



Water Scarcity and Health Concerns in Palestine

2015

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Abbreviations

ARIJ	Applied Research Institute of Jerusalem
Bq/m³	Becquerels Per Cubic Meter
EPA	United States Environmental Protection Agency
G-PCU	Gaza Project Coordination Unit
ICRC	International Committee of the Red Cross
IWMI	International Water Management Institute
JMP	Joint Monitoring Programme for Water Supply and Sanitation
JWC	Joint Water Council
L/c/d	Liters/capita/day
MCM	Million Cubic Meters
MoH	Ministry of Health
Mol	Ministry of Interior
NWC	National Water Council
oPt	Occupied Palestinian Territory
PA	Palestinian Authority
pci/L	Picocuries Per Liter
PHG	Palestinian Hydrology Group
PNIPH	Palestinian National Institute of Public Health
ppm	Parts Per Million
PWA	Palestinian Water Authority
TDS	Total Dissolved Solids
WBWD	West Bank Water Department
WHO	World Health Organization

1. Introduction

Palestine, comprised of the West Bank and Gaza Strip, is located in southwest Asia on the eastern shore of the Mediterranean Sea. The West Bank is bordered to the east by the Jordan River and the Dead Sea, while Israel borders it to the west, north, and south. Like other countries in the region, Palestine has an arid climate and very limited water resources. Average annual rainfall in the West Bank is approximately 450mm, and 400mm in Gaza. Population projections for Palestine predict increasing demands on already low water reserves.¹ In addition to climatic factors, Palestine faces the added burden of political and economic challenges resulting from the Israeli occupation which have negatively impacted access to and management of water resources.

Water quality and quantity issues in Palestine have garnered attention from both local and international non-profits, academic institutions, international development agencies, and governmental bodies. These entities have contributed considerable resources towards researching and raising awareness about water conditions in Palestine. Despite the number of studies and recommendations made, however, the quality and quantity of water in the West Bank and Gaza are continuing to deteriorate.

The main objective of this report is to explore and provide an overview of the ramifications of water scarcity on public health in Palestine, aiming to accomplish the following:

- Review existing national policies or regulations pertaining to the supply of sufficient domestic water supply.
- Provide a comprehensive overview of trends in water quality, quantity, and service level of domestic water supply.
- Highlight national challenges facing domestic water supply and safety management systems in the country.
- Identify qualitative and quantitative assessments and research on the impact of water scarcity on health.

2. Available Water Resources

Water resources in Palestine consist primarily of surface water and groundwater. Other sources include springs and rainwater collected in cisterns.² The major surface water resource is the Jordan River. However, because of the Israeli occupation of the Palestinian Territories, and as agreed in the Oslo Accords, Palestinians do not have any access to water from the Jordan River. Consequently, groundwater resources have become the major source of fresh water supply.

¹ Mimi and Jamous, 2010: 184

² UNEP, 2003.

A total of 383 Palestinian wells in the West Bank connect to the aquifer systems, however 119 of these are either not pumping, abandoned, or in need of rehabilitation. As of 2012, the total annual abstraction from the wells was around 64 million cubic meters (MCM), of which 36 MCM were used for domestic use and 28 MCM for agricultural purposes. In Gaza for the same year, the total abstracted volume was around 185 MCM, of which around 102 MCM was for municipal and domestic use, while 83 MCM was used for agriculture.³



Figure 1. Jordan River Basin (Rand Corporation 2005)

³ PWA, 2013a: 9.

Table 1 shows the average annual abstraction from Palestinian wells between 2007 and 2012. Within the West Bank, there are 39 Israeli wells, with an estimated average annual abstraction of around 54 MCM. Israel utilizes over 500 wells inside the Green Line (mainly in the Western Basin). These wells abstract more than the annual recharge rate of all aquifers, leaving severely limited quantities for Palestinian use.⁴

Table 1: Summary of Total Abstraction from Palestinian Wells Per Use

Basin	Palestinian Abstractions (MCM) in 2012		
	Domestic	Agriculture	Total
Western Basin	12.3	18.1	30.4
Eastern Basin	11.0	9.9	20.9
Northeastern Basin	10.0	3.0	13.0
Total West Bank	33.3	31.0	64.3
Gaza	102	83	185

Source: PWA (2013)

Agricultural water supplies are generally either shallow, old wells or natural springs. Natural springs are not reliable due to severe problems of discharge variability. On average, these springs produce around 49 MCM/year, with lower amounts in dry years and higher in wet years. Due to a lack of storage structures, large quantities of water are lost in wet years, thus, the actual average available resources from springs is much lower than the average spring discharge.⁵

2.1 Total Future Water Needs

For the municipal and industrial sectors, future water needs were estimated using current consumption levels and expected population growth, including those returning from living abroad. For the agricultural sector, future needs were estimated based on the average crop need for water. Total future water needs by the three sectors for 2020 are shown in Table 2 below. According to these calculations, the Palestinian water sector should develop a total of around 860 MCM/year by the year 2020—about three times the supply currently available. Therefore, Palestine would need to develop around 550 MCM/year in addition to existing available resources. This amount is not higher than Palestine’s right to water according to international water laws, or the amount potentially available from renewable sources and other nonconventional resources.⁶

⁴ PWA, 2013a: 9.

⁵ MAS, 2009: 29.

⁶ Ibid: 49.

Table 2. Projected Total Water Needs in MCM/year for 2020

Sector	Amount Needed (MCM)
Municipal	268
Industrial	39
Irrigation	552
Total	859

Source: MAS (2009)

2.2 Water Scarcity

Water scarcity refers to “The lack of access to adequate quantities of water for human and environmental uses.”⁷ Water scarcity can be measured using four different methods: the Falkenmark indicator or water stress index; a criticality ratio; the IWMI⁸ measure; and the water poverty index.⁹ For the purposes of this report, the water stress index was used. According to this indicator, there are three levels of inadequate water access, in order of increasing severity: Water stress, water scarcity, and absolute water scarcity. Water scarcity is assessed by evaluating the population-water equation. When water supplies drop below 1,000 m³ per person, the population faces water scarcity. A water supply below 500 m³ is considered ‘absolute scarcity.’¹⁰ As the United Nations notes, water scarcity can exist as a natural or man-made reality. On a global level, water is not scarce, however it is unevenly distributed and large quantities are wasted and polluted.¹¹ Water scarcity in Palestine is largely the result of inequitable distribution rather than the result of natural causes.^{12,13} Due to Israeli policies, water scarcity is a daily reality for Palestinians.

2.3 Surface Water

Under international conventions, the Jordan River is considered an international watercourse shared between Jordan, Palestine, Israel, Lebanon, and Syria (Figure 1). The river originates from three main springs—Baniyas in the occupied Golan Heights, Dan in Israel, and Hasbani in Lebanon—to form the upper part of the Jordan River. The river flows southward to Lake Tiberias. The lower part of the river, downstream from Lake Tiberias, joins the Yarmouk and Zerka Rivers originating in Syria and Jordan, respectively. The river continues to flow southward to the Dead Sea at approximately 400m below sea level. The natural flow of the river in the absence of extraction is estimated to be 1,250 MCM/year at the entrance to the Dead Sea.¹⁴

⁷ White, 2012.

⁸ International Water Management Institute

⁹ White, 2012.

¹⁰ UN, 2014.

¹¹ Ibid.

¹² Messerschmid, 2011.

¹³ Al-Haq, 2012.

¹⁴ (RAND Corporation 2005).

2.4 Groundwater

Groundwater is the major source of fresh water supply in Palestine. In the West Bank, groundwater is formed in three major drainage aquifers (Figure 1): The Western Aquifer, the Northeastern Aquifer, and the Eastern Aquifer as follows:¹⁵

Western Aquifer Basin: The Western Aquifer Basin is the largest aquifer in the West Bank with a sustainable yield of between 362-400 MCM per year.¹⁶ Israel heavily exploits this basin, taking around of 340-430 MCM per year, and sometimes reaching more than 520 MCM per year.¹⁷ Conversely, Palestinians consumed only 28 MCM through wells in 2012. The upper and lower Cenomanian aquifers make up the main aquifer system in this basin.¹⁸

Northeastern Aquifer Basin: The majority of recharge areas of this basin are located within the West Bank. The aquifer has an annual sustainable yield of 100-145 MCM, however Israel exploits the aquifer at a rate of 103 MCM/year. Palestinian utilization from this basin in 2012 totaled around 23 MCM/year from wells and springs.¹⁹

Eastern Aquifer Basin: All recharge areas of this basin are located in the West Bank, meaning Palestinians have the right to control the water and not share it with Israel.²⁰ Despite this right, Israel continues to utilize around 50 MCM of water per year from the aquifer, in addition to 100 MCM/year from the Dead Sea springs, which are under Israeli control. Conversely, Palestine utilized only around 53 MCM of water from wells and springs in 2012. The estimated sustainable yield from the basin is between 145 and 185 MCM.²¹

Gaza Coastal Aquifer: The Coastal Aquifer is the only water source in the Gaza Strip. The volume of water for this aquifer is extremely limited with a yearly recharge volume ranging from 55-60 MCM per year. Palestinians in the Gaza Strip utilized about 185 MCM in 2012.²² Over-pumping has lowered the groundwater table below sea level, resulting in saline water intrusion in many areas.²³

Well over a decade after the implementation of the Oslo Agreements, Palestinians in the West Bank are still utilizing less than 14% of ground water resources—a stark comparison to the 86% being utilized by Israel.²⁴

¹⁵ (PWA 2013).

¹⁶ Ksia-Amb, 2010:4.

¹⁷ It can reach up to "560 MCM/y which represents around 94% of its annual safe yield, while the Palestinians consume only 6% 922 MCM/y) of the sustainable yield" (ibid).

¹⁸ PWA, 2013a: 8.

¹⁹ PWA, 2013a: 8.

²⁰ Ksia-Amb, 2010: 4.

²¹ PWA, 2013a: 8.

²² PWA, 2013a: 8.

²³ Ksia-Amb, 2010: 5.

²⁴ PWA, 2013a: 9.

3. Current Water Supply

3.1 Current Domestic Water Supply and Consumption

Impeded access to water is one of the most pressing issues that Palestinians face. With Israel controlling over 80% of groundwater in the West Bank, Palestinians are deprived of the majority of the freshwater in their land.²⁵ While West Bank cities and large towns are connected to the water network, around 113,000 Palestinians living in 70 villages are not connected to the central water grid.²⁶ Water supply to these areas is intermittent and precarious. When the West Bank receives little rainfall, spring water is not abundant, and the rainwater harvested is insufficient to meet people's needs. Compounding the issue, the Israeli water company Mekorot cuts off the supply to Palestinians in order to secure a steady amount for Israelis. Disparities between rural and urban areas become particularly pronounced during years with little rainfall.

WHO and UNICEF's Joint Monitoring Programme for Water Supply and Sanitation (JMP) data shows trends in drinking water coverage from 1990 until 2015,²⁷ however information on disparities in water access between rural and urban areas is not covered. Country-specific data on Palestine indicates that access to improved water sources (including piped water) is declining. Perhaps counter-intuitively, this decline is most prevalent in urban areas. In 1990, according to JMP estimates, urban areas in Palestine received 100% of their drinking water from improved water sources, specifically piped sources. In contrast, in 1995, rural areas received 87% of water from improved sources, of which 60% was from piped sources.²⁸

Unimproved drinking sources in rural areas are estimated to have accounted for around 10% of total sources, with approximately 3% of drinking water being obtained from surface water sources. In urban areas, the decline in safe drinking water began in 2000 with the onset of the Second Intifada.²⁹ The sharpest decline can be seen between 2005 and 2010. In 2005, 79% of drinking water was supplied from improved sources, while in 2010, this figure decreased to 65%, and in 2015, it declined to 51%.³⁰ In rural areas, the declining trend of supplies from improved sources is much less severe, falling from 87% in 1995 to 81% in 2015. At the same time, piped water has covered a greater portion of drinking water in rural areas, rising by 14% between 1995 and 2015. Palestine's overall reliance on other improved and unimproved water sources—the origins of which are not specified in either case—has consequently increased over the 25-year study period. Drinking water trends can be seen in Tables 3 and 4, below.

²⁵ B'Tselem, 2014a

²⁶ Ibid.

²⁷ WHO/UNICEF JMP, 2015

²⁸ Estimated data for rural areas is not available until 1995.

²⁹ Since data is provided in 5-year increments, the first decline appears in 2000, though decline may have occurred prior to this year.

³⁰ Over the last fifteen years, total improved drinking water in urban areas has consistently decreased by 14% every 5 years. Again, since data is provided in 5-year increments, it can only be concluded that the decline appears to have occurred every 5 years.

Table 3: Urban Drinking Water Estimates

Estimate Coverage 2015 Update					
Year	Total improved	Piped onto premises	Other improved	Other unimproved	Surface water
1990	100%	100%	0%	0%	0%
1995	100%	100%	0%	0%	0%
2000	93%	87%	6%	6%	1%
2005	79%	72%	7%	20%	1%
2010	65%	57%	8%	34%	1%
2015	51%	50%	1%	48%	1%

Source: JMP (2015)

Table 4: Rural Drinking Water Estimates

Estimated coverage 2015 update					
Year	Total improved	Piped onto premises	Other improved	Other unimproved	Surface water
1990	-	-	-	-	-
1995	87%	60%	27%	10%	3%
2000	85%	64%	21%	12%	3%
2005	84%	68%	16%	13%	3%
2010	83%	72%	11%	14%	3%
2015	81%	74%	7%	16%	3%

Source: JMP (2015)

The data provided by the JMP is descriptive and does not provide any explanation of the findings. However, the observed trend of declining availability of drinking water from improved sources is likely to be indicative of a political phenomenon most prevalent in Gaza. Due to Israeli military assaults on water infrastructure in 2003 in the West Bank, and repeatedly in Gaza (most recently, the attack in July 2014), water infrastructure in Palestine has been systematically destroyed. As explained below, since building materials were barred from entering Gaza due to the Israeli blockade, re-construction of the water infrastructure has been impeded. This is most likely the reason Palestinians in urban areas lost a significant amount of piped water. However, the declining trend in rural areas is less pronounced, since many villages and rural towns were not initially connected to the piped water system. In 1995, 40% of drinking water did not come from piped sources. In five-year increments, this figure decreased to 36%, 32%, 28%, and finally 26%. Furthermore, it is likely that rural areas are not

targeted by Israel to the same extent that urban areas are. Urban areas contain most police stations, government buildings, and political centers, and encompass most refugee camps, which are often targeted most intensively.

No accurate records of domestic water consumption rates in the West Bank are available as quantities allocated to different sectors (i.e. domestic, public, industrial, touristic, and commercial) cannot be disaggregated. Estimated domestic water consumption rates for the West Bank varied between approximately 50 Liters per capita per day (L/c/d) and 90 L/c/d. For the Gaza Strip, per-capita domestic consumption was estimated to be around 80 L/c/d. These consumption rates are lower than the minimum value set by WHO of 100 L/c/d, largely due to Israeli restrictions on Palestinian water usage.³¹

Palestinian Water Authority (PWA) estimates and governmental proposals and suggestions found that the industrial water demand in Palestine represents 6-8% of the total municipal water demand.³²

4. Quality of Drinking Water

The water sector in Palestine is comprised of multiple official bodies that are responsible for planning, implementing, and monitoring activities. Water Law no. 3/2002, enacted on 18 February 2002, led to the formalization of the scope of the PWA, deeming water as publicly owned and managed by the PWA as a public good.³³ In its capacity as owner and manager, the PWA also delegates tasks to other regulatory bodies through the National Water Council (NWC), which is comprised of thirteen regulatory bodies. The NWC is responsible for creating the national water policy and regulating the work and finances of the PWA. A brief description of the key functions of NWC members is provided below:

- **Environmental Quality Authority:** National strategy and policy related to surface and ground water resources
- **Ministry of Planning and International Cooperation:** National policies, plans, and programs related to spatial planning
- **West Bank Water Department (WBWD):** Provision and distribution of water to local water providers and maintenance of water facilities
- **Ministry of Local Government:** Planning and implementation of local (municipal) systems³⁴
- **Ministry of Industry (Mol):** Responsible for effluent standards and re-use of industrial wastewater

³¹ MAS, 2009: 22.

³² Ibid: 25.

³³ Shuval and Dweik, 2004: 9.

³⁴ Shuval and Dweik, 2004: 13.

- **Ministry of Health (MoH):** Ensures water quality standards are maintained; conducts water quality testing in Gaza³⁵
- **Gaza Coastal Municipalities Water Utility (CMWU) (comprised of Gaza's Municipalities):** Supports water supply and sewage services³⁶

The water management system is being reformed, as described in an updated action plan published by the PWA.³⁷ This plan includes overall management and legislative reforms such as capacity building, sanitation improvement, ensuring equitable access, raising public awareness about water demand, and developing national water laws.

4.1 Overview

Water quality pertains to the condition of water, including chemical, physical, and biological characteristics that determine its suitability for particular purposes, such as drinking. Water quality is evaluated through various methods, such as the concentration of dissolved oxygen, bacteria levels, salinity, and turbidity (the amount of material suspended in the water). The concentration of microscopic algae, as well as quantities of pesticides, herbicides, heavy metals, and other contaminants can also be measured.

Palestine faces significant problems related to groundwater quality. Although no water quality database exists, individual studies and monitoring projects indicate severe contamination and quality issues in all major aquifers. In Gaza, poor water supply and sanitation conditions, intrusion of salt water, and health and environmental impacts are severe. Mountain aquifers beneath the West Bank are contaminated with untreated wastewater and have seen increases in concentrations of chloride. In the Northeastern Aquifer, for example, chloride concentration has increased at a rate as high as 19 mg/l annually, mostly because of the influences of irrigation and untreated sewage.³⁸

Water quality in the Gaza Strip is impacted by a number of issues including interactions between soil and water in the unsaturated zone resulting from recharge and return flows, mobilization of deep brines, and the intrusion of seawater.³⁹ Many public health indicators are deteriorating, and access to safe drinking water, a basic human right, is becoming a challenge. A major reason for this crisis is that Palestinians have almost no control over their water resources.

4.2 Water Quality Parameters

The PWA and the Gaza Project Coordination Unit (G-PCU) selected the following parameters to evaluate water quality in the Gaza Strip based on the availability of data, rather than

³⁵ Ibid: 13.

³⁶ Ibid: 13.

³⁷ PWA, 2013b

³⁸ PWA, 2010.

³⁹ Abbas, et al., 2013: 54.

relevance: nitrates, fluorides, bacteria, parasites, heavy metals, light metals, chloride, total dissolved solids, and pH level.⁴⁰

Chloride (Cl)

Chloride concentration exceeded standard limits. PWA values of 600 mg/L were recorded, while the internationally accepted safe level is 250 mg/L. Major portions of the Gaza Strip aquifer have a Cl concentration ranging between 600-2,000 mg/L, while along the coast line, the Cl concentration exceeds 2,000 mg/L and can reach more than 10,000 mg/L in some areas due to the effect of seawater intrusion. A 2014 PWA status report stated that 24.6% of water in Palestine had a chloride concentration less than 250 mg/L, while the remaining 75.4% exceeded the WHO chloride level.⁴¹

Nitrate

Almost 90% of the groundwater wells in the Gaza Strip have nitrate concentrations two to eight times higher than WHO guideline values. These high levels are attributed to wastewater, agricultural fertilizers, pesticides, and industrial pollutants.⁴²

Total Dissolved Solid (TDS)

Groundwater in most of the Gaza Strip exceeds the WHO and PWA TDS guideline limit (1,000 mg/L). More than 50% of the groundwater quality database showed a TDS level of more than 2,000 mg/L. These high values are attributed to seawater intrusion and over-abstraction of water compared to aquifer balancing.

Fluoride

The Centre for Health Research, part of Gaza's Department of Health, found that the level of fluoride in Gaza's drinking water ranges from 0.8–3.8 ppm (as of 2013). These levels are higher than normal levels (0.7–1.2 ppm). According to fluoride quality data monitored by the PWA for the period 2009–2013, the concentration in the majority of the Gaza Strip is within the normal range set by WHO and PWA guidelines, except for the eastern part of Gaza and segments of eastern Khan Younis and Rafah.⁴³

Cations

Most of the cations—magnesium (Mg²⁺), sodium (Na⁺), and potassium (K⁺)—show concentrations higher than the WHO guideline values of 30, 200, and 10 mg/L, respectively.⁴⁴ Most groundwater in Gaza is classified as hard to very hard.⁴⁵

⁴⁰ PWA and G-PCU, 2015.

⁴¹ Ibid.

⁴² Ibid.

⁴³ PWA and G-PCU, 2015.

⁴⁴ p.98:

www.scirp.org/journal/PaperDownload.aspx?DOI=10.4236/jwarp.2010.

⁴⁵ PWA and G-PCU, 2015.

Microbiological Quality of Drinking Water in the Gaza Strip

Reports for Gaza show that 19% of groundwater, 27% of desalinated water, and 20% of water network samples are microbiologically contaminated by total coliform, while 13% of groundwater, 14% of desalinated water, and 12% of water network samples are contaminated by fecal coliform bacteria.⁴⁶ Many local researchers have published results of related studies in international journals, however, there are gaps in monitoring MoH and PWA data on microbiological indicators.

Radiological Quality of Drinking Water

Independent studies have tested the radiological quality of drinking water in the West Bank and Gaza Strip, finding very low levels of radioactive material in Palestine's water and concluding that the effects on public health are minimal to negligible. One study tested the mean and range levels of radiation in Gaza's tap water, concluding that, "In general, most water samples have very low levels of natural radionuclides, and the average alpha concentration was 35.95 Bq/m³ or 0.95 pci/L." These levels were deemed low enough to not be considered a concern to public health.⁴⁷ However, Israel has dumped toxic industrial and radioactive waste into water sources in Gaza, including the Coastal Aquifer.⁴⁸ Additional studies are required to better understand the levels of pollution and its impact on public health.

A study conducted in Nablus tested tap-water, as well as water from springs and wells.⁴⁹ It concluded that radon levels found in spring water and well water tested below US EPA standards, with tap-water levels testing even lower. In contrast, a study conducted in Hebron detected higher levels of radiation in the sampled drinking water.⁵⁰ Authors speculated that this could be related to the abundance of uranium-bearing minerals associated with granite rocks commonly found in the district of Hebron.⁵¹

4.3 Infectious Diseases Related to Water Contamination

Despite the volume of studies on water quality in general, no study has assessed the links between water scarcity and health, and few specifically assess water quality and its effect on health. The 2014 Ministry of Health Annual Report lists several diseases transmitted through contaminated water. Table 5 provides a summary of the incidence rate per 100,000 population for five diseases (two viral and three parasitic).

⁴⁶ Ibid.

⁴⁷ El-Ghossain and Abu Shammala, 2012: 25.

⁴⁸ Eyre, 2010.

⁴⁹ Al Zabadi, H., et al., 2012.

⁵⁰ Thabayneh, et al., 2012.

⁵¹: Ibid: 31.

Table 5. Incidence Rate of Infectious Diseases Transmitted by Water

Disease	Incidence Rate/100,000 population		
	Gaza	West Bank	Total
Hepatitis A	48.9	6.1	22.7
Viral Meningitis	246.9	6.8	99.7
Giardiasis	114.3	0.4	44.5
Ascariasis	4.5	8.5	7.0
Amebiasis	390.7	24.8	166.3

Source: MOH (2014)

Hepatitis A

Hepatitis A is endemic in Palestine, and is largely spread through water contaminated with feces.⁵² In 2014, 1,031 cases of hepatitis A were reported with an incidence rate of 22.7/100,000—171 cases in the West Bank with an incidence rate 6.1/100,000, and 860 cases in Gaza with an incidence rate of 48.9/100,000.⁵³

Mumps

In 2014, 18,535 cases of mumps were reported with an incidence rate of 1,053/100,000. Infections mainly impacted children over six years old.⁵⁴ This indicates the fragility of the health system, which could be worsened by lack of clean and safe water.

Typhoid Fever

Typhoid fever (enteric fever), caused by *Salmonella typhi*, is endemic in Palestine. According to the MoH, in 2014, 61 cases were reported to the epidemiology department with an incidence rate of 3.5/100,000, in the Gaza Strip and 0.1 per 100,000 in the West Bank for both typhoid and paratyphoid.^{55, 56}

Diarrheal Diseases

In the Gaza Strip, acute diarrhea is one of the most common childhood illnesses and the main cause of outpatient visits and hospitalizations. The high incidence of diarrheal disease in some governorates is often linked to contaminated food, low water quantity and poor quality, and inadequate sanitation and hygiene. Effective control measures to prevent diarrhea include

⁵² MoH, 2014: 31.

⁵³ MoH, 2014: 31.

⁵⁴ MoH, 2014: 29.

⁵⁵ Ibid: 36; emphasis added.

⁵⁶ MoH, 2015.

improving sanitation processes, maximizing access to safe water and food supplies, and improving personal hygiene practices.⁵⁷

Diarrhea in Children Under Three Years of Age

The incidence rate of diarrhea in children under three years of age in 2014 was 27.9%, a decrease from the rate reported in 2013 of 41.5%. This reduction could be attributed to underreporting during the Israeli war on Gaza in July and August 2014 when access to clinics was not feasible.⁵⁸

Diarrhea in Children Over Three Years of Age

In the Gaza Strip alone, 35,095 cases of diarrhea in children over the age of three were reported in 2014, with an incidence rate of 2.28%. In 2013, a total of 35,284 cases were reported.⁵⁹

Bloody Diarrhea

Reporting for this disease includes all cases of bloody diarrhea, regardless of the cause, which could be a bacterial infection or parasitic infestation. In 2014, a total of 7,112 cases of bloody diarrhea were reported with an incidence rate of 404/100,000.⁶⁰ This condition is extremely hazardous and potentially life-threatening and is usually related to poor water quality.

Ascariasis

Ascariasis is caused by *Ascaris lumbricoides*, a large intestinal roundworm. It is an endemic disease in Palestine. In 2014, an incidence of 5/100,000 population was reported.⁶¹

Amebiasis

Amebiasis is an intestinal infection (although extra-intestinal forms also exist) caused by *Entamoeba histolytica*, and is endemic in Palestine.⁶² In 2014, a total incidence rate of 7/100,000 was reported, with incidence rates of 4.5 and 8.5 for the Gaza Strip and West Bank, respectively.

Giardiasis

Giardiasis is an infection of the small intestine caused by *Giardia lamblia*, and is endemic in Palestine.⁶³ In 2014, a total incidence rate of 44.5/100,000 population was reported, with incidence rates of 114.3 and 0.4 in the Gaza Strip and West Bank, respectively.

Public health authorities should consider investigating whether high rates of viral meningitis are associated with poor water quality in affected areas in the West Bank and Gaza. Further

⁵⁷ MoH, 2014: 40.

⁵⁸ Ibid: 41.

⁵⁹ Ibid: 42.

⁶⁰ Ibid: 43-4.

⁶¹ Ibid: 47; emphasis added.

⁶² MoH, 2014: 48.

⁶³ Ibid.

research into the levels of heavy metals and pesticide contamination in water and the resulting effect on human health should also be considered.

5. Water Scarcity and its Impact on Health

A recent WHO study highlighted the detrimental impact of resource scarcity on public health in developing countries.⁶⁴ While data related to the impact on public health is sparse and often incomplete, generally, primary health care facilities and hospitals are the most negatively impacted. The WHO report does not include country-specific data, so figures for Palestine are not available.

In the Gaza Strip, nearly 90% of water is unfit for human consumption.⁶⁵ Prior to Israel's 2014 assault on Gaza, water quality was a serious issue, with both Israel and the CMWU over-pumping from the Coastal Aquifer. Excessive extraction of groundwater resulted in years of seawater intrusion, rendering it saline. Salinity and pollution of Gaza's only freshwater source have been continuously aggravated by Israel's repeated military assaults, particularly targeting power stations and sewage facilities. According to the ICRC, water and power are inextricably linked. Gaza faces severe electricity shortages, compelling residents to resort to fuel-powered generators. However, due to Israel's blockade, importing fuel is extremely difficult—sometimes impossible—making fuel a severely limited resource. This, in turn, impedes the CMWU's ability to purify, desalinate, and distribute drinking water.⁶⁶ The effects are particularly egregious on hospitals, which depend on a constant supply of clean water to treat patients and maintain adequate standards of sanitation and hygiene. An unreliable supply of clean water to hospitals increases the risk of patients contracting infections.⁶⁷ In particular, the lack of clean freshwater adversely impacts services such as hemodialysis.⁶⁸

Wastewater treatment facilities throughout the West Bank (in Jenin, Tulkarem, Hebron, and Jerusalem) do not function adequately.⁶⁹ There are an additional six facilities that face operational impediments due to Israeli restrictions. The only facility that operates adequately in the West Bank is in Al-Bireh, leaving the vast majority of wastewater in the West Bank untreated.⁷⁰ Unsurprisingly, only 20% of Palestinian homes are connected to sewage systems.⁷¹ Untreated wastewater produced by Palestinians and Israeli settlers in the West Bank enters the environment through open disposal, leakage from cesspits, and rundown sewage pipes. Non-governmental organizations, such as the Applied Research Institute of Jerusalem (ARIJ) have created wastewater reuse systems for agricultural use, however wastewater reuse on a national scale is still only in the proposal phase.

⁶⁴ WHO and UNICEF, 2015.

⁶⁵ UNICEF 2013:1; B'Tselem 2014b. .

⁶⁶ (ICRC)

⁶⁷ WHO and UNICEF, 2015.

⁶⁸ ICRC, 2014.

⁶⁹ EWASH, 2011.

⁷⁰ B'Tselem, 2009.

⁷¹ (ibid: 19)

The Gaza Strip has four wastewater treatment plants located in Rafah, Beit Lahiya, Gaza City, and Khan Younis. Wastewater from these plants is dispensed from households connected to the sewerage system. Around 60% of households are connected to this system.⁷² While this figure is impressive compared to the West Bank wastewater system, Israel has continued to damage or destroy these treatment plants during its repeated military assaults on Gaza. Through its veto power as part of the Joint Water Committee (JWC), Israel is able to delay and reject Palestinian proposals for additional wastewater treatment plants.

Several studies cited by the local non-profit organization B'Tselem have found the existence of several pollutants from wastewater, however, no comprehensive epidemiological research has been conducted on the effects of raw wastewater on water sources in the West Bank.^{73,74} Similarly, a recent WHO report stated only that in the West Bank, "The water supply situation represents a clear risk for the public health," without providing specific implications.⁷⁵ Regarding Gaza, the WHO report states that, "The deterioration or destruction of the sewage system constitutes a high risk for contamination [sic] and waterborne diseases. To date, there is however no clear epidemiological data confirming a [sic] massive impact on health in the short-term (outbreaks) or long-term (chemicals) attributable to the water problem. The absence of data does not preclude the urgency of retuning the quality of water to internationally acceptable levels."⁷⁶

Water scarcity affects humans at four levels: health, hunger, education, and poverty. Water scarcity in Palestine is due to the dry climate and insufficient yield from groundwater aquifers for the growing population. People are forced to drink low-quality, contaminated water, or water with high levels of undesirable chemicals and risk illness or death from waterborne diseases. Less water also means sewage does not flow properly, resulting in the spread of infectious diseases. Water scarcity forces clinics, restaurants, public spaces, and other places to use very little water for cleaning. This compromises the health of staff and people who use the facilities. Hunger, poverty, and lack of education all are factors that directly and indirectly threaten the lives of individuals.

Despite the absence of a universal definition of and method for measuring water scarcity, there is global awareness of its devastating effects. The latest review of the situation in the Gaza Strip conducted by the PWA and the Austrian Development Agency examined the following indicators of public health diseases: Diarrhea, malnutrition, hepatitis A, typhoid and paratyphoid, parasitic diseases, meningitis, skin diseases, dental caries, renal diseases, and anemia. The study attempted to identify a correlation between certain water indicators and these diseases.⁷⁷

⁷² EWASH, 2011.

⁷³E.g. Al-Quds University, 1998; Bethlehem University, 1999; MoH, 2001; UNEP, 2002.

⁷⁴ B'Tselem, 2009: 27.

⁷⁵ WHO, 2015b: 14.

⁷⁶ WHO, 2015b: 13.

⁷⁷ PWA and G-PCU, 2015

Many gastrointestinal infections (parasitic, bacterial, or viral) are water-related, largely transmitted through the fecal-oral route. Parasitic infections such as *Giardia lamblia* and *Entamoeba histolytica* are highly prevalent among the Palestinian population as reported in several studies. Diarrhea is still common among children under five years of age in Palestine.

Chemical pollution of drinking water increases as the water quantity decreases due to the concentration effect. The most prominent issue presenting a health concern is nitrate content, which could lead to methemoglobinemia, especially for infants.

Vulnerable groups in the population include Infants up to six months,⁷⁸ children between six months and five years old, pregnant or lactating women,⁷⁹ and the elderly.⁸⁰ Globally, diarrheal disease is a leading cause of child mortality and morbidity. Most deaths are due to severe dehydration and fluid loss.⁸¹

A survey conducted by the Palestinian Hydrology Group (PHG) showed that more than one-fifth of all communities reported that at least 1% of the population had water-related health problems, with some communities reporting rates as high as 17%.⁸²

Many acute and chronic health problems can be caused or exacerbated by poor water quality and exposure to untreated wastewater. Water scarcity and high salinity can result in kidney dysfunction or failure, which can be exacerbated by the hot climate.⁸³ Chemicals such as nitrates found in the water supply can cause other water-related illnesses, including diarrhea. The PHG survey found that more than 10% of children under five years old reported having had episodes of diarrhea during the two weeks prior to the survey. Additionally, there are long-term health consequences of ingesting contaminants found in water. For example, high nitrate concentrations can increase anemia and induce spontaneous abortion.⁸⁴ Exposure to raw sewage as a result of the lack of appropriate infrastructure also has significant short- and long-term health implications, especially among vulnerable populations, such as children and the elderly. Finally, communicable diseases such as hepatitis are both the most prevalent and most serious of all health issues associated with the water supply.⁸⁵

Additional epidemiological studies are needed to assess the burden of disease associated with the consumption of low-quality water in Palestine. Epidemiological studies and quantitative risk assessments using data on water quality could provide estimates on acute and chronic illnesses linked to contaminants in drinking water, as well as those linked to low mineral content in desalinated water, such as dental fluorosis, renal illnesses, and cancers.⁸⁶

⁷⁸ Shomar, 2011; Knobloch, et al., 2000.

⁷⁹ WHO, 2015a; Sappenfield, 2013.

⁸⁰ Smith, 1998.

⁸¹ WHO, 2013; Walker, et al., 2013.

⁸² Palestinian Hydrology Group, 2003

⁸³ Bellisari, 1994

⁸⁴ Ibid.

⁸⁵ Ibid.

⁸⁶ NIPH and WHO, 2014: 30.

6. Existing National Laws, Policies, and Regulations Pertaining to Domestic Water Supply

The West Bank and Gaza Strip are geographically separated, and at times have operated as individual legal units.⁸⁷ According to the Palestinian National Authority, roles and responsibilities of stakeholders within the water sector were fragmented and unclear, resulting in inefficient management and a lack of coordination. With its establishment in 1995, the PWA recognized the urgent need to restructure the roles and responsibilities within the water sector in order to better regulate the managerial, technical, and financial performance at the national, regional, and local levels.⁸⁸

Palestinian Water Law

The PWA derives its authority from By-Law No. 2 of 1996 and Water Law No. 3 of 2002, according to which, the PWA is the official body that regulates and is responsible for overall water resources in the West Bank and Gaza.⁸⁹

The Water Law outlines the vision, goals, policies, and strategic principles for the management of the water sector in Palestine. It functions in parallel with other relevant legislation, particularly within the environmental, agricultural, and health sectors.

The objectives of Water Law No. 3 are to:

- Secure sustainable development of water resources based on environmentally sound and enabling bases
- Provide and satisfy societal and individual needs for water in an optimal and equitable way in the Occupied Palestinian Territories (oPt)
- Protect all water resources from pollution and secure water quality, ensuring an environment that is not harmful to human health or well-being, and that sufficient water is available for production and self-renewal⁹⁰

Palestinian President Mahmoud Abbas issued a decree endorsing the new Water Law, which was considered the result of the Water Sector Reform Program led by the PWA.⁹¹ Under the new water law, the Water Sector Regulatory Council is independent from the PWA. The Regulatory Council was established by the Cabinet, which has a Board of Directors representing the public sector, private sector, and civil society. It is responsible for water prices and monitoring the performance of water and wastewater service providers. It will issue licenses for operators to establish the infrastructure needed to supply, desalinate, and treat water, and determine the framework for quality assurance of services and management of consumer complaints. It will set the foundations to represent regional water utilities service

⁸⁷ Shuval and Dwiek, 2004: 4.

⁸⁸ Ibid: 7.

⁸⁹ UNEP, 2003: 21-2.

⁹⁰ Ibid: 23-4.

⁹¹ PWA: <http://www.pwa.ps/page.aspx?id=zgU4xia1791199146azgU4xi>.

providers, monitor the performance of bulk service providers, and ensure that their services are compliant with accepted standards.

The Water Law includes directives to transform the West Bank Water Department into a governmental company which will be owned by the State of Palestine. It includes articles protecting water resources and defined protection zones, as well as articles that allow for sanctions related to the infringement on water resources. The Law requires the presentation of the decree of law to the legislative council in its first session in order to endorse the law and subsequently to revoke all previously nominated legislation pertaining to that law.⁹²

7. Water Strategy in Palestine

In 2013, the PWA finalized the national water strategy, which includes a short-term (2012-2017) and long-term phase (2017-2032). The objectives of the strategy for the public water supply in the West Bank include:

- Creation of a stage development plan of water resources included in the strategy over the lifetime of the plan, showing their location and anticipated volumes.
- Development of an effective plan to establish the inter-governorate transmission infrastructure required to deliver bulk resources to specific locations where they would become the responsibility of a regional service provider to deliver to customers.
- A sufficiently detailed transmission plan that can be elaborated on by others.⁹³

PWA operations and water resource management in Gaza were impacted after Hamas gained control of Gaza in 2007.⁹⁴

8. Water Quality Guidelines

A review of water quality guidelines indicated that national and international water quality standards are generally based on WHO guidelines. In several cases, guidelines were less restrictive than WHO guidelines for specific parameters. This is the case for the PWA, which mandated several parameters that deviate from the WHO guidelines. Parameters that differ from the WHO guidelines largely pertain to the Gaza Strip and are generally related to natural chemical constituents in the water. These do not present direct health concerns, with the exception of nitrate, which is most often related to agricultural activities.⁹⁵

⁹² PWA: <http://www.pwa.ps/page.aspx?id=zgU4xia1791199146azgU4xi>.

⁹³ PWA, 2014: 4.

⁹⁴ World Bank, 2009: xi.

⁹⁵ NIPH and WHO, 2014: 20. ,

9. Impact of the Occupation on Water Resources

Before 1967, Israel utilized accessible water resources and established a national water carrier, Mekorot, that carried water from existing sources to agricultural, municipal, and industrial customers. Following the 1967 War, Israel took control of water resources and developed wells throughout the West Bank, as well as a water supply network serving settlements, which was linked to the Mekorot network. Mekorot supplies an estimated 75 MCM of water to the settlements, of which 44 MCM is produced from wells controlled by Israel or settlers within the West Bank.⁹⁶

Article 40 of the Oslo II Agreement contained provisions on water and sewage that recognized undefined Palestinian water rights and returned some West Bank water resources and service responsibility to the Palestinian National Authority, including the following:

- Set governance arrangements for a five-year interim period, notably the JWC to oversee management of the aquifers, with decisions to be based on consensus between the two parties.
- Allocated specific quantities of the three West Bank aquifers underlying both territories (the share allocated to the Palestinian West Bank was about one-quarter of the allocation to Israel and the settlements).
- Provided for extra supplies in the interim from new wells and from Mekorot (an extra 28.6 MCM was to be allocated for Palestinian needs).
- Estimated future needs for the Palestinian West Bank at 70-80 MCM.

The general expectation was that this interim agreement would be revised within a five-year period, however, 25 years after the agreement it still governs the water sector.⁹⁷

Israel continues to operate under policies and practices that expropriate and assert control over Palestinian water resources, maintaining an unequal and discriminatory distribution of water resources to benefit both Israeli citizens living in Israel and those living in West Bank settlements, while preventing Palestinians from developing or accessing resources, undermining their right to self-determination. Israeli military orders enforce these efforts, transferring power over water resources and water resource management to the occupation authorities.⁹⁸

Palestine's water rights related to the Jordan River have been violated by Israel since 1967. In the early 1950s, the Jordan River had an annual water flow of 1,250 MCM. However, as a result of the diversion of the river through the Israeli National Water Carrier, which diverts water from Lake Tiberias to the Negev Desert, as well as other regional projects, the river is currently highly saline and quality has deteriorated; the flow is now only 200 MCM. Israel utilizes about

⁹⁶ World Bank, 2009: iv.

⁹⁷ Ibid.

⁹⁸ EWASH and Al-Haq, 2011.

82% of the annual safe yield of the groundwater basins to meet 25% of their water needs. Palestinians in the West Bank only consume about 18% of the annual safe yield.⁹⁹

In West Bank cities and towns connected to the water network, average Palestinian water consumption is 73 L/c/d. In northern West Bank cities and towns, consumption is even lower at 52 L/c/d in the Tubas governorate and 38 L/c/d in the Jenin governorate.¹⁰⁰ In contrast, the average Israeli daily per capita consumption is about four times the Palestinian average (300-350 L/c/d).¹⁰¹

Israel has actively prevented the construction and maintenance of water and sanitation infrastructure in the West Bank by exercising its veto through the JWC, which approves all water and sanitation projects in the West Bank. In areas of the West Bank that remained under direct Israeli control following the Oslo agreements (around 61% of West Bank territory) a further layer of bureaucracy exists: the Israeli Civil Administration must grant a permit for any construction, including water and sanitation projects. The vast majority of applications for a permit are denied, and any structure built without a permit faces the risk of demolition by the Israeli authorities. In addition to prohibiting the construction of wells necessary for Palestinians to secure additional quantities of water to support population growth and socio-economic development, such policies have denied communities access to water and sanitation facilities, including water and sewage networks and cisterns for rainwater harvesting.

Israeli 'security' measures implemented throughout the West Bank, including roadblocks, checkpoints, and the segregation wall, have restricted Palestinian access to water resources, services, and facilities. Similarly, the designation of areas as closed military zones, nature reserves, and settler-only roads have prevented Palestinians from accessing large areas of land and limited movement within the areas themselves. These measures isolate communities from their springs, wells, and water sources, forcing Palestinians to travel long distances to access water. Movement restrictions have hindered water tankers and sewage disposal trucks from accessing certain areas, requiring long detours which in many cases have become unaffordable due to increased time and fuel costs.¹⁰²

Gazans are dependent on the Coastal Aquifer for water, however 90-95% of it is unusable due to over-extraction and sewage contamination. As a result, the aquifer has been depleted and is in danger of collapse.¹⁰³ The ongoing Israeli blockade of Gaza and accompanying restrictions prevent rehabilitation efforts and make the search for alternatives extremely difficult. Gazans are not permitted to access water from the Mountain Aquifer, and Israel limits the entry of materials for infrastructure construction, repair, and rehabilitation that would support improved water management. Large-scale desalination of sea water is too costly and

⁹⁹ Hilal, 2011: 14.

¹⁰⁰ B'Tselem, 2014.

¹⁰¹ Amnesty International, 2009.

¹⁰² COHRE, 2008: Executive Summary.

¹⁰³ EWASH: <http://www.ewash.org/en/?view=79Y0cy0nNs3D76djuvAnkDDT>.

unsustainable within the current context given the frequent electricity shortages in Gaza, also a result of the blockade.¹⁰⁴

Israeli settlements have damaged the pipes that supply water to nearby Palestinian villages, and damage has been caused by Israeli tanks during incursions into Palestinian localities. These actions have resulted in significant water loss and prevented Palestinians from using available supplies. The PWA reported that more than 200 communities suffered from water cuts by Israel for long periods, which created a severe water crisis. The siege imposed on Palestinian localities as well as movement restrictions have exacerbated the situation and impeded the delivery of water to villages that are not connected to the water network. Over 350,000 Palestinian residents in the West Bank depend on regular water supplies by water tankers but receive quantities far below the minimum water requirements at high prices.¹⁰⁵

The construction of the separation wall has resulted in the confiscation of Palestinian land and has resulted in the isolation of several Palestinian groundwater wells and springs used for domestic and agricultural purposes. As a result, Palestinians are cut off from their water sources or face increased restrictions on their use.¹⁰⁶

10. Social and Economic Dimensions of the Current Water Situation

As shown in previous sections, water supply services in certain areas are still largely fragmented and inefficient. Additionally, data collection and information systems are inadequate, cost recovery is poor, infrastructure is decaying, and resources are insufficient.¹⁰⁷

Given the ongoing security, economic, water resource, and institutional constraints, typically poor utility performance is deteriorating. Unaccounted for water averages around 34%, and bill collection rates average only 50%.¹⁰⁸ In addition, the prevailing social, economic, and political conditions in Palestine have resulted in many public groups either refusing or being unable to pay their water bills to the service providers.¹⁰⁹

Water is a major household expenditure, accounting for 8% of household income on average for Palestinians in the West Bank—twice the globally accepted standard. Under the current economic situation, inability to pay undermines utility bill collection and financing. However, poor consumers not connected to a network pay the highest costs, sometimes up to one-sixth of their household income or more. The cost of water from tankers has been driven up by restrictions on movement and access, and communities' reduction in consumption by up to half. A preliminary study estimated that the extra cost of tanker water for users may add up to around 1% of GDP.¹¹⁰

¹⁰⁴ Thirsting For Justice: <http://www.thirstingforjustice.org/?question=what-is-the-reason-for-this-discrepancy>.

¹⁰⁵ COHRE, 2008; Amnesty International, 2009.

¹⁰⁶ ARIJ, 2004.

¹⁰⁷ PWA, 2006: 14.

¹⁰⁸ World Bank, 2009: viii.

¹⁰⁹ PWA, 2009.

¹¹⁰ World Bank, 2009: vi.

11. Principal Causes of Water Scarcity in Palestine

11.1 Failings in West Bank Water Resource Development and Management

The current economic and political situation in Palestine, and the policies and practices implemented by Israel in particular, have severely restricted the ability of the Palestinian government to provide adequate water resources to the population. In some cases, humanitarian organizations have also been prevented from providing support to vulnerable communities. Under international law, as the occupying power, Israel is responsible for the welfare of the Palestinian population in the West Bank and is obliged to refrain from obstructing the Palestinian authorities from carrying out duties such as the provision of water and sanitation services.¹¹¹

Within the current governance framework, the PWA is unable to conduct integrated management of water resources in the West Bank as approval by the Israeli authorities is required for any management or infrastructure project proposed by the PA within the West Bank. Under this arrangement, the Israeli authorities have complete control over the allocation and management of West Bank water resources. Israeli territorial jurisdiction over Area C, which makes up 60% of the West Bank, consolidates this control, making integrated planning and management of water resources virtually impossible for the Palestinian government.¹¹²

11.2 Constraints Stemming from the Oslo Agreements and the Occupation

The fundamental inequality between the Israeli and Palestinian authorities has prevented the JWC from effectively functioning as a “joint” water governance body that resolves resource management issues in a collaborative manner.^{113,114} As a result, the development of water resources and services for Palestinians have been reduced below the levels expected during the Oslo negotiations.¹¹⁵

11.3 Constraints Stemming from Palestinian Institutional Weaknesses

The institutional architecture proposed for the water sector has not been fully implemented. Due to a number of governance and management issues, the PWA is not meeting expectations and capacity has decreased, particularly in its ability to effectively negotiate with the JWC.¹¹⁶

The PWA had developed a relatively strong presence in Gaza, however operations and water resource management have since effectively been suspended.¹¹⁷ As a result, the PWA lacks regulatory capacity, and the development and use of unlicensed wells is increasing. Additionally, the political situation has negatively impacted effective linkages with Ramallah.

¹¹¹ EWASH, Executive Summary: http://www.ewash.org/files/library/policies_of_denial_-_water_in_the_west_bank_dec_2008.pdf.

¹¹² World Bank, 2009: vii.

¹¹³ PWA, 2013a: 9.

¹¹⁴ World Bank, 2009: ix.

¹¹⁵ Ibid.

¹¹⁶ Ibid: x.

¹¹⁷ After Hamas won the Gaza elections and took power in 2007.

Gaza's CMWU¹¹⁸ is the most advanced entity supporting regional utilities, however the model is vulnerable due to the political and economic situation.¹¹⁹

11.4 Israel's Obligations

International humanitarian law stipulates that occupying powers are responsible for the welfare of the civilian population in the territory they occupy and must provide, or allow civilians to obtain basic necessities for survival, including food, water, medical supplies, and shelter. Therefore, under the Geneva Conventions, Palestinians are guaranteed access to water for drinking, personal hygiene, and sanitation use. Israel ratified the International Covenant on Economic, Social, and Cultural Rights (ICESCR), which includes the right to water. In September 2010, the UN Human Rights Council affirmed that the right to water and sanitation is legally binding. However, Israel does not recognize either of these rights.¹²⁰

According to official bodies and in line with the desk review conducted for this report, Israel, as an occupying power, must immediately and without delay take the following actions to ensure the right to water and sanitation for the Palestinian people in the occupied West Bank:

- Ensure that adequate quantities of water are available to enable the satisfaction of basic personal and domestic needs, as well as ensure the realization of the rights to food and livelihood, particularly for subsistence farmers.
- Remove all obstacles to water and sanitation service provision, including facilitating access for water tankers and sanitation removal trucks at checkpoints, and opening extra filling points in communities that are not connected to the water supply network.¹²¹
- Remove barriers that restrict the PWA from addressing its duties and responsibilities related to water and wastewater management.
- Ensure Palestinians receive the allocations of fresh water cited in the Oslo II agreement until Permanent Status negotiations secure equitable and reasonable volumes.
- Allow Palestinians in Gaza to rehabilitate their aquifer and develop alternative water sources.¹²²

11.5 PWA Obligations

Under the current conditions, integrated and effective resource management is not possible and would require political changes.¹²³ Reforming JWC and Civil Administration actions

¹¹⁸ Coastal Municipalities Water Utility.

¹¹⁹ World Bank, 2009: xi.

¹²⁰ Thirsting For Justice: <http://www.thirstingforjustice.org/?question=what-are-israels-obligations>.

¹²¹ EWASH, 2008: 43

¹²² COHRE, 2008; World Bank, 2009.

¹²³ World Bank, 2009: xii.

towards Palestinian development should remain a priority until final status agreements are achieved.¹²⁴

A PWA reform program has been developed, but it is important to recognize the significant challenges that will be faced, as well as the need for prioritization and integration.¹²⁵ It is important to note that any attempt to reform the institutional or organizational framework for water management should take into account the impact of the future Permanent Status negotiations.

12. Conclusions and Recommendations

- Palestine faces a number of challenges related to water management. For the Gaza Strip in particular, the shortage of electricity in some areas, as well as the scarcity of economic resources and essential materials such as cement, pipes, and electro-mechanical treatment equipment, in addition to the significant tension between Israel and Palestine over water rights and adherence to agreements on water control, constitute additional barriers. These factors have made water and wastewater services unreliable and even hazardous, posing challenges for the population to obtain adequate amounts of safe water. Similarly, the supply of drinking water is unreliable, and the quality is poor, making its use for consumption uncertain. Individual studies and monitoring projects have indicated severe contamination and water quality problems in all major aquifers.¹²⁶ As the occupying power, Israel is legally obligated to ensure the right to water and sanitation for Palestinians in the occupied West Bank and Gaza.¹²⁷
- Despite the number of studies on water quality in general, no study has assessed the links between water scarcity and health, and few studies specifically assess the link between water quality and its impact on health. Issues regarding data collection and quality make it difficult to understand the realities of water contamination and its contribution to morbidity and mortality in Palestine. Therefore, “Targeted studies are needed to investigate the burden of disease associated with water [scarcity] from different sources and districts in the Gaza Strip, including an estimation of long term effects of consuming substandard water.”¹²⁸ Additionally, “Epidemiological studies assessing burden of disease associated with consumption of low quality water in the Gaza Strip are needed,” and “Further research into the levels of heavy metals and pesticide contamination in water and the resulting effect on human health should be considered.”¹²⁹

¹²⁴ Ibid.

¹²⁵ Ibid: x.

¹²⁶ RAND, 2005: 170.

¹²⁷ EWASH, 2008: 43.

¹²⁸ NIPH and WHO, 2014: 4.

¹²⁹ Ibid: 30.

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