Friends of the Earth Middle East

Water and Sanitation in the Palestinian Jordan Valley: A 2011 Snapshot

May 2011

EcoPeace/Friends of the Earth Middle East

Bethlehem, Palestine

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FoEME would like to recognize and thank the United States Agency for International Development (USAID), the Richard and Rhoda Goldman Fund and the Global Nature Fund/ Ursula Merz Foundation for their support of this project.

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EcoPeace/ Friends of the Earth Middle East (FoEME) is a unique organization at the forefront of the environmental peacemaking movement. As a tri-lateral organization that brings together Jordanian, Palestinian, and Israeli environmentalists, our primary objective is the promotion of cooperative efforts to protect our shared environmental heritage. In so doing, we seek to advance both sustainable regional development and the creation of necessary conditions for lasting peace in our region. FoEME has offices in Amman, Bethlehem, and Tel-Aviv. FoEME is a member of Friends of the Earth International, the largest grassroots environmental organization in the world.

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CONTENTS

ABBREVIATIONS

ANERA – American Near East Refugee Aid
EU – European Union
EWAS – Emergency Water and Sanitation
FoEME – Friends of the Earth Middle East
JICA – Japan International Cooperation Agency
JWC – Joint Water Committee
KfW – Kreditanstalt fur Wiederaufbau
LJR – Lower Jordan River
MCM – Million Cubic Meters
MoF – Palestinian Ministry of Finance
NIS – New Israeli Shekel
PA – Palestinian Authority
PARC – Palestinian Agricultural Relief Committee
PHG – Palestinian Hydrology Group
PWA – Palestinian Water Authority
SHE – Sharhabil Bin Hassneh Eco Park
UNDP – United Nations Development Programme
UNICEF – United Nations Children's Fund
USAID – U.S. Agency for International Development
WHO – World Health Organization
WWTP – Wastewater Treatment Plant

1. EXECUTIVE SUMMARY

'Water and Sanitation in the Jordan Valley: A 2011 Snapshot' is a study undertaken by EcoPeace/Friends of the Earth Middle East (FoEME) to strengthen the knowledge base on the current water and sanitation situation in the Palestinian Jordan Valley. Compiled from a variety of sources, and substantiated by field research, the study seeks to shed light on the stark reality of water scarcity and environmental degradation in the Palestinian Jordan Valley.

Despite having higher per capita water availability on average compared to the rest of the West Bank, Palestinian residents in the Palestinian Jordan Valley still suffer from inadequate levels of fresh water and an environment that is compromised by the discharge of raw sewage, leading to heavy pollution of groundwater resources and the Lower Jordan River.

This study represents the first major in-depth look at water resources and the sanitation situation in the Jordan Valley by the FoEME network, and adds to the burgeoning information on this topic by other organizations. The study is meant as a tool for policy makers and advocacy campaigners, donor agencies and government bodies, to provide for an easy to use reference document, and to enable informed decision-making at all levels. This study will provide further justification for securing Palestinian water rights and access to water resources in the Jordan Valley, including the water of the Lower Jordan River, and to highlight the need for improved wastewater and sanitation management for all communities in the Jordan Valley.

The paper concludes with two sections: an overview of the 'wedges' to conservation concept, which highlights different areas in the Palestinian economy where water can be used more efficiently, thus making available more water for Palestinians in the West Bank; and lastly, a strategy for petitioning decision makers to support the rehabilitation of the Lower Jordan River, and the recognition of Palestinian water rights to the Lower Jordan River and other water resources in the West Bank.

Friends of the Earth Middle East urgently calls upon the governments of Palestine, Israel, and Jordan, with the support of the international community, to partner together in a shared effort to rehabilitate the Lower Jordan River.

2. INTRODUCTION

The current distribution of water resources in the West Bank does not constitute a fair and equitable sharing of this scarce resource. Palestinian consumption reaches, on average, between 50 and 70 litres per capita per day (l/c/d) – and in some communities is no more than 20 l/c/d, which is the minimum amount recommended by the WHO for emergency situation response.[1] In contrast, Israeli settlements have water availability upwards of 487 l/c/d for domestic use.[2] Their lush lawns, irrigated agricultural lands, and swimming pools stand in stark contrast to the surrounding Palestinian villages where access to safe potable water for household use, or water for irrigation of crops, is limited and inconsistent.

The wastewater situation in the West Bank is dire – many Palestinian communities suffer from adverse health effects and the degradation to their natural environment as a result of raw sewage discharged directly into nearby streams and wadis. The sources are both Palestinian communities in the West Bank and Israeli communities inside and outside the West Bank.

This report will seek to compile the best available information on current freshwater resources available to Palestinians and the wastewater and sewage infrastructure in the target area of the Palestinian Jordan Valley. Further, this report will attempt to paint a picture of how much water is used by Israeli settlements in the Jordan Valley. The study limits its focus to the communities where data is available, and therefore this is not to be considered an exhaustive review of the entire Jordan Valley. It is hoped that this report can act as a reference document for organizations looking to formulate policies and design projects on water and wastewater in the Jordan Valley.

2.1: GEOGRAPHICAL SCOPE

The geographical scope of this report is the Palestinian Jordan Valley: from the Bezek Stream in the north of the West Bank, to the northern end of the Dead Sea, and along the Jordan River on the east to the mountain slopes that run the length of the West Bank to the West. The total land area is approximately 1074km^2 or 19% of the total area of the West Bank. This includes the Jericho Governorate, and parts of Tubas Governorate localities which are within the geographical borders of the Jordan Valley.

[1] "Thirsting for Justice: Palestinian Access to Water Restricted." *Amnesty International,* October 2009: pg. 3. Available http://www.amnesty.org/en/library/asset/MDE15/028/2009/en/634f6762-d603-4efb-98ba-42a02acd3f46/mde150282009en.pdf

[2] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's policy in the Jordan Valley & northern Dead Sea". *B'Tselem,* May 2011, Pg. 37. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf

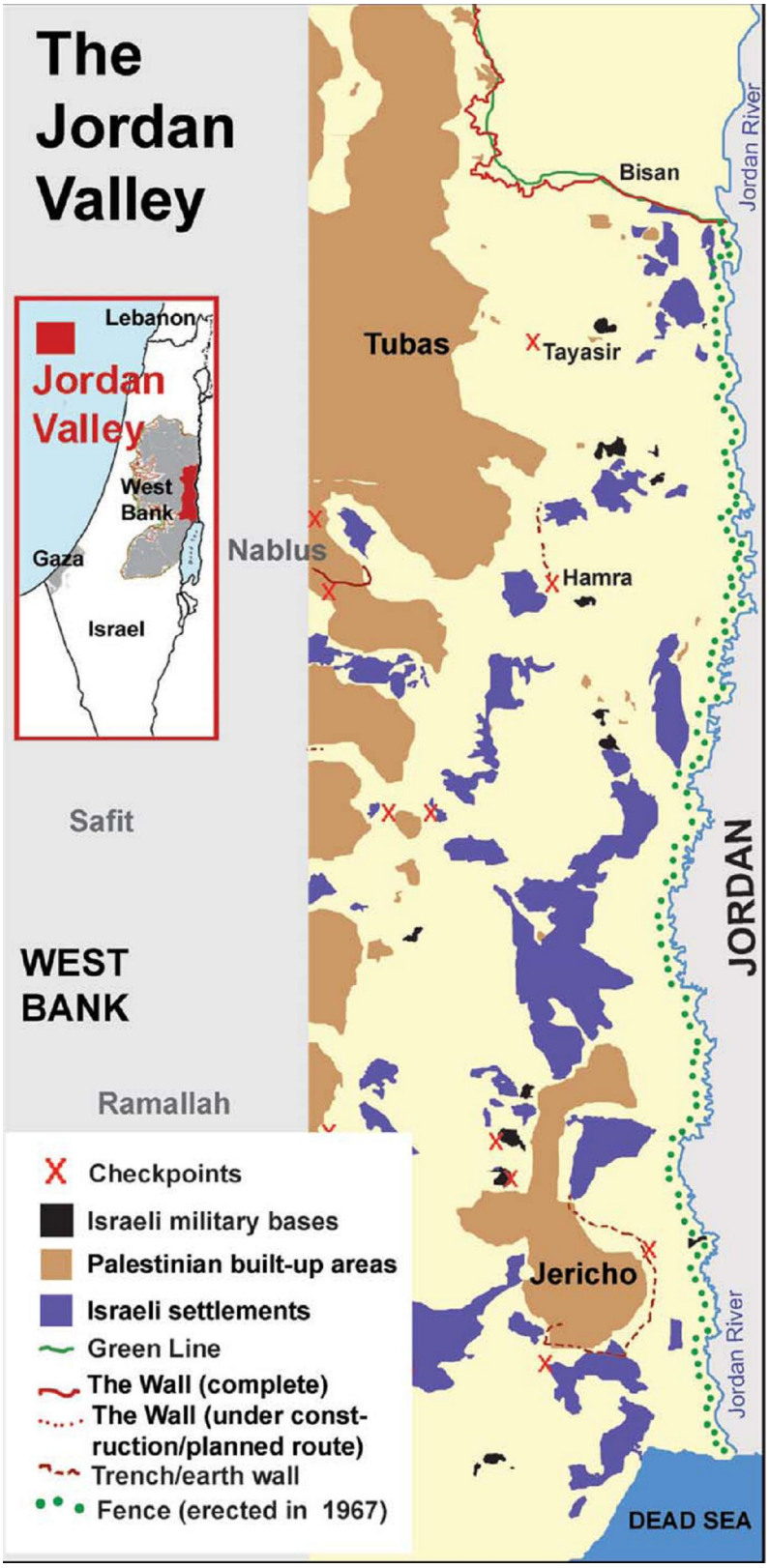

Figure 1: The Jordan Valley Source: Palestinian Solidarity Campaign, 2008.

The Jordan Valley lies 400m below sea level, and is typically arid, with rainfall not exceeding 300 mm per year in the northern part, and less than 150 mm in the southern regions.[3] In general, the Jericho district has little rain, and only a short rainy season ranging between 20-25 days per year.[4]

[3] "Assessment of Water Availability and Access in the Areas Vulnerable to Drought in the Jordan Valley." *UNICEF,* 2010. Pg. 6. Available http://unispal.un.org/pdfs/UNICEF_Water.pdf

[4] "Environmental Profile for The West Bank Volume 2: Jericho District." *Applied Research Institute – Jerusalem*, 1995. Available http://www.arij.org/publications/1995/1995-2%20Environmental%20Profiles%20for%20the%20West%20Bank%20Volume%20%202%20%20Jericho%20District.pdf

Palestinians in the Jordan Valley are restricted from using approximately 80% of the total land area of the valley,[5] which is off-limits due to land having been designated as military fire zones, nature reserves, and settlement municipality zones. One serious consequence of the partitioning of the West Bank has been the inequitable distribution of fresh water to and between Palestinian communities, with detrimental effects on living standards and agricultural production.

2.2: PALESTINIAN POPULATION OF THE WEST BANK

Based on the findings of B'Tselem (2011), as of 2009 there were 64,451 Palestinians living in the Jordan Valley, plus upwards of 15,000 Bedouin.[6]

The Palestinian Bureau of Statistics (2007) puts the population of the Jericho Governorate at 42,320 inhabitants, with a roughly 50/50 split between male and female.[7] Jericho, the largest urban center in the Jericho Governorate, has approximately 18,346 people.[8] In Jericho Governorate, there are 22,466 urban inhabitants, 9,518 rural inhabitants, with the remaining 10,336 inhabitants living in two refugee camps (Ein as Sultan Camp – 3,160, and Aqbat Jaber Camp – 7,176).[9]

The population of the Tubas Governorate (inclusive of areas outside of the Jordan Valley) is 50,261,[10] though the population of the Tubas Governorate in the Jordan Valley, of which this report will focus, is approximately 4,000 inhabitants.

2.3: ISRAELI POPULATION OF THE WEST BANK

It is estimated that the Israeli settler population in the West Bank is 260,000 people (excluding East Jerusalem).[11] There are approximately 9,400 settlers in the Jordan Valley, including those in the north of the Dead Sea, representing 3.1 percent of the total settler population in the West Bank (excluding East Jerusalem).[12] By 2011, there were 37 settlements in the Jordan Valley and northern Dead Sea, including seven unauthorized outposts.[13] For a list of the settlements in the Jordan Valley, see Annex 1.

2.4: SOCIO-DEMOGRAPHICS

The Palestinian West Bank population suffers from a high rate of unemployment, 25.3% as of 2008.[14] The unemployment rate for the Jericho Governorate was 9.9% in 2008, down from a high in the last decade of 14.4% in 2006.[15] In the Tubas Governorate, the unemployment rate fell from 16.7% in 2008 to 13.3% in 2009.[16] The agricultural sector employs the highest percentage of the workforce, at 34.5%.[17]

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[5] "Assessment of Water Availability and Access in the Areas Vulnerable to Drought in the Jordan Valley." *UNICEF,* 2010. Pg. 6. Available http://unispal.un.org/pdfs/UNICEF_Water.pdf
[6] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's policy in the Jordan Valley & northern Dead Sea". *B'Tselem,* May 2011, Pg. 9. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf
[7] Palestinian Bureau of Statistics, pg. 50: Available http://www.pcbs.gov.ps/Portals/_pcbs/census2007/ind_loca_09.pdf
[8] Ibid
[9] Ibid
[10] Ibid pg. 37
[11] "Policies of denial: Lack of access to water in the West Bank." Center on Housing Rights and Evictions, December 2008. Pg. 17. http://www.cohre.org/sites/default/files/policies_of_denial_-_water_in_the_west_bank_dec_2008.pdf
[12] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's policy in the Jordan Valley & northern Dead Sea". *B'Tselem,* May 2011, Pg. 10. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf
[13] Ibid pg. 11. An outpost is an Israeli settlement in the West Bank, illegal under Israeli law.
[14] Palestinian Central Bureau of Statistics http://www.pcbs.gov.ps/Portals/_PCBS/Documents/f6f81e41-8289-42ca-9420-337d8774037f.htm
[15] Palestinian Central Bureau of Statistics http://www.pcbs.gov.ps/Portals/_PCBS/Documents/cddc51cd-b5cb-4cdd-a0ed-1ad99f02ed45.htm
[16] "Integrated Report for the Palestinian Agro-Production and Marketing System." *Applied Research Institute – Jerusalem,* 2010, Pg. 7. Available http://www.arij.org/publications/2010/integratedreport.pdf
[17] Ibid

More than 40% of the Palestinian population of 4 million (Gaza and West Bank) is classified as poor, 38% are food insecure, and 16% cannot afford minimum caloric intake.[18] The Jordan Valley suffers from a high rate of poverty, with 60% of residents living under the poverty line.[19] In Jericho district, approximately 18% of residents were food insecure, jumping up to 33% in the Tubas district.[20]

Water is a significant household expenditure for Palestinians, accounting for 8% of household income – twice the globally accepted average. [21] The West Bank economy is extremely tied to Israel, accounting for 95% of all trade[22] – creating a system of dependence on the occupying power.

3. Water Resources in the West Bank and Jordan River Basin

3.1: The Present Water Situation in the West Bank

Total fresh water resources in the West Bank are comprised of renewable groundwater with an annual capacity estimated at 669 million cubic meters per year (MCM/yr), and runoff water estimated at 215 MCM/yr.[23] Of the total amount of freshwater available in the West Bank, Palestinians abstract less than 20% of the estimated potential, while Israel abstracts the balance and overdraws on its agreed quantity by 50%.[24]

Since the signing of the Oslo II Peace Agreement in 1995, Palestinian water abstractions in the West Bank have actually dropped below the basic level recognized in the agreement (94 MCM/yr in 2009 compared to 118 MCM/yr in 1995),[25] while the Palestinian population has increased by 50% over the same period.[26] Palestinians have been forced to purchase the shortfall in water quantities – approximately 54 MCM/yr or 52% of all water needs in the West Bank – from the Israeli national water carrier, Mekorot.[27] This has further increased the Palestinian dependence on Israel for water supplies – much of which is pumped from within the West Bank, and sold back to Palestinian customers. Currently, the total water quantity utilized by Palestinians in the West Bank is calculated at 148 MCM/yr,[28] with an average per capita water supply of 70 litres per day.

The West Bank is characterized by high water inequalities between Palestinian and Israeli communities. Almost all of the Israeli settlements in the West Bank are connected to the water distribution network, whereas approximately 14%, or 400,000 Palestinians are not connected to the water distribution network.[29] Further, those Palestinian

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[18] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009. Pg. 4

[19] "Eye on the Jordan Valley." *Ma'an Development Center*, 2010, Pg. 21. Available http://www.maan-ctr.org/pdfs/Eyeon%20theJVReportFinal.pdf

[20] Ibid

[21] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009. Pg. v.

[22] "OCHA Special Focus: Increasing Need, Decreasing Access: Tightening Control on Economic Movement." *United Nations Office for the Coordination of Humanitarian Affairs*, 22 January 2008. Available (http://archive.ochaopt.org/documents/Commercial%20Crossings%20V5.pdf)

[23] Executive Summary: National Sector Strategy for Water and Wastewater in Palestine 2011-2013." PWA, March 2010. Pg. 6 http://www.pwa.ps/Portals/_PWA/caffecaa-741d-41fa-adb4-da305af3b568.pdf

[24] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009. Pg. 9.

[25] Executive Summary: National Sector Strategy for Water and Wastewater in Palestine 2011-2013." PWA, March 2010. Pg. 3 http://www.pwa.ps/Portals/_PWA/caffecaa-741d-41fa-adb4-da305af3b568.pdf

[26] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009. Pg. vii.

[27] Executive Summary: National Sector Strategy for Water and Wastewater in Palestine 2011-2013." PWA, March 2010. Pg. 3 http://www.pwa.ps/Portals/_PWA/caffecaa-741d-41fa-adb4-da305af3b568.pdf; Atallah, Nidal. "Water for Life: Water and Sanitation, Hygiene (WaSH) Monitoring Program 2007/2008." Palestinian Hydrology Group, 2008. Pg. 9. Available http://www.phg.org/data/files/publications/general_reports/Reports/2008/waterforlife_07_08.pdf

[28] Executive Summary: National Sector Strategy for Water and Wastewater in Palestine 2011-2013." PWA, March 2010. Pg. 3 http://www.pwa.ps/Portals/_PWA/caffecaa-741d-41fa-adb4-da305af3b568.pdf

[29] "Policies of denial: Lack of access to water in the West Bank." Center on Housing Rights and Evictions, December 2008. Pg. 24. http://www.cohre.org/sites/default/files/policies_of_denial_-_water_in_the_west_bank_dec_2008.pdf

communities that are connected to a water distribution system rely on old and worn out infrastructure, with a rate of 33% water loss on average.[30]

Actual household water use in the West Bank is estimated to average between 50-70 l/c/d, with 50% of households claiming quality problems in their drinking water supply.[31] Jericho generally has the highest available quantities of water in the West Bank per capita (229 l/c/d), whereas the villages of Al Jiftlik and Al Auja (in the Jericho Governorate) have as little as 52 and 42 l/c/d respectively, despite being in close proximity to naturally abundant springs.[32] This illustrates the large disparities between communities and villages within the West Bank, and within specific governorates.

Figure 1: Domestic water consumption per governorate in 2003.[33]

Governorate	Supply		Consumption from Supply		Supplement Water	Consumption				
	Served							Un-Served	Total	
	Mcm/yr	l/c/d	Mcm/yr	l/c/d	Mcm/yr	Mcm/yr	l/c/d	Mcm/yr	Mcm/yr	l/c/d
Jenin	4.23	56.8	2.36	31.7	1.37	3.73	50.0	0.86	4.59	50.0
Tubas	0.72	67.6	0.40	37.7	0.13	0.53	50.0	0.32	0.85	50.0
Tulkarem	5.30	101.3	2.96	56.5	0.00	2.96	56.5	0.41	3.36	55.7
Nablus	9.44	103.3	5.27	57.6	0.00	5.27	57.6	1.36	6.62	56.0
Qalqiliya	3.99	142.8	2.23	79.7	0.00	2.23	79.7	0.28	2.51	75.0
Salfit	1.53	84.5	0.85	47.2	0.05	0.90	50.0	0.21	1.12	50.0
Jericho	2.35	157.0	1.31	87.6	0.00	1.31	87.6	0.00	1.31	87.6
Ramallah	10.86	113.0	6.06	63.1	0.00	6.06	63.1	0.15	6.21	62.7
Jerusalem	7.09	134.7	3.95	75.2	0.00	3.95	75.2	0.03	3.98	75.0
Bethlehem	7.76	127.4	4.33	71.1	0.00	4.33	71.1	0.06	4.39	70.7
Hebron	11.49	66.9	6.41	37.3	2.17	8.58	50.0	0.73	9.32	50.0
Total	64.75	96.5	36.13	53.8	3.72	39.85	59.4	4.41	44.26	58.4

Source: Palestinian Hydrology Group, 2006 (B): 21

For a list of active projects in the Jericho and Tubas Governorate for water treatment and distribution networks, see Annex 2.

3.2: The Present Water Situation in Jericho Governorate

Jericho Governorate is located along the farthest eastern side of the West Bank in the Jordan Valley, and forms more than 11% of the total area of the West Bank, about 634 km^2.[34] The Governorate is one of the most water secure areas in the West Bank, having approximately 2.8 MCM/yr[35] for domestic purposes from wells, springs, and water purchased from Mekorot, and with a water deficit of 20% - the lowest in the West Bank.[36]

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[30] 'The Palestinian Water and Wastewater Sectors: Basic Needs and Development – Ongoing and Proposed Projects by Governorates.' October 2009, PWA. Pg. 211. http://www.pwa.ps/Portals/_PWA/e4e1cac0-2b82-4d46-b494-f38e4e4c86e4.pdf

[31] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009. Pg. v

[32] Atallah, Nidal. "Water for Life: Water and Sanitation, Hygiene (WaSH) Monitoring Program 2007/2008." Palestinian Hydrology Group, 2008. Pg. 48. Available http://www.phg.org/data/files/publications/general_reports/Reports/2008/waterforlife_07_08.pdf

[33] Table adopted from "Supply-Demand Assessment for West Bank and Gaza Strip." *Palestinian Hydrology Group,* May 2006 (B): Pg. 21. Available http://www.phg.org/data/files/publications/general_reports/Reports/2006/supply_demand_2006.pdf

[34] 'The Palestinian Water and Wastewater Sectors: Basic Needs and Development – Ongoing and Proposed Projects by Governorates.' *Palestinian Water Authority,* October 2009. Pg. 115. http://www.pwa.ps/Portals/_PWA/e4e1cac0-2b82-4d46-b494-f38e4e4c86e4.pdf

[35] This amount is in dispute, as the PWA report "The Palestinian Water and Wastewater Sectors" puts the amount at 3.61 MCM/yr for domestic purposes (PWA, 2009: 115).

[36] Al Harithi, Dr. Taleb. " Lower Jordan River Rehabilitation Project: Trans-boundary Diagnostics Analysis Palestine (OPT)." *Friends of the Earth Middle East,* December 2010. Pg. 30. Available http://foeme.org/uploads/12936079411~%5E$%5E~JR_TDA_Palestine.pdf

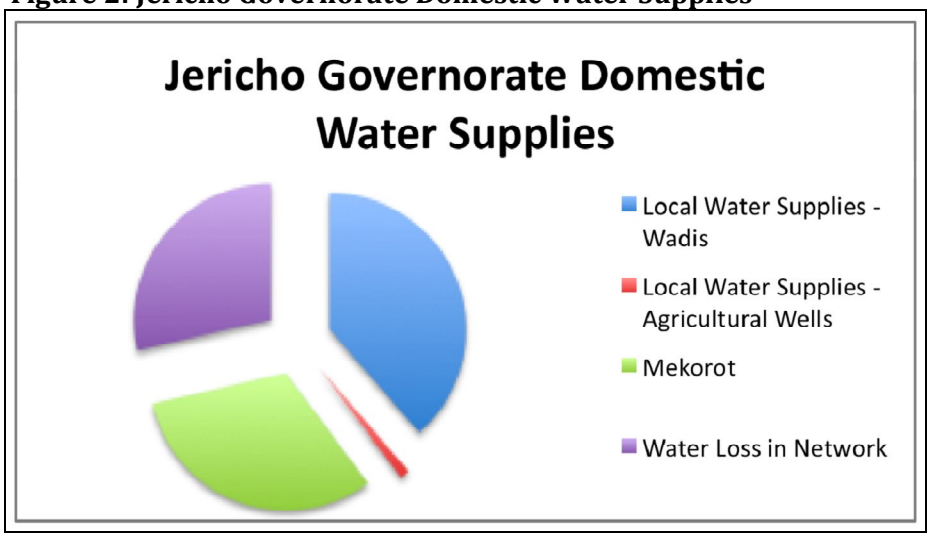
The management of the domestic water supply in the governorate is carried out through municipalities, local councils, and a joint service council.[37]

Network coverage in the Jericho Governorate is almost universal, with 99.88% of residents connected to a water network.[38] However, this represents only 87.5% of all communities in the Jericho Governorate being served or partially served by a water network, and approximately 2% of the total West Bank population.[39]

Domestic Supplies

The vast majority of the local water supplied to residents of Jericho Governorate for domestic use comes from wadis (springs), 1.270 MCM/yr, while the rest, 0.038 MCM/yr, comes from agricultural wells.[40] This represents 55.66% of all domestic water supplies in the governorate.[41] A further 1.042 MCM/yr is purchased from Mekorot, and distributed through the West Bank Water Department, representing the remaining 44.34% of all domestic water supplies in the Jericho Governorate.[42]

Figure 2: Jericho Governorate Domestic Water Supplies



Of the total amount of 2.35 MCM/yr of domestic water supplies in the Jericho Governorate, 0.94 MCM/yr is lost due to leakage in the network and unauthorized connections, while 0.099 MCM/yr goes towards commercial use to serviced areas, representing just 3.3% of total water use for the commercial sector in the West Bank.[43]

Interviews conducted in the villages of Fasayil, Al Jiftlik, Az Zubeidat, and Marj Na'ja determined that residents of these villages do not pay for water. Instead, the cost of water supplied by Mekorot to these villages is deducted from the tax revenues collected by Israel and handed over to the Palestinian Authority. All individuals interviewed indicated this has caused a misuse of water, as residents do not have to worry about the financial cost of using more water.

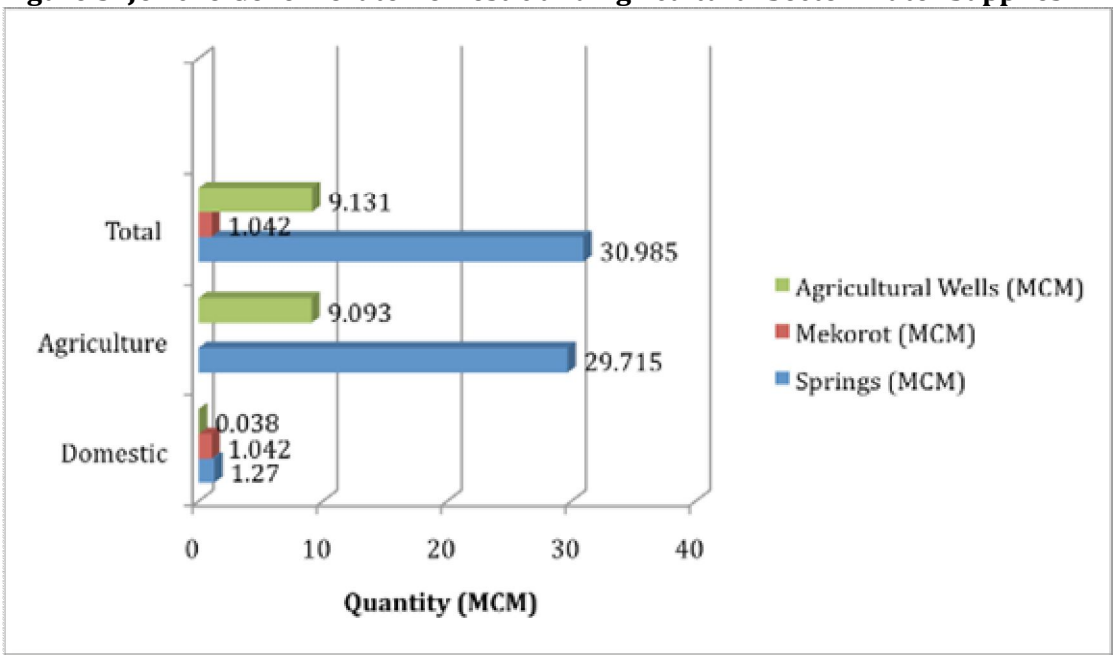
Agricultural Supplies

Water for agricultural purposes constitutes a much larger amount compared to domestic supply. According to the Palestinian Hydrology Group research (2003), net water

[37] The Palestinian Water and Wastewater Sectors: Basic Needs and Development – Ongoing and Proposed Projects by Governorates.' *Palestinian Water Authority,* October 2009. Pg. 115. http://www.pwa.ps/Portals/_PWA/e4e1cac0-2b82-4d46-b494-f38e4e4c86e4.pdf
[38] "Supply-Demand Assessment for West Bank and Gaza Strip." *Palestinian Hydrology Group,* May 2006: Pg. 7. Available http://www.phg.org/data/files/publications/general_reports/Reports/2006/supply_demand_2006.pdf
[39] Ibid pg. 5-6.
[40] Ibid pg. 9
[41] Ibid pg. 16
[42] Ibid pg. 13
[43] Ibid pg. 20, 24

supplies for agriculture in the Jericho Governorate were 38.808 MCM/yr, of which 29.715 MCM/yr was from springs and 9.093 MCM/yr was from agricultural wells. This represents 42.2% of all available water for the agricultural sector in the West Bank for year 2003.[44]

Figure 3: Jericho Governorate Domestic and Agricultural Sector Water Supplies



3.2.1: Water Resources in Jericho Governorate - Wadis

Jericho district has six main wadis (springs), namely Wadi Al-Mallaha, Wadi Al Auja, Wadi Abu Ubeida, Wadi An-Nuw'ema, Wadi Al Qilt and Wadi Al-Ghazal. Wadi Al Mallah runs north-south, and the rest run east-west.[45] Only Wadi Al Qilt has permanent flow, while the rest are intermittent.[46]

3.2.2: Jericho City

The city of Jericho is the most water-secure municipality in the West Bank, with 250 l/c/d, just above the Governorate average of 229 l/c/d.[47] The city obtains all of its domestic water from the Ein Sultan Spring, which has a capacity of 650 m^3/hr, or 5.5 MCM/yr. Of this amount, 42% is used for domestic purposes, and 58% for agriculture.[48]

From 2001, Jericho City has benefited from an upgraded water network, with a 99% connection rate for residents. This has drastically cut down on 'unaccounted for water losses', from 42% prior to the network upgrade, to 17% in 2010.[49]

For agricultural water use, 58% of the discharge (360 m^3/hr) is distributed over four main pipes, each with a capacity of 90m^3/hr.[50] Each hour, 15 m^3 of the 90 m^3 per pipe (60

[44] Ibid pg. 31
[45] "Environmental Profile for The West Bank Volume 2: Jericho District." *Applied Research Institute – Jerusalem*, 1995. Available http://www.arij.org/publications/1995/1995-2%20Environmental%20Profiles%20for%20the%20West%20Bank%20Volume%20%202%20%20Jericho%20District.pdf
[46] Ibid
[47] Author interview with Engineer Ghazi Naji, Director General Services, Municipality of Jericho. 18 April 2011.
[48] Ibid
[49] Ibid
[50] "Water Master Plan for Jericho City". Palestinian Hydrology Group, 2010. Obtained from Engineer Ghazi Naji, Director General Services, Municipality of Jericho. 18 April 2011.

m^3/hr total) goes towards the domestic network, as a contribution towards pumping costs. The remainder of the spring, 42% (290 m^3/hr), in addition to the 60 m^3/hr from the irrigation network, provides 350 m^3/hr in total for domestic purposes.[51] The 350 m^3/hr are pumped to four reservoirs (with total capacity of 4000m^3) during the evenings, then gravity-fed into the domestic network.[52]

3.2.3: Al Auja Town[53]

The town of Al' Auja, 10 kilometers north of Jericho City, is the second largest municipality in the Jericho Governorate, at approximately 5000 inhabitants (including seasonal Bedouins), and is supplied with approximately 500,000 m^3/yr of water for domestic use from the Mekorot system. Of the 5000 residents, only about 70%, or 3500, are connected to the water network, and pay 3.5 NIS/m^3 for their water supplies. The Mekorot supply is permanent, though in the summer there are often severe shortages, at which point residents supplement the Mekorot supply with tanker water, at 5 NIS/m^3, or saline water from agricultural wells. It is estimated that 1000 people (mostly Bedouin) rely on tanker water for all of their water needs, with a total average of 18,000 m^3 of water per every 6 months.[54] The water network in Auja is old, and requires rehabilitation, as there is an estimated 30% leakage in the system. There are current plans to upgrade the network, including the construction of water reservoirs to catch rainfall and flood waters for agricultural purposes.

According to UNICEF (2010), the Bedouin of Auja have access to only 32 l/c/d, at a cost of 15 NIS/m^3, while permanent residents of Auja have access to 76 l/c/d from the Mekorot network.[55]

There are currently seven active agricultural wells in the Al' Auja area, which produced 433,000 m^3 of water in 2008. This is down from 700,000 m^3 pumped in 2000 – a result of three deep wells drilled by Israel in the vicinity of the Palestinian wells. The Israeli deep wells pumped 2.06 MCM in 2008 for the settlement of Yitav, with a population of 227 residents, and other nearby settlements.[56]

3.2.4: Fasayil and Al Jiftlik[57]

The towns of Fasayil and Al Jiftlik, in the central part of the Jericho Governorate, are supplied with water by an aging and intermittent distribution network. Fasayil, with 1,200 residents, and Al Jiftlik, with 5000 residents, are supplied with approximately 27 l/c/d and 166 l/c/d, respectively. Residents of both villages are connected to the network, though during certain times of the year the system suffers from low pressure due to water demands in the Israeli agricultural sector, which draw water from the same network. Tankers are used to supplement the shortage, at a cost of 10 NIS/m^3 in Fasayil and about 33 NIS/m^3 in Al Jiftlik. The difference in price could be explained by the close proximity of a privately owned spring in Fasayil where tankers purchase water, and therefore do not have to travel a far distance to a filling point.

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[51] Ibid
[52] Author Interview with Engineer Ghazi Najj, Director of General Services, Municipality of Jericho. 18 April 18, 2011.
[53] Author interview with Mayor of Auja, Mr. Soleman Romaneen, 21 April 2011, unless otherwise stated.
[54] Mr. Romaneen indicated the Bedouins of Auja change locations for about 6 months of the year, and therefore the amount of water their use in Auja is on a 6 month basis only.
[55] "Assessment of Water Availability and Access in the Areas Vulnerable to Drought in the Jordan Valley." *UNICEF,* 2010. Available http://unispal.un.org/pdfs/UNICEF_Water.pdf
[56] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's Policy in the Jordan Valley and Northern Dead Sea." *B'Tselem,* May 2011, Pg. 37. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf
[57] Author interview with Head of Village Council of Fasayil, Mr. Abrahim A'byat , and Mr. Abed Kassab, Head of Village Council of Al Jiftlik, 16 May 2011, unless otherwise stated.

3.2.5: Az Zubeidat

The village of Az Zubeidat is provided by water for domestic needs by the Mekorot system, which is connected to all residents, at a quantity of approximately 120 l/c/d, or 86,400 m^3/yr. Two main artesian wells are owned by the community, and used primarily for agricultural purposes, with a capacity of 2000 m^3/day per well. When the pressure from the Mekorot network is low due to water demands in the Israeli agricultural sector, which draw water from the same network, tankers are used to supplement water shortages, as are the artesian wells. The wells contribute water to a 200 m^3 freshwater reservoir when the pressure in the Mekorot system is too low to bring water to the reservoir.

Water Reservoir in Az Zubeidat, 200 m^3 capacity. Photo: Jesse Baltutis

3.2.6: Marj Na'ja[58]

All residents of the village of Marj Na'ja are connected to a water network. However, water from Mekorot does not reach the village, due to low pressure and abstraction further up the pipeline. Only 70% of residents get water through the network, which is supplied by an old reservoir of 45 m^3, filled once a day from 2 artesian wells owned by the community. The remaining 30% of villagers obtain their water from tankers, at a cost of around 70-100 NIS per tanker. Per capita water availability is between 70-80 l/c/d.

The two wells are also used for agricultural purposes. One well is located inside of the built-up area of the village (Area B), and supplies 140-160 m^3/hr. The second well is located farther down Road 90 in Area C. This well originally had a discharge of 260 m^3/hr, but due to silt build-up in the well, the depth has decreased from 96m to 46m, and the capacity has dropped to 110 m^3/hr. After desalinization of the increasingly saline water, the supplied quantity is usually 60-70 m^3/hr. The rehabilitation of this well is a top priority for the community of Marj Na'ja.

3.3: *THE PRESENT WATER SITUATION IN TUBAS GOVERNORATE*

The second of two governorates this paper will focus on, Tubas Governorate is located in the northeastern part of the West Bank, with an area of approximately 440 km^2, accounting for 8% of the West Bank area.[59]

In general, the Tubas governorate is highly underserved by a public water network, with only 26.1% of communities served, or partially served.[60] This represents 63.9% of the total population of the governorate, but only 2.2% of the total population of the West Bank.[61]

[58] Information gained from interview with Head of Village Council, Mr. Jamiel Mas'Oud, 16 May 2011, unless otherwise stated.
[59] "The Palestinian Water and Wastewater Sectors: Basic Needs and Development – Ongoing and Proposed Projects by Governorates." *Palestinian Water Authority,* October 2009, Pg. 43. http://www.pwa.ps/Portals/_PWA/e4e1cac0-2b82-4d46-b494-f38e4e4c86e4.pdf
[60] "Supply-Demand Assessment for West Bank and Gaza Strip." *Palestinian Hydrology Group,* May 2006: Pg. 5. Available http://www.phg.org/data/files/publications/general_reports/Reports/2006/supply_demand_2006.pdf
[61] Ibid pg. 6

Domestic Supplies

Domestic water consumption for the governorate is 0.924 MCM/yr with a total per capita average of only 50 l/c/d for the entire governorate.[62] In the served areas of Tubas Governorate, water loss is estimated to be 0.286 MCM/yr, and in the un-served areas 0.017 MCM/yr.[63] Tubas is the poorest Palestinian governorate in terms of water supply service, and suffers from a water deficit of 1.834 MCM/yr.[64] Only two wells currently supply drinking water to the governorate – the old well of Tubas municipality which supplies less than 15 m^3/hr, and the Tammun well which supplies Tubas town with about 1400 m^3/day. The remaining water from the well supplies towns in the governorate with no water connection via filling points for water tankers.[65]

In the villages of Ein el Beida, Kardala and Bardala, residents pay only 0.5 NIS/m^3 for water from the Mekorot network, with the PWA and PA paying the remainder. This is due to an historical agreement these villages have had with Mekorot since the early 1970s.[66]

Agricultural Supplies

The agricultural water supply for the Tubas Governorate is the third highest in the West Bank, with a net water availability for agriculture of 12.553 MCM/yr – 10.461 MCM/yr from springs and 2.272 MCM/yr from wells.[67]

3.3.1: Kardala, Bardala and Ein el Beida

The villages of Kardala, Bardala and Ein el Beida have a unique, though arguably unfair, agreement with Mekorot, which supplies water to the communities at a price of 0.5 NIS/m^3, due to a historical agreement (see footnote 66 for more detail). Total water supplied to all three villages should be 5 MCM/yr as per the agreement with Mekorot. However, the amount supplied to the villages has not changed since the agreement was made in the 1970s, resulting in an increasing population having to cope with static water quantities.

Currently, domestic water availability per capita is 50-60 l/c/d, with an estimated 20, 30-40, and 50% water loss through the networks for Kardala, Ein el Beida and Bardala, respectively. Kardala and Ein al Beida each have a connection rate of 60%, while Bardala has an 80% connection rate. The remaining households obtain their water from tankers, who in turn fill up in neighboring communities at no cost.

3.4: ISRAELI SETTLEMENTS IN THE JORDAN VALLEY

Israeli settlements[68] account for approximately 53% of total ground water abstractions in the West Bank.[69] Mekorot supplies approximately 75 MCM/yr of water to settlements in

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[62] "The Palestinian Water and Wastewater Sectors: Basic Needs and Development – Ongoing and Proposed Projects by Governorates.' *Palestinian Water Authority,* October 2009, Pg. 43. http://www.pwa.ps/Portals/_PWA/e4e1cac0-2b82-4d46-b494-f38e4e4c86e4.pdf

[63] "Supply-Demand Assessment for West Bank and Gaza Strip." *Palestinian Hydrology Group,* May 2006: Pg. 19. Available http://www.phg.org/data/files/publications/general_reports/Reports/2006/supply_demand_2006.pdf

[64] Ibid

[65] "The Palestinian Water and Wastewater Sectors: Basic Needs and Development – Ongoing and Proposed Projects by Governorates.' *Palestinian Water Authority,* October 2009, Pg. 43. http://www.pwa.ps/Portals/_PWA/e4e1cac0-2b82-4d46-b494-f38e4e4c86e4.pdf

[66] During the 1970s, Mekorot drilled a series of wells near to Ein el Beida, Kardala and Bardala, which effectively dried up the water resources for these villages. To compensate, Mekorot supplies water to these villages at a reduced rate, charging only the 'pressure cost' to residents. However, the quantities supplied to these villages as per the original agreement in the 1970s have not changed to account for an increase in population or demands.

[67] "Supply-Demand Assessment for West Bank and Gaza Strip." *Palestinian Hydrology Group,* May 2006: Pg. 31. Available http://www.phg.org/data/files/publications/general_reports/Reports/2006/supply_demand_2006.pdf

[68] According to NGO Peace Now, a settlement is defined as an Israeli community established after 1967 beyond the Green Line on land occupied in the Six-Day war. As of 2011, there were 120 official settlements in the West Bank, excluding East Jerusalem. Information available http://peacenow.org.il/eng/node/297

the West Bank, of which 44 MCM/yr is produced from wells in the West Bank controlled by Israel.[70]

Israel operates 42 abstraction wells located inside of the West Bank, owned and operated by Mekorot, drilled mainly in the Eastern Aquifer in the Jordan Valley, and with a total capacity of 56.9 MCM/yr.[71] Israeli wells are usually much deeper and have a higher yield compared to Palestinian wells, which also leads to the drying up of Palestinian wells located close to an Israeli operated well.

On average, settlers in the Jordan Valley are allocated 487 l/c/d[72] – almost twice that of the most water abundant Palestinian community (ie. Jericho with approximately 250 l/c/d) and almost 20 times as much as the average amount of water available to Bedouin communities in the West Bank.[73] To put this into perspective, the water available to the 9,400 settlers in the Jordan Valley (44.8 MCM/yr) represents about 1/3 of all the water available to the 2.2 million Palestinians in the West Bank in total.[74] Israeli settlements use about 97.5% of all water resources available to them for agriculture in the Jordan Valley.[75] If accounting for domestic and agricultural uses, Israeli settlers in the Jordan Valley have access to 1,312 liters of water per capita on average, mostly used for agriculture.[76]

4. Wastewater and Sewage in the West Bank

4.1: Palestinian Wastewater and Sewage in the West Bank

The majority of towns and villages covering the West Bank lack wastewater networks and must rely instead on septic tanks and cesspits, as network coverage reaches only 32% of the population.[77] Only 56 communities in the West Bank are connected to a network, with the majority only partially connected.[78] It should be noted that the rate at which this collected wastewater is treated in a proper manner is another important question to explore.

It is estimated that 93% of all wastewater in the West Bank is untreated and released into neighboring wadis and valleys, which eventually makes its way into aquifers and the Jordan River.[79] Estimates put the amount of wastewater generated by Palestinians in the West Bank at 56 MCM, representing 62% of all wastewater in the West Bank.[80] Of the total amount, 32.3 MCM are produced in villages, and 23.8 MCM in towns and cities throughout the West Bank.[81] Annually, the total estimated amount of wastewater flows in the West Bank is 91 MCM – from all Palestinian communities, Israeli settlements and from Jerusalem.[82] This leads to the spread of water related diseases, causing severe

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[69] "Policies of denial: Lack of access to water in the West Bank." Center on Housing Rights and Evictions, December 2008. Pg. 17. http://www.cohre.org/sites/default/files/policies_of_denial_-_water_in_the_west_bank_dec_2008.pdf
[70] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009. Pg. iv.
[71] "Policies of denial: Lack of access to water in the West Bank." Center on Housing Rights and Evictions, December 2008. Pg. 13. http://www.cohre.org/sites/default/files/policies_of_denial_-_water_in_the_west_bank_dec_2008.pdf
[72] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's Policy in the Jordan Valley and Northern Dead Sea." *B'Tselem,* May 2011, Pg. 37. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf
[73] Ibid
[74] Ibid
[75] Ibid
[76] Ibid pg. 39
[77] Al Harithi, Dr. Taleb. " Lower Jordan River Rehabilitation Project: Trans-boundary Diagnostics Analysis Palestine (OPT)." *Friends of the Earth Middle East,* December 2010. Pg. 32. Available http://foeme.org/uploads/12936079411~%5E$%5E~JR_TDA_Palestine.pdf
[78] Isaac, Dr. Jad. "Status of the Environment in the Occupied Palestinian Territory." *Applied Research Institute – Jerusalem*, 2007. Pg. 118. http://www.arij.org/publications(2)/papers/2007%20Status%20of%20Environment.pdf
[79] Sbeih, M.Y. "The Role of Small Scale Wastewater Treatment in the Development of Water Resources in the West Bank of Palestine." *Applied Research Institute – Jerusalem*. Pg. 149. http://ressources.ciheam.org/om/pdf/b56_2/00800184.pdf
[80] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 17. http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[81] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 17. http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[82] Ibid pg. 4

health problems in villages and households whose water resources have been contaminated by infiltration of wastewater and sewage into the aquifers.

4.1.1: Jericho City

Currently, the city of Jericho lacks any wastewater disposal network, with inhabitants depending on cesspits for sewage disposal.[83] However, the Japan International Cooperation Agency (JICA), in conjunction with Jericho Municipality and the Palestinian Authority, are in the preliminary stages of planning and development of a wastewater treatment plant for Jericho Municipality. This plant, once operational in 2015 (estimated), will service 70% of the inhabitants of Jericho City, and will have a capacity of 10,000 m^3 per day.[84]

4.1.2: Al Auja Town

Al Auja currently does not have a wastewater collection network. The majority of the town's 4000 permanent residents (excluding Bedouins) use covered cesspits. These cesspits are emptied using tanker trucks, which charge 14 NIS/m^3 to dispose of the wastewater downstream in the Auja Wadi. Many residents also plant the 'cowshook' tree in the vicinity of the cesspit, which absorbs much of the wastewater and cuts down on the need to use tankers for removal of waste.[85]

4.1.3: Fasayil, Al Jiftlik, Az Zubeidat, Marj Na'ja, Ein el Beida, Bardala, Kardala

Common in the vast majority of communities in the Jordan Valley is a lack of proper wastewater and sewage treatment and collection facilities. All villages highlighted in this report, except for Kardala, rely primarily or exclusively on cesspits and septic tanks, which are emptied at a high cost of anywhere between 100-250 NIS per tanker into local wadis or valleys. The high cost for sewage removal by tanker (250 NIS) is found in the northeast villages of Tubas Governorate, as the tanker must come from the city of Tubas for collection. Kardala is 60% connected to a sewage network, though the network discharges directly into Wadi Kardala. The remaining 10% of households use cesspits or septic tanks.

It is estimated that about 70% of water used by a community for domestic purposes ends up as wastewater, and of that, 20% is estimated to seep into the ground when cesspits are used. For the village of Fasayil, this works out to be anywhere between 8,400 to 10,000 m^3/yr of sewage and wastewater removed from village cesspits and septic tanks, and discharged into local wadis, streams, and valleys.

4.2: JERUSALEM AND ISRAELI SETTLEMENT WASTEWATER AND SEWAGE IN THE WEST BANK

After more than 40 years of occupation, Israel has failed to build any *advanced* wastewater treatment plants (WWTP) in settlements in the West Bank.[86] As of 2007, only 81 of 121 settlements in the West Bank were connected to wastewater treatment facilities, with 12 MCM/yr of wastewater treated in settlements, and 5.5 MCM/yr left to flow as raw sewage into streams and valleys throughout the West Bank.[87] This is in direct violation of Article 12, Annex III of the Oslo Interim Agreement, which states (in part) that each side shall:

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[83] Author interview with Engineer Ghazi Naji, Director General Services, Municipality of Jericho. 18 April 2011.
[84] Ibid
[85] Author interview with Mayor of Auja, Mr. Soleman Ramaneen. 21 April 21, 2011.
[86] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 11. http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[87] Ibid pg. 5

> *adopt, apply, and ensure compliance with internationally recognized standards concerning…levels of pollutants discharged through emissions and effluents; acceptable levels of treatment of solid and liquid wastes, and agreed ways and means for disposal of such wastes… [and to take]…the necessary and appropriate measures to prevent the uncontrolled discharge of wastewater and/or effluents to water sources, water systems, and water bodies, including groundwater, surface water and rivers, which may affect the other side, and to promote the proper treatment of domestic and industrial wastewater.*[88]

Seventy-four treatment plants exist for settlements in the West Bank, "though 38 of these are relatively small, compact facilities that can treat [only] small amounts of wastewater, despite the growth in the settlement population over recent decades".[89] The reliability of such WWTPs has been put into question, with reported cases of breakdowns occurring, resulting in sewage flooding Palestinian communities and fields, with devastating health and economic effects.

Much of Jerusalem's annual wastewater, about 17.5 MCM/yr, travels east into the West Bank, with a further 17.5 MCM/yr of wastewater produced by settlements in the West Bank, for a total of 35 MCM/yr – 38% of all wastewater flowing in the West Bank.[90] Much like water usage, the amount of wastewater produced by Israeli settlements in the West Bank is disproportionate to the population – 450,000 settlers in the West Bank, including East Jerusalem - produce almost as much wastewater as the 2.2 million Palestinian residents of the West Bank.[91]

Twenty-five settlements in the Jordan Valley use only preliminary treatment methods of sedimentation and oxidization ponds for wastewater. These are techniques considered outdated, which do not meet the minimum standards required inside of Israel.[92] The wastewater from outposts in the West Bank is not treated in any way.

4.3: WASTEWATER TREATMENT FACILITIES IN THE WEST BANK

As of 2011, only one modern, efficient treatment plant - in Al Bireh - serviced the West Bank. This treatment plant was built in 1998, the only facility built since Oslo, and has a capacity of 5000 m^3 per day, or up to 2 MCM/yr.[93] Other cities which have some sort of rudimentary treatment facilities rely primarily on unlined collection ponds and older plants that provide less than ideal services for wastewater collection and treatment in the West Bank.[94] These can be found primarily in Tulkarem, Jenin and Ramallah. The treatment plant in Ramallah was renovated in 2003. However, its capabilities are inadequate, and much of the barely treated wastewater flows directly into Soreq stream.[95] In Tulkarem, pre-treated wastewater is pumped to an aerated lagoon with a volume of 180,000 m^3 equipped with surface aerators.[96]

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[88] "Oslo Interim Agreement Annex III: September 25, 1995." *MidEast Web Historical Documents*. Accessed 20 April 2011. Available http://www.mideastweb.org/intanx3.htm#app-12
[89] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 6. http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[90] Ibid pg. 7
[91] "Troubled Waters- Palestinians Denied Fair Access to Water." *Amnesty International,* United Kingdom, 2009. Pg. 71. http://www.phg.org/data/files/publications/general_reports/Reports/2009/amnesty_international_09.pdf
[92] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 7. http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[93] Executive Summary: National Sector Strategy for Water and Wastewater in Palestine 2011-2013." PWA, March 2010. Pg. 9 http://www.pwa.ps/Portals/_PWA/caffecaa-741d-41fa-adb4-da305af3b568.pdf
[94] Ibid pg. 8
[95] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 17 http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[96] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009: Pg. 110

4.4: Current and Future Plans for Wastewater Treatment System

The Municipality of Jericho and the Palestinian Authority, with funding from JICA, is in the initial planning stages for the construction of a wastewater treatment plant in Jericho City. This plant, with a capacity of 10,000 m^3/day would service, in the first phase, 70% of residents of Jericho.[97] The funding would cover a wastewater collection network and a treatment system with a resource-circulative system using advanced energy-saving technologies.[98] The treated water would be used for irrigation in local agricultural production. The plant is expected to cost US$ 32 million and would enter into service by 2015.

As of 2011, Al Bireh is the only modern functioning wastewater treatment plant in the West Bank. A new Tulkarem wastewater treatment plant, which would service areas east of the Green Line and south of Wadi Zeimar, was approved by the Israeli Coordinator for Government Activities in the Palestinian Territories on 10th July 2005. However, this decision was on the condition that the plant would meet a 10/10 effluent standard. As of 2009, the Joint Water Committee has not approved the project.[99]

5. Conservation Possibilities

5.1: Wastewater Reuse

In the West Bank there is a total of 39 MCM/yr of wastewater that could be reused in agriculture for irrigation by the year 2020.[100] First, however, it is necessary to invest in a wastewater collection network, treatment plants, and to ensure Palestinian rights and access to wastewater reuse.

Currently, wastewater from Ramallah, Jenin, Tulkarem and Hebron are channeled, without adequate or any treatment, to streams that flow towards Israel,[101] representing a net loss of potential grey water for irrigation. Should this water come to be used by Palestinians in the future, it would represent a dramatic increase in potential water available for irrigation, granted it were given the proper treatment.

According to the B'Tselem Report 'Foul Play' (2009), 17.5 MCM/yr of Jerusalem's wastewater is channeled east, into the West Bank, with the majority flowing into Wadi Nar (Kidron Steam).[102] The water is collected into two diversion facilities near the Dead Sea, in Horqaniya Valley and Og Reservoir, where the water undergoes initial partial treatment in sedimentation pools.[103] Approximately 9.37 MCM and 3 MCM are utilized from the reservoirs, respectively, for irrigation in Israeli settlements in the Jordan Valley. This represents a substantial potential amount of grey water for use in irrigation in the Palestinian agricultural sector in the Jordan Valley, should Palestinians regain control over this grey water resource.

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[97] Author interview with Engineer Ghazi Naji, Director General Services, Municipality of Jericho. 18 April 2011.
[98] "Japan Supports Jericho Wastewater Treatment System – WAFA." *Environment and Climate in the Middle East,* 3 March 2011. Available http://mideastenvironment.apps01.yorku.ca/?p=2085
[99] World Bank, "West Bank and Gaza: Assessment of Restrictions on Palestinian Water Sector Development." Report No. 47657-GZ, April 2009: pg. 110
[100] Al Harithi, Dr. Taleb. " Lower Jordan River Rehabilitation Project: Trans-boundary Diagnostics Analysis Palestine (OPT)." *Friends of the Earth Middle East,* December 2010. Pg. 32. Available http://foeme.org/uploads/12936079411~%5E$%5E~JR_TDA_Palestine.pdf
[101] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 19 http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[102] Ibid pg. 13
[103] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's policy in the Jordan Valley and northern Dead Sea." *B'Tselem,* May 2011. Pg. 36. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf

5.2: WEDGES TO CONSERVATION

The 'wedges' concept, developed by Princeton University's Carbon Mitigation Initiative[104], is used to highlight opportunities for water conservation, which will then improve water access, and availability for the Palestinian people.[105]

There exists several wedges for water conservation in Palestine. The wedges identified in FoEME (2010) for both supply and demand include:

- **Public Awareness Raising (Demand):** Accomplished through campaigns in local media, schools, public places, etc. Up to 10% reduction of total domestic consumption by the year 2020 can be achieved, equaling about 15 MCM, at a cost of about 0.15 – 0.16 USD per m^3.

- **Technological Improvements (Supply and Demand):** Rainwater harvesting infrastructure can be utilized to increase water availability for domestic and agricultural uses. Estimated potential total savings for Palestine at 9 MCM/yr, at a cost of around 0.45 – 0.55 USD per m^3. Dual flush toilets can reduce water use in a single-family residence by 68%, in office bathrooms by 56%, and in restaurants by 52%. At a lower estimate of 35-40%, annual savings can be 21 MCM/yr in Palestine. Reuse of grey water can be used for toilet flushing, although this option requires installation of additional pipe network, and associated potential health hazards. Reduction of network conveyance losses has the potential to save up to 12 MCM/yr, though the cost of infrastructure will be relatively high.

- **Supply Augmentation Possibilities (Supply):** Desalination will provide an additional 72 MCM/yr, at a cost of about 0.70 USD per m^3. The amount of water reclaimed from settlements would be 40 MCM, but would require installation of infrastructure to redirect water from settlements to the Palestinian inhabited areas. Total cost of which is estimated at 24 million USD, with a cost of water 0.70 USD per m^3.

- **Industrial Sector:** Potential savings will not be large, as water use in the industrial sector is not a significant amount in Palestine.

- **Agricultural Sector (Supply and Demand):** Municipality wastewater reuse for irrigation has immense potential for supplying the agricultural sector with a viable water source. Improved irrigation efficiency through the use of drip irrigation, with an estimated 12-15% of freshwater saved, would cost an estimated 0.60 USD per m^3. Rainwater collection and use in agriculture, through either individual collection tanks or through use of dams is possible, but also considered a high cost option, and not likely to have the support of the Israelis

[104] For more information, see http://cmi.princeton.edu/
[105] Al Harithi, Dr. Taleb. " Lower Jordan River Rehabilitation Project: Trans-boundary Diagnostics Analysis Palestine (OPT)." *Friends of the Earth Middle East,* December 2010. Pg. 2. Available http://foeme.org/uploads/12936079411~%5E$%5E~JR_TDA_Palestine.pdf

Taken together, FoEME (2010) estimates the total annual water savings to be around 92 MCM (after adjustment down by 15% due to a possibility of overlap of the proposed options).[106]

Figure 2: Summary of Palestinian Wedges

	Annual MCM (average)	Cost Effectiveness (Cent/m^3)	Long-Term Feasibility Index (1=low, 5=high)
SUPPLY SIDE			
Wastewater reclamation for agriculture	39	55	4-5
Municipal rainwater catchments	9	52	4
Reduction of water conveyance loss	14.5	60	3-4
DEMAND SIDE			
Public awareness	14	45-50	4-5
Improved efficiency of irrigation	11	60	4-5
Reduction of water for toilet flushing	21	55-60	4-5
TOTAL	108.5		
Adjusted by 15% down	92		

Source: FoEME, 2010: 43

Future action on wastewater reuse could amount to 39 MCM/yr (of the 92 MCM identified above) of water availability if the following actions are implemented:

- All sewage to be treated to high standards so as to become a water source;
- Sewage collection network to be extended to all urban areas;
- Receiving stations will be provided for communities under 10,000 people, and wastewater to be tankered to the treatment plants;
- Utilization of wastewater treatment sludge as fertilizer if not unacceptably contaminated;
- Establishment over the period from 2000-2020 of overall 30 wastewater treatment facilities in the Coastal and Inland regions.[107]

5.3: Potential Water Savings

If wastewater in the West Bank were to be considered a resource and full control over it is secured, it is estimated that 39 MCM/yr of treated wastewater could be reused in agriculture for irrigation by the year 2020. Coupled with the potential for water savings through the 'wedges' identified by FoEME (2010), the estimated water savings for Palestine are in the region of 92 MCM by 2020.[108]

5.4: Friends of the Earth Middle East Past and Current Activities

Below is a summary of the past and current projects in which FoEME has either lead or participated in relation to the Palestinian Jordan Valley, with a short description of the activity and the time line.

[106] Al Harithi, Dr. Taleb. " Lower Jordan River Rehabilitation Project: Trans-boundary Diagnostics Analysis Palestine (OPT)." *Friends of the Earth Middle East,* December 2010. Pg. 42-43. Available http://foeme.org/uploads/12936079411~%5E$%5E~JR_TDA_Palestine.pdf
[107] Ibid, pg. 33
[108] Ibid, pg. 42

Name of Activity	Description/Achievement	Date of Completion/Time Line
Auja Environment Center	Serve as focal point for environmental awareness concerning the importance of the Jordan Valley with activities geared towards raising awareness	2009
Auja Water Distribution Network	FoEME lobbied USAID to build a water distribution network for the village of Auja	2011
Rainwater Harvesting Systems	FoEME and USAID built rainwater-harvesting systems in the Jordan Valley as models for water conservation.	Ongoing
Good Water Neighbors	To raise awareness of shared water problems of Palestinians, Jordanians, and Israelis, through dialogue and cooperation on sustainable water management. (http://foeme.org/www/?module=projects	Since 2001 and ongoing
Jordan River Rehabilitation Project	Goal is to identify the means by which water transfers to the LJR could take place and help create the political will to make them happen. (http://foeme.org/www/?module=projects&record_id=153)	2009-2011 and ongoing
Save the Dead Sea	Advocacy campaign calling for the need to create a comprehensive integrated regional development plan for the entire Dead Sea region. (http://foeme.org/www/?module=projects&record_id=21)	Ongoing
Red/Dead Conveyance System	FoEME is advocating for a serious reevaluation of the proposed Red-Dead project, and calls on the World Bank to announce publicly that unless Israel and Jordan halts projects that preempt the outcome of the feasibility study and social impact assessment, the World Bank will withdraw from the study process. (http://foeme.org/www/?module=projects&project_id=51)	Ongoing
Neighbors Paths	This project aims to show the natural and cultural heritage of each one of the 'Good Water Neighbors' communities and to learn about their water resources both in the past and in the present. (http://foeme.org/www/?module=projects&record_id=142)	Ongoing
Grey Water Reuse Systems	FoEME has funded the construction of several grey water reuse systems in Auja village, supplying treated water for use in agriculture.	Ongoing

6. Opportunities and Priorities

This section sets out a strategy for petitioning decision-makers to support both the rehabilitation of the Lower Jordan River and the recognition of Palestinian water rights to the Lower Jordan River and other water resources in the West Bank.

- A point of departure in any advocacy work must be to ensure Palestinian water rights are recognized, access to water resources are guaranteed, and to secure a fair and equitable share of all surface and ground water resources in the West Bank for Palestinian use, including from the Jordan River, considering the historical rights Palestine has over the waters from the Jordan River.

- This must correlate with action taken on the proper collection, treatment and disposal of wastewater and sewage from Palestinian communities. This must be allowed by the Israeli Civil Administration, with promises of non-interference in projects that seek to establish proper treatment facilities in all areas of the West Bank.

- FoEME will work at the national level to recommend the conveyance of treated wastewater from the Al Bireh WWTP and other treatment facilities in the mountainous areas of Palestine for use in the Jordan Valley agricultural sector.

- Through national and international advocacy, a Water Accord on the Eastern Basin must be established. The Eastern Basin is to be completely Palestinian-controlled.

- Development of the Palestinian Jordan Valley Master Plan, with the aim to integrate it with the Israeli and Jordanian Master Plan for the Jordan Valley. (The Palestinian Water Authority, through a letter of support, has endorsed the development of a Palestinian Jordan Valley Master Plan.)

- Development of a Regional Master Plan (RMP) for the rehabilitation of the Lower Jordan River. A forum should be chosen that would allow for the joint preparation of the RMP by Jordanians, Palestinians, and Israelis. This should include decision makers with authority to approve the final plan.

- Identify potential communities for construction of household grey water filtration systems, using the Auja Eco-Center grey water filtration system as a model for other households and communities.

7. Conclusion

The underlying concern for all communities interviewed for this study were to find a permanent supply of good quality water to meet the domestic and agricultural needs of their village, and to find a solution to the sanitation situation, involving the construction of sewage networks and treatment facilities. In a context where Palestinian communities in the Jordan Valley are often in close proximity to water abundant Israeli settlements and are often not supplied with enough water to meet even the most basic of water needs, the provision of clean, continuous, and ample quantities of water is of critical importance.

In the vast majority of communities researched for this paper, the top priorities are the following:

- Construction of water reservoirs
- Rehabilitation of artesian wells
- Rehabilitation of old water distribution networks, to cut down on contamination of water and water loss due to leakages
- Construction of sewage collection network and wastewater treatment plants to stop the disposal of wastewater and sewage into local wadis and valleys.

In light of the severity of the present water situation facing Palestinian communities in the Jordan Valley, and the harmful discharge of raw wastewater and sewage into the local wadis, valleys and environment, this paper has attempted to highlight some of the key facts. To make broad assessments of the water and wastewater situation in Palestine is extremely difficult. Instead, a higher resolution understanding of water realities and the impacts of untreated sewage and wastewater in the local environment is essential for a true picture of the present situation in the West Bank.

This report will provide easily accessible information on this sector, and provide the justification needed to pressure policy makers nationally and internationally to ensure the fair and equitable distribution of water resources among Palestinian residents of the Jordan Valley.

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9. Annexes

Annex 1: Israeli Settlements in the Jordan Valley

Name	Year Established	Population (2009)	Area (dunum)	District	Municipality	Type of Treatment
Aventa	1987	100		Jericho	Megilot	
Almog	1977	153		Jericho	Megilot	Settling and oxidation ponds
Argaman	1968	166	833*	Jericho	Jordan Valley	Settling and oxidation ponds
Beit Ha'arava	1980	95	25*	Jericho	Jordan Valley	
Bqa'ot (Beka'ot)	1972	160	675*	Jericho	Jordan Valley	Settling and oxidation ponds
Gitit	1973	259		Jericho	Jordan Valley	Settling and oxidation ponds
Gilgal	1970	172	650*	Jericho	Jordan Valley	Settling and oxidation ponds
Vered Yericho	1980	194		Jericho	Jordan Valley	Settling and oxidation ponds
Hemdat	1983	147		Jericho	Jordan Valley	
Hamra	1971	132*		Jericho	Jordan Valley	Settling and oxidation ponds
Yitav	1970	118		Jericho	Jordan Valley	Settling and oxidation ponds
Yafit	1980	107	1066*	Jericho	Jordan Valley	Settling and oxidation ponds
Mechola	1968	377	233*	Jericho	Jordan Valley	Settling and oxidation ponds
Mechora	1973	122		Jericho	Jordan Valley	Settling and oxidation ponds
Mevo'ot Yericho	1999	Approx. 15 families*		Jericho	Jordan Valley	
Ma'ale Efraim	1970	1270	714*	Jericho	Jordan Valley	Settling and oxidation ponds
Mitzpe Yericho	1978	1754		Jericho	Binyamin	
Mitzpe Shalem	1971	164		Jericho	Megilot	Settling and oxidation ponds
Masu'a	1970	136	817*	Jericho	Jordan Valley	
Maskiyot*	1982	507		Jericho	Jordan Valley	
Mul Nevo*	2001	5	66			
Niran	1977	54	225*	Jericho	Jordan Valley	Settling and oxidation ponds
Na'ama	1982	102		Jericho	Jordan Valley	Settling and oxidation ponds
Netiv Ha'gdud	1976	175	1037*	Jericho	Jordan Valley	Settling and oxidation ponds
No'omi*	1982	129	425			
Petzael	1975	205		Jericho	Jordan Valley	Settling and oxidation ponds

Kalia	1968	266*	417*	Jericho	Megilot	
Ro'i	1976	150	264*	Jericho	Jordan Valley	Settling and oxidation ponds
Rotem*	2001	18	50	Jericho	Jordan Valley	
Shadmot Mehola	1979	536	609*	Jericho	Jordan Valley	Settling and oxidation ponds
Tomer	1978	282*	366*	Jericho	Jordan Valley	Settling and oxidation ponds
Kokhaf Hashahar*	1977	1530				
Rimmonim***	1977	616				
Qalya	1974	300				
Total Population**		9821				
* Ma'an Development Center 'Eye on the Jordan Valley' 2010	**Does not include outposts in the Jordan Valley	*** B'Tselem "Dispossession and Exploitation" May 2011, pg. 77				

Annex 2: PWA Water Treatment and Distribution Project Summary

The following table is a summary of active projects in the Jericho and Tubas Governorate for water treatment and distribution networks. The information was compiled from the Palestinian Water Authority, 2009.[109]

Community	Type of Project	Project Components	Status/Donor	Implementing Agency	Cost in USD $
Jiftlik	Water	Rehabilitation and extension of internal water network, reservoir, and main pipeline	Secured fund by MoF	PMU	25,000
			Committed USAID/EWAS	ANERA	100,000
			Committed by KfW/UNDP	UNDP	90,000
			Funded by OXFAM	OXFAM	200,000
Fassayel	Water	Rehabilitation and extension of the internal water network, reservoir.	Submitted to JICA	PMU	300,000
Ein Dyuk Tahta	Water	Rehabilitation and extension of the internal water network.	Potential donor KfW	PMU	300,000
Jericho	Water	Rehabilitation and equipping of Jericho Well No. 1 with pump and all its accessories. Construction of main pipeline from the well to Al Sultan spring	Funded by MoF	PMU	400,000
Jericho	Water	Replacement of pipes and improvements of the internal water network	Committed USAID/EWAS	ANERA	94,000
Jericho	Water	Extension of the existing water network	Funded by KFW	PMU	400,000
Aqbat Jaber Camp	Water	Reservoir 1000 m^3, transmission pipeline from Jericho well No. 1	MoF	PMU	280,000
Aqbat Jaber Camp	Water	Rehabilitation and extension of the internal water network	Ongoing funding by French Government	Bencanson/PMU	300,000
Al- Auja	Water	Construction of internal water network, reservoir.	Committed USAID/EWAS	ANERA	1,500,000
Al Hadidiya	Water	Water tankers system, the water supply is 10m^3/day to be increased to 50m^3/day	Proposed to CAP through UNICEF	UNICEF	10,000

[109] The Palestinian Water and Wastewater Sectors: Basic Needs and Development – Ongoing and Proposed Projects by Governorates.' October 2009, PWA.. Available http://www.pwa.ps/Portals/_PWA/e4e1cac0-2b82-4d46-b494-f38e4e4c86e4.pdf

Khirbet Humsa	Water	Water tankers system, the water supply is 10 m^3/day to be increased to 50m^3/day	Proposed to CAP through UNICEF	UNICEF	10,000

Spring ID	Spring Number	Spring Name	Governorate	Locality	Annual Avg Discharge
AC/020	393600213	Baidah	Tubas	Ein el Beida	233,692m^3
AC/021	393650265	Al Dair	Tubas	Ein el Beida	302,352m^3
AC/022	N/A	Al Qur'an	Tubas	Ein el Beida	230,061m^3

Annex 3: Water Sources in the Jordan Valley - Springs[110]

AC/023	393620233	Al Shamsiyyah Al Tehta	Tubas	Ein el Beida	140,145m^3
AC/024	393580286	Al Shamsiyyah Al Fuqa	Tubas	Ein el Beida	113,073m^3
AC/025	N/A	Al Munhadariyyat Al Fuqa	Tubas	Ein el Beida	64,855m^3
AC/025A	N/A	Al Munhadariyyat Al Tehta	Tubas	Ein el Beida	74,845m^3
AC/030A	N/A	Al Himmah Al Fuqa	Tubas	Bardala	31,153m^3
AC/030B	N/A	Al Himmah Al Tehta	Tubas	Bardala	81,750m^3
AC/035	N/A	Blaibel	Tubas	Bardala	232,199m^3
AC/041	412500124	Hammam Al Maleh	Tubas	Bardala	1,062,042m^3
AC/054	452500163	Fasayel	Jericho	Al Jiftlik	658,590m^3
AC/060	454530213	Al Dyuk	Jericho	Jericho	4,980,698m^3
AC/060A	454510193	Al Nwai'mah	Jericho	Jericho	2,604,808m^3
AC/060B	454500183	Al Shusah	Jericho	Jericho	608,192m^3
AC/061	463800214	Al Sultan	Jericho	Jericho	5,569,376m^3
AS/020	463710214	Al Qilt & Al Fawwar	Jericho	Wadi Al Qilt	6,579,396m^3
CB/020A	N/A	Ghazal	Jericho	Dead Sea	399,873m^3
CB/020B	N/A	Tannur	Jericho	Dead Sea	1,885,742m^3
AC/026	N/A	Al Fatur	Tubas	Ein el Beida	N/A
AC/027	N/A	Abu Afeef	Tubas	Ein el Beida	N/A
AC/028	N/A	Al Dabes	Tubas	Ein el Beida	N/A
AC/029	N/A	Frata	Tubas	Bardala	N/A
AC/031	N/A	Kardala	Tubas	Bardala	N/A
AC/032	N/A	Bardala	Tubas	Bardala	N/A
AC/032A	N/A	El'Arak	Tubas	Bardala	N/A
AC/033	N/A	Qa'um	Tubas	Bardala	N/A
AC/034	N/A	El Sufsafe	Tubas	Bardala	N/A
AC/036	N/A	Hasan Al Shuha	Tubas	Bardala	N/A
AC/040	N/A	Al Hulwah	Tubas	Bardala	N/A
AQ/020	N/A	Bassat Mahrug	Jericho	Al Jiftlik	N/A
AQ/021	N/A	Josala	Jericho	Al Jiftlik	N/A
CB/020	N/A	Fashkhah	Bethlehem	Dead Sea	N/A
CB/021	N/A	Ghwair	Jericho	Dead Sea	N/A
CB/021A	N/A	Ghazal Al Shamaliyyah	Jericho	Dead Sea	N/A
CB/022	N/A	Turba	Jericho	Dead Sea	N/A

[110] Summary of Palestinian Hydrological Data 2000 Volume 1: West Bank, PWA

Annex 4: Water Sources in the Jordan Valley: Wadis, Floods and Reservoirs

Name	Governorate/ Locality	Annual Volume Discharge Average (MCM)	Description
Wadi Nar/Kidron Stream	Jerusalem/Bethlehem Governorates	10.2 MCM/yr	Of the approximate flow of 10.2 MCM/yr from Wadi Nar (Kidron Stream)[111], most of which is raw sewage from Jerusalem, Bethlehem, Beit Sahour, Abu Dis, and other villages, 7.3 MCM flows into the Og Reservoir facility north of the Dead Sea, near Nabi Musa.[112] The diversion facility in Horqaniya Valley dams some of this wastewater, gives it preliminary treatment in sedimentation pools and the treated water is used for irrigation of date trees in settlements in the Jordan Valley.[113]
Wadi Al-Qilt	Jerusalem	6.58 MCM/yr	Ein Fara is a seasonal spring, which emerges upstream at an elevation of 325m above sea level through the floor of Wadi Al-Qilt.[114] Ein Fawwar is also a seasonal spring, which emerges 4km downstream of Ein Fara with an average discharge of about 30,000-100,000 CM/day.[115] Ein Al Qilt emerges 2.5 km downstream of Ein Fawwar at an elevation of 10 m above sea level, with a very constant flow rate.[116] Together, the spring system has an annual discharge rate of 6.58 MCM/yr.[117]
Al Auja Spring	Jericho/Al Auja	6-8 MCM/yr	The Palestinian community of Al Auja (less than 5,000 people) is located in Area B and C, and is dependent on the Auja spring for agricultural water. The Auja spring is one of the most important in the Eastern Aquifer basin, traditionally discharging between 6-8 MCM/yr.[118] Currently, however, the spring is dry for many months of the year, in part due to two Mekorot deep wells upstream of the spring which tap the same aquifer, resulting in reduced discharge from the spring.[119]
Dyouk Spring System		8.18 MCM/yr	This system is composed of three springs: Douyk spring (4.98 MCM/yr), Nuwe'ma spring (2.6 MCM/yr), and Shosah spring (.608 MCM/yr).[120]
Tirzah Reservoir		5-9 MCM/yr	The water reservoir of Tirzah, east of Road 90 in the Jordan Valley, collects between 5-9 MCM/yr, almost exclusively from springs, streams and runoff running east from the hills in the West Bank.[121] These are water resources that have historically provided Palestinian communities with water for domestic and agricultural

[111] "West Bank Stream Monitoring." Israel Nature and National Parks Protection Authority, Jerusalem 2010. Available http://www.sviva.gov.il/Enviroment/Static/Binaries/index_pirsumim/p0596_1.pdf
[112] Hareuveni, Eyal. "Foul Play: Neglect of wastewater treatment in the West Bank." *B'Tselem,* June 2009. Pg. 12 http://www.btselem.org/Download/200906_Foul_Play_eng.pdf
[113] Ibid pg. 13
[114] "Environmental Profile for The West Bank Volume 2: Jericho District." *Applied Research Institute – Jerusalem,* 1995. Available http://www.arij.org/publications/1995/1995-2%20Environmental%20Profiles%20for%20the%20West%20Bank%20Volume%20%202%20%20Jericho%20District.pdf
[115] Ibid
[116] Ibid
[117] Summary of Palestinian Hydrological Data 2000 Volume 1: West Bank, PWA
[118] "Policies of denial: Lack of access to water in the West Bank." Center on Housing Rights and Evictions, December 2008. Pg. 37. http://www.cohre.org/sites/default/files/policies_of_denial_-_water_in_the_west_bank_dec_2008.pdf
[119] Ibid
[120] Summary of Palestinian Hydrological Data 2000 Volume 1: West Bank, PWA
[121] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's policy in the Jordan Valley & northern Dead Sea". *B'Tselem,* May 2011, Pg. 31. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf

			purposes, and water that contributed to the recharging of the aquifers and the Jordan River. Currently, the water from the Tirzah reservoir is used for agricultural irrigation and aquaculture projects in Israeli settlements in the Jordan Valley.
Flood Waters		10 MCM/yr	It is estimated that approximately 10 MCM of flood waters, originating in the eastern catchment of Jerusalem and Ramallah areas, flows through the Jericho District, mixing with water from the springs and wadis.[122] This is considered a rough estimate however.
Ein Fashka	Bethlehem/Northern Dead Sea	Approx. 100 MCM/yr	Palestinians do not have access to the waters of the Ein Fashka spring. The PWA formulated a plan for submission to the JWC for a pumping and desalination project at the spring for residents of Bethlehem and Hebron Governorates, but the plan was vetoed by the JWC.[123]

[122] "Environmental Profile for The West Bank Volume 2: Jericho District." *Applied Research Institute – Jerusalem,* 1995. Available http://www.arij.org/publications/1995/1995-2%20Environmental%20Profiles%20for%20the%20West%20Bank%20Volume%20%202%20%20Jericho%20District.pdf

[123] Hareuveni, Eyal. "Dispossession and Exploitation: Israel's policy in the Jordan Valley and northern Dead Sea." *B'Tselem,* May 2011, Pg. 35. Available http://www.btselem.org/Download/201105_Dispossession_and_Exploitation_Eng.pdf

Annex 5: Palestinian Villages in the Jordan Valley – Water Resources[124]

Name	Location	Population	Water Availability (l/c/d)	Water Supply	Water Cost	Distance to water source for community	Other Water Sources/Comments
Al Hadidiyya Area C	Tubas	130	37 (*20)	Community gets its water supply from Ein Shilbi spring	32 NIS/m^3	15.4 kms	
Amriyeen Bedouins	Jericho	24	34	Community gets its water from the Nuweimah Filling Point, with a capacity of 20 m^3 per hour	25 NIS/m^3	3.5 kms	Only 3 families left in village.
Al Aqaba Area C	Tubas	300	56	Tamoun well	15 NIS/m^3	0 kms	Community has 40 cisterns, with an average size of 50 m^3, and an estimated 1000 m^3 of rainwater harvested annually
Atoof	Tubas	370	55	Tamoun well	16 NIS/m^3	7.7 kms	Community has 20 cisterns, with an average size of 60 m^3, and an estimated 600 m^3 of rainwater harvested annually
Al Auja Area A, B and C	Jericho	3500	76	Al Auja gets its water from the Mekorot network, with approximately 266 m^3/day supplied	4 NIS/m^3	0 kms	The supply of water is continuous and 100% of community permanent residents (not including Bedouin) are connected. However, during the summer quantities of water supplied are often decreased. Area residents often use agricultural wells to supplement water supplies.

[124] "Assessment of Water Availability and Access in the Areas Vulnerable to Drought in the Jordan Valley", *UNICEF,* July 2010. Available http://www.unicef.org/oPt/GVC-UNICEF-Report-Dec2010_2.pdf

Al Auja Bedouins	Jericho	1000	32	Some Bedouin get water from the Auja spring, while others are supplied by the Auja Filling Station	10 NIS/m^3 from Auja Spring/ 15 NIS/m^3 from the Auja Filling Station	1.1 kms to the Filling Station	
Az Zubeidat Area B – 90% of population on 70 dunums of land. Area C – 10% of population, majority of agricultural lands in the community.	Jericho	2000 (including seasonal agricultural workers)	110 (*82)	Community gets its domestic water from the Mekorot network, with approximately 220 m^3/day supplied. Water for agricultural purposes comes from 2 main artesian wells, supplying on average 2000 m^3/day per well.	In theory residents pay 4 NIS/m^3. However, the PWA and the P.A. have the cost of water deducted from tax money the Israelis hand over.	0 kms	Water supply is continuous. However, residents still purchase water from tankers to supplement Mekorot supply, at a price of 100 NIS/tanker.
Al Baq'a	Jericho	114	32	Community gets its water from the Mekhmas Filling Point, with a capacity of 20 m^3/hr.	25 NIS/m^3	0 kms	
Bardala Area B and C	Tubas	1960	130 (*209)	Community gets its water from the Mekorot network, with approximately 254 m^3/day supplied	4 NIS/m^3	0 kms	The water supply in Bardala is continuous, with 100% of households in the community connected. Bardala has 40 water cisterns, with an average size of 60 m^3.
Ein al Duyuk al Tahta	Jericho	996					
Ein Al Duyuk Al Fauqa Bedouins	Jericho	154	35	Community gets its water supply from the Shosa Spring.	17 NIS/m^3	0.6 kms	

Ein El Beida Area B and C	Tubas	1600	123	Community gets its water from the Mekorot network, with approximately 197 m^3/day supplied	4 NIS/m^3		The water supply in Ein El Beida is continuous, with 100% of the households in the community connected to the network.
Fasayil al Fauqa Area C	Jericho	500	80	Community gets its water from the Mekorot network, with approximately 40 m^3/day supplied	4 NIS/m^3	0 kms	The water supply in Fasayil al Fauqa is discontinuous, with 100% of households in the community connected to the network.
Fasayil al Tahta	Jericho	800	120	Community gets its water from the Mekorot network, with approximately 96 m^3/day supplied	4 NIS/m^3	0 kms	The water supply to Fasyil al Tahta is continuous, with 100% of households in the community connected to the network.
Fasayil Area B – 800 residents Area C – 400 residents	Jericho	1,200	It is estimated to be around 85 l/c/d.**	The community gets its water from the Mekorot network, with approximately 120,000 m^3/day supplied through an aging network.	In theory residents pay 4 NIS/m^3. However, the PWA and the P.A. have the cost of water deducted from tax money the Israelis hand over.		The water supply is intermittent during the month March-June, as Israeli agriculture demands on the water network lower the pressure to Fasayil. Tankers are used to supplement water supply, at a cost of 10 NIS/m^3. The aging and rusting network covers 100% of residents.
Fasyil al Wusta Area C	Jericho	100 (Bedouin)	80	Community gets its water from the Mekorot network, with approximately 8 m^3/day supplied	4 NIS/m^3	0 kms	The water supply is discontinuous, with 100% of households in the community connected to the network.

Jericho** Area A	Jericho	18,346	229- 250 l/c/d	Community gets its water from the Ein Sultan Spring, with approximately 650 m^3/hr, or 5.5 MCM/yr supplied.	0-100 m^3 per 2 months – 1 NIS 101-150 m^3 2 NIS 151-250 m^3 4 NIS 215 + 5 NIS	0 kms	The water supply is continuous, though often in the summer when the spring discharge decreases in pressure, tankers are used to distribute water to Jericho residents at no extra cost. 48% of spring discharge is for domestic use, while 52% of discharge is for agriculture and for use in refugee camps in area.
Ein Sultan Camp Area A	Jericho	3,160	208*				
Aqbat Jaber Camp Area A	Jericho	7,176	158*				
Al Jiftlik Area C	Jericho	5,176*	160	Community gets its water from the Mekorot network, with approximately 800 m^3/day supplied to the village	4 NIS/m^3	0 kms	The water supply is continuous, with 100% of households in the community connected to the network. Mr. Abed Kassab, head of the village council, informed FoEME of low pressure in the water network during certain times of the year, due to Israeli agricultural water demands, thus making the supply intermittent. Tankers fill up at Froush Bet Dajan spring to supplement the water needs of the community.

Kardala Area C	Tubas	500	150 (*209)	Community gets its water from the Mekorot network, with approximately 45 m^3/day supplied to the village	4 NIS/m^3	0 kms	The water supply is continuous, with 60% of households in the community connected to the network. The 40% not connected cover water needs from tankers who fill from farmers connected to the water network
Mu'arrajat Center (Khalayfa) Area C	Jericho	480	33	The community gets its water from the Talbah Check Point, with an estimated flow of 20 m^3/hr	25 NIS/m^3	2.5 kms	The community has 5 cisterns, with an average size of 60 m^3, and an estimated quantity of water collected from rainwater harvesting of 300 m^3/yr. 80% of people stay in Mu'arrajat Center during April-November, before moving to other localities
Maghayir ad Dir Area C	Jericho	342	32	The community gets its water from the Mekhmas filling point, with an estimated flow of 20 m^3/hr	20 NIS/m^3	1.3 kms	
Marj al Ghazal Area B and C	Tubas	400	150	Community gets its water from the Mekorot network, with approximately 60 m^3/day supplied to the village	4 NIS/m^3	0 kms	The water supply is continuous, with 100% of households in the community connected to the network.
Marj Na'ja Area B – built up areas Area C – Outskirts and agricultural lands	Jericho	950	120 (70-80**)	The community gets its water from two artesian wells for both domestic and agricultural uses. The	In theory residents pay 4 NIS/m^3. However, the PWA and the P.A. have the cost	0 kms	The water supply is discontinuous, with 70% of households in the community connected to the network, which is in turn fed by a reservoir of

				water discharge is about 2.1 MCM/yr. The wells supply the reservoir with water each day.**	of water deducted from tax money the Israelis hand over.**		45m^3. The remaining households get water supplied by tankers from the village well.**
Mu'arrajat East (Milehat/School Side) Area C	Jericho	1140	32	The community gets its water from the Well No. 5 filling point, with approximately 3 m^3/hr supplied	8 NIS/m^3	0.9 kms	
Mu'arrajat Center (Al Mahanieh) Area C	Jericho	115	33	The community gets its water from the Karamelo filling point, with approximately 4 m^3/hr supplied	25 NIS/m^3	3.5 kms	Generally, people stay in this locality from September to April
An Nabi Musa Area B and C	Jericho	309					
An Nuwei'ma Area B and C	Jericho	1,245	*24				
An Nuwei'ma al Fauqa Bedouins Area C	Jericho	128	100	The community gets its water from the Mekorot network, with approximately 13 m^3/day supplied	2 NIS/m^3	0 kms	The water supply is continuous, with 43% of households in the community connected to the network. This locality is served by Nuweemah network that is supplied by Al Nuweimah spring.
Ras Ein Al Auja Area C	Jericho	800	33	The community gets its water from two sources: For domestic use, from the Auja spring, and from the Auja filling point, which supplies approximately 15 m^3/hr	Spring: 3 NIS/m^3 and from the filling point, 25 NIS/m^3	5.2 kms	When Auja spring is dry in the summer, Auja filling point is main water source

Mu'arrajat Center (Tayameen) Area C	Jericho	100	28	The community gets its water from the Karamelo filling point, with approximately 4 m^3/hr supplied	25 NIS/m^3	3.6 kms	

Note: Above statistics are gathered from UNICEF 2010, and supplemented by the author's own interviews with village council members of Fasayil, AL Jiftlik, Az Zubeidat, Marj Na'ja, Ein el Beida, Kardala, and Bardala, for the purpose of gathering information from more communities in the Jordan Valley for this paper. This list is not exhaustive, and some villages in the Jordan Valley were not included in this report. Further, communities where it was not clear whether they are part of the geographical boundaries of the Jordan Valley have been omitted.

*Information from Hareuveni, Eyal. "Dispossession and Exploitation: Israel's Policy in the Jordan Valley and northern Dead Sea." *B'Tselem,* May 2011.
** Information from authors own interviews with village council and municipality representatives.