4 February 1999
Water Crisis in Palestine - Scenarios for Solutions
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Abstract

The available water resources in Israel/Palestine are limited in relation to a growing regional population. Currently the distribution of water resources between Israel and Palestine is unsatisfactory and biased in favor of Israel.

Water available to the Palestinians does not meet their requirements. They have no access to the water of the Jordan River, and the Israeli military orders prevent them from drilling new wells in Palestine.

To achieve a comprehensive, just and durable peace between the Israelis and the Palestinians, it is crucial that ground and surface water resources be allocated on an equal per capita basis.

Following the establishment of a Palestinian state, with full sovereignty over land and natural resources, effective regional cooperation between Palestine, Israel, Jordan, Syria, Lebanon, Egypt, Iraq and Turkey would be of great benefit to the present and future generations.

Introduction

Water is an extremely important issue, not only in the Middle East, but also in every community in the world. Without water, there is no life. Water can create wars or be the key to regional cooperation. To strengthen the peace process in the Middle East, the water issue has to be solved for the benefit of all the core parties. The effective management of water resources is essential to the development of medical, social, agricultural and industrial development in all countries, especially the developing ones.

Water Resources

To comprehend the water situation in historic Palestine (Israel, West Bank and Gaza Strip), it is of great importance to study all the water resources in Israel and Palestine (West Bank and Gaza Strip) in order to understand which of them must be shared between the Palestinians and the Israelis. The proper allocation of water resources would create cooperation and prevent confrontation.

In general, the water quantity depends on the following factors:

- *Climate*: humid, arid or semiarid, rainfall, wind, temperature, evaporation
- *Geography*: run off
- *Geology*: infiltration

Ground Water (See Table 2)

In historic Palestine the ground water resources can be subdivided into the following:

The Mountain Basin:

The Mountain Basin extends from the foot of the Carmel Mountain in the north to the Beer Sheva area in the south, and from the Jordan River and the Dead Sea in the east to the beginning of the Coastal Aquifer in the west. The Mountain Basin consists of the following aquifers:

- The North-Eastern Aquifer (known in Israel as the Nablus-Gilboa Aquifer)
- The Western Aquifer (known in Israel as the Yarqon Taninim Aquifer)
- The Eastern Aquifer

Figure 1 shows the three aquifers in the West Bank. The Eastern Aquifer lies totally in the West Bank while the Western and Northeastern Aquifers extend through the Green Line to the Israeli territories.

The existing extractions, utilization and estimated potential of the Eastern, Northeastern and Western Aquifers, after Article 40 of the Oslo Agreement on September 18, 1995, are shown in Table 1.

The current annual withdrawal for Palestinian use from the Mountain Basin is 118 MCM: 17.38 percent of the estimated sustainable yield of 679 MCM/year.

The Coastal Aquifer:

The Coastal Aquifer stretches from the slopes of the Carmel in the north to the northern Sinai in the south, and from the foothills of the mountains in the east to the Mediterranean Sea in the west. This aquifer consists mainly of sand, sandstone and pebbles of Pliocene to Pleistocene age. Its safe yield is around 300 MCM/yr.

Around 70 MCM/yr. is the total recharge of this aquifer in the Gaza Strip.

The Galilee Aquifers:

The Western Galilee Aquifers consist mainly of limestone and dolomite and are of Cenomanian to Turonian age. The annual recharge is about 115 MCM.

FFThe Eastern Galilee Aquifers consist mainly of basalt, most likely of Tertiary age. The safe yield is around 33 MCM/yr. of which about 10 MCM is brackish.

The Carmel Basin:

There are small aquifers in the Carmel Mountains with a total annual recharge of 39 MCM, of which 8 MCM is brackish.

The Ephraim Mountain Aquifer consists mainly of limestone of Eocene age. Its safe yield is around 22 MCM/yr.

The Western Carmel Coast Aquifer is of Pliocene to Pleistocene age and has an annual safe yield of around 7 MCM of brackish water.

The Negev and Araba Basin:

Its safe yield is around 65 MCM/yr. of which approximately 42 MCM is saline.

Surface Water

The Jordan River Basin:

It can be subdivided into the Upper Jordan with Lake Tiberias (Kinneret) as its main reservoir, and the Lower Jordan with the Yarmouk River as its main tributary.

Lake Tiberias has a catchment area of 2,730 square kilometers. Its mean annual net inflow is about 510 MCM, while its operation storage volume is around 670 MCM. The utilizable water yield is around 470 MCM/year.

The confluence of the Yarmouk River with the Jordan River is about eight kilometers south of Lake Tiberias. The main annual yield of the Yarmouk River is around 450 MCM.

The annual water flow from the Jordan River Basin is around 1,300 MCM.

The Jordan River is an international river. Accordingly, its water has to be shared between Jordan, Palestine, Israel, Syria and Lebanon. Since the Israeli occupation of the West Bank 1967, the Palestinians have not been allowed to use their share from the water of the Jordan River. The share of the Palestinians from the Jordan River Basin, according to the Johnston Plan, 1953, is 215 MCM/year, i.e. 17 percent of the total amount of 1,287 MCM/year. The actual share of the Palestinians today (see above) is 0 percent (see Figure 2).

Wadis:

The major eastern *wadis* in the West Bank are Fara, Quilt and Auja. Wadi Zeimar and Wadi Qana represent the important *wadis* in the western part of the West Bank. The main *wadi* in the Gaza Strip is Wadi Gaza.

The amount of the surface runoff into *wadis* depends on the intensity and duration of the rainfall. The annual water flow from *wadis* is around 100 MCM.

Cisterns:

For storm water harvesting there are around 78,400 cisterns in the West Bank, with an average volume of 70 cubic meters per cistern. This represents an additional 5 MCM/yr. of water for domestic and livestock purposes.

Springs and Seeps:

There are 297 springs and seeps in the West Bank, with 105 springs yielding more than 0.1 liter/sec.. The average annual flow is around 100 MCM.

The amount of fresh water is 55 MCM, used mainly for irrigation. The rest (45MCM) is brackish water.

Water Quality

The geological factor plays a significant role in natural water pollution. The domestic and industrial wastewater and the use of fertilizers and pesticides in agricultural activities could cause the pollution of water.

In regard to the water quality issue, the Palestinians are facing two major problems: the high salinity and the high concentration rate of nitrate.

Salinity

Brackish water is found especially in the Jordan River Valley, West Bank and in different parts of the Gaza Strip.

According to the recommendations of the World Health Organization (WHO), the chloride concentration in drinking water should not exceed 250 mg/l, and the concentration of the total dissolved solids (TDS) should be less than 500 mg/l.

A sodium adsorption ratio (SAR) of more than three would restrict the water use for irrigation.

The high chloride concentration reaches up to 1,763 mg/l in the Jordan Valley area.

In the Gaza Strip, the TDS reaches values of 3,200 mg/l in Khan Younis and 4,000 mg/l in Rafah.

The SAR is up to 8.8 in the Jericho area.

The major causes for salinization are over-pumping of the wells, seawater intrusion and geological factors.

Nitrate

The World Health Organization (WHO) recommended that the concentration of nitrate in drinking water should be less than 45 mg/l. In the Tulkarm area, the concentration of nitrate in some wells is up to 105 mg/l.

The situation is worse in the Gaza Strip. In the northern part of the Gaza Strip, the nitrate concentration is up to 150 mg/l, in wells in the Khan Younis area, up to 350 mg/l. The nitrate concentration in the domestic well in Khan Younis Refugee Camp is 600 mg/l.

The main sources of nitrate pollution are fertilizers, wastewater and cesspits. The high nitrate concentration in drinking water affects infants and causes methemoglobinemia (Blue Baby Syndrome).

Estimated Growth of Water Demand

At present, Palestine has a population of around three million and Israel a population of around 5.8 million. As shown in Table 3, in 1997 the total water consumption was 278 MCM and 1,959 MCM in Palestine and Israel respectively.

It has been estimated that by 2010, the population will have reached 4.1 million in Palestine and 7.6 million in Israel, at which point the water demand will increase to 560 MCM in Palestine and 2,300 MCM in Israel.

Water Crisis

Currently there is a water crisis in Palestine. The water resources are not allocated in a proper manner between the Palestinian and the Israelis. The future water demand is much higher than the renewable water resources. Establishing a Palestinian state with full sovereignty over land and natural resources could solve the water crisis in Palestine.

Water scarcity exists in Israel and regional cooperation is needed. This could be achieved by strengthening the peace process in the Middle East and opening the doors to effective cooperation between the different countries in the region.

Scenarios for Solutions

Proper Water Allocation between the Israelis and the Palestinians

It includes the ground water and surface water resources. The construction of a Palestinian Water National Carrier between the West Bank and Gaza Strip would eliminate the water deficit in the Gaza Strip.

Effective Water Management in Israel and Palestine

The following subjects have to be taken into consideration:

- loss reduction
- public awareness
- capturing storm water in *wadis*
- wastewater reuse
- sea water desalination
- modern irrigation technology

Regional Cooperation

In the future, huge additional amounts of water are needed. Accordingly, regional cooperation regarding the water issue is crucial between Israel, Palestine, Jordan, Syria, Lebanon, Egypt, Iraq and Turkey.

The idea of importing water from Lebanon, Egypt and Turkey should be taken into consideration.