

# Israel-Palestine Water Issues

TimelineActorsHydrologyClimateDemographicsUsageResources

Water is a cardinal issue in the Middle East. Any year there is a drought, it makes headlines. Otherwise, it is always there, lurking in the background, behind the religious and nationalist slogans and rhetoric. There is not much water, and what there is, is claimed by all countries.

Map

Actors

Israel

United States

Palestine

Other

Jordan

Major Events

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Toggle Layers: Israel Palestine Aquifers Battles

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and Professor Emerita Ann E. Larimore.

See the other [GEOMAT](#) projects.

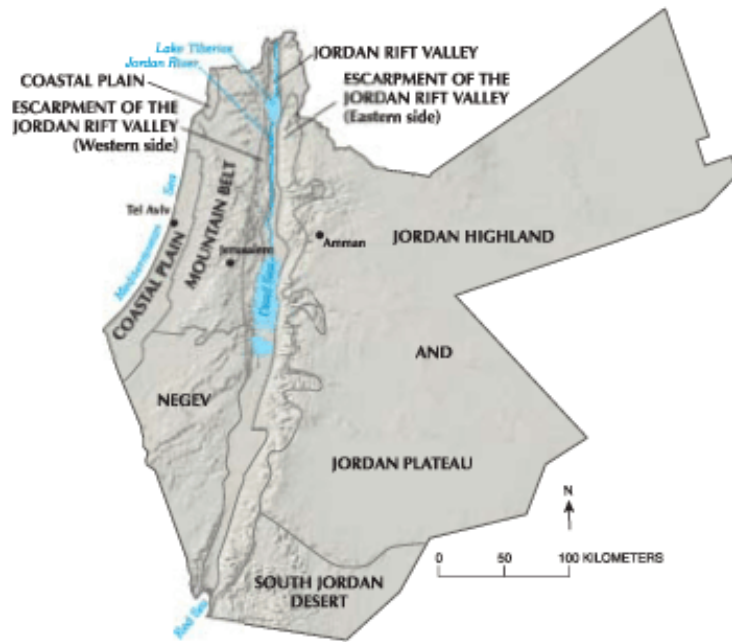
# Israel-Palestine Water Issues

Timeline **Actors** Hydrology Climate Demographics Usage Resources

## Middle-East Water Usage Actors

The Water Crisis of the Middle-East has had a fundamental role many conflicts and meetings between many nation-states and organizations. Israel's and Palestine's hydrological system are all part of the Jordan River watershed. As a result, there is a common purpose to protect this resource by all nations within this watershed as it is a tightly connected system. Specific to the water usage issues of this study there have been four primary actors: Israel, Palestine, Jordan, and the United States.

Israel, Palestine, and Jordan have obvious connections to the limited resources within the Jordan River watershed. Jordan has been actively involved in talks with Israel over many decades. The principle role of United States is as mediator and has been involved in many talks and plans over watershed issues both in the historical and modern context.



Map source: Temporal Trends for Water-Resources Data in Areas of Israeli, Jordanian, and Palestinian Interest. Executive Action Team (EXACT) Multilateral Working Group on Water Resources.

## Israel

Plans for a Jewish Nation of Israel began in the late 19th century. In 1923, the French and British came to a preliminary agreement on the boundaries of what would become Israel and the demarcation of water rights between Israel and Palestine. Although the agreement created boundaries for Palestine containing the majority of the Upper Jordan in Palestine, the boundaries excluded the headwaters of the Litani and the Hasbani Rivers. This marked the beginning of a long history of negotiations and conflict over water ownership.

During the 1950's, Israel began many projects to divert surface water. In October, 1959, in response to concerns over neighbor state diversion of water, Israel started the National Water Carrier project whose primary stated purpose was to store water in the northern Lake Kinneret and supply this water to the southern regions of the country. This system is now operated by [Mekorot](#) - Israel's National Water Company. A map of the current National Water infrastructure can be seen on the [usage](#) page.

## Environmental Issues

limited arable land and natural fresh water resources pose serious constraints; desertification; air pollution from industrial and vehicle emissions; groundwater pollution from industrial and domestic waste, chemical fertilizers, and pesticides

- [additional information on Israel](#)



## Palestine

Palestine has been a nation that has long dealt with the difficult climate and environment of the arid desert. However, with the creation of Israel it has had difficulty gaining control over its own water resources and been subject to the increased immigration of peoples and reduction in water availability. The Ionides Plan commissioned by the British government in 1939 claimed that Palestine did not have the water resource's necessary for continued Jewish immigration.

Palestine has also been the source of terrorist attacks, which undermine political and administrative cooperation between the nations. In January and February, 1965 the newly formed Fateh Guerilla movement carried out a successful attacks on the Israel National Water carrier.

Starting at the Madrid conference of 1991, Palestine has gained increasing control over its own water resources. The Palestinian Water Authority was created in 1993, and the more recent Oslo Interim agreement has provided a solid framework for collaboration between Israel and Palestine.

## Environmental Issues

- Gaza Strip**  
desertification; salination of fresh water; sewage treatment; water-borne disease; soil degradation; depletion and contamination of underground water resources
- West Bank**  
adequacy of fresh water supply; sewage treatment

- [additional information on the West Bank](#)
- [additional information on the Gaza Strip](#)

## Jordan

Throughout the 20th century, Jordan participated in several projects to block or divert water from entering Israel controller aquifers and the National Water Carrier. These skirmishes, in addition with Syria, eventually provided a large contribution to the eruption of the Six-Day war.

However, Jordan also partook in decades of private discussions with Israel and made several agreements for water sharing. Finally in 1994 Jordan and Israel signed a peace treaty.

More recently, Jordan has experienced cooperation, but also friction, with Israel in the face of droughts and consumer water contamination. Much of this effort is partaken by the Executive Action Team (EXACT) Multilateral Working Group on Water Resources



## United States

While the United States does not have a physical link to the hydrological resources of the region, it has had a long-term relationship and impact on the politics and engineering relating to water infrastructure.

At least as early as 1939, the US was providing direct management and recommendations for water utility construction. The Lowdermilk management plan, which was modeled from the Tennessee Valley Authority, called for diverting unused water from the Yarmuk River to irrigate the Jordan Valley and the Negev, and building a Mediterranean Sea-Dead Sea Canal. Later in 1955, the Johnston plan provided a suggested framework for water allocation and management amongst Jordan, Israel, and Palestine. This plan was never ratified by all parties, but still served as a basis for Israel and Jordan to conduct secret "Picnic Table Talks" for decades.

This site was created by [Andrew Turner](#) as part of the [Maps, Timelines, and the Internet: The Quest for Peace in the Middle East](#) course taught by Dr. Sandra Arlinghaus and Professor Emerita Ann E. Larimore.

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# Israel-Palestine Water Issues

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## Mountain and Coastal Aquifers



### Aquifers of the Region

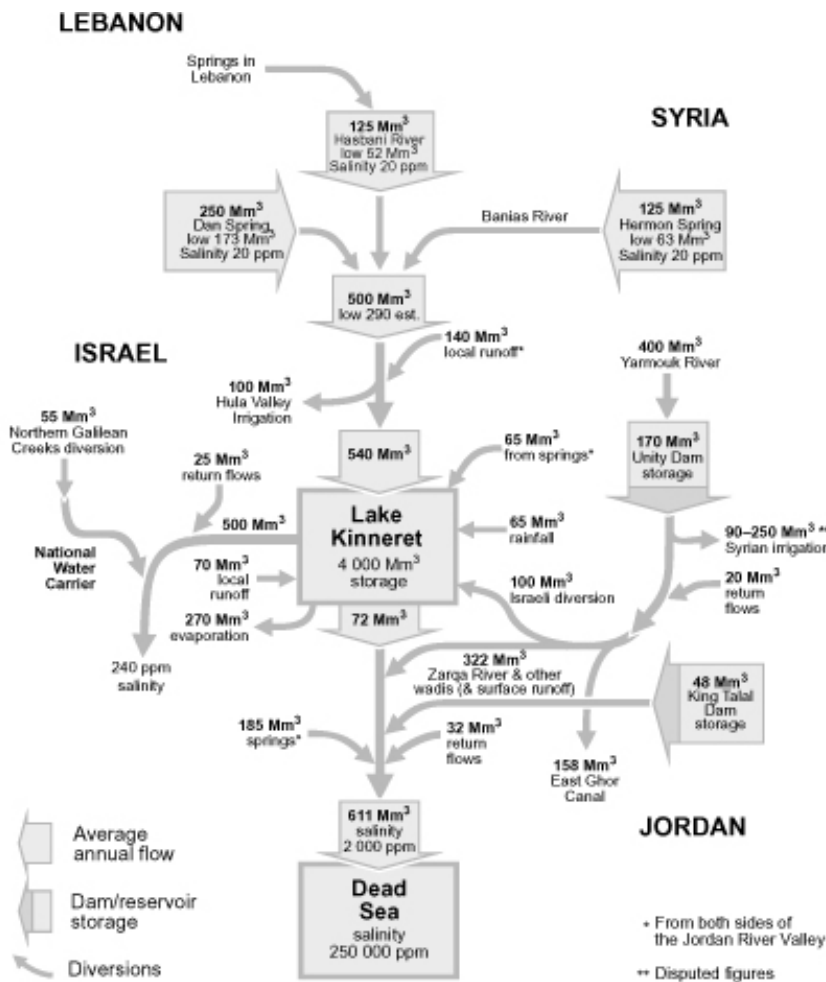
Israel, the West Bank, and Gaza are part of the Jordan River Watershed and utilize three primary aquifers: Coastal, Mountain, and Northern.

The Cenomanian-Turonian Mountain Aquifer system underlying and largely recharged from the West Bank is by far the most important source of water in this area. The aquifer system is highly permeable due to its geological nature. The Coastal Aquifer extends from Gaza in the south to Mount Carmel in the north along some 120 km of Mediterranean coastline. The width of the aquifer varies from 3-10 km in the north to about 20 km in the south, where it constitutes the chief resource of water for Gaza. The depth to groundwater in Gaza ranges from 60 m in the east to 8 m or less near the shore.

The mountain aquifers supply:

- **Yarkon-Tanninim Aquifer** This supplies Israel with about 340 million cubic meters of water annually, which are used by the Jerusalem-Tel-Aviv area. Palestinians use about 20 million cubic meters a year.
- **Nablus-Gilboa Aquifer** This supplies Israel with about 115 million cubic meters a year, largely for agricultural irrigation in the kibbutzim (communes) and moshavim (cooperative settlements) in Galilee.
- **The Eastern Aquifer** This supplies about 40 million cubic meters annually to the Israeli settlements in the Jordan Valley, and about 60 million cubic meters to the Palestinians.

source: [MidEast Web: West Bank Water Resources](#) For more information, see the [EXACT-ME Overview of Middle East Water Resources](#).



Watershed Sources

The Israel-Palestine Aquifers are supplied by numerous ground- and surface- water sources from throughout the region. The figure to the left illustrates the source, and sink, of the water as it passes through the region.

As part of the limited water resource of the region, quality becomes as important as quantity. If aquifers are drained too quickly they threaten to pull in seawater and drastically increase the salinity of the water. In addition, as population grows in the region the potential for contamination of the water supplies to due pollution or purely over abundance of infrastructure.

As is apparent in the diagram, there is a very important chain of interdependency that forces the various nation-states to acknowledge their impact on downstream water quality and quantity.

The National Water Carrier of Israel was created to disseminate water stored in the Lake Kinneret reservoir to the southern regions.

Additional Hydrological Maps

Water Infrastructure

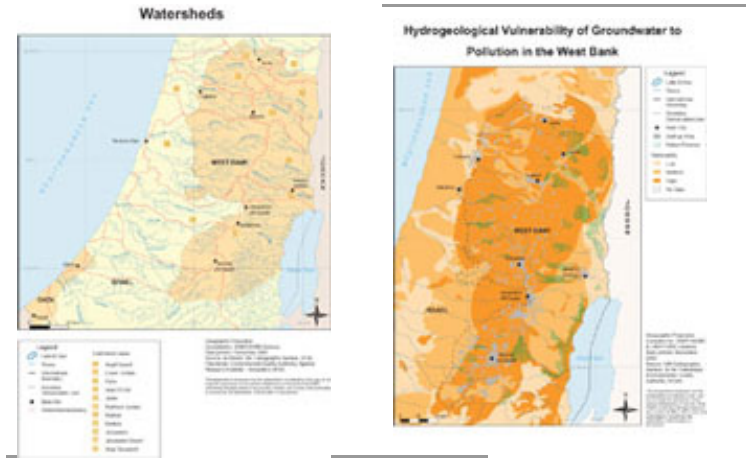
Watersheds

In the Palestinian territories, water is a precious natural resource and its relative scarcity is a major constraint to economic development. This applies throughout the region, which is generally characterised by aridity and water scarcity. With the majority of the region's water resources being shared by more than one country, the allocation and management of transboundary water resources assumes great importance. Global climate change may further magnify the pressure on the water system in the Occupied Palestinian Territories through increased temperatures and evaporation rates and lower and more erratic rainfall.

Water carriers in Gaza

In most of Gaza's municipalities, there is no balance between water supply and demand. The municipalities are responsible for distributing water for domestic and industrial consumption. Each municipality has its own water source and a separate distribution system. Water consumption averages 75 litres per capita per day. Due to the deteriorating distribution network, water losses are very high, in the range of 35-50 %. Most municipalities use groundwater without any treatment except for disinfection. Some municipalities buy water from Mekorot. According to reports and studies by the Palestinian Water Authority, 95 % of Gaza residents receive service, which means that most of the population has access to an indoor tap. Most of the distribution systems in the municipalities operate a timetable for supplying drinking water.

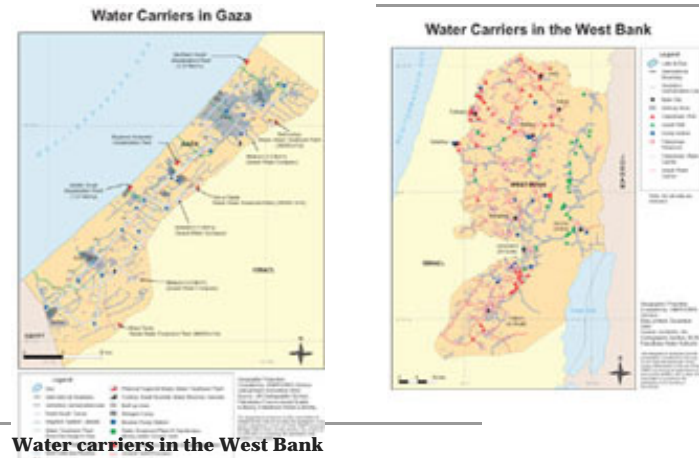




**Hydrological vulnerability of ground water to pollution in the West Bank**

The map is based on information provided by the WCMC and shows areas of high, medium and low vulnerability to pollution due to human activities. The map shows that more than two thirds of the West Bank is categorised as being highly vulnerable.

source: UNEP Maps of Palestine Water Resources



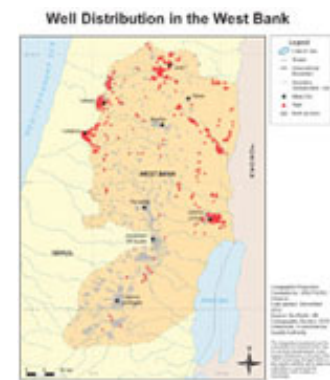
**Water carriers in the West Bank**

The average per capita water consumption is around 70 litres per capita per day. Approximately 88 % of the total West Bank population and 55 % of localities (towns and villages) have access to piped water supply systems (EQA, 2002b).



**Well distribution in Gaza**

Most houses are served from indoor taps and depend on municipal wells for domestic use. The exception to this is the central and eastern part of Khan Yunis Governorate in southern Gaza, which depends mainly on the Israeli water company Mekorot.



**Well distribution in the West Bank**

The major water resources in the West Bank consist of groundwater and springs, while additional sources include rainwater harvesting. There are 40 municipal wells in the West Bank that are used either wholly or partially by Palestinians. Their annual yield is around 30 million m<sup>3</sup> (EQA, 2002a). This is insufficient to meet water demand and the deficit is supplied mainly through springs or through Mekorot (the Israeli Water Company). Some agricultural wells are also used for domestic purposes.

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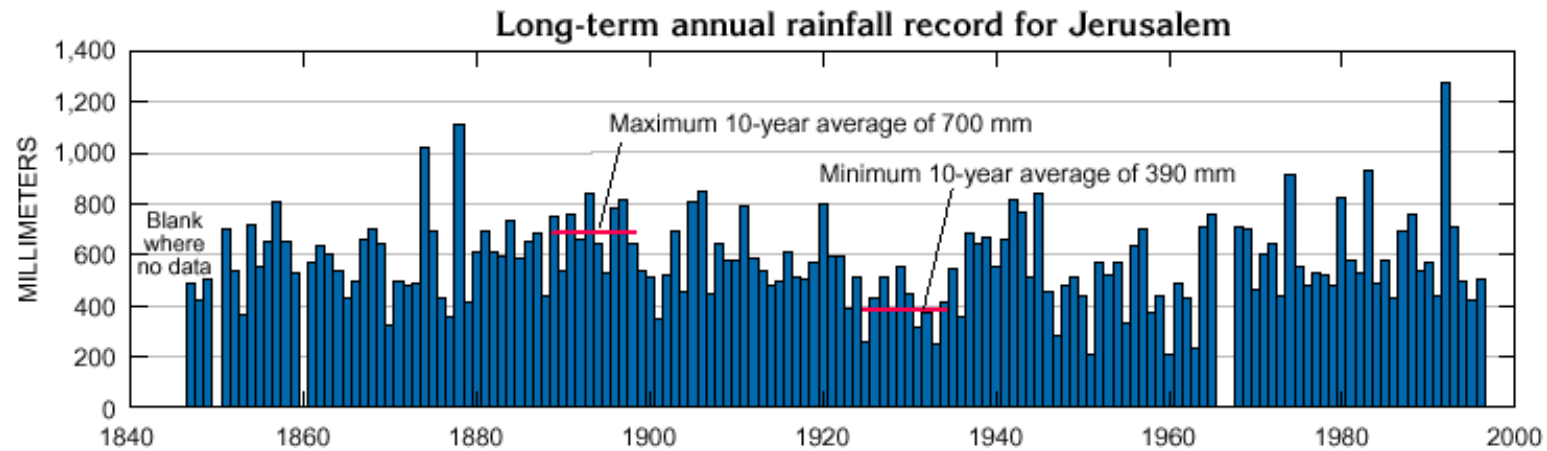
This site was created by [Andrew Turner](#) as part of the [Maps](#), [Timelines](#), and the [Internet: The Quest for Peace in the Middle East](#) course taught by Dr. Sandra Arlinghaus and Professor Emerita Ann E. Larimore.

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# Israel-Palestine Water Issues

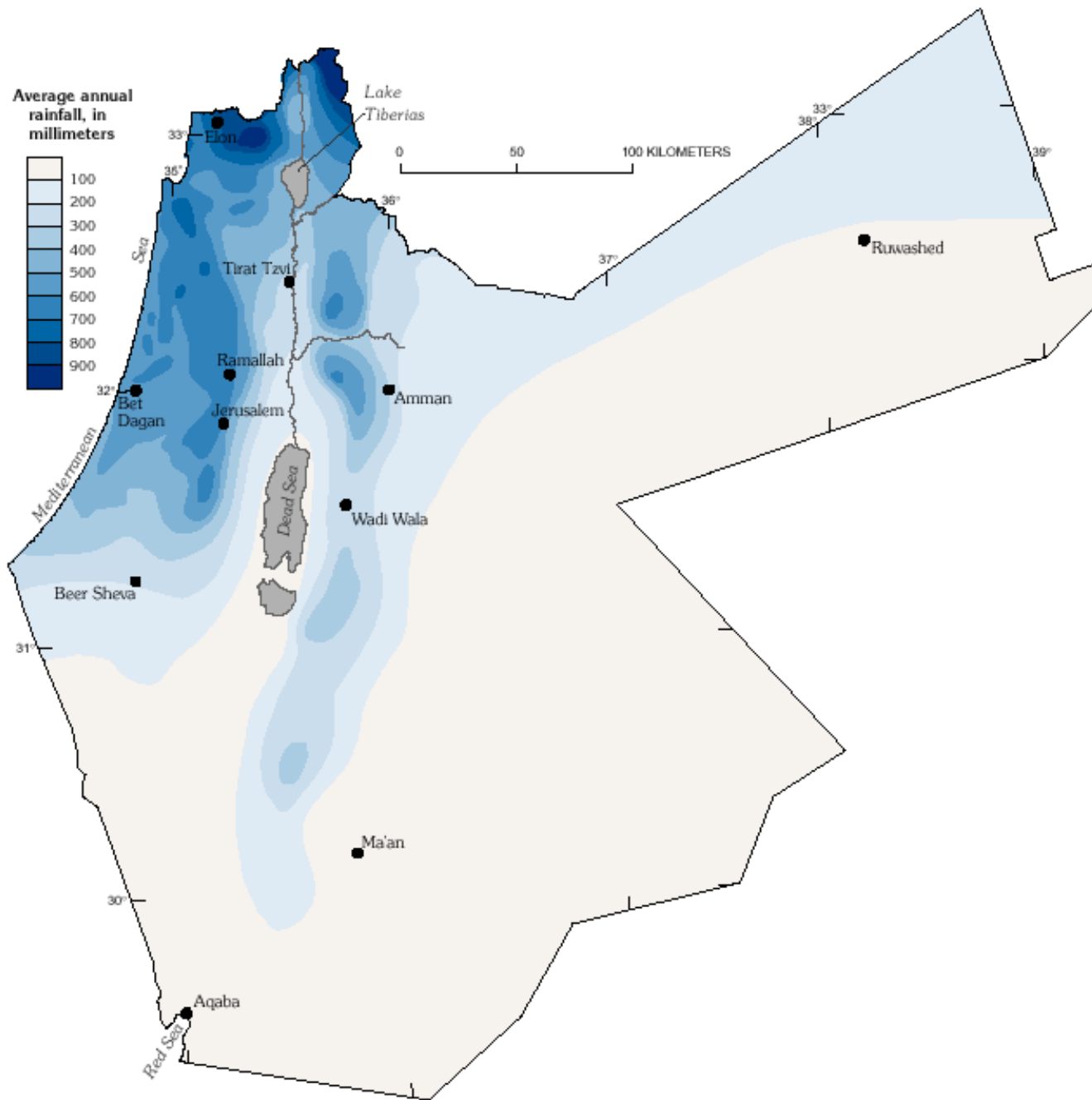
TimelineActorsHydrologyClimateDemographicsUsageResources

## Annual Precipitation

graph source: [EXACT-ME](#)

## Regional Climate

The climatology of the region has an obvious impact on the availability of water. Jordan is 85% Desert, Israel and the West Bank are 60% Desert. Rainfall serves to replenish the watersheds and provide downstream supply of water.



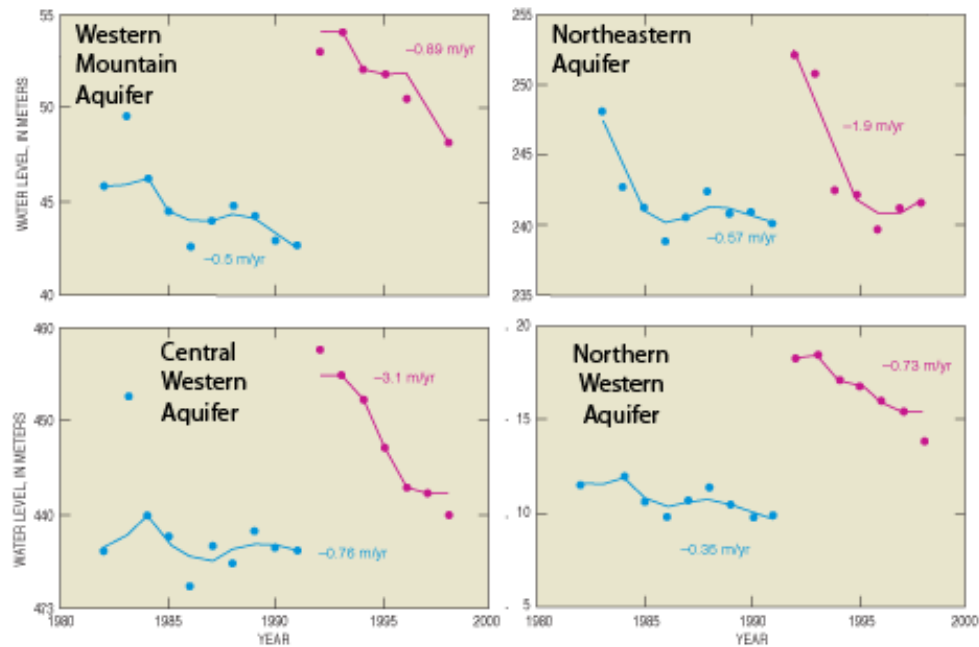
map source:

EXACT-ME

## Trends for groundwater levels in the between 1982–1998

The graph to the left shows the historic trends of groundwater aquifer levels at select wells in each of four regions of the mountain aquifer. The last decade demonstrated a drastic decrease in the levels of the ground water, attributable to increased demand on the water supply as well as a reduced

rainfall in the mid-90's.



source: Temporal Trends for Water-Resources Data in Areas of Israeli, Jordanian, and Palestinian Interest

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# Israel-Palestine Water Issues

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Characteristics	Israel	West Bank and Gaza Strip	Jordan	Summary from 1997
Population (in millions)	5.54	2.54	4.33	In Israel, more than 90 percent of the population lives in urban localities with the remainder living in rural communities.
Literacy (percent)	95	84	87	
Gross Domestic Product (GDP) <sup>a</sup>	85.7	2.98	20.9	
Composition by Sector (percent)				In Jordan, approximately 78 percent live in urban areas and 22 percent in rural communities.
Agriculture	3.5	33	6	
Industry	22	25	28	
Services	74.5	42	66	
Per Capita (US\$)	16,400	1,300	5,000	In the West Bank and Gaza Strip, 29 percent live in urban areas, 65 percent live in rural communities, and 6 percent live in refugee camps. The Gaza Strip, where most of the inhabitants live in refugee camps, is one of the most densely populated areas in the world, with an average population per square kilometer of nearly 2,200 people.
Distribution of Workforce (percent)				
Agriculture	3.5	14.1	7.4	
Industry	22.1	16.2	11.4	
Commerce	13.9	18.2	10.5	
Construction	6.5	19.1	10	
Transport and Communication	6.3	4.8	8.7	
Other Services	47.7	27.6	52	

<sup>a</sup> GDP in billion US\$; all numbers are for gross comparison only, are based on various sources and reporting years, and may not be fully consistent.

SOURCE: Source of data for Israel and Jordan is the CIA Factbook, 1997 (<http://www.odci.gov/cia/publications/factbook/country-frame.html>).  
Source of data for West Bank and Gaza Strip is the Palestinian Central Bureau of Statistics ([http://www.pcbs.org/english/sel\\_stat.htm](http://www.pcbs.org/english/sel_stat.htm)) except for data on GDP composition by sector, which are from the CIA Factbook, 1997.

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Between 1970 and 2000 the population of the region doubled from 6 million to over 12 million. Water usage grew from 2,000 MCM to 3,000 MCM per year (MCM is metric cubic meters, or m<sup>3</sup>).

## Water Usage Statistics

Estimated 1994 Water Use (in MCM/yr (MCM), except per capita use in m<sup>3</sup>/yr)  
Type of Use

	Israel	West Bank and Gaza Strip	Jordan	Total
<b>Domestic</b>				
Ground Water	— <sup>a</sup>	85	208	— <sup>a</sup>
Surface Water	— <sup>a</sup>	0	33	— <sup>a</sup>
Wastewater	0	0	0	0
Subtotal	545	85	241	859 <sup>b</sup>
<b>Agriculture</b>				
Ground Water	— <sup>a</sup>	150	331	— <sup>a</sup>
Surface Water	— <sup>a</sup>	0	382	— <sup>a</sup>
Wastewater	213	0	59	272
Subtotal	1,180	150	772	2,102
<b>Industry</b>				
Ground Water	— <sup>a</sup>	0	43	— <sup>a</sup>
Surface Water	— <sup>a</sup>	0	0	— <sup>a</sup>
Wastewater	0	0	0	0
Subtotal	129	0	43	172
Conveyance Losses <sup>c</sup>	50	—	—	50
<b>Total Water Use</b>				
Ground Water	1,006	235	582	1,811 <sup>b</sup>
Surface Water	685	0	415	1,100
Wastewater	213	0	59	272
Total	1,904	235	1,056	3,183 <sup>b</sup>
Gross Water Use Per Capita	344	93	244	257

<sup>a</sup> Because both ground water and surface water are conveyed in the Israeli National Water Carrier and distributed to domestic, agricultural, and industrial users, the precise sources of these supplies cannot be determined.

<sup>b</sup> This figure is adjusted to eliminate the double counting of about 7 MCM/yr supplied to East Jerusalem and 5 MCM/yr supplied to the Gaza Strip by Israel and included in both the Israeli and the West Bank and Gaza Strip totals.

<sup>c</sup> Conveyance losses are reported only for the National Water Carrier in Israel. Other service distribution systems, such as the King Abdullah Canal in Jordan and all piped distribution systems, have losses that are included in the water-use figures.

SOURCE: Adapted from CES Consulting Engineers and GTZ, 1966. [Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan](#)

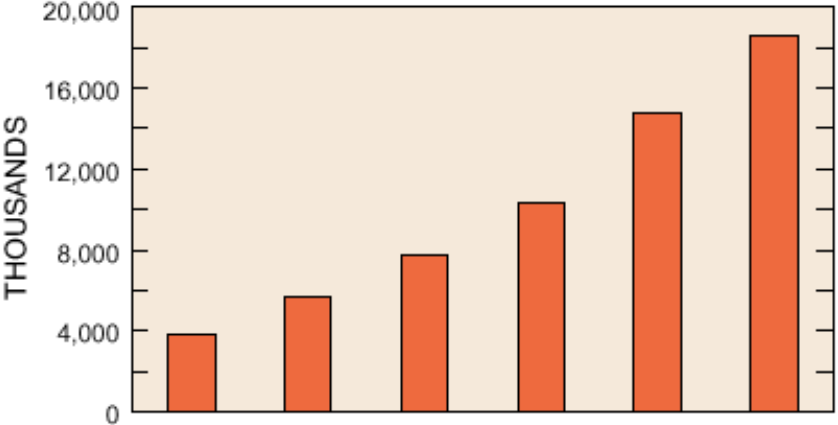
There is significant disparity in water use among Israel, the West Bank and Gaza Strip, and Jordan, particularly in per capita domestic water use. Average per capita use of water in the domestic sector is 98 m<sup>3</sup>/yr in Israel, 34 m<sup>3</sup>/yr in the West Bank and Gaza Strip, and 56 m<sup>3</sup>/yr in Jordan. These per capita figures reflect water put into urban distribution networks; as much as half this water may be lost due to leaky pipes in some systems. Moves toward economic parity will tend to increase water consumption; one planning scenario projects future per capita domestic use of water at 90 m<sup>3</sup>/yr in Israel and 70 m<sup>3</sup>/yr in Jordan and the West Bank and Gaza Strip (CES Consulting Engineers and GTZ, 1996, p. 3-11).

Ground water accounts for 57 percent of total water used and 62 percent of water withdrawn. Current total ground-water withdrawals of 1,811 MCM/yr are in excess of the estimated 1,359 to 1,400 MCM/yr of renewable ground-water resources. The "overpumping" of between 411 and 452 MCM/yr consists of 95 MCM/yr of fresh fossil water (25 MCM/yr in Israel and 70 MCM/yr in Jordan), 81 MCM/yr of brackish fossil water in Israel (CES Consulting Engineers and GTZ, 1996), with the remainder, about 250 MCM/yr, taken from storage, most of it from aquifers in Jordan. The total overpumping in Jordan may be as much as 307 MCM/yr of renewable water.

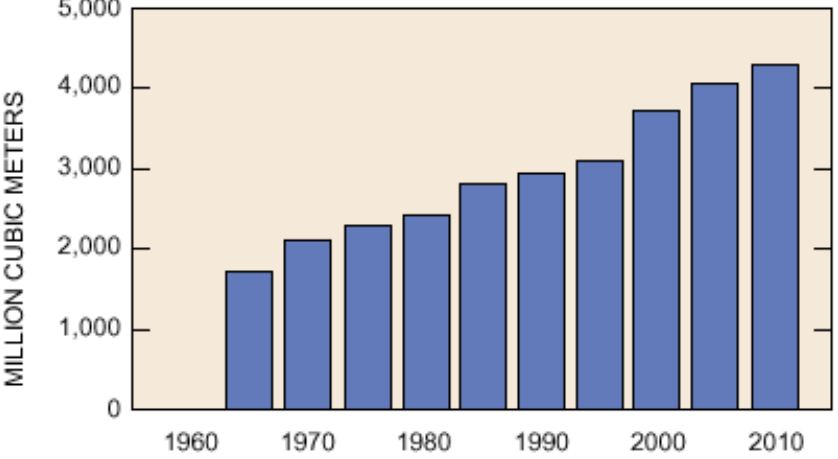
In contrast to ground water, there is a surplus of between 100 and 329 MCM/yr of surface water. This surplus largely represents uncaptured stormwater runoff in the wadis tributary to the Jordan Rift Valley. According to various studies, more than 200 MCM/yr of stormwater runoff may currently be captured by retention structures throughout the study area (BRL-ANTEA, 1995; and Water Authority of Jordan 1996, open files).

## Future Usage

Total population



Total water use



Year	Population (Million)	Surface Water	Ground Water	Brackish	Treated Effluents	Water Supply	
						Desalination	Total
1998	6.0	640	1050	140	260	10	2100
2010	7.4	645	1050	165	470	100	2430
2020	8.6	660	1075	180	565	200	2680

Merikot

Water Demand and Water Sources						
Year	Urban Sector	Natural	Brackish	Wastewater Effluents	Total	
1998	800	920	120	260	1300	2100
2005	980	750	95	380	1225	2430
2010	1060	680	75	490	1245	2680
2020	1330	600	60	640	1300	2680





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TimelineActorsHydrologyClimateDemographicsUsage**Resources**

## Resources

Many resources were used to compile the data for this site. Below are some of the useful links for more information on the Middle-East water issues and tools for accessing more in-depth geospatial data. Special thanks to David Katz and Michael Eyal of the Hydrological Service of Israel for assisting me in gathering some of the GIS data for this project.

## Organizations

- Executive Action Team (EXACT) Multilateral Working Group on Water Resources
- Water Authority of Jordan
- Palestinian Hydrology Group

## Literature

- MidEast Web - Middle East Israel - Palestinian Conflict TimeLine
- A Bibliography of Water and Environmental Issues in the Middle East
- The Middle East - Resources - Water Issues in the Middle East
- Development of Limited Water Resources: Historical and Technological Aspects
- Jewish Virtual Library: Israel's Chronic Water Problem
- Israel's Water Basics
- The New Water Politics of the Middle East
- Water for the Future: The West Bank and Gaza Strip, Israel, and Jordan (free book)
- Israel's Water Economy - Thinking of future generations
- Temporal Trends for Water-Resources Data in Areas of Israeli, Jordanian, and Palestinian Interest
- Analysis of the Oslo Interim Agreement on Water Rights
- The Water Component of the Peace Process Between the Israelis and the Palestinians

## Water in the Middle East

- Jewish Virtual Library: Development of Limited Water Resources: Historical and Technological Aspects
- RainCatcher: An Israeli-Jordanian-Palestinian Pilot Project for Rain Harvesting
- A Future for The Dead Sea: Options for a More Sustainable Water Management
- ::The Palestine Water for Life Campaign

"Concerns about data availability, validity, and reliability are common to all studies on water supply and demand. In the Middle East, however, these concerns rise almost to the point of becoming a fourth crisis."

-Watershed: the Role of Fresh Water in the Israeli–Palestinian Conflict

## Data

- UNEP Maps of Palestine Water Resources
- PalestineRemembered.com: Palestine Maps
- FAO AquaStat database
- Israel Maps - Perry-Castañeda Map Collection - UT Library Online
- Israel - Free GIS Data - GIS Data Depot
- Israel Social Sciences Data Center
- EXACT-ME Hydrogeologic Databases
- Middle East Rainfall Intensity

## Tools

- GeoNames - excellent tool for geocoding toponyms around the world, and includes exonym and endonyms

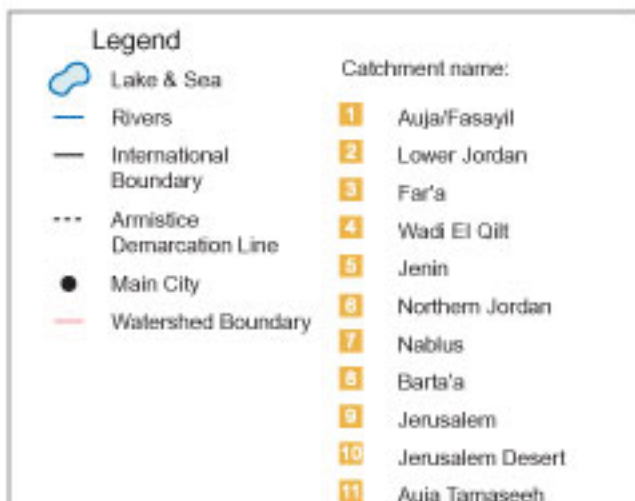
## General Water Information

- Maps and Graphics at UNEP/GRID-Arendal
- The World's Water

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# Watersheds



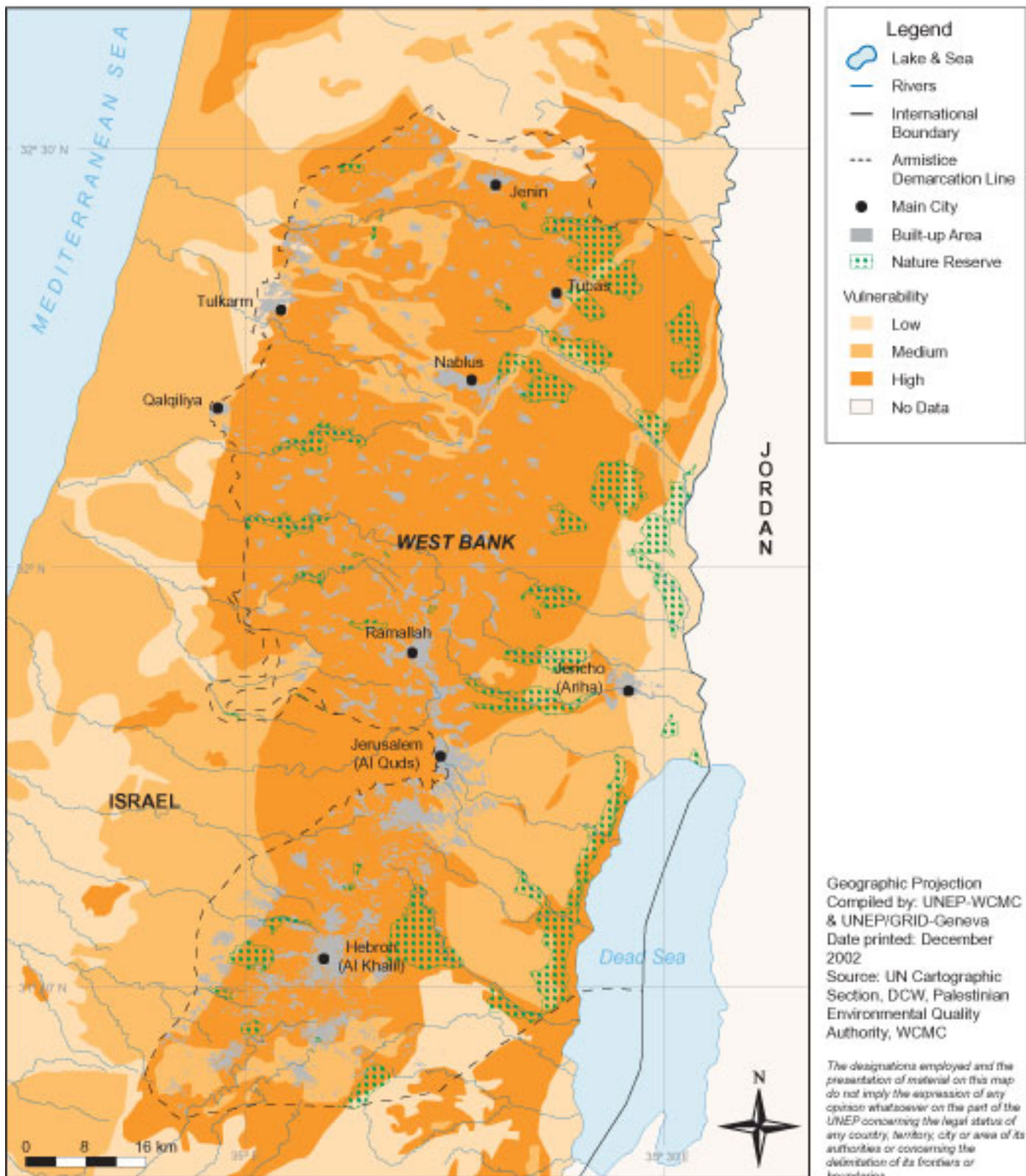
Geographic Projection  
 Compiled by: UNEP/GRID-Geneva  
 Date printed: December 2002  
 Source: ArcWorld, UN Cartographic Section, DCW,  
 Palestinian Environmental Quality Authority, Applied  
 Research Institute - Jerusalem (ARIJ)

*The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the UNEP concerning the legal status of any country, territory, city or area of its authorities or concerning the delimitation of its frontiers or boundaries.*

- 10 Jerusalem Desert
- 11 Auja Tamaseeh



# Hydrogeological Vulnerability of Groundwater to Pollution in the West Bank



# Water Carriers in Gaza



## Legend

- |                            |   |
|----------------------------|---|
| Sea                        | Planned Regional Waste Water Treatment Plant  |
| International Boundary     | Existing Small Brackish Water Reverse Osmosis |
| Armistice Demarcation Line | Built-up Area                                 |
| North-South Carrier        | Refugee Camp                                  |
| Irrigation System Laterals | Booster Pump Station                          |
| Water Treatment Plant      | Water Treatment Plant & Disinfection          |
| Brine Discharge to Sea     | Mixing under Ground Tank                      |
| Reclaimed Water Carrier    | Regional Reverse Osmosis Desalination Plant   |

## Geographic Projection

Compiled by: UNEP/GRID-Geneva  
 Date printed: December 2002  
 Source: UN Cartographic Section,  
 Palestinian Environmental Quality  
 Authority, Palestinian Water Authority

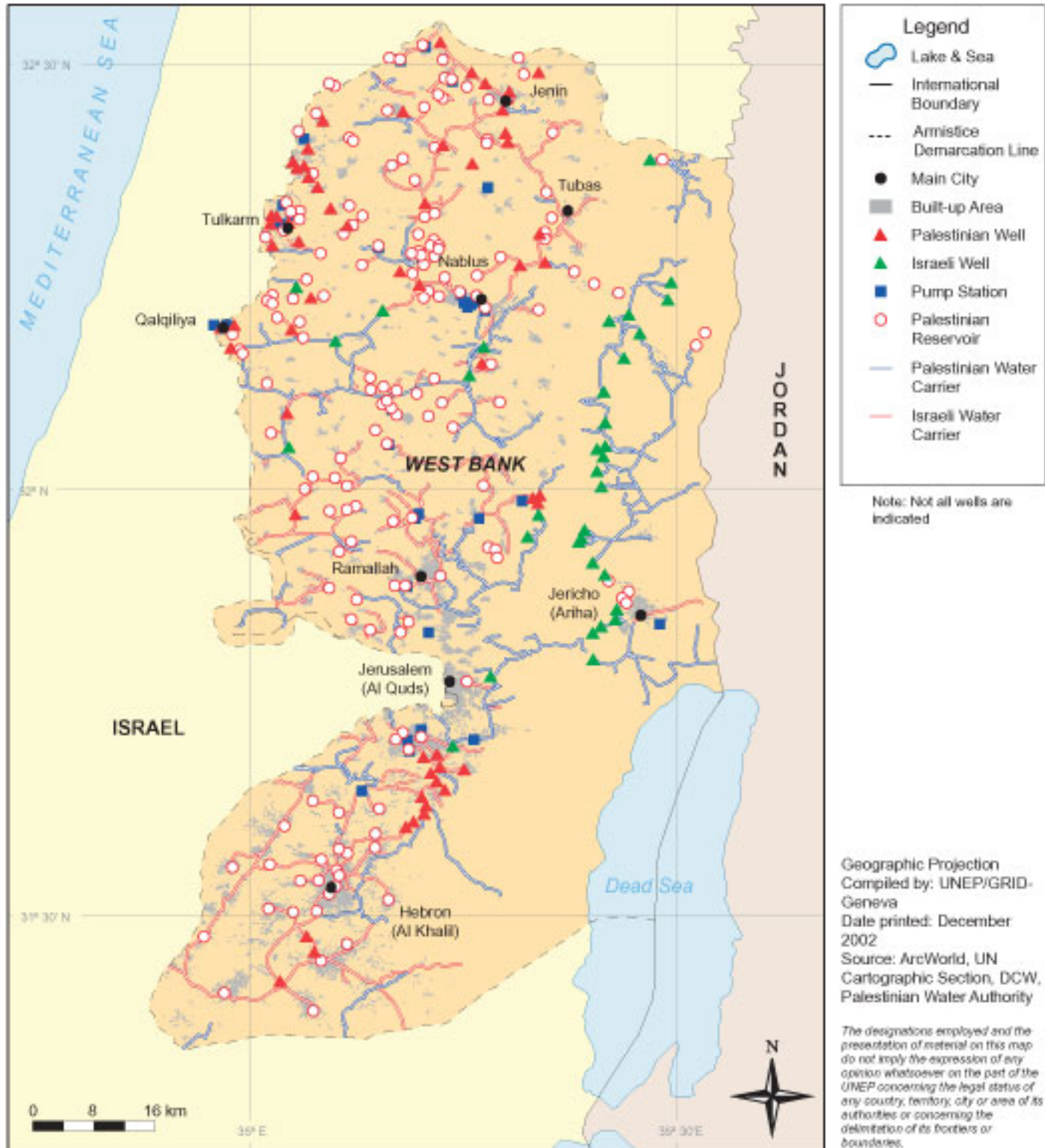
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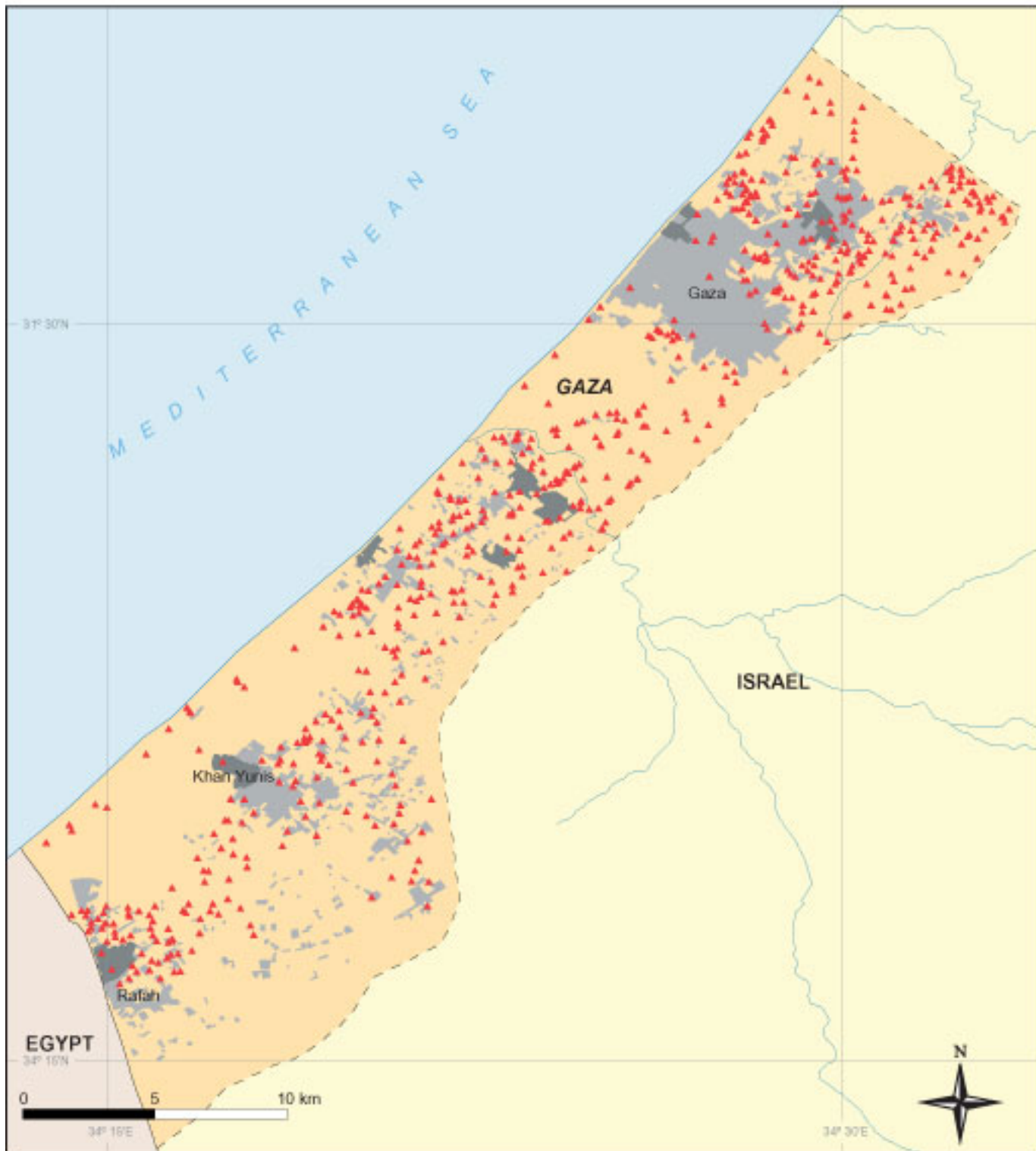


# Water Carriers in the West Bank





# Well Distribution in Gaza



## Legend

- Sea
- River
- Road
- International Boundary
- Armistice Demarcation Line
- Built-up Area
- Refugee Camp

Geographic Projection

Compiled by: UNEP/GRID-Geneva

Date printed: December 2002

Source: UN Cartographic Section, Palestinian Environmental Quality Authority

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# Well Distribution in the West Bank

