Palestinian Water Authority

Water Resources Directorate

Gaza Water Resources Status Report, 2013/2014

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Ramallah Tel: 02 2987665, Fax: 02 2987336 Gaza Tel: 08 28 33609, Fax: 08 282 6630

Website: www.pwa.ps Email: pwa@pwa.ps

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1. Introduction:

Groundwater from the coastal aquifer is the main source of water in the Gaza Strip and provides about 98% of all water supplies, while the remaining 2% is provided through purchasing from the Israeli water company (MEKOROT).

The Gaza Strip is among the areas with the scarcest renewable water resources with average water consumption in 2013/2014 of 90 l/c/d of bad water quality exceeding the recommended standards. This is far below the per capita water resources available in other countries in the Middle East and in the world, constraining economic development, and resulting in health negative impacts. More than half of the available groundwater is used for irrigation (52%), while the remaining is used for domestic water supply and industry.

The water situation in Gaza is very bad in terms of quantity and quality, where the Coastal Aquifer in the Gaza Strip receives an annual average recharge of 55 -60 MCM/y mainly from rainfall, while the annual extraction rates from the aquifer is about 200 MCM. This unsustainable high rates of extraction has led to lowering the groundwater level, the gradual intrusion of seawater and up conning of the underneath saline groundwater. Gaza Aquifer needs to be regenerated before it can be sustainably used again.

This report summarizes the water resources status in Gaza Strip in terms of quantity and quality for the year 2013, based on the results of groundwater level records and its fluctuation with time, groundwater quality of representative water wells covering Gaza Strip, and the total groundwater production as well as per capita consumption in Gaza Strip Governorates.

2. Groundwater Production and Abstraction:

2.1. Domestic Water

Based on the total water production records received from the CMWU and the different municipalities in Gaza Strip the following can be concluded:

Total water supplied to Gaza people for domestic and drinking use is 103.34 MCM/y, categorized as follows;

- 94.1 MCM from municipal groundwater wells
- 2.44 MCM from UN groundwater wells
- 2.8 MCM from private groundwater desalination vendors resulting from 4.80 MCM abstracted from the aquifer
- 4.00 MCM from Mekorot

Assuming the network efficiency of 54% (according to CMWU), the total water consumption is about 56 MCM/y resulting in water per capita consumption of 90.2 l/c/d.

2.2. Agriculture water production:

The total crop area has been increased from 189 thousand Dunoms in 2012 to 201 thousand Dunoms in 2013/2014 and the estimated water quantities for agriculture use including the livestock are about 95.3 MCM/y (92.7 for agriculture and 2.64 for livestock according to MoA). It is clear that there is an annual increase in the agricultural water consumption of about 9.5 % compared to 2012.

3. Groundwater level:

Groundwater level is monitored quarterly by PWA's monitoring team from 87 monitoring wells distributed spatially and covering the whole Gaza Strip Area. After completing measurements, the recorded data is tabulated, presented in contour map and graphs and evaluated for the purpose of identifying the main water level decline and the reason behind that as reference for managing the abstraction rate in terms of quantity and time intervals. As a result of continuing intensive groundwater abstraction, two cones of depression have occurred in the northern and southern areas of the Gaza Strip, with water level of 6m and 19m below sea level respectively (fig.1).

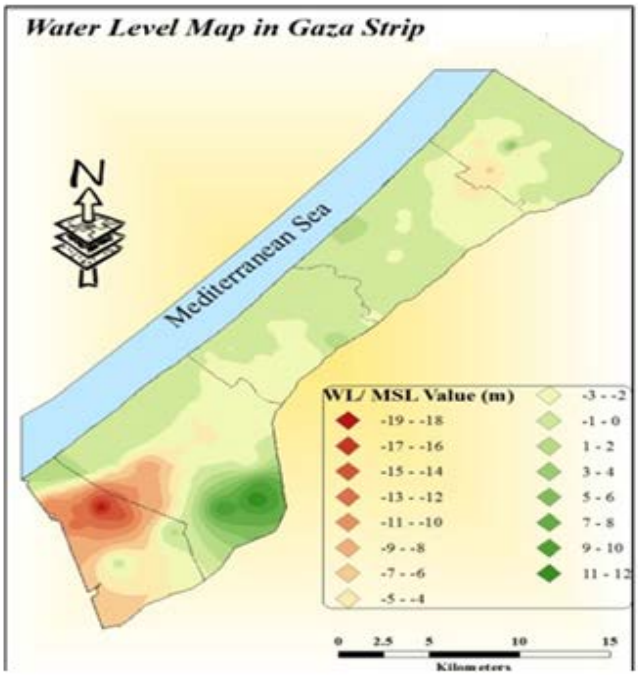

Figure 1: Water Level in Gaza Strip

The water level declines in most of the monitoring wells have continued with the same magnitude and attitude of the year 2012 as well as the previous years. Generally, the magnitude as well as the attitude of groundwater level decline changes from area to another based on; location of the monitoring wells, hydrogeological characteristics of the water bearing formation, production rates in the vicinity of the monitoring wells and the production duration. The significant water level decline has been recorded in the two cones of depression areas that located in the north and south of Gaza Strip (fig.2 & 3) as a result of high density of domestic wells that are pumping continuously with high pumping rates. The influence of the cone of depressions affects all the monitoring wells surrounding, with different degree of influence. The water level decline in Rafah area is significantly high reflecting the low aquifer potential as well as its low renewable water amounts compared to the pumped quantity.

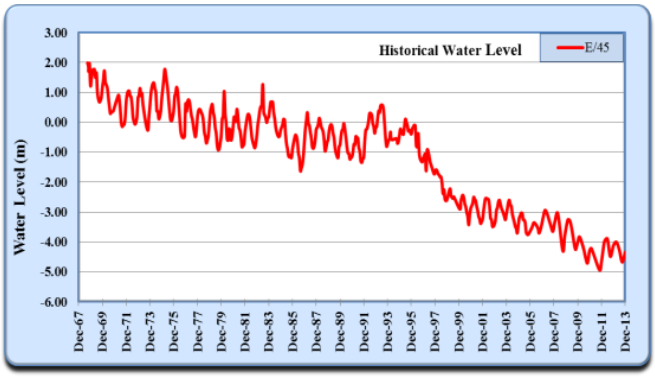

Figure 3: Water Level Decline in The Northern Area

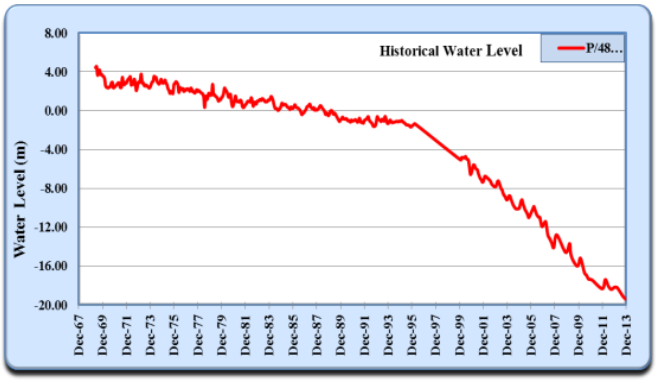

Figure 2: Water Level Decline in The Southern Area

4. Groundwater Quality:

Depending on the results of the groundwater chemical analyses carried out twice a year by Ministry of Health Lab (MOH) for about 211 domestic water wells in Gaza Strip, PWA has audited and evaluated these results through preparing contour maps as well as graphs for the main ions such as Chloride as salinity indicator and Nitrate as pollution reference.

The chloride concentration is represented in the contour map (fig4.) indicates a limited part of the aquifer in North of Gaza and West of Khanyounis (Mawasy) with Cl concentration of 250-500 mg/l. The major parts of the aquifer have a Cl concentration ranging between 600-2000 mg/l, while along the coastal line Cl concentration exceeds 2000 mg/l and can reach more than 10,000 mg/l at some spots due to effect of the seawater intrusion.

Generally, most of the wells show continuous Cl increase as a result of intensive pumping. The magnitude and attitude of Cl increase is controlled by many factors such as; well location, total

depth penetrated, pumping rate and the hydrogeological condition of the underneath water bearing formation.

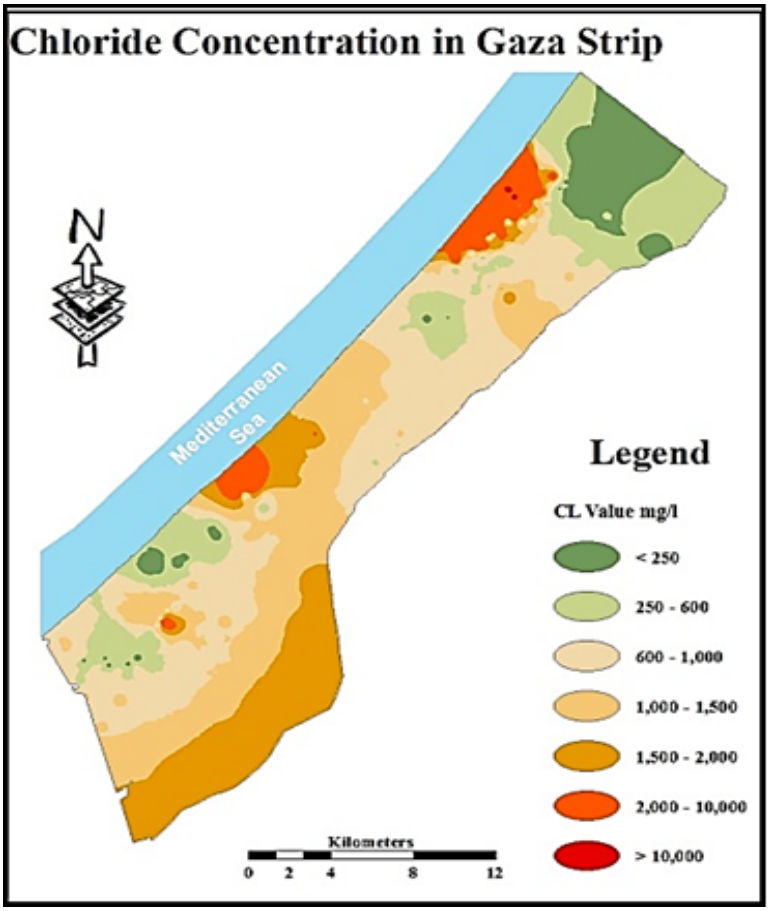

Figure 4: Cl Contour Map

Fig.5 illustrates the continuous Cl increase trends phenomena which represents most of the wells located in the middle and southern areas of the Gaza Strip as a result of up coning of the underneath saline water. While, the seawater intrusion phenomena is presented in (fig.6) that covers most of the wells located close to the shore line covering nearly about 15 % of the total wells (30 wells).

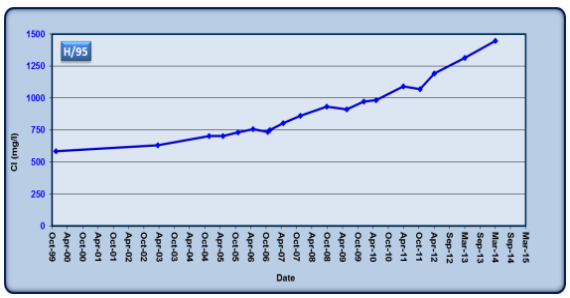

Figure 6: Cl Continouse Increase

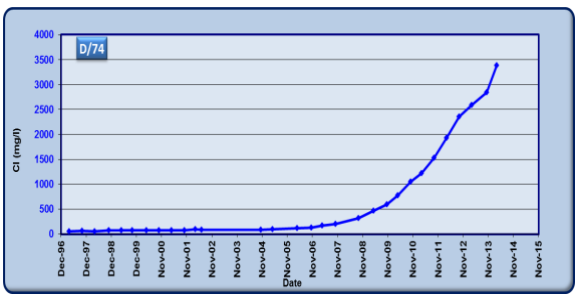

Figure 5: Cl Seawater Introusion Trend

Generally, Chloride concentration in the municipal wells in 2013/2014 ranges from 250 to more than 5000 mg/l. 24.6% of them have chloride concentration less than 250 (WHO allowable limit) while the remaining (75.4%) exceeds the WHO chloride level (fig.7).

Nitrate concentration in the municipal wells ranges from 50 to more than 200 mg/l. 13.3 % of them had Nitrate concentration less than 50 mg/l (WHO allowable limit) while the remaining (86.7%) exceeds the WHO nitrate level as shown in fig.8.

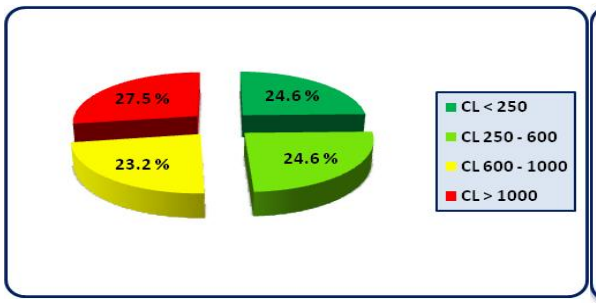

Figure 8: CL Concentration

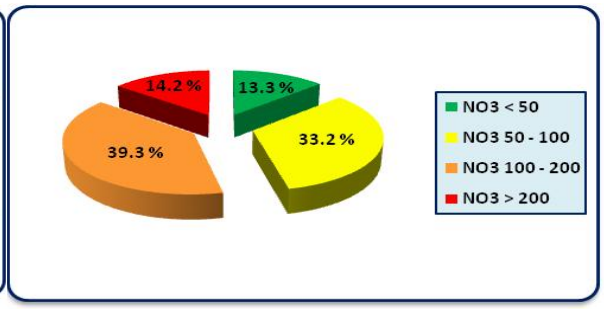

Figure 7: Nitrate Concentration

Taking in consideration the combined concentrations of both chloride and nitrate, it's clear that 3.8% of the domestic water is only matching with WHO drinking limit, while the remaining 96.2% is out of limit (fig.9).

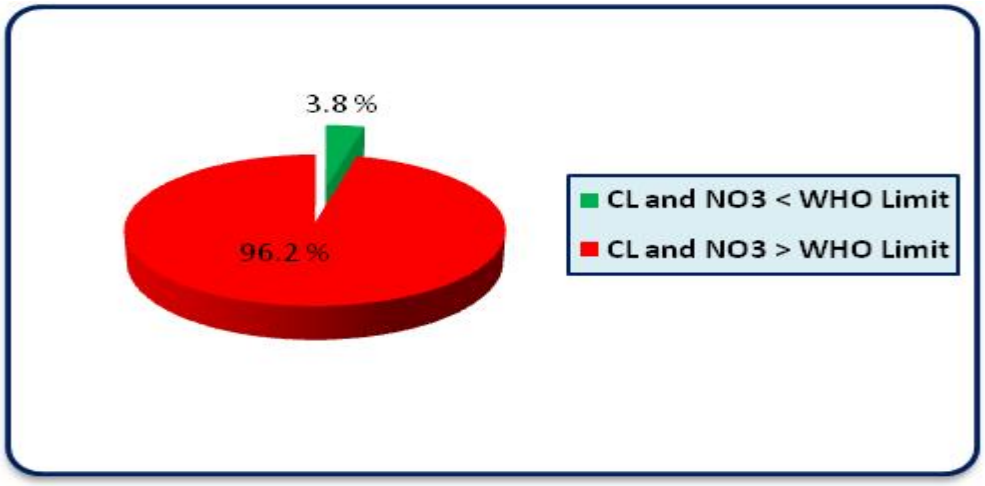

Figure 9: Chloride and Nitrate