Concept for Jericho City

Basic concept of development in each zone has been defined in the following manner.

Built-up Area

The existing built-up area will gradually expand in the in-fill development areas.

New Development Zone

The area to the south of the existing built-up area, currently vacant land with some buildings under construction, will be utilized for new development, accommodating an administrative zone and a commercial center.

Future Development Zone

The area adjacent to the south boundary will be utilized for long-term development in accordance with infrastructure development.

Industrial Zone

The southeastern part, with an existing steel mill, will be used for light industries, including manufacturing or local production. Logistic center or major heavy industries will be developed outside of the city as indicated in a map of the development concept for Greater Jericho area.

Tourism Zone

The area of archeological sites will be developed to accommodate tourism facilities, including hotels, and the existing tourism facilities will be improved.

Agro-tourism Zone

The area surrounded by the existing agricultural area will be developed as an agro-tourism zone with agriculture-related facilities, which will be open to visitors to experience agriculture and enjoy its products.

Administrative Zone

Major administrative functions, which are scattered in various part of the city, will be collectively located in a joint government building in the new development area.

Street Network

A ring road is proposed to alleviate heavy-load traffic outside the city center.

The tourism transportation network will be improved in such a manner that the archeological sites will be connected with pedestrian walk ways shaded by trees along the street.

7 LAND USE PLAN FOR JERICHO CITY

7.1 Land Use Plan

In accordance with the development concept, land use categories and land use types have been determined as summarized in the following table. The land use plan consists of built-up zones, tourism zones, agriculture zones, other land use zones, as well as open spaces, which are classified by land use type.

Table 7.1 Land Use Categories and Land Use Types

Categories	Land Use Type
Built-up Zone	
Built-up area: Low density	It will be located in the existing built-up areas and developed with low density to maintain the existing landscape.
Built-up area: Medium density	It will be located in the south part of the city, and is to be newly developed with medium density. Infrastructure should be developed with a high priority.
Built-up area: Future development	It will be located in the area to the south of the new development area. The area is to be reserved for future development.
Commercial area	It is to be expanded along major streets connecting the city center with major tourism sites. A new commercial center is to be established in the new development zone. The existing city center is to be a tourism center and a new commercial center is to be developed outside the city center.
Industrial area (Industrial Zone)	The industrial area is to be expanded in the existing factory area to accommodate light industries. A buffer zone is to be placed around the industrial area to segregate the zone from residential areas.
Public area (Administrative Zone)	The administrative zone is to be established in the new development area to the south of the city to collectively locate administrative offices which are currently scattered through the city.
Religious area	The existing religious places shall remain as they are.
Tourism Zone	
Tourism area	It will be located to the northwest of the city where archeological sites and tourism facilities are concentrated. The area is to be developed for tourism related facilities such as hotels, restaurants, etc.
Archeological sites	Existing archeological sites are to be preserved by setting their exact boundaries and buffer zones.

Categories	Land Use Type
Agriculture Zone	
Agricultural area	Existing agricultural lands are to be kept as they are.
Agro-tourism area	It will be located to the east of the city where a research center and/or academic facility related to agriculture are to be located. The area is to be used for agro-tourism where tourists and visitors can practice cultivation on holidays and enjoy taste of fresh local agricultural products.
Others	
Cemeteries Buffer Zone Open Space Rivers	These include cemeteries, buffer zone, open space, and rivers. The buffer zone indicates the area around archeological sites and wadi to protect them from any development activities. The area surrounding wadis is to be preserved for open space to provide green space for recreational purposes as well as protection of the natural environment.

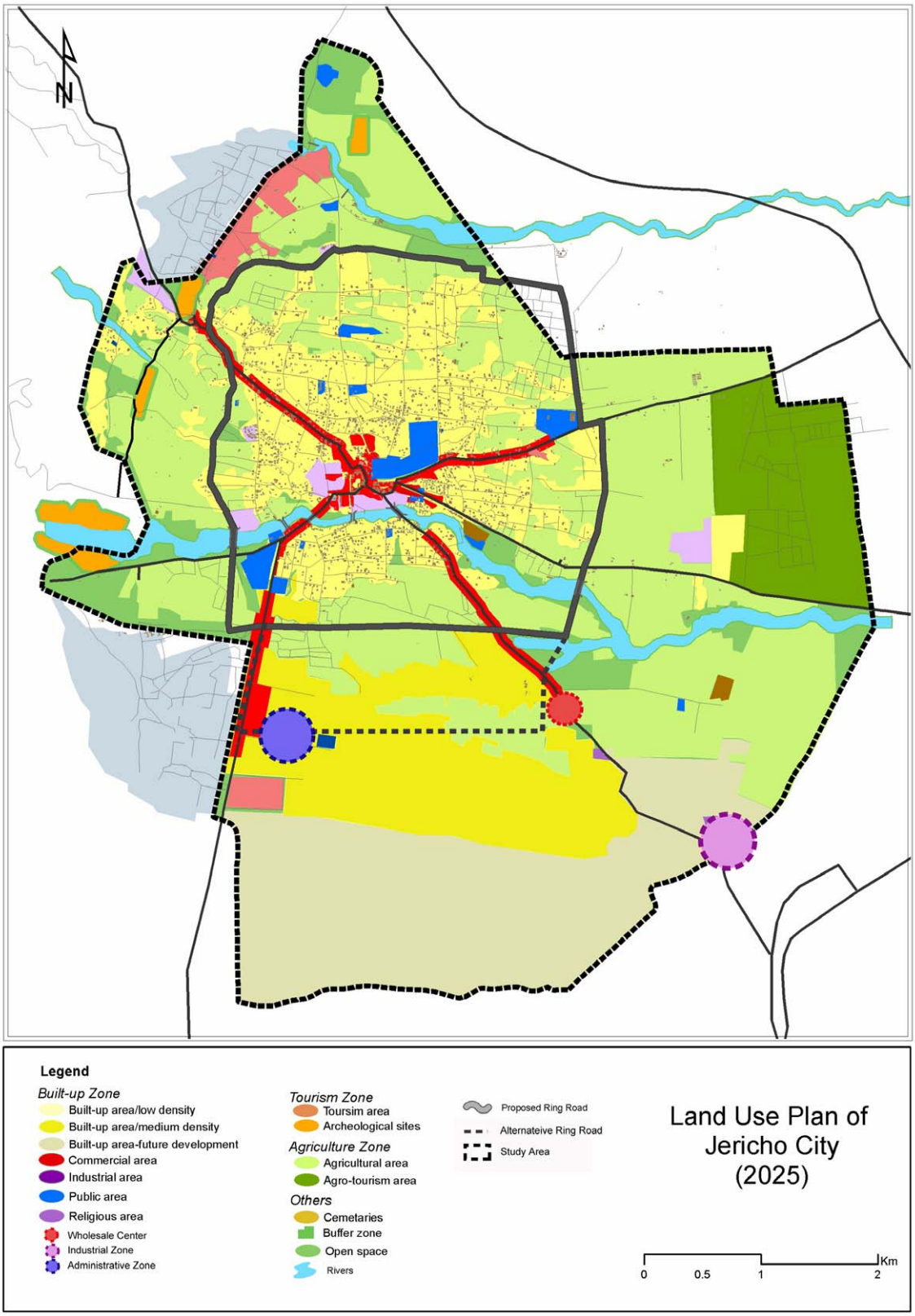
Source: JICA Study Team

A land use plan targeting 2025 has been elaborated as shown on the following page. The area by land use category is calculated from the GIS base map, as summarized in the following table.

Table 7.2 Area by Future Land Use Category

Categories	Area (km^2)	Ratio	Change from 2005 to 2025
Built-up Zone	***17.3***	***51.3%***	***+10.3***
Built up area-low density	5.4	16.1%	0
Built up area-medium density	4.5	13.2%	+4.5
Built up area-future development	5.5	16.3%	+5.5
Commercial area	0.8	2.3%	+0.6
Industrial area	0.3	0.7%	+0.25
Public area(incl. school)	0.5	1.5%	+0.2
Religious area	0.4	1.1%	0
Toursim Zone	***0.7***	***1.9%***	***+0.3***
Tourism area(incl.hotel)	0.5	1.4%	+0.3
Archeological sites	0.2	0.5%	0
Agriculture Zone	***13.4***	***39.9%***	***0.0***
Agriculture area	11.4	33.9%	0
Agro-tourism area	2.0	6.0%	0
Others	***2.3***	***6.9%***	***+0.5***
Buffer Zone	0.05	0.1%	***+0.05***
Open Space	0.6	1.9%	***+0.6***
Cemetaries	0.06	0.2%	0
Rivers	1.6	4.7%	0
Total	***33.7***	***100.0%***	***0***

Source: JICA Study Team



Source: JICA Study Team

Figure 7.1 Land Use Plan Targeting 2025

7.2 Land Use Management

To activate the land use plan or zoning as discussed in the foregoing section, it is necessary to establish a legal system to authorize the plan or zoning of Jericho city. Under the current system, there is no antecedent to authorize a plan at the master plan level. Normally, a plan for regional development with detailed schemes of land use is authorized under Law Number 79, which originated from the 1966 Jordanian Law. Its procedures are indicated in the following chart.

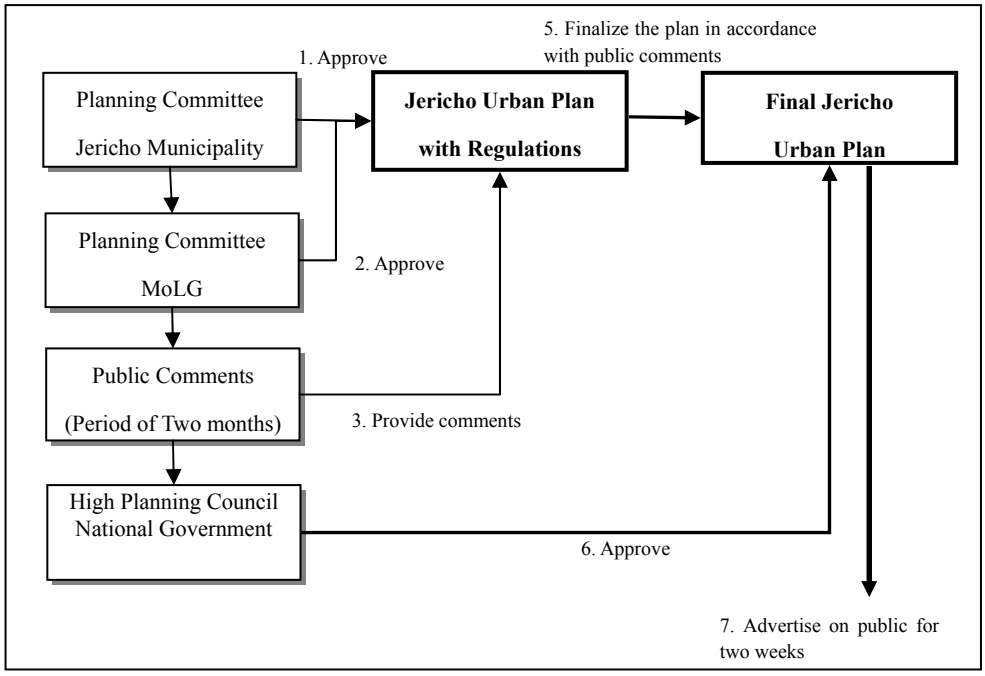


Figure 7.2 Current System to Approve Urban Plans

Firstly, a local planning committee in a municipality approves the regional plan and passes it on to a planning committee in the Ministry of Local Government (MoLG) for its approval. Then, the plan will be open to the public for two months to get public comments, and the comments will be reviewed by the planning committee in the municipality for finalization of the regional plan. Finally the regional plan will be sent to the high planning council at the national level for approval within a one year period. With the approval of the high planning council, the plan will be effective and advertised to the public for two weeks.

Unfortunately, the Jericho city urban development plan proposed in this Study is not a regional plan or urban plan to be approved at the high planning council, but it is at a master plan level. For authorization of the master plan, it is required to establish a process to make it effective under current Law No. 79. The following chart indicates the proposed legal procedure to authorize the master plan together with the subsequent step for approval of a detailed urban plan for Jericho city.

The procedure will be separated into two stages, i.e., the first stage is for authorization of the master plan on a provisional basis and the second stage is for authorization of the detailed urban plan and final authorization of the master plan. At the first stage, the master plan will get provisional approval from the high planning council after the approval of the local planning committee, as well as meetings of the municipality and MoLG. With the provisional approval, the municipality can move on to the second stage to develop a detailed urban plan with consolidated regulations. As for the authorization of the detailed urban plan, the same procedure as the one in the current system is to be followed. Together with the final approval of the detailed plan, final approval of the master plan will be obtained and advertised to the public. It is important to proceed with these steps to make those plans effective at the earliest possible time in order to authorize the municipality to control development activities based upon this master plan and the subsequent detailed urban plan.

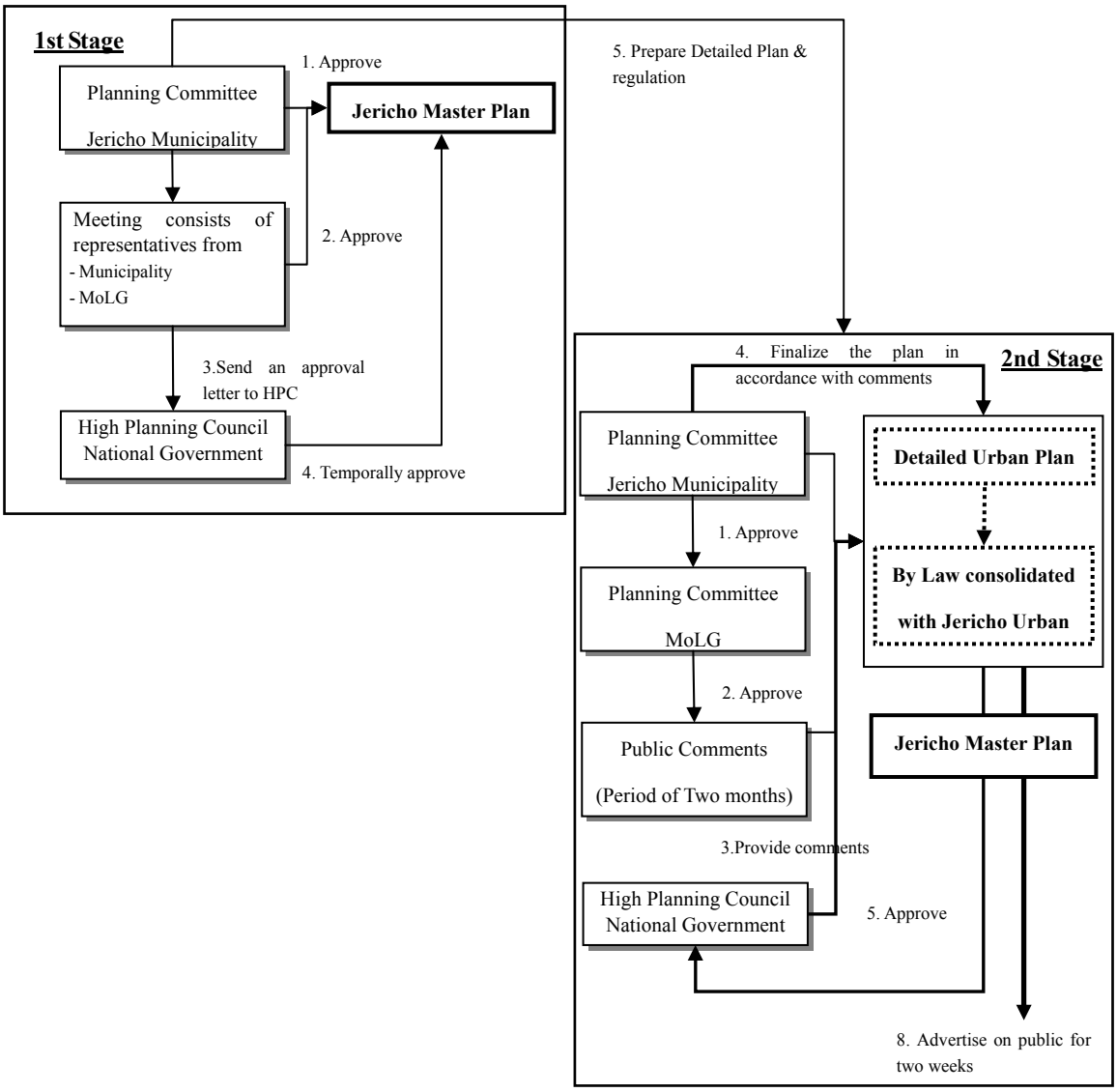


Figure 7.3 Proposed System for Approval of the Master Plan and Detailed Urban Plan

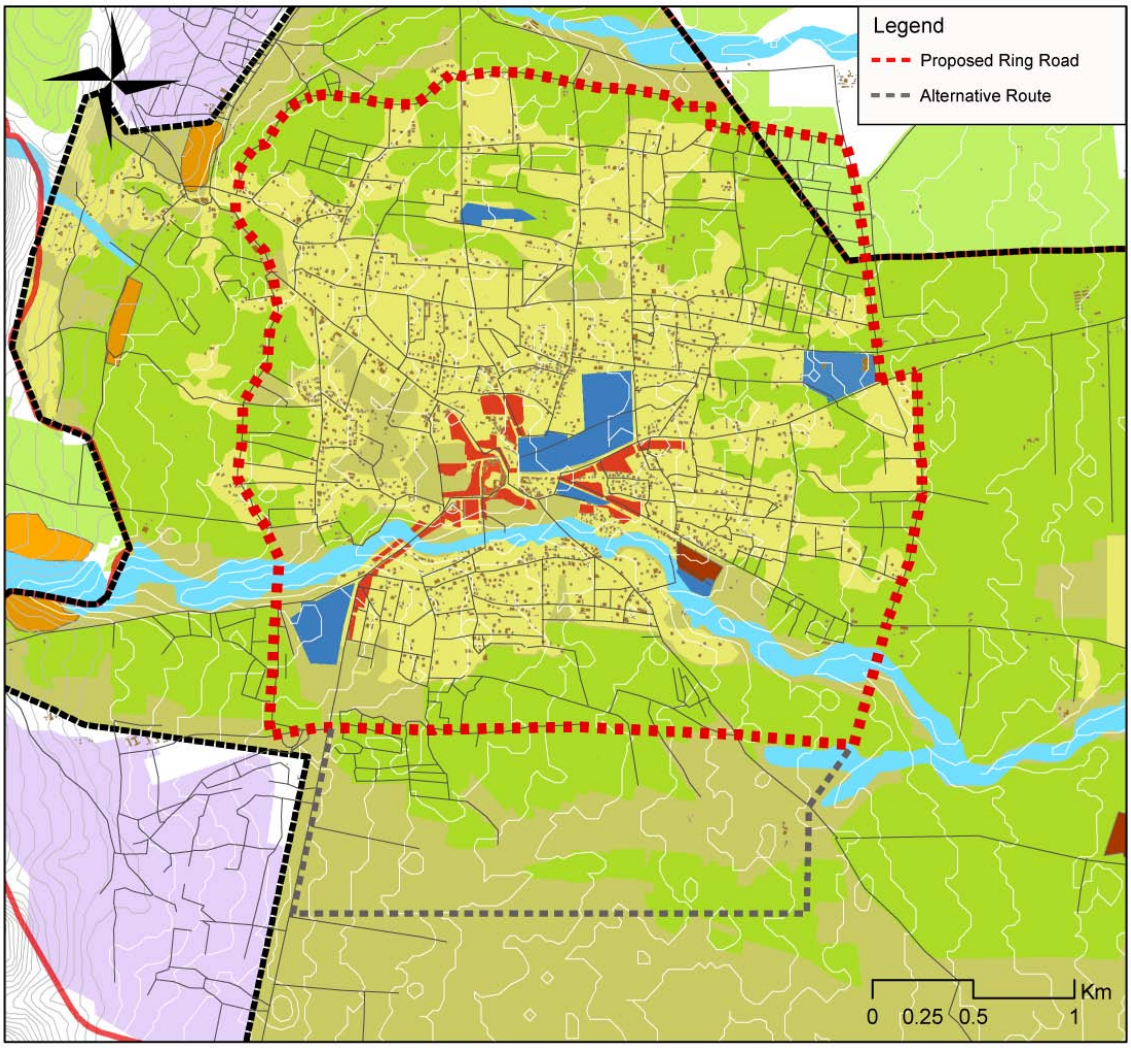
8 FACILITY PLANS

8.1 Transportation Plan

Several programs are proposed for transportation improvement to ensure a better environment for the residents and tourists.

(1) Development of the Jericho Ring Road

In view of the urbanized area, terrain and location of tourism spots, the alignment of the ring road is proposed as in the following figure. The ring road is to run through nearby major tourism spots in the north-western area and the Bridge Bus Terminal in the eastern area. The total length is about 12 km including two bridges across the Wadi al Qilt.



Source: JICA Study Team

Figure 8.1 Proposed Jericho Ring Road

(2) Traffic Management Program

Based on a site reconnaissance, the traffic management measures to be applied to Jericho city are proposed as summarized in the following table. In order to implement such traffic management measures, it will be necessary to conduct further studies which will include analysis of detailed traffic data, identification of traffic problems, formulation of solutions, and estimation of improvement costs.

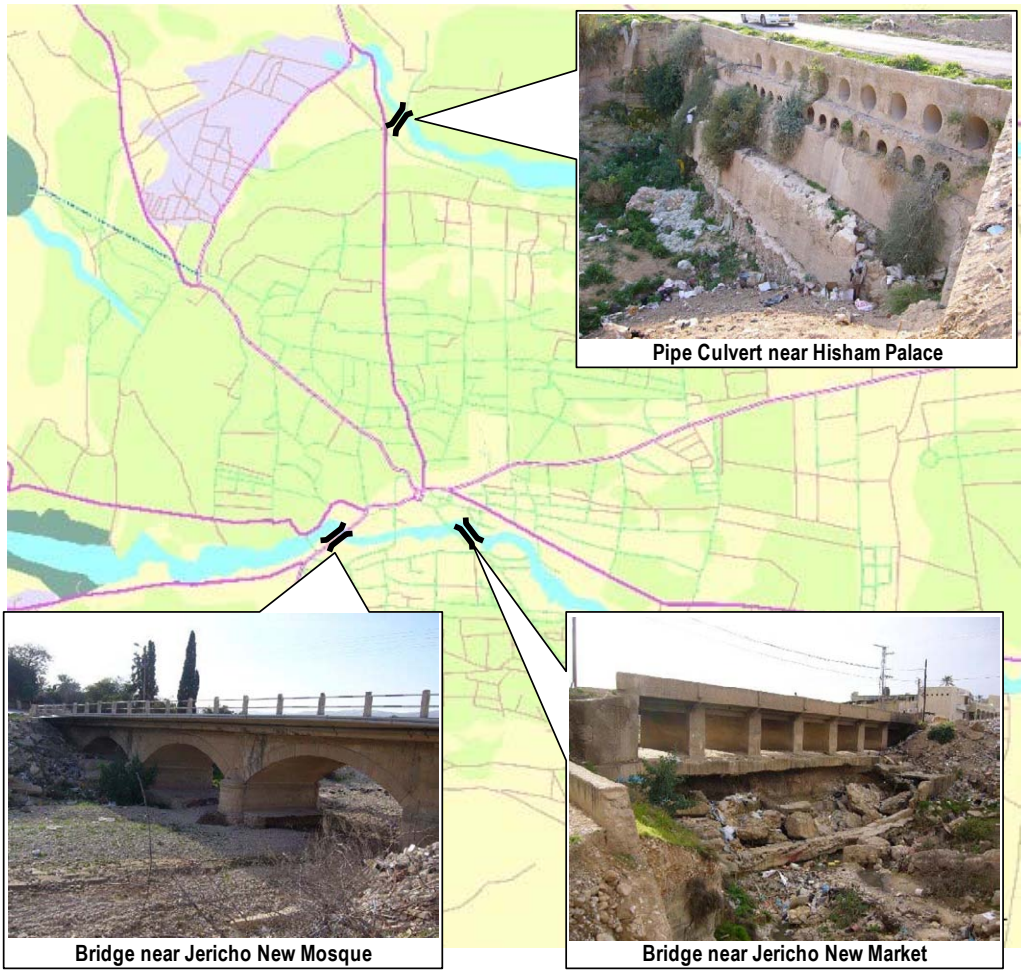
Table 8.1 Proposed Traffic Management Measures

Area	Measures
Roads	Improvement of sidewalks (widening, guardrails, and pavement)
	Installation of road marking (lane lines and pedestrian crossings)
	Installation of street facilities (plants, benches, dust bins and information signs)
	Consideration of traffic regulations (one-way streets and pedestrian malls)
	Installation of traffic signs (regulatory signs and guide signs)
	Parking control (no parking, free parking and paid parking)
Intersections	Geometric improvement
	Installation of Road marking (stop lines, pedestrian crossings, lane lines, directional arrows)
	Turning restrictions
	Installation of facilities such as curve mirrors and lighting

Source: JICA Study Team

(3) Improvement of Wadi Crossings in Jericho

According to the site investigations, two bridges across the Wadi al Qilt and one pipe culvert across the Wadi Nuwei'ma have been critically damaged by flood erosion and scouring. Although the structure of the bridge near the Jericho New Mosque seems to have suffered no serious damage, erosion of abutments and piers, as well as deterioration of the concrete slab are observed. From the technical viewpoint, the bridge would require renovation to eliminate hazardous risks during floods and to ensure safe traffic flow as part of the trunk road running north and south. The bridge near the Jericho New Market and the pipe culvert near Hisham's Palace have damaged riverbed structures on the downstream side. The necessary improvements, including riverbed treatment and slope protection, should be implemented.



Source: JICA Study Team

Figure 8.2 Bridges in Jericho City

(4) Program for Bus Transportation Improvement

Effective Bus Routes

As illustrated in the following figure, routes of the passenger transport services will be divided into inter-city and feeder routes. Buses should be operated for inter-city routes establishing the proper role of bus service, while shared taxis will serve feeder routes in the future. The inter-city routes for buses should be carefully redesigned to cover the cities and villages. In addition, the bus terminals like the Bridge Bus Terminal in Jericho City should enable bus transit to respond to the changing requirements. To achieve this, the bus operators should have some flexibility in deciding their routes based on the travel demand.

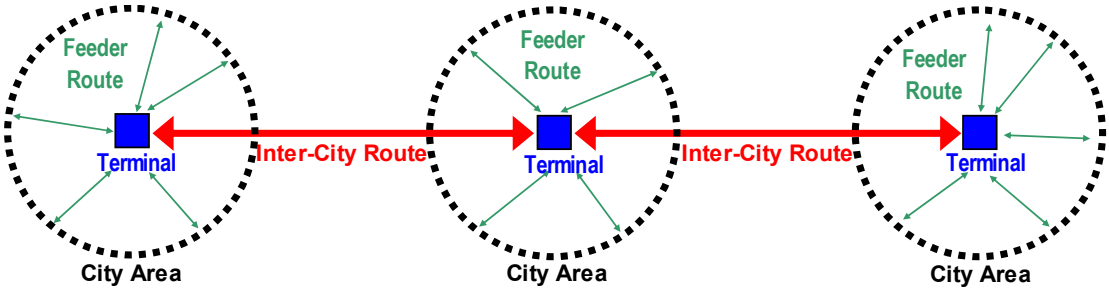


Figure 8.3 Concept for Bus Routes

Improvement in Bus Service

The bus service should be delivered with high frequency to attract more passengers. To achieve higher service frequency, it would be better economically for bus operators to employ the existing small and medium-size buses in the short term. In response to the increase in travel demand, bus operators should replace them with larger buses in the long term. Common facilities like bus stops, and bus shelters should be provided using public investment.

In Jericho city, a circular or shuttle bus operation system will be proposed that will connect the major tourism attraction sites and the city center, as discussed in Chapter 9.1

8.2 Water Supply

The water resource available for domestic use in Jericho City is mainly springs. The urban area in the city has distribution networks for water supply. The regional characteristics of the water use and supply conditions in the city and the surrounding areas are summarized in the following table.

Table 8.2 Current Water Supply Conditions in Jericho City and the Surrounding Areas

Communities		Resource	Network	Pop.	Consumption (m^3/yr)	per capita (lpcd) *1
Jericho	'Ein as Sultan Camp	Spring	○	1,916		207
	Jericho	Spring	○	19,213		
	Al Nuwei'ma	Mekorot		1,096	32	0
	Aqbat Jabar Camp	Mekorot		5,970	340,710	156
	'Ein ad Duyuk al Foqa	Spring	○	766	50,000	82
	'Ein al Duyuk al Tahta	Spring	○	910		

*1 Including water losses
Source: Water Supply for Domestic and Industrial 2003 (PWA)

According to the interview survey to the residents, water supply is at satisfactory level in terms of quality, quantity, and accessibility to water. As indicated, Jericho city has a sufficient

amount of water resource, mainly from Ein Sultan spring, for the projected population of 40,000 in 2025. The spring water will be able to additionally support the population as far as water for domestic use is shifted from the current agriculture use in accordance with a national policy.

Water supply in Jericho city, however, should take into account the following issues.

(i) Loss of water resource in the conveyance system from spring sources to end users

(ii) Decrease in the amount of water for agriculture use due to change of distribution ratio among agriculture use and domestic use

As for the decrease in agriculture use, it is envisaged to promote water saving agriculture, introduce brackish water agriculture, and develop new water resources such as floodwater harvesting and water recycling system. Concerning water supply facility, it is necessary to improve and maintain the conveyance system or distribution network in good condition in order to efficiently utilize the limited water resource.

8.3 Wastewater Treatment

As noted by the residents, the current sanitary condition in the city is one of the most unsatisfactory constraints. Most of generated wastewater is currently discharged into the environment without any treatment. Wastewater collected by vacuum cars owned by the municipality or private companies is discharged into wadis since there is no treatment plant in and around the city. Untreated wastewater discharge is one of the most serious problems of surface and groundwater pollution. Therefore, establishment of a complete wastewater treatment system for Jericho should be implemented for the protection of the urban and regional environment.

The current issues on wastewater treatment are summarized as follows.

(i) There is no public wastewater treatment system in Jericho city. Only 10% of household/buildings are equipped with septic tanks for collection by vacuum car. Remaining 90% have simple cesspit to infiltrate directly to the ground. Only one private vacuum car is collecting wastewater for treatment at a private owned plant (owned by Inter-Continental Hotel Jericho). The private plant is not fully utilized at the moment. It is reported that the long distance from the residential area is a constraint, according to the survey to the residents.

Table 8.3 Outline of Wastewater Treatment Plant in InterContinental Hotel Jericho

Year of Installation	1998
Maximum Treatment Capacity	2,000 m^3/day
Average Treatment Capacity	1,000 m^3/day
Accumulated volume of the treatment	423,517 m^3 (1998-2005)
Treatment Method	Aerobic activated sludge process
System design / fabrication	Israeli made

Note: The sludge generated by the treatment is used as compost for gardening.
Source: JICA Study Team

(ii) Majority of collected wastewater is discharged into Wadi al Qilt without any treatment. For the improvement of wastewater treatment, two alternative systems are considered, i.e., sewer lines with a treatment plant and vacuum cars with a treatment system as follows.

Sewer lines system

- Index of population density needed to introduce sewer lines is about 200 persons/ha[4] while the future population density in the city is about 45 persons/ha. It is necessary to study the viability of introducing the sewer lines.
- Installation of septic tanks to each household needs further study on the collection system.
- As Jericho city is to be developed as an international tourism city with such a suitable environment, it is also needed to take a future image of the city into consideration.

Vacuum cars collection system

- Installation of septic tanks to each household needs further study on the collection system as well as installation of wastewater treatment plant.
- Individual private treatment systems should be installed by major generators such as hotels and building complex.

In assessing these two alternatives, affordability of additional charges for households should be considered, in addition to a detailed plan and accurate cost estimate.

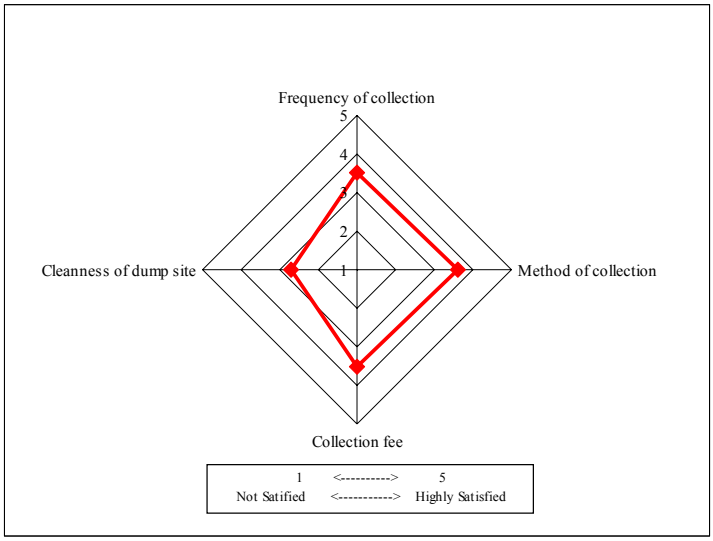
It is recommended that a feasibility level study be conducted on the improvement of the wastewater treatment system in Jericho city at the earliest possible time for the protection of the urban environment, both for the residents and for tourists to visit and stay in a better

[4] Index number defined in the manual of "Appropriate Sanitation Alternatives – A Planning and Design Manual (World Bank Studies in Water Supply and Sanitation 2)"

environment.

8.4 Solid Waste Management

According to the survey to the Jericho residents, the current service level of Jericho municipality for solid waste management is generally unsatisfactory. The most serious issue on solid waste management is the maintenance of the existing dumping site which remains in an unsanitary condition at a site about 2 km from the city center. There is an open dumping site existing in Jericho city without any environmental treatment such as sealing to the ground, provision of the buffer zone and so on. No special treatment for medical hazardous wastes is provided at the dumping site. There is no buffer zone between the road and the dumping site, and the environmental condition is poor. Moreover, bulk of solid waste are dumped anywhere along the Wadi al Qilt and main road in and around the residential zones. The capacity of the existing landfill site is nearly full, and it is needed to find another site for the sanitary landfill site.



Source: JICA Study Team

Figure 8.4 Issues on Solid Waste Management

As for capacity of trash containers installed throughout the city, it is sufficient to treat daily solid waste generated in the city (28-30 tons/day) as indicated in the following table.

Table 8.4 Existing Disposal Containers

Size	Capacity	Units	Total Capacity
Small	1 m^3	132	132 m^3 (40t)
Medium	8−12 m^3	46	552 m^3 (165t)
Large	26 m^3	18	468 m^3 (140t)
Total		196	1,152 m^3 (345t)

Source: Interview with Jericho Municipality

To keep the environment around garbage containers clean is the issue of public awareness. In order to promote the clean environment throughout the city, it is more important to educate the

residents through campaigns. Environmental education at the primary and secondary schools should be encouraged in particular.

As for overall management of solid waste in the city, JICA has been extending technical cooperation in "Capacity Development on Solid Waste Management in Jericho and Jordan River Rift Valley" since September 2005. With a corporation of JICA experts, the solid waste management plan needs to be thoughtfully considered in terms of the reduction, reuse and recycling (3R) of solid waste for the improvement of the urban environment.