5. Transboundary Management
of the Hebron/Besor Watershed in Israel and the Palestinian Authority

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Abstract

Untreated wastewater generated upstream in the West Bank flows downstream into Israel causing environmental and health concerns, as well as exacerbating the conflict between Israelis and Palestinians. This article reports on the first transboundary watershed-based wastewater management and reuse project that is being implemented in the Hebron/Besor watershed. The project offers an alternative to other inefficient unilateral action, which fuels the conflict rather than resolving it for the benefit of the communities living in the area and the environment. The article discusses water-quality monitoring in the Hebron Stream and describes the multiple sources of wastewater in this area, which has a large quarrying and stone-cutting industry.

INTRODUCTION

Around sixteen streams in Israel are transboundary in nature or shared between Israel and the Palestinian Authority, with roughly two thirds originating in Palestinian territory, flowing through Israel and discharging into the Mediterranean Sea to the west. Lack of cooperation between Israel and the Palestinian Authority means that these waterways are all highly polluted, preventing their agricultural, recreational and ecological use. Past experience shows that effective restoration of Israel's streams requires a coordinated effort between Israelis and Palestinians. If one side invests in infrastructure to control pollutants, but the other continues to pollute, this will have no meaningful impact on the regional environment. However, to date such coordination has been minimal and cooperation is difficult. The main objective of this article is to lay a foundation for the effective restoration of the region's transboundary streams by promoting and implementing the concept of transboundary watershed management. The paper argues that as all of Israel's water resources (surface and groundwater) are transboundary, Israeli and Palestinian water policy should center on a transboundary approach to watershed management.[1]

In principle, most water experts in Israel and the Palestinian Authority recognize the need to adopt watershed-based approaches to water management, acknowledging that rivers, wetlands and groundwater provide important ecological services such as waste assimilation, floodwater storage, and erosion control and that these services provide additional social and economic benefits, such as improved water resources for domestic, agricultural, and recreational use. The ongoing Israeli-Palestinian conflict makes the adoption of watershed-based approaches difficult but not impossible.

Israeli and Palestinian water experts have for decades cooperated on transboundary water issues, although this cooperation has been mainly technical or research-based. Because water does not recognize political borders, it can only be effectively managed on the level of the hydrological watershed, through, for example, the implementation of a basin-wide master plan. Based on ecological, historical, physical, economic, and geographical terms agreed upon by both sides, such a master plan serves the best interests of the watershed, regardless of present or future political issues.

TRANSBOUNDARY WASTEWATER CONFLICTS

Drought, population growth and rapid agricultural, industrial, and commercial expansion have widened the gap between water supply and demand in Israel and the Palestinian Authority. Israel has bridged this imbalance by developing sophisticated technologies to increase water supply through desalination and wastewater treatment and reuse, while Palestinian infrastructure, technology, and investment lag behind. West Bank Palestinians experience frequent water shortages and the treatment and reuse of wastewater are very limited. The Palestinian Authority's centralized wastewater collection networks do not service the majority of residents: 73 percent of the population relies on cesspits (Fischendler et al. 2011), in contrast to Israel where less than 10 percent of the population is not connected to the sewage network. The poorly maintained septic tanks and cesspits used by most Palestinian households act only as holding tanks. Cesspits do not have an outlet and do not treat the sewage appropriately. Their function is to collect and store wastewater until it is emptied and disposed of.

Sewage stored in cesspits is either untreated or only partially treated and thus poses a major risk to human health since sewage contains waterborne pathogens that can cause serious illness such as cholera, typhoid, and dysentery. Untreated sewage can also destroy aquatic ecosystems and thus threaten human livelihoods when the associated Biological Oxygen Demand (BOD) and nutrient loading deplete oxygen in the water to levels too low to sustain life. Generally the cesspits in the West Bank are unlined, allowing the inadequately treated sewage to percolate into and pollute the groundwater, which is an important source of drinking and irrigation water for both Israelis and Palestinians. Most cesspits are emptied with vacuum tankers that dump untreated sewage in open areas or in wadis, thus polluting the environment and constituting a public health risk. Roughly 60 million cubic meters of raw sewage is discharged into the environment in the West Bank every year (Fischendler et al. 2011). Much of this sewage flows from the upstream areas in the West Bank, across the Green Line[2] and into the downstream areas in Israel.

Conflict occurs primarily around the Green Line at the point where the sewage from the West Bank crosses into Israel. According to Israeli law, the country is obliged to treat the sewage, but has no right to use it, as the water belongs to the Palestinians according to international law. Israelis demand that the Palestinians treat their sewage, but the Palestinians counter that they are unable to do so as Israel hampers their ability to build the appropriate treatment facilities. Another aspect of the conflict occurs in Area C[3] where Israel proposes to build wastewater treatment plants that will serve both Israeli settlements in Area C and Palestinian communities. Palestinians refuse to consider such a proposition, as this would entail their recognition of the settlements which are deemed illegal according to international law and the international community. Nonetheless, there are a few cases in the West Bank where Israeli settlements and Palestinian communities share a treatment facility.

When the cesspits are not emptied in time, sewage overflows posing serious environmental and public health risks, and contributing to the cross-border conflict. As raw sewage flows downstream, it harms Israeli attempts to rehabilitate surface and groundwater sources. Palestinian inability to treat the sewage hampers the development of the Palestinian agricultural sector as recycled wastewater could form an additional source of irrigation water in the West Bank.

There are three specific sources of conflict over wastewater issues between Israel and the Palestinian Authority (see also Ch. 14):

- Location and construction of treatment facilities
- Cost and benefit sharing
- A lack of bilateral water-quality standards for reuse in irrigation.

Firstly, the location and construction of wastewater treatment facilities is a source of conflict between the parties due to the division of the West Bank into Areas A, B, and C (according to the Oslo II accords[4]) and unilateral actions by both parties. As wastewater treatment facilities should be removed from population centers, usually the most suitable location for the Palestinian Authority to build the plants is the mostly rural Area C. However, all construction in Area C requires recognition, special arrangements, and licensing from the Israeli Civil Administration as well as a permit from the Joint Water Committee,[5] normally an arduous bureaucratic process.

Disagreements often occur when the permit process is delayed, permission is denied, or Israeli military orders halt project implementation. The Palestinian response is to focus on options that can be carried out in Area A where Israeli approval is not needed. However, the dense urban nature of Area A makes it difficult to find an appropriate site for the construction of a wastewater treatment facility. Additionally, rather than implement joint ventures as originally envisaged by the Oslo process, Israel has built several treatment plants on the Israeli side of the Green Line that capture the sewage flowing from the upstream regions of the West Bank. These facilities treat 33 percent of Palestinian urban wastewater (Al-Saed 2010), but are inefficient, non-integrated, and inferior to at-source upstream treatment solutions. This unilateral Israeli move has sparked ardent protests from the Palestinians, who cannot use the treated wastewater, which is instead discharged and used downstream in Israel.

Secondly, wastewater crossing political boundaries leads to disputes over cost and benefit sharing. Treatment plants in Israel operate according to a "polluter pays" principle. Israel deducts the cost of treating Palestinian wastewater at Israeli facilities from jointly collected Palestinian custom and trade taxes before transferring the remaining funds to the Palestinian Ministry of Finance. Over the past 15 years, Israel has charged the Palestinian Authority more than $34 million in reimbursements for wastewater treatment (Al-Saed 2010). The Palestinian Authority objects to the offset and claims that these deductions, which are not supported by bilateral agreements, are illegal. Furthermore, the Palestinian Authority does not receive any of the economic and environmental benefits of the treated effluent – most importantly the return flow for irrigation. In some cases, Israel uses reclaimed Palestinian water for irrigation purposes and river rehabilitation, as is the case with the Alexander River in northern Israel. The Palestinian Authority demands that Israel deducts the value of these benefits from the offset treatment costs. In general and as discussed above, Israel cannot use reclaimed Palestinian water under international water law. Rather, Israel treats the wastewater – mostly at a minimum primary level of treatment – and then discharges it unused into rivers. Collaborative efforts could thus yield significant benefits for both parties in terms of additional water for irrigation, stream and river rehabilitation, and the protection of groundwater resources from pollution.

However, the two parties would have to sign a treaty before treated effluent could be exchanged for additional extraction from the Mountain Aquifer,[6] and water allocations and use would have to be clearly spelled out. Israel and Jordan have signed such a treaty regarding allocation of the Jordan and Yarmouk Rivers, but no such treaty exists between Israel and the Palestinian Authority. As the Palestinian Authority is not a sovereign state, it cannot enter into a formal treaty with Israel. The only agreement between the parties, the Oslo Accords, was designed as an interim accord, not a treaty. It does discuss water allocation of the Mountain Aquifer between the parties, but does not cover the allocation of treated wastewater or options for an exchange scheme.

Finally, the "polluter pays" principle has triggered further disputes, with Israel insisting that the Palestinians adopt Israeli wastewater treatment and reuse standards. These standards, known as the Inbar Standards,[7] require all wastewater treatment plants to treat wastewater to a tertiary level for unrestricted use in irrigation. Many facilities in Israel currently treat wastewater to secondary level and are required to upgrade their facilities to tertiary level. The Palestinian Authority insists that paying for treatment of their wastewater according to Israeli standards is unfair, especially when they do not get to use the treated wastewater for irrigation. This unilateral approach to water quality standards further exacerbates the conflict as Israel makes unreasonable demands on the Palestinians regarding the level of wastewater treatment they should implement. As the Palestinian Authority has a very limited wastewater treatment capacity, it is unreasonable for Israel to require treatment to tertiary level in compliance with the Inbar Standards.

CASE STUDY: Transboundary restoration of the Hebron/ Besor watershed

The Hebron/Besor watershed covers about 3,500 km^2, stretching from the semi-arid region of Hebron in the West Bank and Beer Sheva in the Israeli Negev Desert in the east to the Gaza Strip in the west (Fig. 1). The Hebron Stream originates in the Hebron Hills in the West Bank, crossing the Green Line and flowing into the Israeli city of Beer Sheva where it receives water from tributaries in Israel's northern Negev (such as the Beer Sheva Stream), and ends in the Gaza Strip on the Mediterranean coast (Wadi Gaza). The basin is characterized by many land uses: urban, rural, industrial, agricultural (both crop and livestock), grazing, firing ranges, and open spaces.

Located in a semi-arid to arid region, the streams in the Hebron/Besor Basin are naturally seasonal and water may only flow in the streams six to seven times a year during the rainy season (winter floods). However, today untreated effluent creates a permanent base flow that has profoundly altered the nature of these streams. Around 5 million cubic meters of untreated effluent from domestic, agricultural, and industrial sources in the West Bank is released into the Hebron Stream annually and crosses the Green Line into Israel where it flows westward and is joined by additional effluent from Israeli agriculture and communities.

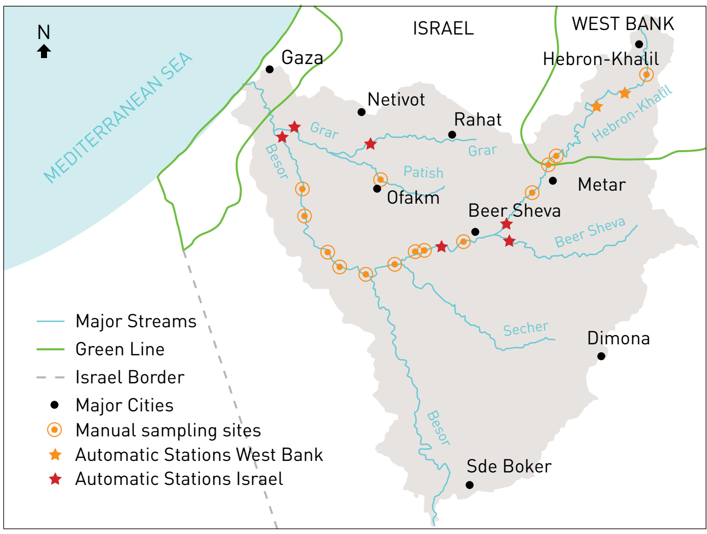
Pollution continues to threaten these streams, as the ongoing conflict between Israel and the Palestinians stands in the way of a watershed-based approach to stream management.

Since the 1990s, the untreated wastewater of the Palestinian city of Hebron and the adjacent Israeli settlement of Qiryat Arba (combined population: approximately 200,000) is released into the Hebron/Besor Stream. In addition to domestic wastewater, the stream also drains the wastewater of nearly 100 industrial facilities. These are mostly small Palestinian marble and stone-cutting plants in the Hebron region.

Preliminary results

This case study discusses a project that is ongoing, and the research has not yet reached the stage where any conclusive results about the state of the watershed or specific recommendations about its restoration can be reported. However, significant progress has been made in the data-gathering phase of the project.

FIGURE 1



The Hebron/Besor watershed. Source: Ghazal Lababidi after Arava Institute for Environmental Studies, 2013.

FIGURE 2

The sheep of Bedouin herders drink from the polluted Hebron stream in the West Bank. Photo: Clive Lipchin, 2013.

Water-quality monitoring

In order to rehabilitate a stream, sources of pollution must first be identified and then removed. Pollution can originate from point sources, i.e. flowing directly into the stream from a single source, or from non-point sources, i.e. flowing indirectly into the stream from diffuse sources. Non-point source pollution is more difficult to identify and regulate than point source pollution. Nevertheless, over the last fifteen years non-point source pollution loads in streams have decreased by 50-80 percent in Israel. Similarly, point source pollution sites have decreased from 130 to 80 sources. This is largely due to daily on-site supervision, inspection and enforcement. These improvements have largely taken place thanks to the introduction of the Inbar Standards mentioned above.

However, despite Israel's efforts to improve water quality in streams, pollution from the

Palestinian Authority continues to cross the Green Line. Israel does not have the jurisdiction to enforce the Inbar Standards in the Palestinian Authority and the wastewater infrastructure in the Palestinian Authority is woefully inadequate (Fig. 2). The result is that large amounts of point and non-point source pollution enter the streams that flow from the West Bank into Israel, such as the Hebron/Besor Stream. The ongoing conflict between Israel and the Palestinians does not allow for the adoption of a watershed-based approach to stream management, with the result that pollution continues to threaten these streams. This project is the first of its kind to adopt a watershed-based approach to stream restoration with water-quality monitoring occurring throughout the watershed (Fig. 3). As the Inbar Standards provide an unprecedented number of quality parameters that set a maximum allowable discharge limit, we have used these standards as our baseline to determine pollution levels in the Hebron/Besor Stream.

The Inbar Standards also impose various obligations, including monitoring and sampling plans to control wastewater effluent discharge, recording and reporting requirements for effluent quality, increased transparency to the public and the publication of monitoring results.

We chose four water-quality monitoring sites, two in the West Bank and two in Israel. The first site is on the outskirts of Hebron, the largest city in the West Bank and in the watershed; the second site is near the Green Line in the southern West Bank; the third site is at the entrance of the Bedouin town of Tel Sheva in Israel just east of Beer Sheva, and the final site is west of Beer Sheva near to Kibbutz Hatzerim. The choice of these sites allows for the comparative assessment of water quality in the Palestinian and Israeli areas of the watershed, as well as before and after the Beer Sheva River Park.[8] The monitoring took place in June 2013.

FIGURE 3

Water-quality sampling in the Hebron Stream in the West Bank. Photo: Clive Lipchin, 2013.

TABLE 1

Parameter	Unit	Inbar Standards, discharge to streams	Upper catchment, West Bank (outskirts of Hebron)	Meitar checkpoint (southern West Bank)	Tel Sheva (east of Beer Sheva)	Near Kibbutz Hatzerim (west of Beer Sheva)
pH		8.5	7.91	8.19	8.31	8.67
Electrical Conductivity (EC)	mS	2.2	2.19	2.35	2.40	2.24
Chlorine (Cl)	mg/L	250	247	252	348	411
Bromine (Br)	mg/L	0.4	0	0	0	0
Sodium (Na)	mg/L	150	196	208	287	285
Phosphate (PO_4)	mg/L	5	0.877	1.092	1.139	0.969
Chemical Oxygen Demand (COD)	mg O_2/L	100	1210	1230	186	170
Total Suspended Solids (TSS)	mg/L	10	1260	2721	62.0	63.0
Ammonium (NH_4)	mg/L	20	2.860	2.965	0.760	0.550
Fluorine (F)	mg/L	2	35.8	18.6	0	0.73

Water-quality monitoring results for the Hebron and Beer Sheva Streams. Source: Field samples gathered and analyzed by the Arava Institute for Environmental Studies, Israel, June 2013.

Table 1 indicates the results of the water-quality monitoring. The highlighted rows show that there is significant pollution along the whole course of the stream, specifically in terms of sodium, Chemical Oxygen Demand (COD) and Total Suspended Solids (TSS). These parameters are well above the Inbar Standards for wastewater discharge to streams, highlighting the low quality of the water in the stream. As a water quality parameter, the COD value is commonly used to indirectly measure the amount of organic compounds in water. In the case of the Hebron/Besor watershed, the COD values are orders of magnitude higher in the West Bank than in Israel, indicating more untreated wastewater is released in the watershed in the West Bank. The primary sources of pollution in this case are most likely the stone-cutting, leather-tanning and olive-oil industries in the Hebron region. TSS is a measure of the amount of suspended particles in the water. Algae, suspended sediment, and organic matter particles can cloud the water, making it more turbid. Suspended particles can clog the gills of fish and once settled, it can foul gravel beds and smother fish eggs and benthic insects. In the case of the Hebron/Besor River, TSS values are orders of magnitude higher in the West Bank than in Israel, further underscoring the high level of untreated wastewater originating from industrial activities in the West Bank.

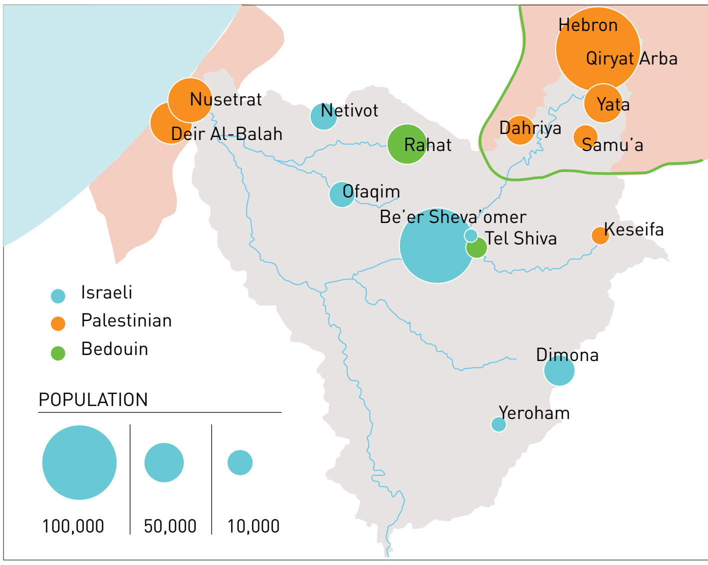
In summary, the table indicates a complex situation of point and non-point source pollution throughout the watershed, both in Israel and the West Bank. Three of the ten parameters do not meet the Inbar Standards, reflecting pollution along the whole course of the Hebron/Besor River, including the part that flows through the Beer Sheva River Park. In some places in the West Bank, the COD concentration exceeds the Inbar Standards values by orders of magnitude. The data is essential to understanding the water management situation in the watershed and providing a baseline for restoration. Further water-quality monitoring will include a comparison of the summer low-flow season and the winter high-flow season.

Socioeconomic characterization of the watershed

In 2010, the Hebron/Besor watershed had an estimated population of 647,167 inhabitants, with Bedouin, Israeli, and Palestinian communities. Figure 4 shows the spatial distribution of these population groups in the watershed. While most of the watershed lies in Israel, more Palestinians live in the watershed if one considers the Palestinian population in the West Bank and Gaza. The Bedouin community is the smallest population group. Figure 5 shows the population distribution in the basin based on 2010 census data and not including the Palestinian population in Gaza. It shows that nearly half of the population in the watershed is Israeli.

Figure 6 shows the differences in average annual per capita water consumption in the Bedouin, Israeli, and Palestinian communities in the

FIGURE 4

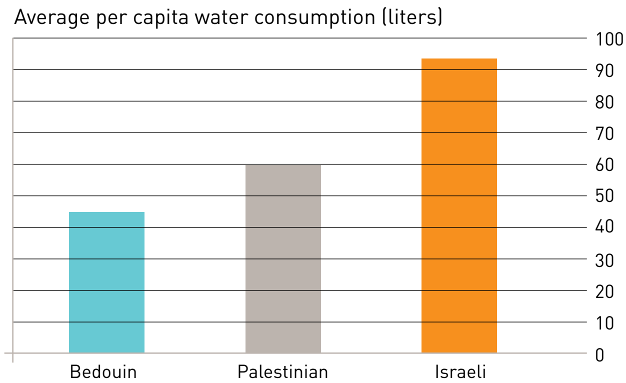


The size and spatial distribution of population groups within the Hebron/Besor watershed. Source: Arava Institute for Environmental Studies, 2013.

FIGURE 5

Population distribution in the Hebron/Besor watershed. Source: Census data from the Israeli Bureau of Statistics (2010) and the Palestinian Bureau of Statistics (2010).

FIGURE 6



Average per capita water consumption for Israelis, Palestinians and Bedouins in the Hebron/Besor watershed. Source: Census data from the Israeli Bureau of Statistics (2010) and the Palestinian Bureau of Statistics (2010).

watershed. The Bedouin population consumes the smallest amount of water (45 liters/capita), followed by the Palestinian population which consumes 60 liters/capita, while the Israelis are the largest consumers with 94 liters/capita. An in-depth socioeconomic analysis of the communities in the watershed that is currently being carried out aims to identify the reasons for the differences in water consumption. These may include socioeconomic factors such as employment, income, and family size, as well as technical factors such as the state of local water infrastructure.

Table 2 breaks down key population and water data for the main communities in the watershed. It reveals the complexity of the socioeconomic context in which water is consumed in the watershed.

This type of analysis is essential for the development of an inclusive watershed restoration strategy that involves and engages all stakeholders. As this project continues, further socioeconomic analysis will be carried out with the aim of achieving a balanced participatory process involving all stakeholders.

TABLE 2

Community	Type	Total Population	Total Water Consumption/ Year (1,000 cubic meters)	Per Capita Water Consumption (L/day)
Chura	Bedouin	17,500	554	31.66
Keseifa	Bedouin	17,400	615	35.34
Rahat	Bedouin	53,100	2089	39.34
Tel Sheva	Bedouin	15,700	732	46.62
Lakiya	Bedouin	9,900	564	56.97
Segev Shalom	Bedouin	7,700	493	64.03
Netivot	Israeli	27,500	1880	68.36
Dimona	Israeli	32,600	2556	78.4
Kiryat Arba	Israeli	7,200	583	80.97
Be'er Sheva	Israeli	195,400	16581	84.86
Ofakim	Israeli	24,200	2149	88.8
Lehavim	Israeli	5,900	546	92.54
Metar	Israeli	6,400	634	99.06
Yeruham	Israeli	8,300	905	109.04
Omer	Israeli	6,600	1059	160.45
Al Ubeidiya	Palestinian	10,753	N/A	56
Der Salah	Palestinian	3,373	N/A	59.5
Bet Sahour	Palestinian	12,367	N/A	60
Halhul	Palestinian	22,128	N/A	65
Hebron	Palestinian	163,146	N/A	70
Total Population		647,167		

Source: Census data from the Israeli Bureau of Statistics (2010) and the Palestinian Bureau of Statistics (2010).

Description of pollution sources in the Hebron/Besor watershed

Some of the most problematic sources of non-point source pollution that flows into the Hebron Stream originate in the upper catchment in and around the West Bank city of Hebron, where a number of local industries such as stone-cutting, leather-tanning and olive-oil production emit heavily polluted wastewater, which is released untreated into the local environment. The city of Hebron currently produces around 24,000 m^3/day of wastewater, most of which is not treated and eventually drains into the Hebron Stream (Al-Zeer and Al-Khatib 2000).

Stone and marble production

Based largely in the area of Hebron and Bethlehem, the stone and marble industry is of great economic importance to the Palestinian Authority, representing the largest manufacturing activity in the territories. The Hebron region has built a reputation for the production of high-quality stone and marble, particularly the world-famous Jerusalem Gold Stone. The industry has an estimated value of $400 million/year, creating between 15,000 and 20,000 direct jobs and many more in related areas. Stone- and marble-cutting activities account for 13 percent of non-agricultural employment, 5 percent of GDP, and hold 1,980 ha of land reserves for future quarries (USM 2011).

It is estimated that the stone-cutting industry uses approximately 0.5 million cubic meters of water per year and produces 3,300 metric tons/year of calcium carbonate solid waste (El-Hamouz 2010). The water is mainly used to cool the saws that cut the rock blocks. The water mixes with the dust to form a viscous liquid, known as slurry. It is estimated that the industry generates approximately 0.7-1.0 million tons of this slurry waste. Stone slurry waste contains heavy metals and suspension solids that vary within the range of 5,000 to 12,000 mg/L, which mainly consist of calcium carbonate (Al-Joulani 2011). The waste generated by the stone-cutting industry has accumulated over the years, as it has been dumped on open land, in valleys, and in sewage systems, causing extensive environmental and health problems (Al-Joulani 2008).

Every year, humans and animals die by drowning in open slurry waste ponds. Moreover, disposal of slurry waste on agricultural land causes a reduction of water infiltration, soil fertility, and plant growth. This practice negatively affects the fertility of the soil, contaminates the ground, increases drainage problems, and reduces groundwater recharge (Al-Joulani 2011).

Additionally, the slurry can clog pipes and block streams. For nearly a decade, slurry from the Hebron Industrial Zone was being released into the municipal wastewater system. Further downstream, in both the West Bank and Israel, Hebron's slurry was causing blockages, creating stagnant pools that attracted disease-carrying mosquitoes and rendered nearby crops useless due to the entry of the stone slurry into the Hebron/Besor watershed. It has been reported that the slurry has flowed into the intake area of the Israeli wastewater treatment facility near Beer Sheva, causing severe problems for the treatment facility as the plant was not designed to handle such a complex and unique pollutant composition (Kahrmann 2013).

The nature of the stone-cutting industry requires a significant amount of water for cooling and dust removal. While most of these enterprises recycle used water after passing it through on-site sedimentation tanks or basins, very few, if any, are connected to a sewage network. Most enterprises regularly drain the total content of the sedimentation tanks in nearby wadis, which can amount to 12 m^3/day of sediment (El-Hamouz 2010).

TABLE 3

Name of City/ Village	Total Municipal Area (km^2)	Contaminated Area (km^2)
Hebron/Al Fahs	43	1.052
Samo	27	0.254
Beit Ummar	34	0.247
Bani Naeem	25	0.216
Saer	17	0.611
Shioukh	5	1.060
Tafuh	22	0.386
Yatta	25	0.489
Total	198	4

Estimated contaminated area from stone cutting in the Hebron District. Source: Al-Joulani 2008.

The stone industry is clearly of great economic importance. However, many problems and challenges must be addressed at the national and local levels in order to realize potential gains. The major environmental challenge is the disposal of the stone slurry waste generated during stone cutting and shaping (Al-Joulani 2012)

In early 2012, USAID recognized that Israelis and Palestinians alike had an interest in ending the illegal disposal of slurry, both because of its environmental and health hazards and because of the key role the stone and marble industry plays in the West Bank economy (Kahrmann 2013).
In May 2012, the USAID water resources and infrastructure office along with representatives from the stone-cutting industry in Hebron reached an agreement to help stop the slurry's release into the wastewater system. Illegal connections to the sewer system were sealed, and liquid slurry waste from factories is now transported to a central processing plant where it is treated and water is recovered for reuse by the factories and the municipality (Ibid.).

Currently, more than 15,000 m^3/month of solid sludge and liquid slurry waste are transported to the Yatta municipal landfill, where it is used to form a cover over solid waste. The layer of slurry and sludge has benefited the villagers living near the Yatta landfill by capping the smells coming from the hills of trash and reducing the number of disease-carrying flies and mosquitoes. Furthermore, it has been reported that significantly fewer feral animals are found feeding on the household garbage in the landfill (Kahrmann 2013).

USAID is exploring additional long-term solutions to the sludge problem, including obliging stone-cutting companies to purchase individual filter presses, which dry and compact the slurry. Water extracted from the slurry is then reclaimed and reused to cool the blades used to cut the stone.

The compacted slurry has the potential to be turned into useful by-products such as gypsum boards, floor tiles, concrete bricks, ornamental fixtures and even pharmaceutical products (Ibid.).

CONCLUSION

The gathering of water-quality data along the Hebron Stream on both sides of the Green Line is a first step in resolving the transboundary wastewater conflict between Israel and the Palestinian Authority. Our work takes a basin approach to the restoration of the Hebron/Besor watershed and aims to develop a more efficient bilateral approach to the treatment and reuse of wastewater to replace the unilateral approach currently in place. However, given the complex nature and diverse sources of wastewater in the area (particularly the stone slurry waste), this is a challenging task. In order to resolve this particular issue, all stakeholders (policy makers, factory operators, water experts, etc.) need to be engaged in identifying the best possible approach to removing stone slurry waste from the watershed through on-site and at-source stone slurry wastewater treatment. The data we are producing clearly indicates the severe pollution of the Hebron/Besor Stream. By communicating and disseminating this data to all stakeholders, we hope to begin the process of effective cross-border stakeholder dialogue to resolve the issue for the benefit of the local communities and the environment.

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ENDNOTES

1. The term "transboundary waters" refers to sources of freshwater that are shared among multiple user groups, with diverse values and different needs associated with water use. In this way, water crosses boundaries - be they those of economic sectors, legal jurisdictions, or political interests. From sets of individual irrigators and environmental advocates, to urban versus rural uses, to nations that straddle international waterways, essentially, all freshwater is transboundary water, and is important to society at local, national, regional, and international scales. Transboundary waters share certain characteristics that make their management especially complicated, most notable of which is that these basins require a more complete understanding of the political, cultural, and social aspects of water, and that integrated management is dependent on extremely intricate awareness of the decision-making process.
2. The de facto border between Israel and the West Bank.
3. Area C is that region of the West Bank where, according to the Oslo Accords signed between Israel and the Palestinian Liberation Organization (PLO), Israel retains both civil and military control.
4. Administrative divisions of the Occupied Palestinian Territories as outlined in the 1995 Oslo II Accords between Israel and the Palestine Liberation Organization. Area A, according to the Accords, consists of land under full civilian and security control by the Palestinian Authority (PA). Area B is Israeli controlled but PA administered, while Area C is controlled entirely by the Israeli government, with authority over both civil administration and police. Areas B and C constitute the majority of the territory, comprised mostly of rural areas, while urban areas – where the majority of the Palestinian population resides – are mostly in Area A.
5. The Israeli-Palestinian Joint Water Committee (JWC) is a joint Israeli-Palestinian authority, created in 1995 under the Oslo II Accords. Its purpose is to manage water- and sewage-related infrastructure in the West Bank, particularly to take decisions on maintenance of existing infrastructure and approval of new projects. Although it was originally intended to be a temporary organ for a five-year interim period, it still exists as of 2014.
6. The Mountain Aquifer is one of the most significant sources of water for both Israelis and Palestinians. Nearly the entire Palestinian population in the West Bank is dependent on springs, wells or water extracted from the Mountain Aquifer for drinking and other uses. In Israel, the Mountain Aquifer supplies water to major population centers.
7. As part of Israel's continued commitment to improving wastewater recovery and reuse, in 2005 a draft set of wastewater reuse standards was published containing 38 updated water-quality parameters. These are known locally as the Inbar Standards after the inter-ministerial committee chairman, Dr. Yossi Inbar, who oversaw the standard review. The Israel Ministry of Environmental Protection and the Ministry of Health adopted these standards in 2007. This new policy requires all future wastewater treatment plants to be able to produce wastewater at a level that allows for "unlimited irrigation or discharge to streams", while existing wastewater treatment plants must be upgraded to meet the new standards. The purpose of the Inbar regulations is to protect public health, prevent pollution of water resources from sewage effluents and enable the use of wastewater recovery for safe discharge back into streams whilst protecting the environment, including ecosystems and biodiversity, soil and crops.
8. The Beer Sheva River Park is a multi-million dollar project to revitalize the downtown area of Beer Sheva by developing recreational and commercial activities. The Beer Sheva River is a central feature of the park.