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WEST BANK AND GAZA

ASSESSMENT OF RESTRICTIONS ON PALESTINIAN WATER SECTOR DEVELOPMENT

Sector Note
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Middle East and North Africa Region
Sustainable Development

The World Bank

B. Gaza

6. The water resource situation in Gaza

Key messages

In Gaza, heavy over drafting has led to groundwater level decline and quality deterioration, including from seawater intrusion
Only 5-10% of the aquifer now meets drinking water quality source standards

70. *The resource is overdrawn and needs to be returned to sustainable levels of extraction.* The sole fresh water resource of Gaza is the coastal aquifer, which also runs beneath the coast of Israel. In contrast to the West Bank situation, Palestinian Gaza is "downstream" of the portion of the aquifer that underlies Israel, with flows coming from Israel into the Gaza portion of the aquifer. With normal flows, the current sustainable yield of the aquifer segment underlying Gaza is estimated at about 57 MCM, around 15% of the total yield of the shared aquifer, which is estimated at 360-420 MCM. Abstractions in recent years have been running well above any estimate of sustainable yield. The overdraft is currently (2008) estimated at 100 MCM, almost 200%. As a result, there has been a continual decline in the static water level, water quality has been deteriorating, and there is an increase of seawater intrusion. Now 5-10% of the portion of the aquifer underlying Gaza is drinkable, with more than 90% of all 150 municipal wells having salt and nitrate levels above WHO standards and so unfit for human consumption.[54]

71. *No new sources have been developed.* Oslo designated 5 MCM of potable water to meet "immediate needs", to be supplied by Mekorot. Following the Coastal Aquifer Management Plan (2001), it was concluded that Gaza cannot supply itself but must find new or alternative sources

[3] Estimates in Table 5.1 assume unconstrained water availability. Opportunity costs would be higher if the Israeli productivity levels were assumed.

[54] Source: PWA Gaza database, CMWU database; communications from Ahmed al Yaqoub and Rebhy Sheik, PWA, February 2009; Messerschmid: "Wassernotstand im Gazastreifen" in: INAMO (informationssstelle naher & mittlerer osten) No. 53, Fruehjahr 2008 (Jahrgang 14) p.46-51 www.inamo.de)

of water, which could be derived from bulk importation, desalination, and waste water reuse. Both a pipeline from Israel to supply the 5 MCM annually agreed upon in Article 40, and a large Gaza desalination plant have been envisaged, but to date neither has been implemented.

72. *The population has responded with a rapid expansion of private well drilling for domestic supply purposes.* Lacking secure access to water, the population has drilled a very large number of unlicensed wells. This has contributed to the long standing degradation of the aquifer through depletion leading to salinization. In addition, lack of wastewater treatment facilities has led to widespread discharge of sewage into the wadis, and to local pollution through inadequate cess pits. As a result, water quality is very poor, with consequent problems for the environment and health.

7. The water supply situation in Gaza

Key messages

In Gaza, network coverage rates are high but closures and conflict have led to the near collapse of water supply reliability
The private sector and households are coping through unlicensed wells and small scale desalination
The utility revenue base has collapsed and the collection rate has fallen to 20%

73. *Water supply coverage is, in principle, better than in the West Bank.* The rate of connections is high, now covering all communities and 98% of the population (Table 7.1). Per capita supply is in principle higher than in the West Bank, and had been going up (average supply of 152 lpcd in 2005, compared with 97 lpcd in the West Bank). Average consumption is, however, only 60% of supply levels, due to network losses. Total M&I supply increased from 52 MCM in 2000 to about 76 MCM in 2005. Actual availability, after losses, increased from 35 MCM to 45 MCM over the same period. Almost all the supply comes from Palestinian controlled sources, with dependency on Mekorot for just 4%.

Table 7.1: Gaza -Population and communities served with network water supply 2005

	2005	%
Total population	1,390,000	
Population served	1,362,000	*98%*
Total communities	40	
Communities served	40	100%

Source: Wo rld Bank 2007a. 3 8

74. *Water quality is very poor and small scale desalination - largely private - has emerged as a stop-gap solution.* A major problem is water quality, with high concentrations of salts and nitrates, compounds that are difficult and costly to remove from drinking water supplies. Between 5% and 10% of water supplied through the network meets potable standards. The poor quality is linked to aquifer overdraft, and to pollution from wastewater seepage and infiltration of agricultural fertilizers. As a coping strategy, the Gaza market has responded by providing private desalination. There are at least 40 private desalination plants selling both wholesale by tanker and retail by jerry can, producing about 2,000 m3 a day.[55] There are also estimated to be more

[55] PWA Gaza commented: "About 20 of these plants are licensed by PWA although there is no capacity to monitor the distribution system of such small scale plants. Hundreds of trucks are transporting and distributing this desalinated water and thousands of small tanks exist at the small shops and supermarkets. Importantly, this water lacks the basic minerals since the majority of minerals are removed by the reverse osmosis process. Unfortunately, this approach of reducing minerals became the competitive criterion among the private sector desalination plants."

than 20,000 home desalination plants. The feedstock is brackish water from wells. Prices are high: NIS 50/m3, but there is no choice. Private production supplements the four public desalination plants run by CMWU (the regional water utility) that produce 1,000 m3/day.[56] Now almost everyone who can, depends on brackish water desalination for drinking[57].

75. *Recently, problems in Gaza water supply and sanitation have reached crisis levels, largely connected to the deteriorating economic, political and security situation.* The closures led to dramatic deterioration in service provision, and the utility has been living from hand to mouth. In November 2008, the CMWU was short of fuel, not only because of closures but also because since August 2008, funds have not been transferred from the PA, due to the inability of PWA to perform its monitoring function (see below, Chapter 25). UNRWA and Save the Children were obliged to step in to provide funds for fuel. The desalination plant at Khan Younis has a capacity of 90 m3/hr, but due to shortage of spares and chemicals it was producing 30 m3 in November 2008.

76. *The closures were having a major impact on water supply.* In November 2008, most water wells had stopped because of lack of spares, others were working at half capacity.[58] Electricity cuts, and lack of diesel for generators, had affected water distribution and pumping up to household reservoirs. The utility had run out of chlorine, indispensable chemical to ensure water disinfection. There was also lack of related chemicals such as anti sealants and spares. Small items such as membranes and dosing pumps were available "through the tunnels" - at twice the price. As a result, at the time, more than 50% of households did not have access to network water, and some households had not had water for more than 10 days.

77. *With the crisis, utility efficiency has dropped and all conditions have subsequently worsened..* Compared to the West Bank, tariffs were already very low, but in November 2008 cost recovery was more or less in abeyance. The collection rate up to 2001-2 is reported to have been 75%, but was estimated in late 2008 at about 20%. Essentially, the revenue base for commercial utility operations has disappeared, the utility is providing a very poor service, and normal accountability both within the utility and in the customer base has collapsed. The December 2008/January 2009 military offensive caused severe damage to the networks, creating yet worse supply conditions and requiring substantial rehabilitation efforts. In late February 2009, 150,000 people were still cut off from network supply, and in three areas (Sheja'yaa, Zaitoun, and Tal Elhawa) damaged infrastructure had led to contamination of drinking water supply by sewage.[59] The continued closure, now preventing the import of pipes and other materials needed to rehabilitate destroyed water supply and sanitation systems, is therefore worsening negative impacts on Gaza's population and water institutions. It is noted that materials requested to repair damages due to the recent military offensive on Gaza are of the same type as needed for more than 18 months which have not been cleared by Israel.

[56] Source: PWA and CMWU databases
[57] See also Gaza Private Water Supply Case Study Annex 11
[58] Source: Fieldwork, Gaza City and Khan Younis, November 24-25, 2008
[59] Communication from World Bank staff based in Gaza, February 19, 2009

8. The sanitation situation in Gaza

Key messages

Gaza's wastewater treatment infrastructure is inadequate and plants are functioning intermittently
Most sewage is returned raw to lagoons, wadis and the sea

78. *Sanitation services in Gaza are also in crisis.* Currently, about 60% of Gaza households are connected to a sewerage network, and there has been some investment in upgrading and extending treatment plants, although the proposed new plants have not been constructed. The system is currently encountering massive problems in both operations and in planned upgrading. The three existing wastewater treatment plants function intermittently, so little sewage is being treated and most is returned raw to lagoons, wadis and the sea. The Gaza City treatment plant has been overloaded way beyond capacity, and it is reported that it has "not been functioning for more than a year".[60]

79. *Unconnected households use cess pits and in the current economic climate they are not being properly emptied.* At Khan Younis, for example, cess pits have been releasing foul water into the aquifer, and also flooding on the roads. Typically, most emptying is by municipal trucks, and there are some discharge points. However, in the current impoverished situation, emptying by truck is too expensive for most households (NIS 20-30 each time). In any case, the treatment plants are not capable of dealing with the extra load. At Khan Younis, a new wastewater treatment plant is planned, but is far from complete and all sewage collected is dumped in storm water drains and into the lagoon. In Beit Lahyia the North Gaza Emergency Sewage Treatment (NGEST) project is under construction to achieve secondary treatment and ultimately aquifer recharge from partially treated effluent now stored in the notorious Beit Lahyia "sewage lake", whose emergency lagoon embankment failed in 2007 causing a deadly sewage flood. One of the two temporary lagoons built after the 2007 accident also collapsed in March 2009.

9. Health and environmental impacts in Gaza

Key messages

Water-related health impacts on the Gaza population, including the potentially fatal blue baby syndrome, are severe
The environment is choked with untreated sewage, threatening Palestinian health and life, as well as water resources and the environment.

80. *With such poor water supply and sanitation conditions, health impacts are predictably severe.* It is reported that "26% of disease in Gaza is water related" - WHO reports that from the samples they collect from wells, "the proportion of contaminants is growing fast".[61] A WHO study found a high concentration of nitrates in the water supply from wells in different localities within the Gaza Strip, and this nitrate contamination was found to be the cause of the incidence of "blue-baby syndrome" among infants in the Gaza Strip. Whilst this disease primarily affects

[60] Source: Fieldwork interviews, PWA and CMWU, Gaza City, November 24-25, 2008
[61] Source: Fieldwork interview, WHO, Gaza City, November 24, 2008

young children, nitrate contamination can also affect pregnant women and might increase the risk of certain types of cancer.[62]

81. *The impact on the environment is dramatic.* Wadi Gaza is choked with sewage. Along the Gaza strip, 16 sewage outfalls go direct to the sea, releasing daily about 70-80,000 m3 of waste water (more than 50% of total wastewater) untreated into the sea. Faecal coliform bacteria cluster around the outfalls. Fish are infected, and the coastline is contaminated, impacting the quality of life of Gazan citizens, and the livelihoods of those who depend on marine resources for their income. Due to coastal zone mixing and currents, Gaza's raw or partially treated sewage discharges can affect water quality at the intake of the Israeli desalination plant at Ashkelon. At Khan Younis, storm drains and collecting ponds were constructed. "People could not afford to empty their septic tanks or cess pits, so they connected to the storm water drain. The lagoon has filled up with sewage, polluting the aquifer which is nearing imminent collapse."[63]

82. *The current situation is threatening not just to well-being but to lives as well.* Gaza residents and the international community are fully aware that "water projects are life-saving projects" especially after the Beit Lahyia "lake" of partially treated sewage burst its banks and drowned five people. However, whilst the first phase of the NGEST project is now underway to mitigate the Beit Lahyia risk, the situation in Khan Younis remains unchanged."[64]

10. The situation of water for agriculture in Gaza

Key messages

Gaza has a potentially very profitable agricultural sector
Incursions and closures have reduced activity to low levels

83. *Although Gaza is urbanized, it has a vital and potentially profitable irrigated agriculture sector.* In fact, amongst the 80% of residents who are refugees from what is now Israel or their descendants, many were displaced farming families Agriculture is almost entirely irrigated, using about 80 MCM of water annually. The irrigated area is about 82,000 dunums, and the main crops are citrus and vegetables. There is some irrigation with brackish water. Efficiency is high, with average water use of 400-500m3/dunum, low for such a warm climate and intensive production system. Protected agriculture is the norm. If markets are available, agriculture is very profitable.

Table 10.1: Area under crops (in dunums)

Crop	Gaza Strip
Vegetables	40,030
Citrus	39,960
Field crops	2,350
Total	**82,340**

Source: MoA 2004a: 60

[62] Sources: Centre on Housing Rights and Evictions Position Paper (2008) "Hostage to Politics: The impact of sanctions and the blockade on the human right to water and sanitation in Gaza"; and Abu Naser, A, et al. "Relation of nitrate contamination of groundwater with methaemoglobin level among infants in Gaza", Eastern Mediterranean Health Journal, Volume 13 No.5, (September-October 2007), http: //www. emro. who. int

[63] Source: Fieldwork interview, Khan Younis Municipality, November 25, 2008

[64] Source: Fieldwork interviews, PWA, CMWU and PMU, Gaza City, November 24-25, 2008; Bank supervision reports for the on-going North Gaza Emergency Sewage Treatment Project

84. *The main problems are water quality and - above all - Israeli interventions and the access controls and closures that impede access to markets.* As discussed above, water quality in Gaza is rapidly deteriorating, and this can have an impact on agricultural yields. But the main constraints are those stemming directly from the political situation, which have resulted in destruction of physical assets and infrastructure, including wells, and restricted access to markets (see Box 11).

Box lib: A desert of greenhouses

During the Second Intifada, about 370 agricultural wells were destroyed by the IDF. Up to 2008, about 100 had been rehabilitated. But with the withdrawal of the settlers, hope for Gaza's irrigated agriculture sector briefly returned. In September 2005, control of some 4,000 dunums of land where greenhouses formerly operated by settlers once operated were transferred, with international support, to PADICO, a Palestinian company established and owned by the PA. During the first season (2006) the greenhouses were rebuilt and operations were successfully launched, but closures impeded markets, and in 2007 losses were reaching $600,000 a day. The operation had to close, and now the area makes a dramatically sad sight, gaunt steel frames stretching as far as the eye can see, all glass shattered, plastic flapping in the wind.

Source: Fieldwork, Khan Younis, November 25, 2008

Annex 11 Gaza Private Water Supply

Case Study

Background

In Gaza, alternative water sources and providers are needed to meet water supply demand and to ease the stress on the coastal aquifer. Innovative private water supply complements the public water supply of PWA and CMWU. The private sector in Gaza is active and entrepreneurial - since 1998, over 20,000 consumers have installed domestic 'reverse osmosis' (RO) desalination units. Today, private desalination plants (industrial and domestic in parallel) are a viable commercial market with further growth potential. Small brackish water desalination units are installed in households or in the community, which are considered as a generally affordable, self-sufficient, and sustainable way to supply water to Gaza's citizens. By entering into formal contracts with the private provider, households or communities receive regular water supply. For most consumers, willingness to pay seems not to be an issue, as water from other suppliers is not equally available (e.g. public supply) or is simply more expensive (e.g. private tanker water). Additionally, as desalination units use sea-water (not brackish water), they do not tap the aquifer, and thus they have additional value-added for preserving groundwater.

Local authorities report that movement and access restrictions (e.g. closures around Gaza) and non-water sector issues hamper the development of the water sector. For instance, IDF implemented closure-related import restrictions and frequent closures of checkpoints limit the availability of spare parts essential to operating and maintaining the desalination plants (industrial, community or household facilities), and chemicals (e.g. chlorine, etc) - needed to maintain safe water supply. Electricity to operate water pumps to fill up water tanks (especially rooftop tanks) is not always available. Furthermore, desalination is electricity-intensive and about 60% of operation costs go into covering energy costs. Similarly, domestic 'RO' desalination units cause an increase in a household's electricity expenses of up to 25%. Local authorities estimate that when private plants are to be run on a cost recovery basis, tariffs need to be increased from the current 1 NIS to 4-5 NIS to cover the investment costs. This will however have a potentially negative effect on households. Finally, desalination water has a lower quality standard than public network water, supplied for instance through PWA.

Desalination - the start

In the 1990s, water quality was generally low in Gaza Population density was already high, and the 1.3 millions inhabitants used groundwater as their only water source. Overdrafting caused the water table to sink below sea level, resulting in sea water intrusion and high salinity.

In 1998, a UK company, Acqua, started a pilot project with a small desalination plant of 200m3/ per day to provide potable water to Shejaia, a Governorate East of Gaza City. The price for a jerry can (20 liters) was 3NIS, equivalent to US 0.78 (1998 prices). Poor households reportedly were unable to afford such prices. In 2000, a NGO project in a refugee camp, "Beach Camp" provided water for poor households at 1NIS per jerry can. Several small private investors also supported this project on a micro-finance basis.

By early 2000, people in Gaza had realized that tap water, sourced from the coastal aquifer, was no longer drinkable due to high salinity from the sea water intrusion and high nitrate pollution from agricultural activity. With an active and entrepreneurial private sector, some Gazan households were able to install small 'reverse osmosis" (RO) desalination units in their kitchens at a unit price of about US$ 300-400. Such a RO unit complements the tap water, supplied by the municipality, now in over 50% of Gaza households. Its capacity is about 100-

200 I/ per day, and water quality is high, reaching TDS levels of below 100, and filtering out the nitrate - a frequent component at dangerously high levels in Gaza's water.[115] According to GVC, Gaza's private sector supplied about 100,000 households with RO plants (including replacement of old units).

Experts report that the investment costs of a commercial desalination plant ranges between US$ 20,000-40,000, most of which private investors cover with their own resources, not through commercial banks. Today, approximately 100 industrial desalination plants are still operational, but only about 30% of them are registered with PWA and MoP and in compliance with regulation, inspection, and water quality standards. Water quality in other plants is kept at high standards due to the strong competition of the market, but in absence of regular inspections these standards remain to be confirmed.

Poor households, however, are unable to afford such a domestic RO installation. They continue to purchase water with jerry cans from commercial desalination plants. Hence, in 2005, an alternative to the domestic RO unit was developed to provide water also for poor households. The new system consists of 200 liter polyethylene tanks, which are filled by a tanker once a week at a price of 10 NIS. Again competition is high, and some private providers give the tank for free, as the household enters into contract with the private provider. If households fill their tank from a competitor, the "free" tanks are taken back. A private provider reports that if water is purchased in bulk, prices drop to 0.5 NIS per jerry can, which is still above the public network price but lower than alternatives.

Although private sector desalination water is generally affordable, self-sufficient, and sustainable, it is very energy intensive, many households are still unable to afford it, and its quality is still a warning sign,. For instance, about 60% of operation costs go into covering energy costs. For a household, the installation of an 'RO' desalination unit can push up its monthly electricity expenses to up to 25%. Plus electricity cuts, associated with the closures, cause disruptions in power supply. According to a private desalination water supplier, GVC, the development of a Gaza power plant could be viable option. Furthermore, when private desalination plants have to operate on cost recovery basis, tariffs will need to be increased from the current 1 NIS to 4-5 NIS to cover the investment costs - this could have negative effects households. Finally, desalination water has a lower quality standard in terms of low water minerals compared to public network water that is supplied for instance through PWA.

PWA or municipalities provide about 70 1/c/d, but cannot reach all households. Local authorities report that low pressure in the network is often an issue, making the filling of rooftop water tanks a frequent challenge. The siege-related restrictions on movement and access and frequent closures of checkpoints limit the import of spare parts -essential to operate the desalination plants (industrial, community or household plants), or of chemicals (e.g. chlorine for disinfection, and sodium hydroxide to restore the ph balance of desalinated water, etc) - needed to maintain safe water supply. Electricity is not always available to operate water pumps to fill up water tanks (especially rooftop tanks).

Analysis

- The key issue is scarcity of safe water. Causes include the over-pumping of the coastal aquiver leading to sea water intrusion; the high nitrate levels in the water due to agricultural activity; and the M&A restriction on import of necessary water treatment chemicals, spare parts and materials to build and maintain water structures.
- Another problem is affordable water supply for poor groups, especially in remote areas of the Gaza strip. Siege-related movement and access restrictions have led to an increase in unemployment and poverty rates, making basic services, such as water supply, increasingly difficult to afford for many households.

[115] GVC has collected data on nitrate and chlorine levels in all governorates in Gaza

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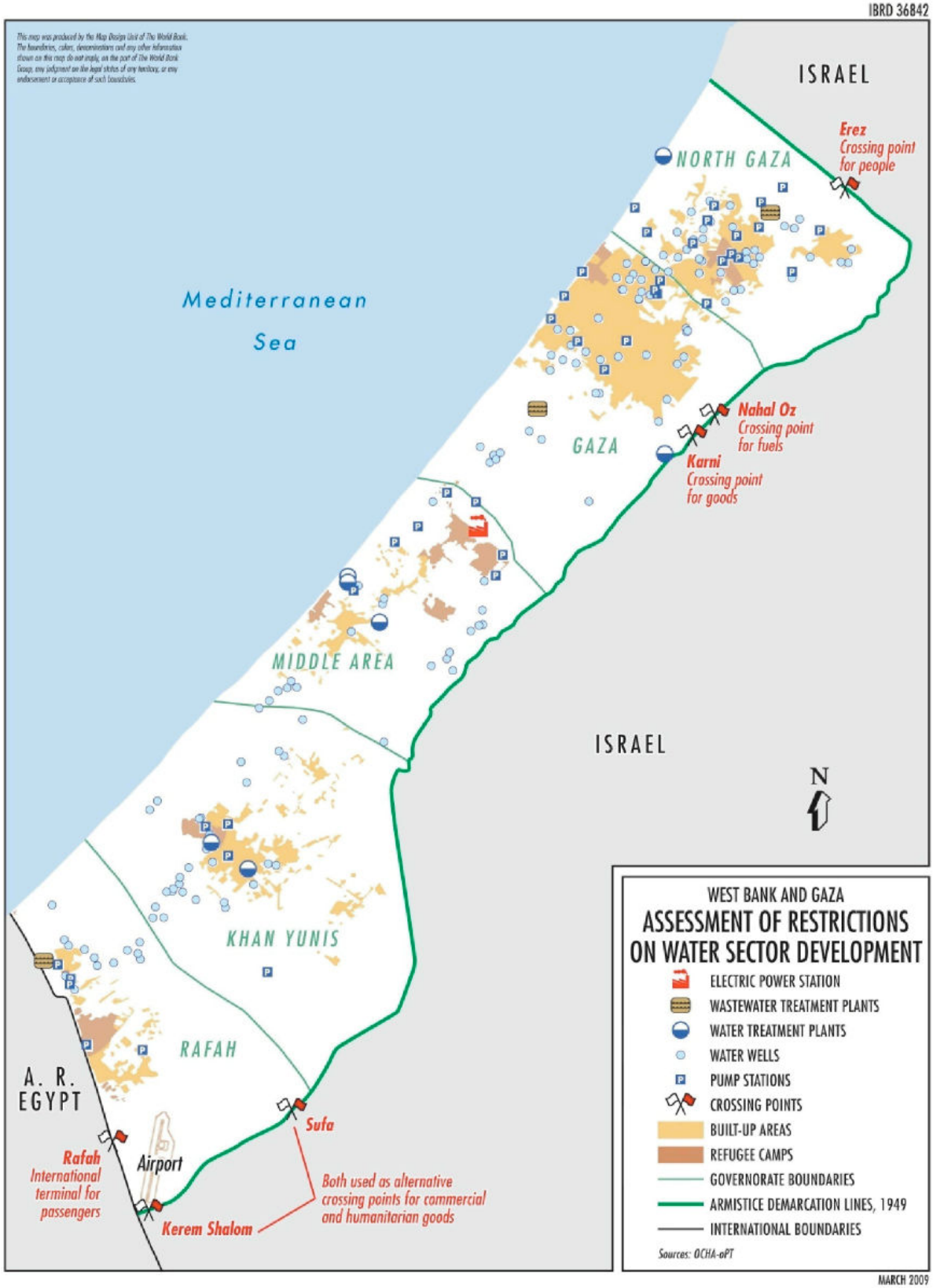

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