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Israel's policies and actions since the creation of the National Water Carrier have increased water scarcity and furthered instability in the Jordan River Valley. By examining the outcomes of the 1967 Six-Day war; the creation of the Separation Wall and settlement building in the West Bank; the violations of international water law during the 2006 war with Lebanon; and the ineffectiveness of the Joint Water Committee, we can better see how Israel's policies and actions concerning water will continue to fuel conflict and reduce water availability. Despite its midstream riparian position, Israel continues to flex its power, controlling a majority of the water resources in the West Bank.

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## *Preface*

During my first trip to Iraq in 2004-2005, I noticed the large size of the lakes and the lushness of the land in the Tigris-Euphrates River Valley. It was difficult to believe that a water resource could flourish in a desert environment. When I returned in 2006, the banks of Lake Habbiniyah had significantly receded and the rivers weren't as wide. During my subsequent trip in 2008-2009, the differences were more pronounced—clearly there was an issue with water scarcity.

Why, then, didn't I research the Tigris-Euphrates River Valley? Certainly, there are important issues regarding the Tigris-Euphrates River Valley and the water sharing between Turkey, Syria, and Iraq. However, Iraq, in its nation-building state, does not yet have the ability to significantly influence water sharing in the region, Turkey continues to deal with its own identity crisis as it tries to maintain ties in the region and earn a place among the European Union, and Syria is well, Syria. Each of these riparian nations has their own internal issues to handle in the near future before they are able to work effectively with each other on water sharing.

The Jordan River Basin has a more immediate concern to me because of the history of the region and the great tension that exists between Israel and Arab nations. No other river basin in the world has caused as much controversy and hostile emotions. Additionally, this is the only river basin where one riparian has improved its water security by occupying and holding on to the territories of its neighbors. Particularly with the Occupied Territories of Palestine and Israel, there is a tremendous disparity in water access, quality, and rights. Because of the need for water to survive, as well as its ability to lend to economic development and education, its equal distribution is crucial in the region to prevent violent conflict.

I would like to acknowledge Dr. Bruce Bechtol and Dr. Edward Erickson for their guidance and assistance with this project.

## Executive Summary:

**Title:** Water Scarcity and Increased Instability—How Israel’s policies and actions since the creation of the National Water Carrier have adversely impacted the Jordan River Basin.

**Author:** Major Carrie M. Howe, United States Marine Corps

**Thesis:** Israel’s policies and actions since the creation of the National Water Carrier have increased water scarcity and furthered instability in the Jordan River Valley.

**Discussion:** By examining the outcomes of the 1967 Six-Day war; the creation of the Separation Wall and settlement building in the West Bank; the violations of international water law during the 2006 war with Lebanon; and the ineffectiveness of the Joint Water Committee, we can better see how Israel’s policies and actions concerning water will continue to fuel conflict and reduce water availability. Despite its midstream riparian position, Israel continues to flex its power, controlling a majority of the water resources in the West Bank.

**Conclusion:** Israel’s policies and actions since the creation of the National Water Carrier have increased the instability and water scarcity in the region. If the Israeli government continues on its current course of limited, if any, cooperation with the other riparians in the region, particularly Palestine, they will further isolate themselves. Implementing more effective plans and projects for equitable distribution, creating a legitimate working group, and promoting water sharing will facilitate economic development for Palestine, paving the way for peace in the region.

*If there is a political will for peace, water will not be a hindrance. If you want reasons to fight, water will give you ample opportunities.*

-Professor Uri Shamir

## **Introduction**

As the world's population increases, water resources will have an increasing importance in international security and strategy. Despite the multiple riparian<sup>1</sup> nations in the world and their ability to share water, albeit more tersely in some regions, the finite amount of freshwater can and will change fragile balances. Nearly 300 river basins and at least as many ground water sources cross international boundaries further exacerbating tensions regarding water quality, usage, and ownership.<sup>2</sup>

Although most water conflicts have been resolved peacefully with cooperation in the past, the same cannot be said for the Jordan River Valley. In the last fifty years, there have been thirty-seven water disputes worldwide involving violence—thirty of those occurred between Israel and one of its neighbors.<sup>3</sup> Shared by four sovereign states—Israel, Jordan, Syria, and Lebanon—as well as the stateless Palestinian people, the transboundary water resources that flow above and below the ground serve as the lifeblood for the inhabitants of the river basin. Without water resources, settlements and economic activity are not possible in the desert region.<sup>4</sup>

Since World War II, no other river basin in the world has generated as much controversy and hostile emotions over the scarce water resources as the Jordan River Basin. Additionally, this is the only river basin where one riparian has improved its water security by occupying and holding on to the territories of its neighbors, exacerbating tension. Israel's policies and actions since the creation of the National Water Carrier have increased water scarcity and furthered instability in the Jordan River Valley. By examining the outcomes of the 1967 Six-Day War; the creation of the Separation Wall and settlement building in the West Bank; the violations of

international water law during the 2006 war with Lebanon; and the ineffectiveness of the Joint Water Committee, we can better see how Israel's policies and actions concerning water will continue to fuel conflict and reduce water availability. Should Israel continue with its aggressive actions and policies with regards to water resources, it will escalate the region closer to conflict and heightened levels of water scarcity.<sup>5</sup>

### **Physical geography**

The Jordan River Valley forms the northern portion of the Dead Sea drainage basin that lies in the rift extending from the mountains of Lebanon to the Gulf of Aqaba on the Red Sea. Despite the size of its vast drainage basin with an area of 15,580 square miles, the Jordan River basin has an insufficient water supply based on the needs of the people and the states that share the water. By the year 2000, the people living in the Jordan River basin drew more than 3.2 billion cubic meters of water, well in excess of the 2.5 billion cubic meters that recharge each year through rainfall. Particularly in Israel and Palestine, the lack of rainfall and the location in an arid region contribute to the deficient water supply as well as the over-abstraction of water.<sup>6</sup>

### **The Jordan River system.**

The Jordan River is the third largest perennial river in the Middle East and the most important surface water source in the Jordan River Valley. It has a historical significance for Jews, Muslims, and Christians alike, fueling ownership debates. The river flows southward through Lebanon, Syria, Israel, and Jordan for a total length of 228 kilometers. There are four main sources of water in the Jordan River Basin: the flow of main rivers, the perennial flow of the wadis, the flood flow of the wadis, and the well supply from ground water.<sup>7</sup>

The river system itself is composed of several elements: the Hasbani, Dan, and Baniyas Rivers are group of karstic springs<sup>8</sup> that originate in the mountain ranges of Lebanon, Israel, and Syria

respectively and act as the source for the Jordan River (see Figure 2). The Dan Spring is the largest spring, encompasses the entire flow of the Dan River, and represents approximately fifty-percent of the discharge to the Upper Jordan.<sup>9</sup>

- The Upper Jordan River flows from the confluence of the Hasbani, Dan, and Banias Rivers in northern Israel to the Lake of Tiberias.<sup>10</sup>
- The Lake of Tiberias, located approximately 210 meters below sea level, is 12 kilometers across and has an average depth of twenty-four meters. Inflows to the Lake are estimated at 500 million cubic meters per year (MCM/y) to 800 MCM/y (see Figure 3).<sup>11</sup>
- The Lower Jordan River historically flowed from the Lake of Tiberias to the Dead Sea; however, today only a small stream of sewage exists. With the head of the river dammed since 1964, its sources are the diverted saline spring waters of the Lake of Tiberias, poorly treated wastewater, perennial wadis, and the Yarmouk River. The water quality of the Lower Jordan is extremely poor and does not serve as a source for drinking water.<sup>12</sup>
- The Yarmouk River originates in Syria and Jordan and flows into the Lower Jordan River approximately ten kilometers downstream of the Lake of Tiberias. However, Jordan and Syrian dams and channels have diverted most of the flow away from the Lower Jordan River.<sup>13</sup>
- Various wadis flow into the Lower Jordan River from all sources including Wadi al Far'a that rises in the West Bank behind Nabulus.
- The Dead Sea is salty brine that sits 400 meters below sea level. The flow into the Lower Jordan River varies between fifty to two hundred MCM/y, approximately twenty-five times less than the pre-1964 discharge. The Dead Sea shrinks at the rate of one meter of shoreline lost per year.<sup>14</sup>

## **Groundwater.**

A larger quantity of freshwater exists as groundwater in the Israel-Palestine transboundary. The groundwater comes naturally to the surface in the form of springs or as an extraction from hundreds of wells that vary in depth from twenty to 700 meters. There are four transboundary aquifer basins (see Figure 4):<sup>15</sup>

- The Western Aquifer Basin (WAB), also known as the Yarqon-Taninin aquifer, is the largest of the four aquifers in terms of volume. It extends from north to south along the western edge of the West Bank. Under the terms of Article 40 of the 1995 Oslo II Interim Agreement, Israel can receive 340 MCM/y and Palestine can receive 42 MCM/y. Its sustainable recharge rate is 362 MCM/y, meaning that Israel and the West Bank draw 100-percent of the resources from this aquifer every year. This aquifer also supplies Israel with more than twenty-five-percent of its water consumption.<sup>16</sup>
- The North Eastern Aquifer Basin (NEAB) has an estimated sustainable recharge rate of 145 MCM/yr. Under the terms of the Oslo II Agreement, Israel is allocated 103 MCM/y and Palestine is allocated forty-two MCM/year. This aquifer also draws 100-percent of its sustainable recharge rate.<sup>17</sup>
- The Eastern Aquifer Basin (EAB) contains the smallest volume of the transboundary aquifers and covers more than half of the West Bank. The sustainable recharge rate is highly controversial because of the terms established in the Oslo II Agreement—Israel receives forty MCM/y and Palestine receives fifty-four MCM/y. Article 40 also refers to additional quantities of seventy-eight MCM/y available for Palestinian usage and development; however, this volume is not sustainable if it exists at all.<sup>18</sup>

The Coastal Aquifer Basin (CAB) extends the full length and width of the Gaza Strip as well as most of the coastline of Israel. Its sustainable recharge rate is approximately 485 MCM/y. It is the only aquifer located within Israeli territory. However, the Oslo II Agreement did not define allocations for extraction from this aquifer. Additionally, the water quality is extremely poor due to over utilization of the aquifer, poor sewage systems, and soil erosion.<sup>19</sup>

The peculiar geography of the Jordan River basin will continue to influence hydropolitics through parameters and constraints. As shown, Israel is and will be heavily dependent upon water that originates outside of its internationally recognized borders. If water use continues at its current rate and the population continues to grow, the water supply in the basin will be insufficient to meet the needs of the people.

### **The creation of the National Water Carrier**

Further demarcated by the United Nations following World War II, the boundaries of the States within the Jordan River Basin have little regard for the hydrological and geographical integrity of the basin and still have unsettled border issues. Geographical studies of the region determined that the aftermath of colonization caused three types of disputes: positional disputes, over the exact location of the boundary; territorial disputes, where neighboring states claim the same border area; and functional disputes, where the boundary creates problems associated with the movement of goods and people or the allocation of resources such as water, oil, or minerals.<sup>20</sup>

The 1948 Arab-Israeli war aggravated the pre-existing difficulties with cooperative water management. The armistice agreements signed in 1949 did not deal with water, nor was the atmosphere conducive to negotiations, so each of the riparians began to utilize the Jordan River system unilaterally. Israel began water planning immediately and completed the All Israel Plan in 1951. It called for the draining of the Huleh swamp, the diversion of the Jordan River, and the

creation of a water carrier. The Israelis began their water plan with the draining of the Huleh swamp in 1951 while temporarily occupying 100 acres and permanently occupying seven acres of Arab-owned land in the demilitarized zone that Israel shared with Syria. This sparked the first of many military clashes between Israeli and Arab residents in disputed territories and demilitarized zones (see Table 1).<sup>21</sup>

### **The Johnston Plan.**

In an attempt to prevent future water conflicts, the Eisenhower administration sent a special envoy, Eric Johnston, to the region in 1953 to try to negotiate a water sharing accord. Philosophically based on the Marshall Plan<sup>22</sup> in Europe, the plan aimed to improve the environmental, economic, and social conditions for the basin residents. The Johnston Plan, one of many development schemes for the Jordan River Basin (see Table 2), followed a tenet of international water law that proposed avoiding the diversion of water from one basin to outside of the basin while those living within the basin do not have a satisfactory water supply regardless of political boundaries. The plan opposed the diversion of water outside of the Jordan River basin and allocated 394 million cubic meters per year to Israel, 774 million cubic meters per year to Jordan, forty-five million cubic meters per year to Syria, and 100 millions cubic meters per year to the Palestinians.<sup>23</sup>

However, the Johnston Plan fell through in the final negotiation stages in the late 1950s. Despite their non-legal binding nature, the allotments of water agreed upon during the Johnston Plan became the guiding principles for which the United States monitored Israel and Jordan on their plans for utilizing Jordan River water. Jordan began its plans for the East Ghor Canal and Israel started its development of the National Water Carrier both under the guise that they would not violate the basic premise behind the Johnston Plan. The Israelis designed the National Water

Carrier to convey the water from the Upper Jordan River out of the Jordan River basin by linking Lake Tiberias to the Mediterranean coastal plain and to the Negev desert in the south.<sup>24</sup>

### **Complications with the Carrier.**

The Carrier design intended to provide a municipal and industrial supply of water for three million people, water for agriculture with a continuous and regular flow, and an additional 170 million cubic meters for increasing agriculture development. Initially, Israel planned to divert the water from the B'not Yacov Bridge in the demilitarized zone with Syria. However, due to the potential to lose economic assistance, Israel compromised by moving the diversion to Eshed Kinrot at the northern corner of Lake Tiberias.<sup>25</sup>

The compromise led to several Israeli concerns—mainly the new diversion point would not produce hydrological power. The new site produced inferior water because of the higher salinity of water pulled from Lake Tiberias instead of directly from the river flow. It also required pumping, consuming more than twenty-percent of Israel's entire electrical power budget.<sup>26</sup>

In response to the plans for the National Water Carrier, Arab states began to threaten to divert the upper Jordan tributaries, the Hasbani and the Baniyas from Israeli territory in an effort to continue to push for the equitable division of Jordan waters. The Israeli leaders warned that actions to carry out a diversion of the Jordan tributaries 'could lead to armed conflict'.<sup>27</sup> They also stated that Israel would develop Jordan waters regardless of Arab reaction.<sup>28</sup>

By 1964, Israel completed a majority of the National Water Carrier; the project became a common concern in which the Arab states could unite. In January and September 1964, Arab heads of state gathered and organized plans to divert the headwaters of the Jordan. These summits established a unified Arab military command as well as a Palestinian organization and

army. Frustrated by Israeli water development, the Arab leaders set up a thirty-million dollar fund to divert water away from the Yarmouk. Syrian and Lebanese engineers built diversion canals; in response, Israeli jets and artillery destroyed the equipment on multiple occasions.<sup>29</sup>

By the 1960s, Arab leaders unanimously rejected Israeli's out of basin water use of Jordan water. They did not believe that the Johnston Plan guidelines were equitable or acceptable, especially when the Arab League rejected the plan. They also rejected the claim that Israel had justification to construct the National Water Carrier because Jordan had the East Ghor Canal. Most Arab countries, but especially Syria, did not regard Israel as a party with Jordan River water riparian rights. Israeli unilateral actions endangered Arab riparians' rights and harmed the quality of the water. Because Israel ignored the Arab League warnings, the Arab states felt entitled to take counteractions, including water diversion.<sup>30</sup>

Israel claimed that the diversion attempts of the Jordan headwaters demonstrated physical aggression, political hostility, and threatened Israel's right to exist. The new Arab diversion schemes, if executed, reduced the supply of water to the National Water Carrier by one-third and contributed to the salinity of Lake Tiberias. Prime Minister Levi Eshkol made Israeli's position very clear in the Knesset on January 16, 1965 when he stated: 'any attempt to deprive Israel of its share of the Jordan River system under the [Johnston] Water Plan [would] be considered an encroachment on our borders'.<sup>31</sup> Eshkol placed great importance on water and refused to compromise. Before his appointment as prime minister, he founded Mekorot, Israeli's water development institution and acted as the lead negotiator during the Johnston talks. In addition to believing the criticality of water in economic growth, he vowed to fight to protect it. Eshkol received significant political pressure from his main political competitor, Moshe Dayan, who urged Eshkol and his government to regard any attempt to divert Israel water as an act of war.<sup>32</sup>

Finally completed in 1964, Israel's National Water Carrier is contained within the pre-1967 Israeli borders yet it is still regarded as outright theft of water by its Arab neighbors. Its unified system of canals, tunnels, and pumps transports approximately 500 million cubic meters per year of water from Lake Tiberias to southwestern Israel—more than 125 miles away and outside the river basin and as well as drawing more than the initial quantity of 394 million cubic meters per year delineated in the Johnston Plan (see Figure 4). At the time, Israel's territory contained less than forty miles of the upper Jordan River; Jordan's territory included the West Bank that contained more than seventy miles of the Jordan River. This project is one of the few examples in the world where one riparian diverts water from an international basin to areas outside the basin without the consent of other riparian states and people sharing the basin.<sup>33</sup>

Israel's strong language and aggressive stance to protect water resources continues in the region. Although regional water scarcity alone did not start the Six-day War, it contributed to the escalation. From 1956 to 1962, the Arab-Israeli conflict saw little activity; however, the construction of the National Water Carrier provoked Arab Summits. During the summits, the Arab leaders developed many anti-Israel schemes—the most important being the plan to divert the Jordan headwaters. Violent attacks and counterattacks by the Arabs and Israelis relating to water diversion and the DMZ increased tension as well as an arms race. Ultimately, the actions on both sides contributed to the onset of war, emphasizing the complexity of water scarcity and Israel's need to establish itself as the most powerful riparian on the Jordan River.

### **The Outcomes of the 1967 Six-day War**

Following the Six-Day War, the power balance shifted in the region and began the growing deterrent power Israel accumulated relative to its neighboring states. Israel's military superiority effectively prevented the Arab side from challenging Israel's water plans and usage and

continues to impact Arab response today. The outcomes of the War radically altered the region's hydropolitical map by ending the skirmishes of the previous years, reducing feelings of insecurity in Israel and beginning the 'Israeli Hegemony Era'. Additionally, the "two peoples, one land"<sup>34</sup> issue returned to the region and reignited the Palestinian problem.<sup>35</sup>

Israel placed the West Bank, Gaza Strip, and Sinai Peninsula under a military government and treated the inhabitants differently than those in the other captured regions of East Jerusalem and Golan Heights. They had no intention of incorporating the residents from these areas into Israel; they merely wanted to claim the resources. Israel hoped to integrate the land from the West Bank and Gaza Strip in order to better defend its borders against external attacks, but most important, they wanted to gain the water reservoirs in the West Bank because of their vital security resource and Israel's scarce water supplies.<sup>36</sup>

The Israeli government continued its efforts to separate the occupied land and its inhabitants. Immediately following the 1967 War, Israel assumed control over all the water resources in the West Bank and Gaza Strip. In a series of military orders, the Israelis imposed the first controls on Palestinian water production. These orders allowed Israel to assume the water resources as state property without having to make a formal declaration and could avoid formally annexing them. Additionally, the Civil Administration of the Israeli Defense Forces assumed the operation of the Jordanian founded and Palestinian-staffed West Bank Water Department, creating ownership and usage issues that continue today. The Israelis used this institution, as well as other controlling devices, to shape Palestinian behavior by modifying daily practices with the hopes of increasing security. However, Israeli's stringent curbs on Palestinian access to water only fueled the Palestinian plight, making the denial of water seem like another Israeli endeavor to dispossess them.<sup>37</sup>

## **West Bank Areas A, B, and C.**

Limitations to Palestinian access to water and movement throughout the West Bank continued following the Oslo II Agreement in 1993. The Israeli government divided the West Bank into different areas: Area A, Area B, and Area C (see Figure 5). Area A comprises approximately seventeen-percent of the West Bank. It is under Palestinian control for government and civil matters and its primary residents are Palestinians. In Area B, the Israelis control the government and civil matters—they approve building permits with regards to housing, economic development, and well digging. Palestinians may live in Area B, twenty-four percent of the West Bank, but the Israeli government subjects them to their laws and rules. Area C makes up almost sixty-percent of the West Bank. The Israeli military governs these areas and limits Palestinians from building, farming, working, and traveling there. Of the land in Area C, eighteen-percent consists of a closed military zone and ten-percent contains nature reserves. Of note, Area C covers the land that parallels the Jordan River and the Dead Sea, disallowing Palestinian access to a major resource in the region. Additionally, the majority of aquifers, wells, and fertile farmland reside in Area C, further restricting Palestinian development and self-sufficiency.<sup>38</sup>

### **Creation of the Separation Wall and Settlement Building: Increasing water scarcity and distribution disparities**

In 2002, the government of Israel began to construct a barrier, touted as a security measure to protect Israeli civilians from Palestinian militant attacks. It consists of eight-meter high concrete walls in some sections and barbed wire, electric fences in other sections. Trenches, security checkpoints, patrol towers, patrol roads, and electronic security zones accompany the fence in an expensive and elaborate effort to physical separate the Palestinians from the Israelis.<sup>39</sup>

The barrier does not follow the 1949 Armistice Line—the Green Line—but significantly encroaches eastward into the West Bank (see Figure 6). In January 2006, 525 kilometers (74.6-percent) of the total length of the projected barrier lies within West Bank territory, creating closed areas. More than 10.1-percent of East Jerusalem and the West Bank lie between the Barrier and the Green Line. Once completed, more than 50,000 West Bank Palestinians living in thirty-eight villages will be included in these closed areas. Additionally, the Barrier will separate more than 280,000 Palestinians from their land.<sup>40</sup>

The case of 'Azzun 'Atma, a Palestinian community located in a closed area, shows how the Barrier separates its residents, not only from their land, but also members of their own community as well as other communities within the West Bank (see Figure 7). The Separation Wall creates a barrier between 'Azzun 'Atma and the West Bank. A planned addition to the Barrier will divide the southern portion of 'Azzun 'Atma from the rest of the community as well as restricting residents' access to Palestinian land. The winding route of the Barrier allows for the territorial contiguity between four Israeli settlements: Etz Efrayim, Elqana, Oranit, and Sha'are Tikva; however, it detracts significantly from the territory in the West Bank.<sup>41</sup>

Communities close to the Barrier once had viable local economies as well as water and land resources. However, the Barrier now isolates wells from the land, creating local impact on transboundary flows. The Palestinian farms experience the greatest impact by the Barrier. Although the Israeli Civil Administration created provisional agreements to allow farmers access to their wells and fields on the other side of the Wall, the Israeli soldiers manning the gates regularly restrict passage, disallowing at their own discretion permit holders to pass. Without regular maintenance and operation, the old wells fall into a state of disrepair with damaging consequences for the people that depend upon them for food and income.<sup>42</sup>

The Separation Barrier also created new water and sanitation needs in an area that already lacks crucial resources and the monetary requirements to fund them. In a 2004 study, the Palestinian Agriculture Ministry contended that the Separation Barrier significantly damaged the water supply. The route of the Barrier left approximately thirty groundwater wells, with a discharge of more than four million cubic meters per year, on the Israeli side of the fence and separated from dependent Palestinians. Additionally, Israel completed less than thirty-percent of the Barrier in 2004—since then, they have completed more than eighty-percent of the Barrier, significantly increasing the amount of damage to the water infrastructure.<sup>43</sup>

In the Governorate of Qalqilya, the Separation Wall runs through the water infrastructure; however, no apparent relationship exists between the route of the Wall and the Palestinian wells (Figure 8). Home to more than 72,000 Palestinians in thirty-two villages<sup>44</sup>, the governorate sits atop the Western Aquifer. The Qalqilya Wall, together with the rest of the Separation Barrier, was built to give Israel total control of the highest productive zones in the aquifer basin and to provide Israeli settlers maximum separation from the Palestinians. In addition to dividing villages, the Israeli government destroyed all Palestinian property within thirty-five meters of the wall including homes, farmland, and water infrastructure.<sup>45</sup> Once considered the ‘bread basket’ of the West Bank because of its fertile land and access to water, Qalqilya lost more than 3,000 dunums<sup>46</sup> of agricultural land, representing more than fifty-percent of the city’s farms, due to the construction of the Barrier. Nineteen wells belonging to the residents of Qalqilya lie outside of the Wall, representing more than thirty-percent of their water supply, essentially rendering useless a large portion of their water infrastructure. The lack of economic, agricultural, and water resources will further isolate the population, increasing the anger and instability in Qalqilya.<sup>47</sup>

### **Water use and allocations:**

The population in the Jordan River Basin has grown at rates substantially above the world average—naturally, from immigration, and from returning refugees. Israel’s current population is over 7.6 million<sup>48</sup> and it grows at a rate of 1.67-percent per year. The West Bank’s current population is 2.45 million people and it increases at a rate of 2.18-percent yearly. By 2025, their populations will reach more than 9.9 million and almost 3.5 million people, respectively. Should a comprehensive and suitable peace occur between Israel and the Palestinians, a large number of Jewish immigrants and Palestinian refugees will settle in the basin, further impacting the pressures on the scarce freshwater resources.<sup>49</sup>

In 2003, Israel’s allocation or consumption of freshwater resources transboundary was 1,600 MCM/year; Palestine’s allocation was 275 MCM/year (see Table 3). This six to one ratio reduces slightly when comparing the size of the populations. However, the skew becomes more severe when adding Israeli’s access to the Negev Aquifer as well as their technical expertise and economic capacity to create ‘new’ water through the desalination of brackish water and seawater. Adding to the asymmetry, Palestinians are barred from all access to and from any use of the Jordan River, despite the fact that it flows through the West Bank.<sup>50</sup>

Water production and consumption from within the West Bank (Table 4) presents a summary of water consumed by all the residents of the West Bank including the water consumed by Israeli citizens living in settlements and military bases within the borders of Palestine. Most noticeable are the inequities in consumption between the Palestinians and Israelis, particularly between the Palestinians and Israeli settlers. In 2003, 230,000 settlers consumed more than one-quarter of the water consumed by 2.4 million Palestinians. However, the terms of per capita consumption demonstrate an even greater disparity. Three-quarters of Palestinians consume

between thirty and one hundred liters of water for domestic use per day—one of the lowest per capita water uses in the world<sup>51</sup>; Israelis consume between 240 to 300 liters per person daily.<sup>52</sup>

Incorporating the value of water into each state's economy has a similar bias. The agriculture sector in Israel contributed to 1.5-percent of the Gross National Product (GNP) in 2001. In Palestine, agriculture assumes between twenty- and thirty-percent of the GNP, even though Israeli settlers and military operations attempt to suppress the farming activity. The ratio of Israeli to Palestinian agriculture water use is approximately nine to one; however, the importance of the farming activity to each state is roughly one to twenty-five.<sup>53</sup>

### **Israeli Control over Water Sources in the West Bank.**

Israel management structures control a variety of freshwater sources in the West Bank. The West Bank Water Department (WBWD) wells consist of thirteen wells operated and maintained although not owned by the WBWD. Created in 1967, the WBWD originally formed as the Jordan Water Resources Authority and, until 1995, the Israeli Civil Administration (ICA) ran the department. The ICA drilled several more wells in the West Bank through the WBWD, intended for use primarily by Israeli settlements. Although the WBWD falls under the PWA, the ICA makes decisions about the operation of WBWD and water management priority. Palestinians continue to turn the water valves under Israeli control, but they cannot make decisions about water management—an unchanged situation since Israel's occupation in 1967.<sup>54</sup>

Israeli-controlled Merokoth owns and manages the Israeli wells within the West Bank. In addition to controlling water resources inside the West Bank, Israel also controls abstractions across the entire Western Aquifer Basin. The Israeli government does not release data on the production capacity of the wells; however, there are twenty-five high capacity wells that produce between forty-four and fifty-nine MCM/year (see Table 5). Israeli settlements and Israeli

military bases receive a majority of this water—the Palestinian villages have the lowest priority.<sup>55</sup>

The Palestinian Water Authority purchases water from Israel. Merokoth delivers the water through twenty-five connection points established through the WBWD prior to the 1995 Oslo II Agreement. The amount of water purchased varies from twenty-two to thirty-six MCM/year. In this case, Merokoth holds power over the Palestinians—Israel threatened to cut-off water supplies to Bethlehem in 2006.<sup>56</sup>

Palestinians also purchase water from Israeli settlers—another aspect of furthering the Israeli-control over water. The 200,000 Palestinians that do not receive water through piped networks collect rainwater during the winter. When they deplete their stocks during the summer, they buy water from private Palestinian tankers; however, when the Israelis deny the tankers access to their regular filling points, the Palestinians will fill up from Israeli settlements at a much higher cost.<sup>57</sup>

Israel controls the abstractions across the entire Western Aquifer Basin through its superior pumping capacity. Its technological advances in high capacity pumps contribute to the skewed distribution of the water from this aquifer. On average, Israel draws 362 MCM/year and Palestine draws twenty-two MCM/year from the Western Aquifer.<sup>58</sup>

#### **Palestinian Control over Water Sources in the West Bank.<sup>59</sup>**

Palestinian water management structures have limited control over the flow of freshwater in the West Bank. Following the Palestinian Water Authority's (PWA) creation in 1996, four wells were developed in the West Bank. Owned and operated by the PWA, these wells are high capacity, producing roughly 3.5 million cubic meters per year (see Table 3).<sup>60</sup>

Traditionally privately owned and regulated, agricultural wells in the West Bank fall under the jurisdiction of the PWA according to the 2002 Water Law. More than 300 of these low-capacity wells exist, producing approximately 34.5 million cubic meters per year. Landowners dug a majority of the wells prior to the Israeli occupation of 1967, and they resist the change from traditional family management of water structures to the central management efforts of the PWA.<sup>61</sup>

According to the 2002 Water Law, municipal wells also fall under the jurisdiction of the PWA. Detached from central planning policies during the Israeli Occupation, the municipalities' service-delivery capabilities exceed those of the PWA. Much like the PWA control of agricultural wells, municipalities do not welcome the developments supported by the PWA.<sup>62</sup>

When comparing Israeli and Palestinian control over water sources in the West Bank, the pronounced disparity not only gives Israel greater control over the resources, but it also discredits the capabilities of the Palestinian Water Authority. Unfortunately, due to the lack of skilled water technicians, funding, and authorization, the PWA does not have the ability to fix problems with the water infrastructure or provide additional water to Palestinians. The Israeli technical superiority and robust water infrastructure provides complete water coverage for its citizens in Israel and its settlements in the West Bank. Conversely, only seventy-eight-percent of residents in the West Bank receive piped water into their homes, demonstrating a tremendous disparity, not only in control of the water, but also with regards to infrastructure.<sup>63</sup>

#### **Violations of International Law—The 2006 War with Lebanon**

Before World War I, international law with regards to rivers served to resolve disputes concerning the freedom of navigation. Since that time, dwindling water supplies and an increasing population have caused policy makers to make attempts to create and provide general

guidelines applicable to the world's watersheds. However, the broad concepts have presented a myriad of challenges.<sup>64</sup>

In the Helsinki Rules of 1966, the International Law Association accepted the concept of a drainage basin and provided guidelines for the reasonable and equitable sharing of a common waterway. Poorly developed international water laws compound the problems of water management. The 1997 Convention on the Non-Navigational Uses of International Water Courses Commission reflects the difficulties associated with marrying legal and hydrological intricacies. In addition to taking twenty-seven-years to develop, it institutionalizes the upstream-downstream conflict calling for both 'equitable use' and an 'obligation not to cause appreciable harm'.<sup>65</sup> However, upstream and downstream riparians have differing opinions with regards to equitable use. Upstream riparians believe that water sharing should incorporate the needs of the present as well as the past, allowing for changes in distribution. Downstream riparians feel that their water requirements should involve increasing allocations based on plans for the future and should also protect preexisting water quantities despite the increases in demand due to population increases.

The Convention provides few practical guidelines for allocations of water—the origin for most water conflicts. Incorporated wholly, the seven relevant factors provide the basis for allocations. These factors are (1) geographic, hydrographic, hydrological, climatic, ecological, and other natural factors; (2) social and economic needs of each riparian state; (3) population dependent on the watercourse; (4) effectors of use in one state on the uses of other states; (5) existing and potential uses; (6) conservation, protection, development and economy of use, and the costs of measures taken to that effect; (7) and the availability of alternatives, or corresponding value, to a particular or planned use.<sup>66</sup>

International Law also governs the conduct of war and seeks to protect civilians and civilian infrastructure. During an armed conflict, military forces have to distinguish between civilian objects that may not be attacked and military objectives that may be attacked with discretion. Military objectives are: "by their location, nature, purpose, or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage." Civilian objects are "all objects which are not military objectives". Objects that are considered "civilian objects" may become legitimate military objectives if they are "being used to make an effective contribution to military action". However, when in doubt, the military presumes the object to be civilian.<sup>67</sup>

International Law prohibits direct attacks against civilian targets as well as indiscriminate attacks, or attacks that strike against military objectives and civilian targets without distinction. Disproportionate attacks, also prohibited, are excessive in relation to the direct military advantage to be gained. The International Law also forbids the striking, damaging, and destroying objects indispensable to the survival of the civilian population, such as water resources or infrastructure. Despite the wide interpretation of these laws, their violation constitutes a war crime.<sup>68</sup>

Most important, international law only concerns itself with the responsibilities and rights of nations. So, some political entities that might claim water rights, such as the Palestinians along the Jordan River, are not represented. However, in the case of the 2006 Israel-Lebanon War, examples exist that highlight the disregard of nations, particularly Israel, to protect water resources during war or conflict.

## The 2006 War with Lebanon

The conflict in Lebanon and in Israel began on 12 July 2006 and ended on 14 August 2006 with a ceasefire under United Nations Security Council Resolution 1701. Although relatively short—lasting only thirty-four days—the Lebanon civilian population felt tremendous impacts with 1,191 people killed. However, the Israeli artillery and jets inflicted the greatest amount of damage to Lebanon's freshwater resources and infrastructure in direct violation of International Water Law.<sup>69</sup>

Although Lebanon does not have any navigable rivers, it does contain many smaller rivers and springs. The Wazzani springs feed directly into the Hasbani River, one of the main tributaries of the Jordan River. The Hasbani then crosses the border into Israel two miles downstream from the springs and feeds into Lake Tiberias.<sup>70</sup>

In September 2002, the Lebanese built a pump, the Wazzani pumping station, on the Hasbani River as part of the recovery efforts following the end of the twenty-two year Israeli occupation in 2000. Intended to supply drinking water to more than sixty villages in Southern Lebanon, the water extracted would account for less than ten-percent of the Hasbani River's annual flow if the pumps ran twenty-four hours a day. However, Israel saw the pump as an encroachment to their freshwater supplies and threatened to destroy the pump, increasing the tensions between the two nations.<sup>71</sup>

Once the conflict began, the Israeli Defense Forces (IDF) targeted civilian infrastructure. On 13 and 15 July 2006, the IDF began their bombing campaign by focusing on the Jiyeh power station and its fuel tanks, approximately twenty-miles south of Beirut. In addition to polluting beaches, surface water, and groundwater with the oil spill that ensued, the southern part

of Lebanon did not have power. Their lack of power also prevented the pumping of drinking water and sewage treatment plant operation, affecting almost two million people.<sup>72</sup>

The Israeli Defense Forces destroyed wells, water mains, pumping stations, storage tanks, and water treatment works throughout Southern Lebanon. Compounded by the broken water pipes that ran underneath bombed roads, the damage disrupted water service throughout the entire country. Damaged and destroyed water facilities include four wells at Fakr al-Din as well as the pipes between the Fakr al-Din station and Wadi al-Rashid. More than fifty storage tanks in Sidon district, Bint Jbeil and al-Wazani sustained severe damage or complete destruction. Two pumping stations were destroyed in the Baalbak-al-Asseera region, as well as the water line between Sebaat and al-Dulbi. The Israeli Defense Forces also hit the al-Qasimiyya channel, Channel 900, and the line from Joun to al-Awwali in the al-Litani area (see Figure 9). Damage incurred to the water infrastructure disrupted the supply, distribution, and management of water resources, leaving them susceptible to contamination risks.<sup>73</sup>

The lack of clean water during the fighting became life-threatening when Israel also destroyed bridges and road networks, prohibiting aid agencies to deliver necessary supplies to residents in Southern Lebanon. Additionally, the lack of electricity compounded issues with sanitation. In many instances, residents of Southern Lebanon drank from the same irrigation ditches that contained waste in order to survive.<sup>74</sup>

International law seeks to protect objects indispensable to the survival of the civilian populace. Although the water pipes sustained collateral damage, it appears that Israeli forces directly targeted the pumping stations, storage tanks, and water treatment plants. It is difficult to understand how they could be identified as military objectives. Even if some of the objectives were military targets, there is little evidence to suggest that Israel exercised caution or rules of

engagement to ensure they avoided damage to civilian infrastructure as important to human life as freshwater resources. Although Hezbollah, a terrorist organization, committed war crimes by targeting hospitals and towns in Israel, the Israeli forces arguably violated international law and committed war crimes as well by targeting civilian infrastructure. Instead of increasing security along their border with Lebanon, the Israelis decreased it by destroying the water infrastructure and impeding the ongoing rehabilitation of the area. Additionally, their disregard for freshwater resources increased the water scarcity. Ironically, in their attempts to decrease the amount of water drawn from the Hasbani River for the Lebanese citizens, the Israelis reduced the amount of water available to their citizens because of the overcompensation required by the Lebanese to replace the lost water, making up for damages to their reservoirs and storage tanks.

### **The Joint Water Committee**

Established under the terms of Article 40 in the Oslo II Agreement for 'joint' Israeli and Palestinian water management of the water resources located within the political borders of the West Bank, the Joint Water Committee (JWC) brings together members of the Israel Water Commission (IWC) and the Palestinian Water Authority (PWA). Despite the 'joint' endeavor of the JWC, its jurisdiction does not cover transboundary resources in Israel, nor does it concern itself with the Gaza Strip. Ultimately, the JWC combines technical expertise with regards to water resources and their infrastructure and the political aspects of management along with military supervision to manage the development of water resources in the West Bank. Although equalities exist at the technical level, the final approvals that rest at the military and political levels distort the apparent equality.<sup>75</sup>

The most important operational responsibility of the JWC is its licensing procedure. According to the procedure, the Civil Administration of the Israeli Defense Forces makes the

final decision in the licensing procedure process for all of the permits requested in Area C of the West Bank. The terms of the Oslo II Agreement designate the areas outside of urban centers, roughly seventy-two percent, to remain under full Israeli control in Area C of the West Bank. Approximately seven-percent of the land in Area C confiscated by Israeli settlers also remains outside of JWC jurisdiction. This leaves twenty-one percent of the land within the West Bank subject to the formal JWC authority.<sup>76</sup>

As shown in Table 6, the JWC licensing procedure ensures that Israeli military interests take precedence over Palestinian developmental and joint Palestinian-Israeli water management interests. The Israeli military forces multiple water development projects, particularly those outside of the urban centers,<sup>77</sup> to relocate considerable distances away from the preferred location or to remain subject to strategic military interests.<sup>78</sup> The entire process demonstrates the imbalance of power between the two sides.<sup>79</sup>

The licensing procedures, coercion, and other forms of compliance all demonstrate the Joint Water Committee's ineffectiveness and displayed façade of 'dressing up domination as cooperation'. Some may see the committee as a model organization between adversaries—in reality; it is an instrument of control. The quality of cooperation instead of the JWC's mere existence should take priority; however, the disparity in bargaining power and the Palestinians' ability to affect change is extremely limited and counterproductive when it comes to water resources. Israel's domination in the JWC is apparent through the case of Jenin and the *Joint Declaration for Keeping the Water Infrastructure out of the Cycle of Violence*.

#### **Failures of Water Declarations and Agreements: The case of the Municipality of Jenin**

Although many conflicts between Israel and her neighbors have involved the control of water resources or the disputed ownership of water resources, the Joint Water Committee's highly

visible *Joint Declaration for Keeping the Water Infrastructure out of the Cycle of Violence* intended to protect valuable freshwater resources from damage during violent actions. Representing Israeli and Palestine, officials from the Joint Water Committee signed and published the agreement on the border of Gaza on January 31, 2001.<sup>80</sup>

The Joint Declaration sought to encourage both Israelis and Palestinians to protect the water supply in Israeli cities and the towns and villages of the West Bank and Gaza Strip. Through the encouragement of cooperation among the general population, the declaration urges the public to prevent damage to the water infrastructure including pipelines, drilling equipment, pumping stations, electricity systems, and any other related infrastructure. However, the military activity that occurred between Israeli Defense Forces (IDF) and the Palestinian factions in Jenin during Operation Defensive Shield during the Second Intifada in April 2002 demonstrates the ineffectiveness of the Joint Declaration in protecting water resources as well as the strategic value for damaging water infrastructure.<sup>81</sup>

Home to approximately 43,000 people, the municipality of Jenin sits on the northernmost hills of the West Bank and borders Israel. Jenin's residents receive their drinking water from four main sources: a Palestinian Water Authority (PWA) well, a municipal well, agricultural wells, and three Israeli-controlled West Bank Water Development Wells.<sup>82</sup>

The IDF invaded and occupied Jenin on three separate occasions: 8-15 September 2001; 28 February to 7 March 2002; and 2-19 April 2002. Although most remember the April 2002 incursion for the magnitude and extent of the physical destruction to the municipality itself,<sup>83</sup> the damage to its water infrastructure was far greater, leaving thousands of people without drinking water for more than two weeks.<sup>84</sup>

In addition to the ground forces and Israeli Air Force, armored D9 bulldozers and tanks contributed to the extensive damage to the water infrastructure (see Appendix A, Table 1). Using rear rippers to build berms and to dig trenches as well as driving over the fragile road networks caused a majority of the destruction to mainlines, pumps, distribution lines, and house connections. Although some of the damage was indiscriminate, other damage can fall under the categories of deliberate, economic, and political (see Appendix A, Table 2). However, the failed attempts of the Jenin Water Department to repair the damage because of IDF interference and disruption served as the greatest disregard to International Humanitarian Law and the Joint Declaration.<sup>85</sup>

Damage to the water infrastructure in Jenin also indicated the inability of the Palestinian Water Authority (PWA) to mitigate the destruction despite the highly publicized Joint Water Declaration. Unable to convince the offices of the JWC to have more water delivered to Jenin through the Israeli controlled, undamaged Mekoroth line, the Palestinian residents of Jenin went without freshwater. Additionally, the PWA did not publicize the Israeli violations of the JWC declaration or the breakdown in cooperation with their Israeli counterparts.<sup>86</sup>

Many analysts use the Joint Declaration as proof that despite the relationships between the politicians and combatants, water experts will work together to carry on in a spirit of cooperation. However, the events in Jenin during the Infitada demonstrate the inability of water agreements, much like international law, to secure water resources during times of violence. If anything, the targeting of water infrastructure, resources, and repair crews becomes strategically important for those riparians in positions of power.

### **The way ahead: Desalination and the Med-Dead Canal.**

Israel looked to desalination plants in the early 1960s as a solution to the freshwater shortage; however, the expensive cost and energy requirement shelved the plans. Israel has since acquired considerable experience with smaller-scale desalination plants located along the Mediterranean Sea, yet the cost of desalinated water remains substantial.<sup>87</sup> In fact, Israel maintains three reverse osmosis desalination plants: Ashkelon, Palmachin, and Hadera with plans to build two additional plants: Ashdod and Soreq by 2012. However, the creation of these plants has done little to reduce the water consumption from transboundary resources in the Jordan River Basin or alleviate regional water scarcity.<sup>88</sup>

Many Middle East water experts have called for the establishment of joint projects in order to find and create the technology necessary to reduce the cost of desalinated water throughout the region; adding to stability. The most ambitious, regional, and large-scale engineering project proposed combines desalination of seawater with a canal system linking the Mediterranean Sea with the Dead Sea. The enhanced Med-Dead Canal takes advantage of the 400-meter elevation difference between the sea and the deepest chasm on the earth's surface and could emphasize desalination fuelled by hydro-power, augmented with solar and conventional energy sources. Instead of a unilateral project focusing on power generation, a new approach to the Med-Dead Canal could create power and provide water in sparsely populated areas to benefit the populations of Egypt, Jordan, Gaza, Israel, and the West Bank.<sup>89</sup>

The Med-Dead Canal would have to be located in an area suitable to regional cooperation, with an intake near the Gaza Strip and a canal parallel to the Egyptian-Israeli border that runs to the Dead Sea (see Figure 10). Through the creation of solar ponds and desalination plants as well as the elevation differential, the project will generate power and enough water to

supply the Jordan River Basin. Because of the nations involved, this large project would require a tremendous amount of cooperation and technical expertise from across the region, if not the globe. Sharing the resources would also promote cooperation, boosting economic growth and overall quality of life. Ultimately, this project will trust and relationships in the potentially volatile region, increasing stability.<sup>90</sup>

Although the Med-Dead Canal is not the perfect solution, its development, implementation, and operation would emphasize cooperation, not just between Israelis and Palestinians, but also throughout the region. However, this large-scale project will require the full cooperation of all the nations involved. Most likely, that cooperation will not be obtained unless a peace agreement has been reached between Israel and Palestine. Unfortunately, peace or a two-state solution does not seem likely until equity exists with land and water resources.

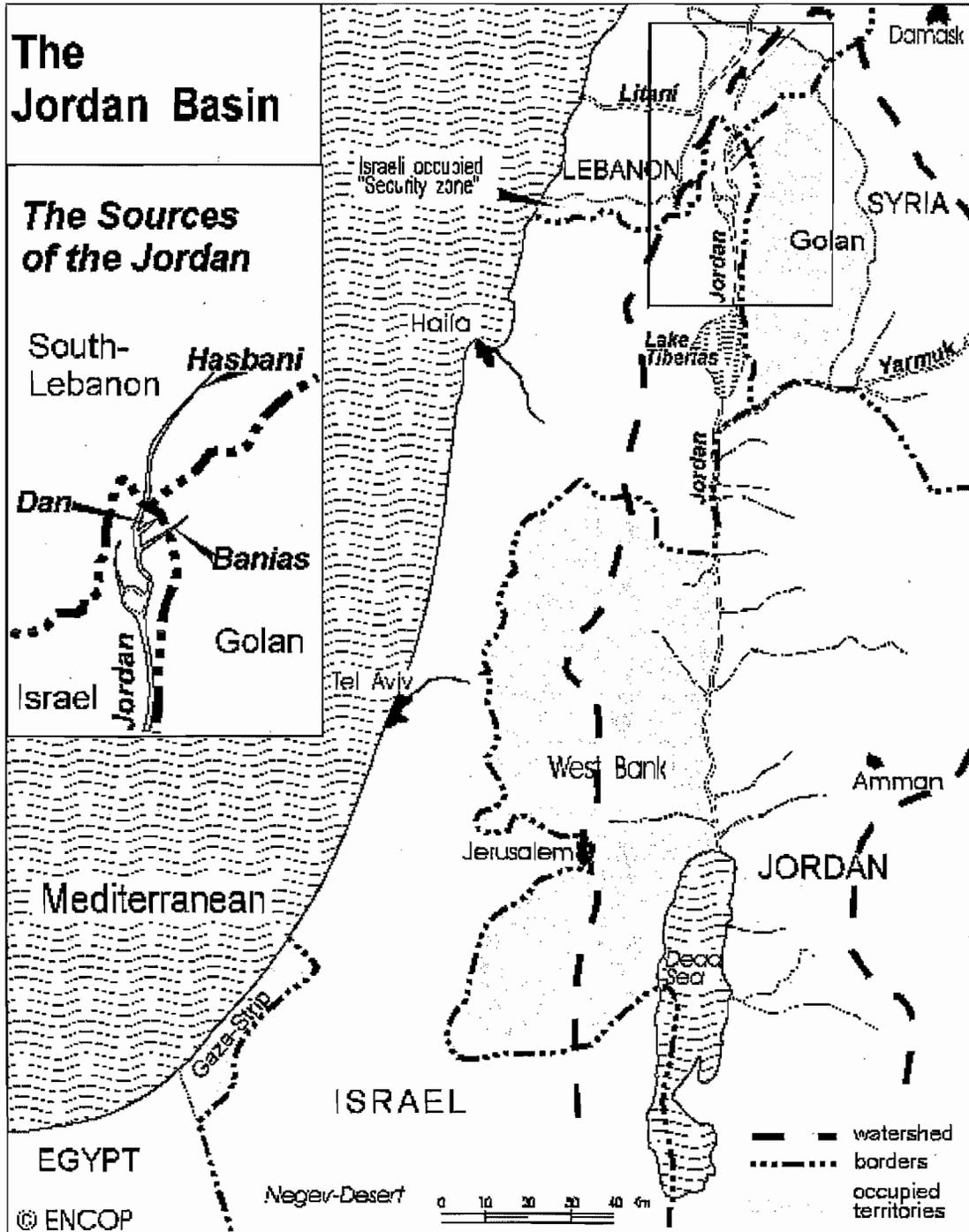
As Israel continues to limit Palestinian access to resources in the West Bank, they decrease their security. History has shown that countries cannot establish viable security without a middle class within their society. However, in order to create a middle class, the state has to have the necessary infrastructure—social, economical, and industrial—to support the development. In order to support development, the state needs resources—most important, land and water. Increased access to water would allow Palestinian agriculture to flourish. Because farming is such an important part of the economy in the West Bank, more citizens would have jobs. Generating more revenue through farming could create an industrial base and entice donors from outside the region to invest in the West Bank. The boost in the economy could further the development of social infrastructure, increasing the number of schools and hospitals. The younger generation, more intelligent because of educational opportunities, could get better, professional jobs, effectively creating a middle class.

These changes, of course, would take a considerable amount of time. However, Israeli water sharing would increase stability in the region. Water sharing would also require Israeli citizens to conserve water or find other solutions, like the Med-Dead Canal, to provide ample freshwater to the region. Today, the extent of Israeli and Palestinian cooperation barely extends beyond data collection. Without disclosure of water use in all parts of Israel, the Occupied Territories, and Israeli settlements, equitable and responsible water sharing will be misleading and will continue, following the trends of the last forty-six years.

### **Conclusion**

Israel's policies and actions since the creation of the National Water Carrier have increased the instability and water scarcity in the region. The examination of the outcomes of the 1967 Six-Day war; the creation of the Separation Wall and settlement building in the West Bank; the violations of international water law during the 2006 war with Lebanon; and the ineffectiveness of the Joint Water Committee demonstrated how Israel's policies and actions concerning water will continue to fuel conflict and reduce water availability. The absence of equal responsibility and power sharing along with the blatant disregard of International Law will further lead to dry taps, environmental degradation, and increased instability. Should Israel continue its current trend of self-serving actions and policies since the creation of the National Water Carrier, water scarcity and instability will increase in the Jordan River Basin. Implementing more effective plans and projects for equitable distribution, creating a legitimate working group, and promoting water equity will facilitate economic development for Palestine, paving the way for peace in the region.

Figure 1: Sources of the Jordan River Basin

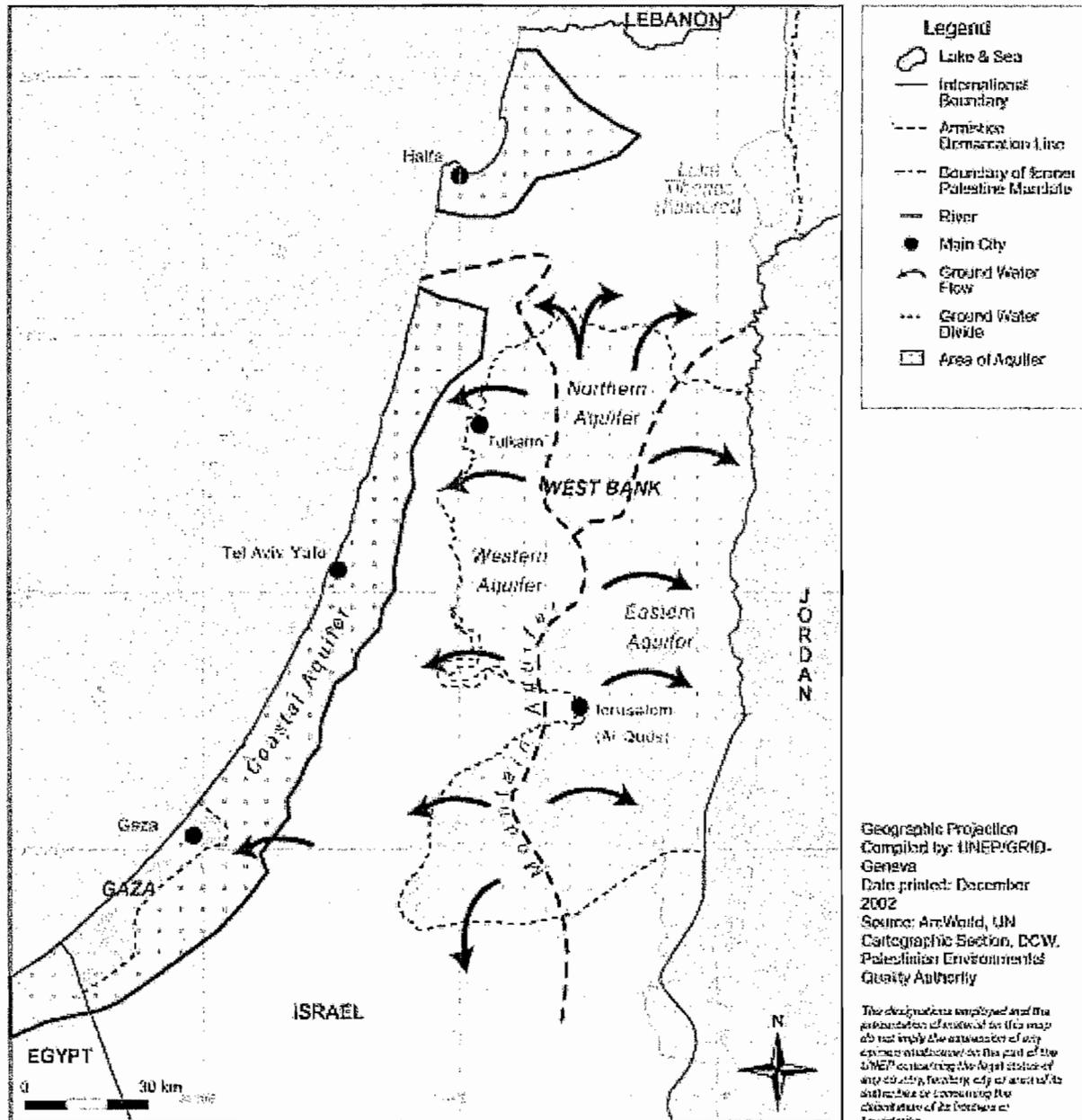


Source: MidEast Web for Coexistence, 2009.



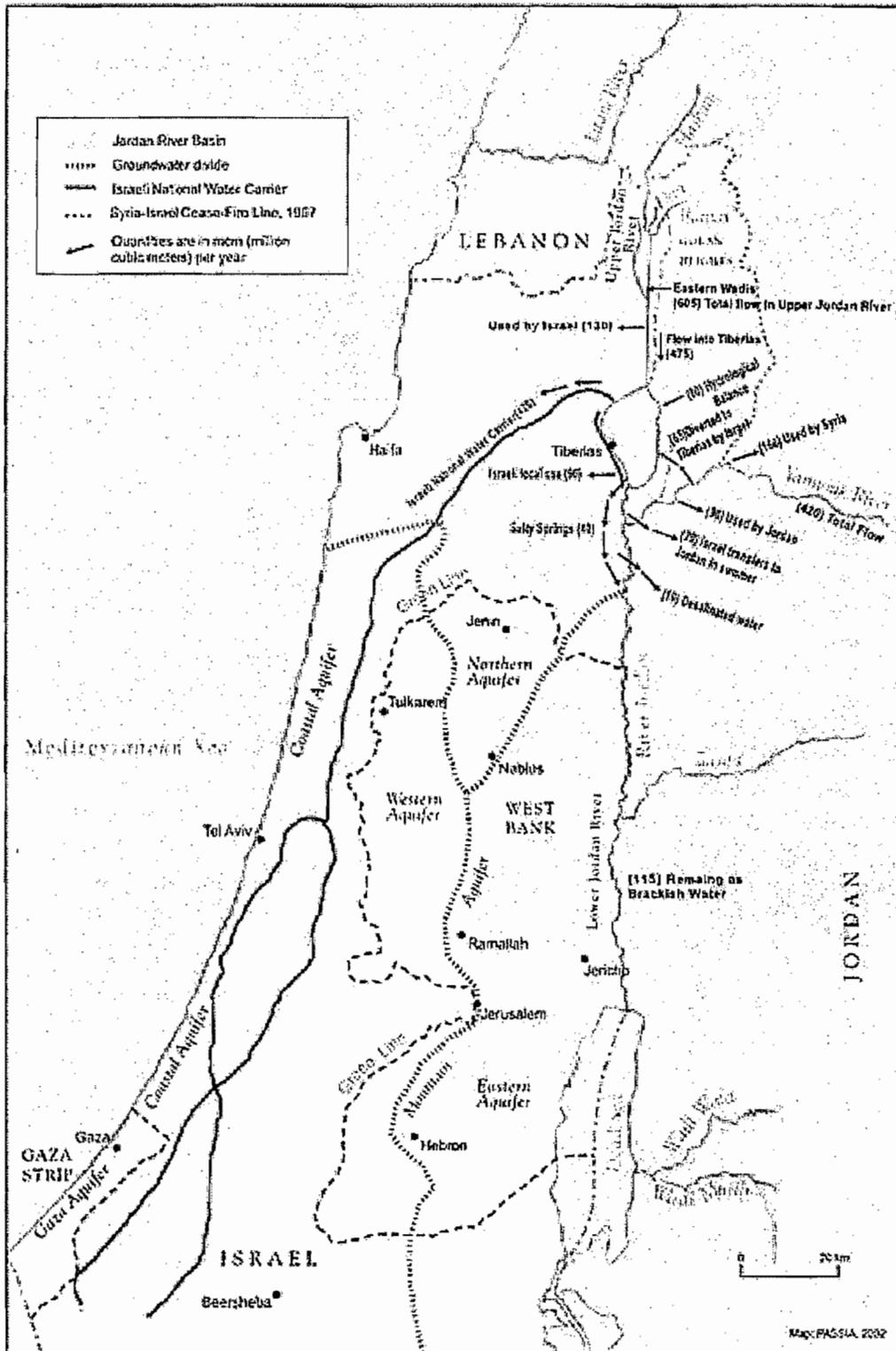
Figure 3: The Mountain and Coastal Aquifers of the Jordan River Basin.

## Mountain and Coastal Aquifers



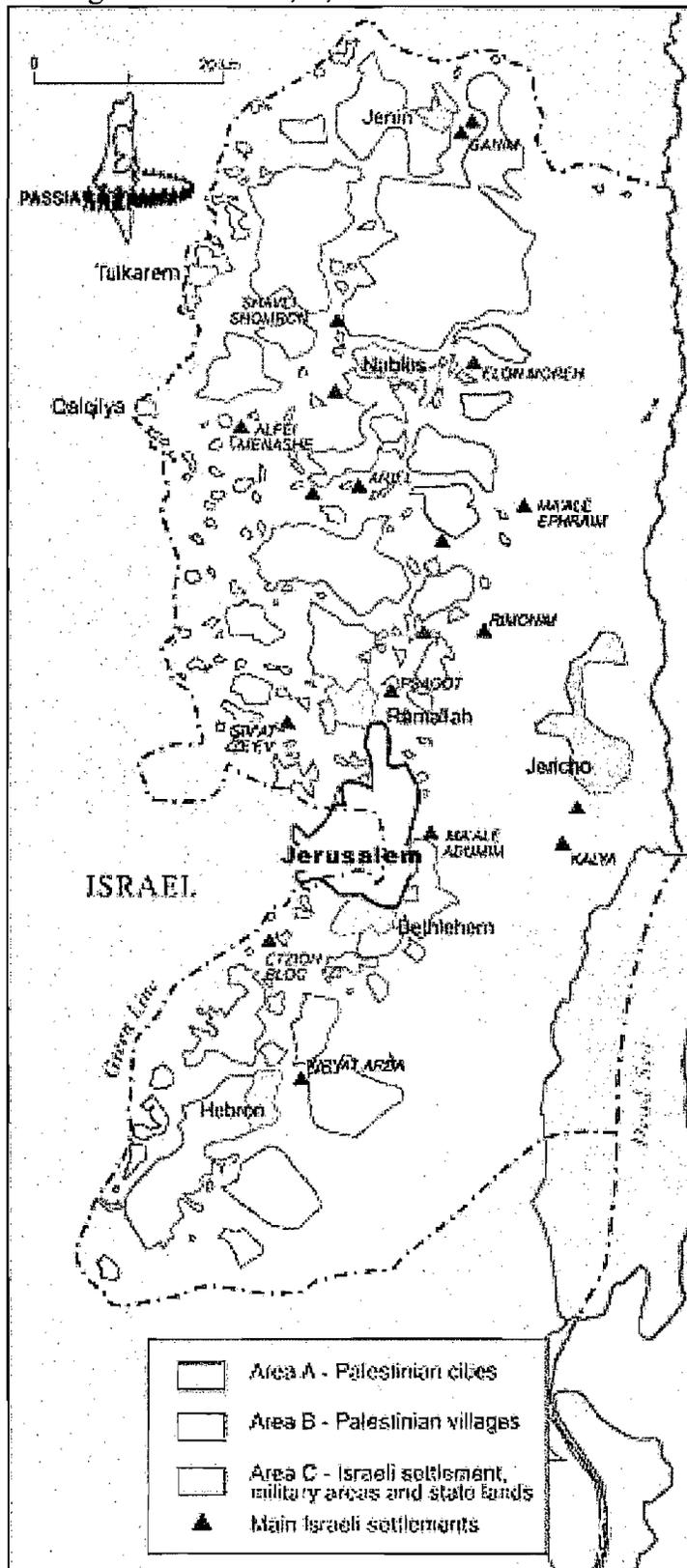
Source: United Nations Development Programme, 2002.

Figure 4: Israel's National Water Carrier and the water sources in the Jordan River Basin



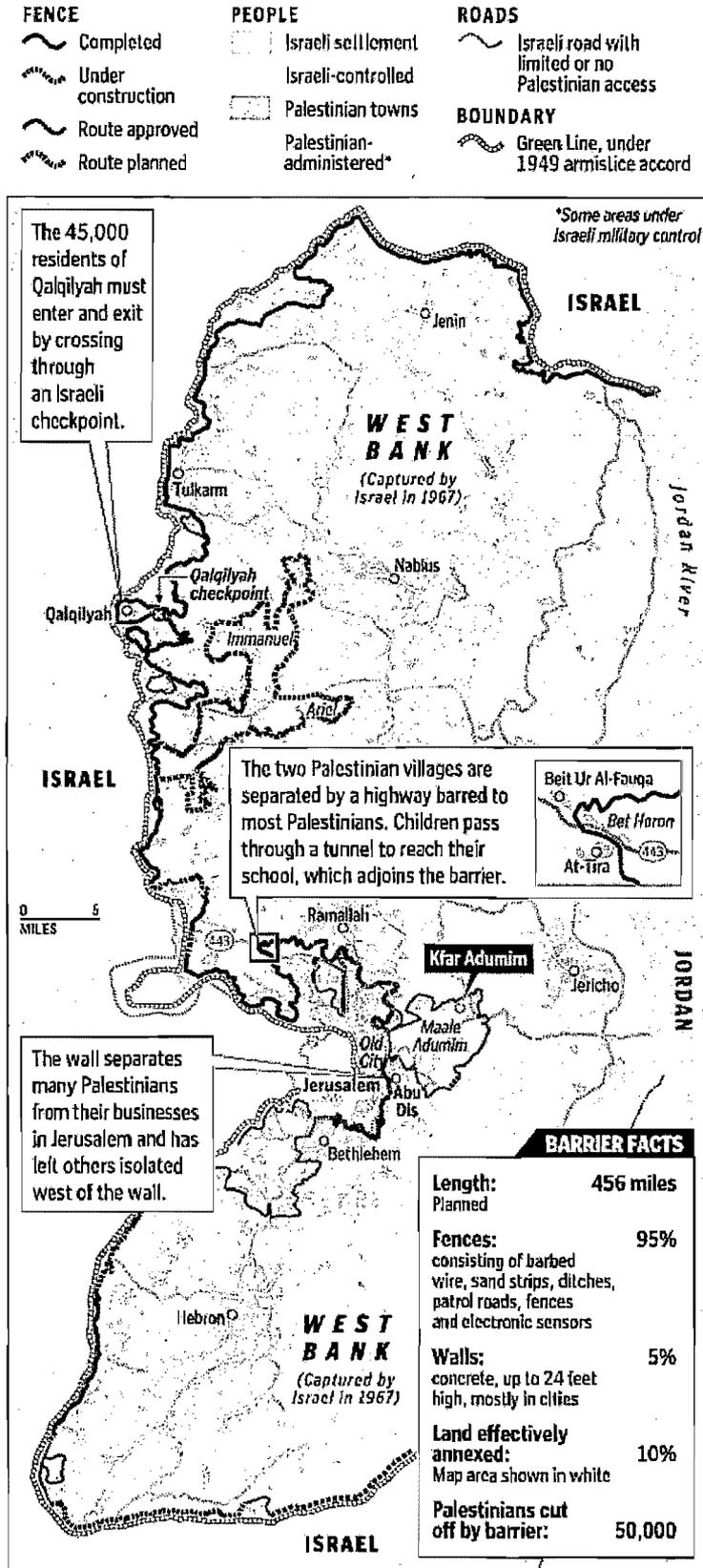
Source: Alice Gray, 2006.

Figure 5: Areas A, B, and C in the West Bank.



Source: Sami Jamil Jadallah, 2009.

Figure 6: Israel's Separation Wall in the West Bank



Source: Mickey Bergman, 2008.

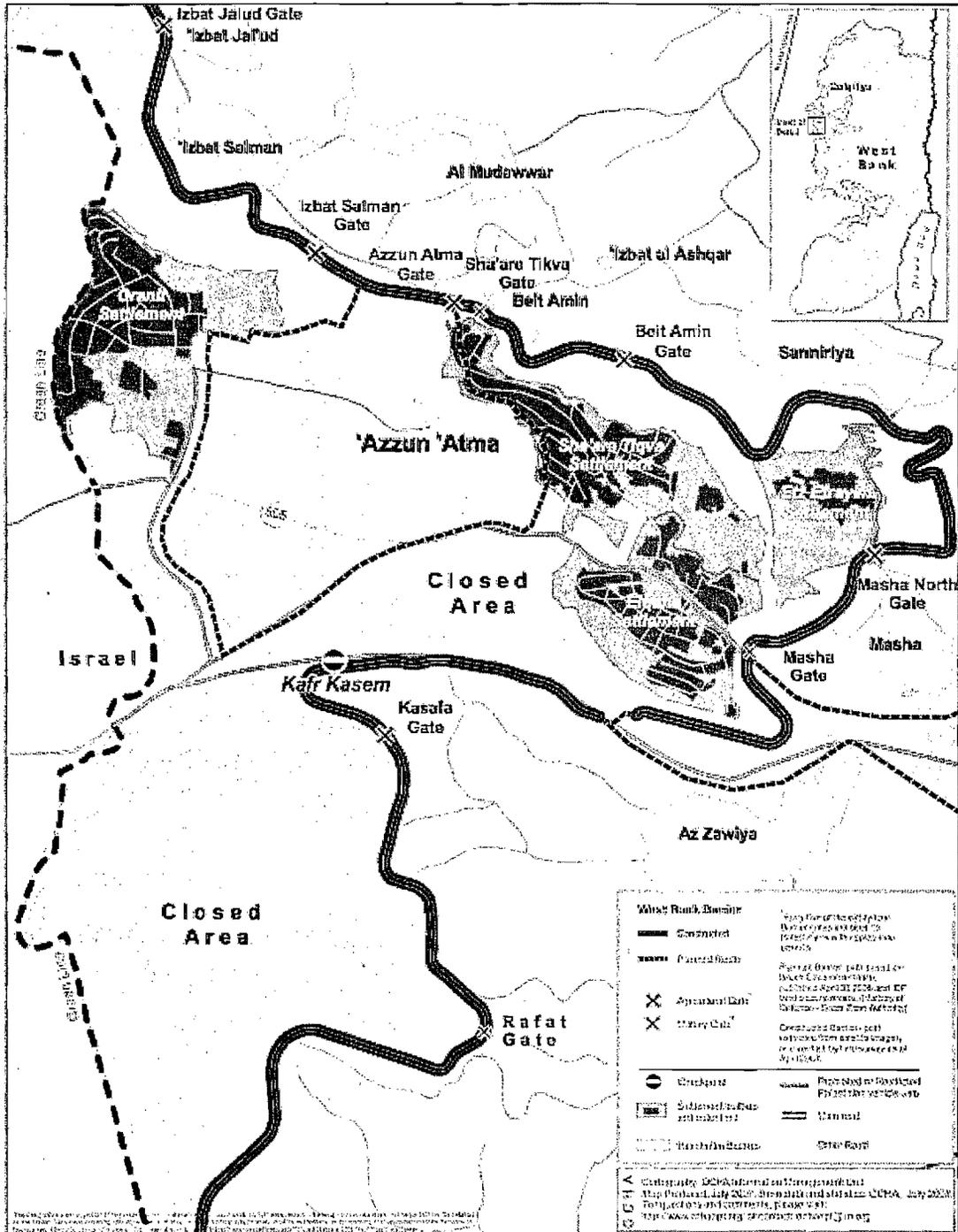
Figure 7: 'Azzun 'Atma



UN Office for the Coordination of Humanitarian Affairs

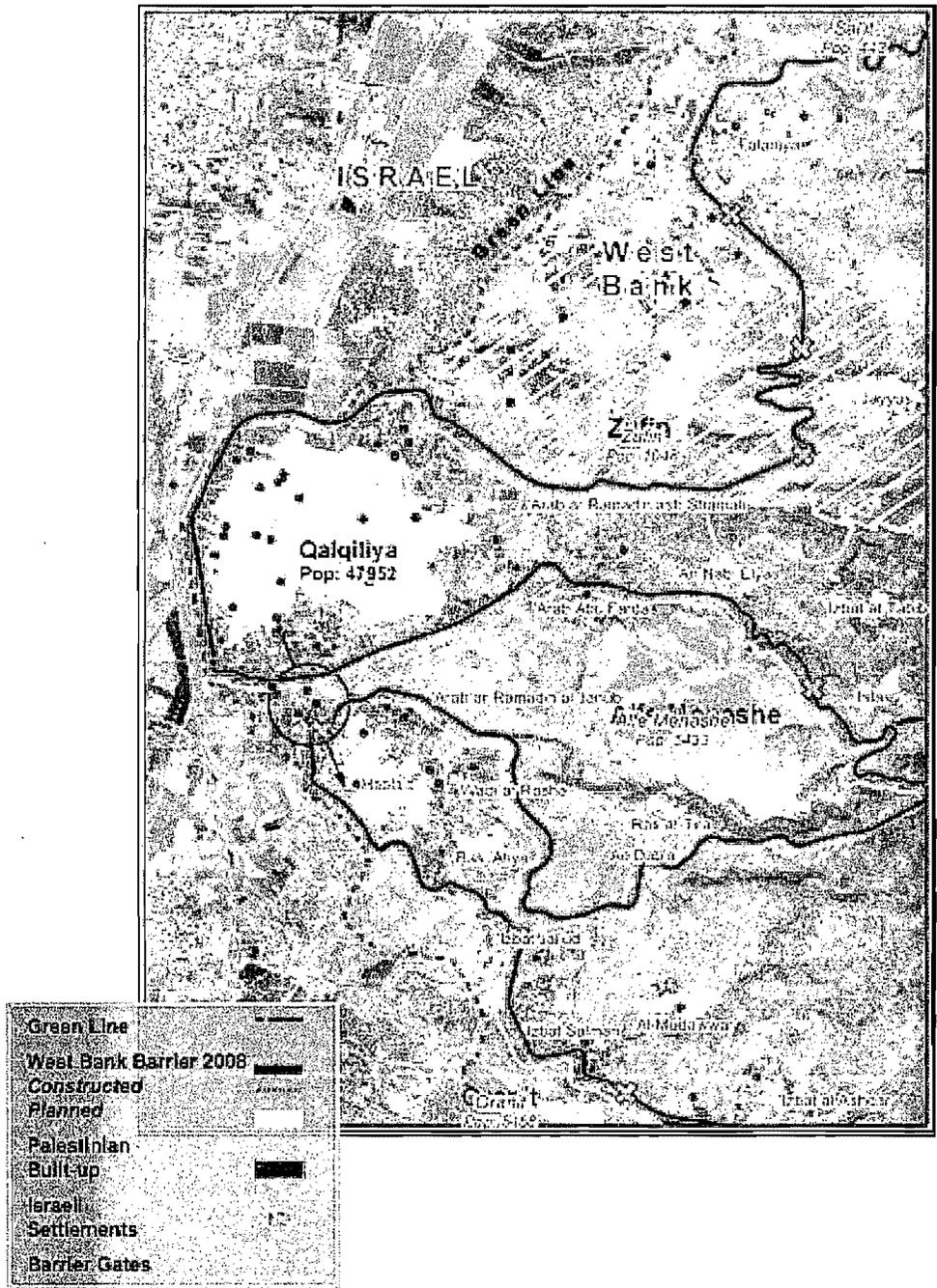
**South Qalqiliya: 'Azzun 'Atma Closed Area**

8 July 2007



Source: United Nations Office for Humanitarian Affairs, 2007.

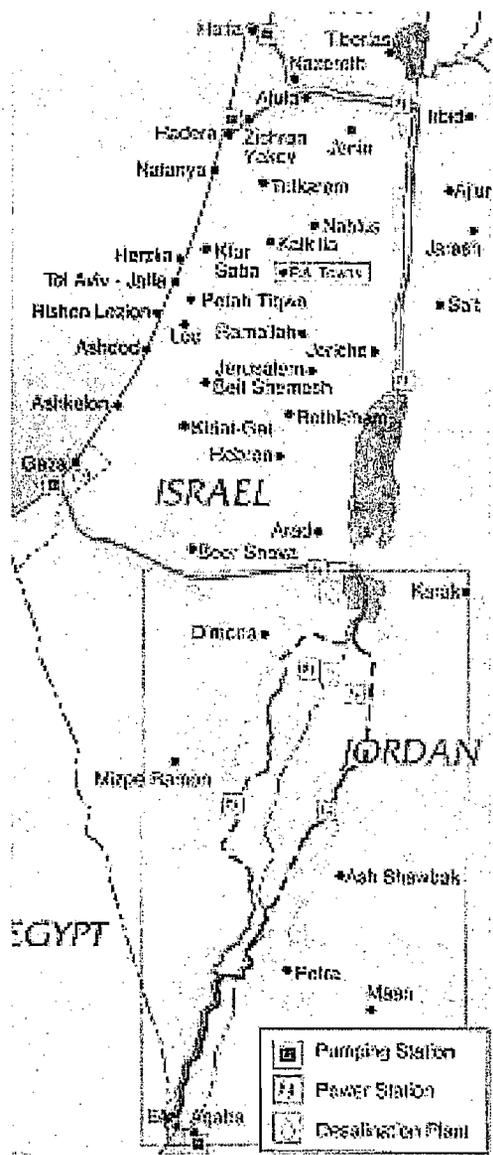
Figure 8: Israel's Separation Wall around Qalqilya, 2003.



Source: United Nations Office for the Coordination of Humanitarian Affairs, 2009.



Figure 10: Mediterranean-Dead Sea Canal



Source: Shari Berke, 1997.

Table 1: Water Related Cease-fire violations

Date	Incident	Immediate Issue	Underlying issue	Resolution
Spring 1951	Shooting in DMZ, both sides invade, Israel expels Arab villagers from DMZ, Israel air force bombs al-Himmah	Arab resistance to Israel land seizure, expulsion from DMZ	Huleh drainage in DMZ	Security Council orders return of Arabs, but villages had been razed.
3-Sep-53	Shooting in DMZ	Water diversion by Israel in DMZ	Sovereignty over DMZ	UN orders work halt, US threatens to end aid, Israel moves intake out of DMZ.
12-Dec-55	Israelis hit Arab villages NE of Sea of Galilee, kill 50 (follows by two days firefight on sea)	Fishing rights	Israeli saboteurs captured inside Syria	Security Council condemns Israel, Syria says no to Johnston Plan, prisoners return two months later
31-Jan-62	Israel destroys lower Tawafiq in DMZ	Israeli drainage ditch in Arab village	Use of land	Syria complains to MAC, Israel boycotts
13-Nov-64	Patrols, exchange of fire, bombing of Tell el-Qadi (source of Dan River)	Road building by Israel into disputed territory	Sovereignty over source of Dan River	Both parties complain to Security Council, Soviets veto
1-Jan-65	Fatah hits pump station (first in a series of attacks on Israel)	Israel existence	Palestine self-determination	None
Spring 1965	Patrols, firing on Israel-Syria border	Road building by Syria in Golan Heights	Arab water diversion	None
14-Jul-66	Israeli air force bombs Syrian construction vehicles, air battle at Banians	Alleged Syrian provocation	Arab water diversion	Security Council discusses, takes no action
15-Aug-66	Exchange of fire on Sea of Galilee	Patrolling, fishing	Land use in DMZ	Syrian note to Security Council
2-Apr-67	Firefight in DMZ	Arab water diversion	Arab water diversion	None
7-Apr-67	Israeli air force bombs Golan, seen over Damascus	Arab water diversion	Arab water diversion	MAC reconvened, no action

Source: Thomas Naff and Ruth C. Matson, 1984, 36-37.

Table 2: Development Schemes for the Jordan River System

<b>Year</b>	<b>Plan</b>	<b>Sponsor</b>
1913	Franghia Plan	Ottoman Empire
1922	Mavromatis Plan	Great Britain
1928	Henriques Report	Great Britain
1935	Palestine Land Development Company	World Zionist Organization
1939	Ionides Survey	Transjordan
1944	Lowdermilk Plan	United States of America
1946	Survey of Palestine	Anglo-American Committee of Inquiry
1948	Hays-Savage Plan	World Zionist Organization
1950	MacDonald Report	Jordan
1951	All Israel Plan	Israel
1952	Bunger Plan	Jordan/United States of America
1953	Main Plan	UNRWA
1953	Israeli Seven-year Plan	Israel
1954	Cotton Plan	Israel
1954	Arab Plan	Arab League Technical Committee
1955	Baker Harza Plan	Jordan
1955	Unified (Johnston) Plan	United States of America
1956	Israeli Ten-year Plan	Israel
1956	Israeli National Water Plan	Israel
1957	Greater Yarmuk Project (East Ghor Canal)	Jordan
1964	Jordan Headwaters Diversion	Arab League

Source: Thomas Naff and Ruth C. Matson, 1984, 31.

Table 3: Allocations or consumption of transboundary resources between Israeli and Palestine, 2003.

Transboundary water source	Allocation or consumption	
	Israel	Palestine
<i>Surface water</i>		
Jordan River System	660	0
Wadi al Far'a	6	6-12
Wadi Gaza	25	0
<i>sub-total</i>	691	9
<i>Groundwater</i>		
Eastern Aquifer Basin	40	68
North Eastern Aquifer Basin	103	42
Western Aquifer Basin	340	22
Coastal Aquifer Basin	429	135
<i>sub-total</i>	912	267
<b>Total</b>	<b>1,603</b>	<b>276</b>

All figures in MCM/y. The figures do not include endogenous sources of freshwater in Israel or Palestine (i.e. the eastward flowing springs arising from the EAB or the Negev aquifer), nor does it consider the 'new water' sources such as desalination and wastewater re-use.

Source: Mark Zeitoun, 2008, 58.

Table 4: Water production and consumption from within the West Bank, classified according to the source of control of production, 2003.

Source	Production or supply in/to the WB	Palestinian consumption in the WB	Israeli consumption in the WB	Control by
Rain water	n/a	5	0	P
PWA wells	3.5	3.5	0	P
Agricultural wells	34.5	34.5	0	P
Municipal wells	15.8	15.8	0	P
Springs	154.2	63.8	88.3	I/P
WBWD wells	8.9-11.9	5.9	4.5	I
Israeli wells inside WB	44-59.4	6.9	48.1	I
Jordan River System	n/a	0	0	I
Supply from Israel	38	22.5-36	9	I
Total Production/Availability of freshwater from sources inside the West Bank				188
Total Palestinian Consumption from groundwater sources inside the West Bank				130
Total Palestinian Consumption from all sources inside the West Bank				135
Total Palestinian Consumption inside the West Bank, from all sources				~165
Total Palestinian Consumption inside of Israel, from all sources				0
Total Palestinian Consumption in the West Bank under Palestinian Control				122.6
Total Palestinian Consumption in the West Bank under Israeli Control				~42
Total Israeli Consumption inside the WB from Israeli wells in the West Bank				~53
Total Israeli Consumption inside the West Bank, from all sources				~61
Total Israeli Consumption under Palestinian Control				0

All figures in MCM/y. I = production or supply controlled by Israeli actors; P = production or supply controlled by Palestinian actors. The table counts water consumed by Palestinian citizens, Israeli settlers, and the Israeli military.

Source: Mark Zeitoun, 2008, 54.

Table 5: Natural recharge, discharge, and well abstraction rates from three of four aquifers transboundary to the West Bank and Israel, 2001.

Basin	Recharge		Discharge		Wells					Springs			
	Average estimated Recharge	Range	Wells & springs in & out WB	Pal & Israeli Wells	Pal total	Israeli Sub-total	Israeli in WB	Israeli out WB	Pal & Israeli springs	Pal total	Israeli Sub-total	in WB	out WB
EAB	161	125-197	204.8	<b>62.7</b>	26.4	36.3	34.3	2	<b>142.1</b>	45.5	96.6	88.3	8.2
NEAB	145	132-177	184.1	<b>91</b>	19.1	71.9	12.9	59	<b>93</b>	17.8	75.2	0	75.2
WAB	366	317.5-366	621	<b>571.6</b>	26.8	544.8	2.8	542	<b>49.4</b>	2.6	46.8	0	46.8
Total	672		1009.9	<b>725.3</b>	72.3	653	50	603	<b>284.5</b>	65.9	218.6	88.3	130.3

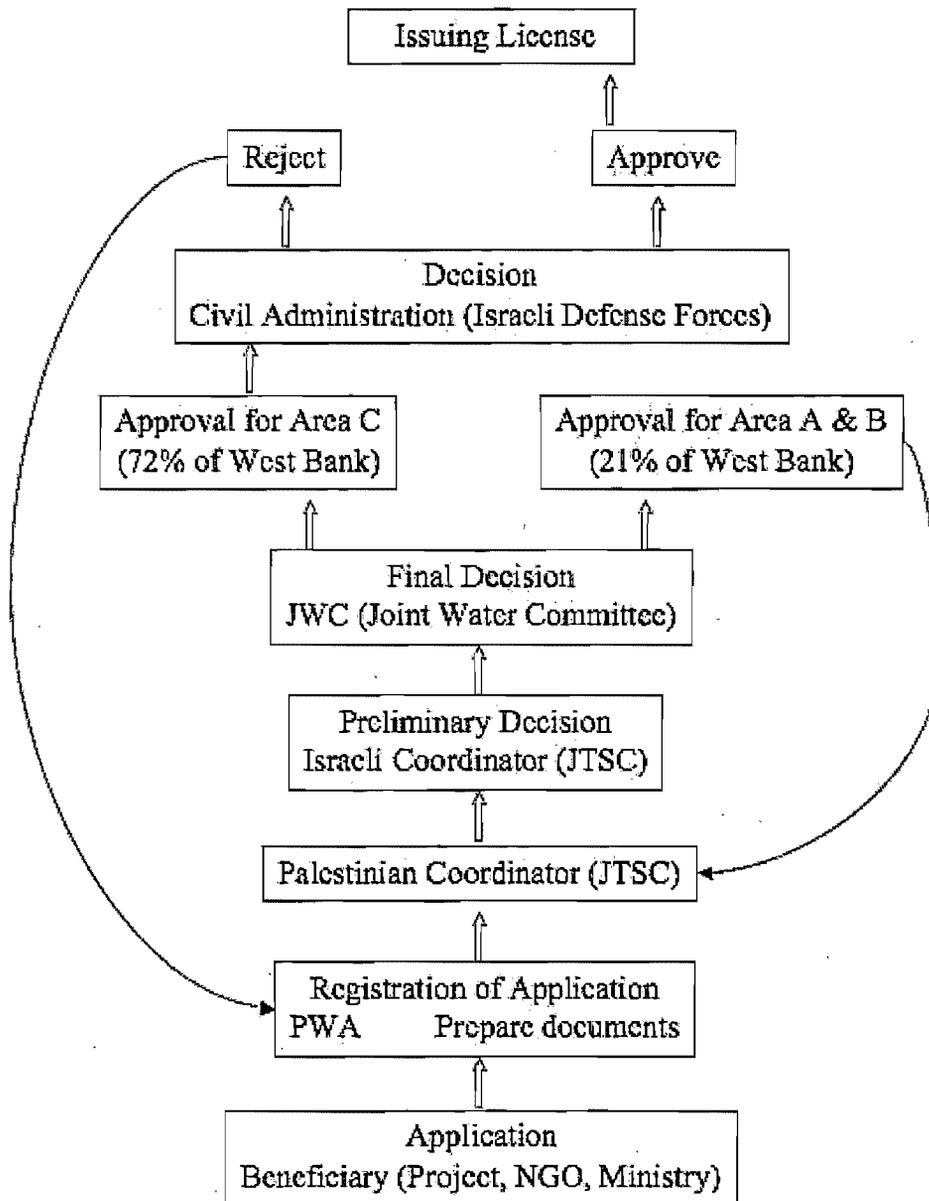
All figures in MCM/y.

EAB=Eastern Aquifer Basin; NEAB=North Eastern Aquifer Basin; WAB=Western Aquifer Basin.

Table does not include Coastal Aquifer Basin, transboundary to Gaza and Israel.

Source: Mark Zeitoun, 2008, 50.

Table 6: The Joint Water Committee--Project Licensing Procedure



Source: Mark Zeitoun, 2008, 100.

## Appendix A

### Description of damages in the Municipality of Jenin

1. A damaged and excavated 14-inch transmission line from the PWA well for a length of more than 60 meters.
2. A damaged and excavated 10-inch transmission line near the Telecom Center for a length of more than 60 meters.
3. An excavated 6-inch mainline in several locations at the Refugee camp.
4. A damaged and excavated mainline near Dahiliya Square for a length of more than 60 meters.
5. An excavated and damaged 3-inch mainline in several locations near the eastern edge of the Refugee camp.
6. A damaged and excavated 4-inch mainline near al Sharkye and the Abu Snan Chamber for a length greater than 180 meters.
7. Multiple excavated 2-inch lines in several locations: Haifa Street, Al Shariqiya, Al Orme for a total length of damage of more than 3,000 meters in the city and 7,400 meters in the refugee camps.
8. Multiple damaged one-inch, three-quarters-inch, and one-half-inch distribution lines and house connections for a total estimated length of damage of more than 3,600 meters in the city and 8,000 meters in the camp.

The estimated cost of the damage to the water infrastructure from the camp is more than 2.1 million dollars for the 2002 incursion; however, the cumulative damage from the incursions from 2001 to 2003 cost more than 7.6 million dollars. These estimates do not include the cost of the disruption to the economic livelihood caused by the damage to the water infrastructure.

Source: Mark Zeitoun, 2008, 90-91.

Table B1: Classification of damages to water infrastructure in Jenin, April 2002.

Type	Description	Example
Infrastructure (indiscriminate)	Unintentional damages to infrastructure suffered under stated IDF rules of engagement (tank or bulldozer traffic, stray bullets, shrapnel, digging of trenches)	<ul style="list-style-type: none"> <li>-crushed manholes or fire hydrants</li> <li>-pin-hole or joint leaks in pipes</li> <li>-watermains broken over a short span</li> <li>-bullet pierced booster pumps and rooftop reservoirs.</li> </ul>
Infrastructure (deliberate)	Deliberate damages to water infrastructure due to IDF military activity	<ul style="list-style-type: none"> <li>-watermains dug up lengthwise</li> <li>-destruction of repair crew equipment (backhoes, compressors, etc.)</li> <li>-destruction of municipal water crew repairwork (when carried out under close coordination with the IDF)</li> <li>-threats to municipal crew impending repairwork.</li> </ul>
Developmental/ Economic	Financial or opportunity costs	<ul style="list-style-type: none"> <li>-water infrastructure projects halted mid-way</li> <li>-lack of water production due to dismissal of well operator</li> <li>-lost opportunities for new development projects due to donor's reluctance to invest</li> <li>-water un-billed for due to physical damages to network</li> <li>-increased break-down due to interruption of routine operations and maintenance.</li> </ul>
Political	Impact on Cooperative agreement between Israeli and Palestinian water technicians (Joint Water Committee)	<ul style="list-style-type: none"> <li>-crippling of established bi-lateral cooperation through the JWC</li> <li>-crippling of Municipality's water-provision capacity and corresponding degeneration of authority</li> <li>-revelation of incapacity for action of PWA and corresponding lack of authority</li> <li>-slow-down of development projects (well-drilling).</li> </ul>

Source: Mark Zeitoun, 2006, 173.

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- <sup>1</sup> In international law, any state that abuts a river; the river must either cross the territory of the state or form part of the state's boundary. Thomas Naff and Ruth C. Matson. *Water in the Middle East: Conflict or Cooperation?* Boulder, CO: Westview, 1984.
- <sup>2</sup> Steven Solomon, *Water: The Epic Struggle for Wealth, Power, and Civilization*. New York: Harper Collins eBooks, 2009, 6004.
- <sup>3</sup> Aaron T. Wolf, Annika Kramer, Alexander Carius, and Geofferey Debalko. "Peace in the Pipeline," *BBCNews.com*, February 13, 2009.  
<http://news.bbc.co.uk/2/hi/science/nature/7886646.stm> (accessed on February 20, 2010).
- <sup>4</sup> Elhance, 1999, 85-86.
- <sup>5</sup> Elhance, 1999, 85-86.
- <sup>6</sup> Masahiro Murahami. *Managing Water for Peace in the Middle East: Alternative Strategies*. Tokyo, Japan: United Nations University, 1995, 74-75; Mostafa Dolatyar and Tim S. Gray. *Water Politics in the Middle East: A Context for Conflict or Cooperation?* New York: St. Martin's, 2000, 85-87; Steven Solomon, 1999, 6522.
- <sup>7</sup> Masahiro Murahami, 1995, 69-70; Arun P. Elhance. *Hydropolitics in the Third World: Conflict and Cooperation in International River Basins*. Washington, D.C.: United States Institute of Peace, 1999, 87.
- <sup>8</sup> A karstic spring is a spring that rises from subsurface conduits in limestone bedrock. Thomas Naff and Ruth C. Matson, 1984, 224.
- <sup>9</sup> Thomas Naff and Ruth C. Matson, 1984, 17.
- <sup>10</sup> For the sake of continuity, Lake of Tiberias will be used throughout the paper. Lake of Tiberias, the Arab name, is also known by the Biblical name of Sea of Gallilee and the Israeli name of Lake Kinneret. Mark Zeitoun. *Power and Water in the Middle East*. New York: Palgrave Macmillan, 2008, 46.
- <sup>11</sup> Mark Zeitoun, 2008, 46; Thomas Naff and Ruth C. Matson, 1984, 19-21.
- <sup>12</sup> Mark Zeitoun, 2008, 46; Thomas Naff and Ruth C. Matson, 1984, 19-21.
- <sup>13</sup> Mark Zeitoun, 2008, 46; Thomas Naff and Ruth C. Matson, 1984, 19-21.
- <sup>14</sup> Mark Zeitoun, 2008, 46; Thomas Naff and Ruth C. Matson, 1984, 19-21.
- <sup>15</sup> Mark Zeitoun, 2008, 48; Thomas Naff and Ruth C. Matson, 1984, 19-21.
- <sup>16</sup> Mark Zeitoun, 2008, 48; Arun Elhance, 1999, 90; The Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip. Annex III: Protocol Concerning Civil Affairs, Article 40: Water and Sewage. September 1995,  
<http://www.mfa.gov.il/MFA/Peace+Process/Guide+to+the+Peace+Process/THE+ISRAELI-PALESTINIAN+INTERIM+AGREEMENT+-+Annex+III.htm>
- <sup>17</sup> Mark Zeitoun, 2008, 48; Thomas Naff and Ruth C. Matson, 1984, 19-21.
- <sup>18</sup> The Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip. Annex III: Protocol Concerning Civil Affairs, Article 40: Water and Sewage. September 1995.
- <sup>19</sup> Mark Zeitoun, 2008, 48.
- <sup>20</sup> Elhance, 1999, 100-101.
- <sup>21</sup> Leslie Schmida, *Keys to Control: Israel's Pursuit of Arab Water Resources*. Washington, D.C.: American Educational Trust, 1984, 8-9; Masahiro Murahami, 1995, 287-289.
- <sup>22</sup> By supporting economic stability and security, US policy makers believed that weaker states would be less vulnerable to Soviet influence. The Jordan River valley and its states were considered to be struggling. Aiding in their economic development was consistent with American policy and similar to the aims of the Marshall Plan. Jeffrey K. Sosland, *Cooperating*

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*Rivals: The Riparian Politics of the Jordan River Basin*. New York: State University of New York, 2007, 38-39.

<sup>23</sup> Arun P. Elhance, 1999, 112-113.

<sup>24</sup> Jeffrey Sosland, 2007, 66.

<sup>25</sup> Israeli leaders also believed that retaining the diversion in the DMZ would provoke Syria and would contribute to negative repercussions from the United States and the United Nations; however, economic assistance remained the primary reason for moving the diversion. If the Israelis had not adjusted the diversion point, the United States would have withheld funding. Jeffrey Sosland, 2007, 68-70.

<sup>26</sup> Jeffrey Sosland, 2007, 70.

<sup>27</sup> Jeffrey Sosland, 2007, 78.

<sup>28</sup> Jeffrey Sosland, 2007, 77-78.

<sup>29</sup> Jeffrey Sosland, 2007, 78-79.

<sup>30</sup> Jeffrey Sosland, 2007, 79-80.

<sup>31</sup> Jeffrey Sosland, 2007, 81.

<sup>32</sup> Jeffrey Sosland, 2007, 81.

<sup>33</sup> Elhance, 1999, 114-115; Zeitoun, 2008, 68.

<sup>34</sup> For the first time since the 1948 War, one sovereign power ruled all over Mandatory Palestine, the area administered by the British from 1920 to 1948. Neve Gordon, *Israel's Occupation*, Berkley, CA: University of California, 2008, 4.

<sup>35</sup> Mark Zeitoun, 2008, 68; Neve Gordon, 2008, 4-5.

<sup>36</sup> Mark Zeitoun, 2008, 68; Neve Gordon, 2008, 4-5.

<sup>37</sup> Mark Zeitoun, 2008, 69-70; Neve Gordon, 2008, 4-5,9.

<sup>38</sup> Robert Fisk, "In the West Bank's stony hills, Palestine is slowly dying,"

IndependentNews.com, January 30, 2010, <http://www.independent.co.uk/news/world/middle-east/in-the-west-banks-stony-hills-palestine-is-slowly-dying-1883669.html>

<sup>39</sup> United Nations Office for the Coordination of Humanitarian Affairs (OCHA): Occupied Palestinian Territory, 2010, <http://www.ochaopt.org/> (accessed on March 29, 2010); Mark Zeitoun, 2008, 93-95.

<sup>40</sup> OCHA: Occupied Palestinian Territory, 2010; Mark Zeitoun, 2008, 94-95.

<sup>41</sup> OCHA: Occupied Palestinian Territory, 2010.

<sup>42</sup> OCHA: Occupied Palestinian Territory, 2010; Mark Zeitoun, 2008, 96-97.

<sup>43</sup> OCHA: Occupied Palestinian Territory, 2010; Anthony H. Cordesman, *The Israeli-Palestinian War: Escalating to Nowhere*, Westport, CT: Praeger Security, 2005, 69.

<sup>44</sup> Population data as of January 1, 2000. Roberto Battista, "Bad Fences Make Bad Neighbors", November 2002, [http://www.robat.scl.net/content/NAD/faqs/fact\\_sheets/bad\\_fences.php](http://www.robat.scl.net/content/NAD/faqs/fact_sheets/bad_fences.php) (accessed April 9, 2010).

<sup>45</sup> Qalqilya was once considered the 'bread basket' of the West Bank because of its fertile land and access to water. Forty-five-percent of their economy was based on agriculture.

<sup>46</sup> Four dunums equals one acre.

<sup>47</sup> Roberto Battista, 2002.

<sup>48</sup> Israel's current population includes the number of people living in Israel, 7,233,701, plus approximately 187,000 settlers living in the West Bank, plus about 20,000 people living in Israeli-occupied Golan Heights, and approximately 177,000 settlers living in East Jerusalem. Central Intelligence Agency (CIA) World Factbook: Israel,

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<https://www.cia.gov/library/publications/the-world-factbook/geos/is.html> (Accessed January 5, 2010).

<sup>49</sup> Central Intelligence Agency (CIA) World Factbook: Israel, 2010; Central Intelligence Agency (CIA) World Factbook: West Bank, <https://www.cia.gov/library/publications/the-world-factbook/geos/we.html>, (Accessed January 5, 2010).

<sup>50</sup> Mark Zeitoun, 2008, 57-59.

<sup>51</sup> The World Health Organization recommends 100 liters per day as the minimum quantity for basic consumption. The Occupied Territories of Palestine rank second to last on water consumption in the world, only in front of Somalia. World Health Organization, *Progress on Sanitation and Drinking Water, 2010 Update*. Paris, France: World Health Organization, 2010.

<sup>52</sup> The Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip. Annex III: Protocol Concerning Civil Affairs, Schedule 8: Joint Water Committee. September 1995; Mark Zeitoun, 2008, 14-15; Jeffrey D. Sachs, *Common Wealth: Economics for a Crowded Planet*. New York: Penguin, 2008, 124.

<sup>53</sup> Mark Zeitoun, 2008, 58.

<sup>54</sup> Mark Zeitoun, 2008, 51-52.

<sup>55</sup> Mark Zeitoun, 2008, 52.

<sup>56</sup> Mark Zeitoun, 2008, 52.

<sup>57</sup> Mark Zeitoun, 2008, 52.

<sup>58</sup> Mark Zeitoun, 2008, 52-53.

<sup>59</sup> The discussion of the disparity between water distribution focuses on the West Bank because the Gaza Strip has had control over their water resources since 2005. Additionally, the Gaza Strip utilizes the Coastal Aquifer. Because of its location 'downstream' from Israeli resources, the Israeli government does not concern itself with quality or quantity of the water by the time it reaches Gaza Strip.

<sup>60</sup> Mark Zeitoun, 2008, 51.

<sup>61</sup> Mark Zeitoun, 2008, 51.

<sup>62</sup> Mark Zeitoun, 2008, 51.

<sup>63</sup> World Health Organization, 2010, 51.

<sup>64</sup> Frederick M. Lorenz, "Strategic Water for Iraq: The Need for Planning and Action," *American University International Law Review*, 24(2), 280-281.

<sup>65</sup> Jerome Delli Priscoli and Aaron T. Wolf. *Managing and Transforming Water Conflicts*. New York: Cambridge University, 2009, 11.

<sup>66</sup> Jerome Delli Priscoli and Aaron T. Wolf, 2009, 11.

<sup>67</sup> Amnesty International, 2006.

<sup>68</sup> Amnesty International, 2006.

<sup>69</sup> United Nations Environmental Program (UNEP), *Lebanon: Post-Conflict Environmental Assessment*, Nairobi, Kenya: United Nations Environmental Program, 2007, 10.

<sup>70</sup> UNEP, 2007, 18.

<sup>71</sup> Nicholas Blanford, "A Lebanese-Israeli conflict threatens to boil over," CSMonitor.com. 21 October 2002. <http://www.csmonitor.com/2002/1021/p08s01-wome.html>

<sup>72</sup> Amnesty International, "Lebanon: Deliberate Destruction or 'Collateral Damage'? Israel's Attacks on Civilian Infrastructure," 2006,

<http://www.amnesty.org/en/library/asset/MDE18/007/2006/en/4c966a70-d3ff-11dd-8743-d305bea2b2c7/mde180072006en.html>

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<sup>73</sup> Amnesty International, 2006.

<sup>74</sup> Amnesty International, 2006.

<sup>75</sup> Mark Zeitoun, 2008, 99-101.

<sup>76</sup> Mark Zeitoun, 2008, 99-101.

<sup>77</sup> Typically, preferred locations for new wells or wastewater treatment plants are outside of the urban centers, allowing room for expansion.

<sup>78</sup> Germany funded a wastewater plant for Salfeet; they intended to build it just outside of municipal boundaries. Although the technical committee of the JWC approved the project, Israeli settler and military interests intervened, resulting in the disapproval of the project. Mark Zeitoun, 2008, 186.

<sup>79</sup> Mark Zeitoun, 2008, 100-102.

<sup>80</sup> International Water Project, "Israel - Palestinian Joint Water Committee: Joint Declaration for Keeping the Water Infrastructure out of the Cycle of Violence" (Accessed on March 18, 2010), <http://www.internationalwaterlaw.org/documents/regionaldocs/israel-palest-jwc1.html>

<sup>81</sup> International Water Project, 2001.

<sup>82</sup> Mark Zeitoun, 2008, 88-89.

<sup>83</sup> The IDF demolished and bulldozed 140 blocks of flats and partially destroyed more than 200 flats in the refugee camp leaving more than 4000 people homeless. Mark Zeitoun, 2008, 88-89.

<sup>84</sup> At the start of the incursion, more than 20,000 people did not have water services. Although the water crews started repairs on 8 April, more than 15,000 people remained without water until 29 April. Mark Zeitoun, 2008, 89-90.

<sup>85</sup> Mark Zeitoun, 2008, 90-91.

<sup>86</sup> Concerns regarding the delicate relationship shared between the Palestinian and Israeli members of the JWC could better explain the PWA's behavior and inaction. Mark Zeitoun, 2008, 92-93.

<sup>87</sup> In 1994, Israel had thirty-five operating facilities delivering water to remote locations. However, their status as a pioneer for the implementation of desalination technology has helped decrease the price of desalinated water from forty cents to ninety cents per cubic meter compared with the cost of fifteen to twenty-five cents per cubic meter from water drawn from aquifers or transported via the National Water Carrier. Alwyn R. Rouyer, *Turning Water into Politics: The Water Issues in the Palestinian-Israeli Conflict*, New York: Palgrave, 2000, 271-272; Harvey Lithwick, "Evaluating Water Balances in Israel," *Water Balances in the Eastern Mediterranean*, Ottawa, Canada: International Development Research Centre, 2001, 41-58.

<sup>88</sup> Harvey Lithwick, 2001, 55-58.

<sup>89</sup> Alwyn R. Rouyer, 2000, 274-275; Aaron T. Wolf, *Hydropolitics along the Jordan River: Scarce water and its impact on the Arab-Israel Conflict*, Tokyo, Japan: United Nations University, 1995, 163-164.

<sup>90</sup> Aaron T. Wolf, 1995, 164-165.

## Bibliography

- Amery, Hussein A. and Aaron T. Wolf. *Water in the Middle East: A Geography of Peace*. Austin, TX: University of Texas, 2000.
- Balzarini, A. Aqua Stress: Factors involving Water Stress. <http://www.aquastress.net>. (Accessed on February 9, 2010).
- Battista, Roberto. "Bad Fences Make Bad Neighbors", November 2002. [http://www.robat.scl.net/content/NAD/faqs/fact\\_sheets/bad\\_fences.php](http://www.robat.scl.net/content/NAD/faqs/fact_sheets/bad_fences.php) (accessed April 9, 2010).
- Bergman, Mickey. "Smart Separation: the Barrier as an Instrument to a Two-state Solution," *MiddleEastProgress.com*, September 7, 2010. <http://middleeastprogress.org/2007/09/smart-separation-2/> (accessed April 2, 2010).
- Berman, Jessica. WHO: Waterborne Disease is World's Leading Killer. *Voice of America News*, March 17, 2005. <http://www1.voanews.com/> (accessed March 9, 2010).
- Blanford, Nicholas. "A Lebanese-Israeli conflict threatens to boil over." *CSMonitor.com*, October, 21 2002. <http://www.csmonitor.com/2002/1021/p08s01-wome.html>
- Central Intelligence Agency (CIA). World Factbook: Gaza Strip. <https://www.cia.gov/library/publications/the-world-factbook/geos/gz.html> (Accessed January 5, 2010).
- Central Intelligence Agency (CIA). World Factbook: Israel. <https://www.cia.gov/library/publications/the-world-factbook/geos/is.html>, (Accessed January 5, 2010).
- Central Intelligence Agency (CIA) World Factbook: West Bank. <https://www.cia.gov/library/publications/the-world-factbook/geos/we.html>, (Accessed January 5, 2010).
- Cordesman, Anthony H. *The Israeli-Palestinian War: Escalating to Nowhere*. Westport, CT: Praeger Security International, 2007.
- Delli Priscoli, Jerome and Aaron T. Wolf. *Managing and Transforming Water Conflicts*. New York: Cambridge University, 2009.
- Diehl, Paul F. and Nils Petter Gleditsch. *Environmental Conflict*. Boulder, CO: Westview, 2001.

- Dolatyar, Mostafa and Tim S. Gray. *Water Politics in the Middle East: A Context for Conflict or Cooperation?* New York: St. Martin's, 2000.
- Elhance, Arun P. *Hydropolitics in the Third World: Conflict and Cooperation in International River Basins*. Washington, D.C.: United States Institute of Peace, 1999.
- Elmusa, Sharif S. *Water Conflict: Economics, Politics, Law, and the Palestinian-Israel Water Resources*. Washington, D.C.: Institute for Palestinian Studies, 1997.
- Fisk, Robert. "In the West Bank's stony hills, Palestine is slowly dying," *IndependentNews.com*, January 30, 2010, <http://www.independent.co.uk/news/world/middle-east/in-the-west-banks-stony-hills-palestine-is-slowly-dying-1883669.html> (accessed March 28, 2010).
- Gray, Alice. "Positive conditions—the Water Crisis in Gaza." *InformationClearingHouse.com*, August 9, 2006. [http://www.informationclearinghouse.info/article14434\\_files/image002.jpg](http://www.informationclearinghouse.info/article14434_files/image002.jpg) (Accessed February 20, 2010).
- Israeli Foreign Ministry. "Israel's Chronic Water Problem." American and Israeli Cooperative Enterprise. <http://www.jewishvirtuallibrary.org/jsource/History/scarcity.html> (Accessed February 28, 2009).
- Klare, Michael T. *Resource Wars: The New Landscape of Global Conflict*. New York: Metropolitan Books, 2004.
- Jadallah, Sami Jali. "Areas A, B, C, and F." *TheSabbahReport.com*, October 20, 2009, [http://sabbah.biz/mt/wp-content/uploads/2009/10/Oslo-II\\_west\\_bank\\_area\\_A\\_B\\_C.gif](http://sabbah.biz/mt/wp-content/uploads/2009/10/Oslo-II_west_bank_area_A_B_C.gif) (accessed April 10, 2010).
- Levite, Aerial E. and Bruno Tertrais. What might the Middle East look by 2025? *Ceri Strategy Papers*. Washington, D.C.: Carnegie Endowment for International Peace, 2008.
- Lithwick, Harvey. "Evaluating Water Balances in Israel," *Water Balances in the Eastern Mediterranean*. Ottawa, Canada: International Development Research Centre, 2001.
- Lorenz, Frederick M. and Edward J. Erickson. *The Euphrates Triangle: Security Implications of the Southeastern Anatolia Project*. Washington, D.C.: National Defense University, 1999.
- Lorenz, Frederick M. "Strategic Water for Iraq: The Need for Planning and Action," *American University International Law Review*, 24(2), 275-299.
- Lowi, Miriam R. *Water and power: The politics of a scarce resource in the Jordan River Basin*. New York, NY: Cambridge University, 1993.
- Manners, I.R. and Barbara McKean Parmenter. "The Middle East: A Geographic Preface."

- Understanding the Contemporary Middle East (2<sup>nd</sup> ed.)*. Boulder, CO: Reinner, 2004.
- Michael, David and Amit Pandya. *Troubled Waters: Climate Change, Hydropolitics, and Transboundary Resources*. Washington, D.C.: Stimson, 2009.
- MidEast Web for Coexistence. Sources of the Jordan River Basin. <http://www.mideastweb.org/> (Accessed on February 14, 2010).
- Murahami, Masahiro. *Managing Water for Peace in the Middle East: Alternative Strategies*. Tokyo, Japan: United Nations University, 1995.
- Naff, Thomas and Ruth C. Matson. *Water in the Middle East: Conflict or Cooperation?* Boulder, CO: Westview, 1984.
- Organization for Economic Cooperation and Development. Development Assistance Committee: Water and Violent Conflict (2005). <http://www.oecd.org/dac/conflict/themes>, (accessed on February 14, 2010).
- Rouyer, Alwyn R. *Turning Water into Politics: The Water Issues in the Palestian-Israeli Conflict*. New York: Palgrave, 2000.
- Sachs, Jeffrey D. *Common Wealth: Economics for a Crowded Planet*. New York: Penguin, 2008.
- Schmida, Leslie. *Keys to Control: Israel's Pursuit of Arab Water Resources*. Washington, D.C.: American Educational Trust, 1984.
- Solomon, Steven. *Water: The Epic Struggle for Wealth, Power, and Civilization*. New York: Harper Collins eBooks, 2009.
- Sosland, Jeffrey K. *Cooperating Rivals: The Riparian Politics of the Jordan River Basin*. New York: State University of New York, 2007.
- United Nations Development Program (UNDP). Geographic Projection: Palestinian Aquifers. December 2002. [http://www.grid.unep.ch/product/map/images/palestine\\_aquiferb.jpg](http://www.grid.unep.ch/product/map/images/palestine_aquiferb.jpg)
- United Nations Development Program (UNDP). Geographic Projection: West Asia. December 2002. [http://www.grid.unep.ch/product/map/index.php?region=west\\_asia](http://www.grid.unep.ch/product/map/index.php?region=west_asia)
- United Nations Environmental Program (UNEP). *Lebanon: Post-Conflict Environmental Assessment*. Nairobi, Kenya: United Nations Environmental Program, 2007.
- United Nations Office for the Coordination of Humanitarian Affairs. The West Bank Barrier. [http://www.ochaopt.org/?module=displaystory&section\\_id=130&story\\_id=1456&format=html&edition\\_id=](http://www.ochaopt.org/?module=displaystory&section_id=130&story_id=1456&format=html&edition_id=)

United Nations Office for the Coordination of Humanitarian Affairs. Humanitarian Overview: the West Bank and East Jerusalem. February 2010. <http://www.ochaopt.org/>

United Nations World Water Development Report. *Water for People, Water for Life*. New York: United Nations, 2003.

United States Geological Survey (U.S.G.S). The Water Cycle: Freshwater Storage. <http://ga.water.usgs.gov/edu/watercyclefreshstorage.html> (Accessed on February 21, 2010).

Wolf, Aaron T. *Hydropolitics along the Jordan River: Scarce water and its impact on the Arab-Israel Conflict*. Tokyo, Japan: United Nations University, 1995.

Wolf, Aaron T, Annika Kramer, Alexander Carius, and Geofferey Debalko. "Peace in the Pipeline," *BBCNews.com*, February 13, 2009. <http://news.bbc.co.uk/2/hi/science/nature/7886646.stm> (accessed on February 20, 2010).

World Health Organization (WHO). *Global Water Supply and Sanitation Assessment 2000*, Geneva: World Health Organization, 2000.

World Health Organization, Progress on Sanitation and Drinking Water, 2010 Update. Paris, France: World Health Organization, 2010.

Zeitoun, Mark. *Power and Water in the Middle East*. New York: Palgrave Macmillan, 2008.