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FLOWING WATERS:  
TOWARDS A MORE EQUITABLE SOLUTION IN THE WEST BANK AND ISRAEL

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## **Executive Summary**

Water is a necessary element of humanity's existence. However, discussions for any agreement between Israel and the Palestinian territories rarely mention water as a hindrance to peace. The main reason being that the conversation regarding water issues has changed over the past decade. The narrative of water conflict between Israel and the West Bank has gone from ecological and political to technological. There are now ways in increase the amount of drinkable water in the area. There are also new ways to use water more efficiently and reuse water for agricultural purposes.

This is not to say that the political narrative has entirely lost efficacy. In fact, the occupation itself, a political problem that needs a political solution, is the largest hindrance in applying these technological solutions to the problem. Israel has increased available drinking water for its people by rapid development of desalination while simultaneously improving ways of reusing wastewater for agriculture. However, the Palestinians, who insist on their rights under international law to the water in the West Bank, refuse to cooperate on the technological front with Israel until those rights are recognized in full.

Consequently the water situations for the Palestinians in the West Bank are dire. On average, they receive almost half the amount of water daily that the World Health Organization recommends. They find respite in methods such as digging illegal wells, buying water at market rates from Israel, and disposing of waste how they can. The division of the West Bank into administrative areas without uniform rule only exacerbates the situation. The Palestinian Authority cannot adequately develop the West Bank and Israel only develops water sources for settlements. The Palestinians refuse to cooperate on these projects because the view cooperation as legitimizing settlement activity.

Until a political solution to the occupation of the West Bank is solved in a final status agreement, there can seemingly be no cooperation on the water issue between the parties. Even though the Joint Water Committee set up by Oslo II is hailed as cooperation, the scheme is rendered ineffective due to the administrative division of the West Bank. And while an overall solution for water scarcity requires a regional effort, the political realities of the region make that complex and difficult. Israel and the West Bank should focus on what they can do to address the problem individually. Therefore, the parties must address water issues in areas that they have control over.

The Palestinians should focus on developing infrastructure in Areas A and B in the West Bank, where they have administrative authority. The Palestinian Authority should also fund educational programs and NGOs that study and implement wide-ranging water demand management programs. Israel should concentrate on increasing supply of drinkable water through desalination in Israel proper and figure out a way to let the price of water rise to curb demand and encourage efficient use. Israel should also focus on building better infrastructure projects in the West Bank near their settlements that can reuse wastewater from the settlements and turn it into agricultural water. Finally, international aid organizations such as USAID should help the Palestinian Authority develop areas under its control and should develop plans that take into consideration any delays that might be caused by the division of governance in the West Bank.

### **The Narrative**

While the Interim Agreement finally addressed water in 1995, it deferred the details to any agreement over the subject to final status negotiations. In the meantime, it allocated water

usage quotas to both sides and set up a political system that was designed to resolve any disputes that may arise.

Unfortunately, that system is not working. The Palestinians are being denied their fair share of water under the international legal doctrine of fair and equitable use, while Israel has developed a water infrastructure that increases efficiency of use and also increases the amount of available drinking water. The Palestinians in the West Bank, on the other hand, do not have economic access to such technology and must depend on themselves and Israel for water. However, they refuse to look for technological solutions until their political rights to the water under the West Bank are realized.

This leads to the question of what narrative should be used to evaluate the water issue. Jan Selby recognizes three possible ones: ecological, technological, and political.<sup>1</sup> The ecological narrative argues that water problems are basically based on increasing populations dealing with increasing resource scarcity. Water is limited and people will fight over it. The technological narrative says that water issues are, above all, technological, economic, and policy inefficiencies. Issues of sustainable and efficient use are the root cause of these types of problems. The political narrative suggests that rights to water and denial of those rights are central to the argument. Therefore, the issue in Israel and the West Bank will be solved only with Israeli recognition of Palestinian water claims and Palestinian receipt of their rightful share of water.

The Israelis and NGOs believe that technology can solve the supply side of the equation and increase efficiency on the demand side. However, the Palestinians, being those deprived of their perceived rights, require that Israel recognize their fair share of water in the West Bank before proceeding.

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<sup>1</sup> Selby, Jan. *Water, Power and Politics in the Middle East*. New York, NY: I.B. Tauris and Co., 2003, p. 21.

The recommendations below recognize that the water problem can be solved with technological advancement and policies that encourage efficient use. However, they recognize the political limitations imposed on any such recommendations resulting from the occupation of the West Bank and the division of rule there.

## **The Oslo II Accords and the JWC**

### Oslo II Agreement and Terms

The Interim Agreement (Oslo II) established the current water regime between Israel and Palestine in 1995. The 1993 Declaration of Principles neglected the water issue for better or worse. It called for the creation of Palestinian Water Administration Authority and cooperation in water development programs to manage resources in the West Bank and Gaza. Beyond these broad stroke commitments, there was little else about water. The 1994 Cairo Agreement went further by giving water resource control in Gaza and the Jericho area to the Palestinian Authority. However, these water sources were seen as insignificant due to their low volume and salinity.<sup>2</sup>

Oslo II was groundbreaking because it contained the first explicit and unequivocal recognition of Palestinian water rights in the West Bank.<sup>3</sup> It deferred the precise details of a water agreement to the final status negotiations, but established a political framework that could theoretically result in joint management of water resources between Israel and the PA in the West Bank. In Article 40 of Appendix 1 in Oslo 2, a Joint Water Committee (JWC) would manage of all water related activity in the West Bank.

The committee contains an equal number of representatives from each side and all decisions made by the JWC would have to be reached by consensus. Examples of things the

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<sup>2</sup> Selby, p. 103

<sup>3</sup> *Oslo Interim Agreement Annex II*. MidEast Web at <http://www.mideastweb.org/intanx3.htm#app-40> (last accessed May 2, 2011).

JWC was to decide on are: licensing and drilling of new wells by either side, all development of water resources and systems, technical details of any projects for additional water, and determining the extraction quota from water resources in the West Bank.

The JWC was not, however, a joint management apparatus in the sense that it would take control of daily tasks. Those were left to the individual Israeli and Palestinian Water Authorities. The systems that serve the “Palestinian population solely, without intervention or obstructions,” would be transferred from Israel control to the PA. The opposite would be applied to water systems solely serving Israelis.<sup>4</sup> Therefore, the JWC would be more of a coordinating body instead of a managing one.

Article 40 also established water usage and development quotas for resources in the West Bank. Section 7 of Article 40 mandates that both sides find 28.6 million cubic meters (MCM) per year extra to meet the immediate demands of the Palestinian population. The previous section of Article 40 set the “future needs of the Palestinians in the West Bank” at 70-80 MCM per year. The agreement allowed Palestinians the right to develop water resources, mainly the Eastern Aquifer, in the West Bank that would help meeting the annual amount agreed upon in section 6.

The Israelis committed to providing 9.5 MCM per year to the West Bank from their own water supplies in order to meet this extra demand. This water, though, would be sold at market rates and not the subsidized rates enjoyed by Israeli citizens.<sup>5</sup> However, one caveat that the agreement places, in section 9(b), is that Israel is to assist in “determining the appropriate

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<sup>4</sup> Id.

<sup>5</sup> Rouyer, Alwyn R. “The water accords of Oslo II: Averting a looming disaster.” *Middle East Policy* 7.1 (1999) : 113-136.

location of drilling for wells,” with relation to developing new water resources to meet immediate Palestinian demand.<sup>6</sup>

#### Israeli and Palestinian Criticisms of Article 40

The Israeli right denounced the Oslo II terms as unfavorable. They accused the accords of giving water away to the Arabs and significantly reducing the amount of control Israel had over water resources. However, even with these reservations, the Israeli right generally regarded Article 40 as a move in the correct direction and saw the implementation of Article 40 as effective and efficient.<sup>7</sup>

Palestinians on the other hand, criticized Oslo II for its deferral of water rights questions to the final status agreements. They also saw Article 40 as a tacit endorsement of Israeli access to Palestinian water resources for the duration of the interim period.<sup>8</sup> The Palestinians also criticized provisions that allowed Israeli settlers continued access to the resources of the West Bank. As discussed below, these complaints would seem justified considering Israel would consume around 87% of the water resources originating from the West Bank and leave only 13% to the Palestinian population.<sup>9</sup>

In terms of implementation, the Palestinians initially had several complaints. The process of getting approval for permits through the Joint Water Commission was too protracted and the West Bank failed to see any results early on.<sup>10</sup> The Palestinians see this as a virtual Israeli veto on water resource development in the West Bank. The permits have to be agreed upon by

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<sup>6</sup> *Oslo Interim Agreement Annex II*, section 9(b) at <http://www.mideastweb.org/intanx3.htm#app-40> (last accessed May 2, 2011).

<sup>7</sup> Rouyer.

<sup>8</sup> Selby, p. 105

<sup>9</sup> Id.

<sup>10</sup> Rouyer.

consensus of the JWC and this usually takes a protracted amount of time. Further, any delay by the JWC as a deliberate attempt at delaying the West Bank development.<sup>11</sup>

## **Geography of Water in Israel and West Bank**

### Above Ground Sources

The above ground sources of water in Israel and the West Bank contribute little to the Palestinians. The Sea of Galilee provides about 30% of Israel's drinking water supply or 242 MCM per year, according to Mekorot.<sup>12</sup> The inflows to the Galilee recharge the water level from estimates of 500-800 MCM per year. The quality of the water is potable with little treatment.<sup>13</sup> The Lower Jordan River, while providing the border between the West Bank and Israel, contributes almost nothing to drinking water in the West Bank. The Israelis and Jordanians divert the water from the Jordan River just north of the West Bank for agricultural use. The Yarmuh is also a significant tributary. However, heavy use by Syria, Jordan, and Israel restrict the contribution it makes to the Jordan River.<sup>14</sup> Further, the Israelis diverted brackish water around the Sea of Galilee to preserve its quality and deposited that water into the Jordan. Therefore, the Jordan River, as it exists in the West Bank is full of salt and nitrates.<sup>15</sup>

### Groundwater Sources

The majority of natural drinking water supplies for Israel and the West Bank come from groundwater sources, mainly aquifers. The Western Aquifer Basin is the largest of the three systems in the West Bank in terms of volume. The water from the western aquifer travels from the mountains of the West Bank, underground through Palestinian territory and appear as springs

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<sup>11</sup> Rouyer.

<sup>12</sup> *Israel's Water Supply System*, Mekorot at <http://www.mekorot.co.il/Eng/Mekorot/Pages/IsraelsWaterSupplySystem.aspx> (last accessed May 2, 2011).

<sup>13</sup> Zeitoun, Mark. *Power and Water in the Middle East*. New York, NY: I.B. Tauris and Co., 2008, p. 46.

<sup>14</sup> "Thirsty for a Solution: The Water Crisis in the Occupied Territories and its Resolution in the Final-Status Agreement." *B'Tselem*, Jerusalem, 2000, p. 21. (can be found at [http://www.btselem.org/english/publications/summaries/200007\\_thirsty\\_for\\_a\\_solution.asp](http://www.btselem.org/english/publications/summaries/200007_thirsty_for_a_solution.asp))

<sup>15</sup> Zeitoun, p. 46

in lower altitude Israeli territory.<sup>16</sup> Most of the recharge area lies in the West Bank and most of its storage area lies in Israeli territory.<sup>17</sup> As explained below, this provides a conundrum for international law. The estimated sustainable recharge rate for this system is about 362 MCM per year. According to the terms of Oslo II, the Israelis are entitled to 340 MCM per year from this source and the Palestinians 22 MCM per year.<sup>18</sup> The entirety of this recharge rate has been allocated for use since the 1950s with 95% of it going to major Israeli metropolitan areas and the rest used for irrigation by the Palestinians.<sup>19</sup>

The Northern Aquifer Basin flows northeast from the Samarian Mountains and is extracted from wells in the West Bank. 93% of both the recharge and storage areas are located in the West Bank with the rest in Israeli territory.<sup>20</sup> The recharge rate stands at about 145 MCM per year with Israel taking 103 MCM per year and the Palestinians 42 MCM per year as stipulated by Oslo II.<sup>21</sup> Israelis use this water mostly for irrigation and settlement use while the Palestinians use it for consumption in Nablus and Jenin.<sup>22</sup>

Finally, the Eastern Aquifer Basin flows from the West Bank mountain range towards the Jordan River and the Dead Sea. Most of the basin, recharge and storage, is located within Palestinian territory, except for a small portion that includes Jerusalem.<sup>23</sup> It has the smallest volume of the basins mentioned and the sustainable recharge rate is disputed. However, according to Oslo II the Israelis are entitled to 40 MCM per year and the Palestinians 54 MCM

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<sup>16</sup> Twite, Robin. Personal Interview. 15 April, 2011.

<sup>17</sup> "Thirsty for a Solution," p. 19.

<sup>18</sup> Zeitoun, p. 47

<sup>19</sup> "Thirsty for a Solution," p. 19.

<sup>20</sup> Id. p. 20

<sup>21</sup> Zeitoun, p. 48

<sup>22</sup> "Thirsty for a Solution," p. 20.

<sup>23</sup> Id.

per year.<sup>24</sup> The map below illustrates the separate aquifer basins and the flow of water from each one.



<sup>24</sup> Zeitoun, p. 48

## Administrative Divisions

On top of the separate water systems that exist in the West Bank, there are administrative divisions that have been put in place under the Israeli occupation. The West Bank has been divided, according to demographics, into three different areas – A, B, and C. Sections designated Area A are majority Palestinian that are under Palestinian Authority control and Palestinian Authority administration. Area B is under Palestinian Authority administrative control but security matters are shared with Israel. Area C, the largest designation of land in the West Bank, is under Israeli military and administrative control. Every potential civilian project that is slated for Area C has to go through the Israeli Civil Administration.

## **Major Water Issues Between Israelis and Palestinians**

### Usage

Usage issues stem from the “equitable and reasonable use” doctrine that dictates the terms of water rights as codified in international law. Because waterways are interdependent and run through several riparian states, one nation cannot use shared water resources as they wish, but must take into account the other states that share that resource.<sup>25</sup> Therefore, while almost the entire WAB recharge and flow area resides within the West Bank, since it runs into Israeli territory, Israel has the right to an “equitable and reasonable” use. However, the Palestinians would also have the same right. It should be noted that this doctrine is not law unto itself but should be used as a guideline for any agreements made between riparian states.

According to a recent report by the World Bank, Palestinians are only able to abstract 20% of potential water resources, whereas Israel is able to abstract nearly 80% of the same

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<sup>25</sup> *International law on water*. B’Tselem, at [http://www.btselem.org/english/water/international\\_law.asp](http://www.btselem.org/english/water/international_law.asp) (last accessed May 2, 2011).

resources in addition to 50% over the amount of water resources allotted under Oslo II.<sup>26</sup> Palestinians have built illegal wells and pipelines connected to Israeli systems in order to obtain water. Israeli authorities have in turn responded by destroying the illegal wells and pipes, claiming that it reduces water flow to villages near Hebron (Israeli report, 10-11).<sup>27</sup> In addition to these claims, the Israelis also cite that illegal wells in Areas A and B are disrupting water flow to the municipalities in the northern valleys.<sup>28</sup> The Israeli Water Authority states that 3.5 MCM per year are being lost as a result of these illegal connections.<sup>29</sup>

The Israelis also claim that Palestinian sewage “flows by gravity towards Israel, principally to the west but also to the south.”<sup>30</sup> Israeli authorities believe this poses a health hazard to the West Bank and Israel. They also claim “no significant progress has been made” to effectively use treated Palestinian wastewater for agricultural purposes.<sup>31</sup> This has led to the closure of several wells in Bethlehem, Jerusalem, and the Jordan Valley. According the Israeli Water Authority, Palestinians generate close to 52 MCM per year of wastewater, 65% of which pollutes groundwater. While the World Bank also acknowledges that wastewater treatment in the West Bank is neglected, it calculates that only 48% of untreated wastewater pollutes groundwater resources.<sup>32</sup>

The Palestinians would respond by citing inequitable access to water resources. According to the Oslo II agreement Palestinians were allotted 20% of water resources in the

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<sup>26</sup> “Assessment of Restrictions on Palestinian Water Sector Development.” The World Bank, Report 47657-GZ, April 2009, p. 9. (can be found at <http://siteresources.worldbank.org/INTWESTBANKGAZA/Resources/WaterRestrictionsReport18Apr2009.pdf>).

<sup>27</sup> “The Issue of Water between Israel and the Palestinians.” Israeli Water Authority Report, March 2009, pp. 10-11. (can be found at <http://www.water.gov.il/Hebrew/about-reshut-hamaim/The-Authority/FilesWatermanagement/WaterIssuesBetweenIsraelandthePalestinians.pdf>).

<sup>28</sup> Id.

<sup>29</sup> Id. p. 11.

<sup>30</sup> Id.

<sup>31</sup> Id. p. 12.

<sup>32</sup> “Assessment of Restrictions on Palestinian Water Sector Development.” p. 20.

West Bank. But between 1999 and 2008, Palestinian abstraction of the aquifers decreased from 138 MCM per year to 84 MCM per year.<sup>33</sup> The drop in usage is attributable to a decrease in the water level in the aquifer caused by Israeli over-abstraction and insufficient rainfall.<sup>34</sup> Simply put, their wells are not deep enough to access the water. As a result, Palestinians are forced to buy water from Israel. According to Amnesty International “Palestinians have access to an average of no more than 60 to 70 liters per capita and some survive much less even than this, as little 10 to 20 liters per person per day”. This is considerably less than the recommended amount of 1000 cubic meters per person per year as stipulated by the World Health Organization. And it is four times less than Israeli per capita consumption.<sup>35</sup> This, the Palestinians argue, is hardly “equitable and reasonable.”

These usage issues can theoretically be solved by technology and better water use practices. Israeli desalination could decrease their reliance on the water from the West Bank aquifers, thereby allowing the Palestinians to use more of the water under their land. For the Palestinians, demand management and wastewater reuse could effectively increase the amount of water for drinking while still providing for agricultural production. However, these possibilities are hindered by politics.

### Politics of Trust and Identity

There are several political issues that come to the fore when discussing water rights between Israel and the Palestinians. First, the Israelis do not trust the Palestinians to adequately manage shared water resources whereas the Palestinians do not trust the Israelis enough to rely on them for their water needs. Second, the Palestinians believe that the JWC process for

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<sup>33</sup> “Troubled Waters – Palestinians Denied Fair Access to Water.” Amnesty International Report, 2009, p. 13.

<sup>34</sup> *Id.*

<sup>35</sup> PLO Negotiations Support Unit Presentation. “Water for a Viable Palestinian State,” Palestinian Liberation Organization, 2008.

approving new projects hinders West Bank development. Third, Israeli identity issues make it politically untenable for Israeli policymakers to make major water concessions. Finally, the Palestinians will only have said in the past that they will improve their infrastructure once they gain access to their share of water under international law.

The Israelis believe that the Palestinians are not serious about managing their wastewater, citing that only \$25 million out of \$130 million earmarked by the PWA for sewage systems has been invested in wastewater treatment plants.<sup>36</sup> The further claim that of the \$500 million donated by the US only 5% has been invested in the construction of wastewater treatment plants. According to an Israeli report the JWC has approved programs for wastewater treatment between 2002 and 2007 in major Palestinian cities.<sup>37</sup> However, the Israelis claim that none of these projects have significantly advanced. They argue that wastewater can be used for irrigation and agriculture, which would free freshwater for municipal use and increase the availability of drinking water.

The Palestinians would contend that the JWC is domination dressed up as cooperation. This asymmetrical nature of the JWC is due to the occupation instead of the inherent structure of the committee. For example, the Civil Administration of the IDF makes ultimate approvals in licensing of all permits in Area C, which comprises 72% of the West Bank. Furthermore, another 6.8% of the West Bank, consisting of Israeli settlements, falls outside the jurisdiction of the JWC.<sup>38</sup> “This leaves roughly 21 percent of the land within the Palestinian politically boundary of the West Bank subject to formally symmetrical JWC authority.”<sup>39</sup> In other words, the PWA is on a level playing field with Israel in 1/5 of the West Bank. Exacerbating this situation is the fact

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<sup>36</sup> “The Issue of Water between Israel and the Palestinians.” p. 14.

<sup>37</sup> Id.

<sup>38</sup> Zeitoun, p. 101.

<sup>39</sup> Id.

that the areas under full Palestinian control are not contiguous but scattered around the West Bank, thereby making large infrastructure projects very difficult to coordinate.

Israeli politician Mossi Raz explains that Israeli politicians would have to pay a heavy political cost to make concessions on water issues.<sup>40</sup> In other words, giving up any type of water resource would not be well received by the Israeli public. There is a connection, Raz says, between Zionism and water that exists to this day. Most Israelis still believe that a majority of their water comes from the Sea of Galilee, a place with religious significance in Judaism. In fact, the Sea of Galilee does not represent the primary source of Israeli water resources anymore and Israel has made various efforts to decrease dependency on that source.<sup>41</sup> But the connection between the Sea of Galilee and the Zionist idea is so strong that people still believe in its primacy as a water source. In an interview with *Newsweek*, former Israeli prime minister Levi Eshkol is quoted as saying, “without control over the sources of water the Zionist dream could not be realized.”<sup>42</sup> Connecting water to the survival of the state is a political connection that hinders any negotiating over resources. The fact that Israel exists in a water scarce region only exacerbates this dynamic.

Finally, one of the major political problems that any solution to water faces is the Palestinian insistence on their legal right to water under the West Bank. This is the official position of the PLO:

The Palestinians accept international law and how it governs the allocation of freshwater resources shared by Israel and the Occupied Palestinian Territories. Under the law of international watercourses, as reflected in the related 1997 United Nations Convention, the State of Palestine is entitled to an equitable and reasonable allocation of shared

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<sup>40</sup> Raz, Mossi. Personal Interview. Jerusalem, 16 March, 2011.

<sup>41</sup> “Israel Increases Rates to Pay for Desalinated Water.” Circle of Blue Website, 16 January 2010 at <http://www.circleofblue.org/waternews/2010/world/israel-increases-rates-to-pay-for-desalinated-water/> (last accessed May 2, 2011).

<sup>42</sup> Peraino, Kevin. “The Myth of Water.” *Newsweek*. 28 June 2008 at <http://www.newsweek.com/2008/06/28/the-myth-of-water.html> (last accessed May 2, 2011).

freshwater resources, including those in the four main aquifers and the Jordan River. The fair allocation of water rights is a critical element for future political stability in the region as a whole. Finally, under international law, Israel must pay compensation for the past and ongoing illegal use of Palestinian water resources.<sup>43</sup>

The Palestinian Water Authority even dismissed the idea resorting to alternative water sources, including desalination, before receiving full access to the aquifers underneath the West Bank.<sup>44</sup>

The PWA claims that the Israeli proposal to construct a desalination plant at Hadera both sidesteps the issue of Palestinian water rights and is economically unfeasible.

These political issues – Israeli mistrust of Palestinian water management, Palestinian demands for their rights under international law, and Israeli identity issues – make any cooperation on the issue of water very untenable. Given these obstacles, the only reasonable method of managing water resources is to encourage each side to act in their own sphere of control to increase their supplies of water and decrease demand.

### **Proposed Solutions**

Any solution to the problem of shared water needs to address the increasing demand and projection of future demand for water in the West Bank and in Israel. This means that the overall water resources must increase, that water has to be used and reused more efficiently, and that the two governments must implement demand management reforms. Israeli success in the field of desalination provides the answer to increasing the amount of water available and therefore lowering their use of the groundwater from the aquifers in the West Bank.

Palestinian water strategy, with the policy of requiring only the equitable and reasonable use of water under international law, needs to focus on increasing supply by conservation

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<sup>43</sup> “Core Issues.” *General Delegation of the PLO, Washington DC*. at <http://www.plomission.us/index.php?page=core-issues-3> (last accessed May 2, 2011).

<sup>44</sup> “The PWA comments on the building of a desalination plant in Hadera.” *Euro-Mediterranean Information System on know-how in the Water Sector*, 16 February 2009 at <http://www.emwis.net/thematicdirs/news/2009/02/palestinian-water-authority-comments-building> (last accessed May 2, 2011).

methods and demand management. They do not trust the Israelis to provide them with desalinated water and argue that the costs of transporting treated water from the Mediterranean to the West Bank would not be economical. Therefore, the West Bank needs to concentrate on wastewater reuse for agriculture to free up freshwater sources for drinking and demand management to use water more efficiently.

### Desalination

The origins of desalination can be traced back to the era of antiquity. During those times, desalination was carried out through processes of solar and thermal distillation.<sup>45</sup> A common example of solar distillation was using the sun's energy to create the effects of evaporation to separate salt from seawater.<sup>46</sup> Likewise, an example of thermal distillation in ancient times was the boiling of seawater.<sup>47</sup> In both processes seawater would be heated, begin to evaporate, and eventually condense. The condensed water was then collected and stored as drinking water. Pre-modern sailors employed solar and thermal distillation methods to prolong their time spent at sea.<sup>48</sup> Solar distillation continued to be a primary means of desalination through the middle of the twentieth century.<sup>49</sup> Nevertheless, the previously widespread use of solar distillation gradually decreased with the advent of other technologies such as reverse osmosis and multi-stage flash.<sup>50</sup>

### *Leading Desalination Technologies*

The most salient membrane-based technology is the process of reverse osmosis (RO).<sup>51</sup> The basic premise of RO is the utilization of intense pressure to push seawater through a semi-

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<sup>45</sup> Lauren F. Greenlee et al., "Reverse osmosis desalination: Water sources, technology, and today's challenges," *Water Research* 43 (2009): 2320.

<sup>46</sup> Soteris A. Kalogirou, "Seawater desalination using renewable energy sources," *Combustion Science* 31 (2005): 246.

<sup>47</sup> Ibid.

<sup>48</sup> Greenlee et al., op. cit., p. 2320.

<sup>49</sup> Kalogirou, op. cit., p. 246-248.

<sup>50</sup> Greenlee et al., *loc. cit.*

<sup>51</sup> Fritzmann et al., "State-of-the-art of reverse osmosis desalination," *Desalination* 216 (2007): 8.

permeable membrane in order to separate salt from water.<sup>52</sup> Multi-stage flash relies on condensing steam to heat seawater, exposing it to a gradient of gradual temperature changes in separate compartments until meeting an “ideal total latent heat recovery”.<sup>53</sup>

### *Desalination in a Cross-National Context*

Israel, Spain, and Australia share notable similarities, especially in terms of climate. All three countries are either arid or semi-arid and have also been affected by droughts.<sup>54</sup> As a result, all three countries utilize seawater desalination extensively. Since these three countries depend heavily on desalination, technological strides made in one country could benefit another. Spain is already recognized as a worldwide leader in desalination technology, as it has multiple companies providing technical know-how and assistance for desalination efforts in countries such as Mexico, the United States, Cape Verde, Iraq, Honduras, India, and Chile.<sup>55</sup>

Desalination is also growing in terms of global popularity.<sup>56</sup> This is especially true in the Mediterranean, where desalination capacity was approximately 4,177,413 MCM in 2008.<sup>57</sup> Desalination exists in various forms in all Mediterranean countries and could potentially lead to regional cooperation. If this trend develops then Mediterranean countries could potentially reach an agreement to create a shared pool of desalinated water resources that all signatories could draw from. This is of course predicated upon the assumption that the total desalination capacity in the Mediterranean will be enough to fuel a supranational project aimed at alleviating region-wide water supply deficiencies. Nevertheless, cooperation on such an endeavor seems very reasonable, considering that Israel - among other Mediterranean countries - is already involved

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<sup>52</sup> Greenlee et al., op. cit., p. 2320; Kalogirou, op. cit., p. 260; Fritzmman, et al., op. cit., p. 8-9.

<sup>53</sup> Kalogirou, op. cit., p. 256.

<sup>54</sup> I. El Saliby et al., “Desalination plants in Australia, review and facts,” *Desalination* 249 (2009): 2; Alon Tal, “Technological Optimism as an Antidote to Water Scarcity”. Paper presented at the Out of Water: Sustaining Development in Arid Climate Conference (Toronto, ON, Canada), 2011

<sup>55</sup> Technology Review, *Desalination in Spain* (Cambridge: Massachusetts Institute of Technology, 2009), 4.

<sup>56</sup> Tal, op. cit., 3.

<sup>57</sup> Tal, *loc. cit.*

with the United Nations Environment Program, Mediterranean Action Plan (MAP).<sup>58</sup> Creating a regional action plan aimed at pooling a large supply of desalinated water will certainly require massive economic investment. However, by having countries ship limited amounts of desalinated water to a central location—Crete for instance—the costs of desalinated water and water in general could potentially decrease. This decrease in cost would be attributable to all countries contributing water towards the supranational desalinated water supply program. Doing so could potentially provide a combined and unprecedented amount of desalinated water for the whole Mediterranean region. Those countries that contribute would then be able to draw desalinated water commensurate with their specific needs. For example, Spain due to its already large desalination capacity would need to utilize a very small amount of the pool's resources, while a country like Israel might need to use more. By distributing desalinated water along the lines of particular individual needs, the supranational organization avoids the possibility of any one country taking the lion's share of resources. In theory, developed nations like Spain, Israel, and Italy would utilize significantly less desalinated water than developing nations in the Mediterranean.

This supranational program would significantly benefit the water situation in the West Bank. Recognizing the relatively small population in the West Bank, Palestinians would be utilizing a comparatively small amount of desalinated water. Additionally, the Palestinians would not be relying solely on Israel for desalinated water but on an international organization instead. This could potentially soften the Palestinian Authority's opposition to buying desalinated water, which is currently based on fears that relying on Israel for water needs would cede sovereignty. The desalinated water could also be provided to Palestinians with very little

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<sup>58</sup> United Nations, *United Nations Environment Programme Mediterranean Action Plan for the Barcelona Convention*, <http://www.unepmap.org/index.php?module=content2&catid=001001004> (May 2011)

cost. Israel would likewise benefit. The Palestinians would in theory receive enough desalinated water to eliminate water shortages, thereby reducing their reliance on local aquifers for municipal use. But in order to prevent political stonewalling from Israel, the supranational organization could make Israeli membership incumbent upon letting Palestinians receive desalinated water without Israeli interference and appropriation of desalinated water bound for the West Bank.

While a supranational desalinated water supply organization in the middle of the Mediterranean might never be realized, it nevertheless illustrates how desalination efforts in one country can help alleviate water issues in another. Israel and the Palestinian Authority would have much to gain by participating in such an endeavor. Participation has the potential to mitigate political issues inhibiting cooperation on water, which could significantly facilitate the realization of a final status agreement on water. Israelis and Palestinians have struggled for years to obtain a final status agreement on water only to have it fall apart due to political grievances and diametrically opposed nationalist ambitions. However, being part of a supranational organization solely responsible for managing and distributing a sustainable supply of cheap desalinated water creates a situation where the political risks for cooperation are significantly minimized. Israelis and Palestinians would in theory need to sacrifice relatively little in order to be members of this supranational organization. By having more than two countries contribute desalinated water to this cooperative body, Israelis and Palestinians would no longer need to bargain over quotas regarding water pricing and distribution. Both parties would essentially be liberated from such difficulties and be able to concentrate on more important issues such as access and rights to local aquifers and cooperative wastewater treatment.

## *Challenges Facing Seawater Desalination*

### Ecological Challenges

Ecologically, the process of desalination has its share of challenges, some of which are embodied by the Ashkelon desalination facility. One ecological issue is the dependence of desalination on electricity, which uses coal. Using coal to fuel electrical operations invariably emits greenhouse gases into the atmosphere. The Ashkelon desalination facility is fueled by a coal-fired on-site power plant, which has raised the ire of Israeli Environmental Protection Minister Gilad Erdan. Erdan, a local of Ashkelon, voiced concerns regarding the environmental impact of the desalination facility's accompanying power plant. Claiming the plant was "highly polluting" Erdan believed Israel should delay expanding the plant, until cleaner technologies became available.<sup>59</sup> He also implied that expansion of the plant was counterproductive, recognizing that Israel would most likely have to accept the upcoming 2012 Kyoto Protocol aimed at reducing greenhouse gas emissions.<sup>60</sup>

Additional ecological impacts of the Ashkelon facility were cited in a report prepared by IDE Technologies. Damage to beach soil was mentioned as a potential impact of constructing the Ashkelon facility.<sup>61</sup> Since close proximity to the sea is often considered an ideal location for seawater desalination facilities, most are usually built on coastlines. The report also identifies damage to the immediate marine environment as an ecological impact. The construction of underwater pipes, designed for dispensing brine into the sea, causes salt sediments to sink to the sea floor, without mixing. The dispensed brine is also laced with numerous chemicals used for pre-treatment of seawater and has the potential to permanently damage marine life near the

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<sup>59</sup> Ehud Zion Waldocks, "Erdan comes out against Ashkelon coal plant," *The Jerusalem Post*, Apr. 6, 2009 (<http://www.jpost.com/HealthAndSci-Tech/ScienceAndEnvironment/Article.aspx?id=138391>).

<sup>60</sup> Ibid.

<sup>61</sup> Rachel Einav and Fredi Lokiec, *Environmental Aspects of a Desalination Plant in Ashkelon*, <http://www.ide-tech.com/article/environmental-aspects-a-desalination-plant-ashkelon-0> (Feb. 1, 2006).

outlets of brine releasing pipes.<sup>62</sup>

Yaakov Garb mentioned other environmental impacts in a talk given at a water conference in Amman, Jordan. Garb implied that the Ashkelon desalination facility was not entirely energy efficient when compared to ideal, minimum energy requirements for desalinating seawater. He noted that the Ashkelon contractual energy amount of 3.9KWh necessary for desalinating one cubic meter of seawater was actually more than the theoretical, ideal minimum of 1KWh required for desalinating one cubic meter of seawater.<sup>63</sup> Additionally, the product of desalination is an overly pure water source, bereft of ions traditionally found in drinking water, ions that usually serve as vital dietary supplements. With regards to agriculture, the altered chemical composition of desalinated water might make it difficult to grow certain crops.<sup>64</sup>

#### Political Challenges

Palestinians have opposed desalination as a means of meeting their water needs. In 1995 “the Palestinian Authority (PA) rejected an Israeli offer to build them a desalination plant in the Israeli city of Hadera, possibly because Palestinian officials feared agreeing to such a deal would imply a forfeit on their claims to Jordan River water rights”.<sup>65</sup> Palestinian policymakers likely recognize that desalinated water would come from Israeli sources. Since Israel would control these facilities, Palestinians would need to acquiesce to costs dictated by Israelis, possibly resulting in high prices for desalinated water. Furthermore, Israel could determine how often desalinated water is delivered to Palestinians in addition to how much desalinated water they would receive.

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<sup>62</sup> Ibid.

<sup>63</sup> Yaakov Garb, “Desalination in Israel: Status, Prospects, and Contexts,” Paper presented at the Water Wisdom Conference (Amman, Jordan), 2008.

<sup>64</sup> Ibid., 7.

<sup>65</sup> Mati Milstein, “Desalination No “Silver Bullet” in Mideast,” *National Geographic News*, May 22, 2008 (<http://news.nationalgeographic.com/news/2008/05/080522-middle-east.html>).

## Social Challenges

Even if Palestinians did accept desalinated water from Israel, the potential increase in water supply and demand would also increase sewage, thereby overburdening a relatively weak Palestinian wastewater treatment infrastructure. From the perspective of Tony Rantissi, a Development Specialist working for USAID in the West Bank, notes ensuring “safe water supplies to population centers future interventions would include capacity-building for operations and maintenance of water facilities”.<sup>66</sup> Despite this need, the Palestinian Authority currently lacks sufficient financial and technical capacity to adequately address potential increases in water supply and sewage. And even in light of USAID sponsored projects aimed at improving the PA’s wastewater treatment capacity, much progress still needs to be made.

It is also possible, as was feared by Australian opponents of desalination, that increased reliance on desalinated water could have the untoward effect of increasing wasteful water consumption. The use of desalinated water is increasing in Israel and could potentially create the perception that water is an infinite natural resource that can be replenished at any given moment. If such a perception becomes widespread, then it is quite possible that Israelis and Palestinians could inadvertently increase their use of natural water resources, under the auspices that water would be readily available. In increasing their use of natural water resources, Israelis and Palestinian could potentially exhaust these sources, subsequently leading to a possible water shortage.

## Economic Challenges

Producing desalinated water is a relatively cheap process for Israel. But the production of desalinated water (~\$0.56) only represents a single element of the total cost of desalination. Desalination is a process that must also account for storage and treatment costs (\$0.07),

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<sup>66</sup> Tony Rantissi, interview via email correspondence, Washington, DC, April 2011.

emissions externalities (\$0.19), and expropriation of coastal land (\$0.10). When these additional costs are incorporated the total price of desalination amounts to a maximum of \$0.92.<sup>67</sup> While \$0.92 is still relatively cheap compared to projected desalination costs for Australia (\$2.00), this price might increase, as Israel is forced to adopt expensive environmentally friendly energy alternatives designed to limit greenhouse gas emissions of current desalination processes.<sup>68</sup>

### *Solutions to Desalination Challenges*

It should be noted that these challenges are not insurmountable. One needs to acknowledge the fact that seawater desalination is a relatively new technology that will evolve and mature over time. Challenges associated with the ecological, political, social and economic spheres will be invariably reduced. But reducing the impact of these challenges will require technical ingenuity and a strong desire to provide Israelis and Palestinians equitable and equal access to water.

#### Environmental Solutions

Minimizing the environmental impacts of desalination plants and their accompanying power sources can be achieved by utilizing alternative energy platforms such as solar, wind, or geothermal energy to fuel desalination processes. Coal-fired plants, despite their efficiency, emit tons of greenhouse gases that have the potential to negatively impact global climate trends. Solar, wind, and geothermal power sources though quite expensive, are cleaner and less environmentally invasive than coal fueled power plants.<sup>69</sup>

#### Social Solutions

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<sup>67</sup> Gadi Rosenthal and David Katz, *An Economic Analysis of Policy Options for Water Conservation in Israel* (Tel Aviv: Friends of the Earth Middle East, 2010), 13.

<sup>68</sup> Tal, op. cit., 7; Yaakov op. cit., 9.

<sup>69</sup> Kalogirou, op. cit., 262.

Changing the way Palestinians and Israelis think about water use is crucial for conserving water. By getting Israelis and Palestinians to reconsider the ways they use water, the region's water resources can be utilized more effectively and more efficiently. More efficient use of water would subsequently result in a smaller environmental impact since less water is being used. The following paragraphs will discuss various ways Israelis and Palestinians can be convinced to save water and implement certain behaviors to use it more efficiently.

Considering Treatment of Increased Waste Resulting from Desalination:

While using alternative energy sources might solve the problem of greenhouse gas emissions, social challenges associated with desalination should also be resolved. Recognizing that desalinated seawater could potentially increase overall water supply in Israel and the West Bank and likewise increase sewage, Israelis and Palestinian policymakers should be made aware of the potential health hazards of neglecting wastewater treatment. Even though Israel seems poised to increase the amount of water generated from desalination, it must consider the effect that greater water supplies will have on subsequent sewage. In order to prevent increased sewage from developing health related complications, Israelis and Palestinians must plan to have the proper waste treatment infrastructure in place, which has the capacity to adequately treat waste resulting from greater consumption of water supplies.

Agricultural Water Conservation Strategies:

Water conservation strategies should also be considered in order to avoid exhausting natural water resources. Agricultural practices should be modified to use water more efficiently. Palestinians could utilize drip-irrigation and sprinklers to water crops, which could potentially conserve ~65% of available water resources.<sup>70</sup> Other potential options include the construction of

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<sup>70</sup> Taleb al Harithi, *Lower Jordan River Rehabilitation Project Trans-Boundary Diagnostic Analysis Palestine (OPT)* (Tel Aviv: Friends of the Earth Middle East, 2009), 41.

rainwater collection systems necessary for storing water for later use or wastewater treatment facilities necessary for providing reusable water.<sup>71</sup> While Israeli authorities could refuse the construction of such facilities, the potential benefits they offer in terms conserving water might be enough to convince Israelis otherwise. If improved irrigation techniques, wastewater reuse, and rainwater collection techniques are implemented, Palestinians could save nearly 122 MCM of water per year.<sup>72</sup> Furthermore, plant switching in Israeli parks and gardens can offer much in terms of conserving water.<sup>73</sup> Plant switching necessitates replacing certain types of plants with plants that need less water. In addition to improved irrigation techniques, plant switching could potentially conserve between 23 and 68 MCM of water per year and reduce municipal water consumption by 50%.<sup>74</sup>

#### Increasing Public Awareness of Water Conservation:

Israeli and Palestinian policymakers should promote water conservation through public awareness campaigns. The Israelis have already implemented numerous programs to raise awareness regarding water conservation through classroom education, television ads, and billboards. These particular strategies have allowed Israel to reduce domestic water consumption by 20 percent.<sup>75</sup> Despite these positive benefits, more can be done by instituting more aggressive public awareness strategies in the form of mandatory town hall meetings, door-to-door advocacy, or media programs dedicated to water conservation. Furthermore, simple everyday measures can be implemented to reduce water use. Israelis and Palestinians living in developed urban areas should be encouraged to limit toilet flushes, reduce time spent bathing, and wash dishes by hand

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<sup>71</sup> Ibid.

<sup>72</sup> Ibid., 42

<sup>73</sup> Rosenthal and Katz, *op. cit.*, 19

<sup>74</sup> Ibid.

<sup>75</sup> Ibid., 18.

as opposed to utilizing dishwashers.<sup>76</sup> If these everyday practices are supplemented by more aggressive public awareness campaigns, then the potential for saving water could increase dramatically.

### *Political Solutions*

Finding solutions to political impediments regarding desalination is a major challenge and will require much in the way of compromise. However, the need to compromise could be offset by offering Palestinian policymakers incentives to accept desalination or providing Israelis with an economic incentive for selling desalinated water at a reasonable price.

#### Political Incentives for Palestinian Acceptance of Desalination:

As was previously mentioned, Palestinians have refused offers to buy desalinated water out of fear that relying on Israel for water needs could jeopardize ambitions for independence. Rather, Palestinian policymakers prefer to exercise their right to abstract more water from the Mountain Aquifer. However, Nader Al-Khateeb, Palestinian general director, Friends of the Earth Middle East conceded that “he would not rule out desalination as an option and said access to drinking water is the bottom line”.<sup>77</sup>

Palestinian policymakers need to recognize that providing clean drinking water to its population is absolutely essential to the overall quality of life. While Palestinian officials are within their right to criticize Israel for over-abstracting from the Mountain Aquifer, they cannot continue to remain idle waiting for Israel to limit rates of abstraction. The Palestinian Authority must recognize that hoping for Israeli concessions on the Mountain Aquifer is tantamount to complacency and ignores the reality that Palestinians need immediate access to clean drinking water. Ordinary Palestinians are forced to dig illegal wells and rainwater cisterns that are usually

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<sup>76</sup> Ibid., 19.

<sup>77</sup> Milstein, *loc. cit.*

destroyed by the Israeli Civil Administration.

In order to limit these practices, the Palestinian Authority should accept Israeli offers to purchase desalinated water. An incentive for doing so would be the avoidance of a potential health emergency that could devastate the West Bank economy. Consuming untreated water has the potential to develop deadly communicable diseases that could potentially develop into an epidemic that has the potential to spread across the West Bank and possibly into Israel. But a primary incentive for accepting desalination could be allowing Palestinians to jointly operate desalination facilities with Israelis. This could possibly cultivate trust between the two parties and give Palestinians a sense of agency with regards to solving domestic water issues.

#### Political Incentives for Israeli Sale of Desalinated Water to Palestinians at Reasonable Rates

While it might be convenient for Israeli policymakers to define the Palestinian Authority as a politically irresponsible bureaucracy unwilling to work on wastewater treatment, such a definition discounts the fact the Palestinians lack the financial and structural capacity to adequately do so. Israelis have criticized the Palestinians for failing to treat sewage, but in doing so have seemingly ignored the reality that Palestinians lacked the financial capacity to build more wastewater treatment facilities much less the ability to adequately maintain those currently operating. Such experiences have created a mutual climate of distrust where Israeli and Palestinian policymakers cannot trust one another. Recognizing this distrust, it is possible that Palestinians also rejected Israeli offers to purchase desalinated water out of concerns that it could be sold for an exuberant price. An article written by Izzat Abdul-Hadi and Thomas White alleges that Mekorot, has at times, sold water to Palestinians at a price seven times higher than that offered to Israeli settlers.<sup>78</sup> Palestinians are still forced to pay higher prices, a trend that is

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<sup>78</sup> Izzat Abdul-Hadi and Thomas White, *Relying on others: provision of water and health care* (Montevideo: Social Watch, 2002), 144.

supposedly caused by unaccounted for water (water loss), due to poor piping infrastructure and illegal connections.<sup>79</sup>

In order to prevent price increases, Israel should consider an economic incentive requiring them to sell Palestinians desalinated water at a reasonable price in exchange for a larger share of Palestinian grown produce. Doing so would provide Israel with an ability to increase the amount of agricultural products sold, allowing it to provide quality produce to Israeli citizens at reduced prices. Palestinians would likewise benefit by reaping increased profits from agricultural sales, which could potentially improve the Palestinian economy, while simultaneously allowing Palestinians to use less freshwater resources for agriculture, potentially saving more for municipal use.

### *Economic Solutions*

In terms of solving some of the economic problems associated with desalination, two options should be considered. The first proposes privatizing desalination plants whereas the second necessitates greater diversification of water resources. These two options hold great potential in terms of making desalinated water affordable for consumers while simultaneously reducing strain placed upon groundwater resources.

#### Privatizing Desalination Plants:

Friends of the Earth Middle East notes that privatization of desalination plants could put public interests at risk.<sup>80</sup> Despite this warning, the organization still believes that privatization could be a good option for Israeli desalination efforts so long as the proper public oversight mechanisms already exist. According to recommendations, Friends of the Earth Middle East

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<sup>79</sup> Kamal Issa, "Economic Value of Water Used for Domestic in West Bank Palestine," in Atef Hamdy and Rossella Monti, eds., *Food Security under Water Scarcity in the Middle East: Problems and Solutions* (Villa Olmo, Como, Italy: Centre International de Hautes Etude Agronomiques Méditerranéennes, 2005), 412-413.

<sup>80</sup> Zecharya et al, *Whose water is it?: Privatization of Water and Sewage Services, Sea Water Desalination and Public Participation* (Tel Aviv: Friends of the Earth Middle East, 2004).

posits that certain aspects of the desalination process could be privatized such as construction and water management while the public maintains a certain degree of ownership in the corporation.<sup>81</sup>

The Israeli government has taken these ideas into consideration, as proper government oversight of privatized water organizations has helped avert criticism.<sup>82</sup> Nevertheless, some Israelis are still weary of completely privatizing water resources, drawing from the unfavorable impacts of water privatization initiatives in nations abroad.<sup>83</sup> Based on scholarly recommendations, Israel should embrace a hybrid of privatized/public desalination facilities to preserve the Israeli public's stake in water resources while simultaneously allowing for limited influence of free market policies to spur competition that could potentially benefit both Israeli and Palestinian consumers with low prices.<sup>84</sup>

#### Greater Diversification of Water Resources:

Israelis and Palestinians obtain water in a number of ways, which include wastewater reuse, desalination, rainwater collection, and abstracting water from underground aquifers. In order to diversify water resources in Israel and the West Bank several ideas come to mind. One is creating a national program that will install simple rainwater collection systems in all municipal, residential, and commercial buildings. After the rainwater has collected it would be picked up by Israeli water companies and delivered to water treatment plants where it could be purified and stored for later distribution. Mandating the installation of rainwater collection systems on all current and future Israeli buildings could yield much greater amounts of water that could be saved as opposed to letting it simply evaporate and go uncollected. These rainwater collection

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<sup>81</sup> Ibid.

<sup>82</sup> Alon Tal, "Water Management in Israel: The Conspicuous Absence of Water Markets," Paper presented at Expo Zaragoza: International Expo "Water and Sustainable Development" (Zaragoza, Spain), 2008.

<sup>83</sup> Ibid.

<sup>84</sup> Tal, *loc. cit*; Tagar, et al., *loc. cit*;

systems would not have to be elaborate and could include large barrels that are connected to central storage locations in buildings. For the sake of numbers if Israel installs one million rainwater collection systems with a maximum capacity of 10 MCM then it could potentially receive 10 MCM of water whenever it rains. That is more than one half of one percent of Israel's total yearly exploitable resources. While this is a very small amount, the potential for rainwater collection to collect such a large amount of water in a single day, has much promise. The option seems feasible, inexpensive, and easy to maintain.<sup>85</sup>

Israel would also benefit by increasing the amount of plants aimed at reusing wastewater. While seawater desalination offers much in terms of water supply, Israelis should not become entirely dependent on the desalinated water. As of 2005, Israelis produced an annual volume of 450 MCM of wastewater. But not all of it is treated and reused. However, even if Israel is only able to add another 100 MCM of volume of treated wastewater, it would nevertheless provide Israelis with an additional amount of exploitable water resources.

By increasing rainwater collection and wastewater reuse, Israelis and Palestinians can continue to produce desalinated water while simultaneously reducing the amount of water drawn from aquifers. While this strategy does not seek to prohibit Israeli and Palestinian use of the aquifers indefinitely, it does seek to make aquifers more manageable, less strained, and more available to both parties. Furthermore, greater diversification of water resources potentially allows the price of water to decrease as well since water would, in theory, be more plentiful and readily available

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<sup>85</sup> Y. Dreizin, "Integrating large scale seawater desalination plants within Israel's water supply system," *Desalination* 220 (2008): 132–149.

## Wastewater Reuse in the West Bank

### The Problem

The main problem regarding wastewater in the West Bank is that it goes untreated. This water, when treated, could be turned around and used for agricultural purposes, therefore freeing up more freshwater resources from the aquifer basis to be used for potable purposes. Israel currently reuses 70% of its wastewater and reclaims it for use in agriculture. By 2020, around 20% of the total water supply and 50% of the irrigation supply will come from treated wastewater in Israel.<sup>86</sup>

However, the story in the West Bank is different. About 25 MCM of untreated sewage from Israeli settlements and Palestinian populations centers alike enters the natural water resources.<sup>87</sup> According to B'Tselem, 5.5 MCM of wastewater flows into the West Bank's streams and valleys from Israeli settlements.<sup>88</sup> Only 81 out of 120 settlement areas in the West Bank are connected to wastewater treatment facilities. And about half of the treatment facilities were built so long ago that they cannot handle the population growth that has occurred since their construction.<sup>89</sup> The Israeli Water Planning Company formulated a plan to service the wastewater treatment needs of the settlements in 1983, but there is no scheduled completion date on the books. There has been some construction of treatment facilities that take wastewater from Israeli settlements into Israel proper for treatment. The Israeli Civil Administration offered to connect Palestinian villages to these systems, but was refused for fear of legitimating Israeli settlements.<sup>90</sup>

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<sup>86</sup> Brooks, David B., and Trottier, Julia. "A Model Agreement to Share Water between Israelis and Palestinians." *Friends of the Earth Middle East* and EcoPeaceFoEME, November 2010, p. 15.

<sup>87</sup> "Assessment of Restrictions on Palestinian Water Sector Development." p. 20.

<sup>88</sup> "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem*, June 2009, at [http://www.btselem.org/Download/200906\\_Foul\\_Play\\_eng.pdf](http://www.btselem.org/Download/200906_Foul_Play_eng.pdf) p. 5.

<sup>89</sup> *Id.* p. 6

<sup>90</sup> *Id.* p. 11

On the Palestinian side, only 20% of homes are connected to sewage systems in the West Bank. These systems are usually outdated, in disrepair, and cannot handle the increased capacity of the past decade.<sup>91</sup> The other 80% of Palestinians use septic tanks and cesspits to rid themselves of wastewater. Typically, they would pay to have the waste removed periodically, but due to the lack of income, the waste usually lingers in storage and finds its way into underground water sources.<sup>92</sup> Furthermore, according to B'Tselem, 90-95% of Palestinian wastewater goes untreated. The Israeli government initially built four wastewater treatment plants in the West Bank in the 1970s. The only one still operating is near Ramallah, and it reroutes wastewater towards an Israeli reservoir.<sup>93</sup>

This results in claims, as mentioned above, by the Israeli government that the Palestinians are neglecting their wastewater management duties delegated to them under Article 40 of the Interim Agreement. Under this provision, the PWA has jurisdiction to over wastewater treatment and has to go through the JWC for approval of any such projects. As mentioned above only 5% of funds raised by the PWA for wastewater treatment plant construction were utilized to that end. One plant was built in al-Birah, which is in Area B of the West Bank and under Palestinian civil authority. This plant currently treats water from a nearby settlement in addition to the Palestinian villages, but the settlers refuse to pay for the service.<sup>94</sup>

Both sides understand and acknowledge the lack of treating wastewater in the West Bank is polluting the Western Aquifer Basin, their most important shared source of water. However, each side accuses the other for not advancing the treatment and reuse agenda. The Israelis, as mentioned above, claim that the Palestinians are not serious about wastewater treatment and

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<sup>91</sup> Id. p. 17

<sup>92</sup> Id.

<sup>93</sup> Id. p. 18

<sup>94</sup> Id. p. 19

reuse.<sup>95</sup> They also claim that the Palestinians fail to cooperate on the issue out of spite (do not want to legitimate the settlements), fail to submit adequate proposals to the JWC, and request materials for construction that could be used for making weapons.<sup>96</sup>

Israeli authorities insist that any Palestinian wastewater treatment plants treat water from the settlements, and to a higher standard that Palestinians in the West Bank can afford. Furthermore, the Israelis are using the JWC to block Palestinian construction in order to reroute Palestinian wastewater to Israel for treatment and use in irrigation. Finally, international donors such as the German Development Bank and USAID have complained that Israel makes it difficult for people working on these projects to get security clearance and for the equipment to clear customs. According to Friends of the Earth Middle East, this increases the cost of construction by 25-40% of original cost.<sup>97</sup>

There are three specific examples of these complaints coming into play. In 1996, a 5 million Euro plant was submitted and approved by the JWC. However, the Civil Administration refused permission on security grounds, then required that the plant treat the wastewater of a nearby settlement. Because of that demand, the PWA refused to participate on the grounds that it would recognize the legitimacy of the settlement. A 26.5 million Euro plant was approved by both the Civil Administration and the JWC but was denied construction by the army due to security risks in Area C. Finally, a 45 million Euro plant was proposed near Hebron and approved by the JWC in 1999. The Civil Administration required modifications of the plant that

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<sup>95</sup> Bromberg, Gidon, and Tagar, Zecharya, and Tamar, Keinan. "A Sleeping Time Bomb: Pollution of the Mountain Aquifer by Sewage." *Friends of the Earth Middle East*, February 2004, p. 15.

<sup>96</sup> *Id.*

<sup>97</sup> *Id.* pp. 15-16

would have escalated the cost by 60%. The PWA and donor organization had to suspend the plan due the increased costs.<sup>98</sup>

### Proposed Solution

Effective wastewater treatment is imperative in order to increase the efficiency of water use in the West Bank. Unfortunately, there seems to be no ideal grounds for cooperation between the Israelis and Palestinians on this front. The Palestinians want to build wastewater treatment facilities, as evidenced by their continuous submission of proposals to the JWC. However, they are either denied by the Civil Administration due to security concerns in Area C or refuse to do so because Israeli authorities require either they conform to the standards of treatment within Israel (thereby making construction prohibitively expensive) or they service nearby settlements (thereby eliciting Palestinian refusal).

The best way to address this situation is to allow and help the Palestinians build wastewater treatment plants near their large population centers in Area A, the area of the West Bank which the PA controls and administers. This has to be a priority for the PA and the PWA. By developing the resources in areas where they have control, the Palestinians would be doing what they can in order to increase the supply of water they have for irrigation and address the issue of sewage. This would benefit them economically and would debase any accusations that the Israelis might lobby at them regarding their efforts at treating wastewater.

However, there are hurdles for acceptance of wastewater reuse in the West Bank. As Charles Easterly, USAID Chief Engineer in the West Bank explains, wastewater reuse has yet to enter the cultural lexicon of the Palestinians.<sup>99</sup> Furthermore the fully loaded costs of reuse have not been compared with the costs of purchasing water from Israel. However, Easterly concedes

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<sup>98</sup> “Assessment of Restrictions on Palestinian Water Sector Development.” p. 40-41

<sup>99</sup> Easterly, Charles. Email interview, 20 April, 2011.

that agricultural wastewater reuse “has the potential to reduce the demand on drinking water quality aquifers.” As explained above, Israelis have successfully used treated wastewater in agriculture to decrease their reliance on freshwater sources. This is also imperative for Israel because desalinated water does not contain the nutrients to make it effective for farming purposes.

Second, the Israeli government needs to focus on more effectively treating wastewater from the settlements in the West Bank. While construction of more wastewater treatment plants that service settlements would serve to legitimize settlement activity in the area, these plants could be part of any land swap deals that are agreed upon in final status negotiations. Furthermore, if the Civil Administration is so adamant about security concerns and not allowing the PWA to construct in Area C unless they meet Israeli standards, then it would make sense that Israel shoulder the costs.

Israeli settlement activity constitutes 25% of all sewage that flows into the West Bank’s freshwater sources and it is clear that the PWA simply cannot afford to build plants according to Israeli demands, which coincide with wastewater treatment regulations found in Israel proper. If Israel were to build these plants and service the Palestinian villages near the settlements, they could take the amount of water that would coincide with the costs incurred by treating the Palestinian wastewater. In other words, if the Israeli plant treated X MCM of water from Palestinian towns, then it would reclaim the amount of water that it cost to treat X MCM and return the rest to the Palestinians for irrigation purposes.

It is unfortunate that the politics of water in the West Bank will not allow for further cooperation in this crucial aspect of water management. Therefore, each party has to act individually with minimal coordination in order to preserve the freshwater sources that they both

use. Otherwise, they are effectively decreasing the amount of water that exists for them while doing nothing.

## **Demand Management in Israel and the West Bank**

### Israeli Agricultural Sector Demand Management

Cheap water is the biggest contributor to increased demand and usage. In most markets, water is priced lower than its market value due to subsidies and price controls. Even in the United States, a family in Phoenix spends less using the same amount of water than one in Boston, even given their different climates.<sup>100</sup> According to Friends of the Earth Middle East, Israel prices water using quotas and volumetric pricing. The former charges the consumer for the amount of water they consume and the latter are limits based on historical use and need. However, the quotas have not been adjusted for water realities since the 1970s.<sup>101</sup> Quotas are a useful way to limit the use of water, but in Israel most irrigational consumers use below their quota.<sup>102</sup> Therefore, prices are probably more influential on demand.

The prices that Israeli farmers pay are highly subsidized and do not reflect true market value. The domestic sector pays higher rates for water, and thereby subsidizes agriculture use. If these subsidies were eliminated, the cost of water per cubic meter nearly doubles. The Israeli government has taken measures to eliminate cross subsidies and government funding for the national water company by 2015, but it is politically unfeasible for the government to allow prices to rise to accurately reflect the level of scarcity. If prices were allowed to rise for farmers, demand would theoretically decrease.

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<sup>100</sup> Walton, Brett. "The Price of Water: A Comparison of Water Rates, Usage in 30 U.S. Cities." *Circle of Blue*, 26 April 2010 at <http://www.circleofblue.org/waternews/2010/world/the-price-of-water-a-comparison-of-water-rates-usage-in-30-u-s-cities/>

<sup>101</sup> Bergstein, Rachel. "Best Practices in Agricultural Water Demand Management: A Comparative Analysis for Israel." *Friends of the Earth Middle East*, June 2010 at [http://foeme.org/uploads/publications\\_public123\\_1.pdf](http://foeme.org/uploads/publications_public123_1.pdf) p. 7

<sup>102</sup> Id.

Another solution for using water more efficiently would be to create a private domestic water market where farmers could trade unused water from their quota. However, according to the Water Law of 1959, water is considered a public good, and customers do not technically own their water. Allowing the free trade of water would allocate water to the most efficient use and the water on the market would be priced according to bids, not national control. Currently, the Israeli government allows agricultural users to trade or sell 30% of their allocated water via the national water company.<sup>103</sup> Examples of successful water markets, which created more efficient use and priced water based on supply and demand, can be found in Australia, Spain, California, and Colorado.<sup>104</sup>

#### Water Loss in the West Bank

One of the key drivers of water inefficiency in the West Bank is loss. A 2008 study found that the municipalities in the West Bank averaged nearly 40-60% water loss. Comparatively, water loss in 47 municipalities in California was only 10%. In total, the major population centers of the West Bank lost about 10.8 MCM of water due to faulty infrastructure alone in 2002.<sup>105</sup> That came out to be around 31.07 million NIS in monetary losses for water services, the equivalent of about \$10 million presently.<sup>106</sup> The problem in the West Bank is due mainly to aged infrastructure that loses water during transmission from source to consumer.<sup>107</sup> In other words, the pipes are leaking.

The PWA needs to improve the monitoring and delivery mechanisms of water in the West Bank. Currently, the Palestinians are losing around half the allocation given to them by

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<sup>103</sup> Id. p. 8

<sup>104</sup> Id. p. 8-9

<sup>105</sup> Alsharif, Kamal, and Feroz, Ehsan, and Klemer, Andrew, and Raab, Raymond. "Governance of water supply systems in the Palestinian Territories: A data envelopment analysis approach to the management of water resources." *Journal of Environmental Management* Vol. 87, (2008) : pp. 89-90.

<sup>106</sup> Alsharif, et al, p. 88.

<sup>107</sup> Alsharif, et al, p. 87.

Oslo II from the Western Aquifer Basin. By repairing aging infrastructure and improving monitoring of delivery, the PWA could save more water from seeping into the ground uselessly and identify areas of their system where efficiency is lagging. The water loss in the West Bank needs to achieve 10% loss rate, or an increase of retention of about 40%, to be able to meet the minimum world requirement that people have access to 100L per person per day that the WHO recommends.<sup>108</sup>

### Domestic Sector Demand Management for Israel and West Bank

Due to the lack of wastewater reuse and irrigational infrastructure to implement wastewater for irrigational purposes, the West Bank should focus on controlling domestic sector demand. Israel should implement these strategies as well. In an interview with former Knesset member Mossi Raz, one of the reasons the Israeli government is not willing to advertise desalination more than it already has is because they worry that people will view the process as providing unlimited water resources.<sup>109</sup>

The first way to decrease domestic demand is through education. In 2003, a case study was done in the West Bank where low cost water treatment plants were installed next to the main schools in the Jenin area.<sup>110</sup> The object of the program was to increase the awareness of the best use of available water resources and promote information on the need to use water efficiently. The treatment facilities were simple constructs that comprised of a septic tank, two biological filters, a sand filter, and a storage tank. The treated wastewater was pumped to the roof of the schools for storage and use in the schools' gardens and fields.<sup>111</sup> The students at the school were asked to take tests measuring their knowledge of water reuse and were also asked to participate

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<sup>108</sup> Alsharif, et al, p. 88.

<sup>109</sup> Raz, Mossi. Personal Interview, 16 March 2011.

<sup>110</sup> Mimi, Z. A., Ziara, M. and Nigim, H. H. "Water Conservation and its Perception in Palestine *Water and Environment Journal*, 17 (2003) : p. 153.

<sup>111</sup> Id.

in the maintenance and operation of the facilities. Through various statistical analyses, the study found that the combination of classroom and practical education not only improved their knowledge of water treatment, but also changed the students' attitudes and practice of effective water use.<sup>112</sup> The study determined that "water education should be recognized as a pertinent and integral part of the daily life of Palestinian schools."<sup>113</sup> Coincidentally, programs like these could address the problems of cultural acceptance of wastewater reuse in the West Bank expressed by Charles Easterly above.

In addition to education there are several other steps that the PA and Israel could take to implement some sort of demand management. Some examples would be offer rebates or tax breaks for installation of water conserving appliances such as low volume showerheads, vacuum toilets, or rainwater cisterns on rooftops. There should also be strict enforcement of violations of water quotas and general misuse to encourage compliance and efficient use. Both governments should impalement some sort of standards regarding mandatory efficiency design in all buildings. This may be more feasible for Israel given their relative wealth, however, having these regulations in place in the West Bank, even if they are not enforced immediately, can be a good starting point when the region becomes capable.

While agricultural use of water remains, and probably will remain, dominant in Israel and the West Bank there are ways to introduce cost saving demand management measures to the domestic sector as well. In a region where water resources are as scarce as they are, every measure of conservation helps the cause of both parties.

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<sup>112</sup> Id. p. 156

<sup>113</sup> Id.

## **Conclusion: A Look Towards the Future**

Israel and the West Bank need to develop their water resources independently to obtain maximum efficiency. In the end, technologies like desalination and wastewater reuse will reduce both communities' reliance on groundwater resources and increase the amount of water available for use. Israel should focus on implementing domestic reforms that accurately reflect the market price of water to encourage efficient use by farmers and the general population alike.

Desalination in Israel should continue as the production costs decrease. However, they should refrain from offering the West Bank desalinated water because of the Palestinians' legal concerns. Demand management strategies such as stricter regulations on use and efficient construction of newer homes and buildings could further reduce wasteful use.

The West Bank needs to develop wastewater reuse facilities and more efficient infrastructure. There simply is not enough water in the aquifer system to supply fair and equitable use by both parties, as they are entitled to under international law. Additionally, the Palestinian Authority needs to implement public awareness and education campaigns focused on the benefits of using recycled water for agriculture. Not only will this reduce the use of freshwater sources to grow crops, but provide farmers in the West Bank with a new water supply. Finally, the amount of water lost needs to be reduced by some 40-50% if the Palestinian Authority is to provide its people with the WHO recommended 100 liters of water per day per person.

Palestinian Prime Minister Salam Fayyad's plan to build a Palestinian state is an encouraging step towards the type of development this paper recommends. Fayyad's initial focus is on Areas A and B where the Palestinian Authority has administrative control. For water, the plan focuses on rehabilitating the main water networks, eliminating illegal consumption,

ensuring delivery of wastewater services to all communities, and developing sewerage networks and treatment plants. Fayyad recognizes that the large projects are not enough because of the development restrictions the PA faces in Area C and therefore encourages the development of low cost water purification stations and wastewater treatment in rural and small communities. Overall, his plan is practical, eliminates the need to cooperate with Israel and focuses on what the PA currently controls. Fayyad does, however, mention development in Area C by working with the international community to pressure the Israeli Civil Administration to approve projects.

If the Palestinian Authority is able to show that it is willing and able to manage the water resources in Areas A and B of the West Bank efficiently and effectively, then they can legitimately claim they can do the same for Area C as well. Cleaning up the wastewater in the aquifer and becoming responsible stakeholders in the shared water resources delegitimizes Israeli claims – and therefore justification of control over West Bank water resources – that the Palestinians are not willing to cooperate.

While full cooperation between the two parties can only come with a final status agreement, each should implement the various suggestions above to build confidence and hopefully overcome the political obstacles that currently exist. Therefore, when a Palestinian state comes into being, the infrastructure and management will exist in the West Bank to provide the Israelis with a legitimate partner in managing the shared water resources between the two states. If this does not occur, then the management, mismanagement, of West Bank water resources will most likely be one of the first conflict to arise between Israel and any future Palestinian state.

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