

Water in Palestine

Problems – Politics – Prospects

Edited by

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PASSIA

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WATER-RELATED POLITICS AND THEIR LEGAL ASPECTS - A PROGRESSIVE APPROACH FOR SOLVING THE WATER CONFLICT

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LIST OF ABBREVIATIONS & ACRONYMS

ARD	Agricultural Research for Development
ARIJ	Applied Research Institute - Jerusalem
cm	cubic meter
cm/yr	cubic meter per year
CPF	Comprehensive Planning Framework
DoP	Declaration of Principles
EAB	Eastern Aquifer Basin
ECEFE	UN Economic Commission for Asia and the Far East
EU	European Union
FAO	Food and Agriculture Organization of the UN
FMEP	Foundation for Middle East Peace
GDP	Gross Domestic Product
GIS	Geographic Information System
GTZ	Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
ICJ	International Court of Justice
IDI	Institut De Droit International (International Law Institute)
ILA	International Law Association
ILC	International Law Commission
JD	Jordanian Dinar
JMCC	Jerusalem Media and Communication Center
JWC	Joint Water Committee
JWU	Jerusalem Water Undertaking
kg	kilogram
km	kilometer
km ²	square kilometer
l/c/d	liter per capita per day
l/day	liter per day
LAW	Palestinian Society for the Protection of Human Rights and the Environment
m	meter
mcm	million cubic meter
mcm/yr	million cubic meter per year
MEDRC	Middle East Desalination Research Center
M&I	Municipal and Industrial
mm	millimeter
MoD	(Israeli) Ministry of Defense
MOPIC	Ministry of Planning and International Cooperation

NEAB	Northeastern Aquifer Basin
NGO	Non-governmental organization
NIS	New Israeli Shekel
No.	number
NWC	National Water Council
NWP	National Water Policy / Plan
O&M	operation and maintenance
OPT	Occupied Palestinian Territories
PA	Palestinian Authority
PCBS	Palestinian Central Bureau of Statistics
PECDAR	Palestinian Economic Council for Development and Reconstruction
PEPA	Palestinian Environmental Protection Agency
PFLP	Popular Front for the Liberation of Palestine
PHG	Palestinian Hydrology Group
PLC	Palestinian Legislative Council
PLO	Palestine Liberation Organization
ppm	parts per million
PWA	Palestinian Water Authority
RWB	Regional Water Board
RWC	Regional Water Company
SMEA	Shomron Municipal Environmental Association
TAC	Technical Advisory Committee
TOR	Terms of Reference
TWC	Transboundary Water Courses
UFW	unaccounted for water
UK	United Kingdom
UN	United Nations
UNGA	United Nations General Assembly
UNESCWA	UN Economic and Social Commission for Western Asia
UNRWA	United Nations Works Agency for Palestinian Refuges
UNSC	United Nations Security Council
US	United States
USAID	United States Agency for International Development
WBWD	West Bank Water Department
WGWR	Working Group on Water Resources
WHO	World Health Organization
WRAP	Water Resources Action Program
WWF	World Water Forum
yr	year

FOREWORD

Water has been a major issue in the Palestinian-Israeli negotiations since the early 1990's, but to date, little progress has been made on either the bilateral or the multilateral track. In the Oslo II Agreement of September 1995, Israel recognized Palestinian water rights, but owing to its complexity and significance, the water issue - together with other thorny issues such as Jerusalem, borders, refugees, settlements and security - was left to the final status negotiations, which were to begin in May 1996 and conclude by 4 May 1999, but have yet to start.

The water problem thus remains one of the most contentious issues that need to be resolved between Israel and Palestine. The current water crisis is not only a consequence of the water scarcity in the region, but also an inherent part of the general Palestinian-Israeli conflict; for instance, the Palestinians have yet to be granted their legal entitlements from the water resources they formally share with Israel.

The agreements signed between Israel and the PLO in the 1990's have also failed to improve the situation as they provide only temporary solutions that are neither fair nor sustainable. Moreover, over the past ten years, Israel has continued to neglect the importance of engaging in serious negotiations relating to water.

In light of the above and based on the fact that the water issue is multidisciplinary in nature, which, coupled with the existing political problems, implies that any solution relating to the water situation will affect other fields, disciplines and issues, the **PASSIA Water Project** attempted to identify those issues, pinpoint the crucial facts, and clarify the commonly used terminology.

Despite the discouraging situation on the ground, this publication argues that there is enough water to meet everybody's needs if equity, fairness and an overall framework for water management are applied. It thus aims to show ways how the current imbalances could be corrected through a mutually beneficial solution that satisfies the needs of both parties in light of existing water resources and the potential feasible alternatives.

To achieve this end, the PASSIA team discussed the idea of producing a publication that reflects the relationship between water and related subject areas, such as legal aspects, economic development, management institutions and resources, the environment, and final status issues (settlements, borders, etc.) with Fadia Daibes, PhD, a specialist in Water Law and Policy, who then agreed to edit the resulting research papers. The papers, which examine the relationship between water and those issues as well as how they will affect future decisions, are presented as follows:

The first chapter of this publication (by Fadia Daibes) describes the general water situation, the history of the water conflict in Palestine, and the water-related political and legal environment. It outlines how the Palestinians' inability to practice legal sovereignty over their indigenous resources and the absence of an agreement governing the utilization, development and management of the transboundary water resources affect their water use, planning and decision-making. The chapter then proposes a progressive approach for solving the Palestinian-Israeli conflict on the basis of the prevailing hydrological and political conditions, the knowledge gained from international state practice, and the rules and principles of International Law.

Chapter two (by Anan Jayyousi) describes the present water supply and use and then discusses future water needs in light of demographic developments. The chapter also investigates available conventional and non-conventional water resource options and proposes main strategic issues that need to be followed in order to fully respond to the supply and demand needs in the region.

Chapter three (by Yousef Nasser) introduces water as a crucial element for development. It looks into the historical development of the Palestinian water sector before discussing the present situation in light of the existing peace agreements as well as the prevailing water use patterns. The chapter further assesses the need and demand for water and its impact on development particularly in terms of the agriculture, industry and commerce sectors.

Chapter Four (by Marwan Haddad) discusses the current water situation in Palestine as well as the various pitfalls and prospects associated with local water resources management. It first takes a critical look at the existing water institutions in Palestine, assessing their structures and performance and pointing at their deficiencies. The author then proposes institutional reforms, which build

on the concepts of decentralization and public private partnership and will hopefully result in a more effective management of water resources.

Chapter Five (by Fayez Freijjat) discusses one of the most important issues associated with the water problem – the Jewish settlements. After first looking at demographic developments with regard to the settler population, the chapter then examines both the environmental and socio-economic impacts these settlements have on agriculture and water resources in the Occupied Territories and the related Israeli environmental policy.

The papers presented here emphasize the option to resolve the water dispute on a reasonable and equitable basis through mutually acknowledging the need for cooperation in terms of the utilization of the available resources. The Palestinian Authority has expressed its commitment to sustainable development, environmental protection, and regional cooperation on many occasions. In September 2002, for instance, in a statement to the Johannesburg World Summit on Sustainable Development, the Palestinian delegation announced the following: "An environmental model based on a strategic vision - to think globally, cooperate regionally, plan nationally and act locally - was set." In order to achieve the needed cooperative approach, Israel must rethink its water policy and turn away from its current unilateral perspective and towards joint regional efforts.

Eventually, Palestinians and Israelis will have no choice but to tackle the thorny issue of water and talk about ways and means of sharing this scarce resource. In order to assist in this process, the **PASSIA Water Project** further developed a glossary of relevant Palestinian terms and concepts in relation to the water issue that could serve as a platform in future negotiations, the aim being to establish a consensus with regard to the use of the terminology among Palestinian experts, negotiators, and politicians.

In addition to the research papers and the glossary, a comprehensive and specialized bibliography of articles, books and other works related to the water issue within the Palestinian-Israeli conflict was compiled. It is published in the appendices along with an annotated Internet Guide containing relevant websites on water, a list of Palestinian institutes and organizations working in the field of water and the environment, and further water-related documentation and maps – all of which, it is hoped, will contribute in

making this a valuable resource book for researchers, students and anyone else with an interest in the Palestinian-Israeli conflict in general and the water issue in particular.

PASSIA would like to express its appreciation of the role and work of the editor of this publication, Mrs. Fadia Daibes, PhD, who identified and recruited the needed (water) experts, commissioned their papers and took on the responsibility of coordinating with the authors regarding the content and structure of their papers, which included discussing various details and analyses. Mrs. Daibes further edited the draft papers of the researchers and was the main source behind the developing of the glossary, which formed part of the **PASSIA Water Project**.

This book would not have been published were it not for the invaluable efforts of the whole PASSIA team, which not only took care of the English language editing, layout and cover design, but also compiled the entries for the Internet Guide, the List of Palestinian Institutes and Organizations, and the bibliography.

Finally, special thanks go to the Canadian Representative Office in Ramallah for the kind support that made the producing and printing of this important and much-needed publication possible.

Dr. Mahdi Abdul Hadi
Head of PASSIA
Jerusalem, October 2003

1. INTRODUCTION

The rights and obligations of the Palestinians and Israelis concerning their international watercourses are not fully understood. The primary reason for this is Palestine's unique political status as an occupied land and the fact that since occupying the West Bank, including Jerusalem, and the Gaza Strip as a result of the Six-Day War of 1967, Israel has constantly refused to relinquish control of any of the territory it occupied. There is consequently a whole range of issues requiring discussion and further investigation.

This paper serves three purposes: first, it offers a general insight into the water-related politics prevailing in Israel and Palestine and their influence on politics in general; second, it identifies the laws governing the utilization, development, and management of shared and indigenous water resources; and third, in its final part, it provides – it is hoped – a progressive framework for solving the Palestinian-Israeli conflict regarding water.

The water-related politics part of the paper will discuss the following:

- a. The legal implications of the political status of Palestine on the water conflict;
- b. The two issues of Palestinian statehood and legitimate 'sovereignty' and their impact on the conflict under discussion;¹
- c. The role played to date by the United Nations (UN) with regard to the Palestinian-Israeli water conflict; and
- d. The relevance of the declarations and treaties signed between the Palestine Liberation Organization (PLO) and the State of Israel to the attempts to end the above-mentioned conflict (see Section 2).

With regard to the legal part of the paper, it will review the laws and regulations governing the utilization of the indigenous Palestinian resources as well as those shared with Israel with an em-

¹ Sovereignty denotes the basic international legal status of a state that is not subject within its territorial jurisdiction to the governmental, executive, legislative, or judicial jurisdiction of a foreign state or to foreign law other than International Law. Sovereignty therefore implies the status of a state as a direct subject of International Law. For more details, see *The Encyclopedia of International Law*, Vol. 1. Amsterdam: Elsevier, 2000, and Brownlie, I. *Principles of Public International Law*, 5th Ed. New York: Oxford University Press, 1999, pp. 105-106.

phasis on determining whether the rules and principles of International Law apply in the case of Palestine.

As to the proposed framework for solving the Palestinian-Israeli water conflict found at the end of the paper, it is based on the current political and legal background. Worthy of mention is the fact that the proposed solution involves the progressive establishment of the grounds for long-term sustainable water arrangements beginning with a non-binding flexible arrangement with the potential to meet short-term needs, followed by the implementation of an intermediate proposal – a combination of coordination and collaboration, being the hoped for outcome of the first arrangements – and eventually, in the third stage, by a final, legal binding arrangement.

1.1 Historical Evolution of the Conflict

A great deal has already been written about the historical evolution, beginning in the early 1900s, of the Arab-Israeli water conflict, with the overwhelming majority of authors and researchers agreeing that water has always been considered an important strategic element in terms of the Israeli plans and regional development. Despite having been promised a “national home” in the Balfour Declaration of 1917, the Zionists were displeased with the land and water resources granted to the Jews by the British in 1919 and consequently embarked on acquiring land as Jewish property in order to promote agricultural colonization based on Jewish labor. The Sykes-Picot Agreement, which was signed between the British and French on 9 March 1916, divided the Levant into zones and constituted the first serious attempt to demarcate a Palestine-Lebanon border. Many would state, therefore, that the root of the Arab-Israeli water conflict can be traced back to the signing of this particular document and the fact that although the regions of the Middle East were divided in the agreement between British and French control, no direct mention was made of water rights. The Sykes-Picot Agreement would most certainly have left the watersheds in the region divided in a most convoluted manner; the Litani and Jordan headwaters just south of the Huleh region would have come under French control, while Lake Tabariyya would have been split into two, with one part coming under international control and the other under French control. The Yarmouk Valley, meanwhile, would have come under both British and French control, while the lower stem of the Jordan River would

have found itself under international control on the West Bank and British control on the East Bank.

It is important to note when considering the history of the Palestinian-Israeli water conflict that prior to the establishment of the State of Israel in 1948, a special UN Committee on Palestine provided evidence showing that Jews owned only 7% of the land, whereas following the creation of the State, the percentage rose to 60%. Also noteworthy is the fact that following the establishment of the State, the main objective of the water plan was to divert as much water as possible outside the Jordan River² Basin into a central conduit leading through the coastal plain up to the northern Negev. The National Water Carrier, which was first operated in 1964, was consequently the outcome of many years of planning, the first stages of which were implemented in 1948.

Between 1967 and September 1995, when Israel signed an agreement with the PLO regarding the interim arrangements in the West Bank and Gaza Strip and 80 mcm of additional water was granted to the Palestinians, the utilization of groundwater within the Occupied Palestinian Territories was governed solely by Israeli legislation and military orders.³ Even prior to 1967 – since 1955, to be exact – Israel was tapping into the Yarkon-Taninim or Western Mountain Aquifer. Today, it relies on three aquifers – the Northeastern, the Western, and the Eastern Mountain Aquifers⁴ –

² The Jordan River begins in three headwaters: the Hasbani River, parts of which flow in Lebanon, and which originates in Syria, having an average flow of 140 mcm/yr and the Dan and Banias rivers, which originate in the Golan Heights and flow into the Jordan River above Lake Tabariyya, having average annual flows of 250 and 120 mcm respectively. The lower Jordan River is fed, meanwhile, from groundwater flow and runoff from the West Bank and Syrian and Jordanian waters and by the Yarmouk River, which originates in Syria and borders Jordan, Syria, and the Golan Heights, with an average flow of 420 mcm/yr. Israel utilizes 685 mcm/yr of the waters of the Jordan River. The Palestinians, meanwhile, have been deprived of access to its waters, even though it represents the main regional surface water system and the only permanent surface water source for Palestine. At present, Israel diverts approximately 75% of the river's water before it reaches the West Bank.

³ Prior to 1967, Jordan issued rules and regulations governing the use and development of water and other water-related matters. The laws remained in effect even after 5 June 1967, when Israel proclaimed that they could be subject to changes introduced by the Israeli Military Commander. Successive military orders were subsequently issued to amend parts of the laws in question, the most significant ones being Military Order 92 of 7 June 1967, Military Order 158 of 19 November 1967, Military Order 291 of 19 December 1968, as well as several others.

⁴ See Annex, Map 1: Water Sources.

all of which recharge in the West Bank and which combined, provide approximately 40% of Israel's water supply. Due to the fact that the Palestinians have constantly been denied access to their share of the Jordan River waters⁵ and the massive imbalance in terms of current water-use rights, there is also a huge imbalance in terms of water consumption, with the Palestinian domestic per capita consumption of 35-80 l/day being far below the standard established by the World Health Organization (WHO), i.e., a minimum of 100 l/day, and the Israeli per capita consumption, which exceeds 300 l/day.⁶

Israel, it should be mentioned, has additional sources of fresh water since as well as the 600 mcm/yr of water from the Jordan River⁷ it is currently utilizing, it also has access to water originating from another five groundwater aquifers located within its territory.⁸ As to the Palestinians' access to water, up until 1995, only a very few drilling and extraction licenses were granted to enhance the supply within Palestinian communities, which meant that the natural increase in water demand due to population growth and industrial and agricultural expansion had to be satisfied from the wells that had already existed prior to the occupation.

In order to support their claims regarding the waters currently being utilized by Israel, Israeli legal experts have usually relied on the precedents of 'Prior Use' or 'Historical Rights' when dealing with regional water resources. Moreover, they have persistently

⁵ One of the main efforts to resolve the conflict took the form of the Johnston Plan, an allocation scheme proposed in 1953 by US Special Envoy to the Middle East, Ambassador Eric Johnston. The plan was the product of negotiations with representatives of Israel, Lebanon, Syria, and Jordan, which led, in 1955 to a unified plan for all the riparians. The plan, however, was never adopted or ratified, in part, because the Arab states (especially Jordan) did not need a comprehensive water development program that included the direct involvement of Israel in order to achieve their immediate development goals. In addition, they did not agree to the criteria that were being used as a basis for dividing the shares amongst the parties involved. More recently, in 1995 to be exact, Israel and Jordan signed a treaty relating to parts of the River Basin (the Yarmouk tributary). See *PASSIA Water Bulletin: The Blue Gold of the Middle East*, July 2002.

⁶ Reference Framework for the Palestinian Position on the Water Issue, Official Reports by the Palestinian Water Authority (PWA) (16 April 2000), on file with author.

⁷ The total average annual flow of the Jordan River is 1,300 mcm. The Palestinians have been denied access to their share - estimated at 200 mcm/yr - since 1967.

⁸ These groundwater aquifers are as follows: Lake Tabariyya, the Western Galilee, the Coastal, the Naqab, and the Carmel.

referred to all "existing uses" as non-negotiable and constantly raised the issue of the availability of "alternatives of comparable value" (desalination, wastewater reuse, and the importing of water from neighboring countries) as a means to supply Palestinian needs. What this means is that Israel's official position in terms of its water dispute with its Palestinian neighbors is based on its objection to sharing the available water resources in a fair and equitable manner, as has been revealed time and time again in the Israeli style of negotiating over the past seven years. In short, although Israel is prepared to discuss the need to meet some of the immediate Palestinian needs, it nevertheless does not appear to consider the water issue one requiring a permanent solution.

For proof of the official Israeli position regarding the water issue, one only has to consider the statement of the former Israeli Minister of Agriculture, who in December 1990 was quoted by the *Ma'ariv* newspaper as stating the following: "It is reality and need which created the Israeli control over the water resources; it would be impossible to give up a drop of water in the West Bank."⁹ As to the former Israeli Water Commissioner Meir Ben Meir, he has repeatedly declared the following positions:

- a. The Palestinians can solve their water problem through pursuing non-conventional sources or through purchasing from Israel;
- b. Although Israel is prepared to discuss allocations and rights pertaining to the uses of water with the Palestinians, it refuses to discuss sovereignty over the available resources;
- c. International Law does not apply in the case of the Palestinians since Palestine is not recognized as an independent state.

In 1991, and after many long years of struggle, the Palestinians and Israelis finally sat down to negotiate. The aim of the Israeli-Palestinian negotiations within the current Middle East peace process was, among other things, to establish a Palestinian interim self-government authority for the Palestinian people in the West Bank and Gaza Strip for a transitional period not exceeding five years, leading to a permanent settlement based on United Nations (UN) Security Council Resolutions 242 and 338. Since the very beginning, the negotiations have been hampered by the inequality in power and until today, the largest hurdle when it comes to the

⁹ Interview in *Ma'ariv*, 17 December 1990.

attempts to reach fair solutions is Israel's superior power in every respect as well as its refusal to recognize the Palestinians' right to exist as a nation and their various national aspirations. As a result, only minimum progress has been made during the last ten years of negotiations while a common agreement on the overarching principles for the future utilization of the transboundary water resources has yet to be achieved. Worthy of mention is the fact that the Jordan River dispute was not a part of the previous negotiations relating to water.

1.2 Links between Water and the Other Contentious Issues within the Final Status Negotiations

1.2.1 Borders and Water

In practice, there has never been a settled boundary between Palestine and Israel, which means that boundaries must be established in the final status negotiations. Clearly, land and water sovereignty should not be disconnected. The borders to be negotiated will be those that existed prior to 1967, which means that the Palestinian Government should eventually enjoy sovereignty in both the West Bank and the Gaza Strip.¹⁰ It is inevitable that any changes regarding the delimitation¹¹ of the borders would have a huge effect – either negative or positive, depending on the changes made – on Palestinian accessibility to the transboundary groundwater.

On 30 April 2003, the United States (US) presented the 'road map' for peace in the Middle East to Israeli Prime Minister Ariel Sharon and newly confirmed Palestinian Prime Minister Mahmoud Abbas with the intention of solving the conflict between Israel and the Palestinians. Together with the European Union (EU), the UN, and Russia, the US defined the 'road map's' destination as "a final and comprehensive settlement of the Israel-Palestinian conflict by 2005." The settlement, negotiated between the parties, would, the parties hoped, "result in the emergence of an independent, de-

¹⁰ See for the legal background of this principle UNSC Resolution 181 and the DoP, Article IV: "The two sides will view the West Bank and the Gaza Strip as a single territorial unit, whose integrity will be preserved during the interim period."

¹¹ The process of determining the location of the borders by referring to reference maps; the demarcation of the border is the physical process of marking out the border on the ground.

mocratic, and viable Palestinian state living side by side in peace and security with Israel and its other neighbors." The Israeli Cabinet, meanwhile, approved a "security concept," which called for the erection of a fence east of the Green Line and around Jerusalem, a buffer zone west of the Jordan, and the continued presence of Israeli security forces in the West Bank. One of the major problems in regard to the aforementioned fence is that 'detours' unilaterally decided upon by Israel result, in a number of areas, in it eating up large areas of Palestinian land. It is, of course, of no surprise that the Palestinians view the fence as an imposed border with the potential for major impacts on the future Palestinian economy and the accessibility of the Palestinians to their natural resources. Equally unsurprising is the fact that the continuation of its construction is considered a real threat to all prospects of reconciliation between the Palestinians and Israelis and a major hindrance in terms of the attempts to implement the 'road map'.

1.2.2 Settlements and Water

In the first half of this century, Israeli leaders believed that settlements were the building blocks upon which sovereignty was created and which defined territorial limits, which is perhaps one of the main reasons why we find, today, approximately 200 Israeli settlements in the West Bank and Gaza Strip. The 1993 and 1995 Oslo Agreements did not expressly prohibit the expansion of settlements but rather deferred the negotiating of borders and settlements until the final status talks, which were due to take place by 1996.¹² Of the settlements in the West Bank, many were strategically located so as to command access to the Mountain Aquifer.

As of today, settlers consume six times more water per capita than the Palestinians.¹³

The main water-related issues that need to be dealt with in the permanent status negotiations are as follows:

¹² Article XXXXI (7) of the Interim Agreement requires both sides to refrain from initiating or taking any step that will change the status of the West Bank and the Gaza Strip pending the outcome of the permanent status negotiations.

¹³ Palestinian Reference Framework on Water; see also Annex, Map 1: Water Sources.

- a. The effect of previous water use on the part of the settlements on Palestinian access to water and the option of compensation;
- b. The impact of any possible agreement relating to the remaining settlements on future Palestinian water use;
- c. The impact of water use and waste disposal in the settlements on the quantity and quality of water that is available to the Palestinians.

1.2.3 Refugees and Water

The issue of refugees is linked to the inalienable right of the Palestinians to self-determination. In accordance with the principle of self-determination, people are entitled to freely determine their political status and to pursue economic, social, and cultural development.¹⁴ Whether the final agreement will allow only some or all of the refugees to return will have direct implications in terms of the future Palestinian water demand projections. Moreover, the decision concerning where the refugees will be settled will obviously have a direct bearing on the future utilization levels of the groundwater resources, which, with the increase in demand, will undoubtedly find themselves carrying a much heavier burden than at present. This particular issue, therefore, must constitute a pivotal part of the negotiations pertaining to the refugees.

2. PALESTINIAN WATER RESOURCES AND THE OCCUPATION

2.1 Role of the Laws of War and Belligerent Occupation

The West Bank (including East Jerusalem) and the Gaza Strip were occupied by Israel as a result of the Six-Day War of 1967,

¹⁴ The 1966 Covenants on Civil and Political Rights and Economic, Social and Cultural Rights. Article 1 states the following:

"1. All peoples have the right of self-determination. By virtue of that right, they freely determine their political status and freely pursue their economic, social and cultural development. 2. All peoples may, for their own ends, freely dispose of their natural wealth and resources without prejudice to any obligations arising out of international economic cooperation, based upon the principle of mutual benefit and International Law. In no case may a people be deprived of its own means of subsistence. 3. The States Parties to the present Covenant, including those having responsibility for the administration of Non-Self-Governing and Trust Territories, shall promote the realization of the right of self-determination, and shall respect that right, in conformity with the provisions of the Charter of the United Nations."

since which time, Israel has controlled all the Palestinian territory. The international community regards the status of the territory in question as occupied territory subject to the laws and regulation pertaining to belligerent occupation, namely, the provisions included in the Hague Conventions of 1899¹⁵ and 1907 (IV)¹⁶ and the Geneva Conventions of 1949.¹⁷ A spectrum of views exists with regard to the adequacy of the existing laws of war in terms of dealing with environmental concerns.¹⁸ It is however beyond the scope of this paper to elaborate on these views so it will be agreed that the codified customary laws of war have been mainly concerned with environmental protection in the sense of prohibiting the wanton destruction of forests, orchards, etc., and the poisoning of wells, springs, and rivers. It should be mentioned at this point that the adoption of these legal instruments does not undermine the role of International Law, particularly in situations that their scope fails to cover.¹⁹

¹⁵ "The Hague Convention on Land Warfare of 1899," *American Journal of International Law*, Vol. 1, 29 July 1899, Treaty Series No. 9.

¹⁶ Hague Convention (IV), Respecting the Laws and Customs of War on Land, and its annex: Regulation Concerning the Laws and Customs of War on Land (entered into force 26 January 1910). This Convention replaced the 1899 Convention on Land and Warfare.

¹⁷ The Geneva Conventions: Convention (I) for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field; Convention (II) for the Amelioration of the Condition of the Wounded, Sick, and Shipwrecked Members of Armed Forces at Sea; Convention (III) Relative to the Treatment of Prisoners of War; and Convention (IV) Relative to the Protection of Civilian Persons in Time of War. Adopted in Geneva, 12 August 1949. *Final Record of the Diplomatic Conference of Geneva of 1949*, Vol. I, Federal Department, Berne: pp.195-341; and 75 UN Treaty Series 5-417.

¹⁸ Four different opinions exist. According to the first, the existing law relevant to environmental protection as found in the Hague Conventions and Geneva Conventions is capable of covering the worst environmental scenario, while according to the second, although the existing law is indeed capable of doing this, Protocol I to the 1949 Conventions is also considered as representing Customary International Law, namely Article 54 (5) and Article 55. As to the third opinion, it considers the existing law inadequate and in need of restatement, while according to the fourth and final opinion, the distinction between wartime and peacetime acts in this context is so vague, irrelevant, and misleading that, if any new development were to occur, it should be concerned with environmental destruction in all scenarios, whether in wartime or peacetime. Plant, G. *Environmental Protection and the Law of War: A 'Fifth Geneva' Convention on the Protection of the Environment in Time of Armed Conflict*. New York: Belhaven Press, 1992.

¹⁹ This is a reformulation of a clause that appears in Article 1(2) of Protocol 1 of the Geneva Convention: "In cases not covered by this Protocol or by other international agreements, civilians and combatants remain under the protection and authority of

2.2 Issues Relevant to Palestinian Sovereignty

2.2.1 Background

The exercise of sovereignty by a state is suspended when in the course of an *occupatio bellica* (belligerent occupation) by enemy forces, its governmental institutions no longer operate or are subject to the orders of the occupying power. Governments in exile may be capable of continuing to exercise their state's sovereignty, but much depends on the effectiveness of such an exercise given the specific circumstances.²⁰ In addition, according to the 1910 Hague Convention, an occupant has limited authority over the occupied territory while sovereignty remains with the original inhabitants:

"The authority of the State having in fact passed into the hands of the occupant, the latter shall do all in his power to restore and ensure, as far as possible, public order and safety, respecting at the same time, unless absolutely prevented, the laws in force in the territory" (Article 34).

Recognized publicists consider the intervention on the part of Israel in the civil laws in force prior to the occupation illegal. Accordingly, the changes that were introduced by Israel to the water laws pertaining to both the West Bank and Gaza Strip are also considered illegal.

2.2.2 The Role of the UN

The binding characters of the resolutions that are adopted by the United Nations General Assembly (UNGA) are highly debated and

the principles of International Law derived from established custom, from the principles of humanity, and from the dictates of public conscience."

In addition, the 1910 Hague Convention states in its preamble: "Until a more complete code of the laws of war has been issued, the High Contracting Parties deem it expedient to declare that, in cases not included in the Regulations adopted by them, the inhabitants and the belligerents remain under the protection and the rule of the principles of the law of nations, as they result from the usages established among civilized peoples, from the laws of humanity, and the dictates of the public conscience. They declare that it is in this sense especially that Articles 1 and 2 of the Regulations adopted must be understood."

²⁰ See *Encyclopedia of International Law*, Vol. 1. Amsterdam: Elsevier, 2000.

are not usually considered a confirmation of the rules and principles that are internationally accepted as law. They may, however, be regarded as the evolution of an international custom or as expressing and evidencing a general principle of law. There is also a strong presumption that if a resolution is a declaration of an already existing law, then it merely confirms the law, which, in any case, must be considered binding. Resolutions with less than unanimous support are obviously more questionable.²¹ In the Palestinian context, many of these resolutions confirm that the right to self-determination is an inalienable right that all peoples should be allowed to enjoy indiscriminately. This principle has been confirmed as such in Article 1(2) of the UN Charter and in numerous other international documents.²² The countless resolutions passed by the UNGA and the establishment of the UN Committee on the Exercise of the Inalienable Rights of the Palestinian People by the Assembly in 1975 are therefore clear evidences of the general recognition of the right of the Palestinians to self-determination.²³ Worthy of mention is the fact that the Secretary-General of the UNGA prepared numerous reports concerning the Israeli practices in the Occupied Palestinian Territories and Israel's obligations under International Law, in particular the Hague Convention IV (1907) and the Geneva Conventions of 1949.²⁴ Furthermore, many UNGA resolutions that were adopted clearly reaf-

²¹ The voting mechanisms in the UNGA are divided between important matters and simple matters, with the former requiring two-thirds of the majority.

²² Article 1(2) of The UN Charter, which entered into force on 24 October 1945, when there were 51 original members (today, 157), states the following: "To develop friendly relations among nations based on respect for the principle of equal rights and self-determination of peoples and to take other appropriate measures to strengthen universal peace."

²³ The relevant UNGA and UNSC resolutions are as follows: UNGA Resolution, A/RES/181(II) (A+B), 29 November 1947, Future Government of Palestine (Termination of Mandate and Partition); UN GA/RES/194 (III), 11 December 1948, Progress Report of the UN Mediator (Establishment of the UN Conciliation Commission following the assassination of the UN mediator, for which the Israeli Government later paid the UN compensation); UNSC Resolution S/RES/242 (1967), 22 November 1967 (recognizing the right to sovereignty of all states and requesting Israeli withdrawal from occupied territories); and UNSC Resolution S/RES/338 (1973), 22 October 1973, (ceasefire and implementation of S/RES/242). The work of the UN in relation to the question of Palestine is led by the Committee on the Exercise of the Inalienable Rights of the Palestinian People - UNGA Resolution A/RES/3376 (XXX), 10 November 1975 (establishment of the Committee on the Exercise of the Inalienable Rights of the Palestinian People).

²⁴ UNGA Social and Economic Council, Documents A/40/381, June 1985, and A/55/84, June 2000.

firmed the inalienable rights of the Palestinian people in relation to their natural resources, including land and water.²⁵ In its latest resolution of 3 March 2003,²⁶ the UNGA once again reaffirmed these inalienable rights and called upon Israel, the occupying power, not to exploit, to cause loss or depletion of or to endanger the natural resources in the Occupied Palestinian Territories, including Jerusalem, and in the Occupied Golan Heights. In the resolution, the Assembly also recognized the right of the Palestinian people to claim restitution²⁷ as a result of any exploitation, loss or depletion of, or danger to, their natural resources, and expressed the hope that the issue would be dealt with in the framework of the final status negotiations between the Palestinian and Israeli sides. The resolution also reaffirmed the need for an immediate resumption of negotiations within the Middle East peace process, on the basis of UN Security Council (UNSC) Resolutions 242 (1967) of 22 November 1967, 338 (1973) of 22 October 1973, and 425 (1978) of 19 March 1978 and the principle of land for peace, as well as the achievement of a final settlement on all tracks.

²⁵ UNGA Resolutions 3175 (XXVIII) of 17 December 1973, 3336 (XXIX) of 17 December 1974, 3516 (XXX) of 15 December 1975, 31/186 of 21 December 1976, 32/161 of 19 December 1977, 34/136 of 14 December 1979, 35/110 of 5 December 1980, 36/173 of 17 December 1981, 37/135 of 1982, 38/144 of 1983, 51/190 of 16 December 1996, and 52/207 of 18 December 1997.

²⁶ UN Doc. A/RES/57/269.

²⁷ In the Chorzow Factory Case (Germany v. Poland) of 1928, the Permanent Court of International Justice (PCIJ), on an issue involving expropriation, emphasized that reparation for an illegal act "must as far as possible, wipe out all the consequences of the illegal act and reestablish the situation which would, in all probability, have existed if that act had not been committed." The Court emphasized the priority of restitution (*restitutio in integrum*); only if this is not possible, the obligation becomes that of paying the value of the property and compensation for such loss. Chorzow Factory Case, 1928, PCIJ, Series A, No. 17.

The International Law Commission (ILC) has maintained these basic principles (reparation and restitution) in its Draft Articles on State Responsibility adopted in the second reading in 2000, A/CN.4/L.600, 11 August 2000. Article 31 (1) states the following: "The responsible State is under an obligation to make full reparation for the injury caused by the internationally wrongful act."

Article 36 further emphasizes this obligation by stating as follows: "A State responsible for an internationally wrongful act is under an obligation to make restitution, that is, to reestablish the situation which existed before the wrongful act was committed, provided and to the extent that restitution is not materially impossible, would not involve a burden out of all proportion to the benefit deriving from restitution instead of compensation."

2.2.3 State of Israel Vis-à-vis the State of Palestine

The Partition Plan²⁸ was approved by a majority vote of the UNGA on 29 November 1947, largely through the influence of the US. Israel accepted the plan and was therefore granted UN membership; the Arab states, on the other hand, rejected it, and Palestine, therefore, was never admitted. In 1967, the tension between Israel and its neighbors erupted into the Six-Day War, with the armies of Egypt, Jordan, and Syrian invading Israel and subsequently losing the war, as a result of which, Israel today occupies the West Bank including East Jerusalem, the Gaza Strip, and the Golan Heights (belonging to Syria).

On 22 November 1967, the UNSC passed Resolution 242, which calls on Israel to withdraw from territories occupied in the Six-Day War of 1967 as well as a just settlement of the refugee problem. In addition, UNGA Resolution 181 of 1947 provides the legal basis for Israeli and Palestinian statehood and mandates full equality and human rights for all citizens of both the State of Israel and the State of Palestine.

Although it is beyond the scope of this paper to elaborate in detail on the issue of Palestinian statehood, it is important, at this point, to acknowledge the importance of International Law as a basis for solving the current conflict.

The question that poses itself in the context of the Palestinian-Israeli conflict is whether International Law could actually serve as the basis for resolving the conflict since Palestine is not yet formally a state. Many scholars have provided their divergent opinions in that regard, and many conflicting ideas have been put forward for debate. Israeli officials, not surprisingly, including former Water Commissioner Meir Ben Meir have repeatedly affirmed that International Law does not apply to the Palestinians since they do not yet have a state. In order to understand the real situation, one

²⁸ In 1947, the British Mandatory Government that ruled in Palestine announced that it intended to give up the Mandate and to hand the problem of Palestine over to the UN. A UN Special Commission recommended that the land be divided as follows: between a "Jewish" state, including 52% of the land, and whose population would be made up of 497,000 Palestinian Arabs and 498,000 Palestinians and settler Jews, and an "Arab" state, including 48% of the land, and whose population would be 98.7% Palestinian Arab (725,000 Arabs and 10,000 Palestinians and settler Jews). Jerusalem, as well as the area surrounding it, would become an "international zone."

must first apprehend what constitutes a state according to International Law, which rules that a state must possess the following:

- A permanent population;
- A defined territory;
- A government; and
- The capacity to enter into relations with other states.

According to at least one legal expert, Palestine, under the provisional government of the PLO, is already a state according to International Law: "All four characteristics have been satisfied by the newly proclaimed independent state of Palestine."²⁹ As to the issue of recognition by other states, the Montevideo Convention on the Rights and Duties of States provides that the political existence of a state is independent of recognition by other states. Even before recognition, the state has the right to defend its integrity and independence, to provide for its conservation and prosperity, and consequently to organize itself as it sees fit.³⁰ The recognition of a state merely signifies that the state that recognizes it accepts the fact that International Law governs the relationships between them and that recognition is not a prerequisite for a state to qualify as a state with all the rights and duties determined by International Law. Recognition is therefore considered unconditional and irrevocable.

2.2.4 *PLO Proclamation of Independence and its Relevance to the UN Charter*

In 1964, the PLO,³¹ the national liberation movement of the Palestinian people, was established by Arab heads of state. In 1988, it accepted, in Algiers, in its Proclamation of Independence³² all UN

²⁹ Boyle, F. "The Creation of the State of Palestine." In *European Journal of International Law*, Vol. 1, 1990.

³⁰ Montevideo Convention on the Rights and Duties of States. Signed in Montevideo, 26 December 1933 (entered into force, 26 December 1934).

³¹ The PLO, the coordinating council for Palestinian organizations, founded in 1964 at the first Arab summit meeting. Composed of various political groups and factions, the PLO is dominated by Al-Fateh, the largest group, whose leader, Yasser Arafat, has been the chairman of the PLO since 1968. Other groups in the PLO include the Syrian-backed As-Saiqa and the Marxist-oriented Popular Front for the Liberation of Palestine (PFLP).

³² PLO Proclamation of Independence, Algiers 1988. Over 114 states have already recognized the newly proclaimed state of Palestine, while only 93 maintain some

Resolutions since 1967 whilst renouncing violence and recognizing Israel's right to exist. As a confirmation of the PLO's intentions, the Proclamation states the following:

"The State of Palestine proclaims its commitment to the principles and purposes of the United Nations, and to the Universal Declaration of Human Rights. It proclaims its commitment as well to the principles and policies of the Non-Aligned Movement. It further announces itself to be a peace-loving State, in adherence to the principles of peaceful coexistence. It will join with all states and peoples in order to assure a permanent peace based upon justice and the respect of rights so that humanity's potential for well-being may be assured, an earnest competition for excellence be maintained, and in which confidence in the future will eliminate fear for those who are just and for whom justice is the only recourse."

At the same time, the State of Palestine committed itself to the principles and purposes of the UN and to the Universal Declaration of Human Rights as well as to the principles and policies of the Non-Aligned Movement. Worthy of mention is the fact that the Proclamation states that the State of Palestine believes in the settlement of regional and international disputes by peaceful means, in accordance with the UN Charter and UN resolutions.

2.3 Summary

The laws of belligerent occupation are still applicable to the West Bank and Gaza Strip. Accordingly, Israel has obligations that must be fulfilled, including, but not restricted to, the safeguarding of the natural resources, including water. Due to the huge importance of water, it is vital that a national or international water arrangement exist in times of war and armed conflict as well as in times of peace.

Palestine has already been recognized as a state by the majority of UN members and it is no doubt only a matter of time until the State of Palestine will be officially declared. Accordingly, not only

form of diplomatic relations with Israel. Furthermore, on 15 December 1988 the UNGA adopted Resolution 43/177, essentially recognizing the new state of Palestine and according it observer state status throughout the UN organization. The resolution was adopted by a vote of 104 in favor, with the US and Israel opposing the resolution and 44 states abstaining.

the laws of belligerent occupation, but also International Law, continue to be applicable in the case of Palestine, which includes in regard to the use and development of transboundary water resources.

3. WATER LEGISLATION IN PALESTINE

3.1 Background

The water policies that have been implemented in the West Bank and Gaza Strip were derived from a variety of legislation, including customary, Ottoman, Mandate, Jordanian, Egyptian, Israeli and military. By means of military orders and regulations, the Israeli Government, since June 1967, has been able to exercise complete legislative, administrative, and judicial authority over the Occupied Palestinian Territories and their inhabitants. Not only are these orders and regulations often not in keeping with the legal framework that existed prior to 1967, but in addition, the existing institutions have also been modified or replaced in order to facilitate the application of the various Israeli water policies.³³

3.2 Ottoman Legislation, 16th Century-1918

Starting from the 16th Century, when the Ottomans ruled Palestine, many of the principles of Muslim religious law, i.e., the *Shari'a*, were absorbed into the legislation regarding water. Muslim tradition regards water as a public or communal commodity, a 'gift of God', which cannot be owned,³⁴ and this important fact has

³³ 39th session of the UNGA, Permanent Sovereignty over National Resources in the Occupied Palestinian and other Arab Territories, Report of the Secretary-General, General A/39/326 E/1984/111, 29 June 1984.

³⁴ Water codes in Muslim countries recognize that water is a public property to be administered by states for the benefit of their citizens. In Oman, for example the principles of the *Shari'a* are the governing legal framework of the State, including those aspects dealing with water. In 1988, Royal Decree No. 82 was issued, declaring that water resources were a national wealth. In Jordan, Law No. 18 of 1988 (Jordan Water Law 1988) declared water public property. Article 25 of the aforementioned law states the following: "Any water resources available within the boundaries of the Kingdom, whether they are surface or groundwater...are considered State-owned property and shall not be used or transported except in compliance with this law."

In Yemen, water ownership, diversion, and use are governed by a mixture of laws and customary practices depending on the water source, land use economic activities and prevailing social and religious customs. Article 8 of the Constitution of

constantly been emphasized during the formulating of laws that relate to water. Only wells can be owned, with exclusive or priority rights to the water remaining with their owners and digging for new wells in the immediate areas being forbidden.³⁵

3.3 British Mandatory Law, 1922-1948

The water rules in effect during the British Mandate period did not repeal the Ottoman water legislation though several new laws were issued. In 1937, for example, the High Commissioner of Palestine passed Law No. 17, the 'Law of Protecting Projects of Public Water', which ruled that any operation related to groundwater abstraction or the construction and rehabilitation of wells would require a permit.³⁶ Another law, Law No. 2 for 1938, titled 'Law on Water Resources Inspection', gave the High Commissioner the authority to enter land and conduct the necessary tests for discovering groundwater. It also specified, however, that in the event of the said operations resulting in damage inflicted on any person, the Commissioner would be obliged to pay compensation.

3.4 Jordanian Laws, 1936-1966

In 1948, the Jordanian Military Commander proclaimed that all Mandatory laws and regulations that were still in existence in Palestine at the conclusion of the Mandate on 15 March 1948 would remain in force in all of the areas in which the Jordanian Arab army was present. Between 1952 and 1966, Jordan issued a number of legislations regarding the use, development, and man-

Yemen states the following: "All types of natural resources and sources of energy, whether aboveground, underground, in territorial water, are the property of the State, which assures their exploitation for public welfare."

³⁵ Bogdanovic, S. *International Law of Water Resources: Contribution of the International Law Association 1954-2000*. The Netherlands: Kluwer Law International, 2000. Bogdanovic explains that the codified Muslim Law is an important source of law in Muslim countries, whereby groundwater belongs to the community. The definition of water as a not-for-sale publicly owned commodity applies to all water dug by unknown persons.

³⁶ Article 4 of Law No. 17 of 1937 states the following: "As of date of publishing the announcement that declares any area for public water projects, no person can do any of the following things in that area: a) Construct a new well or install any other apparatus for extracting water or drawing it to the ground surface; b) conduct any change to an existing well or apparatus which will lead to widen diameter, depth, or power used for extracting water from the well." Furthermore, Article 5 stipulates that to undertake such operations, a permit must first be obtained.

agement of water resources, all of which applied to both the West Bank and the East Bank of the Hashemite Kingdom of Jordan.³⁷ These laws dealt mainly with the settlement of land and water rights, water inspection and monitoring, with a special emphasis on the administration of water resources for the benefit of the public.

3.5 Israeli Water Legislation, 1967-Present

The management of Israel's water is governed by a number of laws of which the Water Law 571-1959 is the core piece of legislation. Other laws include the Water Measurement Law, 5715-1955, the Water Drillings Law, 5715, 1955, the Streams and Springs Authorities Law, 5725-1965, and the Drainage and Flood Control Law 5718-1957.

With the Israeli occupation, water resources came under the 1959 Water Law of Israel. From then on, a large number of military orders -- which superceded the Jordanian legislation - pertaining to the management of water were issued. These orders basically introduced the principles contained in the Water Law of 1959, the first section of which states the following: "The water resources of the State are public property; they are subject to the control of the State and are destined for the requirements of its inhabitants and for the development of the country." Land ownership, meanwhile, is not linked to water, which means that the owners or renters of land do not hold the right to the water connected to it. Additionally, there is no private ownership to water but only private right to use the water, with the right to a water allotment being linked to one of the beneficial uses set out in Section 6 of the Water Law. The change in land ownership does not affect the right to water of the irrigated land. Moreover, the right to a water allotment is not a personal right, which implies that the landowner is not entitled to transfer the water entitlement from one area to another, but a right that is attached to a particular use at a particular location.

³⁷ The laws are as follows: No. 38 for 1946, No. 40 for 1952 on Land and Water Settlement, No. 31 for 1953 on Water Supervision, No. 22 for 1957 for 195 on the Municipalities, No. 12 for 1956 on Water Installation of Hebron, No. 51 for 1959 on the Settlement of the Water Resources, No. 9 for 1966 on the Organization of Matters of Drinking Water in Jerusalem District, and No. 37 for 1966 on the Organization of Natural Resources.

According to the Water Law, there are various licenses that need to be obtained for various purposes: namely, the Production License, the Recharging License, the Drilling License, and the Construction License. In areas that have been declared 'rationing areas', the Water Commissioner has the authority to provide water to a consumer from a different source, with any person affected by his decision being eligible to receive compensation. In addition, according to the Law, the Minister of Infrastructure has the authority to declare any regional water supply system State property, while the Ministry is entrusted with the task of calculating the actual cost of supplying water (the calculation should include the actual expenses of the supplier of water in connection with the production of the water and the supply thereof, including interest, depreciation, and other expenses).

It should be mentioned here that the rules and regulations governing the use and development of water and other water-related matters issued by Jordan prior to 1967 remained in effect even after 5 June 1967, but that, according to an Israeli proclamation issued on that date, they could be subjected to changes introduced by the Military Commander.

3.6 Israeli Military Orders Applicable in the West Bank

From 1967 onward, successive military orders were issued to amend parts of the laws governing the utilization, development, and protection of water resources. The following are considered the most important:

3.6.1 *Military Order 92 (15 August 1967) "Order Concerning Jurisdiction over Water Regulations"*

This order neither cancelled nor adjusted existing water laws; it did, however, transfer all administrative, executive, judicial, and monitoring authorities from the various governors, municipalities and village councils to one person, an Israeli official appointed by the Military Commander. This official was responsible for granting, stopping or adjusting permits, setting and collecting fees and taxes, monitoring water use and setting quotas, stopping the activities of any or all water entities or committees, and forming alternative entities, the members of which he himself was responsible for appointing.

3.6.2 *Military Order 158 (19 November 1967) "Order Concerning the Amendment to the Supervision over Water Law"*

Military Order 158 adjusts the Jordanian Water Supervision Law (No. 31 of 1953) and prohibits the construction of any new water installation without a new official permit. The order contains seven articles and an appendix on permits, with the articles detailing the steps to be taken in order to obtain permits from the Israeli official and stipulating that he has the authority to impose conditions on permits and change those conditions when he wishes, to cancel permits at his discretion, and to refuse to grant permits without being required to provide an explanation. The order also stipulates that the official's decisions are not subject to appeal.

3.6.3 *Military Order 291 (19 December 1968) "Order Concerning Settlement of Disputes over Land and Water"*

Concerning settlements of disputes over land and water, this order declares all prior settlements of disputes regarding water invalid, thereby increasing the already considerable jurisdiction of the Military Commander. Through analyzing the legal system after 1967 under Israeli occupation, one reaches the conclusion that it fails to provide any administrative framework for water management, use and control, other than the instructions of the Israeli official and whomever he appoints. Worthy of mention in this regard is the fact that it is the Israelis themselves who gave themselves the right to deal with all aspects of water management and use in the Occupied Palestinian Territories.

3.7 Palestinian Authority Water Legislation 1995-present

3.7.1 *Background*

Upon the signing of the Declaration of Principles (DoP) and the 1995 Interim Agreement, the Palestinian Authority (PA) inherited an extremely weak water sector characterized by serious institutional fragmentation following 33 years of occupation. Deterioration in terms of the provision and quality of water services is still common, and the responsibilities of the relevant institutions are scattered and unclear. The increasing demand for this valuable resource has obliged the Palestinian Government to secure additional quantities of water, increase the efficiency of the performance of the water supply systems, and attempt to solve the many conflicts between the legitimate users. In addition to the obvious

technical limitations to achieving sustainable development, the water situation in Palestine is also unique in terms of the political implications associated with the water resources requirements. Accordingly, the demands for the various purposes will have to be, for some time to come, tailor-made according to water allocations that are compatible with the agreements in force.

In order to face the above-mentioned challenges and obstacles and stand a chance of achieving sustainable development in the water sector, the PA has been obliged to take a number of measures aimed at minimizing the damaging effects of the current political situation on Palestinian water resources. As things stand at present, the enforcement of water legislation and policies depends on the adequacy and responsiveness of the regulations and on the administrative machinery required to ensure compliance. Parallel to enforcement of the legislation concerned, due consideration must be given to alternative measures such as introducing incentives to encourage Palestinian users to comply with the various laws and regulations.

3.7.2 Palestinian National Water Policy of September 1995

After the signing of the Interim Agreement of 1995, the need for a comprehensive survey of water resources and their development strategies became a top priority as far as the PA was concerned. The adoption of the elements of the National Water Policy (NWP) in September 1995 represented the first step in addressing the important issues of water resources management and planning. The NWP establishes the foundation for decisions regarding the structure and tasks of water sector institutions as well as water sector legislation. It also underpins the necessity of the sustainable development of all water resources and establishes the principle that water resources are a public property of the State. Clearly, the development of the water resources of Palestine must be coordinated on a national level and carried out on the appropriate local level.

3.7.3 Water Resources Management Strategy of May 1998

The overall development objective of the Water Management Strategy is to translate the messages from the NWP into strategic imperatives. The strategy emphasizes the necessary aspects of water development as the establishment of a comprehensive framework for the sustainable management of Palestine's water

resources, in addition to the development of an appropriate institutional set-up for reforming and strengthening the water sector in coordination with relevant stakeholders. This long-term and coordinated strategy for the water sector will be used as an overall basis for further planning relating to the activities and tasks associated with the water sector, with the main objective being the environmentally sound and sustainable development of the water resources through efficient and equitable water management. The eight key elements of the Water Resources Management Strategy are as follows:

1. Secure the Palestinian water rights
2. Strengthen national policies and regulations
3. Develop institutional capacity and human resources
4. Improve information services and assessment of water resources
5. Regulate and coordinate integrated water and wastewater investments and operations
6. Enforce water pollution control and protection of water resources
7. Develop public awareness and participation
8. Promote regional and international cooperation

3.7.4 *Water Law No. 3 for 2002*³⁸

The objective of this particular law, as stated in Article 2, is to "develop and manage the water resources, increasing their capacity, improving their quality and preserving and protecting them from pollution and depletion."³⁹ This objective is fulfilled through: i) The sustainable development of water resources based on environmentally sound and enabling bases; ii) The provision and satisfaction of societal and individual needs for water in an optimal and equitable way; and iii) The protection of all water resources from pollution to secure water quality, an environment not harmful to human health or well-being, and sufficient water for production and self-renewal.

³⁸ This law, hereafter referred to as the Water Law, was issued after being approved by the Palestinian Legislative Council (PLC) during the session held on 18 February 2002.

³⁹ Water resources are identified in Article 1 as "all waters which lie within the territorial land or sea of Palestine, whether conventional (surface or groundwater) such as the waters of springs, including hot springs, wells, ravines, rivers, lakes, seas, and the water collection areas, or unconventional such as sewage water, desalinated water, and brackish water."

The Water Law has 11 chapters. Chapter One encompasses the definitions and general provisions including the aims and the general principles of the Law. Amongst other things, it declares water a public property and states that every person has the right to receive sufficient water of adequate quality for basic water consumption and sanitation needs subject to the provisions of the Law, provided that this right does not contravene the quality or quantity of water resources by causing depletion or pollution. It also, in Article 4, stipulates that water utilization, exploration, development, and any other activity affecting the quantity or the quality of the water resources must be licensed. Chapter Two clarifies the fact that the Palestinian Water Authority (PWA) has a juridical nature and bears full responsibility for managing the water and wastewater resources in Palestine.⁴⁰ Chapter Three establishes the National Water Council (NWC), whose chairman is the Chairman of the PA, whose secretary is the PWA, and whose members include the main Palestinian ministries and other relevant stakeholders.⁴¹ As to the main task of the NWC, it is to ratify policies, plans, and programs pertaining to the water resources of Palestine.⁴² Chapter Four describes the tasks and responsibilities of the Head of the Water Authority, which is basically the implementation of the Law in proper coordination and cooperation with relevant stakeholders.⁴³ Chapter Five embodies the essence of the regulatory functions of the Law, the licensing and tariffs, whereby it is stipulated that users must pay for water licenses and that a unified tariff that encourages conservation and optimal utilization must be set. Chapter Six concerns the financial resources of the PWA. Chapter Seven establishes the National Water Utilities, whose function is to provide water and wastewater services under the supervision of the PWA and in cooperation and coordination with the relevant parties. It should be mentioned here that the NWC

⁴⁰ Article 7 includes the wide-ranging responsibilities of the PWA, which include the setting of the water policy, coordination with stakeholders, the monitoring and assessment of water resources, the declaring of conservation areas, the licensing of water-related activities, etc.

⁴¹ Article 8 states that the following are members of the NWC: the Minister of Agriculture, Minister of Finance, Minister of Health, Minister of Local Government, Minister of Planning and International Cooperation, the Head of the Environment Authority, the Lord Mayor of the Capital, a representative of the Chairman of the Union of Local Authorities, a representative of the Palestinian universities, a representative of the water unions and societies, and a representative of the regional utilities.

⁴² See Article 9 of the Water Law.

⁴³ See Articles 14-17 of the Water Law.

has the authority to suspend or dismantle the services of the board of directors of the regional water and wastewater services providers.⁴⁴ Chapter Eight, "Protection of the Environment," mainly emphasizes that the PWA in cooperation with the relevant ministries and authorities regulates and controls the pollution of water resources. Chapter Nine mandates the PWA to carry out regular inspections and to keep a register of all water-related data and information. Chapter Ten includes provisions relating to violations and sanctions, which mainly emphasize the 'polluter pays principle' and imposes sanctions on all activities undertaken without a permit or license first being obtained, as well as actions that violate the provisions of the Water Law. Finally, Chapter Eleven includes final provisions relating to transitional issues, including the status of licenses that existed prior to the issuance of the Law and the annulment of Law No. 2 for 1996, the status of service provider institutions, and the like.

3.7.5 Summary

All the water resources in the West Bank and Gaza Strip are still under the effective control of Israel, and the future aspects of water cooperation between Israel and Palestine will have to be resolved within the final status negotiations. The PWA, which was established by Presidential Order No. 90 for 1995, is empowered with the mandate to regulate and manage all Palestinian water resources, including transboundary water resources.⁴⁵

The PWA, obviously, has not yet been able to fulfill many of its obligations, nor will it be able to do so unless the geographical scope of its authorities and responsibilities is identified, respected, and recognized. The PWA is facing many obstacles in its endeavor to rehabilitate, build and operate new systems and structures, not least of which is the huge need for investment in water. What is needed is a genuine commitment on the part of the international community as well as Israel to assisting in the establishment of strong institutions of comparable capacities to those in Israel in order to pave the way for cooperation (officially, the parties were expected to start cooperating in 1993, 1994, and 1995 when they

⁴⁴ See Article 28 of the Water Law.

⁴⁵ The PA established the PWA as a statutory institution with its own budget and coming under the authority of the Palestinian Cabinet.

signed three consecutive formal legal arrangements).⁴⁶ Unfortunately, the current emphasis on positions rather than interests serves to intensify the problems associated with water resources and amplify the complexity of the water conflict. On one hand, the Israelis are determined to maintain the status quo as it clearly favors them and reject the reliance on International Law, while on the other, the Palestinians insist that the status quo is neither equitable nor reasonable and that its continuation represents a major violation of International Law.

4. WATER IN THE CONTEXT OF SIGNED TREATIES

4.1 The Declaration of Principles (DoP), 13 September 1993

Annex III of the DoP established an institutional mechanism, the Israeli-Palestinian 'Committee for Economic Cooperation', which was given the task of focusing on many areas, including those in which water is considered important. The resulting cooperation in the field of water includes a 'Water Development Program', prepared by experts from both sides, which specifies the mode of cooperation with regard to the management of water resources in the West Bank and Gaza Strip but which has never been implemented. Annex III of the DoP also calls for the preparation of proposals, studies and plans dealing with the water rights of each party as well as on the equitable utilization of joint water resources, to be implemented in and beyond the interim period.⁴⁷ It also states that the two sides will cooperate in the context of the multilateral peace efforts in promoting a development program for the region, including the West Bank and Gaza Strip.

As to the economic development program for the West Bank and Gaza Strip included in the DoP, it by necessity includes the development of the water infrastructure. At the regional level, the program involves the development of a joint Israeli-Palestinian-Jor-

⁴⁶ DoP, the Gaza-Jericho Agreement between Israel and the PLO, and the Interim Agreement on the West Bank and Gaza Strip.

⁴⁷ Annex III paragraph 1 states the following: "Cooperation in the field of water, including a Water Development Program prepared by experts from both sides, which will also specify the mode of cooperation in the management of water resources in the West Bank and Gaza Strip, and will include proposals for studies and plans on water rights of each party, as well as on the equitable utilization of joint water resources for implementation in and beyond the interim period."

danian plan for the coordinated exploitation of the Dead Sea area, the Mediterranean Sea (Gaza), Dead Sea Canal, and regional desalinization and other water development projects.⁴⁸ Due to the DoP's reference to the necessity for cooperation and coordination on water issues within and beyond the interim period, it was considered the benchmark for future negotiations. Theoretically, the institutional mechanism that was proposed within the DoP allows for dialogue between the two parties on the crucial matters and decisions pertaining to water. The DoP is the only official document in which both parties agreed to undertake studies and prepare proposals on the equitable utilization of joint resources to be implemented in and beyond the Interim Agreement.

4.2 The Gaza-Jericho Agreement, 4 May 1994

This agreement deals with the water issue in the context of environmental protection and the prevention of environmental risks, hazards, and nuisances. It allows for new wells to be drilled on condition that they cause no harm as far as the current Israeli utilization is concerned.⁴⁹ The agreement, which applies only to the water and wastewater resources and systems in the Gaza Strip and the Jericho area, clearly confirms the need for Israel and the Palestinians to adopt, apply, and ensure compliance with internationally recognized standards concerning acceptable levels of land, air, water, and sea pollution, and acceptable solid and liquid waste treatment and disposal levels. In the Agreement, the two parties agreed to establish a subcommittee – the Environmental Expert Committee – to meet when the need arises and deal with all issues of mutual interest including the exchange of all data relevant to the management and operation of the water resources and systems and the mutual prevention of harm to water resources. Worthy of mention is the fact that the Agreement focuses on the 'No Harm Principle' and the continuation of the two parties' current water entitlement rather than on substantive or procedural rules.⁵⁰

⁴⁸ Annex IV of the DoP: "Protocol on Israeli-Palestinian Cooperation Concerning Regional Development Programs."

⁴⁹ Annex III of the Interim Agreement, Article 2, paragraph 31 of "Protocol Concerning Civil Affairs."

⁵⁰ Annex II of the Interim Agreement, Article 2, paragraph 31 states the following: "Without derogating from the powers and responsibilities of the Palestinian Authority, the Palestinian Authority shall not adversely affect these quantities. Israel shall provide the Palestinian Authority with all data concerning the number of wells in the Settlements and the quantities and quality of the water pumped from each well, on a monthly basis."

4.3 The Israeli-Palestinian Interim Agreement on the West Bank and Gaza Strip, 28 September 1995

Within the Israeli-Palestinian Interim Agreement on the West Bank and Gaza Strip (Interim Agreement), which was signed in Washington on 28 September 1995, both parties recognized the need to protect the environment and utilize the natural resources on a sustainable basis. The sphere of cooperation includes among other things sewage solid waste and water. Both parties agreed to strive to utilize the available natural resources, pursuant to their own environmental and developmental policies, in a manner that would prevent damage to the environment and to take the necessary measures to ensure that activities in their respective areas do not cause damage to the environment of the other side.⁵¹ The Agreement explicitly states that Israel recognizes the Palestinian water rights and that these will be negotiated in the permanent status negotiations.⁵² The nature of these rights, however, was not identified, nor were the overarching principles governing the rights and obligations of both parties set out in the text. Moreover, Appendix I of Annex III, Article 40 of the Interim Agreement deals with water allocation only in terms of fulfilling the immediate needs of the Palestinians and does not consider the principle of equitable and reasonable utilization of the water resources by Palestine and Israel.

The two parties agreed to establish a Joint Water Committee (JWC) as an institutional mechanism for the interim period, to be responsible for implementing Article 40. It was further agreed that decisions of the JWC should be reached by consensus, including the agenda, the procedures, and other matters.

4.4 Summary

To date, the water conflict has been dealt with apart from the principles of International Law. The Jordan River dispute is far from being resolved as it requires five riparian countries to agree on water allocation, which is somewhat impossible at the current time. As to the groundwater aquifer shared by Israel and Palestine, the resistance on the part of Israel in terms of establishing

⁵¹ See note 51.

⁵² *Ibid.*, Article 40 of the Interim Agreement.

an agreement based on International Law is linked to three main reasons:

- a. Israel's great dependence on the waters of the Mountain Aquifer, from which it obtains 40% of its total supply;
- b. Israel's knowledge that its current utilization of the shared groundwater resources violate the principles and rules of International Law;
- c. Any future legal arrangement that builds on the rules and principles of International Law and relevant best practice would threaten Israel's absolute control over the water.⁵³

As to the Palestinians,⁵⁴ it is believed from this paper's perspective that they accepted the Interim Agreement arrangement on water driven by two main forces. Firstly, given the transitional nature of the arrangement, the Palestinians anticipated that the final status negotiations would bring them equitable solutions. Secondly, the fact that the Interim Agreement was the only official document in which Israel recognized the Palestinian water rights meant that the Palestinians were optimistic that it would come to represent the first real step towards cooperation and agreement in the field of water.

The obligation to cooperate within these treaties mainly serves the objectives of the Israelis, especially in terms of their objective of protecting the water resources to which they currently have access. The Interim Agreement of 1995 provided only a temporary solution for this complicated conflict, not least of all because, as mentioned above, although it emphasized Israeli recognition of Palestinian water rights in the West Bank, these rights were not defined.⁵⁵ Only additional supplies to serve urgent water needs were allocated for the Palestinians in Article 40, to be developed from the Eastern Mountain Aquifer Basin and any other agreed

⁵³ This view is based on a survey, conducted by the author, relating to the Israeli position *vis-à-vis* the water issue.

⁵⁴ This view is based on the author's six years (1995-2000) of experience working with the PWA. Additionally, the author worked on the preparation of the technical files for the negotiations and prepared documents and files for the JWC.

⁵⁵ Annex III, Article 40, paragraph 1 of the Interim Agreement states the following: "Israel recognizes the Palestinian Water rights in the West Bank. These will be negotiated in the permanent status negotiations and settled in the Permanent Status Agreement relating to the various resources."

upon sources.⁵⁶ Furthermore, again, as mentioned above, there is no agreement concerning the overarching legal principles that will govern the rights and obligations of both parties, with negotiations relating to these rights being postponed until the permanent status negotiations. According to the DoP, the negotiations should have started in 1996 (i.e., three years after the signing of the DoP); to date, however, the unstable political environment that exists in the region has hindered the commencement of any serious negotiations on water.

If one compares what is called for within the Agreement with what has actually been achieved, the complexity of the situation becomes very clear, as does the inequality of the power structures, which has constantly favored the Israelis. Decision-making within the JWC has been unilateral and always dependent on the impact of the proposed Palestinian projects on the status quo of the current Israeli utilization. The 'No Harm Principle' meanwhile has been the dominant factor in the Israeli evaluation and rejection of the Palestinian projects and plans. The complete failure of existing joint mechanisms and institutions – specifically the JWC - in terms of fulfilling even the minimum of obligations during the interim period is but one example of the effect that the abovementioned problems have had on the overall situation. On a technical level, the essential projects for development were delayed, rejected, or put on hold for unjustifiable reasons, and the negotiations on a water agreement are currently frozen due to the tension that exists between the Palestinians and Israelis. The repeated Israeli claim that these projects harm the current Israeli utilization remains a major obstacle, as has been the case since the beginning with regard to the successful implementation of the Agreement. So bad is the situation, that in eight years, the Palestinians have only succeeded in developing 13 mcm out of 80 mcm.

⁵⁶ Annex III, Article 40, paragraph 6 of the Interim Agreement states the following: "Both sides have agreed that the future water needs of the Palestinians in the West Bank are estimated at between 70-80mcm/yr." Of the amount mentioned here, only 28.6 mcm/yr were considered urgent, and a plan on how to develop this amount was included in paragraph 7 (a and b). The remaining 41.4-51.4 mcm will be developed by the Palestinians from the Eastern Aquifer and other agreed sources in the West Bank. See paragraph 7.

5. ROLE OF INTERNATIONAL WATER LAW AND THE WAY FORWARD

5.1 Background

According to the UN, Customary International Law applies in cases where signed agreements and treaties governing the utilization and development of international watercourses are absent.⁵⁷ The conceptual basis for the general body of law may be said to stem from the geographical principle of coherence plus the long-standing legal principle according to which a state must use its own resources so as not to cause harm or injury to others. The fundamental principles of Customary International Law are equitable and reasonable utilization.⁵⁸

States attempting to determine their legal entitlement from shared waters have appealed to four allocation theories, each based on the concept of State sovereignty. These theories are believed to have influenced the evolution of the 'No Harm Rule' and the equitable and reasonable utilization principle.⁵⁹ The theories of

⁵⁷ UN/Natural Resources/Water Series No. 1, Management of International Water Resources: Institutional and Legal Aspects. New York: UN, 1975.

⁵⁸ Several primary sources cite the reasonable and equitable utilization rule as the governing rule of Customary International Law. These include Article 5, UN Watercourses Convention on the Law of Non-navigational Uses of International Watercourses, 21 May 1997, and UNGA Resolution 51/229, (not yet in force). The 1997 International Court of Justice (ICJ) decision also refers to the rule as the guiding principle of law in *obiter dicta*, paragraphs 85 and 147 of the Case Concerning the Gabcikovo-Nagymaros Project (Hungary v. Slovakia), ICJ, 25 September 1997.

⁵⁹ Wouters, P. K. *Rivers of the World: the Fundamental Principles of International Watercourse Law*, unpublished PhD thesis, 1997. The first of these theories is 'absolute territorial sovereignty', which provides that the jurisdiction of a nation within its own territory is necessarily exclusive and absolute and that a state may use the waters of an international river within its boundaries without any consideration of the legal entitlements of other co-basin states to an equitable use of these waters. The second theory of allocation is the 'absolute territorial integrity' theory, which resembles the common law doctrine of riparian rights that is being developed in the US and the United Kingdom (UK) and which links water rights to land ownership.⁵⁹ This theory clearly favors downstream states that demand an undiminished flow in terms of quality and quantity into their territory, as it does not allow upstream states to use the water within their territories in an unreasonable manner if the downstream states withhold their consent. It has already been used in disputes between Pakistan and India, and between Canada and the US, concerning the Indus and Columbia Rivers respectively. The third theory is the doctrine of 'prior appropriation,' sometimes referred to as 'historical use', which asserts the proposition that 'first in time - first in right'. It tends to favor downstream states that succeed in developing their use of

territorial sovereignty and that of territorial integrity are not suited to serve as the basis for formulating rules governing international watercourses, which would equally apply to transboundary groundwater. The theory of limited territorial sovereignty offers a more balanced approach. This being the case, it has been accepted as an appropriate foundation from which to develop International Watercourse Law. The community-of-interests allocation-related theory is not universally endorsed by states.⁶⁰ The theory, it should be mentioned, is consistent with the limited territorial theory, since it recognizes the co-relative rights and obligations of watercourse states with respect to their uses of international waters.

International Law is still perceived by many as being the basis for finding amicable and peaceful solutions for the utilization, development, and protection of shared water resources. The driving force behind the codification and progressive development of International Law in this specific field is the consensus among international organizations that relevant Customary International Law was not considered especially advanced or consolidated. There is accordingly a long and influential history of international legal development in the international water resources field, the pace of which has accelerated markedly during the last 50 years. The growing concern of the international community in terms of the development and proper management and legal frameworks governing international water resources has been reflected in the work of international governmental and non-governmental organizations (NGOs) and in the writings of scholars and publicists, keen to focus attention on the question of the development and management of water resources. In the context of the determination

watercourses before upstream states. It is widely resorted to in arid and semi-arid countries where the demand for water greatly exceeds the supply. This doctrine is not well received by upstream states, which find it unfair to give all the benefits of an international watercourse to those who are faster in developing the resource. The fourth theory of allocation, the 'limited territorial sovereignty' theory, is more connected with the development and evolution of equitable and reasonable utilization principles. This theory respects the equal and similar rights of all riparian states to the use of an international watercourse. Some commentators speak of another theory, i.e., 'the community of interests'. This theory, which is derived from the 'theory of common interests', focuses on the notion of a shared and common interest in the international watercourse, which should be developed as an integrated whole, irrespective of territorial boundaries.

⁶⁰The theory, however, was applied by the Permanent Court of Justice (PCIJ) in the Oder Commission case (for navigational uses) and by the ICJ in the Danube case (a possible extension to non-navigational uses).

of international customs with respect to the use of international waters, several non-governmental and governmental institutions have attempted the codification of these rules of Customary International Law whilst progressively developing an international legal instrument that governs the non-navigational uses of international watercourses.⁶¹ The work of the International Law Institute (Institut De Droit International, IDI), the International Law Association (ILA),⁶² the expert group on the Bellagio Draft Treaty, and the International Law Commission (ILC)⁶³ can be cited in this regard. The modern development of the law in the field of international watercourses demonstrates an increased awareness with regard to the current and emerging water crises, risks associated with the uncontrolled use of waters that cross borders between two or more states, and the importance of international cooperation in resolving conflicts over international waters.

The 1997 Watercourses Convention is to date the most authoritative statement relating to non-navigational uses of international watercourses.⁶⁴ Unfortunately, however, it is not yet in force. The Convention embodies a set of customary international rules and principles that are relevant to the utilization, development, and management of international watercourses including transboundary groundwater. Considered a framework, it guides states in con-

⁶¹ Some highly qualified publicists have attempted to classify the work of these organizations and groups into two categories: the first category includes those who have had a formative influence, and the second, those who have not. The work of NGOs is referred to as 'restatement', that is, unofficial codification, due to their informal institutional character. See Hayton, R.D. "The Formation of the Customary Rules of International Drainage Basin Law." In Garretson, Hayton and Olmstead (eds.), *The Law of International Drainage Basins*. New York: Oceana Publications, 1967. Some eminent writers have succeeded in having a formative influence on the progressive development of International Law. Brownlie emphasizes the fact, for example, that national courts lean on secondary sources including the writings of publicists for their judgements, whereas international courts tend to take these opinions into consideration but without much citation. He further mentions the work of the IDI and the ILC as having an authoritative influence on the content of International Law. This point is still the subject of a heated debate among legal writers. See Brownlie, I. *Principles of Public International Law*, 5th Ed. New York: Oxford University Press, 1999.

⁶² The ILA was founded in 1873 as a consultant for a number of UN agencies; in 1954, it began to work on International Water Law.

⁶³ The ILC was established by the UNGA in 1947 to promote the progressive development of International Law and its codification.

⁶⁴ The UN Convention on the Law of the Non-Navigational Uses of International Watercourses adopted by the UNGA on 21 May 1997.

cluding treaties particular to their international watercourses, including groundwater and surface water. Of fundamental importance is the principle of equitable and reasonable utilization of the international watercourse, which, along with the 'No Harm Rule', governs the utilization, development, and protection of international watercourses; it should be stated, however, that although there is an inherent relationship between the two, the latter is subordinate to the former. The implementation of the latter principle requires that hydrologic, economic, social, and political factors be taken into account when making a final decision, which should be based on an assessment of all the various factors.⁶⁵ With regard to procedural rules, it is stipulated that the duty to cooperate is obligatory. According to Article 8 of the UN Watercourses Convention, this duty is based on sovereign equality, territorial integrity, and mutual benefit, though the principle of cooperation itself does not have a normative character. The duty to cooperate invokes the need to exchange information and data, notify regarding planned measures, and consult and negotiate in the case of conflicts. The procedural rules, in the case of transboundary groundwater, are the most distinct as compared to those relating to international surface water.

The Bellagio Draft Treaty, which presents the most advanced framework in relation to transboundary groundwater regulation, offers the best-suited mechanisms and procedures for the protection, utilization, development, and management of water resources. These include the adoption of a declaration of critical zones for joint administration whereby measures such as those regulating the spacing of wells and pumping rates could be instituted to control withdrawals and thereby guarantee each country its share of the water. The Draft suggests mechanisms for dealing with uncontrolled lowering in the water levels, planned depletion, drought reserves, water quality, the protection of recharge areas, and public health emergencies. Amongst other things, it suggests the establishment of a joint institution for overseeing and administration and sets procedures for settling disputes.

Given its 'framework character', the UN Watercourses Convention fails to address the specific needs of the optimal and sustainable utilization and development of transboundary groundwater. Additionally, it does not adequately and comprehensively respond to the specific regulatory needs of groundwater, nor can it respond to the

⁶⁵ Articles 5 and 6 of the Convention.

regulatory and management needs of confined transboundary groundwater. To compensate for this gap, it is envisaged that the detailed procedures, mechanisms, and required institutions can be borrowed from the Bellagio Draft Treaty. It is therefore proposed that an agreement that is based on a combination of the substantive strengths in the Convention and the procedural strength found in the Bellagio Draft Treaty be formulated to provide an ideal legal solution for the problems associated with transboundary groundwater.

5.2 Application of International Law on the Palestinian-Israeli Conflict over Water

5.2.1 A Progressive Approach

The proposal for approaching the problem within the Palestinian-Israeli context is to progressively establish a solid basis for long-term sustainable arrangements. In light of the historical and current political background, however, there are valid reasons to suggest that in the short term at least, the attaining of a binding arrangement is impossible. In the initial stages at least and given the volatile political situation, it is preferable, without all the formality of treaties, to reach understandings or administrative agreements that are sufficient to allow the desired work to proceed and to bear fruit. The delay and difficulties usually encountered in the more cautious drafting and approving of a formal treaty are thus avoided. This is vitally important, not least of all because Israel does not feel it is in a position to accept the long-term commitments of a treaty at the time being and is therefore not in a position to accomplish prompt ratification. It is suggested here that if the Palestinians and Israelis were to start with an informal arrangement that demonstrates tangible benefits and progress, they could then generate the required national willingness to enter into arrangements of a more formal nature.⁶⁶

⁶⁶ An example of such an approach can be seen in the Plata case. The five Plata basin countries established an intergovernmental body, the Intergovernmental Coordinating Committee, prior to the negotiating of a treaty, through an accord signed by their Foreign Ministers, not acting as plenipotentiaries, at Santa Cruz de la Sierra, Bolivia, on 20 May 1968, which also provisionally approved the Committee's statute. At the same time, a list of priority projects to be implemented by the Committee was adopted. One year later, the governments officially concluded a treaty that confirmed the statute and the list of projects. An agreement concluded in a similar fashion is the statute of the Committee for Coordination and Investigations of

The progressive approach starts with a non-binding flexible arrangement that can serve the short-term need, which gradually builds up into a final legal binding arrangement based on International Law. In between these two extreme solutions lies an intermediate proposal, a combination of coordination and collaboration, being an output of the first arrangement and an input as far as the final one is concerned. The following analysis includes guidance on the structure of this approach including preconditions, measures and actions, shortcomings, impacts and funding requirements.

The progressive approach, in light of the highly stressed political environment that exists in this region, is advisable for many reasons, including the fact that it has the potential to aid the decision-making process by clarifying the various steps that states should take before committing themselves to implementing International Law. The option to end up with a binding treaty is only realistic when the parties collectively agree to commit themselves entirely to the rigors of a formal treaty regime. Under such circumstances, it can be shown that international cooperation efforts are more efficient and allow for greater options.⁶⁷ As mentioned above, if the Palestinians and Israelis start with such an informal arrangement and demonstrate tangible benefits and progress, they will hopefully find themselves in a position to generate the required national willingness to enter into arrangements that are more formal. This approach, which relies on meeting the underlying legal concept of 'equity' at all times, in all circumstances, is by no means a repetition of earlier studies and researches done on the topic in the area of the case study.⁶⁸ It is, however, non-deniable that earlier studies had their influence.

the Lower Mekong Basin. The statute was adopted on 17 September 1957 by representatives of the riparian states at a meeting of a preparatory committee convened for that purpose by the Executive Secretary of the UN Economic Commission for Asia and the Far East (ECEFE).

⁶⁷ The emphasis of the UN Charter on the importance of international cooperation is cited. Paragraph 3 of the preamble states the following: "To achieve international cooperation in solving international problems of an economic, social, cultural, or humanitarian character, and in promoting and encouraging respect for human rights and for fundamental freedoms for all without distinction as to race, sex, language, or religion."

⁶⁸ The only relevant study that can be cited here is one done by an academic Palestinian team. The study, which presented a stepwise open-ended approach for the identification of joint management structures for shared aquifers, falls short in terms of its utilization of International Law. In fact, International Law is completely absent, as evidenced by the fact that at the outset of the research, the 'equity criterion' the researchers referred to was dropped from their list of criteria for the analysis. Maybe that is justified in this particular case, given the political sensitivities under which the

5.2.2 Prerequisites for Successful Cooperation

A precondition for successful cooperation is the mutual acknowledgement of the need for a common base in the interest of international water resources optimization and management and establishing appropriate mechanisms for utilizing the shared resources in an optimal manner for the present as well as future generations. The future water agreement may go beyond the re-allocating of transboundary water and establish the basis for cooperative development and the implementation of common projects and plans. Accordingly, facilitating adequate dialogue and constructive communication is essential in terms of bringing the parties back to the negotiating table.

It is proposed that the underlying common objective among the two parties and the appreciation of the necessity of cooperation with respect to their shared water resources is genuine; *sine qua non*.⁶⁹ This proposal therefore requires them to reconsider their positions toward their future relationship relating to their shared groundwater resources. At the outset of this cooperation, the parties are advised to be cautious of the decisions they take. Among the critical issues they may have to consider is that pertaining to the degree and intensity of their cooperation, which is something that will undoubtedly be dependent on numerous political, social, and economic factors.

The progressive approach is based on some important hypothesis, which are as follows:

- There is very little schematic knowledge about transboundary groundwater especially on the Palestinian side;
- Both parties need guidance on the variety of existing options for international cooperation;

study had to be undertaken. To date, the study has not been brought to the implementation level due to many political reasons. From the point of view of this paper, dropping the 'equity' criterion from the analysis must surely have caused major resistance to the acceptance of the study on the part of the Palestinians. 'Equity', from the point of view of this paper is fundamental, as it is the measure of how equitable or inequitable a certain arrangement is in terms of implementing International Law.

⁶⁹ Ibid.

- The resolution of the conflict is believed to have the potential to result in numerous benefits for both the two sides and their shared resources;
- The ultimate common objective must envisage a final binding legal arrangement based on International Law relating to transboundary groundwater. The design of a legal regime and an institutional structure responsive to the particular basin require a deep understanding of experience and opinion in this particular field. Technical and scientific cooperation is logically accepted as the first step toward ensuring the success of the progressive approach to solving the water dispute.
- This type of arrangement requires that despite the hostilities and the disagreements at the political level, scientists, economists, and lawyers from both sides should establish an operational network of technical coordination and develop rules of procedures essential for protecting and harnessing the transboundary groundwater resources. A simple but critical assumption to be made in this regard is that there must be a genuine desire on the part of the parties to cooperate, to be confirmed through the exchange of notes on the part of competent authorities regarding their position *vis-à-vis* cooperation. The approach is expected to set the stage for thoughtful elaboration at the technical level. It therefore requires a substantial technical input by persons with specialized training and experience.
- Cooperation normally requires an institutional home. It is assumed therefore that since the parties already have a joint international institution - the JWC - this cooperation could be achieved through the development and reactivation of its work. In this context, it is important to start the institutional cooperation by studying the reasons for the past failure of the JWC and agreeing at the technical level on new terms, modes of work, and means of ensuring successful cooperation.⁷⁰ The cooperation within this type of arrangement primarily includes the sharing of data and information and the conducting of joint studies and research,⁷¹ and the parties are therefore ad-

⁷⁰ The JWC was established within the framework of Article 40 of Annex II of the Interim Agreement.

⁷¹ An example in the region is the cooperation in the field of hydro-geological investigations ongoing between Syria and Jordan with regard to the shared Basalt Aquifer. This project is funded by the Economic and Social Council for Western Asia

vised to coordinate their activities and their plans regarding the shared groundwater resources. The technical coordination arrangement clearly requires the establishment of some procedural rules, to whose following both parties should commit themselves. The following discussion presents the steps and measures essential for the successful implementation of such cooperation.

5.2.3 Identify the Problem

Among the actions that the parties need to undertake is that of identifying the nature of the problem, which is perhaps the most difficult and most important step in conflict resolution, particularly given the intense hostility between the parties involved. Once a decision to cooperate has been made, the mobilization of the available expertise in the various fields relevant to water resources management and the enactment of domestic governmental structures capable of effective international cooperation and collaboration becomes necessary. The need for a third party's intervention arises, particularly in this case, where one side is so much more powerful than the other is. It is recommended that the third party be composed of one member nominated by each party in addition to a member not having the nationality of any of the parties concerned, chosen by the nominated members, who shall serve as the chairman.⁷² It is recommended that the third, neutral team's expertise should be diverse and that the team should include a lawyer, a hydro-geologist and an economist. The third-party team could help with the process of identifying the aspects of the problem and the actors, i.e., the main negotiators, whilst acting as an advocate, not only with regard to the accepting of the need for compromise but also in terms of ensuring that the presented facts and information are accurate and reliable. The emphasis within this stage on having reliable data and information articulates a universal requirement, without which the rational management of aquifers at any level is not possible.

The next practical step is to identify the transboundary groundwater resources at issue, the geographic hydro-geologic and hy-

(ESCWA) as part of its initiative with regard to the use, management and protection of internationally shared aquifers in the Mediterranean region.

⁷² This step, i.e., third party intervention, resembles that mentioned in Paragraph (4) of Article 33 of the 1997 UN Convention on Dispute Settlement.

drographic concepts⁷³ the parties are willing to employ and the terminologies they are ready to adopt. The task of identifying which groundwater aquifers are shared between the two sides should focus on scientific evidence and hydro-geological investigations.⁷⁴ By and large, it is agreed that the Northeastern and the Western Aquifer Basins are transboundary. As for the Eastern Aquifer Basin, there is a need to jointly assess its transboundary status. A very important issue is to mutually understand and respect the differences between the parties and try to reconcile between them. These differences arise from the different stages of development, financial and institutional capabilities, and the need for more water, use priorities and environmental concerns.⁷⁵ This exercise will not be an easy task. However, once it is accomplished and the foundation is laid for subsequent requirements and commitments, the remaining tasks will become much simpler.

Another crucial step is the assessment of the strengths and weaknesses of each party with respect to technical personnel and equipment. The fact that Israel has developed faster than the Palestinians have in the field of water resources management and regulation means that the former is in a position to arrange an exchange of personnel and training programs, to include the participation of the less knowledgeable Palestinians.

5.2.4 Agree on Interests, Not Positions

Having identified the problem and the contested groundwater resources, the parties should agree on interests rather than positions and identify options relating to mutual benefits and gains. Each party will negotiate only as long as its interests can be served best at the negotiating table. At this stage, the parties are advised to conduct a joint assessment of how International Law could be employed to achieve an integrative, equitable, and mutually beneficial arrangement, despite the fact that the conflict situation involves fixed resources for which both sides compete. The real challenge is how the parties might reach an agreement,

⁷³ Another significant decision that has to be made concerns the selection of the conceptual hydro-geological management unit.

⁷⁴ These investigations are mainly available on the Israeli side, as during the years of occupation the Palestinians were not allowed to conduct such investigations.

⁷⁵ The long years of occupation have negatively affected all these areas of development for the Palestinians. These differences must be alleviated or modified through the proposed cooperation.

utilizing international legal principles, irrespective of their current relations and the inequity in the power structures. Once this is achieved, however, the parties will become more open to cooperate and collaborate in an environment characterized by faith and good intentions. It is advisable that at this stage, the parties evaluate the total amount of water that exists and the social and economic value that it has for each state. They should also agree on harmonized standards and guidelines to be adopted and implemented by both sides.

5.2.5 *Create Options for Mutual Benefits*

By this stage, the parties will have hopefully developed a common understanding on the availability of the resources, their respective vital human needs, economic and social development needs and the extent to which the available resources can meet all the needs without their sustainability and long-term safe yield being compromised. If the results reveal that even under an equitable and reasonable utilization scenario the existing resources would not solve the regional shortage, the parties would need to create options for mutual benefits and formulate plans for the valuable regional water resources to ensure their sustainable development.⁷⁶ They could also cooperate in the areas of developing non-conventional water resources, i.e., desalinated water and the implementation of regional development projects.⁷⁷

5.2.6 *The Need for a Mediator*

The role of a mediator or a facilitator must be designed to produce wise outcomes efficiently and amicably. It must ensure the development of an integrative arrangement, being of equal benefit to

⁷⁶ Many regional studies have been implemented under the multilateral talks but their influence was insignificant due to the fact that the first step of assessing the legal entitlement in the fashion mentioned here was not taken. Additionally, these projects were carried out under the umbrella of the Multilateral Working Group on Water where donors had offered to pledge money for mutually undertaken water projects that were hoped to contribute to the peace process. The Zambezi Action Plan provides a range of significant tasks and projects that could be implemented as part of the protection of the transboundary groundwater resources. See *The Action Plan for the Environmentally Sound Management of the Common Zambezi River System*, signed in Harare, 28 May 1987.

⁷⁷ These projects include the Mediterranean Sea-Dead Sea and Red Sea-Dead Sea-Conveyance projects (the latter was identified as a Jordanian-Israeli initiative with the possible involvement of the Palestinians).

both sides. Under International Law, the need for mediation in relation to international watercourses arises mainly when watercourse states are in disagreement and cannot themselves solve their disputes using negotiations. In the words of Article 33 of the UN Charter,⁷⁸ they must

“Seek a solution by mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements or other peaceful means of their own choice.”

This article is the only source of International Law that obliges states to follow these processes in the event of negotiations not yielding solutions. Mediation embraces the notion of co-basin states seeking the aid of an outsider that is from a third state or perhaps an international body such as the UN or one of its agencies. In essence, under this type of arrangement the parties to the dispute open themselves to the advice of persons charged with the responsibility of looking at the problem objectively. The aid of third parties by way of good offices, mediation, and conciliation in the resolution of conflicts has not only been advocated but also demonstrated in practice (World Bank-Indus River,⁷⁹ Eric Johnston-Jordan River).

5.2.7 Institutionalization of Cooperation

It is evident from reviewing the various cooperation arrangements between different states that international cooperation is a dynamic process that normally starts with a limited scope but fin-

⁷⁸ UN Charter, Articles 1 and 2, confirmed in the preamble of the 1997 UN Convention.

⁷⁹ The World Bank offered its assistance in order to establish an integrated water resources development and management scheme in the basin. Two countries resumed negotiations under the good offices of the World Bank in 1951, and after nine years of negotiations, the Indus Water Treaty, which is based on the division of the catchment area into two basin countries and allowing them to develop and manage water resources within their own territory, was signed at Karachi by Field Marshal Muhammad Ayub Khan, the then President of Pakistan, Jawaharlal Nehru, the then Indian Prime Minister, and Mr. W.A.B. Illif of the World Bank on 19 September 1960 (effective 1 April 1960). The success of the World Bank in facilitating the negotiations between India and Pakistan regarding the Indus River Basin is a good example of such an intervention whose success is attributed to the following: (a) the support given by the US and other 'Western' governments; (b) the ability of the World Bank to raise funds for the development of the Indus River Basin from its own resources and developed countries; and (c) the riparian countries' willingness to secure funds for the development of the basin.

ishes with a comprehensive agreement covering all aspects. It is clear, therefore, that the institutionalization of cooperation is extremely important and promises greater benefits. The establishment of the appropriate institutions has been found to be the right mechanism for the management and development of international watercourses. Many states have already demonstrated the fact that there is high awareness concerning the importance of institutions in the field of international watercourses cooperation, with illustrative examples including the Niger Basin Authority,⁸⁰ the International Commission on the Protection of the Rhine as found in the 1998 Convention,⁸¹ the Joint Commission on the Joint exploitation of the Geneva Aquifer, and the Joint Water Committee on Water and Wastewater established under the framework of the Interim Agreement between the PLO and Israel.⁸²

5.2.8 The Need for a Modified Transboundary Groundwater Framework Agreement

Given the weaknesses and strengths of the UN Convention of 1997 and the complementary role that the Bellagio Draft Treaty was found to play in formulating a legal agreement between Israel and Palestine concerning their shared groundwater resources, it is recommended that a modified framework treaty be drafted, being a combination of both products with possible groundwater regulation practices to be adopted at the national level. The strength of the UN Convention on the substantive level can balance the weaknesses in the Bellagio Draft Treaty in that regard, while the opposite is true when it comes to the procedural level. In addition to those procedures embraced within the Bellagio Draft Treaty that are believed to derive from national practices, other major procedures can be taken from national regulations and adapted and modified; these include the enactment of a joint permitting/licensing system in regard to the transboundary aquifer that is under joint regulation. The concept of integrated management including the coordinated use with surface water is another area where modification and development can be introduced at the international level.

⁸⁰ The Revised Convention Creating the Niger Basin Authority, signed in D'jamena 1987. *FAO Treaty Collection*, No. 12.

⁸¹ Convention on the Protection of the Rhine, Rotterdam, January 22, 1998.

⁸² Appendix II, Annex III, Article 40 of the Israeli-Palestinian Interim Agreement on the West Bank and Gaza Strip, Washington DC, 28 December 1995.

5.3 Conclusions

Water-related politics is but one pillar of general politics. It has constantly contributed to the creation of the conflict in the past, continues to amplify the present dispute, and is deemed to have bearings on any future political settlement. Many other contentious issues occupy the minds of politicians and negotiators at the present time, the vast majority of which are considered more critical than the water problem. It is however envisaged that prior to the finding of a final solution concerning all the final status negotiation issues, the water problem will be evoked as an interlinked element that calls for concerted attention and comprehensive treatment.

Despite the signed agreements between the PLO and Israel, Palestine is still occupied and the laws of belligerent occupation are still applicable in the West Bank and Gaza Strip. Accordingly, Israel has obligations that it is required to fulfill, which include, but are not restricted to, the safeguarding of the natural resources, including water. This paper demonstrates that Israel has been violating the rules and principles relating to the field of natural resources, specifically water. It also emphasizes that the debate on Palestinian statehood should not in any way discourage researchers from relying on the basis of International Law when exploring solutions and ways out for the best of their countries and nations. This paper further finds that the sovereignty of the Palestinians over their natural resources did not cease to exist as a result of the Israeli occupation, but rather, that it was simply not practiced for a period of time. According to the rules and principles of International Law, Palestine is entitled to an equitable and reasonable share of the international water resources, including the transboundary groundwater shared with Israel. In addition, it finds that despite the marked disparity between the stages of development and the various strengths of Israel and Palestine, the challenge now is how to convert this into a thorough understanding of the mutual benefits to be derived from cooperation. Once this understanding is achieved, the discussion relating to whether or not Palestine formally constitutes a state becomes irrelevant.

An important observation resulting from the conducting of this study is that political willingness is a decisive factor in the entire process of international cooperation. The inability on the part of politicians to accept the consequences of international cooperation is reflected in a lack of willingness to place confidence in joint or international institutions willing to coordinate and cooperate, in

addition to the shortage of local financial and expert human resources. The analysis in the case of the Palestinian-Israeli water conflict reveals that in the absence of genuine intentions to cooperate, even legally binding treaties will not help to solve the dispute. Despite the signed protocols, declarations, and agreements and the emerging joint mechanisms established because of them, reality proves that Israeli control over the groundwater resources is absolute and that water resources are still legally controlled by Israeli military orders that forbid the developing of groundwater resources without the prior consent of the Israeli Water Commissioner. As to the Palestinians, they are merely the administrators of some infrastructure and a number of projects that only serve Palestinian communities.

In spite of the many obstacles mentioned above, this review of national water policies and laws in both Israel and the Palestinian areas confirms that there are strong foundations for cooperation, assuming that both parties, i.e., Israel and the PA, are willing to work hand-in-hand for the benefit of the resources and future generations. Mutuality and the necessity to cooperate are very important concepts, which unfortunately, are not addressed in the existing agreements. The two fundamental substantive rules governing the development and utilization of transboundary groundwater are the equitable and reasonable utilization principle and the 'No Harm Rule'; only if these two principles are adhered to will solving the conflict over water by introducing a progressive multidisciplinary approach result in the desired outcome.

SELECTED BIBLIOGRAPHY

International Legal Instruments

Agenda 21, Chapter 18 "Protection of the Quality and Supply of Freshwater Resources: Application of Integrated Approaches to the Development, Management and Use of Water Resources" UNECD Report Annex II Agenda 21, June 1992, UN Doc. A/Conf/151/26/Rev.1 Vol. 1,14 and Vol. 2, 167,206. Also found at <http://www.igc.org/habitat/agenda21/a21-18.htm> (last visited August 2002).

Caponera, D., *The Requirement for Drafting a modern Code and Water Legislation in the ESCWA Region*, Amman, 1996, E/ESCWA/ENR/1996/WG.1/WP.1, 17 November 1996.

Declaration of the United Nations Conference on the Human Environment, Stockholm, June 16 1972, found at <http://www.unep.org/Documents/Default.asp?DocumentID=97&ArticleID=1503> (last visited May 2003).

The Dublin Statement on Water and Sustainable Development 1992, found at <http://www.gdrc.org/uem/water/dublin-statement.html> (last visited April 2003).

Groundwater Storage and Artificial Recharge, Natural Resources/Water Series No. 2 (United Nations publication, Sales No. E.74.IIA.11).

The Helsinki Rules on the Use of the Waters International Rivers, Report of the Forty-sixth Conference of the international Law Association held at Helsinki, 1966, at 484-532 (1967).

Indigenous Peoples Kyoto Water Declaration, Third World Water Forum, Kyoto, Japan, March 2003, found at http://www.treatycouncil.org/new_page_52112111.htm (last visited September 2003).

The Johannesburg Declaration on Sustainable Development, September 2002, found at <http://www.mofa.go.jp/policy/environment/wssd/2002/document/dec.html> (last visited September 2003).

Johnston Negotiations on the Jordan River Basin, 1955 found at <http://ocid.nacse.org/qml/research/tfdd/toTFDDdocs/92ENG.htm> (last visited May 2003).

The Ministerial Declaration of The Hague on Water Security in the 21st Century, 22 March 2000, The Hague; found at <http://www.idi.or.jp/vision/declarat.htm> (last visited May 2003).

"Resolutions adopted by the Institute of International Law at its Session at Salzburg (4-13 September 1961), on the Utilization of Non-maritime International Waters, 11 September 1961," *Annuaire de l'Institut de Droit International*, Volume 49, Tome II, 381 (1961).

Rio Declaration on the Environment and Development (3-14 June 1992) UN Doc. A/CONF.151/26 United Nations, also found at <http://www.unep.org/unep/rio.htm> (last visited April 2003).

Rofe and Raffety Consulting Engineers, Nablus and Jerusalem Districts. Water Resources Survey, Hashemite Kingdom of Jordan, Central Water Authority, Jordan (1965).

UNECE Task Force on Monitoring and Assessment, under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki 1992), *Inventory of Transboundary Groundwaters*, Vol. 1, Lelystad, 1991.

UNECE Task Force on Monitoring and Assessment, under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki 1992), *Problem-Oriented Approach and the Use of Indicators*, Vol. 2, Lelystad, 1991.

UNECE Task Force on Monitoring and Assessment, under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki 1992), *Application of Models*, Vol. 3, Lelystad, 1991.

UNECE Task Force on Monitoring and Assessment, under the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki 1992), *State of the Art on Monitoring and Assessment of Groundwaters*, Vol. 4, Lelystad, 1991.

The United Nations Convention on the Law of Non-Navigational Uses of International Watercourses, 21 May 1997, UN Doc. A/RES/51/229, 8 July 1997.

United Nations Framework Convention on Climate Change (1992). Found at <http://unfccc.int/resource/docs/convkp/conveng.pdf>.

United Nations General Assembly Social and Economic Council, Documents A/40/381, June 1985, and A/55/84, June 2000.

United Nations Natural Resources/Water Series, No. 1, *The Management of International Water Resources: Institutional and Legal Aspects*, Sales No. E.17.II.A.2 1975.

WCED, *Our Common Future: the Bruntland Report*, Oxford University Press from the World Commission on Environment and Development: New York, 1987.

Troilalden J. (ed.), *Water Laws, Water Institutions and Water Supply Economics: in the Hashemite Kingdom of Jordan, the Palestinian Authority and the State of Israel*. Oslo: CESAR, 1997.

Books

Binnie, P. and A. Boyle, *International Law and the Environment*, New York: Oxford University Press New York, 2002.

Biswas, A. (ed.) *International Waters of the Middle East: From Euphrates-Tigris to Nile*, New York: Oxford University Press, 1994.

Bogdanovic, S., *International Law of Water Resources: Contribution of the International Law Association 1954-2000*, Dordrecht: Kluwer Law International, 2001.

Brownlie, I, *Principles of Public International Law*, New York: Oxford University Press, 5th ed., 1998.

Caponera, D. *Principles of Water Resources Administration: National and International*, Rotterdam: Balkema, 1992.

Fetter, C.W. *Applied Hydrogeology*, New Jersey: Prentice Hall, 3rd ed., 1994.

Hadawi, S., *The Palestine Diary*, Volume 1, New York, 1914-1915.

Hadawi, S., *Bitter Harvest: A Modern History of Palestine*, New York: Interlink Pub Group, 1998.

Plant G. (ed.), *Environmental Protection and the Law of War*, (New York: Belhaven Press, 1992.

Price, M., *Introducing Groundwater*, London: Champen and Hall, 1996.

Roberts, A., *Documents on the Law of War*, Oxford, 1989.

Sherk, G.W., *Dividing the Water: The Resolution of Interstate Conflicts in the United States*. The Netherlands: Kluwer Law International, 2000.

Tanzi, A. and M. Acrari, *The United Nations Convention on the Law of International Watercourses*, Netherlands: Kluwer Law International, 2001.

Winpenny, J. *Managing Water as an Economic Resource*, New York: Routledge, 1994.

Wouters, P.K. (ed.), *International Water Law: Selected Writings of Professor Charles B. Bourne*, The Netherlands: Kluwer Law International, 1997.

Articles

Barberis, J. "The Development of International Transboundary Groundwater Law," *Natural Resources Journal*, Vol. 31, 1991, pp. 167-186.

Bosnjakovic, B. "The Regulation of International Watercourses Under the UN/ECE Regional Agreements," *Water International* (International Water Resources Association), Vol. 25, 2000, pp. 544-552.

Burchi, S., "National Regulations for Groundwater: Options, Issues and Best Practices," in S. Salman (ed.), *Groundwater: Legal and Policy Perspectives*, World Bank Technical Paper No. 456, Washington, 1999.

Burke, J., Moenech, M, and Sauveplane, C., "Groundwater and Society: Problems in Variability and Points of Engagement," in S. Salman (ed.), *Groundwater: Legal and Policy Perspectives*, World Bank Technical Paper No. 456, Washington, 1999.

Caponera D.A. and Alheritiere D., "Principles for International Groundwater Law," *Natural Resources Journal*, Vol. 18, 1978, pp. 589-618.

Chenevert, D.J., "Application of the Draft Articles on the Non-Navigational Uses of International Watercourses to the Water Disputes Involving the Nile River and the Jordan River," *Emory International Law Revision* Vol. 6, 1992, pp. 495, 506.

Eckstein, G., "Application of International Water Law to Transboundary Groundwater Resources, and the Slovak-Hungarian Dispute Over Gabčíkovo-Nagymaros," *Suffolk Transnational Law Review*, Vol. 19, 1995.

Foster, S.S.D. and S.A. Carington, "The Interpretation of Tritium in the Chalk Unsaturated Zone," *Journal of Hydrology*, Vol. 46, 1980, pp. 343-64.

Foster, S. "Essential Concepts for Groundwater Regulators," in S. Salman (ed.), *Groundwater: Legal and Policy Perspectives*, World Bank Technical Paper No. 456, Washington, 1999.

Fresh Water Dispute Database, found at <http://terra.geo.edu/users/tfdd/documents/patterns.html>. (last visited January 2003).

Gross, D. and A. Soffer, "International Groundwater and International Rules: the Case of the Middle East and the Agreement between Israel and Jordan and between Israel and the Palestinians about the Gaza Strip," *Occasional Papers on the Middle East Series*, no. 12, Haifa University, 1996.

Hayton, R.D. "The Groundwater Legal Regime as Instrument of Policy Objectives and Management Requirement, Institutional Alternatives for Mexico US Groundwater Management," *Natural Resources Journal*, Vol. 22, 1982.

Hayton, R.D., "The Law of International Aquifers," *Natural Resources Law*, Vol. 22, 1982, pp. 71-93.

Hayton, R.D., and A. E. Utton, "Transboundary Groundwaters: the Bellagio Draft Treaty," *Natural Resources Journal*, Vol. 29, 1989.

Krishna, R., and S. Salman, "International Groundwater Law and the World Bank Policy for Projects on Transboundary Groundwater," in S. Salman (ed.), *Groundwater: Legal and Policy Perspectives*, World Bank Technical Paper No. 456, Washington, 1999.

Lerner, D., Issar, A. and Simmers, I. "Groundwater Recharge: A Guide to Understanding and Estimating Natural Recharge," *International Association of Hydrogeologists*, Vol. 8, 1990.

McCaffrey, S. "The Harmon Doctrine after 100 years: Buried not Praised," *Natural Resources Journal*, Vol. 36, 1996, pp. 540-590.

Bourne, C. Mediation, "Conciliation and Adjudication in the Settlement of International Drainage Disputes," *Canadian Yearbook of International Law*, Vol. 9, 1971, pp. 114-158.

McCaffrey, S., "International Groundwater Law: Evolution and Context," in S. Salman (ed.), *Groundwater: Legal and Policy Perspectives*, World Bank Technical Paper No. 456, Washington, 1999.

Rosenthal A. and Kronfeld J., ²³⁴U-²³⁸U Disequilibria as an Aid to the Hydrological Study of the Judea Aquifer Group in Eastern Judea and Samaria, *Journal of Hydrology*, Vol. 55, 1982, pp. 149-161.

Sheumann, W. and A. Klaphake, "The Convention on the Law of Non-Navigational Uses of International Watercourse," Conference Paper, Deutsches Institute für Entwicklungspolitik, Bonn, 2001.

Shuval, H.I., "A Proposal for an Equitable Resolution to the Conflicts Between the Israelis and the Palestinians over the Shared Water Resources of the Mountain Aquifer," *Arab Studies Quarterly*, Vol. 22, 2000.

Teclaff L. and E. Teclaff, "Transboundary Groundwater Pollution: Survey and Trends in Law," *Natural Resources Journal*, Vol. 19, 1979, pp. 628-663.

Utton, A., "The Development of International Groundwater Law," *Natural Resources Journal*, Vol. 22, 1982, pp. 95-118.

Utton, A., "The Transfer of Water from an International Border Region: A Tale of Six Cities and the all American Canal," *North Columbia Journal of International Law*, Vol. 16, 1991.

Utton, A., "Commercial Regulation 477: Crane, Diminishing Water Resources and International Law: A US Mexico Case Study," *Cornell International Law*, Vol. 24, 1991.

Utton, A., "The Development of International Groundwater Law," *Natural Resources Journal*, Vol. 22, 1982, pp. 95-118.

Waterbury, J., "Policy and Strategic Considerations Affecting Cooperative Use of the Nile Water Basin," Conference Paper, 5th Nile 2002 Conference, Ethiopia, February 1997.

Wouters, P.K., "Allocation of the Non-Navigational Uses of International Watercourse: Efforts at Codification and the Experience of Canada and the United States," in *The Canadian Yearbook of International Law*, XXX, 1992, pp. 43-88.

Wouters, P.K., "National and International Water Law: Achieving Equitable and Sustainable Use of Water Resources," *Water International*, Vol. 25, No. 4 (2000), pp. 499-512.

Wouters, P., "The Legal Response to International Water Conflicts: the UN Watercourses Convention and Beyond," in *German Yearbook of International Law*, Vol. 42, Berlin: Duncker and Humboldt, 2000.

2

WATER SUPPLY AND DEMAND DEVELOPMENT IN PALESTINE: CURRENT STATUS AND FUTURE PROSPECTS

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1. INTRODUCTION

Palestine is among the countries with the scarcest renewable water resources per capita due to both natural and artificial constraints. The amount in question, that is, only 100 cm/capita/yr is far below the per capita water resources available in the other countries of the world in general and those of the Middle East in particular.¹

Groundwater is the primary source of water for the Palestinians in the West Bank and Gaza Strip, with the groundwater resources of Palestine being extracted from aquifers. The West Bank uplands comprise the regional recharge area for the extensive aquifers, which under natural conditions, discharge from springs. It is estimated that 90% of the total recharge of the aquifer basins originates in the West Bank, while the present Palestinian share of well abstractions is only 13%. As to the major fresh surface water resource in Palestine, it is the Jordan River.² The existing water resources are derived from three groundwater aquifers, a series of springs that emanate from the groundwater, and surface runoff. At the present time the groundwater and springs provide essentially all of the water consumed in the West Bank.

The West Bank is a hilly area, with elevations varying from 400 m below sea level in the Jordan Valley to 1,000 m above sea level in the hills. The West Bank receives rainfall averaging approximately 600 mm per year; however, annual rainfall generally varies from less than 100 mm in the east and south to 700 mm in the north and west. The surface geology of the West Bank is comprised of well-fractured and karstic carbonate rocks, both limestone and dolomite. Various geological formations are generally non-covered and show outcrops at the surface. This is true even for the very deep formations such as Lower Beit Kahil and Kurnub. Outcrops appear at the top of hills as a result of strong folding and faulting. It is likely, therefore, that these hills are major recharge zones for the West Bank aquifer systems, especially in the non-developed and non-covered areas.

¹ *Water Supply and Demand Development in the Middle East*, (1996). A study funded by the German Technical Cooperation (Gesellschaft für Technische Zusammenarbeit - GTZ) and carried out by different Palestinian experts for the Palestinian Water Authority (PWA) [hereinafter referred to as the GTZ study].

² The data in Table 1 was compiled from numerous sources.

At present, water needs exceed the available water supply. The gap between water supply and water needs is growing due to population growth, an improvement in the standard of living, the need to expand irrigated agriculture, and industrialization. This growing gap is calling for the mobilization of any additional conventional and non-conventional water resources. To date, the development of additional water sources has been restricted and controlled by the Israelis since Palestinian water rights have not yet been dealt with in any detail and are due to be discussed in the final status negotiations. It is important to note that the water needs in the West Bank and Gaza Strip have for many years been artificially constrained by non-market forces, which means they cannot be used to forecast future needs. In fact, on the basis of various world and regional water consumption levels, the present magnitude of unsatisfied needs in the West Bank and Gaza Strip almost surpasses current water supply quantities. Thus, it is necessary to plan for and develop more equitable, yet feasible, future water consumption rates and supply capabilities for the needs of the society as well as for development.

2. PRESENT WATER SUPPLY

2.1 Palestinian and Israeli Wells and Springs in the West Bank and Gaza Strip

At present, there are 359 abstraction wells in the West Bank under Palestinian control, most of which are for private use. The Palestinian wells extract approximately 62 mcm/yr on average as follows: 31 municipal wells yielding approximately 16 mcm/yr; 13 West Bank Water Department wells yielding 12 mcm/yr; and 315 agricultural wells abstracting 34.5 mcm/yr. As to the 36 abstraction wells under Israeli control, they extract approximately 42 mcm/yr.³ Table 1 shows the number and abstraction rates of Palestinian and Israeli wells in each aquifer basin in the West Bank.⁴

There are approximately 300 springs in the West Bank, of which 112 are considered major freshwater springs. The total discharge of the major springs is approximately 60 mcm/yr. However, 50% of the spring discharges are of brackish quality and 50% are of

³ See note 1.

⁴ The data in Table 1 was compiled from numerous sources.

freshwater quality. Approximately 49 mcm/yr of the spring discharges are used for irrigation and 4 mcm/yr for municipal and domestic purposes. The average amount of discharge is estimated at 103 mcm/yr (including Ein Gedi Springs, outside the Green Line).

Table 1
Abstraction (mcm/year) of the Palestinian and Israeli Wells in the West Bank

Basin	Palestinian Wells		Israeli Wells	
	No. of wells	Abstraction	No. of wells	Abstraction
Eastern	129	25.12	28	29.85
Northeastern	85	16.48	4	9.82
Western	145	20.78	4	2.10
Total	359	62.37	36	41.77

Note: Data compiled by the author from numerous sources.

It is important to note that 90% of the total recharge of the aquifer basins originates in Palestine while the Palestinian shares of well abstractions and spring discharges are only 13% and 23% respectively. It is estimated that nearly 12%, 54% and 47% of the yield (wells and springs) of the Western Aquifer, Northeastern Aquifer, and Eastern Aquifer respectively consist of saline water. In the Gaza Strip, the current water resources available to the Municipal and Industrial (M&I) sector amount to 53 mcm/year, of which in the year 2000, 48 mcm were abstracted from wells in the aquifer and 5 mcm were supplied by Mekorot, the Israeli water company. The agricultural supply, which is currently 85 mcm/yr, is exclusively supplied from wells in the aquifer. This gives a total abstraction of 133 mcm/yr from an aquifer with an estimated safe yield of 57 mcm/yr.⁵

⁵ CDM, *Comprehensive Planning Framework for Palestinian Water Resources Development* (Task 4). Water Resources Program, Phase 1, USAID and the PWA, 1997 [hereinafter referred to as Task 4 Study].

2.2 Estimated Present Municipal and Industrial Water Use

Water supply data for urban and domestic uses indicates that during the year 2000, the quantity of water supplied to areas in the West Bank with water distribution networks (i.e., areas with piped water supplies) was approximately 51 mcm. The total population in these areas for the same year was estimated to be 1,715,000. According to these figures, the per capita supply rates (including losses) for piped areas are estimated to vary between 61 l/c/d in Hebron and 143 l/c/d in Tulkarem, which gives an average of 89 l/c/d.⁶ The total water consumption for urban and domestic purposes in the West Bank is estimated based on estimated loss rates for various districts and the abovementioned supply rate. The overall loss or unaccounted for water (UFW) rate was estimated to vary between 22% (in Ramallah) and 65 % (in Jericho), i.e., an average of 44% of the total supply. The loss rate in un-piped areas was assumed to be 25%. This UFW rate in piped areas comprises of physical losses, unregistered connections, and meter losses.⁷ Evidently, the use of the overall loss rate for estimating the consumption rates is not realistic as the latter should be estimated based on actual physical losses. Losses related to unregistered connections and metering do not constitute an actual loss of water from the system. They should, however, be considered when assessing the effectiveness and operation of water utilities as they represent a loss of revenues. The combined losses from unregistered connections and meter losses were estimated to be approximately 5% of the total supply. No accurate records of domestic water consumption rates are currently available, as quantities allocated to the various sectors (i.e., domestic, public, industrial, tourism and commercial) cannot be segregated. Domestic water consumption rates were grossly estimated to vary between approximately 30 l/c/d and 110 l/c/d, which gives an average of approximately 60 l/c/d. These estimates were developed assuming that water consumption rates for public, industrial, and commercial uses are approximately 12% of the total consumption quantities, based on data available for selected areas in the West Bank.⁸ They are substantially lower than the World Health Organization (WHO) minimum value of 100 l/c/d due to the Israeli

⁶ These numbers were estimated based on data collected from the *Water Sector Strategic Planning Study* funded by the World Bank in the year 2000.

⁷ Task 4 Study, see note 5.

⁸ See note 6.

restrictions on water usage by the Palestinians (WHO, 1993 report on water consumption for small communities). Some of the water supplied by the Palestinian utilities (approximately 7% of the total amount of supplied water) is purchased in bulk from Israeli utilities. Accordingly, only 76% of the water supplied to piped areas is owned by Palestinian utilities, whereas the remaining 24% is purchased from Israeli ones.

In the Gaza Strip, approximately 53 mcm/yr were used in the urban domestic sector in the year 2000. Approximately 48 mcm of water was supplied from about 90 wells while the remainder was purchased from the Israeli water company, Mekorot. For this analysis, all of the localities in the Gaza Strip are considered to be connected to a pipe distribution system. The total average use is estimated to be 134 l/c/d.⁹ In the Gaza Strip, the overall loss rate was estimated to be approximately 45%, of which 40% was estimated to constitute physical water losses and 5% unregistered connections and meter losses. It is expected that some or most of the unregistered connections are included in the total use figure, which means that the actual consumption rate could be approximately 5% higher. The per capita domestic consumption rate was estimated to be approximately 80 l/c/d. The estimate was developed assuming that the public, industrial, and commercial sectors (including minor quantities for livestock) would require approximately 12% of the total supply. It should be mentioned that the per capita domestic consumption rate does not reflect the entire picture in the Gaza Strip. Groundwater is of poor quality and only a small percentage is considered potable. The poor quality water therefore exacerbates the adverse impact of a low per capita consumption rate.¹⁰

2.3 Estimated Present Irrigation Water Use

The total amount of irrigated West Bank land amounts to approximately 125,600. Although constituting approximately 6% of the cultivated area in the West Bank, the agricultural production of this irrigated area represents 52.6% of the total agricultural production. The irrigated areas and irrigated cropping pattern in Pal-

⁹ Ibid.

¹⁰ Layonnaise Des Eaux, Khateeb and Alalmi/LEKA, Long-Term Planning for the Gaza Strip, (1998).

estine show that most of the irrigated area is concentrated in two regions, namely, the Jordan Valley and the northern districts of Jenin and Tulkarem.¹¹ The current irrigation water supply amounts to approximately 174 mcm/yr, of which 89 mcm/yr are utilized in the West Bank, coming from springs and wells as shown in Table 2.¹² The majority of the water supplies for irrigation come from either small, old wells or natural springs, both of which face severe problems in regard to discharge variability, which renders them unreliable sources of water.

Table 2
Estimated Total Water Supply for Irrigation in the West Bank and Gaza Strip

Districts	Wells (mcm)	Springs (mcm)	Total (mcm)
West Bank	40	49	89
Gaza Strip	85	0	85
Total	125	49	174

3. FUTURE PALESTINIAN WATER NEEDS

3.1 General

As mentioned earlier, the water needs in the West Bank and Gaza Strip have been artificially constrained by non-market forces. As a result, they cannot be used to forecast future needs. In fact, on the basis of various world and regional water consumption levels, the present magnitude of unsatisfied demand in the West Bank and Gaza Strip nearly surpasses current supply quantities. Thus, it is necessary to plan for and develop more equitable, yet feasible, future water consumption rates and supply capabilities for the much-needed social and economic development. Different studies have been carried out for the West Bank and Gaza Strip, each adopting different approaches and assumptions in regard to the different components that will affect future water needs. This section will define all the assumptions that have been used to project future Palestinian water needs and the outcome of these projections.

¹¹ These numbers were estimated by the author using data available in the bibliography.

¹² Ibid.

3.2 Population Projections and Assumptions

Population increase is the fundamental parameter affecting future water needs. This parameter determines not only domestic needs, but also agricultural/livestock (to feed the population) and commercial/industrial needs (to support the economic development of the population). The assessment of future population rates has been carried out using the Palestinian Central Bureau of Statistics (PCBS) 1997 census results as a base and then applying the following population growth rates: 3.5% for the years 1998-2005; 3% for the years 2005-2010; and 2.5% for the years 2010- 2020.

In addition to the natural growth of the base population, allowances have also been made for returnees, who are defined as those Palestinians displaced to other countries following the War of 1967 and their dependents. Various estimates of the number of returnees have been given but it is generally accepted that 500,000 will return (100,000 to Gaza and 400,000 to the West Bank) as Palestine continues to be established as an autonomous political entity. It is assumed that 80,000 have already returned (16,000 to Gaza and 64,000 to the West Bank) and that the remainder will come in equal annual numbers between 2005 and 2010. Additionally, the water needs of the refugees¹³ have been accounted for. The report assumes that the newcomers will be settled in three different location types, namely, the existing cities, the existing satellite locations, and/or new cities. The resulting population projections for the various planning years based on the above assumptions are shown in Table 3 below.

Table 3
Population Projections

Year	Population				Total
	Gaza Strip		West Bank		
	Urban	Rural	Urban	Rural	
1997 Census	947,8	53,760	848,500	751,600	2,601,660
2005	1,248,000	70,800	1,117,300	989,700	3,425,800
2010	1,530,800	82,100	1,631,300	1,147,300	4,391,500
2020	2,059,400	105,100	2,488,100	1,468,500	6,121,100

¹³ Refugees are those Palestinians displaced to other countries after the War of 1948 and their dependents.

3.3 Municipal Water Needs

As far as this report is concerned, future municipal water needs include domestic, public, livestock, commercial, and tourism water needs. Water needs projections for the report are based on the strategy that follows.

- Water needs forecasts are based on target consumption rates, particularly for domestic, public, commercial, and tourism consumption rates based on average WHO standards; these rates vary between urban areas and rural areas.
- Employing the water needs rates approach is not intended to replace the guaranteeing of water rights.
- During the early planning period and until target levels are reached, it is assumed that the need for water will gradually increase. Eventually, however, the rate of increase will decline to reflect the various imposed constraints.
- Water conservation is inherent in these rates, as it is assumed that losses will be gradually reduced from current levels. The reduction is predicated on the assumption that the water supply system will be adequately managed by well-staffed and equipped utilities and that the necessary maintenance programs will be implemented.
- The assessment assumes there will be no resource constraints and no political constraints in predicting future water needs.

The water needs projections are estimated based on the WHO standards of 100 l/c/day and 150 l/c/day as minimum and average domestic water consumption rates. Other consumption rates including public and livestock consumption rates are projected as a percentage of the municipal water needs. These target consumption rates are shown in Table 5 and 5a below for urban and rural areas respectively. Based on these target consumption rates and an estimated physical loss rate ranging from 12% to 8% by the year 2020, Table 4 shows the estimated municipal water needs. The total water needs of 444 mcm/yr projected for the year 2020 gives a total municipal annual per capita water need of 73 cm/yr. According to figures taken from Israeli publications, the annual municipal per capita water need in Israel at the present time amounts to 105 cm/yr.

Table 4
Projected Municipal Water Demand in mcm/yr

Year	2005	2010	2020
West Bank	117	175	283
Gaza Strip	83	108	161
Total Palestine	200	283	444

3.4 Industrial Water Needs

Due to the constraints imposed on the industrial sector in Palestine during the 35 years of occupation, the industrial sector's contribution to the overall economic development was limited. Consequently, the existing situation of the industrial sector in Palestine, which consists mainly of light and small industries, does not represent the stable industrial sector that should eventually exist in Palestine. This implies that the current industrial water needs cannot be utilized for the projection of future industrial water needs. The national vision regarding the industrial sector¹⁴ involves the establishment of between nine and 13 Palestinian industrial estates, eight of which will be distributed between the different governorates of the West Bank and four in the Gaza Strip. In order to meet both the expected development in the industrial sector and the subsequent increase in actual industrial water needs, an additional amount of water should be allocated for this sector.¹⁵ This is justified due to the retardation of industrial development during the years of occupation and the need to rectify the overall situation. According to several studies, which depended on the suggestions and proposals originating from the Palestinian ministries and institutions, it was found that the present industrial water consumption rate in Palestine represents approximately 9% of the total municipal water consumption rate. The estimation for the actual industrial water demand is based on WHO standards, which assumes that industrial water needs represent approximately 16% of domestic water needs. The actual industrial water needs are therefore approximately 29, 41 and 64 mcm/yr for the years 2005, 2010, and 2020 respectively while at present, the total industrial water consumption rate in Palestine is approximately 8 mcm/yr.¹⁶

¹⁴ In reference to the studies carried out by the Ministry of Planning and International Cooperation (MOPIC) and the Ministry of Industry

¹⁵ Reference Framework Document on the Water Issue. PWA, April 2000.

¹⁶ In reference to the studies carried out by MOPIC and the Ministry of Industry.

Table 5

Target Consumption and Water Needs Rates (Urban Areas)

Target	Domestic Consumption		Public Consumption		Livestock Consumption		Total Municipal	Physical	Total
	Rate (l/c/d)	Ratio of Municipal Consumption (%)	Rate (l/c/d)	Ratio of Municipal Consumption (%)	Rate (l/c/d)	Ratio of Municipal Consumption (%)	Consumption Rate (l/c/d)	Loss Rate (%)	Demand Rate (l/c/d)
2005	140	0.90	9	0.06	6	0.04	155	12	175
2010	150	0.90	12	0.07	4	0.03	166	10	185
2020	170	0.90	17	0.09	2	0.01	189	8	209

Table 5a**Target Consumption and Water Needs Rates (Rural Areas)**

Target	Domestic Consumption		Public Consumption		Livestock Consumption		Total Municipal	Physical	Total
	Rate (l/c/d)	Ratio of Municipal Consumption (%)	Rate (l/c/d)	Ratio of Municipal Consumption (%)	Rate (l/c/d)	Ratio of Municipal Consumption (%)	Consumption Rate (l/c/d)	Loss Rate (%)	Demand Rate (l/c/d)
2005	100	0.90	6	0.05	6	0.05	112	12	127
2010	125	0.90	6	0.04	8	0.06	139	10	154
2020	150	0.90	5	0.03	12	0.07	166	8	180

3.5 Irrigation Water Needs

The role of agriculture is particularly important in the economy of Palestine due to its high contribution to the Gross Domestic Product (GDP) and to its role in employing Palestinian workers. Irrigated agriculture contributes more than 35% of total agricultural production, whereas rain-fed agriculture contributes only 24%. Agriculture plays a major role in national trade, as agricultural products account for 23% of the national commodities export. The major share of the water supply in Palestine is being used in agriculture. However, due to the fact that water for agricultural purposes has been controlled by the Israelis since the occupation of the West Bank and Gaza Strip in 1967, the current supply for irrigation in Palestine is almost the same as that that existed prior to the occupation, in spite of the huge need to increase the supply in order to promote Palestine's economic development. At present, the total amount of irrigated land is approximately 240,000 dunums; 126,000 dunums in the West Bank consume some 89 mcm/yr of water, while the irrigated areas in the Gaza, the total area of which is around 114,000 dunums, consume approximately 83 mcm/yr. It should be mentioned that the total irrigated area in Palestine is only one tenth of that in Israel.

It is important to note that the present Palestinian per capita irrigation water share of 52 cm/capita/yr is the lowest in the region and that the future Palestinian per capita agricultural water requirement of 55 cm/capita is still lower than the current rates for Jordan and Israel. The expected expansion in the irrigated area will be only in the West Bank and mainly in the Jordan Valley where land is more available since the Gaza Strip faces severe problems relating to water quality deterioration and urban pressure. For the purpose of estimating the irrigation water needs for Palestine, it was compared with Jordan, which is similar in terms of water resources scarcity and climatic conditions. It is estimated that these needs amount to 0.1 dunum of irrigated land per capita, which is around 70% of the per capita irrigated land in Jordan. This is considered to be a conservative figure according to which the average Palestinian water requirement per dunum is estimated at 550 cm/dunum. Proper irrigation methods and high efficiency technologies are inherent in these values. Based on this and previous population projections, the total land requirements for irrigation will be 343,000, 439,000 and 612,000 dunums in the years 2005, 2010 and 2020 respectively. Based on the above estimates, the annual agricultural water needs will be 189, 241 and 337 mcm/yr for the years 2005, 2010, and 2020 respectively.

3.6 Total Water Needs

Based on the above estimates, the total water demand for the different planning years is shown in Table 6 below. The overall objective of any integrated water resources management plan is to satisfy the water needs associated with sustainable development. To achieve this, and based on the previous needs estimates, the Palestinian water sector should develop an amount of approximately 560 mcm/yr by the year 2020. Although this amount is about twice the amount currently available, it does not exceed the Palestinian water rights in regard to the renewable sources and the other potential non-conventional water resources.

Table 6
Projected Total Water Needs in mcm/yr

Year	2005	2010	2020
Municipal	200	283	444
Industrial	29	41	64
Irrigation	189	241	337
Total Palestine	418	565	845

4. FUTURE POTENTIAL WATER RESOURCES ALTERNATIVES

For the purpose of this analysis, future potential water resources alternatives will be divided into conventional and non-conventional alternatives.

4.1 Conventional Water Resources in the West Bank

Groundwater Resources

Water is supplied to the West Bank area from a series of groundwater aquifers contained within three groundwater systems designated as the Northeastern, Eastern, and Western Aquifers, typically referred to as the Mountain Aquifer System. The aquifers contain many of the same formations; the aquifer boundaries, however, are established as a result of flow patterns. Groundwater flows are generally controlled by various structural features such as faults, karst conduits, and folds. The flow pattern for West Bank aquifers is either to the east towards the Dead Sea, to the west

towards the Mediterranean Sea, or to the northeast. The pattern, however, may vary locally depending on the characteristics of existing structures. Moreover, the exact magnitude of inter-aquifer flow as well as discharge to the Mediterranean and Dead Sea are not presently known. Therefore, it is difficult to accurately assess the magnitude of the groundwater storage in the West Bank. It is estimated that the renewable groundwater resources in the West Bank total 590-690 mcm/yr. Most of this potential is being exploited either naturally (through natural springs) or artificially (through wells).

Various studies have reported different replenishment capacities for the various West Bank aquifers. In a summary of these studies, Wilks (1993) reports that the Western Aquifers are estimated to have an annual replenishment capacity of approximately 350 to 360 mcm/yr, the Eastern Aquifers an annual replenishment capacity of approximately 100 to 130 mcm/yr, and the Northeastern Aquifers an annual replenishment capacity of approximately 140 to 200 mcm/year. The range of reported yields and the Interim Oslo Agreement yields are presented in Table 7 below.¹⁷

Table 7
Estimated Recharges Rates of the West Bank Aquifers

Basin	Reported Yield (mcm/year)	Total Recharges per Article 40 of the Oslo Agreement (mcm/yr)
Northeastern	140-200	145
Eastern	100-130	172
Western	350-360	362
Total	590-690	679

Surface Water Resources

Surface water in the West Bank consists mainly of the Jordan River with its tributaries and wadi floods in high rainfall years.

¹⁷ The presented data was compiled from different sources.

*Wadis*¹⁸

Surface water flow in wadis is referred to as surface runoff, which depends mainly on the quantities and duration of rainfall during the wet season. It was found that surface runoff occurs when rainfall exceeds 50 mm in one day or 70 mm in two consecutive days. The total runoff in the West Bank is estimated at 64 mcm/yr. A Ministry of Planning and International Cooperation (MOPIC) study on water and wastewater shows that some 20 mcm/yr could be utilized from surface floodwater in major wadis by constructing storage dams, to be situated in the wadis themselves.¹⁹ Wadis in the West Bank are divided into two major groups, namely, eastern wadis, and western wadis. Eastern wadis flow from the central mountain towards the Jordan Valley and contribute to the re-charge of shallow aquifers and the Jordan River. Western wadis, meanwhile, flow from the central mountains in a westerly direction towards the Mediterranean Basin. These wadis are of importance for surface water streams, since floods from the different wadis combine to form major streams, which discharge into the Mediterranean Sea.

The Jordan River System

The Jordan River flows from north to south from an elevation of 2200 m above mean sea level at Mount Hermon to approximately 395 m below mean sea level at the Dead Sea. The Jordan River passes a straight distance of approximately 140 km, though the actual river length is approximately 350 km, due to its tortuous path. The catchment area of the Jordan River and Dead Sea basin comprises some 40,650 km². In the northern part (from Al-Huleh to the North), the Jordan River is surrounded by high hills. From Al-Huleh to Lake Tabariyya, it divides the land. The slope of the land there and accordingly the riverbed is slight and directed toward the south. Much steeper gradients than those associated with the Jordan River itself were found in all of its tributaries. The estimated annual discharge in the Jordan River ranges from 1,300-1,800 mcm/yr. Figure 1 shows the pre-utilization water balance for the Jordan River.²⁰

¹⁸ See Glossary of Terms.

¹⁹ The presented data was compiled from different sources.

²⁰ The figures were compiled from many Israeli, Jordanian, and Palestinian sources.

The Palestinian utilization of the water of the Jordan River before 1967 involved the use of 140 pumping units, all of which, after the occupation, were either destroyed or confiscated by the Israeli authorities. In addition, large irrigated areas of the Ghor, previously used by Palestinians, were turned into a closed military zone and later given to Jewish settlers. At present, Palestinians are prohibited from using the water resources in the Jordan River system. Different plans have been proposed and concepts developed for the Jordan River and how to identify the shares of various riparian entities along the basin, yet they have invariably failed or been discarded due to the recalcitrance of Israel in denying its neighbors' equitable rights. One of the most relevant schemes is the Johnston Plan (1953), which proposed the construction of the West Ghor Canal. Under the Johnston Plan, the proposed West Ghor Canal would have supplied 150 mcm/year of Jordan River water to the West Bank, but the plan was never implemented. A variety of different measures (the draining of Huleh Lake, the transferring of saline/brackish water from salty springs to the Lower Jordan, the discharging of industrial wastewater) have been implemented on the Jordan River by Israel, but these have affected its natural flow and caused deterioration in terms of both the environment and water quality and adversely impacted upon the regional ecology.

Israel, for a long time now, has been transferring large quantities of surface water through its National Water Carrier from Upper Jordan to the Negev, primarily for irrigation purposes. The transferred quantities nearly equal the annual discharge of the three main tributaries of the Jordan River. Moreover, the transferal is carried out without the other riparian countries with rights concerning the waters of the river being consulted.

4.2 Conventional Water Resources in the Gaza Strip

Groundwater, which accounts for almost 98% of the current use, is the only significant source of water in the Gaza Strip; the remaining supplies are purchased from Mekorot, the Israeli water company. Surface water that might be available from Wadi Gaza is diverted outside of the area and rainfall either recharges the groundwater or is collected in cisterns and used immediately. Rainfall is the major source of groundwater replenishment in Gaza. It is estimated that almost 40% of the total annual rainfall infiltrates into the ground and recharges the groundwater system. MOPIC reported (in 1996) that the recharge percentage might ap-

proach 60% in sandy areas whereas it varies from 15% to 40% in clay areas. Other sources of groundwater replenishment include groundwater flow from the eastern side, infiltration from surface water runoff, pipe leakage, infiltration of untreated wastewater, and return flow irrigation. MOPIC estimates of the quantity recharged into the Gaza Aquifer from the various sources are summarized in Table 8 below.²¹

Table 8
Groundwater Replenishment for the Gaza Aquifer System

Sources of Return Flow	Estimated Quantity (mcm/yr)	Total (%)
Rainfall	46	41
Groundwater Flow from the East	7	6.3
Surface Water Infiltration	2	1.6
Pipe Leakage	13	11.6
Untreated Wastewater	14	12.5
Irrigation	30	26.8
Total	112	100

Note: Data compiled by the author from numerous sources.

4.3 Non-Conventional Water Resources

Different reports have assessed a variety of non-conventional water resources as alternative future sources. The discrepancy in the results of these resources is due to the different assumptions used in the studies. These resources and their potential as recorded from different studies are described below. It is worth nothing that the Palestinian official position with regard to the non-conservational water resources is very clear and explicit: "No negotiations on the options of and benefit from such resources are accepted prior to the settlement of the Palestinian legal entitlements from the shared conventional resources."²²

²¹ Palestinian Authority, MOPIC, Environmental Planning Directorate. "Gaza Water Resources - Policy Directions in Groundwater Protection and Pollution Control." Gaza, 1996.

²² See paper of Fadia Daibes in this publication.

Water Harvesting Techniques

The collection of rainwater in cisterns is among the most popular techniques for water harvesting in the West Bank, especially in rural areas. According to the Comprehensive Planning Framework (CPF) study for the water sector, although cisterns are expensive, households utilize it as a reliable source of water during severe water shortages.²³ The CPF study estimated that approximately 16 mcm/yr and 8 mcm/yr can be realized from the installation of cisterns in the West Bank and Gaza Strip respectively, while the MOPIC plan for water and wastewater estimated that 4 mcm/yr could be utilized from cisterns by the year 2020. Regardless of the future amount of water that can be utilized through cisterns, most of the studies agree on the following:

- It is an expensive source.
- It is a reliable source especially during water shortage periods.
- The issue of water quality should be further investigated. Some studies, such as the MOPIC study, recommended its use for irrigation purposes.
- The estimated unit water cost for cisterns is more than one dollar, which is similar to the cost per unit of other non-conventional water sources.

Storm Water

The GTZ study estimated the total urban runoff of as approximately 14 mcm/yr. The study shows that at present only ten of the West Bank municipalities have storm-water collection systems, while out of the ten, nine have combined sewer systems and only one has a separate sewer system.²³

Treated Wastewater

The reuse of treated wastewater has been thoroughly investigated in many studies performed for the water sector in Palestine. The issues concerning the reuse of wastewater can be summarized in the following two points:

²³ See note 1.

- The efficiency of the existing treatment plants in the West Bank and Gaza Strip is very low. The reuse of wastewater in the near future is only feasible in areas that already contain a sewerage collection system and that are either constructing or upgrading the existing treatment plant.
- The amount of wastewater that can be utilized by the year 2020 varies according to the different studies from 20 mcm/yr in the CPF study of the water sector to some 40 mcm/yr in the GTZ study and the MOPIC water and wastewater plan. Direct reuse in agriculture is given the first priority in all studies since it is the most feasible solution based on technical, social, economical, and institutional development conditions.

Brackish Water Desalination

It is a known fact that some of the water resources in the Gaza Strip, if not all, as well as some potential sources from the Eastern aquifer in the West Bank suffer from a high salinity rate, which requires that they be desalinated. The GTZ report talked about 53 mcm/yr of brackish water in the West Bank from Al-Fashkah springs, and most of the water of the Coastal Aquifer in Gaza needs to be desalinated.²⁴ At present, Palestinians have very limited experience with desalination. In fact, the only Palestinian experience, according to the GTZ study, is the Deir Al-Balah plant in the Gaza Strip, though it has to be added that other pilot plants have been constructed in the Gaza Strip for demonstration purposes or on a small scale since the publishing of the report.

Sea Water Desalination

Seawater desalination has been mentioned in few studies as a future non-conventional water resource. The option of desalination was discussed in the CPF study for the water sector and investigated further in the GTZ report on water supply and demand development in the Middle East as a regional option. Different locations for the desalination plants have been proposed such as Egypt, Gaza, and Israel. One of the main problems in having desalination plants in Gaza is the limited area of land available. The cost of desalination in the different reports is estimated to vary between one to \$2/cm, which makes this option more expensive than any other conventional option.

²⁴ Ibid.

Water Import by Sea

Few reports including the CPF study for the water sector and the GTZ study on water supply and demand development in the Middle East have discussed water import by sea as a future water resource option to bridge any future gap between water supply and water needs. Two methods of transport have been considered: vinyl bags and old and new oil tankers. The reports mentioned that Turkey is the most feasible source at present for three main reasons although it is understood that Greece is supplying some of its islands. The reasons are as follows:

- It is the closest water-rich country in the region;
- It has already completed the construction of a loading terminal at the mouth of the Manavgat River;
- It has shown a willingness to provide water to the region.

Finally, the reports show that the expected unit cost for transporting the water ranges from US\$0.7 to 1.6/cm depending on the transportation method and the size of the bag or the tanker.

5. FUTURE WATER SUPPLY AND WATER NEEDS DEVELOPMENT STRATEGY

Based on future water needs estimates, there will be a growing gap between water supply and water needs if the Palestinian water rights are not realized and the Palestinians fail to develop their conventional and non-conventional water sources. This gap will act as the major constraint to any economic development in the future. To bridge this gap, the Palestinians will have to develop their potential water resources for the different sectors. Table 9 shows the additional amount of water that needs to be developed over the present use.

Table 9
Additional Quantities to be Developed per Planning Period

Year Sector	Present Use	Up to 2005	2006-2010	2011-2020
Municipal	107	93	176	337
Industrial	8	21	33	56
Irrigation	174	15	67	163

Following is the author's view regarding the resources that need to be developed in each sector as well as the main strategy that needs to be adopted for each sector.

5.1 Municipal and Industrial Sectors

Additional Sources to be Developed

Table 10 below shows the amount of additional water resources to be developed from the different potential alternative sources. The table shows a future reduction in the amount of water to be used from the Gaza Aquifer due to the deterioration in its quality and the present over-pumping rates.

Table 10
Additional Quantities to be Developed from Each Alternative Source

Sector	Year	Up to 2005	2006-2010	2011-2020	Total Amount from Source
West Bank Aquifers		98	100	199	397
Desalination		6	0	0	6
Water Import/Exchange		10	0	0	10
Gaza Groundwater		0	-5	-15	-20

It should be mentioned that the amounts from these alternative sources are subject to the final status negotiations and that the numbers presented here reflect the author's opinion of what is believed to be the most reasonable yet feasible alternative.

Main Strategy Issues

The main strategy issues are as follows:

- At present, the use of non-conventional water resources by Palestinians is not considered feasible due to the lack of infrastructure and the high and unaffordable desalination and importation costs (compared to the cost of developing conventional water resources).
- Based on preliminary estimates, the utilization of the groundwater resources and the Jordan River system is cheaper than

desalination, import or large-scale regional schemes, on top of which, the second and third options involve less supply security. In view of these facts it is recommended that the latter options only be considered as later developments to serve the water gap outside the planning horizon of this study or else be considered emergency measures, to be taken only if the utilization of other solutions does not occur.

- The improvement of the quality of the water supply in the Gaza Strip will focus on those areas where the standard falls below the minimum acceptable for health and taste requirements. Emergency measures in the Gaza Strip shall be introduced to produce minimum acceptable domestic water for all and to initiate actions to improve the overall aquifer in order to endure a sustainable yield and good quality in the long term.
- All existing infrastructure including wells, springs pumping stations, storage reservoirs, and distribution networks should be rehabilitated.
- Planning and construction should be considered a first priority. There should be a phased program to ensure the flexibility of an integrated supply system to facilitate the transfer of water from sources to demand centers and allow for the exchange of water between governorates and regionally. The program should include the construction of a carrier between the West Bank and the Gaza Strip.
- The necessary institutional changes, training, and regulations to ensure the effective management of all development of water resources and the protection of the environment should be implemented.

5.2 Agricultural Sector

Additional Alternative Sources to be Developed

Table 11 below shows the amount of additional water quantities to be developed from the different potential alternative sources to meet the irrigation water needs.

Table 11
Additional Quantities to be Developed for Each Potential Source (mcm/yr)

Sector	Year	2005	2010	2020	Total Amount from Source
Jordan River System		5	32	63	100
Brackish Water Sources (Gaza Aquifer and Jordan Valley Spring)		5	15	25	45
Reuse of Treated Waste Water		5	5	8	18

Main Strategy Issues and Assumptions

The main strategy issues are as follows:

- While the domestic water demands of urban and rural populations will be the first demands to be satisfied from the available fresh water resources, agricultural demand, to the maximum extent practical, should utilize the reuse of wastewater and lower quality waters. This is in recognition of the scarcity of water in the region. Where such waters are not available, not suitable or not commercially developable, the utilization of a greater proportion of the Palestinian water rights relating to agriculture and the Jordan River system should be considered.
- Reclaimed wastewater as well as brackish water will be treated to standards appropriate for the relevant irrigation and for aquifer recharge, and storm water will be channeled to collection facilities for the benefit of agriculture.
- Priority in allocating water for irrigation will be given to areas with the most economic combination of available land, water and human resources.
- The development of new irrigated areas shall be entirely in the West Bank and no expansion should be planned in the Gaza Strip.
- Allocations of new water resources to agriculture will only be

made where the balance between existing water resources and the reuse of wastewater and water requirements is negative, and the cost is below the economic value attached to the use of the water. Good quality water will also have to be allocated, as a priority, to selected high cash crops such as strawberry in the Gaza Strip, and must be available in certain amounts and periods to flush soils utilizing lower quality water.

REFERENCES

CDM, *Comprehensive Planning Framework for Palestinian Water Resources Development (Task 4)*. Water Resources Program, phase 1. USAID and PWA, 1997.

Center for Engineering and Planning. *Water Conservation in Palestine*. 1994.

Al-Musa, S.S. "Towards an Equitable Distribution of the Common Palestinian-Israeli Waters: An International Water Law Framework." In Issac, J., and Shuval H. (eds.) *Water and Peace in the Middle East*. Amsterdam: Elsevier, 1994.

Al-Musa. S. *Negotiating Water: Israel and the Palestinians*. Washington DC: Institute for Palestine Studies, 1996.

Food and Agriculture Organization of the United Nations (FAO), *Wastewater Management for Agriculture Production and Environmental Production in the Near East Region*. Cairo, 1995.

Grey, D.R.C., *The Development of Water Resources of the Occupied Palestinian Territories: Some Key Issues*. Proceedings of the first Israeli-Palestinian International Academic Conference on Water, Zurich, December 1993. Amsterdam: Elsevier, 1993.

GTZ, *Water Supply and Demand Development in the Middle East*. Nablus: WESC, An-Najah University, 1996.

Isaac, J., and H. Shuval (eds.), *Water and Peace in the Middle East*. Amsterdam: Elsevier, 1994.

Kuttab, J. and J. Isaac. "Approaches to the Legal Aspects of the Conflict on Water Rights in Palestine/Israel." In Isaac, J. and H. Shuval (eds.), *Water and Peace in the Middle East*. Amsterdam: Elsevier, 1994.

Layonnaise Des Eaux, Khateeb and Alami (LEKA). *Long Term Planning for Water Sector in Gaza Strip*, 1998.

Moigne et al., *A Guide to the Formulation of Water Resources Strategy*. World Bank, 1994.

Ministry of Planning and International Cooperation (MOPIC), *Gaza Environmental Profile- Groundwater Resources Assessment in the Gaza Strip*, 1995.

MOPIC, *The West Bank Regional Plan*, 1997.

MOPIC, *Water Resources - Policy Directions in Groundwater Protection and Pollution Control*, Gaza, 1996

Palestinian Water Authority, *Water Sector Strategic Planning Study*, 2000.

Palestinian Water Authority, *Characteristic of Drinking Water Wells in Gaza Governorates*, 1997.

PECDAR, *Water Sector Strategic Planning Study*, 2002.

3

PALESTINIAN WATER NEEDS AND RIGHTS IN THE CONTEXT OF PAST AND FUTURE DEVELOPMENT

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1. INTRODUCTION

Development implies a movement from an unsatisfactory state of social reality to another state considered to be superior. In the early days, when the subject of development was emerging, as far as most practitioners and scholars were concerned, a sustained annual economic growth rate of 5-7%¹ meant that development had been achieved. By the late 1960s, however, many countries, in particular Brazil, had experienced sustained economic growth of over 5% but continued to be characterized by high rates of poverty, unemployment, and inequality. In short, for many of these high-growth countries, the standard of living for the vast majority of the people did not improve. Consequently, many students of the subject expanded the meaning of development and saw it as a process involving significant changes in social structures, popular attitudes, and national institutions in addition to economic growth and the reduction of poverty, inequality, and unemployment.

The experience of non-developing countries in the 1970s and 1980s gave further impetus to the evolution of the concept of development. On the 50th anniversary of the Bretton Woods Conference, an eminent assembly of development academics and practitioners formulated a new paradigm within which "...Development is considered to be 'a multi-dimensional, people-centered process':

"The goal of development is to create conditions that will enable each human being to realize her/his potential for political, social, and economic fulfillment in a manner consistent with the common good. Individual rights, duties, and participation are central to this process and to its goal. The first priority is the eradication of poverty, empowering people to gain a measure of control over their lives and to obtain the resources to meet their basic needs in an ecologically sustainable manner. Genuine development is essentially a grassroots, bottom-up process growing from the base with local communities being key players. Economic activity should be managed by human beings, within the bounds of the fragile and exhaustible environment. The market may be a means to achieving these goals, but it is not an end in itself.

¹ M.P. Todaro. *Economic Development*. Reading, Massachusetts: Addison-Wesley, 2000, p.14.

“Decision-making procedures in the development process must embody the principles of participation, transparency, accountability, and subsidiarity.”²

Another view of development presented by Amartya Sen³ (1999) emphasized the persistence of “... remarkable deprivation, destitution, and oppression...” in the world of today. Sen noted many new problems as well as old ones, most significantly the persistence of poverty and unfulfilled elementary needs, the frequency of famines and widespread hunger, violations of elementary political freedoms as well as basic liberties, extensive neglect of the interests of women, and worsening threats to our environment and to the sustainability of our economic and social lives. For Sen, the achievement of development entails the attainment of five types of freedoms by society, namely, political freedoms, economic facilities, social opportunities, transparency guarantees, and protective securities.

These freedoms are interconnected when it comes to their promotion of development: political freedom in the form of free speech and elections helps to promote economic security; social opportunities in the form of education, as well as health facilities, help economic participation; and economic facilities in the form of opportunities for participation in trade and production can help generate personal abundance as well as public resources for social development.

2. DEVELOPMENT AND WATER

2.1 General

During the recent decades, water has come to be recognized as a major factor in the paradigm of development in general and sustainable development in particular. This development is the consequence of the inefficient and unsustainable use of water resources in the developed countries during the 19th and 20th centuries. The process industrialization fueled by seeking ever-increasing profits was one side of the story. The other side, much ignored

² Griesgraber, (ed.). *Rethinking Bretton Woods: Conference Report and Recommendations*. Washington, DC: Center of Concern, 1994, p. 1.

³ Sen, A. *Development as Freedom*. New York: Alfred A. Knopf, 1999.

until recently, consisted of market failures, in particular negative externalities that in turn inflicted major damage to the environment and the destruction of major water resources. This destruction of water resources is the end result of human action; in turn, this destructive human action was based on the misplaced view that water is a renewable resource. A renewable resource implies that the stock of water regenerates itself; the resource flows as never-ending flows that come from a non-depleting stock.

Water plays two important interrelated functions in the process of development. First, water is essential for the satisfaction of basic human needs. Second, it is necessary for economic growth and development. The satisfaction of basic needs is necessary for survival (drinking water), sanitation (health), hygiene (bathing), and food preparation, while the fulfillment of basic needs in turn is a necessary condition for providing the energy, stamina, and good health required by humans in order to work and produce their livelihoods, as well as to attain higher standards of living. Water is therefore an input in the life process, an input in the health process, and an input in the production process.

Water is an essential input in all the productive sectors of an economy. It is a vital input in the production of food (which also overlaps with the basic needs function) and significantly increases the productivity of agriculture. Water is also important and vital in the commercial sector (especially tourism and recreation), as it is in the industrial sector. One of the conditions of development is "...empowering people to gain a measure of control over their lives and to obtain the resources to meet their basic needs in an ecologically sustainable manner."⁴ The use of water grows absolutely in all of these sectors as the society develops and the economy grows. However, the relative share of water allocated to each of these economic sectors tends to change.

In the industrialized world, water has played a significant role in the development process. During the early years of growth and development, the relative scarcity of water resources was not a limiting factor. Whenever the available water supply was fully utilized, the universal solution was to find and develop additional sources. The solution was to increase the supply of water; something referred to today as a supply side solution. Eventually, by

⁴ Griesgraber, op. cit., p.1.

the late 1970s and early 1980s, as the West exhausted its renewable resources by extracting more water than was being replenished and the damage to resources became apparent, a demand management approach to water use moved to center stage and became the eminent policy of the day.

In the United States (US), for example the total quantity of water utilized increased by 145% between 1950 and 1980, but then decreased by 8.6% between 1980 and 1995.⁵ The turnaround of the trend after 1980 is attributed to the shift of policy from a supply management to demand management oriented policy. This trend in consumption behavior applied to all water using sectors in the US except for two. The first, being the 'public supply' (domestic) sector continued to increase its consumption, which between 1980 and 1995 increased by a further 18%. The second, being the 'rural domestic and livestock' sector increased its use by 58% during the same period.⁶ Domestic water use increased with population growth; however, the fact that the growth of population (7%) between 1990 and 1995 outpaced the growth of water use (4%) reflects the success of conservation programs. The decreased use in other sectors is a reflection of more efficient water utilization methods in irrigation, industry, and commerce. The Canadian experience in the post 1980s period is somewhat different. Between 1981 and 1996, total water use increased by over 30%.⁷ However, two sectors, the 'manufacturing' and 'the chemical and chemical products', showed a 2% and 56% decline respectively.⁸ Domestic water use in Canada also increased as is it did in the US, rising by over 10%.⁹

2.2 The Palestinian Case

Since 1948, Palestinians in the West Bank and the Gaza Strip have been constrained and prevented from achieving development. Palestinians have never enjoyed "...conditions that enable each hu-

⁵ US Geological Survey (USGS), *Water Use in the United States*, found at <http://www.ga.usgs.gov/edu/wateruse.html> (last visited August 2003).

⁶ Ibid.

⁷ *Major Withdrawal Uses of Water*. Statistics Canada, found at <http://www.statcan.ca/english/Pgdb/envir05.htm> (last visited August 2003).

⁸ Ibid.

⁹ Ibid.

man being to realize her/his potential for political, social, and economic fulfillment in a manner consistent with the common good," nor have they been "...allowed to gain a measure of control over their lives and to obtain the resources to meet their basic needs in an ecologically sustainable manner." Between 1948 and 1967, the Jordanian regime directed all its resources to the development of the East Bank, which at the time was less developed than the West Bank, and did not allow the necessary freedoms designated by Sen for development. In the Gaza Strip, meanwhile, the Egyptian Administration did very little to develop the area, let alone give the Palestinians the freedom to develop. Between 1967 and up to 1995, the Israeli military occupation denied - as it still does - by force the Palestinians any avenue for development. This policy is consistent with Zionist ideology, which sees the West Bank as 'Judea and Samaria', the 'God-given homeland of the Jewish people', and the Palestinians living there for thousands of years as an irritation.

However, if peace is to be given a chance, then the Palestinian people must be allowed to enjoy their right to both self-determination and the freedom to develop their society, and like any other free people, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies in a manner consistent with the common good of all people in the region. Eventually Palestinians must have greater access to, control over, and use of their natural resources in general and water resources in particular. The lack of access to and control over a vital resource such as water places major obstacles in the path of the development process. The obstacle is more pronounced when the scarcity of the resource has reached dangerous levels. This is confirmed by an assessment made by the United States Agency for International Development (USAID), which said, "The West Bank and Gaza suffer from a chronic water shortage, preventing sustained economic growth and damaging the environment and health of Palestinians."¹⁰ Thus under the prevailing conditions of water access, water control and water use, Palestinians on a global level (in some areas of the West Bank basic needs are more than satisfied, while in others, they are far from being satisfied) have been left unable to secure their basic water needs as well as their water-related developmental needs. What is ironic in the Palestinian case is that it was not Palestinian political, social,

¹⁰ USAID, found at http://www.usaid.gov/wbg/program_water.htm (last visited August 2003).

economic, or cultural policy that produced this situation of chronic scarcity; Palestinians have never had the sovereignty to make policy decisions. It has been and continues to be the policy and the actions of external powers that impose this scarcity upon Palestinian society. In turn, Palestinian society had no option but to manage under imposed scarcity conditions long before the term or concept of demand management was introduced into the natural resource jargon in general and the water resource problem in particular.

Another issue relating to water and development in Palestine needs to be addressed here. Palestinians not only suffer from a chronic shortage of water, or what has been conceptualized as a first order scarcity condition,¹¹ but they also suffer from a shortfall in the social resources necessary to manage this natural resource on a national level. Ohlsson calls the lack of the social resources necessary to manage the natural resource a second order scarcity condition.¹² Thus, for the process of development in Palestine to have a chance of success, there is a need to resolve not only the first order scarcity condition, but also the second order scarcity condition. This in itself is an integral part of the development process. It must be stressed at this point that the resolution of the first order scarcity condition is primarily in the hands of Israel and that the Palestinians must negotiate their rights to more water. On the other hand, the resolution of the second order scarcity condition is in the hands of the Palestinians. During the five-year period between 1995 and 2000, the Palestinian Authority (PA) had the opportunity to resolve this problem, yet it failed to do so, and this failure must not be repeated. Furthermore, the resolution of the second order constraint is not conditional on the resolution of the first order scarcity condition. Removing the second order scarcity can, and must be attempted immediately. First, because there are no physical barriers or constraints facing Palestinians in this endeavor; only domestic social, political, and traditional constraints exist, and can be overcome in the cause of the common good. Second, once the second order scarcity condition is resolved, the Palestinians would be ready and equipped with tools, institutions, and the human capital to manage the increased access and control over the resource. In the recent past, all of the advice coming

¹¹ A first order scarcity condition means a lack of the natural resource, in this case water, as defined by Ohlsson, L., see Trotter, J. *Hydro-Politics in the West Bank and Gaza Strip*. Jerusalem: PASSIA, 1999, p. 132.

¹² Ibid.

from donors and their consultants pushed demand management as the genie that would resolve the Palestinian water crises. Demand management is indeed essential, and incorporating the opportunity cost of water, particularly scarcity opportunity cost is a must, now and in the future. The question of increasing Palestinian access and control over additional water supplies is not an engineering problem or a supply side policy that must not be attempted because in the West they no longer do this. It is a question of necessity for survival, and for development of Palestinian society. In turn, Palestinian development is a necessity for peace.

An additional and important reason for resolving the second order scarcity condition is that if this happens prior to future negotiations with Israel, it will be unable to use the lack of Palestinian management efficiency and responsibility as a pretext for not handing over Palestinian water rights. In the final analysis, the resolution of the first order scarcity condition is a necessary but not sufficient condition for development.

In the following pages, a brief assessment of the past developments within the Palestinian water sector will be presented. This is followed by an overview of the present water scarcity situation, after which an analysis of the role and/or needs of water in Palestinian development will be formulated. Finally, an evaluation of water and development will be presented.

3. HISTORICAL DEVELOPMENTS IN THE PALESTINIAN WATER SECTOR

3.1 The Water Resources

The West Bank, located mainly in the central hill region of historical Palestine, is bounded by the Jordan River and the Dead Sea in the east and by the 1948 armistice lines, later known as the Green Line, in the north, west and south. The area of the West Bank, which is approximately 50 km wide and 130 km long, is around 5,585 km². The Gaza Strip is located in the southwest corner of the Mediterranean coast, and is bounded by the Green Line in the north and east and by the Sinai in the south. The area is approximately 350 km², and at most 14 km wide and 80 km long.

Prior to 1948, the population of the West Bank was approximately 400,000 and that of the Gaza Strip around 80,000; however, im-

mediately after the War of 1948, the population of the West Bank jumped by 300,000 and that of Gaza by around 250,000. The War of 1967 and the occupation of the West Bank and Gaza Strip by Israel further disrupted the population count, and the Israeli census of 1967 found a Palestinian population of 595,900 in the West Bank and 389,700 in the Gaza Strip.¹³

The principle source of water in the West Bank is the Mountain Aquifer, which consists of three sub-aquifers, namely, the Western Aquifer, the Northern Aquifer, and the Eastern Aquifer (see Map 1 in the Annex).

Throughout the period of Jordanian rule, minimal development took place within the water sector in the West Bank. Jordanian policymakers concentrated their development priorities on the East Bank of the Kingdom. This attitude was only natural given that prior to 1948, the West Bank was considered the rural and less developed area of Palestine and the East Bank the West Bank's less developed hinterland. The East Bank had a lot of catching up to do when compared with the West Bank, let alone the coastal urban centers of Palestine. In regards to water regulation and institution building, very little was done prior to 1967. Jordan only formulated laws and regulations related to the control and management of natural resources and water in 1966, and even then, the Law for Regulating Natural Resources, No. 37, 1966 and the Regulations for Controlling Groundwater, No. 88, 1966, although passed, were never implemented in the West Bank.¹⁴

The developments that took place with regard to expanding the water supply in the West Bank irrigation sector between 1948 and 1967 were localized at the community level and financed by local capital. The experience of the village of Falamiah reflects the major developments that took place during the Jordanian period. In Falamiah, five irrigation wells were drilled between 1958 and 1962. These were financed by local private funds only. Given the high average cost (20,000 JD per well at the time), the farmers grouped themselves into companies with each company consisting of 24 shares each.¹⁵ Prior to the Israeli occupation, pumping was

¹³ Central Bureau of Statistics (CBS). *Statistical Abstract of Israel 1970*. Jerusalem: CBS, 1971, pp. 625-626.

¹⁴ Israeli Ministry of Defense (MoD). *Judea-Samaria and The Gaza District A Sixteen-Year Survey (1967-1983)*. Israel: MoD, November 1983, p.14.

¹⁵ Trottier, op.cit., p. 106.

not restricted and access, control, and management of the five wells were in the hands of the shareholder. By 1967, there were 750 wells in the West Bank of which only 413 were in use.¹⁶ The trend during this period was to increase the supply of water to meet the demand of a growing population and the growing demand from agriculture.

In the domestic water use sector, the only significant project initiated during the Jordanian period was the creation of a regional semi-private (or semi-public) water utility, the Jerusalem Water Undertaking (JWU). The JWU was created in 1966 through the Jordanian Law No. 9 of 1966. The law gave the JWU the "... mandate to develop new water resources and to control all projects concerning water in its area"; it also gave it "...the responsibility to provide drinking water to the population, to decide upon the pricing of that water, the cost of services, the methods of collecting payments and the financial, administrative, and technical regulations."¹⁷ The JWU mandate was designed to cover the Ramallah and Al-Bireh district in the north, East Jerusalem in the center, and Bethlehem, Beit Sahour, and Beit Jala in the south. The JWU was able to expand its network to the northern districts, and to Beit Hanina, which now lies in East Jerusalem, before the War of 1967 halted its progress. The Israeli annexation of East Jerusalem prevented its further extension in the city, while the Israeli military government prevented its extension to the Bethlehem area. This is reflected by the fact that in 1995, there were approximately 200 communities in the West Bank not served with piped water. Today that figure stands at around 150 communities without piped water services.

The expansion of water supply networks to both the agricultural and domestic sectors during the Jordanian period, although significant on a local level, was limited at best on the global Palestinian level. At best, only a fraction of the potential water resources of the Mountain Aquifer were exploited, mainly due to the absence of well-defined property rights, a shortage of capital, and the lack of clear and determined government policy to develop the water resource in the West Bank. In the meantime, the Israeli drilling of wells and pumping was proceeding at an accelerated pace. By 1954, Israel completed a water project, which involved the pumping of 200 mcm/yr from the Israeli side of the Western Aq-

¹⁶ *Ibid.*, p.100.

¹⁷ *Ibid.*, p.82.

uifer across the Green Line,¹⁸ and by 1965, it completed the work necessary for the exploitation of the full potential of the Western Aquifer with the construction of approximately 300 wells pumping around 375 mcm/yr, an amount deemed greater than the safe yield of the aquifer.¹⁹ The Northern Aquifer was also fully exploited by Israel before the end of the 1950s. In the post-1967 period, Israel drilled a number of wells inside the West Bank and began to pump 5 mcm/yr to supply Israeli settlements.²⁰

A major source of water in the West Bank that did not require investment is springs. There are between 124 and 131 springs in the West Bank discharging between 28-36 mcm/yr, depending on the amount of rainfall during the winter months.²¹

The Gaza Strip water resources are located underground in sand, sandstone and semi-pervious clay aquifers, unlike the karstic aquifers of the West Bank. The width of the aquifer varies from 3-10 km in the north to about 20 km in the south, the thickness from between 120-180 m at the coastline to 10 m at the eastern border of the Gaza Strip, and the depth of the water between 8 m and 60 m respectively.²² Replenishment comes from rainfall (35-40 mcm/yr) and irrigation returns (20-30 mcm/yr), which gives a total of between 55 to 70 mcm/yr.²³ In 1967, there were 1,200 wells in the Gaza Strip, pumping approximately 65 mcm/yr, which was more or less equal to the rate of replenishment.²⁴ Gaza, like the West Bank, did not experience any economic development, and more or less stagnated. The major activities that dominated the Gaza economy during the period 1948-1967 consisted of agriculture and smuggling, which provided for a minimal standard of living for the population involved in these activities.

¹⁸ Shuval, H., "Towards Resolving Conflicts over Water between Israel and Its Neighbors: The Israeli-Palestinian Shared use of the Mountain Aquifer." In Allen, J.A., (ed.), *Water, Peace and the Middle East*. London: Tauris Academic Studies, 1996, p.140.

¹⁹ Ibid.

²⁰ Ibid., p.141.

²¹ Palestinian Central Bureau of Statistics (PCBS), *Water Statistics in the Palestinian Territory 2002*, found at <http://www.pcbs.org/inside/selcts.htm> (last visited August 2003).

²² Water Resources Action Program (WRAP), *Palestinian Water Resources: A Rapid Interdisciplinary Sector Review and Issues Paper*. Jerusalem: The Task Force of the WRAP-Palestine 1994, p.6.

²³ Ibid.

²⁴ Ibid.

3.2 Developments Under Israeli Occupation

In 1967, when Israel occupied the West Bank, the latter was a capital-poor, labor-intensive agrarian society. Agriculture formed the backbone of the economy, accounting for around 50% of employment and over 40% of the GDP.²⁵ Minor if any development took place during the Jordanian period. Agricultural activity was mostly based on dry farming operated by household fellah units of production. It was characterized by surplus labor, which prior to 1948 tended to migrate to the coastal region of Palestine but after 1948 migrated eastward to Jordan and the Gulf States. The infrastructure (physical and economic) in the West Bank in 1967 was more or less what it was in 1948. The only major difference was the presence of the United Nations Works Agency for Palestinian Refugees (UNRWA), which became the second most important economic sector in the West Bank. During this period it was significant given the scarcity of resources allocated to West Bank development by the Jordanian authorities.

In 1967, the economy of the West Bank was on the one hand cut off from the relations and connections it had established between 1948-1967, while on the other hand, it was re-exposed to the historically more developed coastal-urban region of Palestine, now called Israel. Since 1967, Israeli occupation policy was determined by the political and security imperatives of the Zionist venture in Palestine. The economic policies therefore did not allow for development. Budgets for infrastructure development were miniscule and the structure of the economy remained more or less stationary. However, the Israeli policy to allow Palestinian laborers to work in Israel had a major impact on the welfare and structure of society. Personal incomes increased dramatically, which allowed for individual prosperity, but generated by employment in Israel, not by domestic economic growth or structural change and development. The absence of an environment conducive for capital investment and accumulation, combined with obstacles imposed by numerous military orders, left only one avenue for the investment of growing savings, namely, investment in the housing sector. Throughout the occupation period the construction sectors' contribution to GDP outstripped that of industry's contribution and the share of government spending. New and modern housing with

²⁵ Nasser, Y., *Labor Markets and Rural Household Economics: The Case of Hill Country Palestine (1890-1990) With Special Reference to the Israeli Occupation Period*, Unpublished Ph.D. Thesis, University of Sussex 1995.

indoor plumbing had a major impact on consumption patterns, bringing them closer in line to those in a more developed economy than to the pattern that would reflect the actual structure of the Palestinian economy.

Israel's attempts to maintain its control over the water resources of the Occupied Palestinian Territories commenced immediately after the War of 1967. In October 1967, three months after the occupation, Military Order 158 prohibited the drilling of wells without a permit/license from the military authority, thus limiting the drilling of wells.²⁶ In addition, Israel placed a meter on every existing well used for irrigation and imposed a quota on how much water could be pumped per year.²⁷ It did not, however, impose any restrictions on springs or place quotas on wells for domestic use.²⁸ In addition to prohibiting the drilling of wells without a permit, Israeli military orders prohibited equipping a well without a permit as well as building pumping stations without a permit.²⁹ Between 1967 and 1990, the Israelis granted 23 permits for drilling wells, of which 20 were for domestic use only.

Table 1
Annual Recharge and Use by Population of the Mountain Aquifer Water (mcm/yr)

	Annual Recharge	Use During the 1990s		
		Israeli	Palestinian ^a	Total
Western	350-360	300-400	20-25	320-455
Northern	140-150	100-110	45	145-155
Eastern	150-180	40	42	95
Total	640-690	440-550	116-121	460-705

^a This includes an average of 35 mcm from springs in the West Bank.

Source: Harpaz, et al. "Overview of the Mountain Aquifer." In Feitelson, E. and M. Haddad, *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston: Kluwer Academic Publishers, 2000.

²⁶ Trottier, op. cit., p. 60.

²⁷ Ibid., p.60.

²⁸ Ibid., pp. 60-61.

²⁹ Ibid., p.119.

Table 1 above shows the annual recharge and extraction by population rates for the three aquifers during the 1990s. The recharge rates indicated below were divulged by the Israelis during the interim negotiations of 1995.

In 1967, there were 413³⁰ working wells in the West Bank, whereas by 1983, there were only 300 operating wells as reported by the Israeli Ministry of Defense.³¹ Many wells were closed either because they had dried out, - some due to the fact that Jewish wells had been drilled right next to them³² - because they were located in areas that had been declared a security zone and were thus 'off limits' to Palestinians,³³ or because their owners could not obtain the necessary permits in order to rehabilitate the well or equipment, which became inefficient to use, or simply broke down.³⁴ In 1990, it was reported that there were 364 wells operating of which of which 38 were for domestic use.³⁵ How the number of wells increased from 300 in 1983 as reported by the Ministry of Defense to 364 in 1990 as found by Awartani, when only 23 permits were issued for new wells, may suggest that Awartani over-counted or that since the time of the Ministry count, more permits were given for rehabilitation. In either case, this discrepancy reflects the lack of reliable information pertaining to the subject of water, which is understandable given the extent of the current water dispute. The monopoly of knowledge becomes more pronounced when the issue of settlements and water is considered.

During the 1970s and 1990s, Israeli pumping varied between 300-400 mcm/yr, while Palestinian pumping was restricted by Israel to between 20-25 mcm/yr (see Table 1). During the 1970s and 1980s, Israeli over-pumping resulted in a considerable drop in the groundwater table, which in turn resulted in the drying out of the Auja (Yarkon) spring, and a 50% reduction in the outflow of the

³⁰ Ibid., p.100.

³¹ Israel, MoD, (1983), op. cit., p.15.

³² In 1983, the MoD admitted to only one such case of a Jewish -owned well drilled in 1967, which "...caused a reduction of the water supply available to the Arab population." Israel, MoD, (1983), op. cit., p.15.

³³ Trotter, op. cit., p. 100.

³⁴ Interviews conducted by author with farmers and well owners in the Jericho area.

³⁵ Trotter, op. cit., p. 101.

Timsah (Taninim) spring.³⁶ These two springs form the only draining outlet of the Western Aquifer, and were estimated to have had an outflow of approximately 250 mcm/yr (Auja) and approximately 100-110 mcm/yr (Timsah).

Between 1967 and 1990, a total of 32 wells were drilled to supply illegal Jewish settlements.³⁷ The 32 settler wells in 1990 pumped 47% of the total water extracted in the West Bank, with the 364 Palestinian wells pumping 53% of all water extracted.³⁸ This reflects the degree of control Israel imposes over water resources by the permit system (no rehabilitation), and the quota system (the quantity quotas allowed in 1967 were more or less the same as those allowed today). In 1999/2000, the total amount of water pumped from Palestinian wells in the West Bank came to 56.88 mcm/yr or 8.5% of the annual recharge (640 mcm) of the Mountain Aquifer³⁹ while a further 38.11 mcm/yr came from springs, bringing the total water used from the Mountain Aquifer by Palestinians to 94.99 mcm/yr (or around 14% of the aquifer's range of 640 to 679 mcm/yr recharge rate).

From an Israeli perspective, the controlling of water resources in the Gaza Strip was not crucial in terms of the Israelis' overall water supply. The 65 mcm being pumped every year in 1967 by the 1,200 wells was barely enough to meet domestic and irrigation use. In addition, the withdrawal of water from the Gaza Aquifer would not have an impact on Israeli water supplies. Therefore, the number of permits given for drilling wells increased to 1,791 by 1990, with 49 wells being for domestic use and the rest for irrigation.⁴⁰ This was a significant and dangerous increase for an area that was already pumping the quantity considered optimal for preserving the water source as a renewable source. By 1993, there were 2,100 registered wells and an additional 900 unregistered (illegal) wells pumping water in the Gaza Strip, extracting between 100-110 mcm/yr, which was well above the replenishment rate of

³⁶ Harpaz, Y., et al. "Overview of the Mountain Aquifer." In Feitelson, E., and Haddad, M., *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston: Kluwer Academic Publishers, 2000, pp. 323-327, p. 50.

³⁷ Trottier, op. cit., p. 100.

³⁸ Ibid., p.100.

³⁹ PCBS, found at <http://www.pcbs.org/inside/selcts.htm> (last visited August 2003).

⁴⁰ Trottier, op. cit., p. 101.

around 65 mcm/yr.⁴¹ The consequences for the water resources have been disastrous: the decline in the water levels, the reduction in well capacities, the intrusion of seawater, and increasing salinity to intolerable levels. If allowed to continue, these will eventually lead to irreparable damage to the aquifer. In 1993, three wells in the Sheikh Radwan neighborhood of Gaza City were shut down due to the water being drawn containing a level of non-dissolved solids of 1,200 parts per million (ppm).⁴²

A significant change during this period was the increase in domestic consumption. The personal prosperity resulting from wages earned in Israel allowed Palestinians to improve their housing conditions and erect local infrastructure, namely electricity and water networks, on a community level. The impact on Palestinian domestic consumption has been significant. In 1968, it was estimated by the military occupation forces that Palestinian per capita consumption in the West Bank was 13.6 liters per capita per day (l/c/d), rising to double that in 1973, and by 1980, the rate had risen to almost 55 l/c/d.⁴³ Since then, per capita consumption in the West Bank has increased, but in some districts it still remains low, and in some communities it is the same as it was in 1967 (see below). The major investment in water networks took place in the major towns/cities and was administered by the municipal authorities. In many cases, the capital investment in these networks was subsidized by foreign non-governmental organizations (NGOs) working in the region whose objective was to make the Palestinian living conditions under Israeli occupation tolerable. During the same period, the Israeli military revealed "...the virtually unchanged consumption totals for agriculture..."⁴⁴

⁴¹ WRAP, op. cit., p. 6.

⁴² Ibid., p.6.

⁴³ Israeli Ministry of Defense. *Judea-Samaria And The Gaza District A Sixteen-Year Survey (1967-1983)*. Jerusalem: MoD, November 1983, p.16.

⁴⁴Ibid., p.16.

4. PRESENT SITUATION

4.1 The Peace Agreements and Water

In 1994, a study conducted by Hisham Awartani⁴⁵ projected that by the year 2000, the Palestinians in the Occupied Palestinian Territories would require 370.6 mcm of water per year. The year 2000 came and went, and now in the year 2003, the Palestinian population in the Occupied Palestinian Territories receives 279.8 mcm/yr⁴⁶ (129.7 mcm in the West Bank and 150.1 mcm in the Gaza Strip). This amount is almost 100 mcm short of what was expected by Awartani from the peace dividend. A year or less after the study made its prediction, the Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip was signed in Washington on 28 September 1995. Annex III, Appendix 1, Article 40 of the Interim Agreement stipulated "Maintaining existing quantities of utilization from the resources [the mountain aquifers]..." and Schedule 10 went on to list the quantities each side would have access to (see Table 2 overleaf) during the interim period before the Permanent Status Agreement was to be completed in 2000.

The Interim Agreement made official the conditions that existed prior to its signing, which means that what Israel took by force of the gun and military orders was now legitimized by agreement. Article 40 also recognized Palestinian water rights in the West Bank, but these were to be negotiated and settled in the Permanent Status Agreement, which today does not see the light at the 'entrance of the tunnel' let alone at the end of the tunnel. The Agreement contains an undertaking on the part of Israel to increase the amount of water allocated to the Palestinians by 28.6 mcm/yr during the interim period.⁴⁷ However, this commitment as well as the allocation according to Schedule 10 has until now not been fully honored. Official Palestinian records show that in 2002, Palestinian extraction from the West Bank aquifers by means of wells and by means of springs equaled 94.99 mcm/yr as opposed to the 118 mcm/yr agreed upon (see Table 2).

⁴⁵ Quoted in Ali Wihaidi, "The Economic Aspects of Joint Management of Shared Aquifers: A Palestinian Perspective." In Feitelson, E., and Haddad, M., *Joint Management of Shared Aquifers: The First Workshop*. Jerusalem: The Truman Institute and The Palestine Consultancy Group, 1994.

⁴⁶ PCBS. *Water Statistics in the Palestinian Territory 2002*, found at <http://www.pcbs.org/inside/selcts.htm> (last visited August 2003).

⁴⁷ Israeli Ministry of Foreign Affairs. *Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip*. Jerusalem: State of Israel, 1995, p.179.

Table 2
Average Annual Recharge of Mountain Aquifers, Extraction, and Utilization by Source and by Population, According to Annex III, Appendix 1, Article 40, Schedule 10 of the Israeli-Palestinian Interim Agreement, September 1995, in mcm/yr (%)

Aquifers	Israeli Share			Palestinian Share			Total	To be Developed
	Wells	Springs	Total	Wells	Springs	Total		
Eastern	40	0	40 (42.6%)	24	30	54 (57.4%)	94	78
North-eastern	103 ^a		103 (70.1)	25	17	42 (28.9%)	145	0
Western	340	0	340 (94%)	20	2	22 (6%)	362	
Total	483		483 (80.4%)	69	49	118 (19.6%)	601	78

^a Schedule 10 combines the amount of water from both sources, i.e., wells and springs.

Source: Israeli Ministry of Foreign Affairs. *Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip*. Jerusalem: State of Israel, 1995, p. 200.

However, total Palestinian consumption in the West Bank in 2002 was equal to 129.7 mcm/yr, the difference being made up by the purchase of water from Israel (approximately 34.8 mcm/yr). Furthermore, Israel committed itself to supplying this water at the full real cost of production at the source plus conveyance to the point of delivery; however, the price charged to the Palestinian Water Authority (PWA), i.e., over NIS 2.30 per unit⁴⁸ is well over the marginal cost of supply (NIS 1.6)⁴⁹ and well over what cities in Israel are charged (NIS 1.83).⁵⁰ The cost to the JWU of pumping the water it purchased from Mekorot in 1994 was around NIS 0.20 per cubic meter.

Article 40 did not only freeze the quantity of water that could be extracted by Palestinians, it also upheld the same conditions the military authorities had imposed on the Palestinian water sector prior to the signing of the accords. These included the licensing and approval of drilling of new wells (Paragraph 1a, Schedule 8, Appendix1, Annex III), the approval of all development of water resources and systems (Paragraph 1a, Schedule 8, Appendix1, Annex III), and even the approval of "plans for construction of new water and sewage systems or modifications of existing systems," which required the prior approval of the Joint Water Committee (JWC - Paragraph 2d, Schedule 8, Appendix1, Annex III).⁵¹ The JWC, which was also created by Article 40, consisted of an equal number of Palestinians and Israelis, who were required to reach their decisions by consensus, which meant that problems arose when the Israeli members vetoed proposals submitted by the Palestinians and vice versa. In short, control over water resources continues to be in Israeli hands, especially when it comes to the development of Palestinian water resources.

However, the Interim Agreement did recognize the immediate need of the Palestinians for an additional quantity of water, i.e., between 70-80 mcm/yr (Paragraph 6, Article 40). Israel committed itself to supplying an additional 9.5 mcm/yr for domestic consumption and permitted the Palestinians to increase their water

⁴⁸PCBS. *Water Statistics in the Palestinian Territories 2002*, found at <http://www.pcbs.org/inside/selcts.htm> (last visited September 2003).

⁴⁹ "The Bottom Line/And Now, Laundered Water," *Ha'aretz*, 14 May 2003.

⁵⁰ Ibid.

⁵¹ Israeli Ministry of Foreign Affairs. *Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip*. Jerusalem: State of Israel, 1995, pp. 196-197.

supply by 19.1 mcm/yr, mostly from the Eastern Aquifer. The remainder of the 70-80 mcm (41.4-51.4 mcm) could only be developed by the Palestinians from the Eastern Aquifer (Paragraph 7(b) 6, Article 40). It must be noted, however, that the water is mostly saline.

Table 3
Supply of Water in Palestine by Source, by Region,
and by Use, 2002 (000s cm)

Wells	West Bank		Gaza Strip		Palestine	
	Quantity	%	Quantity	%	Quantity	%
Domestic Use	22,714.1	39.9	59,000.0	40.3	81,714.1	40.2
Irrigation Use	34,166.6	60.1	87,500.0	59.7	121,666.6	59.8
Total	56,880.7	100.0	146,500.0	100.0	203,380.7	100.0
Springs						
Domestic Use	5,068.0	13.3	-	-	5,068.0	13.3
Irrigation Use	33,043.6	86.7	-	-	33,043.6	86.7
Total	38,111.6	100.0	-	-	38,111.6	100.0
Purchase from Israel						
Domestic Use	34,789.2	100.0	3,600.0	100.0	38,389.2	100.0
Irrigation Use	-	-	-	-	-	-
Total	34,789.2	100.0	3,600.0	100.0	38,389.2	100.0
From All Sources						
Domestic Use	62,571.3	48.2	62,600.0	41.7	125,171.3	44.8
Irrigation Use	67,210.2	51.8	87,500.0	58.3	154,710.2	55.2
Total	129,781.5	100.0	150,100.0	100.0		
Total Water Used	129,781.5	46.4	150,100.0	53.6	279,881.5	100.0

Source: PCBS, *Water Statistics in the Palestinian Territory 2002*, found at <http://www.pcbs.org/inside/selcts.htm> (last visited August 2003).

The price Israel charged the PA per cubic meter of water in 2001 averaged 2.34 NIS (\$0.55), in spite of the fact that the reported production cost of one cubic meter of water produced and sold by the JWU in 1994 was equal to \$0.25. At the same time, to make up for their deficit of over 5mcm/yr, the JWU purchased this quantity of water from Israel at an average cost of \$0.59/cm, more than double the JWU's production cost per unit.⁵² The total purchase cost of water in 1994 equaled 44% of the total operational costs of the JWU.⁵³ The average water cost reported by Mekorot did not rise since 1993; on the contrary, it fell (see Table 4 below) due to improvements in infrastructure and efficiency, and by 1999 it fell to approximately \$0.26/cm. As a result of the improved efficiency, government subsidies fell from 40% in 1993 to 23% in 1999. In 2002, Palestinians paid over \$21 million to Israel for water (\$0.55 per unit for approximately 38.34 mcm. Under the current tariff structure within Israel, water supplied to the urban and the industrial sectors incurs the full cost, while water supplied to agriculture in the remote and the elevated areas is subsidized.

Table 4
Mekorot Water Cost and Government Subsidy 1993-1999

Year	Average Water Cost (US Cent/cm)	Government Support (%)
1993	36.4	40
1994	34.4	35
1995	32.8	26
1996	30.5	23
...		
1999	26.2	23

Source: Israeli Ministry of National Infrastructure found at <http://www.mni.gov.il/english/units/Water/FinancingandPricingofWater.shtml> (last visited August 2003).

Under the terms of the Interim Agreement, the water situation in the Gaza Strip was left more or less as it was prior to 1993. Article 40 paragraph 24 of the Agreement stated, "The existing agreements and arrangements between the sides concerning water resources and sewage systems in the Gaza Strip shall remain un-

⁵² JWU. *Performance and Prospects*. Ramallah, Palestine: JWU, December 1995, p. 52.

⁵³ *Ibid.*, p.53.

changed, as detailed in Schedule 11.⁵⁴ Schedule 11 restates in nine paragraphs the relationship existing prior to the Oslo agreements. However, Article 40 paragraph 7 committed Israel to supply Gaza with 5 mcm/yr at "...the full real cost of production at the source and the conveyance all the way to the point of delivery..."⁵⁵ Yet despite this commitment made in 1995, Israel supplied only 3.6 mcm/ yr to Gaza. The Palestinians mixed this fresh water with the highly saline water they produced, and sold it to the domestic sector.

4.2 Present Palestinian Water Use

The amount of water allocated to the Palestinians as set by the Interim Agreement is shown in Tables 2 and 3 above and in Table 7 below. Of the total 129.78 mcm utilized in 2002, in the West Bank, Palestinians had 'autonomy' over between 94-118 mcm/yr depending on the rate of recharge, while in the Gaza Strip, of the 150 mcm utilized in 2002, Palestinians had full control over 146.4 mcm. The deficit of 34.7 mcm in the West Bank and 3.6 mcm in the Gaza Strip was purchased from Israel. The amount purchased each year may vary. The PA may demand a given quantity of water at the prevailing cost, but that does not mean that the quantity will be supplied. In fact, the Israelis rarely comply with supplying the quantities demanded by the Palestinians,⁵⁶ particularly during dry and drought periods. For example, in 2000 Israel sold 12.14 mcm from the wells they drilled and control in the West Bank to the PA, but the following year, this amount fell to 9.21 mcm, and the year after, i.e., 2002, to 8.95 mcm.⁵⁷ Note that with the Interim Agreement, Israel committed itself to selling the Gaza Strip a quantity of 5 mcm/yr but that in 2002, it only sold the Strip 3.6 mcm.

In many parts of the West Bank, the water supply is intermittent due to the limited and intermittent supply of water from Israel. Consequently, a significant business in water vending by tanker trucks has developed in these areas. The prices the water merchants charge are exuberant compared to the prevailing price of municipal water in the same area, but when there is no water in

⁵⁴ *Ibid.*, p.182.

⁵⁵ *Ibid.*, p.181.

⁵⁶ Interview with Abdul Karim Assad, Director of the JWU.

⁵⁷ PCBS figures, found at <http://www.pcbs.org/inside/selcts.htm> (last visited August 2003).

the pipes, people have no choice but to resort to this type of water supply. The cost of piped water charged to consumers in all of the districts varies between \$1.00 and \$1.50 per cm; these prices, it should be mentioned, are significantly lower than those charged by water vendors (see Table 5 below). The vendor prices can be said to reflect the value people attach to water for their basic needs, i.e., drinking, cooking, and hygiene, including bathing.

Table 5
The Price of Water Sold by Tank Vendors in Different Districts of the West Bank 2003

District	NIS per cm	US \$ per cm
Bethlehem	23	4.90
Hebron	17	3.63
Jenin	12	2.56
Nablus	14	2.99
Qalqilya	11	2.35
Ramallah	23	4.91
Salfit	22	4.70
Tubas	11	2.35
Tulkarem	15	3.20

Prices in NIS from a PHG field survey, February 2003.
US\$ prices estimated according to March 2003 exchange rates.

4.2.1 Use by Sector

Detailed data on use by sector is not readily available for the West Bank and Gaza Strip. The available breakdown is by domestic consumption and by irrigation consumption. In the West Bank, almost 52% of water was in 2002 utilized by agriculture and 42% by the domestic sector, while in the Gaza Strip, over 58% was utilized by agriculture and less than 42% by domestic consumers (see Table 3 above). However, the JWU provides a more detailed breakdown for the Ramallah district and parts of East Jerusalem. Its sale of water to the Palestinian population (the JWU also supplies water to ten or so Israeli settlements and army bases) consists of domestic (89.5%), industrial (8.1%), and commercial (2.3%).

Domestic consumption in Palestine has been constantly increasing over the years. This increase is related to population increases on the one hand and the extension of piped water to more people and localities on the other. As more and more towns and villages

were connected to piped water, the water per capita consumption increased (there are still over 200,000 people, in around 150 localities in the West Bank, not connected to piped water). Although on average the quantity of water supplied for domestic use in the West Bank averages over 84 l/c/d, there is a wide discrepancy between the different areas (see Table 6 below).

Table 6
Water Supply for Domestic Sector by Daily per Capita and Governorate/District, 2001

Governorate/ District	Water Supply for Domestic Sector (1000 cm)	Population	Daily per Capita (l/c/d)
Palestinian Territories	104,020.0	3,381,751	84.3
West Bank	60,720.0	2,152,501	77.3
Jenin	4,500.0	231,070	53.4
Tubas	530.0	42,088	34.5
Tulkarem	5,800.0	152,715	104.1
Nablus	9,300.0	297,484	85.6
Qalqilya	2,420.0	84,116	78.8
Salfit	1,400.0	55,967	68.5
Ramallah, Al-Bireh, and Jerusalem	15,870.0	623,671	69.7
Jericho	2,700.0	38,017	194.6
Bethlehem & Hebron	18,200.0	627,373	79.5
Gaza Strip	43,300.0	1,229,250	96.5
North Gaza	14,600.0	229,321	174.4
Gaza	11,500.0	435,463	72.4
Deir Al-Balah	6,500.0	178,149	100.0
Khan Younis	6,700.0	239,395	76.7

Source: PCBS, *Water Statistics in the Palestinian Territory 2001*, found at <http://www.pcbs.org/inside/selcts.htm>.

Caution should be used when considering the figures in Table 6 above. The per capita consumption rate for the Ramallah district indicates a daily per capita consumption of approximately 70 l/c/d. In this district, the JWU, the most efficient water utility in the West Bank, only serves around 200,000 people with approximately 10 mcm/yr. Thus, the remaining population of over 400,000 consumes almost 6 mcm/yr or approximately 38 l/c/d. Those connected to the JWU consume on average 130 l/c/d. The implication is that if an efficient network is extended to the rest of the popu-

lation in the Ramallah district, that is, if development occurs, then average consumption will rise significantly.

Although Gaza has a higher rate of per capita consumption, it does not mean that the consumers in Gaza are better off than those in the West Bank. The reason for this is the fact that the domestic water is of an inferior quality due to high salinity rates, the result of high consumption levels, which suggests over-pumping, which in turn causes the high salinity.

The maximum amount of water available to Palestinian agriculture for irrigation purposes has remained fixed by Israeli imposed quotas. However, the amount can vary due to first, the variability in the replenishment rate, given that almost half of all irrigation water came from springs in 2001-2002 (see Table 3 above) and the fact that springs are the first source to be depleted in the summer months and the last to fill up in the winter months. For example, in the three years 1999, 2000, and 2001, spring water discharge in the West Bank was equal to 28.26 mcm, 36.37 mcm, and 28.99 mcm respectively. The second reason for the variability of water supply to the irrigation sector is the yearly reassessment and reallocation of the quota set by the Israeli authorities in the past and at present.

Table 7
Water Supply by Source and Use in Palestine,
2001 and 2002 (000s cm)

	For Domestic Consumption 2002		For Irrigation 2001		
	Total	l/c/d	Total	Dunums	cm/Dunum
West Bank					
From West Bank	27,782.10	37.92	58,568.00	118,976	492.2
Purchased from Israel	34,789.20	47.48	-		
Total Supply	62,571.30	85.40	58,568.00		
Gaza Strip					
From Gaza Strip	59,000.00	124.40	84,000.00	123,599	679.6
Purchased from Israel	3,600.00	7.59	-		
Total Supply	62,600.00	131.99	84,000.00		

Source: PCBS. *Water Statistics in the Palestinian Territory 2002*; and *Water Statistics in the Palestinian Territory 2001*, found at <http://www.pcbs.org/inside/seicts.htm> (last visited August 2003).

For example, in 1993 it was estimated that the agricultural sector consumed between 80-100 mcm/yr.⁵⁸ During the late 1990s and early 2000s, however, the quantity of water used in irrigation fell from a high of 67.14 mcm/yr in 1999 to a low of 58.56 mcm/yr in 2001. This variability was mainly due to the variability in spring water outflow. Between 1994 and 2002, irrigation from wells varied from a high of 38.88 mcm/yr to a low of 32.67 mcm/yr (2001). With regard to the water taken from spring flows for irrigation purposes, the variation was even more pronounced. Between 1994 and 2002, spring water flows varied between a high of 60.78 mcm/yr to a low of 25.89 mcm/yr (a difference of over 35 mcm/yr). Corresponding to this variation, the quantity of land under irrigation has also varied. The amount of land under irrigation in 1968 was approximately 85,000 dunums. However, over the past decade, the amount has tended to vary between 90,000 and 120,000 dunums. The variability in the quantity of land irrigated as shown above is primarily a function of the supply of water. However, the increase in the quantity of land under irrigation given the quantity of water has increased since 1968. This is mainly due to the application of efficient irrigation systems, such as drip irrigation, ground tunnel drip irrigation, and plastic houses irrigation.

The major constraint on increasing the quantity of land under irrigation is the amount of available water. It was estimated that the total amount of land that can be readily irrigated in the West Bank is around 172,000 dunums, and that with minimal investment, a further 440,000 dunums could be made suitable for certain types of irrigated crops. Furthermore, it was assumed that each dunum required on average of 700 cm of water per year.⁵⁹ However, the current water consumption per dunum of irrigated land is less than 500 cm (see Table 7 above).

The contribution of water to agricultural output and productivity is significant. Table 8 below shows the yield per dunum of crops cultivated without irrigation and the yield per dunum of crops cultivated thanks to the use of various types of irrigation methods.

⁵⁸ World Bank. *Developing the Occupied Territories: An Investment in Peace*. Volumes 1-6. Washington, DC: World Bank, 1993.

⁵⁹ Baskin, G., "The Clash Over Water: An Attempt at Demystification," *Palestine-Israel Journal of Politics, Economics, and Culture*, No. 3 (Summer 1994).

The increase in output per dunum is substantial. The output of cucumbers per dunum increases from 250 kg/dunum in the case of rain fed crops to 2,077 kg/dunum in the case of drip irrigated crops and to an astounding 8,852 kg/dunum in the case of plastic house irrigated crops. The productivity of tomatoes shows a similar trend in terms of the percentage of increase, whilst all the other crops listed below show significant increases.

Table 8
Yield per Dunum of Various Crops, Rain Fed and
by Type of Irrigation System, 2000/2002

Crop	Yield per Dunum (kg)			
	Rain Fed	Irrigated		
		Drip	Plastic House	Surface Tunnel
Cucumber	250	2,077	8,852	2,559
Squash	356	2,131	2,632	2,396
Tomato	503	4,615	15,334	4,251
Okra	354	543		
Cauliflower	640	2,559		
Green Beans	350	980	1,881	1,707

Source: PCBS, found at <http://www.pCBS.org/inside/selcts.htm> (last visited September 2003).

5. WATER NEEDS AND DEMANDS FOR DEVELOPMENT

The need of the Palestinians for greater amounts of water than they are presently receiving is not a matter of contention. The fact that water is a necessary factor in social, cultural, and economic development is also widely recognized.

In this section, an assessment of the need and demand for water and its impact on development will be made. First, an assessment of the basic need for water will be addressed. This will be followed by an assessment of the demand for water in agriculture, then an assessment of demand by industry and commerce.

5.1 Basic Needs and Demand for Water

According to the World Health Organization (WHO), the optimal average amount of water required in order to sustain human life is 100 l/c/d.⁶⁰ This quantity of water covers the basic need for water for drinking, sanitation, bathing, and the preparation of food. Gleick has put the minimum for meeting these basic needs at 50 l/c/d.⁶¹ However, WHO classifies this quantity as 'intermediate access', and indicates doubt that it would meet bathing and laundry needs. In many parts of Palestine, consumption is less than 100 l/c/d. For example, Bethlehem and Hebron inhabitants receive 79 l/c/d, Tubas area inhabitants 29.1 l/c/d, and Jenin district inhabitants 47.5 l/c/d.⁶² The average consumption rate for the West Bank is 84.3 l/c/d, which falls short of the 100 l/c/d. It should be noted that this average per capita consumption is achieved after the purchase of 34.78 mcm from Israel, and that without this purchase, the average consumption rate in the West Bank would fall to 37.9 l/c/d.

The average of 84 l/c/d of water supplied to the domestic sector in Palestine falls somewhere between intermediate access and optimal access according to WHO criteria. However, in most developed countries, as development takes place and standards of living move higher, the average per capita consumption increases. Only next door in Israel, the population enjoys a consumption rate of approximately 250 l/c/d for domestic use.⁶³ In 1993, it was found that industrial water use in Israel was equal to 63 l/c/d.⁶⁴

In the following analysis of the water needs of the Palestinians, the following universally recognized principle of International Water Law forms the starting point of our analysis: as stated by Shuval, "...regardless of all other factors, a nation on a shared water basin has the right to expect that the minimal water needs of do-

⁶⁰ WHO. *Domestic Water Quantity, Service Level and Health*, found at http://www.who.int/water_sanitation_health/diseases/wsh0302/en/ (last visited August 2003).

⁶¹ Gleick, P. H. *Basic Water Requirements for Human Activities: Meeting Basic Needs*, found at <http://www.pacinst.org/basic-water-needs.pdf> (last visited July 2003).

⁶² PCBS. *Water Statistics in the Palestinian Territory 2002*, found at <http://www.pcbs.org/inside/selcts.htm> (last visited August 2003).

⁶³ Israeli Ministry of National Infrastructure, found at <http://www.mni.gov.il/english/units/Water/WaterProductionandConsumption.shtml> (last visited September 2003).

⁶⁴ Shuval, op. cit., p.159.

mestic uses required for its survival be met."⁶⁵ In this analysis, 50 l/c/d will be considered the intermediate amount that allows for human survival or subsistence. The quantity of 75 l/c/d will be considered moderate, falling between the intermediate and the optimal. A high of 125 l/c/d will be considered as a level of consumption that can sustain a prolonged period of development. In assessing minimal water requirements for an urban industrial society, Shuval proposes the quantity of 273 l/c/d, allocated to the following sectors: over 210 l/c/d for domestic and urban use and 63 l/c/d for industrial use. It is assumed that this quantity is what Israel is expected to live with comfortably by some researchers, and it is the level that Palestinian consumption will eventually rise to according to a Ben Gurion University/Tahal report conducted for the World Bank.⁶⁶ The conclusion that Palestinian consumption rates are about to converge with those associated with Israel is suspect given that Palestinians in Israel ('Israeli Arabs') today consume an average amount of water which is equal to half that consumed by their fellow Jewish citizens.⁶⁷

In the following water needs analysis, four water needs projections are discussed. The first projection was based on intermediate needs (50 l/c/d), the second on moderate needs (75 l/c/d), the third on optimal needs (100 l/c/d), and the fourth and last on high needs (125 l/c/d). Population growth projections do not include net immigration, and the population growth rate used in the analysis starts with the figures reported by the PCBS, i.e., 3.2% for the West Bank and 4% for the Gaza Strip. These rates are applied to the first five-year period (2004-2008), whereas during the second five-year period, the growth rate is reduced by one tenth of one percent. The same reduction is applied to each of the following five-year periods, which means that the growth rates of the population in the West Bank by the year 2005 is 2.8% and 3.6% in the Gaza Strip. This is despite the fact that the growth rate of the Palestinian population has remained relatively stable over the past decades. The reduction was made on the assumption that with the onset of development, population growth rates will tend to fall. Furthermore, it is always safer to err on the conservative

⁶⁵ *Ibid.*, p.153.

⁶⁶ *Ibid.*, p.159.

⁶⁷ "Study: Jews Consume 50% More Water than Arab Citizens," *Ha'aretz*, 12 May 2003.

side of an estimate. The results for each of the scenarios are shown in Table 9 below.

Table 9
Projected Population and Water Demand, for Different Domestic Use Scenarios

Region	Year	Pop-ulation ^a (millions)	Water Needs (mcm/yr)			
			Inter- mediate (50 l/c/d)	Moder- ate (75 l/c/d)	Optimal (100 l/c/d)	High (125 l/c/d)
West Bank	2003	2.30	42.06	63.09	84.13	105.16
	2005	2.45	44.80	67.20	89.60	112.00
	2010	2.87	52.34	78.51	104.68	130.84
	2015	3.33	60.85	91.28	121.70	152.13
	2020	3.86	70.41	105.61	140.81	176.01
	2025	4.44	81.07	121.60	162.13	202.67
Gaza Strip	2003	1.33	24.27	36.40	48.53	60.67
	2005	1.44	26.25	39.37	52.49	65.62
	2010	1.75	31.87	47.81	63.74	79.68
	2015	2.11	38.52	57.77	77.03	96.29
	2020	2.54	46.32	69.48	92.65	115.81
	2025	3.04	55.44	83.17	110.89	138.61

^a Population figures for 2003 are from the PCBS. The projected growth for the first five years after 2003 is calculated using the natural increase rate from the PCBS (3.2% for the West Bank and 4% for Gaza); for each following five-year period, the natural rate of increase was reduced by 0.1% for each region, so the natural rate of increase for 2025 in the West Bank was equal to 2.8% and in Gaza, 3.6%. Although the rate of natural increase did not change significantly during the past 10 to 15 years, it is assumed that with the onset of the development process, the natural growth rate will, or at least should, decrease.

The quantity of domestic water supplied in the West Bank in 2002 was equal to 62.57 mcm (see Table 3 above). The results of projections in Table 9 above show that the Palestinian population in the West Bank has enough domestic water to meet its 'intermediate needs' up to the year 2015, but only if no development takes place. If we assume an equal distribution of the available domestic water resources, this also means that part of the population must experience a fall in their standard of living. Beyond the year 2015, water to meet the 'intermediate needs' will not be available and must be transferred from other uses, such as agriculture, which in turn means a reduction in agricultural output, and therefore a reduction in income and GDP. Table 9 shows that 'moderate needs' are already exhausted in the year 2003, and by the year 2005, all

the available water (domestic and irrigation) utilized in the West Bank today will have to be allocated to domestic consumption. Under the 'optimal needs' scenario, the exhaustion of all water resources for domestic consumption occurs in the year 2015. With regard to the 'high needs' scenario, the year 2007 will be the year when all available water is consumed by the domestic sector.

Looking at the results from a different angle, if we assume that water supply is not a constraint, that development does take place, and that complementary to this development the 'optimal needs' level of water will be demanded, then it is safe to assume that by the year 2015 the domestic sector would demand 121.7 mcm/yr. At the given level of supply, this would mean a water shortage equal to 60 mcm/yr.

5.2 Development Needs and Demands for Water

5.2.1 Irrigation Demand

Water for agricultural use was capped at 1968 levels by the military authorities, and all subsequent increases in the amount of irrigated land since then can be attributed to improvements in efficiency. The agricultural sector, up to the early 1990s, continued to account for approximately 25% of the GDP, falling from between 35-45% in the early 1970s. Today, after the Oslo peace process, when some sectors of the economy were freed from Israeli military control, the share of agriculture contributes between 9.5-14% of the GDP.⁶⁸ The agricultural sector has changed significantly but has not entered into a phase of development whereby it can contribute to economic growth and development. In short, the potential of the agricultural sector has yet to be tapped.

As shown above, the amount of additional land immediately prone to irrigation is around 50,000 dunums. The amount of extra water needed to irrigate this additional land, if we base the calculation on the present average consumption rate of 492.2 cm/dunum as shown in Table 7 above, would be 24.61 mcm/yr. If we go further and assume that we can extend irrigation to an additional 400,000 dunums as suggested by Awartani above, then the additional water requirement would rise further by 196 mcm/yr. Moreover, the

⁶⁸ PCBS, *Time Series Statistics - National Accounts*, found at <http://www.pcbs.org/inside/selcts.htm>, (last visited September 2003).

employing of various irrigation methods in relation to the growing of certain cash crops would no doubt lead to major increases in output. This increase in output would contribute significantly to income and development. However, increased output on its own may have a negative impact on the market prices, and therefore the full impact on development may not be forthcoming. The market must be able to absorb the increases in output so that the benefits to development are realized. In addition to water, export markets also represent a major constraint on agricultural development.

The importance of water and markets to agriculture was revealed in a study conducted in 2000 by Butterfield et al.⁶⁹ This study, which attempted to identify the major constraints on Palestinian agriculture, used a linear programming model and specified an objective function to be maximized and a set of constraints to be satisfied. The set of constraints includes the land and water constraints, technological constraints, and boundary conditions that set upper limits on key variables of the model.

The major conclusions reached by the study indicate that water was the most significant constraint on agricultural output and development. A limited export market for agricultural output was a secondary but also major constraint on agriculture.

The model was used to conduct three experiments to estimate the limitations imposed by water and export markets on West Bank agriculture. The first experiment assumed unlimited amounts of irrigation water as well as unlimited exports at fixed existing prices; this provided a reference for the following two experiments. The second experiment limited the amount of irrigation water to the amount of water then available from local Palestinian sources (92 mcm/yr). The third experiment assumed unlimited water and limited crop exports, i.e., one million tones per crop. The export limit, it should be mentioned, was significantly lower than the export figure of over two million tones realized for two crops in the unconstrained experiment, but still large enough to allow the solution to deviate from the existing pattern of production.

⁶⁹ Butterfield, D., Isaac, J., Kubursi, A., and Spencer, S. *Impacts of Water and Export Market Restrictions on Palestinian Agriculture*, found at <http://socserv.socsci.mcmaster.ca/kubursi/ebooks/water.htm> (last visited September 2003).

The results of the three experiments are summarized in Table 10 below.

Table 10
The Impact of Water and Export Market Constraints on West Bank Agriculture

	Net Profits (\$billion)	Total Water Used (mcm)	No. of Crops Cultivated	Total Output Tones (million)	Total Exports Tones (million)
Unlimited Water and Unlimited Export Markets	5.93	497 (92 plus 405)	9	7.65	7.691
Limited Water and Unlimited Export Markets	4.32	92	6	3.804	3.784
Unlimited Water Use and Limited Export Markets	4.59	476 (92 plus 384)	11	7.142	7.063

Source: Butterfield, D., Isaac, J., Kubursi, A., and Spencer, S. *Impacts of Water and Export Market Restrictions on Palestinian Agriculture*, found at <http://www.socserv.socsci.mcmaster.ca/kubursi/ebooks/water.htm> (last visited September 2003).

The results of this study show that water is a major constraint on the development of the agricultural sector. However, what is more significant is that by removing the water constraint, net profits of the agricultural sector would rise to \$4.59 billion, an amount almost equal to the total GDP of the West Bank in the years 1999 and 2000. This is highly significant, given that it would require an additional 384 mcm of water. That is, every cubic meter of water used in agriculture would add over \$9.50 to profit. What is also significant is that cultivation would concentrate on 11 cash crops and water would not be wasted on ideological crops such as cotton, as is the case in Israel. If export markets are open and are not constrained, net profit would increase to \$5.93 billion and water use would rise to 497 mcm. The additional 21 mcm of water would increase net profits by \$1.34 billion, or every additional cubic meter of water beyond 476 mcm/yr would add over \$60 to net profit.

5.2.2 Industrial and Commercial Demand

Caution is necessary when addressing industrial and commercial demand for water in Palestine. This is because no major economic or structural developments have taken place in these two sectors since 1967 and only minor developments have been witnessed since 1993. In developed countries, the tendency has been for there to be an initial increase in demand followed by a more stable level of demand due to the introduction of more efficient water use methods in the commercial and industrial sectors. In the case of Palestine, we expect to see a spurt in demand for water in these two sectors and eventually see them stabilize. For example, Israeli consumption in the industrial sector rose from 55 mcm/yr in the mid-1960s, continued to rise up to the mid-1990s to 124 mcm/yr, and stabilized at this level during the years between 1996 and 2000.⁷⁰ The percentage share of industrial consumption during the respective period rose from 4% of total consumption in 1964/65 to 6% in the early 1980s, and has remained at 6% ever since. Worthy of mention is the fact that the share of agricultural consumption (which remained absolutely stable over this period at around 1.1 billion cm/yr) fell from 81% in 1964/65 to 59% in 2000.

Table 11
Distribution of Water by the JWU by Type of Customer

Year		Domestic	Industrial	Commercial	Total
1982	mcm/yr	1,950.9	58.9	48.0	2,057.8
	%	94.8%	2.9%	2.3%	100.0%
....					
1987	mcm/yr	3,125.5	159.5	66.0	3,351.0
	%	93.3%	4.8%	2.0%	100.0%
....					
1992	mcm/yr	3,892.5	261.3	74.2	4,228.0
	%	92.1%	6.2%	1.8%	100.0%
1993	mcm/yr	4,093.9	378.1	102.2	4,574.3
	%	89.5%	8.3%	2.2%	100.0%
1994	mcm/yr	4,247.2	385.9	110.2	4,743.4
	%	89.5%	8.1%	2.3%	100.0%

Source: JWU. *Performance & Prospects*. Ramallah: JWU, Dec. 1995, p. 8.

⁷⁰ CBS. *Statistical Abstract of Israel 2002 (53)*. Jerusalem: State of Israel, 2003, found at http://www.cbs.gov.il/shnaton53/download/st21_06.xls, pp.21-29.

The JWU provides us with a breakdown of consumption within Palestine according to customers. The data is shown in Table 11 above. Domestic consumption as a percentage of total water distributed by the JWU tended to fall between the years 1982 to 1994 from almost 95% to less than 90%, while the share of industry almost tripled during the same period and the share of commercial consumption remained relatively constant. At best, these figures show a trend under present circumstances of uncertainty and minimal development in the economic sectors. However, it can be pointed out that the trend in consumption shown in Table 11 above is similar to trends shown by Israel. Demand for water when development is allowed to take place will also be influenced by industrial and commercial demand, not to mention municipal demand (for parks and recreation etc.).

6. CONCLUSION

In this paper, water is dealt with as a scarce resource in its many dimensions, as a source of human survival, health and hygiene, and as an input in the agricultural, industrial, commercial and service sectors of an economy. Historically, different societies dealt with a water shortage situation in different ways. In their quest for survival and/or development some societies have dealt with the water scarcity problem by adapting to the dictates of the environment, while other societies have confronted and adapted the environment to meet the purposes of society. In traditional societies, before the advent of industrial society, humans more or less designed their way of living within the constraints set by the environment. However, when humans entered the age of 'knowledge production' and applied this knowledge to the production of commodities, they entered the era of altering the environment to suit their way of life. Unfortunately, not enough knowledge was produced to inform humans of the irreversible damage that can be caused to the environment by human actions. Only recently have they realized that the two paths - altering one's way of life and altering the environment to suit one's way of life - are not mutually exclusive, and that a combination of these two approaches is necessary for development and sustainability.

The Palestinian people have never had the freedom and resources to alter the environment to meet their society's needs. Historically, Palestinians have had to alter their way of life to meet the conditions imposed upon them against their will. When most Palestinian

women had to – and many still do – bring water from the nearest spring to the village, transporting it on their heads, they valued every unit of water and managed its use efficiently to the last drop, often using each unit of water more than once. Today, when piped water supplies are cut off for days and sometimes weeks at a time, as is the case in many localities, people manage the use of the water they have in their reservoirs tanks very wisely.

It has repeatedly been stated that Israel has modern water laws, institutions, and management systems that allocate water to its most efficient use. At the same time, Palestinian water control, use, and management systems and institutions have been characterized as traditional and inefficient and requiring modernization. Yet, it is Israel that suffers from the influence of interest groups that keeps water for agriculture priced below its marginal cost and forces the domestic and industrial sectors to be overcharged for their water use.⁷¹ It is the same forces that have allowed for the over pumping of water from the Coastal Aquifer and the Western Aquifer, where today, even after a good rainy season, in 2002/2003 the aquifer remains between three and four meters below the level it was at five years ago and between eight and nine meters below the level that followed the winter of 1991/1992, the wettest season in recent decades (every 0.5 meters translates into approximately 50 mcm of water).⁷²

As well as being denied the right to develop their water supply since 1967, the Palestinians have been obliged to witness a decrease in the capacity of their water pumps and are unable to replace or refurbish the pumps without Israeli permission, as was the case in 1995 according to Jericho and Tulkarem area well owners. The number of wells in the West Bank has declined from the pre-1967 number. Palestinians have not been allowed to face the natural water scarcity conditions of the region, nor have they been allowed to deal with this situation. Instead, they have found themselves face to face with an intensified water scarcity situation, imposed by Israeli occupation dictates in the form of military orders and then the dictates of the Oslo plus 'peace' agreements, which more or less made official and legitimized the pre-Oslo occupation policies. The first and foremost problem facing Palestinian

⁷¹ Agriculture in Israel pays NIS 0.97/cm for fresh water, while cities and industry pay NIS 1.83/cm. The marginal cost of water in 2003 was estimated at NIS 1.6/cm. See "The Bottom Line/And Now, Laundered Water." In *Ha'aretz*, 14 May 2003.

⁷² "Aquifers in Danger, Despite Wet Winter." In *Ha'aretz*, 30 June 2003.

water needs for both population growth and development therefore is the removal of Israeli-imposed constraints on water supply. The argument that Israel has priority user rights⁷³ to West Bank water does not hold. If it were to hold, then so, too, should the argument that the Palestinians have priority user rights in regard to the waters of historical Palestine. It was the Palestinians who tilled and lived on the land of Palestine for thousands of years before Zionist settlers engaged in ethnic cleansing in 1947/1948. Furthermore, the principles associated with human rights and advocated and recognized by the majority of governments of the civilized world today were responsible for dictating the human and political right of "one man one vote" in South Africa. The same principle can be applied to water in Palestine: one man, one measure of water.

The prospects of removing Israeli constraints on Palestinian access and control to a greater quantity of water are not good; however, doing this is necessary if peace is to be achieved. Even if Palestinians increase their access to water it will improve but will not remove the first order scarcity condition, namely the natural scarcity in the resource itself. This must be dealt with in a manner different from that set by the example of Israel. Palestinians must learn from the mistakes made by Israel and not allow them to be repeated in Palestine.

With regard to the issue of the second order scarcity condition facing Palestinians, even if control over water and access to an increased water supply takes place in the near future, this does not mean that the water problem is solved. Palestinian population growth within a few decades would require most if not all the increased supply of water as discussed above. Once control over and access to water supplies are achieved, the centrality of management must be addressed seriously and with a vision incorporating increasing water scarcity. A successful water management system must confront all of the following issues: From an engineering perspective it must answer, "Can it be done?" while from an economic perspective, the question of "At what cost?" must be addressed, and from the realm of politics arises the question of, "Is it politically feasible?" Anyone who is environmentally aware might very well ask the question, "Should it be done at all?"

⁷³ Shuval, op. cit., p.157.

The PWA has attempted to establish a legal and institutional system to meet this challenge. However, its efforts have not been serious enough to prevent regional political patrons from determining the allocation and use of Palestinian water resources, as in the case involving the Ein Al-Sultan spring in Jericho⁷⁴. Nor has the PWA been able to curtail the wasteful use of scarce donor funding in the construction of redundant networks and 'white elephants'. This was the case when the Germans funded and built a pipeline and the Americans funded and built a pipeline and the end result was two pipelines running parallel to each other connecting Hebron to the same wells located to the north.⁷⁵ Until now, more than seven years after the creation of the PWA, no Palestinian water law has been passed. Furthermore, Palestinian regulation and management of water must aim to marginalize narrow and local interests, as well as foreign meddling, and prioritize Palestinian public interest now and for future generations. Resolving the second order scarcity condition is the immediate issue facing the PWA; it is also a prerequisite for successfully dealing with the first order scarcity condition.

⁷⁴ Trotter, J. *Hydro-Politics in the West Bank and Gaza Strip*. Jerusalem: PASSIA, 1999, p.85.

⁷⁵ *Ibid.*, p. 94.

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FUTURE WATER INSTITUTIONS IN PALESTINE

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1. INTRODUCTION

Water resource management issues in the Middle East and the Mediterranean Region are among the most critical of any region in the world. Annual per capita water availability for the Southern Mediterranean region has fallen from approximately 3,400 cm in 1960 to an average of about 1,200 cm today.¹ It is projected to fall to just over 500 cm in 2025 due to a high population growth rate and increased urban and rural water use. In many parts of the region, dwindling water resources are threatening people's livelihood, the environment, and economic growth. Intermittent supply is common in many cities and agricultural water supply faces the challenge of competing demands for water.² The critical issues raised at the WWF also apply to the Palestinian case.³ In discussing the reasons behind the state of underdevelopment in the Middle East, including Palestine and the water sector, Kuran (2003)⁴ found that the reason is that certain components of the region's legal infrastructure stagnated during a long period when their Western counterparts were giving way to the modern economy.

Because both institutions and regulations can be considered 'rules of the game', all regulatory reforms can be analyzed as institutional reforms. Thus, it is important to develop a theory for bureaucratic regulation regarding both institutional issues and analysis.⁵ The institutionalization of water issues, commitments, and responsibilities in regions such as the Middle East including legal/administrative, political, economic, environmental, and finan-

¹ World Resources Institute (1996). *World Resources 1996-1997 - A Guide to Global Environment*. New York: Oxford University Press. See also World Water Forum (WWF). *Draft Statement of Middle East and Mediterranean Regional Day: From Scarcity through Reform to Security*. Third WWF Ministerial Conference on 22 March 2003.

² Ibid.

³ Ibid.

⁴ Kuran, T. *Why the Middle East Is Economically Underdeveloped: Historical Mechanisms of Institutional Stagnation*. Forum Series on the Role of Institutions in Promoting Economic Growth Forum 7, Institutional Barriers to Economic Change: Cases Considered, Forum Series Directed by the Mercatus Center at George Mason University and The IRIS Center, sponsored by USAID, June 2003, Washington DC.

⁵ Franco-Barrios, A., 2003, *Building a Transparent and Honest Government in Mexico. Institutional Reforms and Anticorruption Policy*, Inter-ministerial Commission for Transparency and Against Corruption in Federal Public Administration. Mexico, June 2003.

cial elements of regional water management is not generally accepted or fairly understood and/or practiced. There is a particular need for research studies which are able to trace and quantitatively evaluate not only the multidimensional linkages among various components of water institutions but also the way their influences are channeled through various institutional layers and are finally reflected in water sector performance.⁶

2. THE NEED FOR INSTITUTIONALIZING WATER RESOURCES MANAGEMENT IN PALESTINE

The Palestinian Water Authority (PWA) has prepared the National Water Plan (NWP), which defines a massive investment program of projects and activities needed for water sector development in the Gaza strip and the West Bank over the next 20 years. This investment program requires approximately US\$5 billion.⁷

For the purpose of this paper, the following is taken for granted:

- 1) One of the important economic development factors is having a reliable and safe water supply;
- 2) Wastewater flows must be managed effectively to protect freshwater from pollution. They must be reintegrated safely in the water cycle and accounted for in the water budget;⁸
- 3) Sustainable production of major food commodities and optimal land use depend largely on integrated approaches to land and water management, in order to achieve food security, alleviate poverty and protect the natural resource base;⁹

⁶ Saleh, M. and A. Dinar. *Water Challenge and Institutional Response: A Cross-Country Perspective*. Study report, Development Research Group and the Rural Development Department, the World Bank, May 1999.

⁷ Middle East Desalination Research Center (MEDRC). MEDRC News publication, Muscat, February 2003, found at <http://www.MEDRC.org>

⁸ Bakir, H., *Wastewater Management Services in Water-Stressed Countries: Guiding Principles and Options for Sustainable Development*, Paper presented at the 2nd Asian Conference on Water and Wastewater Management. Tehran, Islamic Republic of Iran, May 2001.

⁹ Agricultural Research for Development (ARD). *European Commission Strategy Document "Agricultural Research for Development."* Strategic paper presented at the Rome Meeting of the European Forum on Agricultural Research for Development, Working Group 6: Integrated Land and Water Management for Sustainable

- 4) The coincidence of water scarcity in the Middle East and weak water institutions will not allow doing any better with less water;
- 5) The water sector crisis is linked to institutional changes through a chain of economic, political, and natural factors, both within and outside the water sector;¹⁰
- 6) Water institutions reduce uncertainty and optimize options in water supply for the present time as well as the future;
- 7) Economic development for the Middle East including Palestine will continue to be limited and poor if efficient water institutions are not properly created, efficiently operated, and well maintained;
- 8) Success in water policy reform hinges partly on the possibility of identifying the proper institution (within government and/or private sector), with the power and authority to implement the intended policy reforms;
- 9) An institutional reform strategy must be flexible and tailored to the requirements of individual countries and/or group of countries sharing surface or groundwater basin states.¹¹

Given the forgoing, it is evident that water institutions represent the driving force behind changes in the overall management of water resources, which defines the overall benefits that a country can derive from its water resources. Also evident is the fact that institutional reform is a central requirement for comprehensive water planning and management in any country yet is one of the most difficult measures to implement. Accordingly, to implement the NWP, the PWA will need to carry out institutional reforms. This paper presents an attempt to put forward and discuss the author's point of view concerning future water institutions in Palestine. It presents an institutional setup adopting an integrated approach to sustainable water management in Palestine, allowing regional co-operation and international as well as private sector involvement.

Food Production in Arid and Semi-Arid Areas (including WANA/Southern Mediterranean), May 2002.

¹⁰ Saleh and Dinar, op. cit.

¹¹ World Water Forum (WWF). *Draft Statement of Middle East and Mediterranean Regional Day: From Scarcity through Reform to Security*. Third WWF Ministerial Conference on 22 March 2003.

3. A SUMMARY OF WATER INSTITUTIONS IN PALESTINE

The PWA is the official regulatory institution responsible for water resources management and protection in Palestine. This responsibility includes policy, planning, management and regulation of water resources utilization, and development. Other institutions such as municipal water departments, water utilities, local communities, and village councils represent the direct link with consumers as they operate and manage water supply systems for the benefit of the citizens. The institutions responsible for the operation and maintenance of water supply for domestic and industrial purposes are municipal water departments, independent utilities, local committees and village councils, and departments connected with the Israeli Civil Administration. The United Nations Relief and Works Agency for the Palestinian Refugees in the Near East (UNRWA) has been operating and managing water supply systems within the Palestinian refugee camps since 1948. Water supply for agriculture is operated privately by individual farmers, family farmers, and collective or cooperative management associations such as the cooperative for the Fara'a water project in the Jordan Valley. The PWA through the West Bank Water Department¹² or the Hydrology and Water Department of the Ministry of Agriculture in the Gaza Strip checks on a regular basis the water quality and allocated quotas for the agricultural water sector. In general, these different water institutions have overall inadequate technical and human capacities leading to inefficient management, poor technical and financial records, high rates of unaccounted for water (UFW), and other deficiencies. Section 3 gives a more detailed assessment of these deficiencies.

There is a long list of non-governmental organizations (NGOs), scientific and technical groups, professional and other associations working on water management and related environmental issues in Palestine. These water institutions represent an opportunity for Palestinian civil society to participate jointly with national and institutions of both a national and international nature.

¹² Prior to the Israeli occupation of 1967, the West Bank Water Department (WBWD) was a part of the Jordan Natural Resources Authority. Until now, the WBWD is still formally connected and falls under the supervision and control of the Israeli occupation authority. The main tasks of the WBWD were to provide water for drinking and irrigation purposes, monitor water levels, and measure springs discharge and groundwater abstraction.

A brief description of the institutions responsible for the operation of the water supply for the domestic sector is given in the following discussion.

3.1 The Palestinian Water Authority

The PWA was established by Presidential Order No. 90 for April 1995. By-law No. 2 was enacted in February 1996, the main theme being to identify the authority and powers given to the PWA. According to By-law No. 2, the PWA has a juridical character and its own budget and comes under the authority of the President of the Palestinian Authority (PA). The PWA is the official authority responsible for regulating and managing all water resources in Palestine including wastewater. Through By-law No. 2, the National Water Council (NWC) was established, chaired by the President of the PA (see Table 1). The members of the council are representatives of the Ministry of Agriculture, the Ministry of Local Government, the Ministry of Planning and International Cooperation (MOPIC), now Ministry of Planning, the Ministry of Health, the Environment Authority, and universities. The main functions of this council are to review and approve national water policies and water quotas, reconsider the issue of private ownership of water, examine the central water protects and approve their implementation, and enhance regional and international cooperation in water.

Table 1
Institutional Framework in the Palestinian Water Sector

Cabinet of Ministries		Decision Making Level
National Water Council		
Palestinian Water Authority		Regulatory Level
Bulk Water Utility		Service Delivery Level
Regional Water Utilities	Water Users' Associations	

Source:¹³ www.semide-ps.org

¹³ Found at <http://www.semide-ps.org> (see Institutions and Contact Information).

The Palestinian national water policy adopted by the PWA and the PA¹⁴ is characterized by the following main principles, which will hopefully one day govern water resources management in Palestine:

- 1) All sources of water should be the property of the State;
- 2) Water has a unique value for human survival and health, and all citizens have a right to water of good quality for personal consumption at prices they can afford;
- 3) Industrial and agricultural development and investment must be compatible with the water resource quantity available;
- 4) Water is an economic good;
- 5) Water supply must be based on the sustainable development of all available water resources;
- 6) The development of the water resources of Palestine must be coordinated at the national level, and carried out at the appropriate local level;
- 7) The national water sector management should be carried out by one responsible body, with the separation of institutional responsibility for policy and regulatory functions from the service delivery function;
- 8) Public participation in water sector management should be ensured;
- 9) Water management at all levels should integrate water quality and water quantity;
- 10) Water supply and wastewater management should be integrated at all administrative levels;
- 11) The optimal development of water supply must be complemented by consistent water demand management and should be integrated at all administrative levels;

¹⁴ Ibid.

- 12) The protection and pollution control of water resources should be ensured;
- 13) The 'polluter pays' principle should be applied;
- 14) The conservation and optimum utilization of water resources should be promoted and enhanced;
- 15) The government will pursue Palestinian interests in connection with obtaining the right of water resources shared by other countries based on the principle of equality.¹⁵

3.2 Municipal Water Departments

Most existing municipalities were established before 1967. These departments dealt with the planning, development, management, and maintenance of drinking water networks, sewerage networks and other water resources development. Since the occupation, the role of these departments has been limited to the operation and maintenance of the water and sewerage networks. These departments suffer from a multitude of constraints, which render their work inefficient and limit the possibility for improvements.¹⁶

3.3 Administratively Independent Utilities

Some municipalities joined hands in certain areas to overcome the shortcomings of separate municipal departments. In the Ramallah area, the Jerusalem Water Undertaking (JWU) was established in 1963 by the Jordanian Government to serve the Ramallah district including the cities/towns of Ramallah, Al-Bireh, Deir Debwan, Silwad, Beit Hanina, Beitunia, and currently some 40 villages and refugee camps. In Bethlehem, the Water and Sewerage Department serves Bethlehem, Beit Jala, Beit Sahour and a number of villages and refugees camps. These water utilities are administratively and financially independent and each has its own board of directors.¹⁷

¹⁵ *Ibid.*

¹⁶ Daibes, F. *Institutional Survey: The Water Sector of Palestine*. Survey prepared in the Framework of the Hebron Water Access and Storage Project, ERM, May 2000 (on file with the author).

¹⁷ *Ibid.*

3.4 Local Committees and Village Councils

Approximately one quarter of all Palestinian villages have village councils. These local bodies manage and develop public services in the village including the supply of domestic water, energy and sanitary services. Local committees are formed when there is no council. The councils and committees are generally unqualified from a technical, administrative and financial viewpoint, which results in overall inefficient management.

3.5 Departments Connected With the Israeli Civil Administration

The West Bank Water Department, which was originally part of the Jordan Natural Resources Authority, is now under the direct supervision and control of the Officer for Water Affairs of the Israeli Civil Administration.¹⁸

4. ASSESSMENT OF EXISTING WATER INSTITUTIONS

The organizations operating the Palestinian water sector suffer from several constraints and deficiencies, which, if dealt with in the appropriate manner, would result in an increase in the efficiency of the organizations and consequently the services provided by the water sector. These problem areas have developed and deteriorated over the last 38 years of Israeli occupation and control of Palestinian water resources and systems. The smaller the scale of the water systems, the poorer the management and administration of the system and the higher the state of deterioration. The following constraints and deficiencies are inter-related and affect each other; therefore, reiteration of common causes and impacts might appear during the consideration of each of them.

4.1 Institutional and Human Resources Constraints

Due to excessive unemployment during the years of occupation, water institutions in Palestine have been obliged to hire extra labor for the same activities. Proper training and capacity building of staff at all levels of management and performance monitoring is minimal or lacking. This has resulted in organizational, technical,

¹⁸ Ibid.

administrative and logistic weaknesses, a lack of flexibility and bureaucratic limitations, general inefficiency, over- employment, and high salary rates relative to the total expenses.

4.2 Coordination Between Related Institutions

Water resources management institutions in Palestine are still in their infancy as the practice of water resources management on the ground is relatively recent. There is a lack of actual on site inter-relationship and efficient coordination and cooperation on inter-related water issues and aspects between the PWA and other PA organs such as the Palestinian Environmental Protection Agency (PEPA), the Palestinian Ministry of Agriculture, the Palestinian Ministry of Local Affairs, the Palestinian Ministry of Planning, and so on. This deficiency has resulted in a failure to integrate the various economic sectors in Palestine and has had a negative effect on the overall efficiency of water services and use in Palestine as a whole. The inter-related water issues and aspects include water supply and demand management, water resources development, water quality monitoring and protection, knowledge upgrade and institutional change, appropriate technical and technological level development, public-private sector involvement and participation, and others.

4.3 Financial Constraints

Most of the water-related organizations in Palestine suffer from severe financial deficits and a lack of funds, which limits both development and the extent and quality of delivered services. The main reasons for this situation are the lack of investment or poor investment on the part of the occupational authorities in the water sector in the Palestinian areas over decades of direct control and the poor economic conditions prevailing in the country. Modern financial planning systems are rarely implemented in the water institutions including water departments at municipalities and water committees in villages, nor do these institutions have the qualified staff for this purpose.

Proper planning without proper funding will result in non-realistic expectations and unsatisfactory outcomes. The biggest challenge, therefore, in terms of implementing the PWA plan is facilitating harmony between realistic priorities and realistic funding along with an appropriate phasing mechanism.

4.4 High Percentage of Unaccounted for Water

UFW in water distribution networks in Palestine, being the difference between produced water or purchased quantities and sold quantities, varies percentage wise between 25 and 55% of the total water supply. These extremely high losses are mainly a result of deteriorated water networks, illegal practices on the part of consumers, and metering problems.¹⁹

4.5 Ineffective Fee Collection Practices

The prevailing social, economic and political conditions in Palestine have resulted in many public groups refusing to pay their taxes and/or utility bills. This phenomenon is particularly widespread in refugee camps and villages. (The outstanding balances of water bills reach 100% in certain areas.)

4.6 Contradictory Taxing and Pricing Procedures

The various water utilities currently implement different water taxing and pricing rates without clear terms of reference or an established basis for setting the taxes or prices. The water bills, in general, do not even cover operation and maintenance costs, which means that at the immediate short-term level, the water utilities are generating losses. The high percentage of UFW, which reaches in certain cases 60%, results in relatively high water prices and the inability of the Palestinian water utilities to achieve cost recovery. The methods of calculating unit costs and prices are not standardized. Most water utilities or departments do not keep proper financial records or registers of assets. Direct costs are sometimes taken into consideration in calculating the prices, but provisions for internal and external donations and financial support and unpaid accounts are not included.

4.7 Cost Recovery and Operational Performance

In most water utilities in Palestine, cost recovery including operation and maintenance (O&M) costs, capital costs, the costs of environmental protection, and the costs reserved for future development of the water systems and resources has not been accom-

¹⁹ Haddad, M. "Planning Water Supply Under Complex and Changing Political Conditions: Palestine as a Case Study," *Water Policy Journal*, Vol. 1, 1998, pp.177-192.

plished by water suppliers for both domestic and agricultural use. Very few water utilities achieve O&M cost recovery. This situation is due to several internal and external factors within the utilities and their surrounding environment. An example of such a case is the JWU in Ramallah.

Low water prices and poor recovery rates threaten the efficient maintenance of existing water infrastructure as well as additional investment in future water development projects. International funding organizations would like to see the following:

- 1) Initial and continuous contribution of local utilities with regard to ongoing and planned water projects and activities in order to secure sustainability of the project(s) under consideration and cost recovery;
- 2) The spending of funds on the planned activities and in accordance with clear technical and financial rules, specifications, and standards;
- 3) The proper managing and implementing of the various projects; and
- 4) The direct or indirect contribution of the projects to the steady positive economic growth of the Occupied Palestinian Territories.

4.8 Political and Water Availability Uncertainty

Water supply and demand management along with access to water resources in Palestine was influenced by the appropriation of water to Jewish settlements²⁰ following the beginning of the massive immigration of Jews to Palestine at the end of the 19th Century. These influences and practices continued during the creation of the State of Israel in 1948, expanded after the War of 1967, and continue until today. Israel forced these influences and practices upon the Palestinian people using power and control, which resulted, amongst other things, in the following: (1) Full direct control on the part of the Israeli army of all water resources in Palestine; (2) The imposing of a fixed water supply quota on the

²⁰ See chapter by Fayeze Freij in this publication.

Palestinians by the Israeli authorities (see Figure 1); and (3) Limited access on the part of the Palestinians to their water resources.

The limited water supply to Palestinians has shaped the development of the country ever since.²¹ This practice had resulted in poor capacity building in the water sector, limited rural development, poor if not negative economic growth, an increase in poverty, poor health and sanitation conditions, and physical and human environment deterioration in the Occupied Palestinian Territories.²² As a result, the PA exists in a complex environment over which it has no control, not least of all, because it is not officially recognized as the government of a state or country. The implementation of PA basic and essential projects and plans will take many years, perhaps decades, to achieve, if, indeed, they are achievable at all. Quick results should not be expected unless the political and economic status of the country changes dramatically in a positive direction.

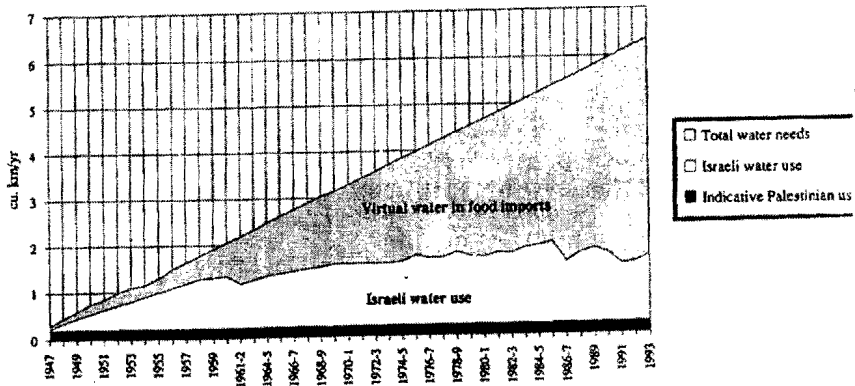
4.9 Government Involvement and Bureaucratic Control

In the PA administrative structures, the PWA is super governed by the Palestinian Cabinet followed by the NWC. Both the Cabinet and the NWC are chaired by President Arafat (see Table 1). This institutional setup or administrative framework sounds reasonable in theory. In reality, however, its actual implementation has been minimal, if not totally absent. In other words, the decision making and the regulatory levels of the structure were absent, while the PWA was neither successful in developing the bulk water utilities nor in providing a higher standard water delivery service (see Table 1). For example, although the NWC was established to ensure the approval of water policy and coordination between the PA organs, it actually in practice represents a stagnant or frozen body. NWC meetings are very limited in number and ceremonial in nature. This situation needs to be changed if positive outcomes are to be achieved.

²¹ See chapter by Yousef Nassar in this publication.

²² Haddad, M. *Urban Water Environment in the Palestinian Territory: Planning Under Complex Conditions*. Paper presented at the International Conference on the Urban Environment in the Mediterranean, Valletta, Malta, October 1997; and Haddad, M. "Planning Water Supply Under Complex and Changing Political Conditions: Palestine as a Case Study," *Water Policy Journal*, Vol. 1, 1998, pp.177-192.

Figure 1
Israeli and Palestinian Water Use 1947-1993



Source: Allan, 1995.²³

In order for the appropriate administrative changes to occur, water-related institutional reform in Palestine needs to be structured in nature and to include legal reforms, such as those relating to clear implementation and onsite power and authority. Water-related institutional reforms cannot be separated from the needed and ongoing overall Palestinian institutional reforms. Structural reform includes human and technical capacity building and the proper development and management of scarce water resources, all of which requires strong water institutions headed by well-trained professional development specialists and managers. In human capacity building and other activities, a leadership program capacity-building program should be included. Future institutional reforms should ensure that the PWA and other related PA organs synchronize their policies, plans, and actions. It is of vital importance that effective coordination regarding water resources development and management exist between the PWA and sectors other than the water sector and that this coordination include very close interaction and collaboration between the various administrative levels, as well as ensuring the involvement of all the different stakeholders.

²³ T. Allan. "Water in the Middle East and in Israel-Palestine: Some Local and Global Resource Issues," in Haddad M. and Feitelson (eds.), *The Proceedings of the Second Workshop on Joint Management of Shared Aquifers*. Jerusalem: Truman Center for Peace and Palestine Consultancy Group, 1995, pp. 31-44.

4.10 Water Infrastructure

Water infrastructure (the system of water wells, springs, reservoirs, networks, pumping stations, etc.) in Palestine is characterized by the existence of disjointed remote sites and locations. It therefore has to face, in addition to the problems associated with the occupation and the related administrative/legal control problem, the major problem of its not representing a united water system, neither physically nor on paper. As a result, it will take extreme efforts, considerable time, and large amounts of money to turn it into a reliable and integrated national water system.

4.11 Water-Related Environmental Considerations

Water quality management has been the last concern of the water institutions in Palestine. There are no certified laboratories, no regular monitoring of water resources and uses, and no qualified personnel trained for such duties and tasks. Solid and liquid waste management practices are far from being accepted and their impact on ground and surface water quality is not assessed. Environmental considerations are of critical importance as far as people, their resources, and sustainable economic growth are concerned. They therefore need to be given due consideration in any future water sector institutional reforms.

4.12 Palestinian-Israeli Joint Water Committee

The Palestinian-Israeli Joint Water Committee (JWC), which was created under the framework of the Interim Agreement,²⁴ is intended to coordinate water management activities between Israel as the full controller of water resources in Palestine and the PA until the final status negotiations, at which point, the water dispute between the two sides should finally be solved. The JWC, throughout its eight years of existence, has been considered by the Palestinian side a cause of further and continuous suffering due to the fact that what was agreed upon was never accomplished.²⁵

²⁴ Israeli-Palestinian Interim Agreement on the West Bank and Gaza Strip, Appendix II, Annex III, Article 40, Washington DC, 28 September 1995, found at <http://www.miftah.org/Documents/documents/piia/interim.html>.

²⁵ F. Kawash, "Palestinian Water Authority," speech made during the World Water Week, Stockholm, Sweden, August 2003.

5. PROPOSED FUTURE INSTITUTIONAL REFORMS

5.1 Reality and Institutional Reforms in Palestine

The main reality is the Israeli military occupation of the Palestinian land and resources and the recognition of the fact that for as long as the current conflict continues, many institutional reforms will be meaningless. Institutional water sector reforms are urgently needed in the Palestinian society in order to facilitate reliable and sustainable water supply services, safe public health and sanitation services and conditions, and better protection and conservation of water resources. These future water-related institutional reforms need to be holistic in nature and include operation management and coordinating between various water activities and different sectors. Sectoral water allocations within future water-related institutional reform need to be managed in an equitable manner to secure positive stable economic growth and ensure efficient water use with minimal environmental impacts and high food security (see Figure 2).

Upon assessing the existing water institutions, it becomes clear that there are several requirements that need to be fulfilled in order for the anticipated reforms to prove successful and result in positive changes (see Figure 2). These requirements include the following:

- The reforms should be structural in nature;
- The reforms should be enforced by the law;
- Institutions should have the power and authority necessary to carry out reforms and follow up activities and tasks;
- Institutions should adopt, allow, and integrate plans and policies relating to regional cooperation;
- The reforms should call for and make the most of the expected international support for the Palestinian people and the new State of Palestine.

The future water-related institutional reforms also necessitate the following:

- That there be continuous technical level development;
- That costs, tariffs, and fees be set so as to ensure cost recovery and sustainable development;

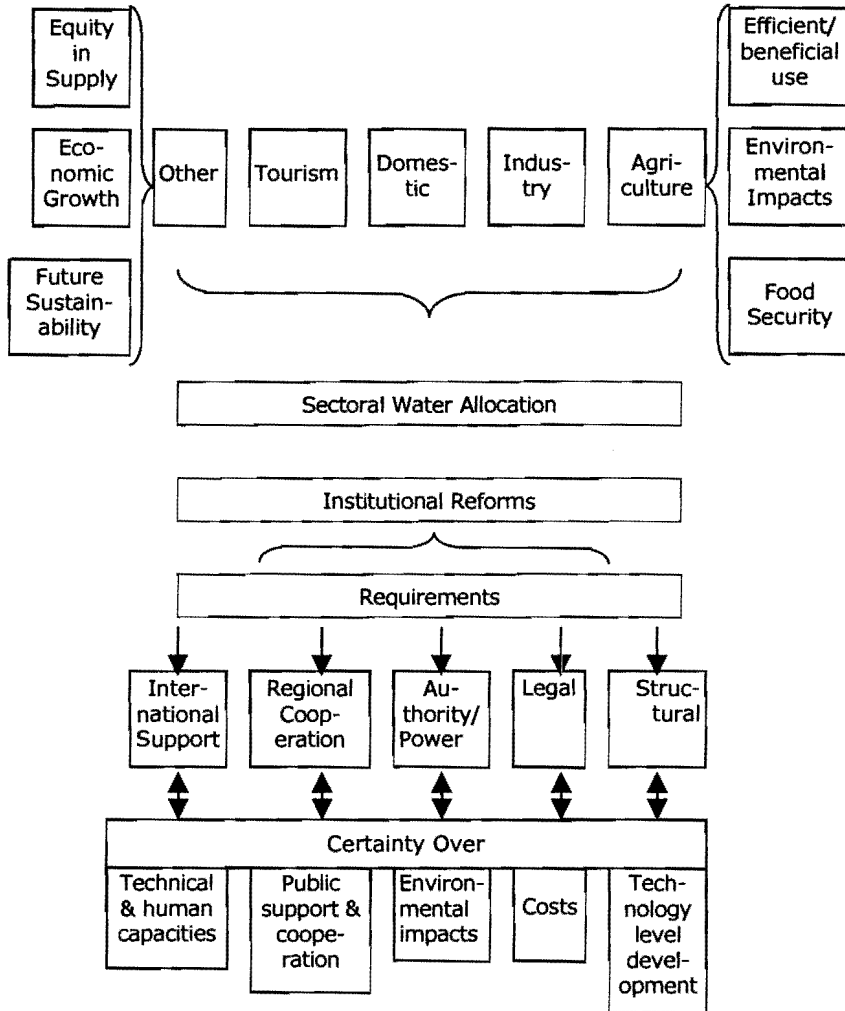
- That there should be continuous technical and human capacity building;
- That the environment should always be taken into consideration;
- That the public be involved in ongoing and future water activities and projects (see Figure 2).

A new up-to-date approach towards future institutional reforms in the water sector in Palestine, which takes into account the deficiencies and constraints presented in previous sections, requires rethinking the unfitting application of centralized water management systems. To deal with political, economic, social instabilities, and the outlined institutional deficiencies and constraints, the new approach needs to be based on a management pattern involving both centralized and decentralized water management systems which will gradually develop and upgrade and result in the existence of a better, reliable, safe, and more cost-effective water supply within a clear legal framework.

5.2 Reform Driving Force and Process

The existing administrative water management structure set by the PA (see Table 1) is conceptually acceptable; however, the less than satisfactory implementation of its elements has emptied it of substance. For example, the NWC, which was meant to be the national decision-making body and the controlling mechanism for the performance of the PWA, is at present nothing but a group of inactive representatives headed by a very busy president who has very little time to spend on water resources management. The PA currently functions like a centralized state, and the decentralization of authority is at present not recommended or accepted. A work philosophy based on decentralization and/or the compartmentalization of tasks and duties may result if not well-planned, -defined, and -controlled in fragmented and disjointed responsibility and work practices throughout the water utilities, which could have a disastrous effect on a country with low local-level capacities and inadequate resources.

Figure 2
Interrelationships of Proposed Institutional Reforms
Requirements and Sectoral Water Allocation



However, in order to facilitate future water-related institutional reforms, some tasks and activities need to be shifted from the central governmental control to private sector management. In this regard, the following are recommended:

- 1) Policy and programming, planning and design, engineering, operations and maintenance, resource development and asset management, including procurement, staffing, and inventory taking should be compartmentalized as departments within the PWA, with each department having a clear mandate and
- 2) Well drilling, the installation of strategic mains, reservoir building, fees and bills collection, and automatic control and/or monitoring of the water system should be transferred to the private sector.

5.2.1 The NWC as the Main Top-To-Down Decision Maker

The two most important questions now are what would be necessary for water-related institutional reforms to materialize and how can the obstacles in the way of those reforms be removed? A top-to-down and down-to-top management approach is the answer to this question, whereby a powerful NWC would be in charge of strategic decision making, an effective water system-managing PWA, fully operational regional and local water institutions, and a cooperative, supportive private sector, all cooperating together with a clear legal/administrative mandate (see Table 2).

Table 2
Proposed Future Water-Related Institutional Structure in Palestine

Ministry of Planning		Decision Making Level
National Water Council		
Palestinian Water Authority		Management Level
Regional Water Utilities	Private Sector With or Without International Joint venture	Service Delivery Level
National, Regional, International and UN Coordination Unit	Public Coordination Unit	

An effective, powerful, and authorized NWC will constitute the reform driver or driving force. Amongst other things, it will be responsible for the following:

- Coordinating/integrating the various PA organs. This will include the integration of water tasks, activities, and duties within the overall economic planning and policy analysis of the country. This integration will facilitate and determine the water demands of the whole economy, help in the conservation of resources, the preservation of the environment, and the minimization of costs, as well as in maintaining the needed water supply at a reasonable cost;
- Strategic planning and checking plans for future water supply demand management including resource development;
- Checking the performance of the PWA and guiding its development; and
- Constituting the legal/administrative implementation power behind PWA actions, activities, and programs.

In order to guarantee its effectiveness and performance, the NWC should take the form of a multidisciplinary fulltime working unit made up of a group of experts on various aspects of Palestinian water resources management and administratively connected with the Ministry of Planning instead of the head of the Cabinet (the Prime Minister) or the President.

5.2.2 The PWA as the Full Management Body

The role of the PWA in the proposed structure will change from being a regulatory role to one involving the full management of water resources (supply, use, and development). It is proposed that the PWA should adopt the following organizational changes:

- The PWA should be restructured administratively to include six main units: the Technical Unit, the Administrative Unit, the Data Bank Unit, the Research and Development Unit, the Local, Regional, UN, and International Cooperation Unit, and the Public Coordination Unit (see Figure 3).
- The West Bank and Gaza Strip should be divided administratively into three regional water utilities: the West Bank Water Utility, the Gaza Strip Water Utility, and the Jordan River Water Utility (see Figure 4).
- Within each of the regional water utilities, policy and programming, planning and design, engineering, operations and maintenance, resource development and asset management,

including procurement, staffing, and inventory taking should be compartmentalized as departments. Each regional water utility will be responsible for sub-local water departments (i.e., municipalities, village councils, and refugee camps) located within its jurisdiction area.

- The PWA directorate, through its administrative unit, will regularly conduct performance and expenditure monitoring and control. This monitoring and control will require the appropriate follow up, which, amongst other things, will ensure that regional utility heads work in accordance with the rules and regulations whilst considering the various sub-local water departments as a single entity.

Figure 3
Administrative Structure of PWA Directorate

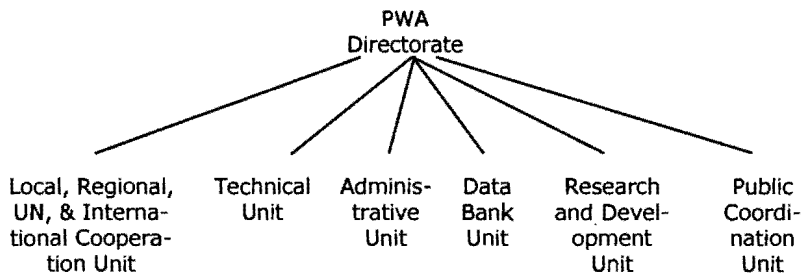
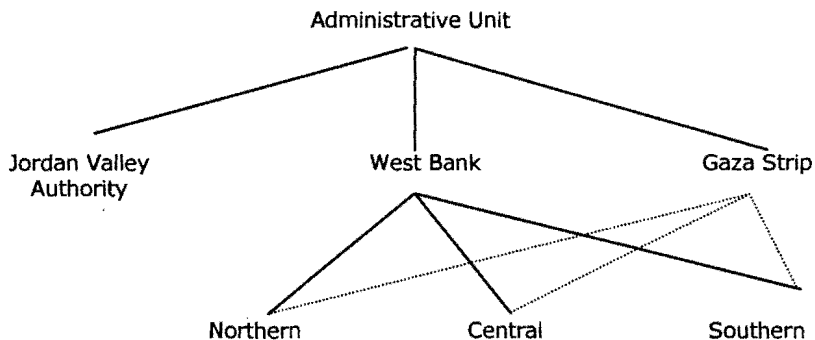


Figure 4
Administrative Unit Structure



5.2.3 Down-To-Top Interaction

The power and mandate given to the NWC and the PWA should allow for active interaction with the private sector and the public. The proposed Public Coordination Unit within the PWA should be responsible for the following:

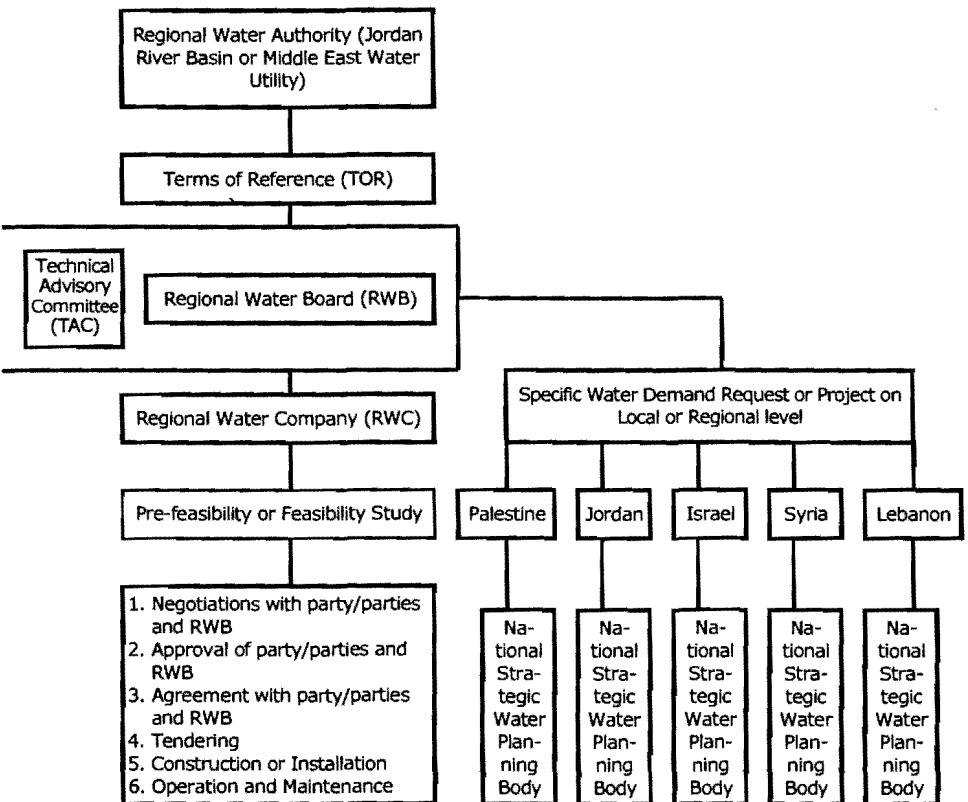
- 1) Properly and by resorting to the various available means informing and educating the public continuously to guarantee public participation in and/or support for PWA activities and programs, and
- 2) Properly and by resorting to the various available means understanding the public and its reactions, interests, and needs and conveying these to the PWA directorate on a regular basis.

As to the proposed Local, Regional, UN, and International Coordination Unit within the PWA, it should be responsible for seeking, controlling, and directing funding through national, regional, international, and UN institutions and sources.

It is often argued that local experiences, capacity, and resources in terms of managing and developing water resources are limited, especially in developing countries or societies such as the Palestinian one and that accordingly, international or third party involvement and support is necessary. In the Palestinian case, international friends and supporters along with UN institutions are needed to pursue and facilitate water projects and activities as well as their financing. Regional cooperation, including in terms of finding solutions to water problems, is also necessary and highly recommended. Regional cooperation mechanisms are very difficult to implement, especially where transboundary water resources management is not agreed upon by riparians and differences exist between the economic and/or military power of the parties involved. Nevertheless, in the Palestinian case, the three concepts are essential: regional cooperation is needed along with international support for and involvement with a national water utility that has adopted an integrated water management approach allowing private sector involvement and participation. A framework for a regional water institution in the Middle East was proposed in 1999 by the author and can be used as a basis for an operational

regional water authority.²⁶ This regional institution will aim at regional cooperation in the development of water supply and demand in the Middle East (see Figure 5).

Figure 5
Organization Chart of Regional Water Authority



²⁶ Haddad, M. "Institutional Framework for Regional Cooperation in the Development of Water Supply and Demand in the Middle East." In *Journal of the American Water Resources Association (JAWRA)*, Vol. 35, No. 4, pp.729-739, August 1999.

6. SUMMARY AND CONCLUDING REMARKS

- The institutionalization of water issues, commitments, and responsibilities in Palestine is not generally accepted, understood, and/or practiced.
- The reason behind the state of underdevelopment in Palestine including that associated with the water sector is the fact that certain components of the legal infrastructure have stagnated over a long period of time.
- All regulatory reforms can be analyzed as institutional reforms. It is therefore important to develop the necessary regulations in regard to both institutional issues and analysis.
- The Palestinian NWP, which constitutes a massive investment program, requires approximately US\$5 billion for its implementation. The successful implementation of this plan will need to be accompanied by appropriate institutional reforms in the water sector.
- The organizations operating the Palestinian water sector suffer from several constraints and deficiencies. Were these to be dealt with in the appropriate manner, there would surely be an increase in the efficiency of the organizations and consequently the services provided by the water sector. These problem areas have developed and deteriorated over the last 38 years of Israeli occupation and control of Palestinian water resources and systems.
- Among the institutional deficiencies and constraints facing the Palestinian water sector are the lack of organizational and human resources, poor coordination between related institutions, financial constraints, a high percentage of UFW, ineffective fee collection practices, contradictory taxing and pricing procedures, poor operational performance, political and water availability uncertainty, an imbalanced and ineffective Palestinian-Israeli JWC, unregulated governmental involvement, a weak water infrastructure, and poor environmental management.
- Without solving the current Palestinian-Israeli conflict over land and resources, many water-related institutional reforms will be meaningless.

- A new up-to-date approach towards future water-related institutional reforms needs to be based on a management pattern allowing for both centralized and decentralized water management systems, which will gradually develop and upgrade, leading to a better, more reliable, and safer cost-effective water supply within a clear legal framework.
- The water-related institutional reform process should be characterized by a top-to-down and down-to-top management approach, whereby a powerful NWC would be in charge of strategic decision making and an effective, water system-managing PWA, fully operational regional and local water institutions, and a cooperative, supportive private sector, all of which would cooperate together with a clear legal/administrative mandate.
- In order to facilitate future water-related institutional reforms, it is necessary to first shift some tasks and activities from the control of central government to private sector management. This shift - which needs to be implemented in phases - and the determination of the number and type of tasks and activities to be shifted both need to be studied very carefully.
- The future water-related institutional reforms need to be holistic in nature and include operation management and coordinating between various water activities and different sectors. Sectoral water allocations within future water-related institutional reform need to be managed in an equitable manner to secure positive stable economic growth and ensure efficient water use with minimal environmental impacts and high food security.
- Several requirements and considerations need to be fulfilled in order for the anticipated institutional reforms to take place and result in positive outcomes, including legal, structural, power and authority reforms and the integration of plans and activities among the related economic sectors.
- The future water-related institutional reforms also necessitate the following:
 - That there be continuous technical level development;
 - That costs, tariffs, and fees be set so as to ensure cost recovery and sustainable development;
 - That there should be continuous technical and human capacity building;

- That the environment should always be taken into consideration;
- That the public be involved in ongoing and future water activities and projects.
- An effective, powerful, and fully authorized NWC with the necessary means and tools will constitute the reform driver or driving force. The NWC should take the form of a fulltime working unit made up of a group of multidisciplinary experts on various aspects of Palestinian water resources management and administratively connected with the Ministry of Planning instead of the head of the Cabinet (the Prime Minister) or the President.
- The NWC will be responsible, amongst other things, for coordinating between various PA organs and PWA, strategic water planning and checking PWA plans for future water supply demand management, including resource development, checking the performance of the PWA and guiding its development, and constituting the legal/administrative implementation power behind PWA actions, activities, and programs.
- The role of the PWA in the proposed structure will change from a regulatory role to one involving the full management of water resources (supply, use, and development). It is proposed that the PWA be restructured administratively to include six main units: the Technical Unit, the Administrative Unit, the Data Bank Unit, the Research and Development Unit, the Local, Regional, UN, and International Cooperation Unit, and the Public Coordination Unit. It is also proposed that the West Bank and Gaza Strip should be divided administratively into three regional water utilities: the West Bank Water Utility, the Gaza Strip Water Utility, and the Jordan River Water Utility.
- Within each of the regional water utilities, policy and programming, planning and design, engineering, operations and maintenance, resource development and asset management, including procurement, staffing, and inventory taking/keeping should be compartmentalized as departments. Each regional water utility will be responsible for sub-local water departments located within its jurisdiction area.
- Through its administrative unit, the PWA will conduct regular progress follow-up, performance and expenditure monitoring

and control. This will ensure that regional utility heads work in accordance with the rules and regulations whilst considering the sub-local water departments as a single entity.

- The power and mandate given to the NWC and the PWA should allow for active interaction and controlled relationships with the private sector and the public.
- The proposed Public Coordination Unit within the PWA should be responsible for the following:
 - 1) Properly and by resorting to the various available means informing and educating the public continuously to guarantee public participation in and/or support for PWA activities and programs, and
 - 2) Properly and by resorting to the various available means understanding the public and its reactions, interests, and needs and conveying these to the PWA directorate on a regular basis.
- The proposed Local, UN, Regional and International Coordination Unit within the PWA should be responsible for seeking, controlling, and directing funding through national, regional, international, and UN institutions and sources.
- International or third party involvement and support is of vital importance. In the Palestinian case, international friends and supporters along with UN institutions are needed to pursue and facilitate water projects and activities as well as their financing.
- Regional cooperation with regard to solving problems related to water is necessary and highly recommended.

5

IMPACT OF JEWISH SETTLEMENTS ON PALESTINIAN WATER RESOURCES

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1. INTRODUCTION

Israel began establishing Jewish settlements in the West Bank and the Gaza Strip following the War of 1967 as a means of consolidating its control of Palestinian territory from both a security and an ideological standpoint. The building of Jewish settlements on confiscated land in most areas of the West Bank and Gaza Strip is a clear violation of Article 49 of the Fourth Geneva Convention,¹ which states that the "occupying power shall not deport or transfer part of its own civilian population into the territory it occupies."

Settlements are considered the most significant obstacle to the peace process and represent one of the most contentious issues, the resolution of which has been delayed to the final status negotiations.² The recent Israeli announcement regarding Israel's decision to cease building operations and freeze new settlements was made in order to avert world public opinion from the real Israeli practices. Worthy of mention in this regard is the fact that the announcement did not preclude the expansion of existing settlements or the constructing of thousands of new units to enhance existing settlements and increase the number of settlers.

The Jewish settlements are constructed in very sensitive locations such as mountain peaks and semi-deserted areas throughout the Palestinian districts. They therefore represent a real danger to Palestinian natural resources. They also contribute to the deforming of the social structure of Palestinian society through imposing Israeli control on land and water resources and destroying the infrastructure of Palestinian economic sectors by creating hegemony in terms of the local market and transferring Palestinian farmers as unskilled workers and cheap labor to the Israeli sectors.³

¹ The Geneva Conventions: Convention (I) for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field; (II) for the Amelioration of the Conditions of the Wounded Sick and Shipwrecked Members of Armed Forces at Sea; Convention (III) Relative to the Treatment of Prisoners of War; and Convention (IV) Relative to the Protection of Civilian Persons in Time of War, adopted in Geneva, 12 August 1949: Final Record of the Diplomatic Conference of Geneva of 1949, Vol. I, Federal Department, Berne, pp.195-341; 75 United Nations Treaty Series 5-417.

² The other issues are security, borders, refugees, Jerusalem, and water.

³ For more on this see Freijat, F. "Social and Economic Elements of Reproduction of Palestinian Family on the Territory of Future Palestine," in *Africa, Asia, America, and Latin America* (published by Warsaw University, Department of Geography and Regional Studies, Institute of Developing Countries), Vol. 74 (1977), pp. 33-47.

The increasing expansion of the settlements has been accompanied by the relocation of many industrial, communication, and other activities from Israel to the settlements surrounding West Bank rural areas. This has had disastrous consequences for the local Palestinians, not least of all because with the encroachment of Israeli occupation and the presence of settlers in hilltop settlements, thousands of dunums⁴ of high-value agricultural land has been transformed in such a way that the land is no longer suitable for agriculture.

During the last 36 years, the Israeli authorities have exhausted both the Palestinian land budget and taxes and customs in order to provide settlers with their requirements. In the meantime, the Palestinian institutions, whether municipalities or town councils have been left unable to cover the Palestinians' daily needs. To date, Israel has not only continued to increase the number of Jewish settlements, but has also continued to neglect the environmentally sound management of the waste coming from the settlements and the enforcing of environmental regulations or protection measures. Environmental protection, it should be stressed, is one of the most important elements in terms of achieving a sustainable peace. It is not a one-nation issue; on the contrary, each side is required to do its utmost to live not only in peace, but also to guarantee a safe environment.

Environmental regulations in the Jewish settlements with regard to soil, air, and water quality, and restrictions on industrial development generally, have been far less comprehensive and much less assiduously enforced in the settlements when compared with Israel.⁵ Combined with state-subsidized incentives for Israel businesses to locate to industrial parks in and near settlements, the laxity of environmental enforcement and monitoring has resulted in the relocating of a number of 'dirty' concerns in the Occupied Palestinian Territories. Factories posing an environmental risk generally use wet processes in regard to the manufacturing of packaged food, metal coating, and textiles.⁶ Moreover, the waste-

⁴ Land measurement unit equivalent to 1,000 m²

⁵ Palestinian Water Authority (PWA), *Water Sector Strategic Planning Study, Interim Report*, Vol. 3, Appendix 9. Ramallah, Palestine: December 1998.

⁶ Le Monde Diplomatique, Middle East: The Faultline: "*The Socio-economic Impact of Settlements on Land, Water, and the Palestinian Economy*", Foundation for Middle East Peace, Washington, DC 1998, found at: <http://mondediplo.com/focus/mideast/a2332>.

water from settlements is most commonly collected in networks that empty into the surrounding land or else is disposed of through cesspits without being properly treated, thereby further polluting the Palestinian environment.

As is well known, the territories under the control of the Palestinian Authority (PA) and Israel are mostly arid and lacking in reliable water sources. Therefore, both sides face the problem of finding new sources of water to serve growing populations. The search for additional water sources will be pointless, however, if the existing sources are not preserved. Polluting underground water sources to the point where they will be unusable will have dire effects on the quality of life as well as on economic conditions, and untreated wastewater, industrial activities, improper solid waste disposal, and other environmentally unfriendly actions performed in the West Bank pose a huge threat to the water sources of both Israel and the Palestinians.⁷

This paper is not intended to be political propaganda, but rather to alert the public to the highly important and urgent need to tackle the problems associated with water and the environmentally unfriendly actions that take place in the Israeli settlements. In the context of this topic it is worth mentioning that the Israeli authorities go to great lengths to prevent the publication of any information pertaining to the environment-related activities of the Israeli settlements, such as water consumption quantities and the quality of disposed wastes, which means, amongst other things, that this paper relies upon the available statistics and information collected during field visits to the areas surrounding Jewish settlements and the affected Palestinian areas.

The following discussion presents a number of facts and figures concerning the environmental effect of the Jewish settlements on the Palestinian environment in the West Bank. The data that is presented is the best that the researcher could collect and compile from the public domain. The highlighting of the Israeli environmental policy that is practiced in the West Bank under slogans such as "Out of sight, out of mind," "End of pipe technology," and others will hopefully assist the Palestinian decision makers in formulating their official position in relation to the assessment of the real impact of settlements on the water issue.

⁷ PWA. *Environmental Impact of Jewish Colonies in the West Bank*. Ramallah, Palestine: 1997, pp. 2-3.

1.1 Demographic Changes

Since 1967, successive Israeli governments have aimed to create facts on the ground by increasing the number of settlers in the West Bank and Gaza Strip in order to achieve demographic equilibrium in the two areas. It is difficult to estimate the population of the Jewish settlements since access to the settlements themselves as well as to population data sources is impossible. Therefore, in estimating the population figures for the Jewish settlements, it was necessary to rely upon population projections for certain settlements and the presumption that other settlements in the same category would maintain the same population net density (see Table 1). The population net density (p/dunum) for each settlement category is illustrated in the following table:

Table 1
Population Net Densities of Jewish Settlements

Category	Civic	Agricultural	Tourism	Military	Industrial
Pop. Net Density	2.5	1.5	1.5	2.5	1.5

Utilizing the abovementioned methodology, the total population of the Jewish settlements located in the West bank is estimated to be around 200,000, excluding the Jewish settlers living in the city of Jerusalem. It should be mentioned that the Israeli Central Bureau of Statistics estimated the number of Israeli settlers living in the West Bank at about 140,000 as of the end of 1997. This particular estimation relied upon a theoretical model based on annual growth rate. It is therefore unreliable, since the increase in the number of settlers is not restricted to natural growth only but also to immigration and the arrival of large numbers of newcomers who decided to settle in the West Bank. According to the 1995 annual publication of Israel's Central Bureau of Statistics, *The Statistical Abstract of Israel*, the population growth rate in Israel in 1994 was 2.7%, while the settler growth was 9.8%, or over three times the national figure. In the same year, the settlements absorbed 8,000 immigrants from both across the Green Line and other countries, which means that the number of settlers immigrating to the West Bank in 1994 was twice the natural increase in the settler popula-

tion in the West Bank for the same year.⁸ Meanwhile, the number of Israeli settlers increased from 137,000 to 150,661 due to a high migration rate, which reached 9,000 persons per year by the year 1996, a little less than twice the natural increase in the settler population, i.e., 4,661.⁹ Worthy of mention in this regard is that a Peace Now report indicated that the settlers in the West Bank numbered 154,400 in 1999.¹⁰

As well as being affected by natural growth and immigration, the increase in the number of Jewish settlers living in the Occupied Palestinian Territories is also affected by Israeli measures and facilities that encourage Israeli investment in the West Bank, including the Israeli measure whereby Jewish settlers in the West Bank are not sanctioned for failing to abide by the same stringent Israeli regulations regarding waste discharge that are applied in Israel proper. According to the Foundation for Middle East Peace (FMEP),¹¹ there are 130 Israeli settlements in the West Bank, 16 in the Gaza Strip, and 11 in East Jerusalem, while the total number of settlers is 213,672 (excluding the 170,400 settlers in East Jerusalem). Of this figure, 50%, or approximately 100,000 settlers, live in eight settlements in the West Bank and Gaza Strip. According to the same report, built-up settlement areas occupy 1.4% of the West Bank's 5,640 km², while settlement boundaries enclose almost 10% of West Bank territory. Moreover, with the outbreak of the Al-Aqsa Intifada in September 2000, Israel appeared to start planning 'no-go' areas between 70 and 500 meters wide around each and every settlement and military installation in the Occupied Palestinian Territories. In addition, the settler population (excluding East Jerusalem) has increased by 5,000 since the beginning of 2003 to 231,000.¹² Between 2001-2003, approximately 1.5-5% of Israeli settlers left these settlements and moved to Israel. During the same period, however, the increase in popu-

⁸ Annual publication of Israel's Central Bureau of Statistics, *The Statistical Abstract of Israel, 1995*. See also: *Report on Israeli Settlement in the Occupied Territories*, a bimonthly publication of the FMEP, Vol. 6, No. 3 (May 1996).

⁹ Peace Now. *Changes in the Settlements Since the Establishment of the Likud Government*, Peace Now Report No. 9, 1996.

¹⁰ Peace Now. "Occupied Territories Population and Housing Report," *Settlement Watch*, May 1999.

¹¹ FMEP Report, *Report on Israeli Settlement in the Occupied Territories*, Vol. 11, No. 2 (March-April 2002).

¹² FMEP Report, *Report on Israeli Settlement in the Occupied Territories*, Vol. 13, No. 4 (July-August 2003).

lation attributable to the arrival of newcomers and natural growth reached 5% per annum. The table that follows shows the population growth in Israeli settlements in the West Bank.

Table 2
Population Growth In Israeli Settlements in the West Bank

January	Year	December	Real	%	National Average Growth	New Settlers	Immigrants	Natural Growth
172,100	1999	183.800	11.700	6.8%	2.8%	14,500	1,600	5,300
183.800	2000	198.200	14.400	7.8%	2.6%	16,500	1,300	6,000
198.200	2001	208.200	10.000	5.0%	2.2%	13,200	1,000	6,400

Source: General Statistics Department [Israel]. "Summary of Israeli Statistics 2000-2001" (tables 2, 5, and 16), in *Statistical Abstract for 2000-2001*. (Note: These numbers exclude East Jerusalem.)

2. WATER CONSUMPTION IN THE ISRAELI SETTLEMENTS

The overall estimated amount of water coming from renewable water sources in the Occupied Palestinian Territories is approximately 939 mcm/yr: 679 mcm/yr from West Bank groundwater (Eastern, Western, Northeastern groundwater aquifers), 60 mcm/yr from the Gaza Aquifer, and 200 mcm/yr from the Jordan River.¹³ The total amount of water coming from renewable water sources in geographic Palestine comes to nearly 2.0 billion cm/yr. Of the 2.0 billion cubic meters, 250 mcm (160 mcm for agricultural purposes and 90 mcm for urban use) of water are used by Palestinians living in the West Bank and Gaza Strip while the rest is used by the Israelis, including the settlers. This means that 88% of Palestine's renewable water resources and 75% of the renewable water resources of the West Bank and Gaza Strip are being utilized by Israel. The actual distribution of 679 mcm of West Bank groundwater is as follows:

- 56.6 % for use in Israel;
- 23.8% for use by the 170,000 West Bank settlers (excluding those residing in East Jerusalem); and

¹³ This is the estimated contribution of the West Bank to the total flow of the Jordan River. The figure, which is debated, is based on the Johnston Plan of 1955. It is worth noting that the Palestinians have been denied access to the waters of the Jordan River since 1967.

- 19.6 % for use by the 1.8 million Palestinians living in the West Bank.

The following table compares between water utilization in the Jewish settlement of Kiryat Arba and a major Palestinian city located in the same district, i.e., Hebron.

Table 3
Comparison of Water Allocation

	Kiryat Arba (Settlers)	Hebron (Palestinians)
Population in December 1997	5,800	119,230
Household water supply in 1997	765,120 m ³	3,170,952 m ³
Allocation in:		
February 1997	45,100 m ³	254,660 m ³
July 1997	98,530 m ³	216,230 m ³
Daily Usage (Per Person):		
July 1997	547 liters/day	58 liters/day
July 1998	NA	45 liters/day

Source: Water data is from the Palestinian Water Authority (PWA). Information appeared in *Ha'aretz*, 31 July 1998.

The above table reveals a shocking fact, namely, that the water consumption of an Israeli settler is approximately nine times more than that of a Palestinian individual. Worthy of mention in this regard is the fact that according to a Peace Now report, "The Jewish settlers' per capita irrigated areas are seven and thirteen times larger than the areas accorded to Palestinians for irrigation in the Gaza Strip and West Bank respectively."¹⁴

A report issued in November 1992 by the Jerusalem Media and Communication Center (JMCC), entitled *Israeli Obstacles to Economic Development in the Occupied Palestinian Territories*, notes that a lack of water has forced Palestinian farmers to reduce the amount of land that is cultivated due to the lack of water and that the digging of new, deep wells for settlements, particularly in the Jordan Valley, has caused subsequent shortages for Palestinian

¹⁴ Quoted in FMEP, *Report on Israeli Settlement in the Occupied Territories*, Vol. 8, No. 4 (July-August 1998).

farmers.¹⁵ Any increase in the number of settlers results in an increase in the demand for water, whether for agricultural, municipal or industrial purposes in the settlements. In addition, the growth of the populations in the settlements necessitates expanding the existing settlements and constructing new ones whilst increasing the accompanying facilities, which obviously leads to an increase in the effluent of wastewater. Assuming that every Israeli consumes 333 cm/yr (as much as four Palestinians), then the total consumption of settlers in the West Bank (excluding East Jerusalem) was 59 mcm in 1999, 64 mcm in 2000, and 69 mcm in 2001.¹⁶

During the current Intifada, the closure imposed on the Occupied Palestinian Territories has seriously affected the availability of water as far as the Palestinian communities are concerned.

The main problems can be summarized as follows:

1. The amount of water supplied by Israel to the Bethlehem-Hebron region was decreased from 33,000 cm/day to 20,000 cm/day in order to meet the needs of settlers. The Israeli Coordinator of Government Activities in the Territories responded to complaints by saying that Israel is supplying the Hebron region with 23,000 cm/day, i.e., more than the 17,500 cm/day stipulated in the Oslo II Agreement. Shortages were also attributed to PA administrative shortcomings.
2. Many towns and villages are suffering from a water shortage as a result of the closing off of the Occupied Palestinian Territories.
3. Water prices have increased as a result of the inability of water tankers to fetch water from nearby sources.
4. Many tankers have been obliged to return empty as a result of the high pressure on the water openings and sources located inside the areas under Palestinian control.
5. Some well pumps are inactive as a result of the non-availability of fuel.

¹⁵ FMEP Report, *Report on Israeli Settlement in the Occupied Territories*, Vol. 11, No. 2 (March-April 2002).

¹⁶ Palestinian Hydrology Group (PHG). *Report on the Impact of Closure on Water Supply to Palestinian Villages and Towns*, found at: http://www.phg.org/report_01.html.

6. The closure has prevented people from reaching the pumping stations and wells in order to operate the water supply systems and carry out maintenance work, as was the case in Sannur (Jenin district).

3. ENVIRONMENTAL AND SOCIOECONOMIC IMPACTS OF ISRAELI SETTLEMENTS IN THE PALESTINIAN TERRITORIES

The impact of Israeli settlements and settlers on Palestinian land and water resources is but one aspect of a broad relationship of inequality and dependency established and promoted by the occupation during the last three decades. While there have been anecdotal enquiries into specific examples of this phenomena – for example, Palestinian construction workers building Israeli settlements or the effects on an adjacent Palestinian community of sewage produced by a settlement - there have been no studies that focus on the overall economic effects of settlements themselves, singly or collectively, on Palestinians. Nevertheless, there is some data available that offers a broad insight into the nature and scale of the impact of settlements on Palestinian land and water resources.

Israel's occupation of the West Bank and Gaza Strip is essentially a contest for control of the region's resources, principally land and water. To the extent that these assets are used mainly by one antagonist, occupation has been structured so that the other loses. Settlers have long represented an Israeli intention to remain permanently on the land and to control its destiny, necessarily at the expense of the Palestinians. Without settlements, as Israelis have long acknowledged, they would be merely an "occupying" army. The implantation of civilian Israeli settlements is, therefore, the primary obstacle to Palestinian self-determination.

All Israeli settlements in the West Bank are currently located in Area C, which is under exclusive Israeli control and which comprises 72% of the West Bank. Israel similarly controls approximately 15% of the Gaza Strip. Assessing the precise effect of the loss and reallocation of Palestinian land to Israeli settlements is difficult. The World Bank, in a draft of its September 1993 study *Developing the Occupied Territories – An Investment in Peace*, notes the following:

"Confiscation of Palestinian land has enabled Israel to proceed with the construction of settlements and related structures in various areas of the West Bank that were traditionally considered to be wilderness zones. Most important among these are the eastern slopes and the central part of the West Bank, which once housed a variety of wildlife and provided a winter grazing ground for livestock and recreation for the local population. ..."

Similarly, building agricultural settlements in the Jordan Valley has gradually deprived the Palestinian inhabitants of these areas of their richest soil and water wells. A similar situation has developed in the Gaza Strip where settlements have encroached upon fertile inland and coastal areas. The Israeli settlements program has not been accompanied by adequate and proper environmental considerations. Consequently, none of the settlements have developed sewage treatment plants and sewage is often allowed to run into valleys even if a neighboring Palestinian village is threatened. The sewage 'system' of the settlements on the eastern hills and slopes north of Jerusalem, for example, has contaminated fresh water supplies for drinking and the irrigation of Palestinian areas as far as Jericho.

3.1 Agricultural Land

In 1967, 2,300 sq km of the West Bank and Gaza Strip were cultivated by Palestinians. In 1989, the figure was only 1,945 sq km, or 31.5% of the West Bank and Gaza Strip.¹⁷ Agriculture comprised 24% of the Palestinian GDP in 1966, the same percentage as in the 1980-85 (pre-Intifada) period. By 1994, however, the percentage had decreased to less than 15%. In 1966, the agricultural sector provided employment for 55,000 Palestinians, or 43% of all Palestinian workers, whereas in the 1980-85 period, there were only 40,000 people employed in the agricultural sector, accounting for 24% of employed Palestinians, with the percentage decreasing further in 1993 to only 22%.¹⁸ These gross indicators

¹⁷ *Agriculture and Development in Western Asia*, joint publication of the UN Economic and Social Commission for Western Asia (UNESCWA) and the Food and Agriculture Organization of the UN (FAO), No. 16 (December 1994), pp.8-9.

¹⁸ Kurzom, G. *Towards Alternative Self-reliant Agricultural Development*, Development Studies Program and MA'AN Development Center, Ramallah, 2001, p. 9. See also: Ministry of Planning and International Cooperation (MOPIC), *National Policies for Physical Development - The West Bank and Gaza Strip Governorate*, December 1998, p. 32.

do not lead to specific conclusions regarding the effect of settlements on agricultural employment or production or land under cultivation because settlements are only one of a number of variables that must be considered when assessing these trends. There are specific regions, however, such as the Jordan Valley, where a direct link can be established between the loss of Palestinian agricultural opportunities and Israeli settlements. Although the confiscation of agricultural land and its transfer to settlements result in the loss of agricultural income and employment, this has never been quantified beyond anecdotal reporting.

The following table illustrates the geographic distribution of agricultural and urban settlements in 2001:

Table 4
Agricultural and Urban Settlements in 2001

Type of Settlement	Number of Settlements in the West Bank and Gaza Strip	Total Population
Agricultural Settlements	10	9,700
Socialist Agricultural Settlements	69	4,7000
European Collective Kibbutzim (farms)	90	1,800
Agricultural Moshavim	32	8,800
Total Number of Rural Settlers	120	62,000
Urban 2000-9,999	14	57,500
Urban 10,000-19,999	4	63,000
Urban 20,000-49,999	1	25,800
Total Urban Settlements Population	19	146,300
Total Population	139	208,300

Source: *Statistical Abstract of Israel, 2002*, table 209

Contamination by sewage undoubtedly affects Palestinian agriculture in the region around Kiryat Arba and elsewhere in a negative manner. In addition, there are economic and environmental costs associated with Israeli-owned industries in the Occupied Palestinian Territories, such as a recycling plant for used motor oil, stone quarries, and other plants where harmful and toxic byproducts are produced.

3.2 Water

Access to water, rather than a scarcity of land, remains the greatest obstacle to Palestinian agricultural development.¹⁹ For Israel, water has been a vital precondition for meeting its fundamental challenge, namely, the creation of a vibrant economy to sustain an increasing Jewish community. Without an adequate supply of water, the concept of massive Jewish immigration and settlement would be imperiled, and without immigration and settlement Israel's leadership would fear for its future.²⁰ Water, settlement, and security have thus become complementary pieces of Israel's security outlook.

Almost the entire increase in demand by Israelis since 1967 has been met by resorting to the waters of the West Bank and the Upper Jordan River.²¹ Israel, however, is in the midst of a water emergency. Even with the resources conquered in 1967, it is pumping more water from its aquifers than nature can replace, while in the West Bank, not only is it exploiting water for its own population, both in Israel and the Occupied Palestinian Territories, amounting to 15% of total consumption, but it is also preventing the Palestinian community from increasing its water use by barely 20% beyond the amount used in 1967, and even then, the water can only be for personal use, not for agriculture and economic development.

Since the beginning of bilateral and multilateral negotiations earlier this decade in Madrid, Israel has sought to protect its continuing control over this precious resource in the West Bank, which was described by Israel's state comptroller in February 1993²² as the "principle reservoir of drinking water for the Dan region, Tel

¹⁹ Dubbeling, M. & Meyboom, M. *The Sheep/Goat and Olive Cropping Systems in the West Bank, A Study on the Possibilities and Limitations of Integration*. Series of Development Studies (10), Ramallah: MA'AN Development Center, July 1997, p.4.

²⁰ Le Monde Diplomatique, Middle East: The Faultline: "The Socio-economic Impact of Settlements on Land, Water, and the Palestinian Economy", Foundation for Middle East Peace, Washington, DC 1998, found at: <http://mondediplo.com/focus/mideast/a2332>.

²¹ Lowi, M., *West Bank Water Resources and the Resolution of Conflicts in the Middle East*, published by Peace and Conflict Studies Program of the University of Toronto and the International Security Studies Program of the American Academy of Arts and Sciences, Paper Series No. 1, September, 1992.

²² State Comptroller, *Report on the Administration of Israel's Water Economy*. Jerusalem: State Comptroller, 1990, p. 53 [Hebrew].

Aviv, Jerusalem, and Beersheba," and the "most important long-term source in the [national] water system." The water requirements of Israel's settlements are a small segment of this larger mosaic of Israeli exploitation of the water resources in the Occupied Palestinian Territories.

At a time when settlers accounted for barely 10% of the population in the West Bank (1987), Palestinian consumption totaled 115 mcm, while settler consumption equaled 97 mcm. Approximately 160 Israeli-owned industrial concerns are located in the West Bank. For Israeli industrialists, the West Bank has, at least in one sphere, enjoyed a comparative advantage over Israel as environmental regulations relating to soil, air, and water quality and restrictions on industrial development have generally been far less comprehensive and much less assiduously enforced compared with inside Israel. Combined with state-subsidized incentives for Israeli businesses to locate to industrial parks in and near settlements, the relative laxity of environmental enforcement and monitoring has led, as mentioned previously, to the relocating of a number of 'dirty' concerns in the Occupied Palestinian Territories. Factories posing an environmental risk generally use wet processes in manufacturing packaged food, metal coating, and textiles. The Shomron Municipal Environmental Association (SMEA), a governmental body established by settlers living in the northern part of the West Bank to monitor and improve environmental quality, acknowledges the fact that "wastewater effluents from these plants and from nearly 100 residential communities in our region, if not properly treated, pose a threat to the groundwater quality in the region. In addition, industrial air emissions and noise generation can be problematic at some factories."²³ Forty-five businesses operate in the industrial park of Burkan, adjacent to the settlement of Ariel. Most are engaged in the production of fabrics and plastics for export. Palestinians complain that industrial waste generated in the industrial park is dumped on Palestinian land. "The owners of these factories escape the tighter rules on health and the environment inside Israel itself to work in the West Bank, where they get tax breaks," explained Khalil Suleiman, an environmental expert from An-Najah University in Nablus. In addition to Burkan, Palestinians have complained about the operation of industrial facilities located inside the settlements of Ariel, Karnei Shomron, Kiryat Arba, and Kedumim. Of particular concern

²³ FMEP, *Report on Israeli Settlement in the Occupied Territories*, Vol. 8, No. 4 (July-August 1998).

is the effect of industrial development on the quality of ground-water, which Palestinian investigators have found to be "significantly more polluted" near settlements than it is elsewhere.

The settlement of Kiryat Arba has been identified by Palestinian investigators as "the main source of pollution in the Hebron area." A tile factory located in the settlement industrial area at one time flushed its wastewater through the sewage system, which resulted in numerous problems. The city of Hebron successfully petitioned the Israeli High Court to stop this practice. Today, the wastewater is transported in tanks and dumped in a Palestinian field in spite of the fact that it contains high levels of calcium carbonate, which increases the already high pH level of the land.²⁴

3.2.1 The Case of Geshurei Industries

Geshurei Industries, a manufacturer of pesticides and fertilizers, was originally located in the Israeli town of Kfar Saba. Concern about the environmental effects of the factory - on land, public health, and agriculture - resulted in an Israeli court issuing an order in 1982 to close the plant. Since 1987, the factory has been operating across the Green Line, in the West Bank town of Tulkarem, where there are effectively no controls on waste disposal or air pollution. Other Israeli industrial polluters, including those working in asbestos, fiberglass, pesticides, and flammable gases, have also relocated to the Tulkarem area. According to a report by the Palestinian Society for the Protection of Human Rights and the Environment (LAW), factory pollution from Geshurei Industries directly affects 144 dunums of prime agricultural land in the Tulkarem region and "causes substantial damage to the public health." The Israeli High Court has ordered some remedial action, including compensating affected farmers, but the Geshurei Industries plant remains open. LAW's report notes the following effects of the factory's activities: the decay of a majority of trees and other vegetation around the plant; the settling of chemical dust and residue and a liquid substance that leaves calcium-like deposits on the land and vegetation, causing a decrease in field and hothouse agricultural production; the prominence of sodium and salt factory byproducts in soil samples of land found to be non-arable, both of which are prominent consequences of wastewater contamination of agricultural land; and the discovery of sulfamic,

²⁴ Ibid.

a starting material for a herbicide used as a non-selective weed killer, in groundwater samples from the area surrounding the factory. The report also notes "this is clear evidence of polluting groundwater through leakage of chemicals, and proof of the improper disposal of wastes and byproducts."

LAW also documented "a very high ratio of health-related problems among farmers and people living around the factory, including severe headaches, itchy eyes, spastic and chronic coughs, and bronchial asthma." Also interesting in this regard is the fact that the Palestinian Ministry of Agriculture has recently noted "the public health of the community has not been well-documented due to decades of military occupation and direct conflict, suggesting that environmentally related health problems may be more pervasive than currently estimated. The long-term impact on soil and groundwater has similarly received inadequate attention."²⁵

Tulkarem's agricultural land has historically been a significant factor in the local economy. As a consequence of the harmful effects of Israeli-operated industry around Tulkarem, agricultural profits were reduced by 21.5% between 1992 and 1997, according to LAW. The Palestinian Ministry of Agriculture estimates that 17% of Tulkarem's agricultural land has been affected by pollution originating at the six Israeli concerns located in the Tulkarem area, some of which are less than 100 meters from residential housing. Three of the factories sit on what Palestinians claim to be Waqf land, while the other sites are claimed by private Palestinian owners.

Settlers have been implicated by Palestinians in what the latter refer to as "pesticide attacks" in which the settlers have destroyed cultivated fields by spraying chemical pesticides during the agricultural season. LAW notes that in one incident in the village of Turmus Aya, settlers sprayed crops of vegetables, cereals, and olive trees in this fashion.

3.2.2 Dumps

Hundreds of sites for the disposal of trash are located in the Occupied Palestinian Territories, including dozens that are unauthorized. There are 246 sites in the West Bank north of Jerusalem

²⁵ PWA, *Environmental Impact of Jewish Colonies in the West Bank/Palestine*, 1997, p. 18.

alone.²⁶ Most of the sites are simple and primitive with few if any environmental safeguards and not one is used exclusively by settlements or Palestinian communities. SMEA acknowledges that the sites are "improperly maintained, generating odors and smoke which are a nuisance to neighboring residents, as well as posing a threat to groundwater quality."²⁷ A site in Jayous, near the northern West Bank town of Qalqilya, is typical. Sited on 12 dunums, 200 meters from the riverbed that serves as a source of drinking water for the village of Azoun, the site opened in 1990 and is administered by Palestinians under the direction of SMEA. It is used principally by the settlements of Karnei Shomron, Kedumim, Tzofim, and Ma'ale Shomron. SMEA is now being pressured by Israeli trash contractors to permit them to use the dump for trash generated in Israel, the Israeli dump they were using previously having been closed by the Israeli Government. Residents of Azoun complain of an epidemic of flies in summer and of smoke wafting into the village when trash is burned. Moreover, they claim that 200 olive trees have been damaged by smoke. Sites such as the one at Jayous are attractive trash disposal options for Israeli communities. With disposal costs three to six times greater in Israel, sites in the West Bank offer many Israeli towns a closer, cheaper alternative to dumps within Israel proper. Worthy of note in this regard is the fact that Israel conducted a Geographic Information System (GIS) study in 1996 as part of an effort to develop a master plan to establish priorities to improve and to consolidate the system of trash disposal in the West Bank. The resulting master plan, however, is being devised with no official or informal Palestinian participation.

3.2.3 Quarries

There are literally thousands of stone quarries in the West Bank, supplying 80% of the material needs of Israel's construction sector, with a large amount of the stone being used in settlement construction. Israeli concerns operate six West Bank quarries. Most of these quarries have operated for years, but the PA has also considered establishing new quarries in Palestinian-controlled areas, run in partnership with Israeli companies. One of these, at a controversial site in Wadi At-Teen - an important natural grazing

²⁶ Qumsieh, V. *Impact of Jewish Colonies in the West Bank*. Bethlehem: Applied Research Institute-Jerusalem (ARIJ), October 1997.

²⁷ FMEP, *Report on Israeli Settlement in the Occupied Territories*, Vol. 8, No. 4 (July-August 1998).

area that supports livestock farmers in neighboring Palestinian villages - was to be the new site of a quarry whose operators were relocating from sites in Israel. The Applied Research Institute - Jerusalem (ARIJ) notes in its report *Wadi At-Teen Quarry and the Systematic Expropriation of Palestinian National Resources*, that "the construction of a quarry at Wadi At-Teen will undoubtedly bring environmental degradation, threaten the biodiversity and wildlife in the area, close off major natural grazing and agricultural areas, and deprive Palestinian farmers of run-off water used for irrigation. Furthermore, the plan will adversely affect the living environment in neighboring Palestinian villages due to dust and other types of air pollution. Most important, this project allows Israel to exploit Palestinian stone, the main natural raw material in the West Bank." The public outcry over plans to establish a quarry at Wadi At-Teen has recently forced the PA to reconsider the project. "What is the PA planning to tell those who demonstrated against settlement activity in Wadi At-Teen?" asked Palestinian Legislative Council (PLC) member Hassan Khreisheh before reconsideration was announced. "How can we tell Israel to stop building settlements when we are granting them even more land to establish quarries?" Many quarries are located in close proximity to Palestinian residential areas, which is particularly disturbing since the clouds of dust they produce pose certain health risks, which is why we find Palestinians residing in such areas complaining that local residents are suffering from increased levels of asthma and acute bronchial infections. It should be mentioned that settlers have organized to prevent the operation of quarries near their residential areas and that, together with Palestinians, they have filed a unique, joint appeal to oppose the creation of a new stone-crushing site in the village of Dura, near Hebron.

4. OBSTACLES TO SETTLER-PALESTINIAN COOPERATION

The mitigation of environmental problems in the Occupied Palestinian Territories, including those caused by the existence and expansion of settlements, is viewed by some Israelis as a forum for joint Israeli-Palestinian action, yet Israeli environmental planners continue to view Palestinians as junior partners at best.²⁸ Palestinians, for their part, are willing to cooperate with Israeli communities within Israel's pre-1967 borders, but they refuse as a

²⁸ FMEP, *Report on Israeli Settlement in the Occupied Territories*, Vol. 8, No. 4 (July-August 1998).

matter of principle to participate in joint efforts with settlers. "Our feeling - in fact, it's more than a feeling," explained the director of the settlers' Judea Towns Association for the Environment, "is that the Palestinian Authority is not interested in cooperating with us."²⁹ In Hebron, to cite one example, the Palestinian municipality refuses to participate in a wastewater treatment scheme in which some of the treated water will be used by Israeli settlers. Rafael Eitan, Israel's Minister of Environment recently warned, "If the Palestinian Authority doesn't answer our request for cooperation we will carry out the projects essential to protect the environment in Israel and the residents of the territories ourselves, and I will act to deduct the costs from the money forwarded by the government to the Authority." Palestinians recognize that, even without taking the settlements into consideration, the West Bank and Gaza Strip have numerous environmental problems. "Environmentally speaking," explained Imad Atrash, director of Children for the Protection of Nature in Palestine, "I am very depressed. We have problems with pollution, sewage, industrial zones situated in residential areas, as well as disposable diapers." The prevailing sentiment among Palestinians is to treat the environmental implications of settlement expansion as a political issue, one related to the continuing Palestinian refusal, particularly on a popular level, to concede the principle of joint action with settler and settler-oriented institutions.

5. CONCLUSIONS

1. The impact of existing Israeli settlements in the West Bank and Gaza Strip is demeaning Palestinian political sovereignty and preventing any regional interconnections whilst preventing the establishment of an independent Palestinian entity.
2. The Israeli settlements stand as a barrier in front of the defining of the potential for future socioeconomic development and the absolute future needs, in terms of water and land, of the ever-growing population in Palestine.
3. There is an urgent need to define the environmental causalities and adverse impacts of Israeli settlements and the value of compensation.

²⁹ Ibid.

4. Israeli settlements are the main obstacle in terms of the development of the agricultural sector. Agricultural development is contingent upon Palestinian sovereignty over land and water resources.

REFERENCES

Agriculture and Development in Western Asia, joint publication of the UN Economic and Social Commission for Western Asia (UNESCWA) and the Food and Agriculture Organization of the UN (FAO), No. 16 (December 1994).

Israeli Central Bureau of Statistics, *The Statistical Abstract of Israel*, 1995.

Dubbeling, M. & Meyboom, M. *The Sheep/Goat and Olive Cropping Systems in the West Bank, A Study on the Possibilities and Limitations of Integration*. Series of Development Studies (10), Ramallah: MA'AN Development Center, July 1997.

Final Record of the Diplomatic Conference of Geneva of 1949, Vol. I, Federal Department, Berne, pp. 195-341; or: 75 United Nations Treaty Series 5-417.

Foundation of Middle East Peace (FMEP): *Report on Israeli Settlement in the Occupied Territories* (bimonthly newsletter). Washington, DC: FMEP, various issues.

Foundation for Middle East Peace (Washington, DC 1998), "The Socio-economic Impact of Settlements on Land, Water, and the Palestinian Economy," *Le Monde Diplomatique, Middle East: The Fault Line*; see <http://mondediplo.com/focus/mideast/a2332>.

Freijat, F. "Social and Economic Elements of Reproduction of Palestinian Family on the Territory of Future Palestine," in *Africa, Asia, America and Latin America* (published by Warsaw University, Department of Geography and Regional Studies, Institute of Developing Countries), Vol. 74 (1977), pp. 33-47.

Kurzom, G. *Towards Alternative Self-reliant Agricultural Development*. Ramallah: Development Studies Program and MA'AN Development Center, 2001.

Lowi, M., *West Bank Water Resources and the Resolution of Conflicts in the Middle East*, published by the Peace and Conflict Studies Program of the University of Toronto and the International Security Studies Program of the American Academy of Arts and Sciences, Paper Series No. 1, September 1992.

Ministry of Planning and International Cooperation (MOPIC). *National Policies for Physical Development - The West Bank and Gaza Strip Governorate*, December 1998.

Palestinian Hydrology Group (PHG). *Report on the Impact of Closure on Water Supply to Palestinian Villages and Towns*, updated on 5 Nov. 2000, found at http://www.phg.org/report_01.html.

Palestinian Water Authority (PWA), *Water Sector Strategic Planning Study, Interim Report*, Vol. 3, Appendix 9. Ramallah: PWA, December 1998.

PWA. *Environmental Impact of Jewish Colonies in the West Bank*. Ramallah: PWA, 1997.

Peace Now. *Changes in the Settlements Since the Establishment of the Likud Government*, Report No. 9 (1996).

Peace Now. *Settlements Watch - Occupied Territories Population and Housing Report*, May 1999.

Qumsieh, V. *Impact of Jewish Colonies in the West Bank*. Bethlehem: Applied Research Institute-Jerusalem (ARIJ), October 1997.

State Comptroller. *Report on the Administration of Israel's Water Economy*. Jerusalem: State Comptroller, 1990. (Hebrew).

ANNEXES

ANNEX 1 - Geographic Distribution and Population Growth of Israeli Settlements in Palestine

Name	Population			Date of Establishment	Region
	2001 ^c	2000 ^b	1999 ^a		
Adora		271	291	1983	Mount Hebron
Alei Zahav		391	355	1982	Samaria
Alfei Menashe	5,000	4,580	4,410	1983	Samaria
Alon Shvut	2,900	2,680	2,230	1970	Etzion Bloc
Almog		167	156	1977	Jordan Valley
Almon		698	672	1982	Benjamin
Argeman		164	155	1968	Jordan Valley
Ariel	16,000	15,600	15,100	1978	Samaria
Asfar (Metzad)		361	356	1984	Mount Hebron
Ateret		302	287	1981	Benjamin
Avnei Hefetz		785	695	N/A	Samaria
Barkan		1,150	1,080	1981	Samaria
Beit Aryeh		2,380	2,330	1981	Samaria
Beit El		4,120	3,800	1977	Benjamin
Beit Ha-Arava		55	45	1980	Jordan Valley
Beit Horon		772	720	1977	Benjamin
Benjamin					
Beqa'ot		144	144	1972	Jordan Valley
Betar Illit	17,300	15,800	12,700	1985	Etzion Bloc
Bitronot (Nahal)				1984	Jordan Valley
Bracha		752	714	1982	Samaria
Dolev		880	850	1983	Benjamin
Doran				1982	Mount Hebron
Efrat	6,500	6,430	6,230	1980	Etzion Bloc
Elazar		784	747	1975	Etzion Bloc
Eli		1,900	1,730	1984	Samaria
Elisha (Nahal)		753	N/A	1983	Jordan Valley
Elkana	3,000	2,990	2,940	1977	Samaria
Elon Moreh		1,060	1,050	1979	Samaria
Emmanuel	2,700	3,040	3,150	1982	Samaria
Ein Hogla				1982	Jordan Valley
Enav		500	504	1981	Samaria
Eshkolot		171	148	1982	Mount Hebron
Etz Ephraim		525	500	1985	Samaria
Gannim		158	149	1983	Samaria

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Geva Binyamin (Adam)		1,020	707	1983	Benjamin
Gva'ot				1984	Etzion Bloc
Gilgal		180	164	1970	Jordan Valley
Gittit		100	109	1973	Jordan Valley
Givat Ze'ev	10,500	10,300	10,000	1982	Benjamin
Giv'on Ha-Hadasha		1,190	1,180	1980	Benjamin
Hagai		406	405	1984	Mount Hebron
Halmish		922	1,100	1977	Benjamin
Hamra		147	149	1971	Jordan Valley
Har Adar (Givat Ha-Radar)		1,420	1,380	1986	Benjamin
Har Gilo		369	363	1972	Etzion Bloc
Hashmona'im		1,830	1,770	1985	Benjamin
Hebron				1980	
Hemdat (Nahal)			N/A	1980	Jordan Valley
Hermesh		279	272	1982	Samaria
Hinanit		481	432	1981	Samaria
Homesh		159	163	1980	Samaria
Itamar		541	511	1984	Samaria
Kaddim		148	138	1983	Samaria
Kalya		260	262	1968	Jordan Valley
Karnei Tsur		481	422	1984	Etzion Bloc
Karmel		246	252	1981	Mount Hebron
Karnei Shomron		5,890	5,590	1978	Samaria
Kedar		447	393	1984	Benjamin
Kedumim	2,700	2,660	2,540	1975	Samaria
Kfar Adumim		1,690	1,590	1979	Benjamin
Kfar Etzion		427	421	1967	Etzion Bloc
Kfar Tapuah		347	352	1978	Samaria
Kiryat Arba	6,400	6,380	6,240	1972	Mount Hebron
Kiryat Netafim		249	240	1982	Samaria
Kochav Ha-Shahar		1,150	1,080	1977	Benjamin
Kochav Ya'acov (Abir Ya'acov)		1,640	1,260	1984	Benjamin
Lapid				N/A	Benjamin
Ma'ale Adumim	25,800	24,900	23,800	1975	Benjamin
Ma'ale Amos		336	342	1981	Etzion Bloc
Ma'ale Ephraim		1,480	1,460	1970	Jordan Valley
Ma'ale Levona		445	447	1983	Benjamin
Ma'ale Mikhmesh		826	753	1981	Benjamin
Ma'ale Shomron		527	486	1980	Samaria
Mahane Giv'on				1977	Benjamin

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Ma'on		283	265	1981	Mount Hebron
Maskiyyot		507	N/A	1987	Jordan Valley
Massu'a		148	140	1970	Jordan Valley
Mattityahu		1,380	1,410	1981	Benjamin
Mehola		306	315	1968	Jordan Valley
Mehora		113	120	1973	Jordan Valley
Menorah		768	332	1998	Jordan Valley
Mevo Dotan		310	314	1978	Samaria
Mevo Horon		497	494	1970	Benjamin
Mezadot Yehuda		422	412	1980	Mount Hebron
Migdal Oz		289	280	1977	Etzion Bloc
Migdalim		154	150	1984	Samaria
Mitzpe Shalem		210	208	1971	Megilot
Mitzpe Yeriho		1,210	1,160	1978	Benjamin
Modi'in Ilit	19,200	16,400	13,000	1981	
Na'aleh		137	105	Approx. 1981	Benjamin
Nahli'el		244	230	1984	Benjamin
Negohot		409	N/A	1982	Mount Hebron
Netiv Ha-Gedud		139	143	1976	Jordan Valley
Neve Daniyyel		933	868	1982	Etzion Bloc
Nili		721	666	1981	Benjamin
Niran		56	45	1977	Jordan Valley
Nofim		385	362		Samaria
Nokdim		611	526	1982	Etzion Bloc
No'omi		121	133	1982	Jordan Valley
Ofarim		686	623	1989	Benjamin
Ofra	2,000	1,880	1,870	1975	Benjamin
Oranit	5,200	5,070	4,780	1984	Samaria
Othiel		560	553	1983	Mount Hebron
Pedu'el		885	834	1984	Samaria
Pene Hever (Ma'ale Hever)		304	266	1982	Mount Hebron
Psagot		1,090	1,030	1981	Benjamin
Peza'el		224	228	1975	Jordan Valley
Rehan		120	100	1977	Samaria
Revava		504	389	1991	Samaria
Rimonim		499	474	1977	Benjamin
Ro'I		141	133	1976	Jordan Valley
Rosh Tsurim		265	290	1969	Etzion Bloc
Rotem (Nahal)				1984	
Sa Nur		52	54	1982	Samaria
Salit		410	377	1977	Samaria
Sha'are Tikva	3,500	3,380	3,220	1982	Samaria
Shadmot Mehola		399	400	1978	

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Shaked		497	468	1981	Samaria
Shani		483	490	1989	Mount Hebron
Shavei Shomron		573	569	1977	Samaria
Shilo		1,580	1,490	1979	Benjamin
Shim'a		296	263	1985	Mount Hebron
Shvut Rachel				N/A	
Susiya		482	468	1983	Mount Hebron
Talmon		1,250	1,150	1989	Benjamin
Tekoa		980	948	1977	Etzion Bloc
Telem		97	101	1981	Mount Hebron
Tene (Ma'ale Omarim)		561	580	1983	Mount Hebron
Tomer		308	307	1978	Jordan Valley
Tsurif				1984	Etzion Bloc
Vered Jericho		164	155	1980	Benjamin
Ya'arit				N/A	Samaria
Yafit		125	118	1980	Jordan Valley
Yakir		822	765	1981	Samaria
Yitav		114	107	1970	Jordan Valley
Yitzhar		329	328	1983	Samaria
Zufin		857	794	N/A	Samaria
Total:		128,700	192,976	177,411	

Sources:

^a List of Localities: Their Population and Codes, 31 Dec. 1999. Jerusalem: Central Bureau of Statistics (CBS), 2000.

^b Source: List of Localities: Their Population and Codes, 31 Dec. 2000. Jerusalem: CBS, 2001.

^c Source: List of Localities: Their Population and Codes, 31 December 2001. Jerusalem: CBS, 2002.

ANNEX 2 - Environmentally Hazardous Settlements

The following settlements are considered those with the largest high-risk potential sewage pollution in the West Bank:

District	No. of Settlements	% of Total Settlements	Settlements
Hebron	30	17%	Adurim, Bet Ein, Tsurif, Haggai, Karnei Tsur, Karmel, Kiryat Arba, Ma'on, Mezadot Yehuda, Shim'a, Otniel, Susiya
Bethlehem	17	9%	Efrat, Betar, Gilo, Har Gilo, Ma'ale Amos, Neve Daniel, Rosh Tsurim
Jericho	20	11%	Vered Yeriho, Mitzpe Yeriho, Shalem Zion
Jerusalem	26	15%	Neve Ya'acov, Ma'ale Mikhmas, Ma'ale Adumim
Ramallah	26	15%	Bet Aryeh, Bet El, Halmish, Kochav Ha-Shahar, Rimonim, Psagot and the military base
Nablus	12	7%	Elon Moreh, Bracha, Eli, Homesh, Shave' Shomron, Tal Hayim (Yitmar), Migdalim
Tulkarem	03	2%	
Jenin	09	5%	Rehan, Meerav, the military camp
Tubas	10	6%	Beqa'ot, Ro'I
Salfit	11	6%	Ariel, Eli, Elkana, Bar'kan, Kiryat Netafim, Yakir, Nofim, Revava
Qalqilya	13	7%	Alfei Menashe, Emmanuel, Karnei Shomron, Sha'are Tikva, Tzofim, Oranit, Tsur-Egal

Source: Al-Titi, Ramez and Sali Ar-Rabi, "The Settlements and Environmental Pollution," *Water & Environment* (published bi-annually by the PHG), February 1998. (In Arabic)

ANNEX 3 - Industrial Settlements and their Impact on the Environment

District	Settlement	Industry	Environmental damage
Ramallah	Atarot	Aluminum, cement, and plastic	Alkaline substances are discharged, which results in desertification and the releasing of poisonous gases
	Kfarot	Avocado, Aluminum	
	Nili	Aluminum	
	Rimonim	Vehicle tires, sparkling plugs	
	Shilta	Fiberglass, plastic, and food	
	Mevo Horon	Leather	
Hebron	Halmish	Unknown	
	Kiryat Arba	Alcohol	
Nablus	Kharsina	Unknown	
	Elon Moreh	Aluminum	
	Homesh	Aluminum	
	Migdalim	Dying, leather, plastic	
Jenin	Itamar	Aluminum	
	Hinanit	Gas	
Tulkarem	Geshurei (factories owned by settlers)	Pesticides, fiberglass and Dexon gas	
Salfit	Barkan (includes more than 80 factories)	Aluminum, fiberglass, plastic, and concrete	
Jericho	Khan Al-Ahmar area	Plastic, rubber and leather	

Source: Al-Titi, Ramez and Sali Ar-Rabi, "The Settlements and Environmental Pollution," *Water & Environment* (published biannually by the PHG), February 1998. (In Arabic)

GLOSSARY¹

AGRICULTURE Agriculture contributes approx. 10-14% of the Palestinian GDP and generates some 25% of all Palestinian exports. This figure was almost 24% prior to 1967. Since the sector suffers from restricted access to water resources, over 90% of the cultivated West Bank area depends on rain-fed farming methods. In contrast, Israel irrigates over 50% of its cultivated land, although the agricultural sector contributes less than 3% to its GDP.

ALL-ISRAEL PLAN Publicized by Israel in 1951. Based on the Lowdermilk Plan, the plan included the draining of the Huleh Lake and swamps, the diversion of the northern Jordan River and the construction of a carrier to the coastal plain and the Negev.

AQUIFERS Any subsurface geological formation, such as a layer or layers of rock or other geological strata of sufficient porosity and permeability, which contains water and from which water may be extracted in appreciable quantities. Water that is in the upper zone of the soil is not included.

ARAVA/ARABA The Arava/Araba Valley stretches between the Dead Sea in the north and the Red Sea (Aqaba and Eilat) in the south. It is part of the Syrian-African Rift and includes both Israeli and Jordanian territories with varying levels and densities of agricultural and urban settlements on both sides of the border.

AREA A, B, C Jurisdictional divisions created in the West Bank in 1995 with the Oslo II Agreement. Area A, initially being the urban centers only, came under PA administrative and internal security responsibility and eventually comprised 17.2% of the West Bank; Area B, being the built-up areas of the remaining principal villages and eventually 23.8% of the West Bank, remained under Israeli military occupation, but the PA became responsible for services and civilian administration; Area C, eventually being 59% of the West Bank, remained under exclusive Israeli civil and military administration. Areas A, B & C were considered operational until late 2001, after which Israeli military incursions and reoccupations eroded the currency of the jurisdictional divisions. Israel had retained *overall* security responsibility for all areas, including the right to 'hot pursuit' into area A throughout the Oslo process.

¹ After extensive research, the most appropriate and widely accepted general definitions were accepted for the purpose of this particular publication. The entries related to water as well as the legal terminology were compiled and developed by Fadia Daibes. The political terms were taken from PASSIA's *Dictionary of Palestinian Political Terms*.

ARID a. Zone in which precipitation is lacking to the extent that irrigation must be practiced to support cultivation; and b. Zone in which average evaporation exceeds precipitation.

ARTESIAN WATER Groundwater that is under pressure when tapped by a well and that is able to rise above the level at which it is first encountered. It may or may not flow out at ground level.

ARTICLE 40 Article of the Oslo II Agreement, Annex III, Appendix I, which deals with water allocation but refers to the immediate needs of the Palestinians without considering the principle of equitable and reasonable utilization of the water resources by both sides. Additional amounts of 70-80 mcm were allocated for the Palestinians with 28.6 mcm/yr identified as immediate needs. The future needs of the Palestinians on the West Bank were estimated at 70-80 mcm/yr. The two parties agreed to establish a Joint Water Committee (JWC) to serve as an institutional mechanism for the interim period, mainly to oversee the implementation of Article 40.

BANIAS RIVER Originates in the Occupied Golan Heights and flows into the Jordan above Lake Tabariyya with an average annual flow of 120 mcm. See *also* **JORDAN RIVER**.

BELLAGIO DRAFT TREATY A proposed legal framework concluded by eminent legal experts in Bellagio, Italy in 1989. The draft provides mechanisms allowing for the international aquifers in critical areas to be managed by mutual agreement rather than continuing to be subjected to unilateral leaking. The treaty addresses contamination, depletion, drought and transboundary transfers as well as withdrawal and recharge issues. The fundamental goal is to achieve joint optimum utilization and the avoidance of disputes over shared groundwaters during a period of ever-increasing pressure upon this priceless resource.

BENEFICIAL USE Use that is generally recognized as economically and socially valuable. A beneficial use does not need to be the most productive use to which the water may be put, nor must it utilize the most efficient methods known to ensure maximum utilization. Beneficial use excludes unnecessary waste, which is to be determined on a case-by-case basis given the circumstances of the watercourse, the users, and the uses. The beneficial uses of transboundary water courses (TWC) may include water consumption for domestic purposes, irrigation, mining, industrial and municipal uses, hydroelectric generation, navigation, fishing, discharge of wastes, access to the stream for the purposes of recreation and tourism, and protection from erosion, among others.

BORDERS A frontier between states. *See also* **GREEN LINE**.

BRACKISH WATER Water which contains more sea salts than freshwater but less than the open sea. Brackish water environments are also fluctuating environments with the level of salinity dependent on the tide, the amount of freshwater entering from rivers or as rain, and the rate of evaporation.

BYPASS ROAD Term that emerged with the Oslo Accords referring to roads used by the Israelis to link settlements with each other and with Israel proper to circumvent Palestinian built-up areas. Usually built at the expense of Palestinian agricultural land and development plans.

CAIRO AGREEMENT *see* **GAZA-JERICHO AUTONOMY AGREEMENT**

CISTERN An excavation in the ground used to collect rainwater runoff from the roof of a house or building and any other drainage area prepared for the purpose. Also the term for the receptacle used to hold the water that is collected.

COASTAL AQUIFER The Coastal Aquifer stretches along the Mediterranean Sea. Its length from north to south is 120 km and its width 7-20 km. The active storage of the aquifer is estimated at 20 billion cm (cubic meters) of water and its safe yield is close to 300 mcm (million cubic meters)/yr. The aquifer contributes some 20% of the fresh water supply of Israel's water supply.

CONTAMINATION Any detrimental chemical, physical, biological, or temperature change in the content or characteristics of a body of water.

CONSERVATION The continuing protection and management of natural resources in accordance with principles that assure their optimum long-term economic and social benefits.

CORE PARTIES These are Egypt, Jordan, Israel, and the Palestinians within the framework of the multilateral talks between Israel and the Arab states. Although Syria and Lebanon were invited to participate, they formally boycotted the talks.

CLOSED MILITARY ZONE Area declared to be closed whereby destruction of most of the roads in this 'buffer zone' takes place. Characterized by a massive increase in the military presence there and heavy surveillance of the local Palestinian population. The Israeli army controls such areas east of the armistice line while the

Israeli police monitor it on the western side, where the army does not have a mandate to operate.

CUSTOMARY INTERNATIONAL LAW Certain 'unwritten' rules generally accepted by states as legally binding; a general practice of states accepted as law. Customary rules/laws may be 'codified' in a multilateral convention, such as the 1997 International Watercourses Convention. However, these rules are legally binding for all states regardless of whether or not they are parties to such a 'codification' treaty. The customary rules that govern the conduct of transboundary watercourse states *vis-à-vis* each other include the following: the principle of equitable and reasonable utilization; the duty to give notice of a planned measure (use) that may cause significant adverse effects; the duty to take measures aimed at preventing significant harm to or within the territory of another TWC state; the duty to cooperate; and the duty to peacefully settle international disputes.

In the case of the West Bank and Gaza, Israel has failed to comply with the abovementioned rules, which constitute part of Customary International Law, by claiming that Palestine is not yet a state.

DAN RIVER Originates in the Occupied Golan Heights and flows into the Jordan above Lake Tabariyya with an average annual flow of 250 mcm.

DECLARATION OF PRINCIPLES (DoP) Agreement reached between PLO members and Israeli government officials, secretly negotiated in Oslo and signed in Washington DC on 13 Sept. 1993. Provides the guidelines for future negotiations as well as for a Palestinian five-year interim autonomy period in the West Bank and Gaza, followed by a permanent settlement based on UNSC Res. 242 and 338. Postponed difficult issues such as Jerusalem, refugees, settlements, water, security, and borders. Annex III established an institutional mechanism, the Israeli-Palestinian 'Committee for Economic Cooperation', which was given the task of focusing on various areas, including water. One of the anticipated outcomes was a 'Water Development Program' prepared by experts from both sides in order to find a way for the parties to cooperate in the management of water resources in the West Bank and Gaza and encourage the preparation of proposals, studies, and plans on water rights and utilization for each party. On the regional level, the two sides agreed to cooperate in using the Dead Sea area and working on projects such as a Mediterranean Sea (Gaza)-Dead Sea Canal and regional desalinization plants.

The DoP is the only official document in which both parties agreed to undertake studies and prepare proposals on the equitable utilization of joint resources to be implemented during and beyond the Interim Agreement. For this reason, amongst others, it was considered the benchmark for future negotiations.

DEPLETION Diminishing of water from groundwater aquifers at a rate greater than that of their natural renewal rate.

DESALINATION Removal of salts from saline water to provide freshwater.

DISCHARGE Volume of water that passes through a given location within a given period of time.

DIVERSION Transfer of water from a water source (e.g., stream, lake, aquifer) by a canal, pipe, well, or other conduit to another watercourse or to the land.

DOMESTIC WATER USE Water used for household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens.

DROUGHT A continuous and lengthy period during which no significant precipitation is recorded.

DUNUM Unit of land area used in Palestine (1 dunum = 1,000 sq. meters = approx. 1/4 acre).

DUTY An obligation that requires a certain action or the abstention from an act. A legal obligation is synonymous with a legal duty. A legal entitlement is synonymous with a legal right.

EASTERN AQUIFER BASIN (EAB) Transboundary aquifer (but not shared with Israel) located and recharged almost entirely in the West Bank, with the feeding and storage area spread over 2,200 km² mostly in the West Bank. A small part of recharge is located west of the Green Line, incl. West Jerusalem. The Oslo II Agreement estimated the recharge of the EAB at 172 mcm/yr. This aquifer feeds the lower Jordan River and it is therefore considered to be the Palestinian contribution to the waters of the Jordan River Basin.

ENVIRONMENT All external factors, conditions, and influences that affect an organism or a community.

EQUITABLE AND REASONABLE UTILIZATION The fundamental principle of International Water Law entitling a transboundary watercourse state to an equitable and reasonable share of the uses and benefits of a watercourse and creating the correlative obligation not to deprive other transboundary watercourse states of their respective rights. Factors that may be used to identify an equitable and reasonable use are summarized in Article 6 of the 1997 UN Convention on the Non-Navigational Uses of International Watercourses.

EROSION Wearing down or washing away of the soil and land surface by water, wind, or ice.

EVAPOTRANSPIRATION The net moisture loss to the atmosphere caused by the evaporation of moisture from the soil surface and transpiration by vegetation.

FLOW Rate of water discharged from a source; expressed in volume with respect to time.

FOURTH GENEVA CONVENTION (12 AUGUST 1949) The Fourth Geneva Convention, approved by the UNGA in 1949, deals, *inter alia*, with war crimes. Known formally as the Convention on the Protection of Civilian Persons in Time of War, it requires UN nations to enact laws that made it illegal to commit or order others to commit "grave breaches" of the Convention, and to actively seek to bring such offenders to trial. The Convention requires that an occupying state take full responsibility for meeting the needs of the civilian population under occupation. Care shall also be taken in warfare to protect the natural environment against widespread long-term severe damage. This protection includes the prohibition of the use of methods or means of warfare that are intended or may be expected to cause damage to the natural environment and thereby to prejudice the health or survival of the population.

FRANGHIA PLAN One of the first plans related to the Jordan River, which proposed, in 1913, the use of the Jordan River system for irrigation and electricity. Sponsored by the Ottoman Empire, the plan floundered with the fall of the Empire after World War I.

FRESH WATER Water that generally contains less than 1,000 milligrams per liter of dissolved solids such as salts, metals, nutrients, etc.

GAZA AQUIFER A classical coastal aquifer, which represents the sole water source of the Gaza Strip and which covers an area of 360 (km²) with a total recharge of approximately 60 mcm/yr. The

Gaza Aquifer is threatened by seawater and salt groundwater intrusion due to over pumping, as well as by pollution, especially nitrates from the overuse of fertilizers and the infiltration of sewage.

GAZA-JERICHO AUTONOMY AGREEMENT Also referred to as the Cairo or Oslo I Agreement. Signed on 4 May 1994, the Agreement outlines the first stage of Palestinian autonomy - in Gaza and Jericho - incl. Israeli redeployment and the establishment of a Palestinian self-government authority. Israel remains in control of the settlements, military locations, and security matters. The stipulated interim period ended on 4 May 1999 and triggered a heated debate among the Palestinians as to whether or not they should unilaterally declare a Palestinian state. The Agreement, which only applied to the water and wastewater resources and systems in the Gaza and Jericho areas, tackled the water issue in the context of environmental protection and the prevention of environmental hazards. It allowed for the drilling of new wells as long as they caused no harm to Israel's current water utilization. It also confirmed the need to adopt, apply and ensure compliance with internationally recognized standards for acceptable levels of land, air, water, and sea pollution, and standards for solid and liquid waste treatment and disposal. A subcommittee was to deal with all issues of mutual interest; the institutional mechanism was an Environmental Expert Committee to be convened when the need arose. Oslo I focused more on the 'No Harm Principle' and the continuation of current water entitlements than it did on substantive or procedural rules.

GHOR (Arabic: *Al-Ghawr*) A 110-km long region of the Jordan Valley between Lake Tabariyya and the Dead Sea, on the border of Jordan, Israel and the West Bank. Entirely below sea level and bordered by steep escarpments, it is part of the Great Rift Valley complex. The Jordan River meanders 49 m below the surface through the Ghor. Although the Ghor's flat terraces are fertile, agricultural development is impeded by aridity.

GHOR CANAL Built between 1955-66, the Ghor Canal (also referred to as East Ghor Canal) runs parallel to the Jordan River for 72 km from the Yarmouk River to the Zarqa River. The canal makes year-round cultivation possible, with wheat, vegetables, and citrus fruit being the main products. The southern extension of the canal was halted by the War of 1967. In the southern part of the Ghor, oasis farming is practiced; in the non-irrigated parts, sheep and goat herding predominates.

GOLAN HEIGHTS Militarily and strategically important region that Israel captured from Syria in the Six-Day War of 1967.

GREEN AREA Areas zoned by municipal authorities for open space in which no construction is allowed so as to maintain a minimum of greenery in a city. Often used, however, to block Palestinian development and absorb the land for settlement expansion.

GREEN LINE Term used following Israel's occupation of the West Bank and Gaza Strip in 1967 to refer to the post-1948 War cease-fire line (proper name is '1949 Armistice Line'), i.e., the 'border' separating pre-1967 Israel from the OPT. The demarcation line (laid down in the Armistice Agreements of 1949) is the internationally recognized border. (Israel itself has yet to specify the boundaries of the State of Israel.)

GROUNDWATER The water contained in interconnected pores located below the water table in an unconfined aquifer or located in a confined aquifer that is supplying wells and springs. Currently some 85% of the groundwater in the West Bank and Gaza Strip is exploited by Israel, supplying approx. 40% of Israel's water. Because Palestine is not allowed to utilize the Jordan River waters, groundwater is the only Palestinian water source.

THE HAGUE REGULATIONS (26 JANUARY 1910) Widely believed to constitute one of the main components of Customary International Law and therefore legally binding on all nations, incl. Israel, although Israel does not accept this. Although Israel denies that the West Bank and Gaza Strip are under its belligerent occupation, the Israeli Supreme Court of Justice, sitting as a high court with jurisdiction over the territories, has constantly held that the Hague Regulations are applicable. The Regulations oblige the occupying state to safeguard the natural and other resources and to provide the original citizens with their needs from these resources. The obligations of the occupying state by no means imply that the state has the right of ownership or the right to dispose of the natural resources or transfer them to its own territory. On the contrary, the right of guardianship has its own limitations in terms of the amounts being used from these resources. Previous exploitation rates should be maintained unless otherwise required by the military.

HARM Damage or any detrimental consequence of a human activity such as, *inter alia*, a. Loss of life or personal injury; b. Loss or injury to property; c. The costs of reasonable measures to prevent or minimize such loss or injury; d. Environmental harm, including the

costs of reasonable measures to prevent or minimize such harm and the costs of reasonable measures of reinstatement or restoration of the environment actually undertaken or to be undertaken. Under Customary Law, a TWC state has the duty to take all reasonable measures to prevent causing *significant harm* to other TWC states.

HASBANI RIVER Originates in Syria, with parts flowing into Lebanon; average flow of 140 mcm/yr.

HAZARDOUS WASTE Waste that poses a risk to human health or the environment and requires special disposal techniques to make it harmless or less dangerous.

HEADWATERS Source and upper reaches of a stream or a reservoir.

HULEH LAKE (Arabic: *Bahr Al-Hulah*) Near sea-level lake formed by a natural dam of basalt in northeast Israel; the Jordan River exits from its southern end. In ancient times the lake was called the Waters of Merom. Between 1950 and 1958, approx. 12,350 acres (5,000 hectares) of the lake's swampy shore were drained by Israel. The land is irrigated by the Jordan River.

HYDROLOGIC CYCLE The constant circulation of water from the sea, through the atmosphere, to the land, and back to the sea by overland, underground, and atmospheric routes.

HYDROLOGY The science of waters of the earth; water's properties, circulation, principles, and distribution.

INDUSTRIAL WATER USE Water used for industrial purposes, e.g., in steel, chemical, paper, and petroleum factories.

INTERIM AGREEMENT ON THE WEST BANK AND THE GAZA STRIP
Also referred to as the Taba or Oslo II Agreement. Concluded in Taba on 26 Sept. 1995 and signed in Washington two days later (i.e., 28 Sept. 1995). Outlines the second stage of Palestinian autonomy, extending it to other parts of the West Bank, which is divided into Area A (full Palestinian civil jurisdiction and internal security), Area B (full Palestinian civil jurisdiction, joint Israeli-Palestinian internal security), and Area C (Israeli civil and overall security control). Furthermore, the election and powers of Palestinian Legislative Council were determined. (Oct. 1997 was the target date for the completion of further redeployment and Oct. 1999 for reaching a final status agreement.) In the Agreement, both parties recognized the need to protect the environment, utilize natural resources on a sustainable and environmentally sound basis and

cooperate in sewage, solid waste, and water issues. The Agreement explicitly states that Israel recognizes Palestinian water rights, to be negotiated in the final status talks without further elaboration on the nature of these rights or the principles governing the rights and obligations of both parties. Article 12, meanwhile, expressly recognizes water as a natural resource. Annex III, Appendix I, Article 40 of the Agreement deals with water allocation.

INTERNATIONAL LAW The law that governs the relations between entities capable of possessing international rights and duties and having the capacity to maintain those rights by bringing international claims.

INTERNATIONAL WATERCOURSE A watercourse, parts of which are situated in different states.

IRRIGATION The controlled application of water for agricultural purposes through manmade systems to supply water requirements not satisfied by rainfall.

ISRAELI-JORDANIAN PEACE TREATY Treaty signed on 26 Oct. 1994. In Article 6, the parties agreed to recognize their rightful water allocations with regard to the Jordan and Yarmouk Rivers and the Araba/Arava groundwater in accordance with the agreed upon principles with the quantity and quality to be respected. They further agreed to find practical and just solutions to their water problems, not to harm each other's water resources, and to cooperate in regional and international research and development projects investigating existing and new water resources, water availability, the conservation of water resources, etc.

JOHNSTON PLAN Allocation scheme proposed in 1953 by US Special Envoy to the Middle East, Ambassador Eric Johnston. The plan was the product of negotiations with representatives of Israel, Lebanon, Syria and Jordan, which led, in 1955, to a unified plan for all the riparians. The plan was never adopted or ratified partly because the Arab states (especially Jordan) did not need a comprehensive water development program that directly involved Israel to achieve their immediate development goals. In addition, the Arabs did not agree to the criteria that were used for dividing the shares among the parties.

Unified (Johnston) Plan 1953-1955: Water Allocations to Riparians of the Jordan River System					
	Lebanon	Syria	Jordan	Israel	Total
Hasbani	35				35
Banias		20		20	
Jordan (Main Stream)		22	100	375	497
Yarmouk		90	377	25	492
Side Wadis			243	243	
Total Unified Plan	35	132	720	400	1,287

Source: Naff and Matson (1984), see <http://www.unu.edu/unupress/unupbooks/80859e/80859E06.htm>

JOINT WATER COMMITTEE (JWC) In order to implement their undertakings under Article 40 of the 1995 Interim Agreement, the Palestinians and Israelis agreed to establish, upon the signing of the Agreement, a permanent JWC for the interim period.

JORDAN RIVER The Jordan River begins in three headwaters. The Hasbani River originates in Syria, with parts flowing into Lebanon, and has an average flow of 140 mcm/yr. The Dan and Banias Rivers originate in the Golan Heights and both flow into the Jordan above Lake Tabariyya, having average annual flows of 250 and 120 mcm respectively. The lower Jordan River is fed from groundwater flow and runoff from the West Bank, Syrian, and Jordanian waters, and by the Yarmouk River, which originates in Syria and borders Jordan, Syria and the Golan Heights with an average flow of 420 mcm/yr. Israel uses 685 mcm/yr from the Jordan River while the Palestinians have constantly been denied access to its waters, even though it is the main regional surface water system and the only permanent surface water source for Palestine. Currently, Israel diverts 75% of the river's water before it reaches the West Bank.

JORDAN RIVER BASIN Major international watercourse in the Middle East region; shared between Syria, Lebanon, Jordan, Palestine, and Israel.

LAKE TABARIYYA (also called Lake of Tiberias, Sea of Galilee; Arabic: *Buhayrat Tabariyya*) Lake on the southwestern Syrian-Palestinian border through which the Jordan River flows. From 1948 to 1967 Syria had access to its northeastern shoreline. Located 209 m below sea level, it has a surface area of 166 square km. The

sea's maximum depth, which occurs in the northeast, is 48 m. Measuring 21 km from north to south and 11 km from east to west, it is pear-shaped. The lake is fed primarily by the Jordan River, with other streams and wadis (seasonal watercourses) flowing into it from the hills of the Galilee. In the rivers associated with the lake and at the bottom of the lake itself are many mineral deposits. Because of these deposits and because of the strong evaporation, the lake's waters are relatively salty. The lake was the main dispute in the recent peace talks between Israel and Syria; Israel's refusal to return a few kilometers on the northeastern shore brought the talks to a dead end in April 2000.

LOWDERMILK PLAN Plan recommended by the US in 1944, based on the idea of irrigating the Negev Desert with the waters of the Jordan River and the Litani River and refilling the Dead Sea through a canal from the Mediterranean Sea. The plan was abandoned following the change of circumstances in the Jordan River Basin after World War II, i.e., with the creation of Israel and the influx of large numbers of refugees.

LOWER JORDAN The Lower Jordan River is the 105 km portion of the Rift Valley that stretches from Lake Tabariyya to the Dead Sea. Because of its windy nature, its actual length is approx. 215 km. Along its path the very powerful Yarmouk River and the Jabbok join it from the east, while the Harod Stream and Wadi Faria flow into it from the west. The flow of the Jordan today is only a meager portion of what it used to be for the Israelis pump water out of Lake Tabariyya for drinking and agricultural purposes and only allow a very small portion to flow out the southwest end of the lake. In addition, the Jordanians divert a major portion of the Yarmouk River for similar uses, the river being a major source of water for Jordan. Water quality in the lower Jordan does not support many uses because of the large quantities of chlorides introduced from saline springs along the Lower Jordan River or diverted from Lake Tabariyya and from irrigation return flows. Chloride concentrations are much higher during the summer when there is less dilution by rainfall runoff.

MADRID CONFERENCE Middle East Peace Conference opened in Madrid on 30 Oct. 1991 under the co-chairmanship of the US and the Soviet Union instead of the long-discussed UN-sponsored international conference. Initiated two tracks: bilateral talks (started in Washington on 9 Dec. 1991) and multilateral talks (started in Moscow on 28 Jan. 1992).

MED-DEAD AND RED-DEAD CANALS Two methods have been proposed by Jordan and Israel for diverting seawater to generate power for desalinization - the 'Red-Dead' Project and the 'Med-Dead' Project. Both projects would require close cooperation between Jordan and Israel, not least of all because the Dead Sea, to which the water would be imported, could not sustain the influx of both projects. The Red-Dead route proposes building a canal from the Red Sea at Aqaba through the Arava Valley to the Dead Sea, a distance of roughly 200 km. After raising the water 200 m to the 'peak' of the Arava Valley 80 km inland, the water would be allowed to run downhill through a series of cascades in order to generate electricity or hydrostatic pressure for desalinization, or a dynamic combination of both. Supporters of the project also point out that the seawater could provide lakes and ponds along the route for recreation and aquaculture.

The Israeli-proposed project is the 'Med-Dead' conduit, a canal to convey water from the Mediterranean Sea to the Dead Sea utilizing the same technologies as the 'Red-Dead' Project. Two routes have been proposed, the first from Israel's southern coast to the south of the Dead Sea near Sodom, and the second from northern Israel, cutting southeast to the Jordan Valley, and then south in parallel with the Jordan River into the Dead Sea. Both routes have advantages and disadvantages over the other.

MEKOROT Israeli Water Company with control over water issues since 1982.

MIDDLE EAST DESALINATION RESEARCH CENTER (MEDRC)
Established in Oman in late 1996 as part of the Working Group on Water Resources to coordinate and sponsor research in the area of desalination.

MIDDLE EAST REGIONAL STUDY ON WATER SUPPLY AND DEMAND Project undertaken by Germany (1998) as part of the Working Group on Water Resources to determine long-term strategies for the development of additional water resources and future joint water resource management, considering issues such as population growth, water use and water quality.

MILITARY ORDER 92 Issued by Israel on 15 Aug. 1967, transferring the authority over water resources to the area military commander.

MILITARY ORDER 158 Issued by Israel on 19 Nov. 1967, forbidding the unlicensed construction of new water infrastructures.

MILITARY ORDER 291 Issued by Israel on 19 Dec. 1968, confiscating all water resources and declaring them State property.

MULTILATERAL TALKS Launched at the 1991 Madrid Conference, split into five working groups on issues of common interest and importance throughout the region, coordinated by the World Bank and dealing respectively with water, security and armaments control, refugees, environment, and economic development. Various rounds of talks were held until 1995, while only a few steering committee meetings took place in 1996 before the peace process ended in a stalemate.

MULTILATERAL WORKING GROUP ON WATER RESOURCES (WGWR) One of five working groups established as part of the multilateral track to address issues of mutual interest on a regional basis, with the US as gavel holder and Japan and the EU as co-organizers. Focuses on the enhancement of water data availability and water supply, water management practices, and concepts of regional water cooperation.

NATIONAL WATER CARRIER Unilateral Israeli effort to manage Israel's water resources; fully operational since 1964, and designed to bring water from the less arid north to the arid areas in the south. It diverts water from the Jordan River above the northwest corner of Lake Tabariya.

NATURAL GROUNDWATER RECHARGE The residual water from the hydrological cycle that reaches the deeper parts of an aquifer after runoff evaporation, transpiration and infiltration have taken place.

NATURAL RESOURCES A nation's natural resources include its minerals, energy, land, water, and biota. These renewable and non-renewable resources are needed to sustain life and to maintain and enhance economic strength.

NON-RENEWABLE AQUIFER Water in aquifers that are not recharged, or are recharged so slowly that significant withdrawals will cause depletion. Typically, water in non-renewable aquifers is hundreds if not thousands (or millions) of years old.

NORTHEASTERN AQUIFER BASIN (NEAB) Transboundary aquifer covering the areas of Nablus and Jenin in the West Bank; its waters flow northwards to their major outlets in the Bet Shean Springs in northern Israel. The feeding and storage area of 700 km² lies almost completely in the West Bank (650 km²). The NEAB starts near Nablus and flows towards the Gilboa Mountains, Jez-

reel, and Bet Shean Valley to the northeast. In the Oslo II Agreement, the recharge of the NEAB was estimated to yield 145 mcm/yr.

OPERATION 'DEFENSIVE SHIELD' Israeli reinvasion of West Bank cities in March/April 2002 (during the Al-Aqsa Intifada), which left most of the population under prolonged curfews and the PA infrastructure in ruins whilst causing unprecedented damage to private and public properties.

OSLO I see **GAZA-JERICHO AGREEMENT**

OSLO II see **INTERIM AGREEMENT ON THE WEST BANK AND GAZA STRIP**

OVER-PUMPING When uncontrolled groundwater withdrawals exceed the safe yield of the aquifer.

OVER-USE If a groundwater source is utilized more than its annual renewable replenishment; leads to a gradual decrease of the groundwater level, increased salinity, and the drying up of springs and wells.

PALESTINIAN NATIONAL AUTHORITY (PA) Established on the basis of the DoP signed by the PLO and Israel on 13 Sept. 1993 as a temporary administrative body to serve during the interim period and govern Palestinian affairs in the self-rule areas.

PALESTINIAN WATER AUTHORITY (PWA) A regulatory governmental institution established in 1995 that assumed administrative responsibility for water resources (while Israel maintained overall control).

PER CAPITA USE Average amount of water used per person during a standard time period, generally per day. Palestinian per-capita consumption per day is estimated at 50-70 liters (with some areas receiving the meager amount of 19 liters), and Israel's consumption at 350 liters, which is approx. five times higher. The minimum water consumption per person recommended by the World Health Organization (WHO) is 100 liters per day.

POLLUTION Industrial and institutional wastes and other harmful or objectionable material existing in sufficient quantities to result in a measurable degradation of the water quality.

POTABLE WATER Water of a quality suitable, safe, or prepared for drinking.

PUBLIC WATER USE Water supplied from a public water supply and used for public-municipal purposes such as firefighting, street cleaning, parks, and swimming pools.

RAINFALL Water falling to earth in drops that have been condensed from moisture in the atmosphere.

RAIN-FED FARMING (as opposed to irrigated farming, also referred to as dry-land farming) Farming system that depends on natural rainfall/precipitation, usually due to the lack or inadequacy of water resources. Rain-fed agriculture in the West Bank occupies approx. 93% of the total cultivated land, yet contributes only 47% of the total production.

REASONABLE UTILIZATION see **EQUITABLE AND REASONABLE UTILIZATION**

RECHARGE The introduction of surface or groundwater-to-groundwater storage facilities such as an aquifer.

RECHARGE AREA An area in which water can infiltrate the soil and replenish an aquifer (e.g., where rainwater soaks through the earth).

REGIONAL WATER DATA BANKS PROJECT One of the main activities of the Working Group on Water Resources, aimed at improving the availability and applicability of water data information to support the decision-making process for the PWA, the Israeli Hydrological Service, and the Jordanian Ministry of Water and Irrigation.

RENEWABLE WATER RESOURCES Waters whose supply can essentially never be exhausted, usually because it is continuously produced (i.e., replenished in the course of natural events).

REPLENISHMENT The act of replenishing an aquifer; in Palestine, the annual replenishment of the principal aquifer basins occurs primarily as a result of the rain falling on West Bank mountains that does not evaporate or run into the wadis.

RESERVOIR A pond, lake, or basin (natural or artificial) that stores, regulates, or controls water.

RIGHT The inherent power to act, a privilege or an interest protected by law.

RIPARIAN International Law speaks of a riparian country/state when part of that country/state's territory is located within a river basin area. In the recent codification of International Law, such countries/states are referred to as "Drainage Basin States" or "Water-course States." The Jordan River waters are shared by five riparians: Jordan, Israel, Syria, Lebanon, and the West Bank.

RIPARIAN WATER RIGHTS Right of an owner of land contiguous to or bordering on a natural stream or lake to take water from the source for use on the contiguous land.

RIVER A natural stream of water of substantial volume.

RIVER BASIN A term used to designate the area drained by a river and its tributaries.

ROAD MAP Presented by the US on 30 April 2003 to Israeli PM Ariel Sharon and Palestinian PM Mahmoud Abbas. Consists of a plan developed by the 'Quartet' (US, EU, UN, and Russia) to reach "a final and comprehensive settlement of the Israel-Palestinian conflict by 2005," incl. the emergence of "an independent, democratic, and viable Palestinian state living side by side in peace and security with Israel and its other neighbors."

SALINITY Amount of dissolved salts in a given volume of water.

SALTWATER INTRUSION The invasion of fresh surface water or groundwater by saltwater.

SAFE YIELD Exploitable groundwater; amount of naturally occurring groundwater that can be economically and legally withdrawn from an aquifer over a long period without impairing the native groundwater quality or creating an undesirable effect such as environmental damage. Typically considered to be the maximum rate of continuous diversion or withdrawal that can be maintained indefinitely without depleting the supply.

SEA OF GALILEE *see* LAKE TABARIYYA

SELF-DETERMINATION The right to self-determination is an inalienable right enjoyed by all peoples indiscriminately. It has been confirmed as such in Article 1(2) of the UN Charter and in numerous other international documents.

SEMI-ARID CLIMATE Characterized by low rainfall and very long dry seasons. Rainfall is irregular and unpredictable from year to year and across landscapes. Although semi-arid zones are suitable for raising livestock, sheep, goats, and camels fare better than cattle. Epizootic diseases are a significant problem in Africa, the Middle East, and Asia, while worldwide livestock productivity continues to be curtailed by the lack of feed and water during each lengthy dry season.

SEPARATION FENCE (Also referred to as Wall, Barrier, Apartheid Wall, Separation Fence/Barrier) Fence, and in some areas, an actual wall, erected by Israel within the West Bank on the pretext of security to prevent Palestinians from infiltrating into Israel. Its construction involves the confiscation of large amounts of fertile Palestinian land, the 'ghettoization' of Palestinian towns and villages, and the cutting off of some 12,000 Palestinians from social services, schools, and their farmlands. In some places, the fence runs along the Green Line, but elsewhere it penetrates the West Bank, in some cases, by up to several km. Some Palestinian specialists predict that the fence will eventually leave some 10% of the West Bank territory in Israeli hands.

SEPTIC TANK Tank used to hold domestic wastes when a sewer line is not available to carry them to a treatment plant.

SETTLEMENTS The Zionist experience of state-building in Palestine in the first half of this century led Israeli leaders to believe that civilian Jewish settlements were the building blocks upon which sovereignty was created and which defined its territorial limits. Today, there are some 200 Israeli settlements in the OPT, excluding Jerusalem, with over 200,000 settlers in the West Bank and some 7,000 in the Gaza Strip. In the West Bank, settlements, adjacent confiscated land, bypass roads, and other land controlled by the Israeli army cover 59% of the area, and in the Gaza Strip, approx. 20%. In addition, there are approx. 200,000 settlers in East Jerusalem and 16,000 in the Golan Heights. Many Israeli settlements in the West Bank are strategically located to command access to the main aquifer underlying the West Bank and Israel.

SEWAGE Waste and wastewater produced by residential and commercial establishments and discharged into sewers.

SEWAGE SYSTEM Pipelines or conduits, pumping stations, and all other structures, devices, and facilities used for collecting or conducting wastes to a point for treatment or disposal.

SEWER A channel or conduit that carries wastewater and storm water runoff from the source to a treatment plant or receiving stream.

SEWERAGE Entire system of sewage collection, treatment, and disposal.

SHARED WATERS A river or lake that is part of the boundary between two or more countries or separate areas with clearly defined boundaries that possess rights to the water.

SHARM ESH-SHEIKH AGREEMENT Agreement for the implementation of the Wye River Memorandum. Signed by the new Israeli PM Ehud Barak and Yasser Arafat in Sharm Esh-Sheikh on 4 Sept. 1999, witnessed by US Sec. of State Albright, Egyptian Pres. Mubarak and Jordan's King Abdullah II. Stipulated that Israel would withdraw in three stages from another 11% of West Bank land, release some 350 Palestinian political prisoners, open the safe passages, and begin permanent status talks on 13 Sept. 1999 to reach a framework for a settlement by Feb. 2000 and a final peace agreement by Sept. 2000. Israeli redeployments are split as follows:

- 15 Sept. 1999: Transfer of 7% from Area C to B;
- 15 Nov. 1999: 3% from C to B, and of 2% from B to A;
- 20 Jan. 2000: 1% from C to A, and 5.1 % from B to A.

SOVEREIGNTY The right of a state to exercise complete jurisdiction over its own territory. According to International Law, sovereignty denotes the basic international legal status of a state that is not subject within its territorial jurisdiction to the governmental, executive, or judicial jurisdiction of a foreign state or to foreign law other than International Law. The exercise of sovereignty by a state is suspended when in the course of an *occupatio bellica* (belligerent occupation) by enemy forces, its governmental institutions no longer operate or are subject to the orders of the occupying power. In addition, according to the Hague Regulations an occupier has limited authority over the occupied territory while sovereignty lies with the original inhabitants.

Applying the above in the case of the West Bank and Gaza Strip, the Palestinian sovereignty over the land and natural resources has not been extinguished as a result of the Israeli occupation. The intervention on the part of Israel in the civil laws in force prior to the occupation is considered illegal by recognized publicists. Accordingly, the changes that were introduced by Israel to the Water Law applying to both the West Bank and the Gaza Strip are also considered illegal. In the view of the world community, the Pales-

tinians enjoy permanent sovereignty over their natural resources, including their water resources. The UNGA has adopted resolutions on the question that generally both reaffirm the right of the Palestinian people to self-determination, including the right to their independent state and express the hope that the Palestinian people will soon be exercising their right to self-determination, which is not subject to any veto, in the current peace process.

SPRINGS Groundwater seeping or flowing out of the earth's surface; springs occur where the water table reaches the surface.

STATEHOOD International Law rules that a state must possess the following in order to qualify as a state:

- a. permanent population;
- b. a defined territory;
- c. a government; and
- d. the capacity to enter into relations with other states.

SURFACE WATER All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, seas, etc.). The main regional surface water system and the only permanent surface water source for Palestine is the Jordan River and its tributaries.

SUSTAINABLE DEVELOPMENT Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

SWAMP A type of wetland that is dominated by woody vegetation and does not accumulate appreciable peat deposits.

TRANSBOUNDARY AQUIFER International watercourse; there are different cases:

- a. Where a confined aquifer is intersected by an international boundary, the aquifer is not linked hydrologically with other groundwater or surface water, and consequently, only the aquifer itself can be considered a shared natural resource;
- b. Where an aquifer lies entirely within the territory of one state but is interconnected with an international river, with one being dependent on the other;
- c. Where an aquifer is entirely situated within the territory of one state but gets recharged in another state;
- d. Aquifers found entirely in the territory of one state but hydrogeologically connected with another aquifer in a neighboring state (J. Barberis, "The Development of International Transboundary Groundwater Law," *Natural Resources Journal*, Vol. 31, 1991, pp.167-186).

TRANSITIONAL PERIOD AND PERMANENT STATUS NEGOTIATIONS Article V of the DoP states the following:

- a. "The five-year transitional period will begin upon the withdrawal from the Gaza Strip and Jericho area.
- b. Permanent status negotiations will commence as soon as possible, but not later than the beginning of the third year of the interim period, between the Government of Israel and the representatives of the Palestinian people.
- c. It is understood that these negotiations shall cover remaining issues, including: Jerusalem, refugees, settlements, security arrangements, borders, relations and cooperation with other neighbors, and other issues of common interest.
- d. The two parties agree that the outcome of the permanent status negotiations should not be prejudiced or preempted by agreements reached for the interim period."

TRIBUTARY A stream or small river that contributes its water to another stream, larger river or other body of water.

UNITED NATIONS The UN General Assembly (GA) and Security Council (SC) have adopted and repeatedly reaffirmed numerous resolutions in relation to the Palestinian people's right to self-determination. An important aspect of that right is permanent sovereignty over natural resources including water. UNGA Res. 3005 (Dec. 1972) recognized that the Palestinians' right of permanent sovereignty applies to the resources of the OPT. This has also been repeated in numerous subsequent UN reports. (For a full list of UN resolutions on Palestine related to water see: <http://domino.un.org/unispal.nsf> and click "water" on the subject menu.)

UNITED NATIONS CHARTER Provides principles by which all UN resolutions have been guided, reaffirming the applicability of the Fourth Geneva Convention on the Protection of Civilian Persons in Times of War of 12 August 1949 to the OPT, incl. Jerusalem and other Arab territories occupied by Israel since 1967.

UNITED NATIONS CONVENTION ON THE LAW OF NON-NAVIGATIONAL USES OF INTERNATIONAL WATERCOURSES Adopted by the UNGA on 21 May 1997 as a global framework agreement with the aim of ensuring the utilization, development, conservation, management, and protection of international watercourses. It codifies the general principles and rules of Customary International Law and progressively develops, modifies, and alters existing laws. The Convention follows the ecosystem approach, which emphasizes the need for integrated quality and quantity management with regard to surface water and groundwater and their related ecosystems.

UN SECURITY COUNCIL RESOLUTION 242 Adopted on 22 Nov. 1967, the Resolution calls on Israel to withdraw its army from territories occupied in the course of the War of 1967.

VITAL HUMAN NEEDS Drinking water sufficient to sustain human life and water required for the production of food in order to prevent starvation. This definition - based on the definition under the 1997 UN IWC Convention - is the one used here.

WADI Arabic term meaning dry riverbed or watercourse; often – but not always - the wadi runs with water during the rainy season.

WASTE WATER Water that carries waste from homes, industries, and businesses that is not for reuse unless treated.

WASTE WATER TREATMENT Facility containing a series of tanks, screens, filters, and other types of equipment by which pollutants are removed from water.

WATER BALANCE Inventory of water based on the principle that during a certain time interval, the total water gain attributed to a given catchment area or body of water must equal the total water loss plus the net change in storage in the catchment area or body of water. The estimated balance for the West Bank and Gaza Strip is given below:

Hydrologic Parameter	West Bank Contribution to Water Balance		Gaza Strip Contribution to Water Balance		Total
	%	MCM/yr	%	MCM/yr	
Annual Rainfall	100	2248	100	101	2349
Evapotranspiration	-68	-1529	-52.5	-53	-1582
Surface Runoff	- 3.2	-71	-1.98	-2	-72
Natural Re-charge	28.8	648	45.5	46	694

WATER CONSUMPTION Abstracted water that is no longer available for use because it has evaporated, transpired, been incorporated into products and crops, consumed by man or livestock, ejected directly into sea, or otherwise removed from freshwater resources. Water losses sustained during the transporting of water between the place where it is extracted and that where it is used are excluded.

WATERCOURSE A depression formed by runoff moving over the surface of the earth; any natural or artificial channel through which water flows: a lake, river, creek, stream, wash, arroyo, channel, or other topographic feature on or over which water flows, at least periodically.

WATERCOURSE SYSTEM A system of surface and underground waters constituting by virtue of their physical relationship a unitary whole and flowing into a common terminus.

WATERCOURSE STATE A state in whose territories parts of an international watercourse are located.

WATER DEMAND Actual quantity of water required for various needs (irrigation, supply, consumption, storage etc.) over a given period as conditioned by economic, social, and other factors. The table below presents the projected demand in Israel, Palestine, and Jordan based on a regional study funded by the German Government for the benefit of the three Core Parties.

Per Capita Annual Water Demand (cm/yr)			
	Israel	Palestine	Jordan
2000	105	50	74
2010	115	57	72
2040	145	83	86

Source: Middle East Regional Water Supply and Demand Development Study, 1998. GTZ, Palestine.

WATER FLOW The rate at which water flows in a certain area, measured in volume and time.

WATER MANAGEMENT The study, planning, monitoring, and application of quantitative and qualitative control and development techniques for long-term, multiple uses of the diverse forms of water resources.

WATER QUALITY The chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

WATER RESOURCES Water available, or capable of being made available, for use in sufficient quantity and quality at a location and over a period of time appropriate for an identifiable demand. The water resources of Palestine comprise groundwater aquifers and sub-aquifers, which are recharged by rainwater and underground

flows between the basins. The surface water sources consist of perennial and seasonal rivers and lakes of which the Jordan River and its tributaries and Lake Tabariyya are the major ones.

WATERSHED Land area from which water drains toward a common watercourse in a natural basin (e.g., a particular stream, river, or lake).

WATER SUPPLY The collection, treatment, storage, and distribution of potable water from source to consumer.

Water Supply for Various Uses in the Region (mcm/yr)				
Country	Domestic	Agriculture	Industry	Total
Jordan	78	739.5	43.5	870
Israel	672	1,365	129	2,166
West Bank	57	89	Included in domestic	146
Gaza Strip	50	85	Included in domestic	108

Sources: For Jordan: *Middle East Regional Water Supply and Demand Development Study*, 1998, <http://www.unu.edu/unupress/unupbooks/80859e/80859E02.htm#Hydrography>; for Israel: *Statistical Abstract of Israel*, No. 51, 2000; for the West Bank/Gaza Strip: PWA, *Water Sector Strategic Plan*, 2000.

WATER TABLE (also referred to as water or groundwater level) The upper surface of groundwater in an unconfined aquifer below which pores in the rocks are saturated, i.e., filled with water.

WATER USE All water services together with any other anthropogenic activity for the purpose of extracting benefit from the utilization of water resources. In the OPT, the current situation is as follows:

Israeli vs. Palestinian Utilization of the West Bank Aquifer Basins (mcm/yr)					
Aquifer Basin	Annual Re-charge	Water Use			
		Israeli	Settlement	Palestinian	Total
Western	362	340	10	22	372
Northeastern	145	103	5	42	150
Eastern	172	40 from wells	50	54	144
Coastal Aquifer	300	300	0	0	300
- of which Gaza	60	0	5-10	110	115-120

Sources: <http://www.wws.princeton.edu/~wws401c/geography.html#mountain>; Article 40 of the Oslo Agreement II.

WATER YIELD a. Quantity of water which can be collected for a given use from surface or groundwater sources in a basin in a given time interval; b. Quantity of water derived from a unit area of a drainage basin in a given time interval.

WELL Artificial excavation, drilled in such a way that it either fully or partially penetrates an aquifer, and constructed in such a way that it facilitates the withdrawal of water from it.

WESTERN AQUIFER BASIN Transboundary aquifer located in the western part of the West Bank. The recharge area is 1,800 km² of which 1,400 km² lie in the West Bank. The storage area of 2,500 km² lies in Israel. Two major natural outlets are Rash Al-Ein (Rosh Ha'ayn) and the Tamaseeh Springs. The Western Aquifer Basis is estimated to have a recharge of 362 mcm/yr.

WORKING GROUP ON WATER RESOURCES (WGWR) Established by the multilateral negotiation track with the US as gavel holder and Japan and the EU as co-organizers. Has established four broad agenda items addressing the availability of water data, water management practices, water supply, and regional water management and cooperation.

YARMOUK RIVER Originates in Syria, borders Jordan, Syria and the Occupied Golan Heights. Has an average flow of 420 mcm/yr.

YIELD Quantity of water expressed either as a continuous rate of flow or as a volume per unit of time. It can be collected for a given use, or uses, from surface or groundwater sources on a watershed.

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BIBLIOGRAPHY

Related to the Water Issue in the Middle East Water With a Focus on the Palestinian-Israeli Conflict¹

Abouali, Gamal. "Natural Resources Under Occupation: The Status of Palestinian Water Under International Law," *Pace International Law Review*, vol. 10, no. 2 (1998), pp. 411-574.

_____. "Continued Control: Israel, Palestinian Water and the Interim Agreement," *Palestinian Yearbook of International Law*, 9 (1998), pp. 63-113

Abu-Taleb, Maher. "Regional Cooperation in Water Resource Management," in Elis Boulding (ed.), *Peace-Building in the Middle East: Challenges for States and for Civil Society*. Boulder, 1994.

Adam, R., "Government Failure and Public Indifference: A Portrait of Water Pollution in Israel," *Colorado Journal of International Environmental Law & Policy*, vol. 11, no. 2 (2000), pp. 257-376.

Ahram, E. and H. Siniora, "The Gaza Strip Water Problem: An Emergency Solution for the Palestinian Population," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam: Elsevier, 1994, pp. 261-271.

Ahmad, Abdullah A. "Law No. 18 of 1988 - Water Authority Law," in *Jordan Environmental Profile Status and Abatement*. Amman, Jordan, 1989, pp. 115-37.

Albert, Jeff, "Transformations of Middle Eastern Natural Environments: Legacies and Lessons," *Yale School of Forestry and Environmental Studies*, 103, Yale University Press, 1998.

Allan, J.A. "Economic and Political Adjustments to Scarce Water in the Middle East," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam: Elsevier, 1994.

¹ The scope of this bibliography is limited to English languages articles and books, i.e., references that are easily to find for researchers, while sources such as unpublished theses, conference papers, etc. were excluded.

_____. "Substitutes for Water are being Found in the Middle East and North Africa," *Geojournal*, vol. 28, no. 3 (1992), pp. 375-385.

_____. "Economic and Political Adjustments to Water Scarcity in the Middle East," in C.A.O. van Niewenhuijze, *Fifth Euro-Arab Dialogue*. The Hague: Rabbani Foundation, 1993, pp. 43-55.

_____. "The Nile: The Need for an Integrated Water Management Policy," in G. Nonneman (ed.), *The Middle East and Europe: The Search for Stability and Integration*. London, 1993, 2nd ed., pp. 235-244.

_____. "Mechanisms for Reducing Tension over Water: Substituting for Water (in the Middle East)," *MEED*, vol. 38, no. 4 (January 1994), pp. 12-14.

_____. "Water in the Arab Middle East: Availability and Management," in Ali Ihsan Bagis (ed.), *Water as an Element of Cooperation and Development in the Middle East*. Turkey, Ankara: Ayna Publications in cooperation with the Friedrich Naumann Foundation, May 1994, pp. 65-100.

_____. "A Transition in the Political-Economy of Water and the Environment in Israel-Palestine," in *Joint Management of Shared Aquifers*. Jerusalem: Truman Center for Peace and Palestine Consultancy Group, 1995.

_____. "Water in the Middle East and in Israel-Palestine: Some Local and Global Resource Issues," in *Joint Management of Shared Aquifers*. Jerusalem: Truman Center for Peace and Palestine Consultancy Group, 1995.

_____. "Water Deficits and Management Options in Arid Regions with Special Reference to the Middle East and North Africa," in *Water Resources Management in Arid Countries*. Muscat, Oman: Ministry of Water Resources, 1995, pp. 1-8.

Allan, J.A. (ed.). *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Collection: Library of Modern Middle East Studies, no. 9, vol. XIX. London: Tauris Academic Studies, 1996.

Allan, J.A. and M. Karshenas. "Managing Environmental Capital: The Case of Water in Israel, Jordan, the West Bank and Gaza, 1947 to 1995," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Library of Modern Middle East Studies, vol. 9. New York: Tauris Academic Studies, 1996, pp. 121-133.

Allan, J.A., and Chibli Mallat. *Water in the Middle East – Legal, Political and Commercial Implications*. London: British Academy Press, 1995.

Allan, R. A. *The Middle East Water Question: Hydropolitics and the Global Economy*. Taurus, 2001.

Allan, Tony. "Watersheds and Problemsheds: Explaining the Absence of Armed Conflict over Water in the Middle East," *Middle East Review of International Affairs*, vol. 2, (#5) no. 1 (March 1998), pp. 1-4.

Alster, J.P., "Water in the Peace Process," *Justice*, no. 9 (1996), pp. 11-16.

_____. "Water in the Peace Process: Israel-Syria-Palestinians," *Justice*, no. 10 (1996), pp. 4-8.

Amery, Hussein A. "The Litani River of Lebanon," *Geographical Review*, vol. 83, no. 3 (July 1993), pp. 229-237.

_____. "Water Scarcity as a Factor in Arab-Israeli Wars and Emerging Peace," *Studies in Conflict & Terrorism*, vol. 20, no. 1 (1997), pp. 95-104.

Amery, Hussein A. and Atif Abdallah Kubursi. "The Litani River: The Case Against Interbasin Transfer," in Collings, Deirdre (ed.), *Peace for Lebanon*. Boulder CO: Rienner, 1994, pp. 174-194.

Amery, Hussein A. and Aaron T. Wolf (eds.). *Water in the Middle East: A Geography of Peace*. Austin, Texas: University of Texas Press, 2000.

Amiran, R., "The Water Supply of Israelite Jerusalem," in Yigael Yadin (ed.) *Jerusalem Revealed - Archaeology in the Holy City 1968-1974*, Jerusalem: The Israel Exploration Society, 1975.

Applied Research Institute - Jerusalem. *Dry Land Farming in Palestine*. Bethlehem: ARIJ, 1994.

_____. *Water Resources and Irrigated Agriculture in the West Bank*. Bethlehem: ARIJ, March 1998.

_____. *Environmental Profile of the West Bank*. (Various Volumes) Bethlehem: ARIJ, 1995 and 1996.

_____. *The Status of the Environment in the West Bank*. Bethlehem: ARIJ, October 1997.

Arar, Nedal Hamdi. "Cultural Responses to Water Shortage Among Palestinians in Jordan: the Water Crisis and its Impact on Child Health," *Human Organization*, Vol. 57(3), Fall 1998: 284-291.

Arlosoroff, S. "Managing Scarce Water - Recent Israeli Experience," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Library of Modern Middle East Studies, vol. 9. New York: Tauris Academic Studies, 1996, pp. 21-48.

_____. "Water Resource Management in Israel," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston et. al.: Kluwer Academic Publishers, 2001, pp. 57-74.

Assaf, Karen. "Replenishment of Palestinian Waters by Artificial Recharge as a Non-controversial Option in Water Resource Management in the West Bank and Gaza Strip," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam et. al.: Elsevier, 1994, pp. 301-314.

_____. "Palestinian Water Resources - Water Quality," in Robin Twite and Jad Isaac (eds.), *Our Shared Environment: Israelis and Palestinians Thinking Together About the Environment of the Region in Which They Live*. Jerusalem: IPCRI, December 1994, pp. 279-313.

_____. "The Need for Joint Management and Monitoring of the Water 'Usage' Cycle," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston et. al.: Kluwer Academic Publishers, 2001, pp. 75-82

Assaf, Karen and Said Assaf. *The Status of Domestic Water Supply in Six Villages of the West Bank and Gaza Strip*. Westport, Connecticut: Save the Children Federation, 1985.

_____. *The Chemical and Hydrological Status of the Wells at the Arab Development Society Project*. Birzeit University Research Center for Swedish Save the Children Organization, 1984.

Assaf, Karen; Al-Khatib, Nader; Kally, Elisha and Hlhel Shuval. *A Proposal for the Development of a Regional Water Master Plan Prepared by a Joint Israeli-Palestinian Team*. Jerusalem: IPCRI, October 1993.

Awartani, Hisham. *Artesian Wells in Palestine, Present Status and Future Aspirations*. An-Najah National University, Nablus, Jerusalem: PHG, 1992.

_____. "A Projection of the Demand for Water in the West Bank and Gaza Strip, 1992-2005," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam et. al.: Elsevier, 1994, pp. 7-31.

Awartani, Hisham and Sayel Wishahi. *Wells in the Jordan Valley: Current Conditions, Rehabilitation Prospects*. Research Reports Series, No. 11. Center for Palestine Research and Studies, Economics Department, February 1999.

Bagis, Ali Ihsan (ed.), *Water as An Element of Cooperation and Development in the Middle East*, Ankara: Ayna Publications in cooperation with the Friederich Naumann Foundation in Turkey, 1994.

Baim, Karen, A. "Come Hell or High Water: A Water Regime for the Jordan River Basin," *Washington University Law Quarterly*, vol. 75 (1997).

Barberis, Julio A. *International Goundwater Resources Law*. FAO Legislative Study, 40, Rome, 1986.

Barberis, Julio. "The Development of International Law of Transboundary Groundwater," *Natural Resources Journal*, vol. 31, no. 1 (1991), pp. 167-186.

Barhoum, M.I. "East Jordan Valley Villagers Versus Social Institutions," *International Review of Modern Sociology* 10, 1 (1980), pp. 37-65.

Baskin, Gershon. "The Clash over Water: An Attempt at Demystification," *Palestine-Israel Journal*, no. 3 (Summer 1994), pp. 27-35.

Baskin, Gershon (ed.). *Water: Conflict or Cooperation*. Jerusalem: IPCRI, March 1993.

Beaumont, Peter. "Water - A Resource under Pressure," in G. Nonneman (ed.), *The Middle East and Europe: The Search for Stability and Integration*, London, 2nd ed., 1993, pp. 183-188.

_____. "The Myth of Water Wars and the Future of Irrigated Agriculture in the Middle East," *International Journal of Water Resources Development*, vol. 10, no. 1 (1994), pp. 9-22.

Becker, Nir and Naomi Zeitouni. "Reallocating Water Resources in the Middle East Through Market Mechanisms," *International Journal of Water Resources Development*, vol. 12, no. 1 (March 1996), pp. 17-32.

_____. "A Market Solution for the Israeli-Palestinian Water Dispute," *Water International*, vol. 23, no. 4 (December 1998), pp. 238-43.

Beg, Mirza Arshad Ali. "Water Supply Systems in the Muslim World," *Islamic Thought and Scientific Creativity*, 4 ii (1993), pp. 49-68.

Bellisari, Anna. "Public Health and the Water Crisis in the Occupied Territories," *Journal of Palestine Studies*, vol. 23, no. 2 (1994), pp. 52-63.

Ben Meir, M., "Water Management Policy in Israel - A Comprehensive Approach," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 33-39.

Benvenisti, Eyal. "International Law and the Mountain Aquifer," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 229-238.

Benvenisti, Eyal and Haim Gvirtzman. "Harnessing International Law to Determine Israeli-Palestinian Water Rights: The Mountain Aquifers," *Natural Resources Journal*, vol. 33, no. 3 (Summer 1993), pp. 543-567.

Berck, Peter and Jonathan Lipow. "Real and Ideal Water Rights: the Prospects for Water Rights Reform in Israel, Gaza, and the West Bank," *Resources and Energy Economics*, vol. 16, no. 4 (November 1994), pp. 287-302.

Berkoff, Jeremy. *A Strategy for Managing Water in the Middle East and North Africa. Directions in Development*. The World Bank: Washington D.C., 1994.

Beschorner, Natasha. *Water and Instability in the Middle East: An Analysis of Environmental, Economic and Political Factors Influencing Water Management and Water Disputes in the Jordan and Nile Basins and Tigris-Euphrates Region*. London: Brassey's, 1992.

_____. *Water and Instability in the Middle East*. Adelphi Paper, 273, London: International Institute for Strategic Studies, Winter 1992/93.

Biger, G. "River and Lake Boundaries in Israel," in C.H. Schofield and R.N. Schofield (eds.), *The Middle East and North Africa*. London: Routledge, 1994 (World Boundaries, 2), pp. 99-109.

Biswas, Asit, K. (ed.) *International Waters of the Middle East: From Euphrates-Tigris to Nile*. Oxford: Oxford University Press, 1994.

_____. *Core and Periphery - A Comprehensive Approach to Middle Eastern Water*. Oxford University Press, 1997.

Bleier, Ronald, "Will Nile Water Go to Israel? North Sinai Pipelines and the Politics of Scarcity," *Middle East Policy*, vol. 5, no. 3 (September 1997), pp. 113-124.

Brill, E., U. Chakravorty and E. Hochman. "Transboundary Water Allocation Between Israel and the Gaza Strip: Desalination, Recycling, and Fresh Water," in *Conflict and Cooperation on Transboundary Water Resources*, Boston, Dordrecht [etc]: Kluwer Academic Publishers, 1998, pp. 381-400.

Brimberg, Jack; Mehrez, Abraham and Oron, Gideon. "Economic Development of Groundwater in Arid Zones with Applications to the Negev Desert, Israel," *Management Science*, vol. 40, no. 3 (March 1994), pp. 353-363.

Brooks, David. "Adjusting to the Flow: Two Comments on Middle East Water Crisis," *Water International*, vol. 18, no. 1 (1993), pp. 33-39.

_____. "Economics, Ecology and Equity: Lessons from the Energy Crisis in Managing Water Shared by Israelis and Palestinians," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 441-450.

_____. "Between the Great Rivers: Water in the Heart of the Middle East," in Eglal Rached, Eva Rathgeber and David Brooks (eds.), *Water Management in Africa and the Middle East, Challenges and Opportunities*. Ottawa: International Development Research Center, 1996, pp. 73-93.

Brooks, David B. and Stephen C. Lonergan. *The Economic, Ecological and Geopolitical Dimensions of Water in Israel*. Victoria: Centre for Sustainable Regional Development, 1993.

_____. *Watershed: The Role of Fresh Water in the Israeli-Palestinian Conflict*. Ottawa: International Development Research Center, 1994.

Bruins, H.J. and A. Tuinhof. *Water in the Gaza Strip*. Government of the Netherlands, Ministry of Foreign Affairs, Directorate General for International Cooperation: Den Haag, 1991.

B'Tselem, *Disputed Waters: Israel's Responsibility for the Water Shortage in the Occupied Territories*. Jerusalem, September 1998.

_____. *Thirsty for a Solution*. Jerusalem, July 2000.

_____. *Not Even a Drop - The Water Crisis in Palestinian Villages Without a Water Network*. Jerusalem, 2001.

Bulloch, John and Adel Darwish. *Water Wars: Coming Conflicts in the Middle East*. London: Victor Gollancz, 1993.

Burchi, Stefano. *Treaties Concerning the Non-navigational Uses of International Watercourses - Europe*. FAO Legislative Study, 50, FAO, Rome, 1993.

Canadian Journal of Development Studies - Special Issue on Sustainable Water Resources Management in Arid Countries: Middle East and Northern Africa, 1992.

Caponera, Dante A. *Water Laws in Moslem Countries*. FAO Irrigation and Drainage Paper 20/1, 1973.

_____. "Legal Aspects of Transboundary River Basins in the Middle East: The Al-Asi (Orontes), The Jordan and The Nile," *Natural Resources Journal*, vol. 33, no. 3 (Summer 1993), pp. 629-663.

_____. "The Legal-Institutional Issues Involved in the Solution of Water Conflicts in the Middle East: the Jordan," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 163-180.

Center for Engineering and Planning Ramallah. *Water Conservation in Palestine*. Paper prepared under the auspices of the World Bank. The World Bank: Washington DC, 1994.

Chenevert, D.J., "Application of the Draft Articles on the Non-navigational Uses of International Watercourses to the Water Disputes Involving the Nile River and the Jordan River," *Emory International Law Review*, vol. 6, no. 2 (1992), pp. 495-575.

Cippà, Andrea. *Water Management in the City of Hebron, October 1997*. Report No. 1945. Hebron, Palestine: TIPH, 1997.

Civic, M.A., "A Comparative Analysis of the Israeli and Arab Water Law Traditions and Insights for Modern Water Sharing Agreements," *Denver Journal of International Law and Policy*, vol. 26, no. 3 (1998), pp. 437-452.

_____. "A New Conceptual Framework for Jordan River Basin Management: A Proposal for a Trusteeship Commission," *Colorado Journal on International Environmental Law and Policy*, vol. 9, no. 2 (1998), pp. 285-329.

Cohen, H.A. and Plaut, S. "Quenching the Levant's Thirst," *Middle East Quarterly*, 2 (1995), pp. 37-44.

Committee on Sustainable Water Supplies for the Middle East. *Water for the Future. The West Bank and Gaza Strip, Israel and Jordan*. Washington, DC: National Academy Press, 1999.

Dabbagh, Taysir (ed.). *Desalination: The Neglected Option: Water in the Arab World - Symposium at Harvard University, 1-3 October, 1993*. Kuwait: [s.n.], 1993.

Davis, Uri; Maks, Antonia E.L. and Richardson, John. "Israel's Water Policies," *International Journal of Palestine Studies*, vol. IX, no. 2 (Winter 1980), pp. 3-31.

Dees, Joseph L. "Jordan's East Ghor Canal Project," *Middle East Journal*, vol. 13 (Autumn 1959), pp. 357-371.

Dellapenna, Joseph W., "Water in the Jordan Valley: The Potential and Limits of Law," *The Palestine Yearbook of International Law*, 15 (1989).

_____. "Designing the Legal Structures of Water Management Needed to Fulfill the Israeli-Palestinian Declaration of Principles," *The Palestine Yearbook of International Law*, Vol. 7 (1992/1994), pp. 63-103.

_____. "Rivers as Legal Structures: the Examples of the Jordan and the Nile," *Natural Resources Journal*, vol. 36, no. 2 (Spring 1996), pp. 217-250.

Deshazo, Randy and Sutherland, John W. *Building Bridges, Diplomacy and Regime Formation in the Jordan River Valley*. Lanham, Maryland: University Press of America, 1996.

Dichter, H., "The Legal Status of Israel's Water Policies in the Occupied Territories," *Harvard International Law Journal*, 35 (1994), no. 2, pp. 565-594.

Dillman, Jeffrey. "Water Rights in the Occupied Territories," *Journal of Palestine Studies*, vol. 19, no. 1 (1989), pp. 46-71.

Dinar, Ariel and Aaron Wolf. "International Markets for Water and the Potential for Regional Cooperation: Economic and Political Perspectives

in the Western Middle East," *Economic Development and Cultural Change*, vol. 43, no. 1 (October 1994), pp. 43-66.

_____. "Economic Potential and Political Considerations of Regional Water Trade: the Western Middle East Example," *Resources and Energy Economics*, vol. 16, no. 4 (November 1994), pp. 335-357.

_____. *Potential for Regional Water Transfer and Cooperation: The Case of the Western Middle East*. Milano: [s.n.], 1994.

Dodge, T. and Tell, T. "Peace and the Politics of Water in Jordan," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*, Library of Modern Middle East Studies, vol. 9. New York: Tauris Academic Studies, 1996, pp. 169-184.

Dolatyar, Mostafa and Tim S. Gray. *Water Politics in the Middle East: A Context for Conflict or Co-operation?* London: Macmillan Press Ltd., 2000.

Dombrowsky, I., "The Jordan River Basin: Prospects for Cooperation Within the Middle East Peace Process?" in *Water in the Middle East: Potential for Conflicts and Prospects for Cooperation*, Berlin [etc.]: Springer, 1998, pp. 91-112.

Donkers, Henk. "Fresh Water as a Source of International Conflicts: The Water Conflicts between Israel, Jordan and the Palestinians," in Edward H.P. Brans, Esther J. de Haan, André Nollkaemper and Jan Rinzema (eds.), *The Scarcity of Water, Emerging Legal and Policy Responses*. London: Kluwer Law International, 1997, pp. 135-157.

Dottridge, J. and Gibbs, B. "Water for Sustainable Development in the North-Eastern Badia, Jordan," in P. Howsam and R.C. Carter (eds.), *Water Policy: Allocation and Management in Practice*. London: E & FN Spon, 1996, pp. 87-94.

Downey, Terrence J. and Bruce Mitchell. "Middle East Water: Acute or Chronic Problem?" *Water International*, vol. 18, no. 1 (March 1993), pp. 1-4.

Drake, Christine. "Water Resource Conflict in the Middle East," *Journal of Geography*, vol. 96, no. 1 (January 1997), pp. 5-12.

Drezon-Tepler, Marcia. "Contested Waters and the Prospects for Arab-Israeli Peace," *Middle Eastern Studies*, vol. 30, no. 2 (April 1994), pp. 281-303.

Eaton, J.W. and D.J. Eaton. "Water Utilization in the Yarmuk-Jordan, 1192-1992," in *Water and Peace in the Middle East: Proceedings of*

the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992, Amsterdam [etc.]: Elsevier, 1994, pp. 93-105.

Eckstein, Zvi, Zakai, Dan, Nachtom, Yuval and Gideon Fishelson. "The Allocation of Water Sources among Israel, the West Bank and Gaza: An Economic Analysis," *The Economic Quarterly* (Israel), vol. 41, no. 3 (1995), pp. 331-368.

ECSCWA. *Land and Water Policies in the Arab Region: A Contribution to the Expert Group Consultation on Sustainable Agricultural and Rural Development, Cairo, 25-29 September 1994*. ECSCWA and FAO, E/ESCWA/AGR/1994/2.

El-Eini, R. I.M. "The Implementation of British Agricultural Policy in Palestine in the 1930s," *Middle Eastern Studies*, vol. 32, no. 4 (October 1996), pp. 211-250.

Eisenboerg, Aharon. "Drinking Water Quality in Israel," in Robin Twite and Jad Isaac (eds.), *Our Shared Environment: Israelis and Palestinians Thinking Together About the Environment of the Region in Which They Live*. Jerusalem: IPCRI, December 1994, pp. 314-338.

Elhance, A.P. *Hydropolitics in the Third World: Conflict and Cooperation in the International River Basin*. United States Institute for Peace Studies, 1999.

Elmusa, Sharif S. *The Water Issue and the Palestinian-Israeli Conflict*. Washington, D.C.: Center for Policy Analysis on Palestine, 1993.

_____. "Dividing the Common Palestinian-Israeli Waters - An International Water Law Approach," *Journal of Palestine Studies*, vol. 22, no. 3 (Spring 1993), pp. 57-77.

_____. "The Israeli-Palestinian Water Dispute can be Resolved," *Palestine-Israel Journal of Politics, Economics and Culture*, no. 3, Jerusalem (Summer 1994), pp. 18-26.

_____. "Towards an Equitable Distribution of the Common Palestinian-Israeli Waters: An International Water Law Framework," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 451-467.

_____. "The Jordan-Israel Water Agreement: A Model or an Exception?" *Journal of Palestine Studies*, vol. 24, no. 3 (Spring 1995), pp. 63-73.

_____. "Dividing Common Water Resources According to International Water Law: The case of the Palestinian-Israeli Waters," *Natural Resources Journal*, vol. 35, no. 2 (Spring 1995), pp. 223-242.

_____. "The Land-Water Nexus in the Israeli-Palestinian Conflict," *Journal of Palestine Studies*, vol. 25, no. 3 (Spring 1996), pp. 69-78.

_____. *Negotiating Water: Israel and the Palestinians*. A Final Status Issues Paper. Washington, DC: Institute for Palestine Studies, 1996.

_____. *Water Conflict: Economics, Politics, Law and Palestinian-Israeli Water Resources*. Washington, DC: Institute for Palestine Studies, 1997.

Falkenmark, Malin. "Middle East Hydropolitics: Water Scarcity and Conflicts in the Middle East," *Ambio*, vol. 18, no. 6 (1989), pp. 350-352.

Falkenmark, Malin and Gunnar Lindth. "Water and Economic Development," in Gleick, Peter H. (ed.), *Water in Crisis. A Guide to the World's Fresh Water Resources*. New York: Oxford University Press, 1993, pp. 80-91.

Farid, Abdel M. and Hussein Sirriyeh (eds.). *Israel & Arab Water. An international Symposium, Amman, 25-26 January 1984*. London: Ithaca Press, 1985.

Fathallah, Raed Mounir. "Water Disputes in the Middle East: An International Law Analysis of the Israel-Jordan Peace Accord," *Journal of Land Use and Environmental Law*, vol. 12, no. 1 (Fall 1996), pp. 119-152.

Feitelson, Eran. "Water Rights Within a Water Cycle Framework," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case With an International Perspective*. Boston [etc.]: Kluwer Academic Publishers, 2001, pp. 395-405.

Feitelson, Eran and Marwan Haddad, (eds.). *Joint Management of Shared Aquifers*. Palestine Consultancy Group and the Harry S. Truman Research Institute for the Advancement of Peace. 1995.

_____. "A Stepwise Open-Ended Approach to the Identification of Joint Management Structures for Shared Aquifers (Israel, Palestinian Authority)," *Water International*, vol. 23, no. 4 (December 1998), pp. 227-237.

_____. *Identification of Joint Management Structures for Shared Aquifers: A Cooperative Palestinian-Israeli Effort*, Washington, D.C.: World Bank, 1998.

_____. *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*, Boston [etc.]: Kluwer Academic Publishers, 2001.

Feitelson, Eran, M. Haddad, S. Arlosoroff and T. Nasseredin. *Joint Management of Shared Aquifers: An Implementation-Oriented Agenda, Final Report Phase II*. Jerusalem: The Palestine Consultancy Group and the Truman Institute, 1999.

Feuilherade, Peter and Alan George. "Water Pressure," *The Middle East*, no. 229 (December 1993), pp. 31-33.

Fishelson, Gideon, *Solutions for the Scarcity Water in the Middle East in Times of Peace*. Tel Aviv, 1992.

_____. "The Allocation and Marginal Value Product of Water in Israeli Agriculture," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 427-440.

_____. "The Water Market in Israel: an Example for Increasing the Supply," *Resource and Energy Economics*, vol. 16, no. 4 (November 1994), pp. 321-334.

Fisher, Franklin M. "The Economics of water Dispute Resolution, Project Evaluation and Management: An Application to the Middle East," *International Journal of Water Resources Development*, vol. 11, no. 4 (1 December 1995), pp. 377-391.

Fisher, Franklin M. and Hossein Askari. "Optimal Water Management in the Middle East and Other Regions," *Finance and Development (IMF)*, vol. 8, no. 3 (September 2001).

Frey, Frederick W. "The Political Context of Conflict and Cooperation Over International River Basins," *Water International*, vol. 18, no. 1 (1993), pp. 54-68.

Frey, Frederick W. and Thomas Naff. "Water: An Emerging Issue in the Middle East," *The Annals of the American Academy of Political and Social Science*, vol. 482 (November 1985), pp. 65-84.

Friedler E. "Water Reuse - An Integral Part of Water Resources Management: Israel as a Case Study," *Water Policy*, 3 (2001).

Gärber, Andrä and Elias Salameh (eds.). *Jordan's Water Resources and their Future Potential*. Proceedings of a Symposium, 27-28 October 1991 in Amman. Amman: Friedrich Ebert Stiftung, 1992.

Gammoh, J.S. *A Study of Socio-economic Structure of North Shouneh and South Shouneh in the Jordan Valley, with Particular Reference to the Agricultural Extension*. FAO, Rome, 1981.

Garfinkle, Adam. *Israel and Jordan in the Shadow of War: Functional Ties and Futile Diplomacy in a Small Place*. New York: St. Martin's Press, 1992.

_____. *War, Water, and Negotiation in the Middle East: The Case of the Palestine-Syria Border, 1916-1923*. Tel Aviv: Tel Aviv University, Moshe Dayan Center for Middle Eastern and African Studies, 1994.

German Overseas Institute. *Water in the Middle East and North Africa; Literature since 1985, a Selected Bibliography*. Near and Middle East Documentation Service, Series A, no. 23, Hamburg, 1995.

Ghanem, Marwan. *Hydrogeology and Hydrochemistry of the Faria Drainage Basin*. Freiberg, Germany: Technische Universitat Bergakademie Freiberg, 1999.

Ghazi, M. "Arab Versus Jews in Galilee: Competition for Regional Resources," *GeoJournal*, vol. 21, no. 4 (1999), pp. 325-336.

Ghezawi, Ali Z. and Khasawneh, Mohammad M. *Irrigation Water and Agriculture in the Jordan Valley and Southern Ghore: The Possibility of Cultivating Substitute Crops*. Amman: Center for International Studies, Royal Scientific Society.

Gleick, Peter H. (ed.). *Water in Crisis; A Guide to the World's Fresh Water Resources*. New York: Oxford University Press, 1993.

_____. "Water, War & Peace in the Middle East," in *Environment*, vol. 36, no. 3 (1994), pp. 7-15 and 35-42.

Gleick, Peter H., Yolles, Peter and Haleh Hatami. "Water, War and Peace in the Middle East," *Environment*, vol. 36, no. 3 (April 1994), pp. 6-15.

Glueckstern, Pinchas and Gideon Fishelson. *Water Desalination and the Red Sea-Dead Sea Canal*. Tel Aviv: University of Tel Aviv, 1992.

Green, Elizabeth Anne. "Hydropolitics in the Middle East," *Strategic Review*, vol. 21, no. 2 (Spring 1993). pp. 72-76.

Gregory, J. R. "Liquid Asset," *World Monitor*, 28 (November 1991).

Grey, D. "The Development of the Water Resources of the Occupied Palestinian Territories: Some Key Issues," in J. Issac and H. Shuval (eds.), *Water and Peace in the Middle East: Proceedings of the First*

Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992, Amsterdam [etc.]: Elsevier, 1994, pp. 219-228.

Gruen, George E. *The Water Crisis: The Next Middle East Conflict*. A Simon Wiesenthal Center Report. Los Angeles, rev. ed., 1992.

_____. "Turkey's Potential Contribution to Arab-Israel Peace," *Turkish Review of Middle East Studies*. vol. 8 (1993), pp. 179-214.

_____. "Contribution of Water Imports to Israeli-Palestinian-Jordanian Peace," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 273-288.

Gvirtzman, H. "Groundwater Allocation in Judea and Samaria," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 205-218.

Haddad, Marwan. "Environmental Conditions in the Occupied West Bank," in *Proceedings of Workshop on Environment, Land and Water Establishment*. Jerusalem, 1992.

_____. "An Approach for Regional Management of Water Shortages in the Middle East," in Bagis, Ali Ihsan (ed.), *Water as An Element of Cooperation and Development in the Middle East*, Ankara: Ayna Publications in cooperation with the Friederich Naumann Foundation in Turkey, 1994, pp. 67-79.

Haddad, Marwan and Numan Mized. "Water Resources in the Middle East: Conflict and Solutions," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Library of Modern Middle East Studies, vol. 9. New York: Tauris Academic Studies, 1996, pp. 3-17.

Haddad Marwan and K. Lindner. "Sustainable Water Demand Management Versus Developing New and Additional Water in the Middle East: A Critical Review," *Water Policy*, 3 (2001).

Haddad, Marwan, Feitelson, Eran, S. Arlosoroff and T. Nasseredin. "A Proposed Agenda for Joint Israeli-Palestinian Management of Shared Groundwater," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston [etc.]: Kluwer Academic Publishers, 2001, pp. 475-493.

Haddadin, Munthir J. "Water and the Peace Process: Two Perspectives, A View from Jordan," *Policy Focus*, no. 20 (September 1992); pp. 14-19.

_____. "Learning to Share: Divided Sovereignty over Water Resources," *Harvard International Review*, vol. 17, no.3 (Summer 1995), pp. 22-25.

_____. "Water Management: A Jordanian Viewpoint," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Library of Modern Middle East Studies, Vol. 9. New York: Tauris Academic Studies, 1996, pp. 59-73.

Hagan, Ross. *Achieving Sustainable Irrigation Water Conservation in the Jordan Valley, Water Quality Improvement and Conservation Project*. Report 3114-95-3b-06, DAI (USAID), December 1995.

Hagan, Ross; Abu-Khate, Mohammad I.; Emtairah, Ismael Y. and Jamal Al-Rashdan. *Survey of Farm Water Management in the Jordan Valley Water Quality Improvement and Conservation Project*. Report 3114-95-3b-03, DAI (USAID), April 1995.

Hagan, Ross E. and Darryl Kuhnle. *Promoting Water Conservation by Training Jordan Valley Farmers Water Quality Improvement and Conservation Project*. Report 3114-95-3b-04, DAI (USAID) October 1995.

Hamadneh, Abdullah. "Aims and Dimensions of the Israeli Mediterranean-Dead Sea Canal Project," in Farid, Abdel Majid and Hussein Sirriyeh (eds.), *Israel & Arab Water. An international symposium, Amman 25-26 January 1984*. London: Ithaka, 1985, pp. 45-50.

Harpaz, Y., Marwan Haddad and S. Arlosoroff, "Overview of the Mountain Aquifer: A Shared Israeli-Palestinian Resource," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston [etc.]: Kluwer Academic Publishers, 2001, pp. 43-56,

The Hashemite Kingdom of Jordan. *East Ghor Project, Questions and Answers*. First edition, 1 July 1962.

Al-Hassan, Omar. *Water Resources in the Middle East*. London: Gulf Centre for Strategic Studies, 1996.

Hauptert, John S. "Recent Progress of Jordan's East Ghor Canal Project," *The Professional Geographer*, vol. 18 (January 1966), pp. 9-13.

Hayton, Robert D. "The Law of International Aquifers," *Natural Resources Journal*, vol. 22 (1982).

Bibliography

Hazleton, J.E. *The Impact of the East Ghor Canal Project on Land Consolidation, Distribution and Tenure*. Amman: Economic Research Department, Royal Scientific Society, 1974.

_____. "Land Reform in Jordan: The East Ghor Canal Project," *Middle Eastern Studies*, 15 (1979), pp. 258-269.

Hillel, Dan. *Rivers of Eden: The Struggle for Water and the Quest for Peace in the Middle East*, New York: Oxford University Press, 1994.

El-Hindi, Jamal L. "The West Bank Aquifer and Conventions Regarding Laws of Belligerent Occupation," *Michigan Journal of International Law*, vol. 11, no. 4 (Summer 1990), pp. 1400-1423.

_____. "Compensation as Part of Equitable Utilization in the Israeli-Palestinian Water Context," *22 Arab Studies Quarterly*, 113 (2000).

Hirsch, A.M. "Water Legislation in the Middle East," *American Journal of Comparative Law*, vol. 8 (1959).

Hoch, Dov. "The Middle East Water Crisis," *Midstream*, vol. 39, no. 4 (May 1993), pp. 16-19.

Hoch, Gary, "The Politics of Water in the Middle East: The Fast Dwindling Resource Remains the Region's Most Dangerous Problem," *Middle East Insight*, vol. 9 (March/April 1993), pp. 17-21.

_____. "Will the Next War Be Over Water? Middle East Countries Struggle Over Limited Supplies of Life-giving Water," *Moment*, vol. 18, no. 4 (August 1993), pp. 34-38.

Hof, Frederic C. "The Yarmouk and the Jordan Rivers in the Israel-Jordan Peace Treaty," *Middle East Policy*, vol. 3, no. 4 (April 1995), pp. 47-56.

_____. "The Water Dimension of Golan Heights Negotiations," *Middle East Policy*, vol. 5, no. 2 (May 1997), pp. 129-141.

Hoffmann, Berthold. "Hydro Paranoia and Its Myths - The Issue of Water in the Middle East," *Orient, Zeitschrift des Deutschen Orient-Institutes* 39, Heft 2 (1998), pp. 251-269.

Hoffmann, D. "Potential Applications for Desalination in the Area," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 315-327.

Holubeshen, Moufida and Hussein A. Amery. *Annotated Bibliography of Water in the Middle East*. University of Toronto: Centre for International Studies, 1995.

Housen-Couriel, Deborah. *Some Examples of Cooperation in the Management and Use of International Water Resources*. The Harry S. Truman Research Institute for the Advancement of Peace, The Hebrew University of Jerusalem, March 1994.

Howell, P.P. and J.A. Allan (eds.). *The Nile: Sharing a Scarce Resource. A Historical and Technical Review of Water Management and of Economic and Legal Issues*. Cambridge: Cambridge University Press, 1994.

Howsam, P. and R.C. Carter (eds.). *Water Law, Water Rights and Water Policy: Allocation and Management in Practice*. London: E & FN, 1996, pp. 371-378.

Hudes, Karen. *Shared Water Resources in the Jordan River Basin*. Spokane, Washington, DC: Gonzaga University, 1999.

Inan, Y. "Legal Dimensions of International Watercourse (Euphrates and Tigris)," in Bagis, Ali Ihsan (ed.), *Water as An Element of Cooperation and Development in the Middle East*, Ankara: Ayna Publications in cooperation with the Friederich Naumann Foundation in Turkey, 1994, pp.

Ingrosso, Pietro; Abu Jabal, Mohammad and Benedetta Oddo (eds.). *Groundwater in Israel Palestine and Sinai, Selected Bibliography (1985-1996)*. Gaza Strip: Water Research Center, Al-Azhar University, 1997.

International Institute for Infrastructural, Hydraulic and Environmental Engineering and Birzeit University. *Water Sector Capacity Building in Palestine*, IHE and BZU, 1996.

"The International Law Commission's First Ten Draft Articles on the Law of the Non-navigational Uses of International Watercourses," *Fordham International Law Journal*, vol. 19, no. 5 (1996), pp. 2180-2230.

Isaac, Jad. "Environmental Protection and Sustainable Development in Palestine," in Robin Twite and Jad Isaac (eds.), *Our Shared Environment*. Jerusalem: Israeli/Palestinian Center for Research and Information, December 1994.

_____. "Core Issues of the Palestinian-Israeli Water Dispute," in Spillmann, Kurt R. and Günther Bächler (eds.), *Environmental Crisis: Regional Conflicts and Ways of Cooperation*. Proceedings of an Inter-

Bibliography

national Conference at Centro Stefano Franscini, Ascona/Switzerland, 2-7 October, 1994. ENCOF Occasional Paper, No. 14. Swiss Federal Institute of Technology/Zurich/Berne: Swiss Peace Foundation, 1995.

_____. (ed.). *The Status of the Environment in the West Bank*. Applied Research Institute - Jerusalem, June 1997.

_____. "A Palestinian Perspective on the Water Crisis," *Palestine-Israel Journal of Politics, Economics and Culture*, vol. 5, no. 1 (1998), pp. 54-58.

_____. "The Essentials of Sustainable Water Resource Management in Israel and Palestine," *Arab Studies Quarterly*, vol. 22, no. 2 (2000).

Isaac, Jad and M. Owewi. "The Potential of GIS in Water Management and Conflict Resolution," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston [etc.]: Kluwer Academic Publishers, 2001, pp. 329-345.

Isaac, Jad and Jan Selby. "The Palestinian Water Crisis: Status, Projections and Potential for Resolution," *Natural Resources Forum*, vol. 20, no. 1 (February 1996), pp. 17-26.

Isaac, Jad and Hillel Shuval (eds). *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994.

Isaac, Jad and Robin Twite (eds.). *Our Shared Environment*. IPCRI: Jerusalem, 1994.

Israel, Water Law 5719-1959. *Sefer Ha-Chukkim*, no. 288, 13 August 1959.

"Israel/Jordan: Cooperation in Environment Protection," *Environmental Policy and Law*, vol. 25, no. 6 (1995), p. 323.

Israeli, Jordanian, and Palestinian Study Teams, Middle East Peace Process, Multilateral Working Group on Water Resources. *Middle East Regional Study on Water Supply and Demand Development*. Concluding Report Sponsored by the Government of the Federal Republic of Germany, February 1998.

Israeli Military Orders in the Occupied Palestinian West Bank 1967-1992. Jerusalem: JMCC, 2nd edition, 1995.

Israel's Policy on the West Bank Water Resources. Prepared for and under the guidance of the Committee on the Exercise of the Inalienable Rights of the Palestinian People. New York: UN, 1980 (A/AC 183).

Issa S. and G. De Bruijn. *Water Laws and Regulations in Palestine*. Jerusalem: LAW, 1994.

Issar, Arie S. "Fossil Water under the Deserts of the Middle East: A Safeguard Against Strife," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 351-361.

Jägerskog, Anders. *The Jordan River Basin: Explaining Inter-State Water Cooperation Through Regime Theory*. London: SOAS Water Issues Study Group, Occasional Paper No. 31, June 2001.

Al-Jayyousi, Odeh Rashed and Muhammad Rashid Shatanawi. "An Analysis of Future Water Policies in Jordan Using Decision Support Systems," *Water Resources Development*, vol. 11, no. 3 (1995), pp. 315-330.

Jordanian Ministry of Water and Irrigation, Palestinian Water Authority, and the Israeli Hydrological Service. *Overview of Middle East Water Resources: Water Resources of Palestinian, Jordanian, and Israeli Interest*. US Government Printing Office, 1999.

Just R. and S. Netanyahu (ed.). *Conflict and Cooperation on Transboundary Water Resources*. Boston: Kluwer Academic Press, 2001.

Kahan, David. *Agriculture and Water Resources in the West Bank and Gaza 1967-1987*. Boulder, Colorado: West Bank Data Base Project, Westview Press, 1987.

Kahhaleh, Subhi. *The Water Problem in Israel and Its Repercussions on the Arab-Israeli Conflict*. Institute For Palestine Studies Papers, no. 9 (E), Beirut, 1981.

Kalkafi, Eyal. "Ben-Gurion, Sharett and the Johnston Plan," *Studies in Zionism*, vol. 13, no. 2 (August 1992), pp. 165-186.

Kally, Elisha. *A Middle East Water Plan under Peace*. Tel Aviv University: Armand Hammer Fund for Economic Cooperation in the Middle East, 1986.

_____. "Costs of Inter-regional Conveyance of Water and Costs of Sea Water Desalination," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Confer-*

Bibliography

ence on Water, Zürich, Switzerland, 10-13 December 1992, Amsterdam [etc.]: Elsevier, 1994, pp. 289-300.

Kally, E. and G. Fishelson. *Water and Peace: Water Resources and the Arab-Israeli Peace Process*. Westport: Praeger, in cooperation with the Armand Hammer Fund for Economic Cooperation in the Middle East, Tel Aviv University, 1993.

Kamal, Sana. "Water Crisis Dissolves," *Middle East International* (16 May 1997), pp. 11-12.

Kartin A. "Factors Inhibiting Structural Changes in Israel's Water Policy," *Political Geography*, 19 (2000).

Kay, P.A, "Measuring Sustainability in Israel's Water System," *Water international*, vol. 25, no. 4 (2000), pp. 617-623.

Al-Khateeb, N., "Sociocultural Acceptability of Wastewater Reuse in Palestine," in *Water Management in Islam*, Tokyo, New York, Paris: United Nations University Press, 2001, pp. 79-84.

Al-Khatib, N. and K. Assaf, "Palestinian Water Supplies and Demands," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam et. al.: Elsevier, 1994, pp. 55-68.

Khawaja, Marwan. "The Dynamics of Local Collective Action in the West Bank: A Test of Rival Explanations," *Economic Development and Cultural Change*, vol. 44, no. 1 (October 1995), pp. 147-179.

Khuri, Rami, G. *The Jordan Valley. Life and Society below Sea Level*. Published in Association with the J.V.A., Longman, 1981.

Klein, Micha. "Water Balance of the Upper Jordan River Basin," *Water International*, vol. 23, no. 4 (December 1998), pp. 244-248.

Kliot, Nurit. *Water Resources and Conflict in the Middle East*. London, New York: Routledge, 1994.

_____. "Milk and Honey But No Water: Scarce Water Resources in the Israeli-Palestinian-Jordanian Realm," in Spillmann, Kurt R. and Günther Bächler (eds.), *Environmental Crisis: Regional Conflicts and Ways of Cooperation*. Proceedings of an International Conference at Centro Stefano Franscini, Ascona/Switzerland, 2-7 October, 1994. EN-COP Occasional Paper, No. 14. Swiss Federal Institute of Technology/Zurich/Berne: Swiss Peace Foundation, 1995.

Kliot, Nurit and Shmueli, Deborah. "Real and Ideal Institutional Frameworks for Managing the Common Arab-Israeli Water Resources (Israel)," *Water International*, vol. 23, no. 4 (December 1998), pp. 216-226.

Al-Kloub, B. and T.T. Al-Shemmeri, "Application of Multi-criteria Decision Aid to Rank the Jordan-Yarmouk Basin Co-riparians According to the Helsinki and ILC Rules," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Library of Modern Middle East Studies, vol. 9. New York: Tauris Academic Studies, 1996, pp. 185-207.

Kolars, John. "Hydro-Geographic Background to the Utilization of International Waters in the Middle East," *American Society of International Law: Proceedings of the 80th Annual Meeting*, 1986.

_____. "The Course of Water in the Arab Middle East," *American-Arab Affairs*, no. 33 (1990), pp. 66-67.

_____. "Water Resources of the Middle East," *Canadian Journal of Development Studies. Special Issue on Sustainable Water Resources Management in Arid Countries: Middle East and Northern Africa* (1992), pp. 107-108.

_____. "The Litani River in the Context of Middle Eastern Water Resources," in J. Kolars and T. Naff (eds.), *The Waters of the Litani in Regional Context*. Oxford: Centre for Lebanese Studies, 1993 (Prospects for Lebanon, 7), pp. 21-60.

_____. "The Middle East Growing Water Crisis," *Research & Exploration*, vol. 9 (November 1993), pp. 39-49.

_____. "Water Resources of the Middle East," in *Israel Water: Study for the World Bank*, Washington DC, 1994.

Kolars, John F., Naff, Thomas and Khalil Malouf. *The Waters of the Litani in Regional Context*. Oxford: Centre for Lebanese Studies, 1993.

Kubursi, Atif and Jad Isaac. *Water Scarcity, Water Wars, or Dry Peace in the Middle East*, Reports and Papers no.19, Water and Dispute Prevention - South Perspectives. Washington, D.C.: Center for the Global South, American University, 1998.

Kuttab, J. and J. Ishaq. "Approaches to the Legal Aspects of the Conflict on Water Rights in Palestine-Israel," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 239-249.

Laster, Richard. "Environmental Law in Israel Today," in Robin Twite and Jad Isaac (eds.), *Our Shared Environment: Israelis and Palestinians Thinking Together About the Environment of the Region in Which They Live*. Jerusalem: IPCRI, December 1994, pp. 107-146.

Lesch, A.M. "Water Policy in the Context of Palestinian Self-Government," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 413-426.

Libiszewski, Stephan. *Water Disputes in the Jordan Basin Region and their Role in the Resolution of the Arab-Israeli Conflict*. ENCOF Occasional Paper no. 13. Zürich: Center for Security Studies and Conflict Research, Swiss Federal Research Institute of Technology, 1995.

Lindholm, H. "Water and the Arab-Israeli Conflict: An Imperative for Regional Cooperation?" in *Regional Case Studies of Water Conflicts*. Padrigu Papers. Gothenburg, Sweden: Peace and Development Research Institute, 1992.

_____. "Water and the Arab-Israeli Conflict," in *Hydropolitics: Conflicts Over Water as a Development Constraint*. London and New Jersey: Zed Books; Dhaka: University Press, 1995, pp. 55-90.

Loneragan, Stephen C. "The Use of Economic Instruments for Efficient Water Use: Possibilities for Joint Groundwater Management in the West Bank and Gaza," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston [etc.]: Kluwer Academic Publishers, 2001, pp. 349-361.

Loneragan, Stephen C. and David B. Brooks. *The Economic, Ecological and Geopolitical Dimensions of Water in Israel*. Victoria, BC: University of Victoria, Center for Sustainable Regional Development, 1994.

_____. *Watershed: The Role of Fresh Water in Palestinian-Israeli Conflict*. Ottawa: International Development Research Center, 1994.

Loneragan, Stephen C. and Barb Kavanagh. "Climate Change, Water Resources and Security in the Middle East," *Global Environmental Change*, September 1991, pp. 272-290.

Lowi, Miriam R. *West Bank Water Resources and the Resolution of Conflict in the Middle East*. Occasional Paper Series of the Project on Environmental Change and Acute Conflict No. 1. Toronto, Cambridge/MA, 1992.

_____. "Bridging the Divide: Transboundary Resource Disputes and the Case of West Bank Water," *International Security*, Vol.18, No. 1 (Summer 1993), pp. 113-138.

_____. *Water and Power. The Politics of a Scarce Resource in the Jordan River Basin*. Cambridge: Cambridge University Press, 1995.

_____. "Conflict and Cooperation in Resource Development," in Elis Boulding, ed., *Peace Building in the Middle East: Challenges for States and for Civil Society*, Boulder, 1994.

_____. "Rivers of Conflicts, Rivers of Peace," *Journal of International Affairs*, vol. 49, no. 1 (Summer 1995), pp. 123-144.

_____. "Bridging the Divide: Transboundary Resource Disputes and the Case of West Bank Water," in *Global Dangers: Changing Dimensions of International Security*. Cambridge, MA [etc.]: MIT Press, 1995, pp. 118-143.

Lowi, M. and J. Rothman. "Arabs and Israelis: The Jordan River," in Faure, Guy Olivier and Jeffrey Z. Rubin (eds.), *Culture and Negotiation: The Resolution of Water Disputes*. Newbury Park, CA, [etc.]: Sage, 1993, pp. 156-175.

Mahal, Ibrahim. "Environmental and Socioeconomic Effects of Irrigation Schemes in the Arab Near East," *Desertification Control Bulletin*, vol. 24 (1994), pp. 42-47.

Macoun, A., and H. El-Naser. "Groundwater Resources Management in Jordan: Policy and Regulatory Issues," in *Groundwater: Legal and Policy Perspectives*. Washington D.C.: World Bank, 1999, pp. 105-115.

Mallat, H. "Water Laws in Lebanon," in *Water in the Middle East: Legal, Political and Commercial Implications*. London, [etc.]: Tauris Academic Studies, 1995, pp. 151-174.

Malouf, Khalil. "Beyond Litani - A Commentary," in J. Kolars and T. Naff (eds.), *The Waters of the Litani in Regional Context*. Oxford: Centre for Lebanese Studies, 1993 (Prospects for Lebanon, 7), pp. 61-65.

Manisali, Erol. "Water and Middle East Relations," *International Journal of Turkish Studies*, vol. 6, no. 1/2 (Winter 1992-1994), pp. 165-170.

Matthews, O. "Judicial Resolution of Transboundary Water Conflicts," *Water Resources Bulletin*, vol. 30, no. 3 (June 1994), pp. 375-383.

Manners, I.R. "Problems of Water Resource Management in a Semi-arid Environment: The Case of Irrigation Agriculture in the Central Jordan Rift Valley," in *Spatial Aspects of Development*. London: John Wiley and Sons, 1974, pp. 95-113.

Masri, Anan and Abu Faris, Hussam. *Water and Sanitation Systems in the Rural Areas, West Bank*. Jerusalem: Catholic Relief Services, November 1994.

Matar I., *Exploitation of Land and Water Resources for Jewish Colonies in the Occupies Territories*," in Playfair E. (ed.), *International Law and the Administration of Occupied Territories. Two Decades of Israeli Occupation of the West Bank and Gaza Strip*. Oxford: Clarendon Press, 1992.

McCaffrey, S. "Middle East Water Problems: The Jordan River," in *The Scarcity of Water: Emerging Legal and Policy Responses*. London, The Hague, [etc.]: Kluwer Law International, 1997, pp. 158-165.

Medzini, Arnon. "Water Conflicts in the Middle East," in P. Howsam and R.C. Carter (eds.), *Water Policy: Allocation and Management in Practice*. London: E & FN Spon, 1996, pp. 267-274.

Meehan, Maureen. "Palestine's Water Shortages: Short-Term Solutions, Long-Term Disaster. *The Washington Report on Middle East Affairs*, (August-September 2000), pp. 17+.

Middle East Water Commission. "Observations Regarding Water Sharing and Management: An Intensive Analysis of the Jordan River Basin with Reference to Long-distance Transfers," *International Journal of Water Resources Development*, vol. 11, no. 4 (December 1995), pp. 351-375.

Ministry of Planning and International Cooperation (MOPIC). *Regional Plan for the West Bank Governorates. Water and Wastewater, Existing Situation*. Ramallah, 1st edition, December 1998.

_____. Directorate for Urban and Rural Planning, Sensitive Water Resources. *Recharge Areas In The West Bank Governorates. Emergency Natural Resources Protection Plan*. Ramallah, 2nd edition, December 1998.

_____. *Emergency Natural Resources Protection Plan for Palestine, "West Bank Governorates"*. December 1998.

_____. *The Regional Plan for the West Bank Governorates*. December 1998.

_____. *The Regional Plan for the West Bank Governorates (Executive Summary)*. December 1998.

Moore, James W. "Parting the Waters: Calculating Israeli and Palestinian Entitlements to the West Bank Aquifers and the Jordan River Basin," *Middle East Policy*, vol. 3, no. 2 (April 1994), pp. 91-108.

_____. "An Israeli-Palestinian Water-Sharing Regime," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*, Amsterdam [etc.]: Elsevier, 1994, pp. 181-192.

_____. "Defining National Property Rights to a Common Property Resource: The Case of the West Bank Aquifers," *Resource and Energy Economics*, vol. 16, no. 4 (November 1994), pp. 373-390.

Moorehead, Jennifer. "Water for Palestine," *The Sanitation and Environment Program of the Palestinian Hydrology Group*. Jerusalem: PHG, 1999, pp. 1-24.

Morris, Mary E. *Dividing the Waters: Reaching Equitable Water Solutions in the Middle East*. Santa Monica, CA: RAND, 1993.

_____. "Water and Conflict in the Middle East: Threats and Opportunities," *Studies in Conflict & Terrorism*, vol. 20, no. 1 (January-March 1997), pp. 1-13.

_____. *Water Scarcity and Security Concerns in the Middle East*. Emirates Occasional Paper No. 14. Abu Dhabi: Emirates Center for Strategic Studies and Research, 1998.

Mousa, M. "A General View of the Water Situation in the Occupied Palestinian Territories," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 523-528.

Al-Mubarak Al-Weshah, Radwan. "Jordan's Water Resources: A Technical Perspective," *Water International*, vol. 17, no. 3 (1992), pp. 124-132.

Murakami, Masahiro. *Managing Water for Peace in the Middle East: Alternative Strategies*. Tokyo, New York, Paris: United Nations University Press, 1995.

_____. "Alternative Strategies in the Inter-State Regional Development of the Jordan Rift Valley," in *Central Eurasian Water Crisis: Caspian, Aral, and Dead Seas*. Tokyo [etc.]: UNU Press, 1998, pp. 154-180.

Murakami, M. and K. Musiake. "The Jordan River and the Litani," in Biswas, Asit K. (ed.), *International Waters of the Middle East: From Euphrates-Tigris to Nile*. Bombay, [etc.]: Oxford University Press, 1994, pp. 117-155.

Musallam, Ramzi. *Water: Sources of Conflict in the Middle East in the 1990s*. London: Gulf Centre for Strategic Studies, 1990.

Muslih, Muhammad. "The Golan: Israel, Syria, and Strategic Calculations," *Middle East Journal*, vol. 47, no. 4 (1993), pp. 611-632.

Mustafa, I. "The Arab-Israeli Conflict Over Water Resources," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 123-133.

Nachmani, Amikan. "A Commodity in Scarcity: The Politics of Water in the Middle East," *Survey of Arab Affairs*, no. 35 (1994).

_____. "The Politics of Water in the Middle East," in Coulombis, Theodore A., Veremis, Thanos M. and Thanos Dokos (eds.), *The Southeast European Yearbook 1993*. Athens: ELIAMEP, 1994, pp. 147-165.

_____. "The Politics of Water in the Middle East," in Inbar, Efraim (ed.), *Regional Security Regimes*. Albany, N.Y, 1995.

_____. "Water Jitters in the Middle East," *Studies in Conflict and Terrorism*, vol. 20, no.1 (January-March 1997), pp. 67-93. (Reprinted in *Security and Policy Studies* No. 32, The BESA Center for Strategic Studies, Bar-Ilan University, Israel, June 1997).

Naff, Thomas. "Water: An Emerging Issue in the Middle East?" *The Annals of the American Academy of Political Scientists*, November 1985.

_____. *Data and Analysis of the Jordan River System*. Philadelphia: Associates for Middle East Research, May 1987.

_____. "Israel and the Waters of South Lebanon," in J. Kolars and T. Naff (eds.), *The Waters of the Litani in Regional Context*. Oxford: Centre for Lebanese Studies, 1993 (Prospects for Lebanon, 7), pp. 1-19.

_____. "Water: That Peculiar Substance," *Research & Exploration (Special Issue)*, vol. 9 (November 1993), pp. 7-17.

_____. "Hazards to Middle East Stability in the 1990s: Economics, Populations, and Water," in P. Marr and W. Lewis (eds.), *Riding the*

Tiger: The Middle East Challenge after the Cold War. Boulder: Westview, 1993, pp. 137-162.

_____. "A Case for Demand-Side Water Management," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 83-92.

_____. "Information, Water, and Conflict: Exploring the Linkages in the Middle East," *Water International*, vol. 22, no. 1 (March 1997), pp. 16-27.

Naff, Thomas and Matson, Ruth C. *Water in the Middle East. Conflict or Cooperation?* Middle East Research Institute, University of Pennsylvania. Boulder: Westview Press, 1984.

Nasser, Y. "Palestinian Management Options and Challenges within an Environment of Scarcity and Power Imbalance," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Library of Modern Middle East Studies, vol. 9. New York: Tauris Academic Studies, 1996, pp. 49-57.

Nassereddin, T. "Legal and Administrative Responsibility of Domestic Water Supply to the Palestinians," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston [etc.]: Kluwer Academic Publishers, 2001, pp.107-114.

Neff, Donald. "Israel-Syria: Conflict at the Jordan River, 1949-1967," *Journal of Palestine Studies*, vol. 23, no. 4 (Summer 1994), pp. 26-40.

Netanyahu, S. "Trans-Boundary Water Policy Coordination under Uncertainty, The Israeli-Palestinian Mountain Aquifer," in P. Howsam and R.C. Carter (eds.) *Water Policy: Allocation and Management in Practice*. London: E & FN Spon, 1996, pp. 275-282.

Netanyahu, S., R.E. Just and J.K. Horowitz. "Bargaining Over Shared Aquifers: The Case of Israel and the Palestinians," in *Conflict and Cooperation on Trans-boundary Water Resources*. Boston, Dordrecht [etc.]: Kluwer Academic Publishers, 1998, pp. 41-60.

_____. "Israeli-Palestinian bargaining over the Mountain Aquifer," in *Management of Shared Groundwater Resources: The Israeli-Palestinian Case with an International Perspective*. Boston [etc.]: Kluwer Academic Publishers, 2001, pp. 115-129.

Nijim, Basheer K. "Water Resources in the History of the Palestine-Israel Conflict," *GeoJournal*, vol. 21, no. 4 (1990), pp. 317-323.

Norconsult International A.S. *Water Tariff Study*. Vol. I, Working Document Report, May 1998.

Nuseibeh, Mustafa and Taher Nasser Eddin. *Palestinian Freshwater Springs: Springs Description, Flow & Water Quality Data, 1970-1994*. Jerusalem: Palestine Consultancy Group (PCG), 1995.

Ohlsson, Leif. *Water - An Elusive and Ultimate Constraint for Development in Regional Case Studies of Water Conflicts*. Padrigu Papers. Gothenburg, Sweden: Peace and Development Research Institute, 1992.

_____. (ed.). *Hydropolitics: Conflicts over Water as a Development Constraint*. Zed Books, 1995.

_____. *Environment, Scarcity and Conflict: A Study of Malthusian Concerns*. Department of Peace and Development Research, University of Göteborg, 1999.

Okun, D.A. "The Role of Reclamation and Reuse in Addressing Community Water Needs in Israel and the West Bank," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 329-338.

O'Sullivan, Edmund; Bodgener, Jim; J. T. Allan. "Water," *Middle East Economic Digest*, vol. 38, no. 4 (28 January 1994), pp. 7-16.

Palestine Environment Protection National Authority, *Gaza Environmental Profile - Survey of Natural Resources, Part 1, Gaza Strip*, June 1994.

Palestinian Hydrology Group. *The Social, Environmental and Economic Impact of Water Losses in the Gaza Strip*. Jerusalem, 1996.

Palestinian National Authority. *1999 Draft Water Law* (Arabic).

_____. *Draft Strategy for Water Management in Palestine*. 1999.

_____. *Agricultural Water Management and Conservation Methods in Gaza*. Governorates Department of Planning and Water Resources, May 1999.

Palestinian Water Authority. *Integrated Water Resources Management, Identification of Needs and Investment Projects Vol.1, Gaza City*. December 1996.

_____. *Palestinian Water Authority Regulations*. Draft.

_____. *Water Sector Strategic Planning Study; Interim Report*. Executive Report, Vol. 1. Palestinian National Authority, December 1998.

_____, *Strategy for Water Management in Palestine, January 1999*. Palestinian National Authority.

Pallas, P. "Conjunctive Use of Surface and Groundwater, Land and Water Integration and River Basin Management," *FAO Land and Water Bulletin* 1 (1995).

Parsons, S.B. "The Development of a Water Resource Management Infrastructure for the West Bank and Gaza," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 497-503.

Pearce, Fred. "Wells of Conflict on the West Bank," *The New Scientist*, June 1, 1991, pp. 36-40.

_____. *The Dammed: Rivers, Dams and the Coming World Water Crisis*. London 1992.

Picard, E. "Aspects of International Law of the Water Conflict in the Middle East," in Bagis, Ali Ihsan (ed.), *Water as An Element of Cooperation and Development in the Middle East*, Ankara: Ayna Publications in cooperation with the Friederich Naumann Foundation in Turkey, 1994, pp 213-223.

Postel, Sandra. "Trouble on Tap. Valuing Water Resources as the Precious Commodity it Really is Would Go a Long Way Toward Staving off Shortages in the Next Century," *World Watch*, Vol. 2, No. 5 (1989); pp. 12-20.

Project in Development and the Environment (PRIDE). *A Strategy for Managing Jordan's Water Resources*. Technical Report No. 4. Washington DC: USAID, 1992.

Qashu, Hasan. *The Middle East Water Strategist: A Long-Term Framework for Integrated Water Resources Planning and Management*. Washington, DC, 1993.

Rached, Eglal; Rathgeber, Eva and Brooks, David (eds). *Water Management in Africa and the Middle East, Challenges and Opportunities*. Ottawa: International Development Research Center, 1996.

Reguer, Sara. "Controversial Waters: Exploitation of the Jordan River, 1950-1980," *Middle Eastern Studies*, vol. 29, no. 1 (January 1993), pp. 53-90.

Reiss, Peter; Al-Rashdan, Jamal and Hanbali, Mohammad. *Opportunities & Options for Participatory Irrigation Management in Central Jordan Valley, Water Quality Improvement and Conservation Project*. Report 3114-95-3b-02, DAI (USAID), January 1995.

Renger, J. "The Middle East Peace Process: Obstacles to Cooperation Over Shared Waters," in *Water in the Middle East: Potential for Conflicts and Prospects for Cooperation*. Berlin [etc.]: Springer, 1998, pp. 47-55.

Rivera, Daniel. *Private Sector Participation in the Water Supply and Wastewater Sector: Lessons from Six Developing Countries*. Directions in Development. Washington, DC: World Bank, 1996.

Rogers, Peter and Peter Lydon (eds.). *Water in the Arab World: Perspectives and Progress*. Cambridge, Mass.: Harvard University Press, 1994.

Rouyer, Alwyn R. "Zionism and Water: Influences on Israel's Water Policy During the Pre-State Period," *Arab Studies Quarterly*, vol. 18, no. 4 (Autumn 1996), pp. 25-48.

_____. "The Water Issue in the Palestinian-Israeli Peace Process," *Survival*, vol. 39, no. 2 (Summer 1997), pp. 57-81.

_____. *Turning Water Into Politics: The Water Issue in the Palestinian-Israeli Conflict*. Basingstoke [etc.]: Macmillan, 2000.

Rowland, M.A. "The Evolution of Two Water Resource Management Systems: Case Studies of Tampa Bay and the Middle East," in *Colorado Journal of International Environmental Law & Policy*, 11 (2000), no. 2, pp. 411-469.

Rowley, G. "Multinational and National Competition for Water in the Middle East: Towards the Deepening Crisis," *Journal of Environmental Management*, vol. 39, no. 3 (November 1993), pp. 187-198.

Sabbagh, A. "Conflict Over Water in the Middle East: From a Security and Strategic Point of View," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 505-514.

Sabbah, Walid, Jad Isaac et al., *Water Resources and Irrigated Agriculture in the West Bank*, Bethlehem: ARIJ, 1998.

Salameh, Elias. "Effects of the Mediterranean-Dead Sea Canal Project on Jordan's Groundwater Resources," in Farid, Abdel Majid and Hus-

sein Sirriyeh (eds.), *Israel & Arab Water. An international symposium, Amman 25-26 January 1984*. London: Ithaka, 1985, pp. 33-44.

_____. "Jordan's Water Resources: Development and Future Prospects," *Arab American Affairs*, (Summer 1990), pp. 69-77.

_____. "Analysis of the Middle East water: Problems and options of their solutions," in Bagis, Ali Ihsan (ed.), *Water as An Element of Cooperation and Development in the Middle East*, Ankara: Ayna Publications in cooperation with the Friederich Naumann Foundation in Turkey, 1994, pp. 321-337.

Salameh, Elias and Helen Bannayan. *Water Resources of Jordan. Present Status and Future Potentials*. Amman: Friedrich Ebert Stiftung, 1993.

Saleh, Anis Ezzat. *Internal Evaluation of Palestinian Water Industry*. Jerusalem: Palestinian Hydrology Group, January 1999.

Salem, H.S. "A Budget of the Surface and Underground Water in Northern Jordan," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 135-162.

Saleth, R. Maria and Ariel Dinar. *Water Challenge and Institutional Response: A Cross Country Perspective*. Washington, DC: World Bank, 1999.

Saliba, Samir N. *The Jordan River Dispute*. Den Haag: Martinus Unihet, 1968.

Salman, Salman M.A. *The Legal Framework for Water Users' Associations: A Comparative Study*. World Bank Technical Paper, no. 360, Washington, DC: World Bank, 1997.

Salmi, Ralph, H. "Water, the Red Line: The Interdependence of Palestinian and Israeli Water Resources," *Studies in Conflict & Terrorism*, vol. 20, no. 1 (January-March 1997), pp. 15-65.

Sbeith, M.Y. "Re-use of Waste Water for Irrigation in the West Bank: Some Aspects," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 339-350.

Scanlan, Kevin P., *The International Law Commission's First Ten Draft Articles on the Law of the Non-Navigational Uses of International Watercourses: Do They Adequately Address all the Major Issues of Water*

Usage in the Middle East? *Fordham International Law Journal*, Vol. 19, 2180, June 1996.

Scarpa, David J. "Eastward Groundwater Flow from the Mountain Aquifer," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 193-203.

Schechter, Mordechai. *Water Sharing Through Trade in Markets for Water Rights: An Illustrative Application to the Middle East*. Optimization of Conflict Resolution, Working Paper No. 4. University of Haifa, The Jewish-Arab Center/Gustav Heinemann-Institute of Middle Eastern Studies, 1994.

_____. "Sharing Water Resources in the Middle East: Economic Perspectives - Introductory Remarks," *Resource and Energy Economics*, vol. 16, no. 4 (November 1994), pp. 265-269.

Scheumann, W. & M. Schiffler (eds.). *Water in the Middle East: Potential for Conflicts and Prospects for Cooperation*. New York: Springer-Verlag, July 1998.

Schiff, Ze'ev. "Israel's Water Security Lines," in *Policywatch*, no. 75 (1993), pp. 1-3.

Schiffler, Manuel. "Sustainable Development of Water Resources in Jordan: Ecological and Economic Aspects in a Long-term Perspective," in *Water in the Middle East: Legal, Political and Commercial Implications*, London, [etc.]: Tauris Academic Studies, 1995, pp. 239-259.

_____. *The Economics of Groundwater Management in Arid Countries: Theory, International Experience and a Case Study of Jordan*. London, [etc.]: Frank Cass, 1998.

Schwarz, J. "Management of Israel's Water Resources," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 69-82.

Schwarzbach, David A. "Promised Land: But What About the Water?" *Amicus Journal*, vol. 17, no. 2 (Summer 1995), pp. 35-39.

Sexton, Richard. *Perspectives on the Middle East Water Crisis: Analyzing Water Scarcity Problems in Jordan and Israel*. London: ODI Publications, 1990.

_____. "The Middle East Water Crisis: Is it the Making of a New Middle East Regional Order?" *Capitalism, Environment, Socialism*, 3 (4), December 1992, pp. 65.

Shapland, Greg. *Rivers of Discord, International Water Disputes in the Middle East*. London: C. Hurst & Co./New York: St. Martin's Press, 1997.

Shatanawi, Muhammad R. "Legal and Institutional Aspects of Water Management in Jordan," in *Sustainable Development and Management of Water Resources: A Legal Framework for the Mediterranean*. Rome: Institute for Legal Studies on the International Community – CNR, 1999, pp. 187-195.

Shatanawi, Muhammad R. and Al-Jayyousi, Odeh. "Evaluating Market-Oriented Water Policies in Jordan: A Comparative Study," *Water International*, vol. 20 (1995), pp. 88-97.

Shawar, Tania. "The Emergency Natural Resources Protection Plan for Palestine West Bank Governorates," *Middle East Environment Watch*, vol. 2, no. 4 (Spring 2000), pp. 6 -7.

Shawwa, Isam R. "The Water Situation in Gaza," in Baskin, Gershon (ed.), *Water: Conflict or Cooperation*. Jerusalem: IPCRI, 1993, pp. 23-36.

_____. "Water Situation in the Gaza Strip," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 251-259.

Sherman, Martin. *The Politics of Water in the Middle East: An Israeli Perspective of the Hydro-Political Aspects of the Conflict*. MacMillan Press and St. Martin's Press, 1999.

Shute, H.J. "Water in the Arab-Israel Conflict," *International Perspectives* (July-August 1986), pp. 22-24.

Shuval, Hillel I. "Approaches to Resolving the Water Conflicts Between Israel and her Neighbors - A Regional Water for Peace Plan," *Water International*, vol. 17, no. 3 (1992), pp. 133-143.

_____. "Approaches to Finding an Equitable Solution to the Water Resources Problems Shared by Israelis and the Palestinians over the Use of the Mountain Aquifer," in Baskin, Gershon (ed.), *Water: Conflict or Cooperation*. Jerusalem: IPCRI, 1993, pp. 37-84.

_____. "An Inventory of the Water Resources of the Area of Israel and the Occupied Territories: Estimated Water Supply Potential and

Current Utilization," in Assaf, Karen, Al-Khatib, Nader, Kally, Elisha and Hillel Shuval (eds.), *A Proposal for the Development of a Regional Water Master Plan*. Jerusalem: IPCRI, 1993, pp. 73-114.

_____. "Proposed Principles and Methodology for the Equitable Allocation of the Water Resources Shared by the Israelis, Palestinians, Jordanians, Lebanese and Syrians," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 481-496.

_____. "Towards Resolving Conflicts over Water between Israel and its Neighbors: the Israeli-Palestinian Shared Use of the Mountain Aquifer as a Case Study," in *Water, Peace and the Middle East: Negotiating Resources in the Jordan Basin*. Library of Modern Middle East Studies, Vol. 9. New York: Tauris Academic Studies, 1996, pp.137-168.

_____. "A Water-for-Peace Plan," *Palestine-Israel Journal*, vol. III, no. 3/4 (Summer-Fall 1996), pp. 74-83.

_____. "Sustainable Water Development Under Conditions of Scarcity: Israel as a Case Study," in *Sustainable Development and Management of Water Resources: A Legal Framework for the Mediterranean*. Rome: Institute for Legal Studies on the International Community - CNR, 1999, pp. 196-223.

_____. "A Proposal for An Equitable Resolution to the Conflicts Between the Israelis and the Palestinians Over the Shared Water Resources of the Mountain Aquifer," *Arab Studies Quarterly*, 2000.

Smith, H.A. "The Waters of the Jordan: A Problem of International Water Control," *International Affairs*, vol. 25 (1949).

Soffer, Arnon. "The Litani River: Fact and Fiction," *Middle Eastern Studies*, vol. 30, no. 4 (October 1994), pp. 963-974.

_____. "The Relevance of the Johnston Plan to the Reality of 1993 and Beyond," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Conference on Water, Zürich, Switzerland, 10-13 December 1992*. Amsterdam [etc.]: Elsevier, 1994, pp. 107-121.

_____. *Rivers of Fire: The Conflict over Water in the Middle East*. Lanham, Md.: Rowan & Littlefield 1998.

Spiegel, Steven L. and David J. Pervin (eds.). *Practical Peacemaking in the Middle East, Vol. 2, The Environment, Water, Refugees, and Economic Cooperation and Development*. New York: Garland, 1995.

Starr, Joyce. "Water Wars," *Foreign Policy*, no. 82 (Spring 1991), pp. 17-36.

_____. "The Quest for Water from Biblical Times to the Present," *Environmental Science and Technology*, vol. 27, no. 7 (July 1993), pp. 1264-1267.

_____. *Covenant Over Middle Eastern Waters: Key to World Survival*. New York: H. Holt, 1995.

Starr, Joyce and Daniel C. Stoll. *United States Foreign Policy on Water Resources in the Middle East*. Washington DC: Center for Strategic & International Studies (CSIS), 1987.

Starr, Joyce and Daniel C. Stoll (eds.). *The Politics of Scarcity: Water in the Middle East*. Boulder, Co: Westview Press, 1988.

Stauffer, T., *Water and War in the Middle East: The Hydraulic Parameters of Conflict*, Washington, D.C.: The Center for Policy Analysis on Palestine, 1996.

Stout, Glenn E. and Radwan A. Al-Weshah (eds.). *International Symposium on Water Resources in the Middle East: Policy and Institutional Aspects*. Urbana, Ill: International Water Resources Association, 1993.

Stork, Joe. "Water and Israel's Occupation Strategy," *MERIP Reports* (July-August 1983), pp. 19-24.

Sutcliffe, Claud R. "The East Ghor Canal Project: A Case Study of Refugee Resettlement, 1961-1966," *The Middle East Journal*, vol. 27, no. 4 (Fall 1973), pp. 471-482.

Swain, Ashok. "A New Challenge: Water Scarcity in the Arab World," *Arab Studies Quarterly*, vol. 20, no. 1 (Winter 1998), pp. 1-11.

Systematic Index of International Water Resources Treaties, Declarations Acts and Cases by Basin. FAO, Legislative Study, 15, Rome, 1978.

Systematic Index of International Water Resources Treaties, Declarations Acts and Cases by Basin. FAO, Legislative Study, 34, Rome, 1984.

Al-Tamimi, Abdel Rahman. *Water: A Factor for Conflict or Peace in the Middle East*. Israeli-Palestinian Peace Research Project, Working Paper Series No. 20, Jerusalem: Harry Truman Research Institute, the Hebrew University 1991.

_____. "A Technical Framework for Final-Status Negotiations over Water," *Palestine-Israel Journal*, vol. III, no. 3/4 (Summer-Fall 1996), pp. 67-74.

_____. "Legal and Institutional Problems of Water Resources Management in Palestine," in *Sustainable Development and Management of Water Resources: A Legal Framework for the Mediterranean*. Rome: Institute for Legal Studies on the International Community - CNR, 1999, pp. 236-243.

Tarasofsky, Richard G. "International Law and Water Conflicts in the Middle East," *Environmental Policy and Law*, vol. 23, no. 2 (1 April 1993), pp. 70-73.

Teclaff, Ludwig. *The River Basin in History and Law*. The Hague: Nijhoff, 1967.

_____. *Abstraction and Use of Water. A Comparison of Legal Regimes*. United Nations, Department of Economic and Social Affairs (ST/ECA/154), 1972.

_____. *Legal and Institutional Responses to Growing Water Demand*. Legislative Study, 14, FAO, Rome, 1977.

Telerant, Niva. "Riparian Rights Under International Law: A Study of the Israeli-Jordan Peace Treaty," *Loyola of Los Angeles International and Comparative Law Journal*, vol. 18, (1995).

Tiffen, Mary. "Sustainable Resource Management and Project Planning," in J. T. Winpenny (ed.), *Development Research: The Environmental Challenge*. London: Overseas Development Institute, 1992, pp. 92-102.

Torbjorn, Damhaug. *Water Master Planning Co-operation Palestinian Water Authority (PWA), Strengthening of PWA's Planning Capacity*. Mission Report, 23 September 1998.

Treaties Concerning the Non-navigational Uses of International Watercourses, Asia. FAO Legislative Series, 55, FAO, Rome, 1995.

Trolldalen, Jon Martin. "Troubled Waters in the Middle East: The Process Towards the First Regional Water Declaration Between Jordan, Palestinian Authority, and Israel," *Natural Resources Journal*, vol. 21, no. 2 (May 1997), pp. 101-108.

Trolldalen, Jon Martin, N. P. Fjeld and J. Gjessing. *Water Resources Data for Decision Making in the Middle East* (three Volumes). Oslo: Centre for Environmental Studies and Resource Management (CESAR), 1995.

Trottier, Julie. *Hydropolitics in the West Bank and Gaza Strip*. Jerusalem: PASSIA, 1999.

_____. "Water and the Challenge of Palestinian Institution Building," *Journal of Palestine Studies*, vol. 29, no. 2 (Winter 2000), pp. 35-50.

Turan, Ilter. "Water Problems? Can the United Nations Help? A Discussion With Special Reference to the Middle East," *Water International*, vol. 21, no. 1 (1 March 1996), pp. 1-11.

Turan, Ilter and Gun Kut. "Political-Ideological Constraints on Intra-Basin Cooperation on Transboundary Waters," *Natural Resources Forum*, vol. 21, no. 2 (May 1997), pp. 139-145.

Turton, A.R. *Water State and Sovereignty: The Hydropolitical Challenges for States in Arid Regions*. MEWREW Occasional Paper, no. 5. SOAS, University of London, January 1999.

Tvedt, T. "The Struggle for Water in the Middle East," *Revue Canadienne d'Etude du Développement*, ISS/92 (1992).

Twite, Robin and Issac, Jad (eds.). *Our Shared Environment: Israelis and Palestinians Thinking Together About the Environment of the Region in Which They Live*. Jerusalem: Israel/Palestine Center for Research for Information, December 1994.

United Nations. *Ground Water in the Eastern Mediterranean and Western Asia*. Natural Resources Water Series No. 9, New York: UN, 1982.

_____. *Water and Peace in the Middle East*. Amman: UN, 26 January 1993. (E/ESCWA/ENR/1993/3).

_____. *Land and Water Policies in the Near East Region: Case Studies on Egypt, Jordan and Pakistan*. New York: UN, 1994. (E/ESCWA/AGR/1994/10).

_____. *Proceedings of the Expert Group Meeting on the Implications of Agenda 21 for Integrated Water Management in the ESCWA Region, Amman, 2-5 October 1995*. New York: UN, 1996. (E/ESCWA/ENR/1996/5)

_____. *Assessment of Water Quality in the ESCWA Region*. New York: UN, 1996.

_____. *Water Legislation in Selected ESCWA Member Countries*. New York: UN, 1997 (E/ESCWA/ENR/1997/2).

United Nations, Economic and Social Council (ECOSOC). "Permanent Sovereignty over National Resource in the Occupied Palestinian Territories," in *Journal of Palestine Studies*, Vol. 14, No. 2 (1985).

United Nations, Food and Agriculture Organization. *Water Resources of the Near East Region: A Review*. Rome: UN FAO, 1997.

United States Government, US Army Corps of Engineers. *Water in the Sand: A Survey of Middle East Water Issues*. Washington, DC, 1991.

United States National Academy of Sciences et. al. *Water for the Future. The West Bank and Gaza Strip, Israel and Jordan*, Washington: National Academy Press, 1999.

United States Agency for International Development. *Water Resources Action Plan for the Near East*. Washington, D.C: USAID Bureau for the Near East, 1993.

Valette, François and Hubert Colas. *Integrated Water Resources Management Modeling in Mediterranean Region, Rapport a la Commission Européenne*. Contribution to the Multilateral Working Group on Water Resources. Montpellier, France: Centre d'Ecotechniques du CNRS.

van Edig, Annette. *Aspects of Palestinian Water Rights*. Ramallah: Ramallah Center for Human Rights Studies, May 1999.

van Tuijl, Willem. *Improving Water Use in Agriculture. Experiences in the Middle East and North Africa*. World Bank Technical Paper. The World Bank: Washington DC, n.d.

Venema, Henry David; Schiller, Eric J. and Iwra, M. "Water Resources Planning for the Senegal River Basin," *Water International*, vol. 20 (1995), pp. 61-71.

Venter, A.J. "The Oldest Threat: Water in the Middle East," *Middle East Policy*, vol. 6, no. 1, (1998), pp. 126-136.

Vesilind, Priit J. "Water: The Middle East's Critical Resource," *National Geographic*, vol. 183, no. 5 (May 1993), pp. 38-71.

Wachtel, Boaz. "From Peace Pipelines to Peace Canals: The Search for a Solution to the Middle East Water Crisis," *Middle East Insight*, vol. 10 (November/December 1993), pp. 25-29.

_____. "The Peace Canal Project: a multiple conflict resolution perspective for the Middle East," in *Water and Peace in the Middle East: Proceedings of the First Israeli-Palestinian International Academic Con-*

Wolf, Aaron T. and J. Ross. "The Impact of Scarce Water Resources on the Arab-Israeli Conflict," *Natural Resources Journal*, vol. 32, no. 4 (1992), pp. 919-958.

The World Bank. *A Strategy for Managing Water in the Middle East and North Africa*. Washington, DC, 1993.

_____. *Developing the Occupied Territories. An Investment in Peace Vol. 1: Overview*. A World Bank Publication, September 1993.

_____. *From Scarcity to Security: Averting a Water Crisis in the Middle East and North Africa*. Washington, DC, 1996.

Wouters, Patricia, *An Assessment of Recent Development in International Water Courses Law through the Prism of Substantive Rules Governing Use Allocation*. *Natural Resources Journal*, 1996 (special issue).

Yalcintas, Nevzat et al. *Water Conflict in the Middle East*. Istanbul: Aydinlar Ocagi, 1996. p.

Yaron, Dan. "An Approach to the Problem of Water Allocation to Israel and the Palestinian Entity," *Resources and Energy Economics*, vol. 16, no. 4 (November 1994), pp. 271-287.

Zarour, Hisham and Jad Isaac. "Nature's Apportionment and the Open Market: A Promising Solution to the Arab-Israeli Water Conflict," *Water International*, vol. 15, no. 4 (1993), pp. 40-53.

Zeitouni, Naomi. *Two Models of Water Market Mechanisms with an Illustrative Application to the Middle East*. Milano: [s.n.], 1994.

Zeitouni, Naomi, Becker, Nir and Mordechai Shechter. "Sharing Water Resources in the Middle East: Economic Perspectives," *Resource and Energy Economics*, vol. 16, no. 4 (November 1994).

_____. "Models of Water Market Mechanisms and an Illustrative Application to the Middle East," *Resources and Energy Economics*, vol. 16, no. 4 (November 1994), pp. 303-320.

Zeitouni, Naomi and Ariel Dinar. "Mitigating Negative Water Quality and Quality Externalities by Joint Management and Adjacent Aquifers," *Environmental and Resource Economics*, vol. 9, no. 1 (January 1997), pp. 1-20.

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WATER-RELATED DOCUMENTS

Document 1:

DECLARATION OF PRINCIPLES ON INTERIM SELF-GOVERNMENT ARRANGEMENTS SEPTEMBER 13, 1993

ARTICLE VII - INTERIM AGREEMENT

4. In order to enable the Council to promote economic growth, upon its inauguration, the Council will establish, among other things, a Palestinian Electricity Authority, a Gaza Sea Port Authority, a Palestinian Development Bank, a Palestinian Export Promotion Board, a Palestinian Environmental Authority, a Palestinian Land Authority and a Palestinian Water Administration Authority, and any other Authorities agreed upon, in accordance with the Interim Agreement that will specify their powers and responsibilities.

ANNEX III - PROTOCOL ON ISRAELI-PALESTINIAN COOPERATION IN ECONOMIC AND DEVELOPMENT PROGRAMS

The two sides agree to establish an Israeli-Palestinian continuing Committee for Economic Cooperation, focusing, among other things, on the following:

1. Cooperation in the field of water, including a Water Development Program prepared by experts from both sides, which will also specify the mode of cooperation in the management of water resources in the West Bank and Gaza Strip, and will include proposals for studies and plans on water rights of each party, as well as on the equitable utilization of joint water resources for implementation in and beyond the interim period.

Document 2:

TREATY OF PEACE BETWEEN THE STATE OF ISRAEL AND THE HASHEMITE KINGDOM OF JORDAN 26 OCTOBER 1994

ARTICLE 6 - WATER

With the view to achieving a comprehensive and lasting settlement of all the water problems between them:

1. The Parties agree mutually to recognize the rightful allocations of both of them in Jordan River and Yarmouk River waters and Araba/Arava ground water in accordance with the agreed acceptable principles, quantities and quality as set out in Annex II , which shall be fully respected and complied with.
2. The Parties, recognizing the necessity to find a practical, just and agreed solution to their water problems and with the view that the subject of water can form the basis for the advancement of co- operation between them, jointly undertake to ensure that the management and development of their water resources do not, in any way, harm the water resources of the other Party.
3. The Parties recognize that their water resources are not sufficient to meet their needs. More water should be supplied for their use through various methods, including projects of regional and international co-operation.
4. In light of paragraph 3 of this Article, with the understanding that co-operation in water-related subjects would be to the benefit of both Parties, and will help alleviate their water shortages, and that water issues along their entire boundary must be dealt with in their totality, including the possibility of trans-boundary water transfers, the Parties agree to search for ways to alleviate water shortage and to co- operate in the following fields:
 - a. development of existing and new water resources, increasing the water availability including co- operation on a regional basis as appropriate, and minimizing wastage of water resources through the chain of their uses;
 - b. prevention of contamination of water resources;
 - c. mutual assistance in the alleviation of water shortages;
 - d. transfer of information and joint research and development in water-related subjects, and review of the potentials for enhancement of water resources development and use.
5. The implementation of both Parties' undertakings under this Article is detailed in Annex II.

ANNEX II - WATER RELATED MATTERS

Pursuant to Article 6 of the Treaty, Israel and Jordan agreed on the following Articles on water related matters:

Article I: Allocation

1. Water from the Yarmouk River
 - a. Summer period - 15th May to 15th October of each year. Israel pumps (12) MCM and Jordan gets the rest of the flow.
 - b. Winter period - 16th October to 14th May of each year. Israel pumps (13) MCM and Jordan is entitled to the rest of the flow subject to provisions outlined herein below: Jordan concedes to

Israel pumping an additional (20) MCM from the Yarmouk in winter in return for Israel conceding to transferring to Jordan during the summer period the quantity specified in paragraphs (2.a) below from the Jordan River.

- c. In order that waste of water will be minimized, Israel and Jordan may use, downstream of point 121/Adassiya Diversion, excess floodwater that is not usable and will evidently go to waste unused.

2. Water from the Jordan River

- a. Summer period - 15th May to 15th October of each year. In return for the additional water that Jordan concedes to Israel in winter in accordance with paragraph (1.b) above, Israel concedes to transfer to Jordan in the summer period (20) MCM from the Jordan River directly upstream from Deganya gates on the river. Jordan shall pay the operation and maintenance cost of such transfer through existing systems (not including capital cost) and shall bear the total cost of any new transmission system. A separate protocol shall regulate this transfer.
- b. Winter period - 16th October to 14th May of each year. Jordan is entitled to store for its use a minimum average of (20) MCM of the floods in the Jordan River south of its confluence with the Yarmouk (as outlined in Article II below). Excess floods that are not usable and that will otherwise be wasted can be utilized for the benefit of the two Parties including pumped storage off the course of the river.
- c. In addition to the above, Israel is entitled to maintain its current uses of the Jordan River waters between its confluence with the Yarmouk and its confluence with Tirat Zvi/Wadi Yabis. Jordan is entitled to an annual quantity equivalent to that of Israel, provided however, that Jordan's use will not harm the quantity or quality of the above Israeli uses. The Joint Water Committee (outlined in Article VII below) will survey existing uses for documentation and prevention of appreciable harm.
- d. Jordan is entitled to an annual quantity of (10) MCM of desalinated water from the desalination of about (20) MCM of saline springs now diverted to the Jordan River. Israel will explore the possibility of financing the operation and maintenance cost of the supply to Jordan of this desalinated water (not including capital cost). Until the desalination facilities are operational, and upon the entry into force of the Treaty, Israel will supply Jordan (10) MCM of Jordan River water from the same location as in (2. a) above, outside the summer period and during dates Jordan selects, subject to the maximum capacity of transmission.

3. Additional Water

Israel and Jordan shall cooperate in finding sources for the supply to Jordan of an additional quantity of (50) MCM/year of water of drinkable

standards. To this end, the Joint Water Committee will develop, within one year from the entry into force of the Treaty, a plan for the supply to Jordan of the abovementioned additional water. This plan will be forwarded to the respective governments for discussion and decision.

4. Operation and Maintenance

- a. Operation and maintenance of the systems on Israeli territory that supply Jordan with water, and their electricity supply, shall be Israel's responsibility. The operation and maintenance of the new systems that serve only Jordan will be contracted at Jordan's expense to authorities or companies selected by Jordan.
- b. Israel will guarantee easy unhindered access of personnel and equipment to such new systems for operation and maintenance. This subject will be further detailed in the agreements to be signed between Israel and the authorities or companies selected by Jordan.

Article II: Storage

1. Israel and Jordan shall cooperate to build a diversion/storage dam on the Yarmouk River directly downstream of the point 121/Adassiya Diversion. The purpose is to improve the diversion efficiency into the King Abdullah Canal of the water allocation of the Hashemite Kingdom of Jordan, and possibly for the diversion of Israel's allocation of the river water. Other purposes can be mutually agreed.
2. Israel and Jordan shall cooperate to build a system of water storage on the Jordan River, along their common boundary, between its confluence with the Yarmouk River and its confluence with Tirat Zvi/ Wadi Yabis, in order to implement the provision of paragraph (2.b) of Article I above. The storage system can also be made to accommodate more floods; Israel may use up to (3) MCM/year of added storage capacity.
3. Other storage reservoirs can be discussed and agreed upon mutually.

Article III: Water Quality and Protection

1. Israel and Jordan each undertake to protect, within their own jurisdiction, the shared waters of the Jordan and Yarmouk Rivers, and Arava/Araba groundwater, against any pollution, contamination, harm or unauthorized withdrawals of each other's allocations.
2. For this purpose, Israel and Jordan will jointly monitor the quality of water along their boundary, by use of jointly established monitoring stations to be operated under the guidance of the Joint Water Committee.
3. Israel and Jordan will each prohibit the disposal of municipal and industrial wastewater into the course of the Yarmouk or the Jordan Rivers before they are treated to standards allowing their unrestricted agricultural use. Implementation of this prohibition shall be completed within three years from the entry into force of the Treaty.

4. The quality of water supplied from one country to the other at any given location shall be equivalent to the quality of the water used from the same location by the supplying country.
5. Saline springs currently diverted to the Jordan River are earmarked for desalination within four years. Both countries shall cooperate to ensure that the resulting brine will not be disposed of in the Jordan River or in any of its tributaries.
6. Israel and Jordan will each protect water systems in its own territory, supplying water to the other, against any pollution, contamination, harm or unauthorised withdrawal of each other's allocations.

Article IV: Groundwater in Emek Ha'arava/Wadi Araba

1. In accordance with the provisions of this Treaty, some wells drilled and used by Israel along with their associated systems fall on the Jordanian side of the borders. These wells and systems are under Jordan's sovereignty. Israel shall retain the use of these wells and systems in the quantity and quality detailed in Appendix to this Annex, that shall be jointly prepared by 31st December, 1994. Neither country shall take, nor cause to be taken, any measure that may appreciably reduce the yields of quality of these wells and systems.
2. Throughout the period of Israel's use of these wells and systems, replacement of any well that may fail among them shall be licensed by Jordan in accordance with the laws and regulations then in effect. For this purpose, the failed well shall be treated as though it was drilled under license from the competent Jordanian authority at the time of its drilling. Israel shall supply Jordan with the log of each of the wells and the technical information about it to be kept on record. The replacement well shall be connected to the Israeli electricity and water systems.
3. Israel may increase the abstraction rate from wells and systems in Jordan by up to (10) MCM/year above the yields referred to in paragraph 1 above, subject to a determination by the Joint Water Committee that this undertaking is hydrogeologically feasible and does not harm existing Jordanian uses. Such increase is to be carried out within five years from the entry into force of the Treaty.
4. Operation and Maintenance
 - a. Operation and maintenance of the wells and systems on Jordanian territory that supply Israel with water, and their electricity supply shall be Jordan's responsibility. The operation and maintenance of these wells and systems will be contracted at Israel's expense to authorities or companies selected by Israel.
 - b. Jordan will guarantee easy unhindered access of personnel and equipment to such wells and systems for operation and maintenance. This subject will be further detailed in the agreements to be signed between Jordan and the authorities or companies selected by Israel.

Article V: Notification and Agreement

1. Artificial changes in or of the course of the Jordan and Yarmouk Rivers can only be made by mutual agreement.
2. Each country undertakes to notify the other, six months ahead of time, of any intended projects, which are likely to change the flow of either of the above rivers along their common boundary, or the quality of such flow. The subject will be discussed in the Joint Water Committee with the aim of preventing harm and mitigating adverse impacts such projects may cause.

Article VI: Co-operation

1. Israel and Jordan undertake to exchange relevant data on water resources through the Joint Water Committee.
2. Israel and Jordan shall co-operate in developing plans for purposes of increasing water supplies and improving water use efficiency, within the context of bilateral, regional or international cooperation.

Article VII: Joint Water Committee

1. For the purpose of the implementation of this Annex, the Parties will establish a Joint Water Committee comprised of three members from each country.
2. The Joint Water Committee will, with the approval of the respective governments, specify its work procedures, the frequency of its meetings, and the details of its scope of work. The Committee may invite experts and/or advisors as may be required.
3. The Committee may form, as it deems necessary, a number of specialized sub-committees and assign them technical tasks. In this context, it is agreed that these sub-committees will include a northern sub-committee and a southern sub-committee, for the management on the ground of the mutual water resources in these sectors.

Document 3:

**OSLO II INTERIM AGREEMENT, ANNEX III
WASHINGTON, D.C., 28 SEPTEMBER 1995**

ARTICLE 40: Water and Sewage

On the basis of goodwill, both sides have reached the following agreement in the sphere of Water and Sewage:

Principles

1. Israel recognizes the Palestinian water rights in the West Bank. These will be negotiated in the permanent status negotiations and settled in

the Permanent Status Agreement relating to the various water resources.

2. Both sides recognize the necessity to develop additional water for various uses.
3. While respecting each side's powers and responsibilities in the sphere of water and sewage in their respective areas, both sides agree to coordinate the management of water and sewage resources and systems in the West Bank during the interim period, in accordance with the following principles:
 - a. Maintaining existing quantities of utilization from the resources, taking into consideration the quantities of additional water for the Palestinians from the Eastern Aquifer and other agreed sources in the West Bank as detailed in this Article.
 - b. Preventing the deterioration of water quality in water resources.
 - c. Using the water resources in a manner, which will ensure sustainable use in the future, in quantity and quality.
 - d. Adjusting the utilization of the resources according to variable climatological and hydrological conditions.
 - e. Taking all necessary measures to prevent any harm to water resources, including those utilized by the other side.
 - f. Treating, reusing or properly disposing of all domestic, urban, industrial, and agricultural sewage.
 - g. Existing water and sewage systems shall be operated, maintained and developed in a coordinated manner, as set out in this Article.
 - h. Each side shall take all necessary measures to prevent any harm to the water and sewage systems in their respective areas.
 - i. Each side shall ensure that the provisions of this Article are applied to all resources and systems, including those privately owned or operated, in their respective areas.

Transfer of Authority

4. The Israeli side shall transfer to the Palestinian side, and the Palestinian side shall assume, powers and responsibilities in the sphere of water and sewage in the West Bank related solely to Palestinians, that are currently held by the military government and its Civil Administration, except for the issues that will be negotiated in the permanent status negotiations, in accordance with the provisions of this Article.
5. The issue of ownership of water and sewage related infrastructure in the West Bank will be addressed in the permanent status negotiations.

Additional Water

6. Both sides have agreed that the future needs of the Palestinians in the West Bank are estimated to be between 70 - 80 mcm/year.

7. In this framework, and in order to meet the immediate needs of the Palestinians in fresh water for domestic use, both sides recognize the necessity to make available to the Palestinians during the interim period a total quantity of 28.6 mcm/year, as detailed below:
 - a. Israeli Commitment:
 1. Additional supply to Hebron and the Bethlehem area, including the construction of the required pipeline - 1 mcm/year.
 2. Additional supply to Ramallah area - 0.5 mcm/year.
 3. Additional supply to an agreed take-off point in the Salfit area - 0.6 mcm/year.
 4. Additional supply to the Nablus area - 1 mcm/year.
 5. The drilling of an additional well in the Jenin area - 1.4 mcm/yr.
 6. Additional supply to the Gaza Strip - 5 mcm/year.
 7. The capital cost of items (1) and (5) above shall be borne by Israel.
 - b. Palestinian Responsibility:
 1. An additional well in the Nablus area - 2.1 mcm/year.
 2. Additional supply to the Hebron, Bethlehem and Ramallah areas from the Eastern Aquifer or other agreed sources in the West Bank - 17 mcm/year.
 3. A new pipeline to convey the 5 mcm/year from the existing Israeli water system to the Gaza Strip. In the future, this quantity will come from desalination in Israel.
 4. The connecting pipeline from the Salfit take-off point to Salfit.
 5. The connection of the additional well in the Jenin area to the consumers.
 6. The remainder of the estimated quantity of the Palestinian needs mentioned in paragraph 6 above, over the quantities mentioned in this paragraph (41.4 - 51.4 mcm/year), shall be developed by the Palestinians from the Eastern Aquifer and other agreed sources in the West Bank. The Palestinians will have the right to utilize this amount for their needs (domestic and agricultural).
8. The provisions of paragraphs 6-7 above shall not prejudice the provisions of paragraph 1 to this Article.
9. Israel shall assist the Council in the implementation of the provisions of paragraph 7 above, including the following:
 - a. Making available all relevant data.
 - b. Determining the appropriate locations for drilling of wells.
10. In order to enable the implementation of paragraph 7 above, both sides shall negotiate and finalize as soon as possible a Protocol concerning the above projects, in accordance with paragraphs 18-19 below.

The Joint Water Committee

11. In order to implement their undertakings under this Article, the two sides will establish, upon the signing of this Agreement, a perma-

ment Joint Water Committee (JWC) for the interim period, under the auspices of the CAC.

12. The function of the JWC shall be to deal with all water and sewage related issues in the West Bank including, inter alia:
 - a. Coordinated management of water resources.
 - b. Coordinated management of water and sewage systems.
 - c. Protection of water resources and water and sewage systems.
 - d. Exchange of information relating to water and sewage laws and regulations.
 - e. Overseeing the operation of the joint supervision and enforcement mechanism.
 - f. Resolution of water and sewage related disputes.
 - g. Cooperation in the field of water and sewage, as detailed in this Article.
 - h. Arrangements for water supply from one side to the other.
 - i. Monitoring systems. The existing regulations concerning measurement and monitoring shall remain in force until the JWC decides otherwise.
 - j. Other issues of mutual interest in the sphere of water and sewage.
13. The JWC shall be comprised of an equal number of representatives from each side.
14. All decisions of the JWC shall be reached by consensus, including the agenda, its procedures and other matters.
15. Detailed responsibilities and obligations of the JWC for the implementation of its functions are set out in Schedule 8.

Supervision and Enforcement Mechanism

16. Both sides recognize the necessity to establish a joint mechanism for supervision over and enforcement of their agreements in the field of water and sewage, in the West Bank.
17. For this purpose, both sides shall establish, upon the signing of this Agreement, Joint Supervision and Enforcement Teams (JSET), whose structure, role, and mode of operation is detailed in Schedule 9.

Water Purchases

18. Both sides have agreed that in the case of purchase of water by one side from the other, the purchaser shall pay the full real cost incurred by the supplier, including the cost of production at the source and the conveyance all the way to the point of delivery. Relevant provisions will be included in the Protocol referred to in paragraph 19 below.
19. The JWC will develop a Protocol relating to all aspects of the supply of water from one side to the other, including, inter alia, reliability of supply, quality of supplied water, schedule of delivery and off-set of debts.

Mutual Cooperation

20. Both sides will cooperate in the field of water and sewage, including, inter alia:
- a. Cooperation in the framework of the Israeli-Palestinian Continuing Committee for Economic Cooperation, in accordance with the provisions of Article XI and Annex III of the Declaration of Principles.
 - b. Cooperation concerning regional development programs, in accordance with the provisions of Article XI and Annex IV of the Declaration of Principles.
 - c. Cooperation, within the framework of the joint Israeli-Palestinian-American Committee, on water production and development related projects agreed upon by the JWC.
 - d. Cooperation in the promotion and development of other agreed water-related and sewage-related joint projects, in existing or future multi-lateral forums.
 - e. Cooperation in water-related technology transfer, research and development, training, and setting of standards.
 - f. Cooperation in the development of mechanisms for dealing with water-related and sewage related natural and man-made emergencies and extreme conditions.
 - g. Cooperation in the exchange of available relevant water and sewage data, including:
 1. Measurements and maps related to water resources and uses.
 2. Reports, plans, studies, researches and project documents related to water and sewage.
 3. Data concerning the existing extractions, utilization and estimated potential of the Eastern, North-Eastern and Western Aquifers (attached as Schedule 10).

Protection of Water Resources and Water and Sewage Systems

21. Each side shall take all necessary measures to prevent any harm, pollution, or deterioration of water quality of the water resources.
22. Each side shall take all necessary measures for the physical protection of the water and sewage systems in their respective areas.
23. Each side shall take all necessary measures to prevent any pollution or contamination of the water and sewage systems, including those of the other side.
24. Each side shall reimburse the other for any unauthorized use of or sabotage to water and sewage systems situated in the areas under its responsibility which serve the other side.

The Gaza Strip

25. The existing agreements and arrangements between the sides concerning water resources and water and sewage systems in the Gaza Strip shall remain unchanged, as detailed in Schedule 11.

SCHEDULE 8 - Joint Water Committee

Pursuant to Article 40, paragraph 15 of this Appendix, the obligations and responsibilities of the JWC shall include:

1. Coordinated management of the water resources as detailed hereunder, while maintaining the existing utilization from the aquifers as detailed in Schedule 10, and taking into consideration the quantities of additional water for the Palestinians as detailed in Article 40. It is understood that the above-mentioned Schedule 10 contains average annual quantities, which shall constitute the basis and guidelines for the operation and decisions of the JWC:
 - a. All licensing and drilling of new wells and the increase of extraction from any water source, by either side, shall require the prior approval of the JWC.
 - b. All development of water resources and systems, by either side, shall require the prior approval of the JWC.
 - c. Notwithstanding the provisions of a. and b. above, it is understood that the projects for additional water detailed in paragraph 7 of Article 40, are agreed in principle between the two sides. Accordingly, only the geo-hydrological and technical details and specifications of these projects shall be brought before the JWC for approval prior to the commencement of the final design and implementation process.
 - d. When conditions, such as climatological or hydrological variability, dictate a reduction or enable an increase in the extraction from a resource, the JWC shall determine the changes in the extractions and in the resultant supply. These changes will be allocated between the two sides by the JWC in accordance with methods and procedures determined by it.
 - e. The JWC shall prepare, within three months of the signing of this Agreement, a Schedule to be attached to this Agreement, of extraction quotas from the water resources, based on the existing licenses and permits. The JWC shall update this Schedule on a yearly basis and as otherwise required.
2. Coordinated management of water and sewage systems in the West Bank, as follows:
 - a. Existing water and sewage systems, which serve the Palestinian population solely, shall be operated and maintained by the Palestinian side solely, without interference or obstructions, in accordance with the provisions of Article 40.
 - b. Existing water and sewage systems serving Israelis, shall continue to be operated and maintained by the Israeli side solely, without interference or obstructions, in accordance with the provisions of Article 40.

- c. The systems referred to in a and b above shall be defined on Maps to be agreed upon by the JWC within three months from the signing of this Agreement.
- d. Plans for construction of new water and sewage systems or modification of existing systems require the prior approval of the JWC.

SCHEDULE 9 - Supervision and Enforcement Mechanism

Pursuant to Article 40, Paragraph 17 of this Appendix:

1. Both sides shall establish, upon the signing of this Agreement, no less than five Joint Supervision and Enforcement Teams (JSETs) for the West Bank, under the control and supervision of the JWC, which shall commence operation immediately.
2. Each JSET shall be comprised of no less than two representatives from each side, each side in its own vehicle, unless otherwise agreed. The JWC may agree on changes in the number of JSETs and their structure.
3. Each side will pay its own costs, as required to carry out all tasks detailed in this Schedule. Common costs will be shared equally.
4. The JSETs shall operate, in the field, to monitor, supervise and enforce the implementation of Article 40 and this Schedule, and to rectify the situation whenever an infringement has been detected, concerning the following:
 - a. Extraction from water resources in accordance with the decisions of the JWC, and the Schedule to be prepared by it in accordance with sub- paragraph 1.e of Schedule 8.
 - b. Unauthorized connections to the supply systems and unauthorized water uses;
 - c. Drilling of wells and development of new projects for water supply from all sources;
 - d. Prevention of contamination and pollution of water resources and systems;
 - e. Ensuring the execution of the instructions of the JWC on the operation of monitoring and measurement systems;
 - f. Operation and maintenance of systems for collection, treatment, disposal and reuse, of domestic and industrial sewage, of urban and agricultural runoff, and of urban and agricultural drainage systems;
 - g. The electric and energy systems which provide power to all the above systems;
 - h. The Supervisory Control and Data Acquisition (SCADA) systems for all the above systems;
 - i. Water and sewage quality analyses carried out in approved laboratories, to ascertain that these laboratories operate according to accepted standards and practices, as agreed by the JWC. A list of the approved laboratories will be developed by the JWC;
 - j. Any other task, as instructed by the JWC.

5. Activities of the JSETs shall be in accordance with the following:
- a. The JSETs shall be entitled, upon coordination with the relevant DCO, to free, unrestricted and secure access to all water and sewage facilities and systems, including those privately owned or operated, as required for the fulfillment of their function.
 - b. All members of the JSET shall be issued identification cards, in Arabic, Hebrew and English containing their full names and a photograph.
 - c. Each JSET will operate in accordance with a regular schedule of site visits, to wells, springs and other water sources, water works, and sewage systems, as developed by the JWC.
 - d. In addition, either side may require that a JSET visit a particular water or sewage facility or system, in order to ensure that no infringements have occurred. When such a requirement has been issued, the JSET shall visit the site in question as soon as possible, and no later than within 24 hours.
 - e. Upon arrival at a water or sewage facility or system, the JSET shall collect and record all relevant data, including photographs as required, and ascertain whether an infringement has occurred. In such cases, the JSET shall take all necessary measures to rectify it, and reinstate the status quo ante, in accordance with the provisions of this Agreement. If the JSET cannot agree on the actions to be taken, the matter will be referred immediately to the two Chairmen of the JWC for decision.
 - f. The JSET shall be assisted by the DCOs and other security mechanisms established under this Agreement, to enable the JSET to implement its functions.
 - g. The JSET shall report its findings and operations to the JWC, using forms which will be developed by the JWC.

SCHEDULE 10 - Data Concerning Aquifers

Pursuant to Article 40, paragraph 20 and Schedule 8 paragraph 1 of this Appendix:

The existing extractions, utilization and estimated potential of the Eastern, North-Eastern, and Western Aquifers are as follows:

Eastern Aquifer:

- In the Jordan Valley, 40 mcm to Israeli users, from wells;
- 24 mcm to Palestinians, from wells;
- 30 mcm to Palestinians, from springs;
- 78 mcm remaining quantities to be developed from the Eastern Aquifer;
- Total = 172 mcm.

North-Eastern Aquifer:

103 mcm to Israeli users, from the Gilboa and Beisan springs, including from wells;

25 mcm to Palestinian users around Jenin;

17 mcm to Palestinian users from East Nablus springs;

Total = 145 mcm.

Western Aquifer:

340 mcm used within Israel;

20 mcm to Palestinians;

2 mcm to Palestinians, from springs near Nablus;

Total = 362 mcm.

All figures are average annual estimates. The total annual recharge is 679 mcm.

SCHEDULE 11 - The Gaza Strip

Pursuant to Article 40, Paragraph 25:

1. All water and sewage (hereinafter referred to as "water") systems and resources in the Gaza Strip shall be operated, managed and developed (including drilling) by the Council, in a manner that shall prevent any harm to the water resources.
2. As an exception to paragraph 1., the existing water systems supplying water to the Settlements and the Military Installation Area, and the water systems and resources inside them shall continue to be operated and managed by Mekoroth Water Co.
3. All pumping from water resources in the Settlements and the Military Installation Area shall be in accordance with existing quantities of drinking water and agricultural water. Without derogating from the powers and responsibilities of the Council, the Council shall not adversely affect these quantities. Israel shall provide the Council with all data concerning the number of wells in the Settlements and the quantities and quality of the water pumped from each well, on a monthly basis.
4. Without derogating from the powers and responsibilities of the Council, the Council shall enable the supply of water to the Gush Katif settlement area and Kfar Darom settlement by Mekoroth, as well as the maintenance by Mekoroth of the water systems supplying these locations.
5. The Council shall pay Mekoroth for the cost of water supplied from Israel and for the real expenses incurred in supplying water to the Council.
6. All relations between the Council and Mekoroth shall be dealt with in a commercial agreement.

7. The Council shall take the necessary measures to ensure the protection of all water systems in the Gaza Strip.
8. The two sides shall establish a subcommittee to deal with all issues of mutual interest including the exchange of all relevant data to the management and operation of the water resources and systems and mutual prevention of harm to water resources.
9. The subcommittee shall agree upon its agenda and upon the procedures and manner of its meetings, and may invite experts or advisers as it sees fit.

Document 4:

**CONVENTION ON THE LAW OF THE NON-NAVIGATIONAL USES
OF INTERNATIONAL WATERCOURSES, ADOPTED BY UNGA
RESOLUTION 51/229 OF 21 MAY 1997**

The Parties to the present Convention,

Conscious of the importance of international watercourses and the non-navigational uses thereof in many regions of the world,

Having in mind Article 13, paragraph 1 (a), of the Charter of the United Nations, which provides that the General Assembly shall initiate studies and make recommendations for the purpose of encouraging the progressive development of international law and its codification,

Considering that successful codification and progressive development of rules of international law regarding non-navigational uses of international watercourses would assist in promoting and implementing the purposes and principles set forth in Articles 1 and 2 of the Charter of the United Nations,

Taking into account the problems affecting many international watercourses resulting from, among other things, increasing demands and pollution,

Expressing the conviction that a framework convention will ensure the utilization, development, conservation, management and protection of international watercourses and the promotion of the optimal and sustainable utilization thereof for present and future generations,

Affirming the importance of international cooperation and good-neighbourliness in this field,

Aware of the special situation and needs of developing countries, Recalling the principles and recommendations adopted by the United Nations Conference on Environment and Development of 1992 in the Rio Declaration and Agenda 21,

Recalling also the existing bilateral and multilateral agreements regarding the non-navigational uses of international watercourses,

Mindful of the valuable contribution of international organizations, both governmental and non-governmental, to the codification and progressive development of international law in this field,

Appreciative of the work carried out by the International Law Commission on the law of the non-navigational uses of international watercourses,

Bearing in mind United Nations General Assembly resolution 49/52 of 9 December 1994,

Have agreed as follows:

PART I - INTRODUCTION

Article 1 - Scope of the present Convention

1. The present Convention applies to uses of international watercourses and of their waters for purposes other than navigation and to measures of protection, preservation and management related to the uses of those watercourses and their waters.
2. The uses of international watercourses for navigation is not within the scope of the present Convention except insofar as other uses affect navigation or are affected by navigation.

Article 2 - Use of terms

For the purposes of the present Convention:

- (a) "Watercourse" means a system of surface waters and ground waters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus;
- (b) "International watercourse" means a watercourse, parts of which are situated in different States;
- (c) "Watercourse State" means a State Party to the present Convention in whose territory part of an international watercourse is situated, or a Party that is a regional economic integration organization, in the territory of one or more of whose Member States part of an international watercourse is situated;
- (d) "Regional economic integration organization" means an organization constituted by sovereign States of a given region, to which its member States have transferred competence in respect of matters governed by this Convention and which has been duly authorized in accordance with its internal procedures, to sign, ratify, accept, approve or accede to it.

Article 3 - Watercourse agreements

1. In the absence of an agreement to the contrary, nothing in the present Convention shall affect the rights or obligations of a watercourse State arising from agreements in force for it on the date on which it became a party to the present Convention.

2. Notwithstanding the provisions of paragraph 1, parties to agreements referred to in paragraph 1 may, where necessary, consider harmonizing such agreements with the basic principles of the present Convention.
3. Watercourse States may enter into one or more agreements, hereinafter referred to as "watercourse agreements", which apply and adjust the provisions of the present Convention to the characteristics and uses of a particular international watercourse or part thereof.
4. Where a watercourse agreement is concluded between two or more watercourse States, it shall define the waters to which it applies. Such an agreement may be entered into with respect to an entire international watercourse or any part thereof or a particular project, program or use except insofar as the agreement adversely affects, to a significant extent, the use by one or more other watercourse States of the waters of the watercourse, without their express consent.
5. Where a watercourse State considers that adjustment and application of the provisions of the present Convention is required because of the characteristics and uses of a particular international watercourse, watercourse States shall consult with a view to negotiating in good faith for the purpose of concluding a watercourse agreement or agreements.
6. Where some but not all watercourse States to a particular international watercourse are parties to an agreement, nothing in such agreement shall affect the rights or obligations under the present Convention of watercourse States that are not parties to such an agreement.

Article 4 - Parties to watercourse agreements

1. Every watercourse State is entitled to participate in the negotiation of and to become a party to any watercourse agreement that applies to the entire international watercourse, as well as to participate in any relevant consultations.
2. A watercourse State whose use of an international watercourse may be affected to a significant extent by the implementation of a proposed watercourse agreement that applies only to a part of the watercourse or to a particular project, program or use is entitled to participate in consultations on such an agreement and, where appropriate, in the negotiation thereof in good faith with a view to becoming a party thereto, to the extent that its use is thereby affected.

PART II - GENERAL PRINCIPLES

Article 5 - Equitable and reasonable utilization and participation

1. Watercourse States shall in their respective territories utilize an international watercourse in an equitable and reasonable manner. In particular, an international watercourse shall be used and developed by watercourse States with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the in-

terests of the watercourse States concerned, consistent with adequate protection of the watercourse.

2. Watercourse States shall participate in the use, development and protection of an international watercourse in an equitable and reasonable manner. Such participation includes both the right to utilize the watercourse and the duty to cooperate in the protection and development thereof, as provided in the present Convention.

Article 6 - Factors relevant to equitable and reasonable utilization

1. Utilization of an international watercourse in an equitable and reasonable manner within the meaning of article 5 requires taking into account all relevant factors and circumstances, including:
 - (a) Geographic, hydrographic, hydrological, climatic, ecological and other factors of a natural character;
 - (b) The social and economic needs of the watercourse States concerned;
 - (c) The population dependent on the watercourse in each watercourse State;
 - (d) The effects of the use or uses of the watercourses in one watercourse State on other watercourse States;
 - (e) Existing and potential uses of the watercourse;
 - (f) Conservation, protection, development and economy of use of the water resources of the watercourse and the costs of measures taken to that effect;
 - (g) The availability of alternatives, of comparable value, to a particular planned or existing use.
2. In the application of article 5 or paragraph 1 of this article, watercourse States concerned shall, when the need arises, enter into consultations in a spirit of cooperation.
3. The weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors. In determining what is a reasonable and equitable use, all relevant factors are to be considered together and a conclusion reached on the basis of the whole.

Article 7 - Obligation not to cause significant harm

1. Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States.
2. Where significant harm nevertheless is caused to another watercourse State, the States whose use causes such harm shall, in the absence of agreement to such use, take all appropriate measures, having due regard for the provisions of articles 5 and 6, in consultation with the affected State, to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation.

Article 8 - General obligation to cooperate

1. Watercourse States shall cooperate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of an international watercourse.
2. In determining the manner of such cooperation, watercourse States may consider the establishment of joint mechanisms or commissions, as deemed necessary by them, to facilitate cooperation on relevant measures and procedures in the light of experience gained through cooperation in existing joint mechanisms and commissions in various regions.

Article 9 - Regular exchange of data and information

1. Pursuant to article 8, watercourse States shall on a regular basis exchange readily available data and information on the condition of the watercourse, in particular that of a hydrological, meteorological, hydrogeological and ecological nature and related to the water quality as well as related forecasts.
2. If a watercourse State is requested by another watercourse State to provide data or information that is not readily available, it shall employ its best efforts to comply with the request but may condition its compliance upon payment by the requesting State of the reasonable costs of collecting and, where appropriate, processing such data or information.
3. Watercourse States shall employ their best efforts to collect and, where appropriate, to process data and information in a manner which facilitates its utilization by the other watercourse States to which it is communicated.

Article 10 - Relationship between different kinds of uses

1. In the absence of agreement or custom to the contrary, no use of an international watercourse enjoys inherent priority over other uses.
2. In the event of a conflict between uses of an international watercourse, it shall be resolved with reference to articles 5 to 7, with special regard being given to the requirements of vital human needs.

PART III - PLANNED MEASURES

Article 11 - Information concerning planned measures

Watercourse States shall exchange information and consult each other and, if necessary, negotiate on the possible effects of planned measures on the condition of an international watercourse.

Article 12 - Notification concerning planned measures with possible adverse effects

Before a watercourse State implements or permits the implementation of planned measures which may have a significant adverse effect upon other watercourse States, it shall provide those States with timely notification thereof. Such notification shall be accompanied by available

technical data and information, including the results of any environmental impact assessment, in order to enable the notified States to evaluate the possible effects of the planned measures.

Article 13 - Period for reply to notification

Unless otherwise agreed:

- (a) A watercourse State providing a notification under article 12 shall allow the notified States a period of six months within which to study and evaluate the possible effects of the planned measures and to communicate the findings to it;
- (b) This period shall, at the request of a notified State for which the evaluation of the planned measures poses special difficulty, be extended for a period of six months.

Article 14 - Obligations of the notifying State during the period for reply

During the period referred to in article 13, the notifying State:

- (a) Shall cooperate with the notified States by providing them, on request, with any additional data and information that is available and necessary for an accurate evaluation; and
- (b) Shall not implement or permit the implementation of the planned measures without the consent of the notified States.

Article 15 - Reply to notification

The notified States shall communicate their findings to the notifying State as early as possible within the period applicable pursuant to article 13. If a notified State finds that implementation of the planned measures would be inconsistent with the provisions of articles 5 or 7, it shall attach to its finding a documented explanation setting forth the reasons for the finding.

Article 16 - Absence of reply to notification

- 1. If, within the period applicable pursuant to article 13, the notifying State receives no communication under article 15, it may, subject to its obligations under articles 5 and 7, proceed with the implementation of the planned measures, in accordance with the notification and any other data and information provided to the notified States.
- 2. Any claim to compensation by a notified State which has failed to reply within the period applicable pursuant to article 13 may be offset by the costs incurred by the notifying State for action undertaken after the expiration of the time for a reply which would not have been undertaken if the notified State had objected within that period.

Article 17 - Consultations and negotiations concerning planned measures

- 1. If a communication is made under article 15 that implementation of the planned measures would be inconsistent with the provisions of

- articles 5 or 7, the notifying State and the State making the communication shall enter into consultations and, if necessary, negotiations with a view to arriving at an equitable resolution of the situation.
2. The consultations and negotiations shall be conducted on the basis that each State must in good faith pay reasonable regard to the rights and legitimate interests of the other State.
 3. During the course of the consultations and negotiations, the notifying State shall, if so requested by the notified State at the time it makes the communication, refrain from implementing or permitting the implementation of the planned measures for a period of six months unless otherwise agreed.

Article 18 - Procedures in the absence of notification

1. If a watercourse State has reasonable grounds to believe that another watercourse State is planning measures that may have a significant adverse effect upon it, the former State may request the latter to apply the provisions of article 12. The request shall be accompanied by a documented explanation setting forth its grounds.
2. In the event that the State planning the measures nevertheless finds that it is not under an obligation to provide a notification under article 12, it shall so inform the other State, providing a documented explanation setting forth the reasons for such finding. If this finding does not satisfy the other State, the two States shall, at the request of that other State, promptly enter into consultations and negotiations in the manner indicated in paragraphs 1 and 2 of article 17.
3. During the course of the consultations and negotiations, the State planning the measures shall, if so requested by the other State at the time it requests the initiation of consultations and negotiations, refrain from implementing or permitting the implementation of those measures for a period of six months unless otherwise agreed.

Article 19 - Urgent implementation of planned measures

1. In the event that the implementation of planned measures is of the utmost urgency in order to protect public health, public safety or other equally important interests, the State planning the measures may, subject to articles 5 and 7, immediately proceed to implementation, notwithstanding the provisions of article 14 and paragraph 3 of article 17.
2. In such case, a formal declaration of the urgency of the measures shall be communicated without delay to the other watercourse States referred to in article 12 together with the relevant data and information.
3. The State planning the measures shall, at the request of any of the States referred to in paragraph 2, promptly enter into consultations and negotiations with it in the manner indicated in paragraphs 1 and 2 of article 17.

PART IV - PROTECTION, PRESERVATION AND MANAGEMENT

Article 20 - Protection and preservation of ecosystems

Watercourse States shall, individually and, where appropriate, jointly, protect and preserve the ecosystems of international watercourses.

Article 21 - Prevention, reduction and control of pollution

1. For the purpose of this article, "pollution of an international watercourse" means any detrimental alteration in the composition or quality of the waters of an international watercourse, which results directly or indirectly from human conduct.
2. Watercourse States shall, individually and, where appropriate, jointly, prevent, reduce and control the pollution of an international watercourse that may cause significant harm to other watercourse States or to their environment, including harm to human health or safety, to the use of the waters for any beneficial purpose or to the living resources of the watercourse. Watercourse States shall take steps to harmonize their policies in this connection.
3. Watercourse States shall, at the request of any of them, consult with a view to arriving at mutually agreeable measures and methods to prevent, reduce and control pollution of an international watercourse, such as:
 - (a) Setting joint water quality objectives and criteria;
 - (b) Establishing techniques and practices to address pollution from point and non-point sources;
 - (c) Establishing lists of substances the introduction of which into the waters of an international watercourse is to be prohibited, limited, investigated or monitored.

Article 22 - Introduction of alien or new species

Watercourse States shall take all measures necessary to prevent the introduction of species, alien or new, into an international watercourse which may have effects detrimental to the ecosystem of the watercourse resulting in significant harm to other watercourse States.

Article 23 - Protection and preservation of the marine environment

Watercourse States shall, individually and, where appropriate, in cooperation with other States, take all measures with respect to an international watercourse that are necessary to protect and preserve the marine environment, including estuaries, taking into account generally accepted international rules and standards.

Article 24 - Management

1. Watercourse States shall, at the request of any of them, enter into consultations concerning the management of an international watercourse, which may include the establishment of a joint management mechanism.

2. For the purposes of this article, "management" refers, in particular, to:
 - (a) Planning the sustainable development of an international watercourse and providing for the implementation of any plans adopted; and
 - (b) Otherwise promoting the rational and optimal utilization, protection and control of the watercourse.

Article 25 - Regulation

1. Watercourse States shall cooperate, where appropriate, to respond to needs or opportunities for regulation of the flow of the waters of an international watercourse.
2. Unless otherwise agreed, watercourse States shall participate on an equitable basis in the construction and maintenance or defrayal of the costs of such regulation works as they may have agreed to undertake.
3. For the purposes of this article, "regulation" means the use of hydraulic works or any other continuing measure to alter, vary or otherwise control the flow of the waters of an international watercourse.

Article 26 - Installations

1. Watercourse States shall, within their respective territories, employ their best efforts to maintain and protect installations, facilities and other works related to an international watercourse.
2. Watercourse States shall, at the request of any of them which has reasonable grounds to believe that it may suffer significant adverse effects, enter into consultations with regard to:
 - (a) The safe operation and maintenance of installations, facilities or other works related to an international watercourse; and
 - (b) The protection of installations, facilities or other works from willful or negligent acts or the forces of nature.

PART V - HARMFUL CONDITIONS AND EMERGENCY SITUATIONS

Article 27 - Prevention and mitigation of harmful conditions

Watercourse States shall, individually and, where appropriate, jointly, take all appropriate measures to prevent or mitigate conditions related to an international watercourse that may be harmful to other watercourse States, whether resulting from natural causes or human conduct, such as flood or ice conditions, water-borne diseases, siltation, erosion, salt-water intrusion, drought or desertification.

Article 28 - Emergency situations

1. For the purposes of this article, "emergency" means a situation that causes, or poses an imminent threat of causing, serious harm to watercourse States or other States and that results suddenly from natural causes, such as floods, the breaking up of ice, landslides or earthquakes, or from human conduct, such as industrial accidents.

2. A watercourse State shall, without delay and by the most expeditious means available, notify other potentially affected States and competent international organizations of any emergency originating within its territory.
3. A watercourse State within whose territory an emergency originates shall, in cooperation with potentially affected States and, where appropriate, competent international organizations, immediately take all practicable measures necessitated by the circumstances to prevent, mitigate and eliminate harmful effects of the emergency.
4. When necessary, watercourse States shall jointly develop contingency plans for responding to emergencies, in cooperation, where appropriate, with other potentially affected States and competent international organizations.

PART VI - MISCELLANEOUS PROVISIONS

Article 29 - International watercourses and installations in time of armed conflict

International watercourses and related installations, facilities and other works shall enjoy the protection accorded by the principles and rules of international law applicable in international and non-international armed conflict and shall not be used in violation of those principles and rules.

Article 30 - Indirect procedures

In cases where there are serious obstacles to direct contacts between watercourse States, the States concerned shall fulfill their obligations of cooperation provided for in the present Convention, including exchange of data and information, notification, communication, consultations and negotiations, through any indirect procedure accepted by them.

Article 31-Data and information vital to national defense or security

Nothing in the present Convention obliges a watercourse State to provide data or information vital to its national defense or security. Nevertheless, that State shall cooperate in good faith with the other watercourse States with a view to providing as much information as possible under the circumstances.

Article 32 - Non-discrimination

Unless the watercourse States concerned have agreed otherwise for the protection of the interests of persons, natural or juridical, who have suffered or are under a serious threat of suffering significant transboundary harm as a result of activities related to an international watercourse, a watercourse State shall not discriminate on the basis of nationality or residence or place where the injury occurred, in granting to such persons, in accordance with its legal system, access to judicial or other procedures,

or a right to claim compensation or other relief in respect of significant harm caused by such activities carried on in its territory.

Article 33 - Settlement of disputes

1. In the event of a dispute between two or more Parties concerning the interpretation or application of the present Convention, the Parties concerned shall, in the absence of an applicable agreement between them, seek a settlement of the dispute by peaceful means in accordance with the following provisions.
2. If the Parties concerned cannot reach agreement by negotiation requested by one of them, they may jointly seek the good offices of, or request mediation or conciliation by, a third party, or make use, as appropriate, of any joint watercourse institutions that may have been established by them or agree to submit the dispute to arbitration or to the International Court of Justice.
3. Subject to the operation of paragraph 10, if after six months from the time of the request for negotiations referred to in paragraph 2, the Parties concerned have not been able to settle their dispute through negotiation or any other means referred to in paragraph 2, the dispute shall be submitted, at the request of any of the parties to the dispute, to impartial fact-finding in accordance with paragraphs 4 to 9, unless the Parties otherwise agree.
4. A Fact-finding Commission shall be established, composed of one member nominated by each Party concerned and in addition a member not having the nationality of any of the Parties concerned chosen by the nominated members who shall serve as Chairman.
5. If the members nominated by the Parties are unable to agree on a Chairman within three months of the request for the establishment of the Commission, any Party concerned may request the Secretary-General of the United Nations to appoint the Chairman who shall not have the nationality of any of the parties to the dispute or of any riparian State of the watercourse concerned. If one of the Parties fails to nominate a member within three months of the initial request pursuant to paragraph 3, any other Party concerned may request the Secretary-General of the United Nations to appoint a person who shall not have the nationality of any of the parties to the dispute or of any riparian State of the watercourse concerned. The person so appointed shall constitute a single-member Commission.
6. The Commission shall determine its own procedure.
7. The Parties concerned have the obligation to provide the Commission with such information as it may require and, on request, to permit the Commission to have access to their respective territory and to inspect any facilities, plant, equipment, construction or natural feature relevant for the purpose of its inquiry.
8. The Commission shall adopt its report by a majority vote, unless it is a single-member Commission, and shall submit that report to the Par-

ties concerned setting forth its findings and the reasons therefore and such recommendations as it deems appropriate for an equitable solution of the dispute, which the Parties concerned shall consider in good faith.

9. The expenses of the Commission shall be borne equally by the Parties concerned.
10. When ratifying, accepting, approving or acceding to the present Convention, or at any time thereafter, a Party which is not a regional economic integration organization may declare in a written instrument submitted to the Depositary that, in respect of any dispute not resolved in accordance with paragraph 2, it recognizes as compulsory ipso facto and without special agreement in relation to any Party accepting the same obligation:
 - (a) Submission of the dispute to the International Court of Justice; and/or
 - (b) Arbitration by an arbitral tribunal established and operating, unless the parties to the dispute otherwise agreed, in accordance with the procedure laid down in the annex to the present Convention.

A Party which is a regional economic integration organization may make a declaration with like effect in relation to arbitration in accordance with subparagraph (b).

PART VII - FINAL CLAUSES

Article 34 - Signature

The present Convention shall be open for signature by all States and by regional economic integration organizations from 21 May 1997 until 20 May 2000 at United Nations Headquarters in New York.

Article 35 - Ratification, acceptance, approval or accession

1. The present Convention is subject to ratification, acceptance, approval or accession by States and by regional economic integration organizations. The instruments of ratification, acceptance, approval or accession shall be deposited with the Secretary-General of the United Nations.
2. Any regional economic integration organization, which becomes a Party to this Convention without any of its member States being a Party shall be bound by all the obligations under the Convention. In the case of such organizations, one or more of whose member States is a Party to this Convention, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under the Convention. In such cases, the organization and the member States shall not be entitled to exercise rights under the Convention concurrently.
3. In their instruments of ratification, acceptance, approval or accession, the regional economic integration organizations shall declare the extent of their competence with respect to the matters governed by the

Convention. These organizations shall also inform the Secretary-General of the United Nations of any substantial modification in the extent of their competence.

Article 36 - Entry into force

1. The present Convention shall enter into force on the ninetieth day following the date of deposit of the thirty-fifth instrument of ratification, acceptance, approval or accession with the Secretary-General of the United Nations.
2. For each State or regional economic integration organization that ratifies, accepts or approves the Convention or accedes thereto after the deposit of the thirty-fifth instrument of ratification, acceptance, approval or accession, the Convention shall enter into force on the ninetieth day after the deposit by such State or regional economic integration organization of its instrument of ratification, acceptance, approval or accession.
3. For the purposes of paragraphs 1 and 2, any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by States.

Article 37 - Authentic texts

The original of the present Convention, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

ANNEX - ARBITRATION

Article 1

Unless the parties to the dispute otherwise agree, the arbitration pursuant to article 33 of the Convention shall take place in accordance with articles 2 to 14 of the present annex.

Article 2

The claimant party shall notify the respondent party that it is referring a dispute to arbitration pursuant to article 33 of the Convention. The notification shall state the subject matter of arbitration and include, in particular, the articles of the Convention, the interpretation or application of which are at issue. If the parties do not agree on the subject matter of the dispute, the arbitral tribunal shall determine the subject matter.

Article 3

1. In disputes between two parties, the arbitral tribunal shall consist of three members. Each of the parties to the dispute shall appoint an arbitrator and the two arbitrators so appointed shall designate by common agreement the third arbitrator, who shall be the Chairman of the tribunal. The latter shall not be a national of one of the parties to the dispute

- or of any riparian State of the watercourse concerned, nor have his or her usual place of residence in the territory of one of these parties or such riparian State, nor have dealt with the case in any other capacity.
2. In disputes between more than two parties, parties in the same interest shall appoint one arbitrator jointly by agreement.
 3. Any vacancy shall be filled in the manner prescribed for the initial appointment.

Article 4

1. If the Chairman of the arbitral tribunal has not been designated within two months of the appointment of the second arbitrator, the President of the International Court of Justice shall, at the request of a party, designate the Chairman within a further two-month period.
2. If one of the parties to the dispute does not appoint an arbitrator within two months of receipt of the request, the other party may inform the President of the International Court of Justice, who shall make the designation within a further two-month period.

Article 5

The arbitral tribunal shall render its decisions in accordance with the provisions of this Convention and international law.

Article 6

Unless the parties to the dispute otherwise agree, the arbitral tribunal shall determine its own rules of procedure.

Article 7

The arbitral tribunal may, at the request of one of the Parties, recommend essential interim measures of protection.

Article 8

1. The parties to the dispute shall facilitate the work of the arbitral tribunal and, in particular, using all means at their disposal, shall:
 - (a) Provide it with all relevant documents, information and facilities; and
 - (b) Enable it, when necessary, to call witnesses or experts and receive their evidence.
2. The parties and the arbitrators are under an obligation to protect the confidentiality of any information they receive in confidence during the proceedings of the arbitral tribunal.

Article 9

Unless the arbitral tribunal determines otherwise because of the particular circumstances of the case, the costs of the tribunal shall be borne by the parties to the dispute in equal shares. The tribunal shall keep a record of all its costs, and shall furnish a final statement thereof to the parties.

Article 10

Any Party that has an interest of a legal nature in the subject matter of the dispute, which may be affected by the decision in the case, may intervene in the proceedings with the consent of the tribunal.

Article 11

The tribunal may hear and determine counterclaims arising directly out of the subject matter of the dispute.

Article 12

Decisions both on procedure and substance of the arbitral tribunal shall be taken by a majority vote of its members.

Article 13

If one of the parties to the dispute does not appear before the arbitral tribunal or fails to defend its case, the other party may request the tribunal to continue the proceedings and to make its award. Absence of a party or a failure of a party to defend its case shall not constitute a bar to the proceedings. Before rendering its final decision, the arbitral tribunal must satisfy itself that the claim is well founded in fact and law.

Article 14

1. The tribunal shall render its final decision within five months of the date on which it is fully constituted unless it finds it necessary to extend the time limit for a period, which should not exceed five more months.
 2. The final decision of the arbitral tribunal shall be confined to the subject matter of the dispute and shall state the reasons on which it is based. It shall contain the names of the members who have participated and the date of the final decision. Any member of the tribunal may attach a separate or dissenting opinion to the final decision.
 3. The award shall be binding on the parties to the dispute. It shall be without appeal unless the parties to the dispute have agreed in advance to an appellate procedure.
 4. Any controversy, which may arise between the parties to the dispute as regards the interpretation or manner of implementation of the final decision may be submitted by either party for decision to the arbitral tribunal, which rendered it.
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Document 5:

PALESTINIAN WATER LAW NO. 3, RAMALLAH, 17 JULY 2002

*Chairman of the Executive Committee of the Palestine Liberation Organization
Chairman of the Palestinian National Authority*

After reviewing the Safeguarding of Public Water Supplies Ordinance No. 17/1937 effective in Palestine,

And Water Resources Testing Law No. 2/1938 effective in Palestine,

And Water Control Law No.31/1953 effective in West Bank Governorates,

And Law No. 2/1996 regarding the establishment of the Palestinian Water Authority,

And Law No. 1/1997 regarding the Palestinian Local Authorities,

And Resolution No. 66/1997 regarding the Internal Regulations of the Palestinian Water Authority,

And on the proposed law submitted by the Cabinet of Ministers,

And after the approval of the Legislative Council in its session held on 18/2/2002

We issued the following law:

CHAPTER ONE - Definitions & General Provisions

Article (1)

The following words and expressions shall have the stated meaning unless the context indicates otherwise:

The Authority - The Water Authority

The Council - The National Water Council

The Head - The Head of the Palestinian Water Authority

Water Supply - The supply of water from all available resources.

Water Resources - All water resources which lie within the territorial land or sea of Palestine, whether conventional (surface or ground waters) such as the waters of springs, including hot springs, wells, ravines, rivers, lakes, seas, and water collection areas, or unconventional such as sewage water, desalinated water, and brackish water.

Water Resources Management - Development, improvement, and protection of water resources, and plans for its use.

Water Policy - The policy set by the Council for the preservation of natural and political rights on the water resources, its uses, and projects in Palestine.

Facility - Any facilities or constructions intended for Water utilization, whether by extraction, or collection, or storage.

Water Recharge - Directing waters to the lower layers (ground) from any water resource including floods waters, or treated wastewater, whether this is done directly by recharging the wells or reservoirs or by drilling or by permitting water to seep from the surface to the subterranean soil.

Sanitary Sewage - A system for collecting, disposing of and treating wastewater

Well - Any facility intended for to extract ground waters to the surface.

Spring - Place for the exit of ground waters from inside the earth in a natural fashion.

Groundwaters - Waters available in the ground water reservoir.

Surface Waters - Any moving or still waters above the ground surface, including ravines, rivers, wadis, water springs, or any fountains, collection of sewage water, lakes, and seas.

Groundwater Reservoir - Formation or geological layers of materials, which permit the seepage of water to its inside, and its storage under the surface of the ground, which are capable of exploitation.

Right of Possession - Is the right to manage, supervise, plan and regulate all water resources without derogation of the existing rights of usage.

National Water Utility - Is the party responsible for providing water in bulk, at the national level.

Regional Water Utilities - Institutions and interests that provide services of water and wastewater.

Pollution- Any change that occurs to the quality and constituents of water, which leads to harm to the health of humans and to the environment.

Pollutant - Any material that could lead to a change in the qualities and constituents of water, which may lead to harm to humans and to the environment.

Water Quality Standards - Standards, which the Authority shall participate in setting in cooperation with the relevant official bodies, to preserve the ideal standards for water quality.

Water Meter - An approved instrument for measuring the quantity of water that flows past a specific point.

Water Tariff System - System that is based on studied standards in order to set a water tariff.

Network - The set of pipes deriving from the main water Pipe line to the end user.

Environment - The surroundings, which include living creatures together with the air, water, soil, and structures built upon it, and the interaction between them.

The Water Environs - A specified area surrounding a water resource and a water facility.

Exploration - All operations relating to search for, and investigating water resources and it includes drilling, analysis, and other detailed studies.

Article (2)

This law aims to develop and manage the water resources, increasing their capacity, improving their quality, and preserving and protecting them from pollution and depletion.

Article (3)

1. All water resources available in Palestine are considered public property.
2. The environs of a water resource or a public water facility shall be determined in accordance with objective criteria according to regulations to be issued for this purpose.
3. Every person shall have the right to obtain his needs of water of a suitable quality for his use, and every official or private institution that provides water services must take the necessary steps to insure this right and to make the necessary plans for developing these services.

Article (4)

It is prohibited to drill or explore or extract or collect or desalinate or treat waters for commercial purposes or to set up or operate a facility for water or wastewater without obtaining a license therefore.

Article (5)

1. The use of water shall be made for meeting the following needs:
 - a - Residential needs.
 - b - Agriculture and irrigation.
 - c - Industrial demand.
 - d - Commercial demand.
 - e - Tourism demand.
 - f - Any other public or private uses.
2. An approval and a license are deemed necessary to be obtained before changing the right of usage from one to another.

CHAPTER Two - The Water Authority

Article (6)

1. A public institution called "the Water Authority" shall be created by virtue of this law, and it shall have a juridical personality, and its budget shall be included within the general budget of the Palestinian National Authority.
2. The Authority shall be subject directly to the Chairman of the Palestinian National Authority.
3. The main headquarter for the Authority shall be Jerusalem, and its temporary headquarter shall be in any other place that is determined by the Authority.

Article (7)

In pursuance of the goals intended by this law, the Authority shall exercise the following tasks and responsibilities:

1. It shall have full responsibility for managing the water resources and wastewater in Palestine.

2. Setting the general water policy and working to implement it in coordination and cooperation with the relevant parties, and presenting periodic reports concerning the water status to the Council.
3. Surveying the different water resources, and suggesting allocations of water and determining the priorities of usage.
4. Creating reservation areas for protection from the danger of pollution, and exercising oversight and supervision over such areas, and approvals for transfer of water between the different geographic areas.
5. Licensing the exploitation of water resources including the construction of public and private wells, regulating them, water exploration, drilling exploratory, testing and production wells, and any other matter's or activities relating to water or wastewater, in cooperation and coordination with the relevant parties.
6. Studying water and wastewater projects, and projects that integrate them, and setting design standards, and quality assurance, and technical specifications, and work to control its implementation.
7. Rehabilitating and developing water departments for the bulk water supply at the level of the different national governorates, considering them national water utilities, and setting their tasks and responsibilities in accordance with regulations that are issued by the Cabinet of Ministers for this purpose.
8. Coordination and cooperation with the relevant parties to set plans, and programs for regulating the use of water, and preventing wastage, and conserve consumption, and carrying out public awareness campaigns regarding this aspect.
9. Supervising the profession of well drilling and qualifying contractors in the field of constructing water facilities in accordance with procedures that are set by the law.
10. Setting plans and programs for training the technical staff working in the water sector to develop the management of water resources and supervise its implementation and development.
11. Working towards achieving a fair distribution and optimal utilization in order to ensure the sustainability of ground and surface water resources through cooperation and coordination with the relevant parties and finding solutions and suitable alternatives in case of emergencies.
12. Regulating and supervising research and studies relating to water and wastewater, and following up with the concerned and specialized parties.
13. Rehabilitating the centers for researches, studies, and training working in the water sector in accordance to the procedures to be set by the regulations referred to in paragraph 7 supra.
14. Participating in setting approved standards for the water quality for the different usages in cooperation with the relevant parties and insuring promulgation.
15. Working to develop and coordinate programs for international, regional, and bilateral technical cooperation in the field of water re-

- sources; holding conferences, and seminars, and representing Palestine in regional and international meetings in this field.
16. Preparing draft laws and regulations and issuing directives concerning water resources and executing them, and giving opinions with regard to the technical aspect in all disputes relating to water resources.
 17. Any other tasks that are to be assigned by virtue of applicable laws and regulations.

CHAPTER THREE - The National Water Council

Article (8)

First: The National Water Council shall be composed as follows:

- | | |
|--|-----------------|
| 1. The Chairman of the Palestinian Authority | Chairman |
| 2. The Minister of Agriculture | Member |
| 3. The Minister of Finance | Member |
| 4. The Minister of Health | Member |
| 5. The Minister of Local Government | Member |
| 6. The Minister of Planning & International Cooperation | Member |
| 7. The Head of Environment Authority | Member |
| 8. The Head of the Water Authority | Member |
| 9. The lord Mayor of the Capital | Member |
| 10. A Representative for Chairman of the Union
of Local Authorities | Member |
| 11. A Representative for the Palestinian Universities | Member |
| 12. A Representative for the Water Unions and Societies | Member |
| 13. A Representative for the Regional Utilities | Member |

Second: The Council shall select among its members a vice-Chairman.

Third: The Head of the Authority shall be the secretary of the Council.

Fourth: The representatives of the private sector shall be selected on the basis of experience, specialization, and competency in this field, and they shall be appointed by a decision from the Chairman of the Palestinian National Authority.

Fifth: the period of a membership of the representatives of the non-governmental sector shall be two years and this period may be extended once.

Article (9)

The Council shall carry out the following tasks and responsibilities:

1. Sanction the general water policy.
2. Sanction the policy for development and utilization of water resources and the different usage.

3. Ratify plans and programs aimed at organizing the usage of water, the preventing wastage, and directing consumption.
4. Ratify the tariff policy.
5. Confirming the allocation of funds for investment in the water sector.
6. Approving the periodic reports concerning the activities of the Authority and its work.
7. Approving the Authority's guidelines and confirming the internal regulations that govern its administrations and operations.
8. Confirming the appointment of the board of directors of the regional utilities.
9. Approving the annual budget of the Authority and presenting it to the Council of Ministers to confirm it.
10. Implementing the financial regulations prevailing in the Palestinian National Authority.
11. Any other tasks which are delegated to it according to the provisions of this law.

Article (10)

1. The Council shall meet at the invitation of its Chairman at least once every six months. An emergency meeting may be held at the request of the Chairman of the Council or four of its members when ever necessary. The meeting shall be chaired by the Chairman, or by the vice chairman in his absence.
2. For the validity of the meetings of the council, at least 8 members must be present including the Chairman of the Council or the vice-chairman. The decisions of the Council shall be issued by a majority of the present members and, where the votes are equal the side including the Chairman or the vice – chairman shall have a deciding vote.
3. The Secretary of the Council shall have the task of preparing the agenda for the meetings of the Council, for issuing the written invitations, and for drafting its resolutions and implementing them.

Article (11)

The Council may utilize the services of experienced and specialized experts, and consultants, and technical.

Article (12)

The Council may form, from among its members, one or more committees, permanent or temporary, to which it shall delegate some of its tasks or responsibilities, or assign to such committee a specific task and report about it.

Article (13)

1. No member of the Council, nor any employee of the Authority may be a party in any contract, including contracts for purchases of necessities, or bids for carrying out works that the Authority is party

to, nor may such a person work in these projects or works or obtain any profit or material benefit from it directly or indirectly, except for the salaries and bonuses that he receives from his employment with the Authority, or for his participating in any of the tasks that are delegated to him according the provisions of the Law and the regulations issued with regard to.

2. If any member of the Council, of any employee of the Authority violates the provisions of subsection (1) of this article, he shall be subject to the legal sanctions and procedures, and will be required to return all the sums that he obtained as a result of this violation, in addition to paying compensation for the losses or damages to the Authority or to any party who has suffered as a result of his violation.

CHAPTER FOUR - The Head of the Authority - His Tasks and Responsibilities

Article (14)

1. The Chairman of the National Authority shall appoint, by presidential decree, based on the recommendation of the National Water Council, a Head for the Authority, and a Deputy Head, from among those with experience, specialization and competence in the field, and it shall be determined in the decree the employment level for both of them.
2. The Deputy Head shall carry out the tasks and responsibilities delegated to the Head during his absence or when his position becomes vacant.

Article (15)

First: The Head shall have the following tasks and responsibilities:

1. Organizing and managing the Authority and supervision of all its employees, and its different directorates.
2. Preparing the budget and the financial reports and presenting them to the official bodies to approve, and confirm them in accordance with proper procedures.
3. Implementing the decisions of the Council.
4. Signing water agreements on behalf of the government, in accordance with the provisions of the prevailing laws and regulations.
5. Participating in activities aimed at improving regional and international cooperation in the field of water and wastewater.
6. Preparing periodic reports about the activities of the Authority, and its level of performance, and suggesting solutions to confront the difficulties and obstacles facing the progress of the work.
7. Any tasks assigned to him by the Council or the Cabinet of Ministers.

Second: The Head of the Authority may delegate some of his tasks to his Deputy.

Article (16)

1. The Authority may appoint an advisor, or a group of advisors for carrying out its tasks.
2. The Authority may use advisors or experts representing the different sectors to carry out its tasks whenever it is necessary to do so.
3. It is not permitted for any of the advisors or their relatives to the second degree, to have any interest in any matter that is presented to him for his opinion.

Article (17)

The employees of the Authority, and its advisors, shall bound to the instructions that are issued with respect to maintaining the secrecy of information and the obligation not to publish them in the field of water, or any other field that is delegated to them.

CHAPTER FIVE – Licensing and Tariffs

Article (18)

In accordance with the provisions of this law, fees for licensing shall be imposed and shall set the conditions, and period, and procedures, and transferability, and amendments, and renewal, and all matters pertaining thereto, including permits, pursuant to regulations to be issued for this purpose.

Article (19)

The Authority may amend, suspend, or cancel a license if the licensee fails to initiate the project during the period specified in the license, or if it discovers that incorrect information was given, or if the project is not being implemented in the manner specified in the conditions of the license, or contrary to the provisions of the Law.

Article (20)

Unified tariff system for water shall be set, which may be amended from time to time, with the aim of encouraging the water users to conserve the available water resources and its optimal usage in accordance with the regulations that shall be issued for that purpose.

CHAPTER SIX – Financial Resources

Article (21)

The financial resources of the Authority shall consist of:

1. The amounts allotted for it in the general budget of the Palestinian National Authority.

2. Grants, dons, assistance, loans, and any other resources that are available to the Authority and which the Council of Ministers agrees to accept, shall be placed in a special account for the Authority and shall be supervised directly by the Ministry of Finance and the Authority.

Article (22)

The monies of the Authority shall be considered public monies and shall be collected in accordance with the Law for the Collection of Public Monies in force.

Article (23)

1. All monies collected by the Authority shall be deposited in the general account of the Treasury, which is administered by the Finance Ministry.
2. The accounts of the Authority and its records and all its financial affairs shall be conducted in accordance with the laws of the Palestinian National Authority and in accordance with the accounting procedures adopted by the Palestinian National Authority.
3. The accounts of the Authority shall be audited by the Finance Ministry and the General Control Institution.
4. The Authority shall enjoy the exemptions and facilities available to the government and the ministers and governmental departments.

Article (24)

Despite the provisions of any other law, no governmental department, or official institution, or private institution or any person real or juridical, shall be exempted from the fees and costs, levies, or usage fees which are realized or imposed for services given by the Authority in accordance with the provisions of this Law.

CHAPTER SEVEN - Regional Water Utilities

Article (25)

By virtue of this law, National Water Utilities will be established based on the desire of local committees and water users associations, to provide water and wastewater services and it will set the tasks and responsibilities and their composition, and management, and financial resources, and dismantling, and all matters pertaining to their work in accordance with regulations that will be issued for this purpose.

Article (26)

Regional utilities and water users associations shall set the prices of water for different usage, in accordance with the approved tariff system.

Article (27)

The Authority may contract with regional utilities to operate alternative water systems.

Article (28)

1. The Authority shall have the right to supervise an control regional utilities and water users associations, in cooperation and coordination with the relevant parties, and to take all the procedures necessary regarding them for violating the provisions of this Law or the regulations or directives issued thereunder.
2. The Council, based on the recommendation of the relevant parties, is to decide by means of a reasoned decision to suspend or dismantle the services of the board of directors for of any regional utilities or water user associations and this decision shall be subject to appeal before the relevant court.

CHAPTER EIGHT – Protection of the Environment

Article (29)

Without contravention of the provisions of the Environmental Law and the regulations and directives issued under it, and in cooperation and coordination with the relevant authorities for the protection of water resources and the prevention of its pollution, the Authority shall carry out the following actions:

1. Participate in regulating the use of agricultural and industrial materials, which may cause pollution to the water resources or its supply systems.
2. Participate in preparing special guidelines for the environmental impact assessment for any activity relating to water resources or their supply systems.
3. Participate in preparing special mechanisms for crises management when there is a draught or flooding or a plague that is spread through water, or general pollution.
4. Participate in preparing a list of the names of pollutants, which require licensing, and compensation for damages resulting therefrom.

Article (30)

The Authority may issue a decree to halt the production or supply of water if it appears that its source or supply system is polluted, and it may close the source or system if pollution continues, and it must notify the relevant Authority of this and to eliminate the pollutants in an expeditious fashion.

Article (31)

1. The Authority, in coordination with the other relevant parties, may consider any area that contains ground waters a protected area, if the quality or quantity of water is in danger of pollution, or if carrying out the water policy requires such action, on condition that it provide alternate water resources.

2. A notice shall be advertised in the local news papers thirty days prior declaring an area to be a protected area, including restrictions on use of water, and it may also by a subsequent notice cancel or amend the original notice whenever such action is necessary.

Article (32)

Anyone who causes pollution in any water resource or its supply system must remove the pollution to that source or system at his own expense, and in case he refuses or fails to do so, the Authority must remove the pollution and carry out the cleaning operations on the expense of party causing the pollution after notifying him of this regardless of the costs, which shall be levied from him in accordance with the Law for Collecting Public Monies.

CHAPTER NINE – Control and Inspection

Article (33)

The Authority shall carry out the tasks of control over the water resources including:

1. Keeping records that contain detailed information about water usage and licenses.
2. Licensed Operators of water or wastewater facilities must give periodic reports concerning the production, distribution, or use of water at the times set by the Authority.
3. The Authority shall have the right to set the necessary rules and standard for inspecting, calibrating and repairing damaged meters and to control the leak of water.

Article (34)

1. Without contradiction from the provisions of this Law, the Authority may ask for requisite of land and property or enter the property of others in order to carry out its activities.
2. The Authority shall have the right to inspect water resources and systems of supply, and any place where pollution is suspected, and to enter any private or public property or building to accomplish this purpose in accordance with proper procedures.
3. Employees who will be assigned by a decree from the Chairman of the Authority as holding the status of Law Officers, to apprehend crimes, and violations which have been prohibited by the Law.

CHAPTER TEN – Violations and Sanctions

Article (35)

Without derogation from any more onerous punishments provided for in other laws,

- a) A prison sentence of not less than six months' nor more than one year or a fine of not less than one thousand dinars and not more than five thousand dinars or its equivalent in local currency, shall be imposed on any one who commits any of the following actions:
 1. Polluting any water resource or supply system, or causing such action and failing to redress it within the period set for him by the Authority.
 2. Drilling ground water wells without license or contradicting the terms of the license issued to him.
 3. Violating on any water resource or sewage system, causing its damage or leading to the break out of one of them.
 4. Supplying water to or permitting the supply of water to him or to others without a license to do so.
- b) A prison sentence of not less than one month and not more than six months or a fine of not less than one hundred dinars and not more than one thousand dinars or its equivalent in local currency shall be imposed on any one whom:
 1. Carries out any activity or tasks, which is not permitted for any one other than the Authority by virtue of this Law without the prior written permission of the Authority.
 2. Acts with respect to water resources, waters, or related projects or public sewage in a manner that contradicts the provisions of this Law.

CHAPTER ELEVEN – Final Provisions

Article (36)

Anyone who is convicted of carrying out any of the actions specified in Article (35), the court may sentence him, to pay the cost of the damages that have resulted from his violation and to be obliged to remove its causes and consequences and return the status to what it was before he committed the violation, all that to be done within the period that is specified for him by the court, and if he fails to do so, the relevant authorities shall order the implementation of these activities and shall charge all the costs to the defendant.

Article (37)

In case of repetition of the crimes listed in Article (35), the punishment stated in that article shall be doubled.

Article (38)

Licenses issued by virtue of the prevailing Laws and regulations, before endorsing this law, shall continue to be valid until its period is finished, and it is brought into compliance with the provisions of this Law.

Article (39)

The owner of land or real estates which is being damaged as a result of the entry of the employees of the Authority shall have the right to reasonable compensation either for the denial of his ability to use the land, or any damage occurring to water or crops or the deprivation of the water resource.

Article (40)

By virtue of the provisions of this Law, all rights to supervise, regulate and plan for the water resources shall be transferred to the Authority upon the coming into force of this law.

Article (41)

Without contradicting any of the provisions of this Law, the relevant governmental authorities, or private or official institutions, or municipalities shall continue to exercise the authorities and responsibilities granted to it under the laws and regulations that are in operations till the regional utilities referred to in the provisions of this Law are brought into existence.

Article (42)

The Cabinet of Ministers, based upon the recommendation of the Council, may issue any regulations that it finds suitable, to implement the provisions of this Law.

Article (43)

The Law of the Water Authority Number 2 for the year 1996 and any other legislation that contradicts the provisions of this Law are hereby revealed.

Article (44)

All parties, each within its jurisdiction, shall implement the provisions of this Law which shall come into force 30 days after it is published in the Official Gazette.

Issued in Ramallah on 17 / 7 / 2002 A.D. 8 / Jamadi Awwal / 1423 A.H.

Yasser Arafat

Chairman of the Executive Committee of the Palestine Liberation Organization

Chairman of the Palestinian National Authority

INTERNET GUIDE

→ General Water Websites → Water and International Law →
Water in Palestine and the Middle East → Publications

GENERAL WATER WEBSITES

<http://freshwater.unep.net/>

Website of United Nations Environmental Programme (UNEP), which includes information on the best practices, conferences, policy and strategy documents, etc. and has an important links section to websites related to global water assessments and announcements.

www.transboundarywaters.orst.edu

Website hosted by Oregon University; includes an Atlas of International Freshwater Agreements (documents and maps); a searchable Transboundary Freshwater Dispute Database (TFDD); a Transboundary Freshwater Spatial Database (biophysical, socioeconomic, and geopolitical data relating to international river basins); an international water event database, documenting historical international water relations from 1948 to 1999; and an International River Basin Register listing the world's international river basins.

<http://www.iah.org/>

Website of the International Hydrogeologists Association, which focuses on groundwater issues. Has news on groundwater events, conferences, materials and information on hydrogeology and groundwater as well as related links. There is also an online version of the *Hydrogeology Journal* (members only).

<http://www.fao.org/waicent/faoinfo/agricult/agl/aglw/aquastat/main/index.stm>

Website of AQUASTAT, FAO's global information system of water and agriculture providing information on the state of agricultural water management across the world, with emphasis on developing countries and countries in transition. Contains a database, country profiles, regional overviews, maps, institutions, water resources, documents links and a glossary.

<http://www.fao.org/Legal/Prs-OL/isarm.pdf>

Internationally Shared (Transboundary) Aquifer Resources Management - Their Significance and Sustainable Management: A Framework Document, IHP Non-Serial Publications on Hydrology (SC-2001/WS/40), Paris: UNESCO, 2001.

<http://www.emwis.org>

The site of the Euro-Mediterranean Information System on the know-how in the water sector - an information and knowledge exchange tool on water issues (e.g., institutions, documentation, training, research & development, and data management) among the Euro-Mediterranean partnership countries.

<http://www.thewaterpage.com/index.htm>

Initiative dedicated to the promotion of sustainable water resources management and use with emphasis on the development, utilization and protection of water in Africa and other developing regions. Has lots of informational and educational features, incl. articles, documents, pictures, databases, as well as legal subjects.

WATER AND INTERNATIONAL LAW

<http://www.fao.org/docrep/W7414B/W7414B00.htm>

Website of FAO includes the text of treaties concerning the non-navigational uses of International Watercourse in Africa.

www.dundee.ac.uk/law/iwlr

Website of the International Water Law Research Institute (IWLRI) at Dundee University, Scotland. Includes reports, materials on water law and policy research and university courses, information on advisory/consultancy services to national governments, commissions, donors, NGOs, etc., and information on conferences and other activities. It also has an electronic Law Library with a unique collection of sources in both international and national water law, as well as a useful list of links.

<http://www.fao.org/Legal/legstud/ls65-e.pdf>

Sources of International Water Law including treaties, conventions, resolutions and declarations.

<http://www.fao.org/docrep/003/x9419e/x9419e00.htm#Contents>

FAO publication - Legislative Study 70 - directed at policymakers, lawmakers and government administrators: *Water Rights Administration - Experience, Issues and Guidelines*.

WATER IN PALESTINE AND THE MIDDLE EAST

<http://domino.un.org/unispal.nsf>

Website of the United Nations Information System on the Question of Palestine (UNISPAL), which contains the texts of current and historical UN material concerning Palestine and other issues related to the Middle East situation. Search documents by 'subject', then 'water'.

<http://waternet.rug.ac.be/>

Website of the Department of Third World Studies, University of Gent, on the role of water in conflict and cooperation, with focus on the Israeli-Palestinian water conflict and the Jordan River Basin; includes announcements, conference information, articles, legal issues, and links.

<http://www.btselem.org/>

See link on *The Water Crisis in the Occupied Territories*.

<http://exact-me.org/>

Website of the Executive Action Team (EXACT) Multilateral Working Group on Water Resources with information on publications, projects, and institutions as well as links and an online textbook entitled *Water-Care* jointly prepared by Jordanian, Israeli, and Palestinian writers and available in English, Arabic and Hebrew.

<http://www.arij.org/>

Website of the Applied Research Institute of Jerusalem (ARIJ), a non-profit organization dedicated to promoting sustainable development in the Palestinian territories and the self-reliance of the Palestinian people through greater control over their natural resources. Has lots of online articles, reports and other publications on issues related to land, water and environment in Palestine.

<http://gurukul.ucc.american.edu/ted/deadsea.htm>

Case study on the Dead Sea Canal of the Trade and Environment Database, American University, The School of International Service, Washington.

<http://www.american.edu/projects/mandala/TED/ice/JORDAN.HTM>

Case study on the Jordan River Dispute of the Trade and Environment Database, American University, The School of International Service, Washington.

<http://www.american.edu/projects/mandala/TED/ice/GAZA.HTM>

Case study on Water and Conflict in the Gaza Strip of the Trade and Environment Database, American University, The School of International Service, Washington.

<http://www.nad-plo.org/permanent/water.html>

Page by the PLO's Negotiations Affairs Department on Water as one of the permanent status issues.

<http://www.cesr.org/PROGRAMS/waterpalestine.htm>

Page of the Center for Social and Economic Rights on the *Palestinian Right to Water*.

<http://www.mni.gov.il/english/units/water/water.shtml>

The website on Israel's water sector from the Israeli Ministry of National Infrastructure.

http://www.iepic.org.il/pages/iepic/index_eng.html

Website of the Israeli Environmental Policy Information Center; has articles, information on legislation, and a newsletter.

<http://www.al-bab.com/arab/env/water.htm>

Water portal of the Arab Gateway, includes books, articles and links and is sub-organized into the categories 'regional overview,' 'Nile Basin,' 'Palestine & Israel,' 'Jordan Basin,' 'Tigris & Euphrates,' and 'Arabian peninsula'.

<http://water1.geol.upenn.edu/>

Website of the Middle East Water Information Network with its web-accessible Middle East Water Database, containing some 10,000 catalogued entries, sorted by classification, country, or basin.

<http://www2.soas.ac.uk/Geography/WaterIssues/Home.html>

Website of the SOAS (School of Oriental & African Studies) Water Issues Group, has articles, a water resource database and online newsletters.

http://www.idrc.ca/waterdemand/docs/english/index_eng.shtml

Website of the Water Demand Management forum's Middle East and North Africa section; contains articles, documentation, a newsletter, bibliographies, articles, project reports and a directory of water-related institutions in the region.

http://www.smuc.ac.uk/RiversWEB/sources/middle_east_water.htm

Online sources on Hydropolitics in the Middle East.

<http://www.columbia.edu/cu/lweb/indiv/mideast/cuvm/water.html>

Resource page on *Water in the Middle East* of Columbia University's library.

<http://www.biu.ac.il/SOC/besa/meria/research-g/water.html>

MERIA's online research guide on Middle East water issues.

<http://www.medrc.org.om/>

Website of the Middle East Desalination Center.

ONLINE PUBLICATIONS:

<http://www.unu.edu/unupress/unupbooks/80859e/80859E00.htm#Contents>

Full text online version of the book *Hydropolitics along the Jordan River - Scarce Water and its Impact on the Arab-Israeli Conflict* by Aaron T. Wolf.

<http://www.biu.ac.il/SOC/besa/water/zaslavsky.html>

"Definition of Israel's Water Problems" or "Water as a Metaphor," article by Dan Zaslavsky.

<http://desip.igc.org/TheftOfWater.html>

"Israel's Appropriation of Arab Water: An Obstacle to Peace" by Ronald Bleier, *Middle East Labor Bulletin*, Spring 1994.

<http://www.bankwatch.org/downloads/waterforpalestine.pdf>

A Critical Assessment of the European Investment Bank's Lending Strategy in the Rehabilitation of Water Resources in the Southern West Bank.

<http://www.yale.edu/environment/publications/bulletin/103pdfs/103shamir.pdf>

Water Agreements between Israel and Its Neighbors. By Uri Shamir.

<http://www.internationalwaterlaw.org/Bibliography/IWL-general.htm>

Online Bibliography on International Water Law.

http://usembassy-israel.org.il/publish/press/worldbnk/archive/march/wb1_3-20.htm

World Bank report on the *Water Crisis in Mideast, North Africa.*

<http://www.worldbank.org/html/dec/Publications/Workpapers/wps2000series/wps2045/wps2045.pdf>

Water Challenge and Institutional Response: A Cross Country Perspective. By Saleth, R. Maria and Ariel Dinar. Washington, D.C.: World Bank, 1999.

<http://www.netcomuk.co.uk/~jpap/dolat.htm>

"Water Diplomacy in the Middle East," by Mostafa Dolatyar

http://www.un.org/Depts/dhl/me_water.htm

Online bibliography on *Water Resources in the Middle East* by the United Nations Dag Hammarskjöld Library.

<http://www.biu.ac.il/SOC/besa/meria/journal/1998/issue1/jv2n1a7.html>

"Watersheds and Problemsheds: Explaining the Absence of Armed Conflict Over Water in the Middle East," by Tony Allan, *MERIA Journal*, Volume 2, No. 1 (March 1998).

<http://www.mideastnews.com/WaterWars.htm>

"The next major conflict in the Middle East Water Wars," lecture by Adel Darwish, Conference on Environment and Quality of Life, Geneva, June 1994.

[http://www2.soas.ac.uk/Geography/WaterIssues/Occasional Papers/ AcrobatFiles/OCC15.PDF](http://www2.soas.ac.uk/Geography/WaterIssues/OccasionalPapers/ AcrobatFiles/OCC15.PDF)

"Israel and Water in the Framework of the Arab-Israeli Conflict," by J. A. Allan, SOAS, 1999.

[http://www2.soas.ac.uk/Geography/WaterIssues/Occasional Papers/ AcrobatFiles/OCC13.PDF](http://www2.soas.ac.uk/Geography/WaterIssues/OccasionalPapers/ AcrobatFiles/OCC13.PDF)

"The quality and sustainability of the water resources available to Arab villages to the west of the divide in the southern West Bank," by D. S. Scarpa.

[http://www2.soas.ac.uk/Geography/WaterIssues/Occasional Papers/ AcrobatFiles/OCC31.pdf](http://www2.soas.ac.uk/Geography/WaterIssues/OccasionalPapers/ AcrobatFiles/OCC31.pdf)

The Jordan River Basin: explaining interstate water co-operation through regime theory," by Anders Jägerskog, SOAS, 2001.

[http://www2.soas.ac.uk/Geography/WaterIssues/Occasional Papers/ AcrobatFiles/OCC41.pdf](http://www2.soas.ac.uk/Geography/WaterIssues/OccasionalPapers/ AcrobatFiles/OCC41.pdf)

"The sanctioned discourse - a crucial factor for understanding water policy in the Jordan River Basin," by Anders Jägerskog, SOAS, 2002.

<http://www.fao.org/waicent/faoinfo/sustdev/EPdirect/EPan0006.htm>

"Water Resources Issues in the Arab States Region," by Alain Marcoux.

<http://www.palestinecenter.org/cpap/pubs/19990819pb.html>

"Water and Palestinian-Israeli Peace Negotiations," by Jad Isaac, 1999.

<http://waternet.rug.ac.be/waterpolicy.htm>

“Israeli Water Policy in a Regional Context of Conflict: Prospects for Sustainable Development for Israelis and Palestinians?” by Stefan Deconinck, 2002.

<http://www.ifpri.org/2020/briefs/number31.htm>

“Middle East Water Conflicts and Directions for Conflict Resolution” by Aaron T. Wolf, April 1996.

<http://www.akdeniz.edu.tr/muhfak/publications/gap.html>

“Water Resources in the Middle East: Forthcoming Problems and Solutions for Sustainable Development of the Region,” by Bülent Topkava, July 1998.

<http://www.ciaonet.org/isa/dis01/>

“The Israeli-Palestinian Water Conflict and its Resolution: A View through International Relations Theory,” by Shlomi Dinar, 1999.

PALESTINIAN INSTITUTES AND ORGANIZATIONS WORKING IN THE FIELD OF WATER & ENVIRONMENT

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Dir.: Dr. Jad Isaac
Tel.: 02-2741889/70535
Fax: 02-2776966
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E-mail: ceohsg@palnet.com
Jericho: Tel.: 02-2321927

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Main St., Old Hashemite Bldg., Al-Bireh, PO Box 3662, Ramallah

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Eastern Tower, near Council of Churches, PO Box 1175, Gaza

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<http://www.mena.gov.ps>

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W a t e r Problems – Politics - Prospects

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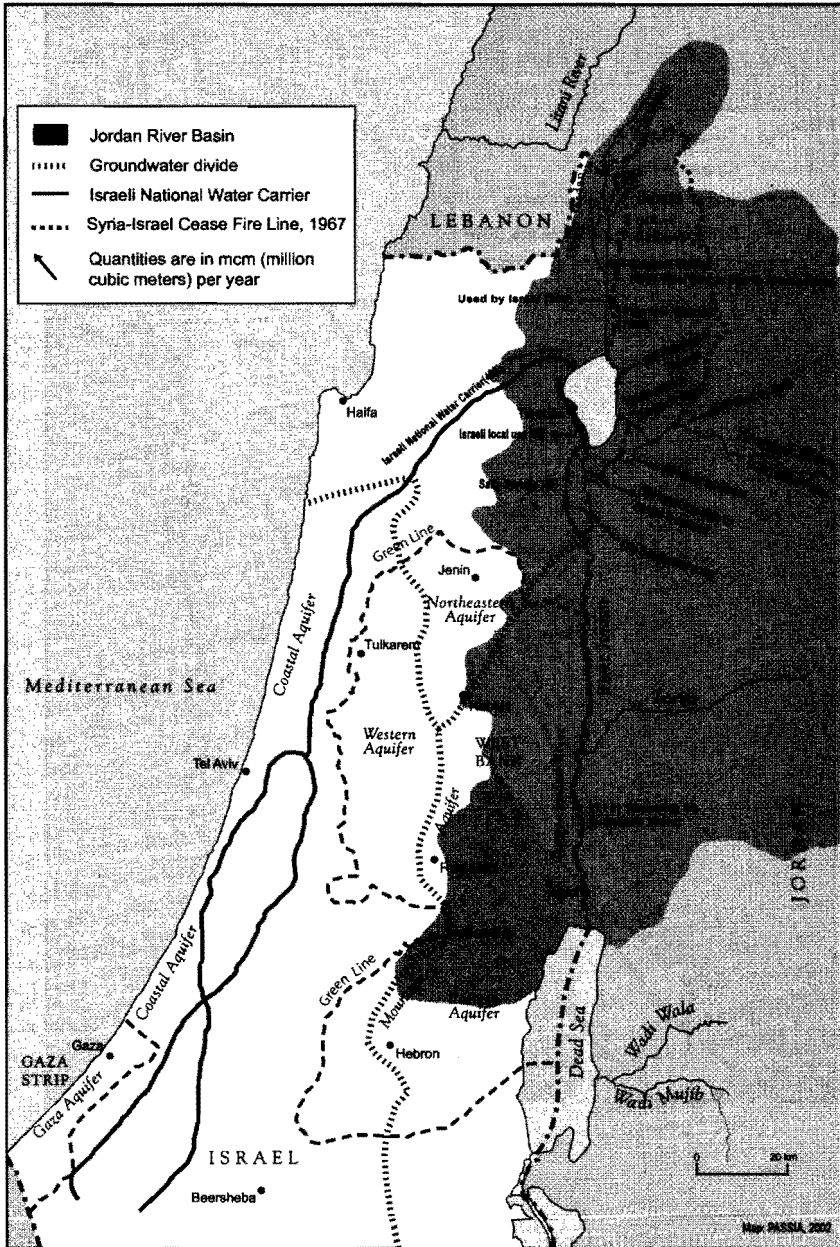
Tel.: 02-2741242

Fax: 02-2744440

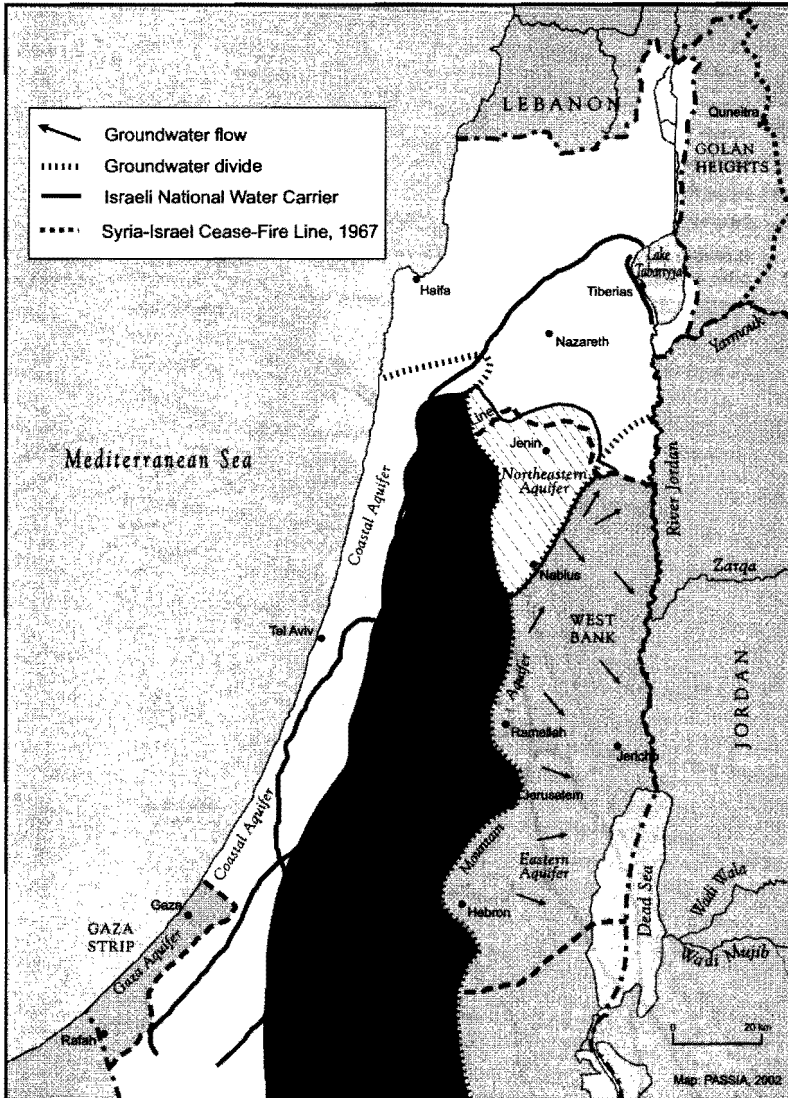
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Map 1 - Water Sources



Map 2 - Jordan River Basin (Water Balance and Use)



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