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Sustainable Water Resources Management of Gaza Coastal Aquifer, Palestine

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Abstract

During the Israeli occupation to Gaza Strip a great damages have been occurred especially in Rafah area which is located close to the Egyptian border as a security excuse by Israeli forces. As a continuation of Israeli security control, a moat at the Philadelphia corridor along the Israeli (Palestinian)-Egyptian border has been proposed and/or suggested as a matter of Israeli security monitoring and controlling. Based on the Israeli sources, the moat will be in the range of 50-100 meters in wide, 15-25 meters in depth and 4 Kilometers in length. There are no other details about the location of the moat and if the moat will be filled by freshwater, brackish or sea water or remain empty. Whether the moat will be lined or unlined, separated from the groundwater resources or not.

The Israeli military forces were planning to construct an elevated moat starting from topography with 10-20 meters depth, 50-100 meter wide. This moat will be filled with water or remain empty or they may construct seawater canal starting from the Mediterranean. This means that they will dig until they reach levels below the mean sea level. Accordingly Palestinian Water Authority (PWA)/ Water resources Directorate (WRD) in cooperation with the Palestinian Hydrogeological Group (PHG) submitted a proposal to the UNESCO for conducting a research project to study the possible impact of that canal on the groundwater coastal aquifer in both Palestinian and Egyptian side. The research has been completed and accepted by the technical UNESCO s committee. The main objective of this study was to simulate the new boundary condition at the southern border of Gaza Strip regarding the seawater canal (constant head boundary) or seawater moat (recharge with fixed concentrations) using groundwater flow and transport module and evaluate the impact of this new boundary condition of the local groundwater quality and the agricultural and domestic production wells on both sides of the border. The seawater/freshwater interface have been predicted and the local groundwater quality was evaluated against this new boundary condition. However and based on numerical and convergence problems encountered during the model calibration and development using the SEAWAT code the seawater/freshwater interface is not predicted but rather the advection and dispersion phenomena of the contaminated water (such as seawater) have been studied and investigated and its impact on the local groundwater quality and the production wells in the area.

During the study the impacts of both the seawater moat and the seawater canal on the local Water is one of the most important natural resources and has a major role in the development of all the economical sectors. Syria is one of the Arab countries that suffers from water resources problems. Most of its the resources come from the annual rainfall on the watersheds. The international shared water resources have also a great influence like; Tigris, Euphrates, Assy, and Yarmok Rivers. Due to the increase in demand in the different economical and humanities sectors (Irrigation, Industry, Municipalities), it is hardly possible to satisfy these needs without increasing the technical efficiency of the water use, conserving it, and investigate how to use it more effective.

In this paper, the current sit uations of the available conventional and non-conventional water resources have been analyzed. Also the requirements for the different sectors have been estimated to visualize the expected problems in the future to predict the possibility of satisfying the needs in the near future. Therefore different solution alternatives should be proposed and evaluated. Water pricing as a tool for water demand management to control and reduce the usage recover the operation and maintenance cost and supply water to the different sectors. Countries experiences have been studied to find the most convenient solution that suit Syria. Using this tool will help in increasing the country budget to improve the efficiency of the water structures and in expanding the services to larger persons. Among the conclusions of the research; pricing tool can be applied in irrigation sector by (1) volumetric pricing for groundwater used for irrigation whereas applying constant fee for surface water from governmental irrigation network. (2) Applying crop taxes. Regarding the industrial sector; increasing the water rate and using meters for the wells. For the municipalities; different strip rating should be used with higher rates for the upper strip.

Introduction

Water is the most precious and valuable natural resource in the Middle East in general and in Gaza Strip in particular. It is vital for socio-economic growth and sustainability of the environment.

Gaza Strip is in critical situation that requires immediate efforts to improve the water situation in terms of quality and quantity. Demand greatly exceeds water supply. In addition water quality is very poor and the aquifer is being over pumped. Very limited water supplied for domestic use is potable. More than 70% of the aquifer are brackish or saline water and less than 30% are fresh water. About 65% of the total pumped water are used for agricultural purposes. If uncontrolled pumping is allowed to continue the aquifer, which is the primary source for the Gaza Strip, will become unusable as a source of fresh municipal water and most agricultural extraction will be too saline for crop irrigation.

This paper presents an overview of the water resources as well as the current and future water demands for the different use. The problem is expected to grow and water deficit in terms of quantity will reach to about 100mcm/y by year 2020, while the water quality will be deteriorated dramatically. .

One of the goals of Palestinian Water Authority (PWA) is "to manage the limited water resources available to exploit fully in a sustainable and an environmentally safe manner". To achieve that goal it requires developing a clear comprehensive management plan. The main issue of that plan is wastewater collection, treatment, distribution and reuse for. New water resources to be added to the aquifer system is needed to minimize the water deficit and to improve the groundwater in terms of quality and quantity.

Implementation of the management plan will require sustainable sources of revenue as well as strong regulatory body.

Water Resources

Gaza's water resources are essentially limited to that part of the coastal aquifer that underlies its 360km^2 area (Fig.1). The coastal aquifer is the only aquifer in the Gaza Strip and is composed of Pleistocene marine sand and sandstone, intercalated with clayey layers. The maximum thickness of the different bearing horizons occurs in the northwest along the coast (150m) and decreasing gradually toward the east and southeast along the eastern border of Gaza Strip to less that 10m (Fig.2).

The base of coastal aquifer system is formed of impervious clay shade rocks of Neogene age (Saqiyah formation) with a total thickness ranges between 500-1000m.

Depth to water level of the coastal aquifer varies between few meters in the low land area alone the shoreline and about 70m along the eastern border.

The coastal aquifer holds approximately $5x10^9m^3$ of groundwater of different quality. However, only 1.4 $x10^9m^3$ of this is “ freshwater”, with chloride content of less than 500mg/l. This fresh groundwater typically occurs in the form of lenses that float on the top of the brackish and/or saline ground water. That means that approximately 70% of the aquifer are brackish or saline water and only 30% are fresh water.

The major source of renewable groundwater in the aquifer is rainfall. Rainfall is sporadic across Gaza and generally varies from 400mm/y in the North to about 200mm/y in the south. The total rainfall recharge to the aquifer is estimated to be approximately $45m^3/y$. The remaining rainwater evaporates or dissipates as run-off during the short periods of heavy rainstorms.

The lateral inflow to the aquifer is estimated at between 10-15 $x10^6m^3/y$. Some recharge is available from the major surface flow (Wadi Gaza). But because of the extensive extraction from Wadi Gaza in Israel, this recharge is limited to, at its best 1.5-$2x10^6m^3$ during the ten or 50 days the Wadi actually flows in a normal year. As a result, the total freshwater recharge at present is limited to approximately 56.5-62 $x10^6m^3/y$.

Under natural conditions, groundwater flow in the Gaza Strip is towards the Mediterranean Sea, where it discharges to the sea. However, Pumping over 40 years has significantly disturbed natural flow patterns. Large cone of depression have formed in the north and south where water levels are below mean sea level, including inflow of seawater towards the major pumping centers (fig.3).

Between 1970-1993, groundwater levels dropped by almost 2-meters on average. This drop is most apparent in the south, and is a reflection of lower recharge from rainfall in this area. In the north, most wells exhibit a relatively slower drop.

Water Balance

The water balance of the Gaza coastal aquifer has been developed based on estimate of all water inputs and outputs to the aquifer system. The Gaza coastal aquifer is a dynamic system with continuously changing inflows and flows. The present net aquifer balance is negative, that is, there is a water deficit. Under defined average climatic conditions and total abstraction and return flows, the net deficit is about 40-50MCM/y. Implication of the net deficit include:

- Lowering of water level (documented).
- Reduction in availability of fresh groundwater (documented).
- Seawater intrusion (documented), and potentially up-coning of deep brines (partly documented).

It is estimated that only 10 percent of the total aquifer volume may be considered fresh, meeting with the WHO drinking water standard. This corresponds to a total of about 500 MCM. The time frame for complete depletion of fresh groundwater will depend on continued abstraction volumes and patterns. Using a rate of aquifer depletion of about 40-50MCM/y, it can be theoretically calculated that depletion would occur in 10-13 years.

The net deficit has led to a lowering of the water table in the past 30-40 years and inland migration of seawater. Of these two factors, seawater intrusion accounts for a greater fraction of the volume loss, but it is less visible and thus tends to lessen the perception of the worsening aquifer evolution.

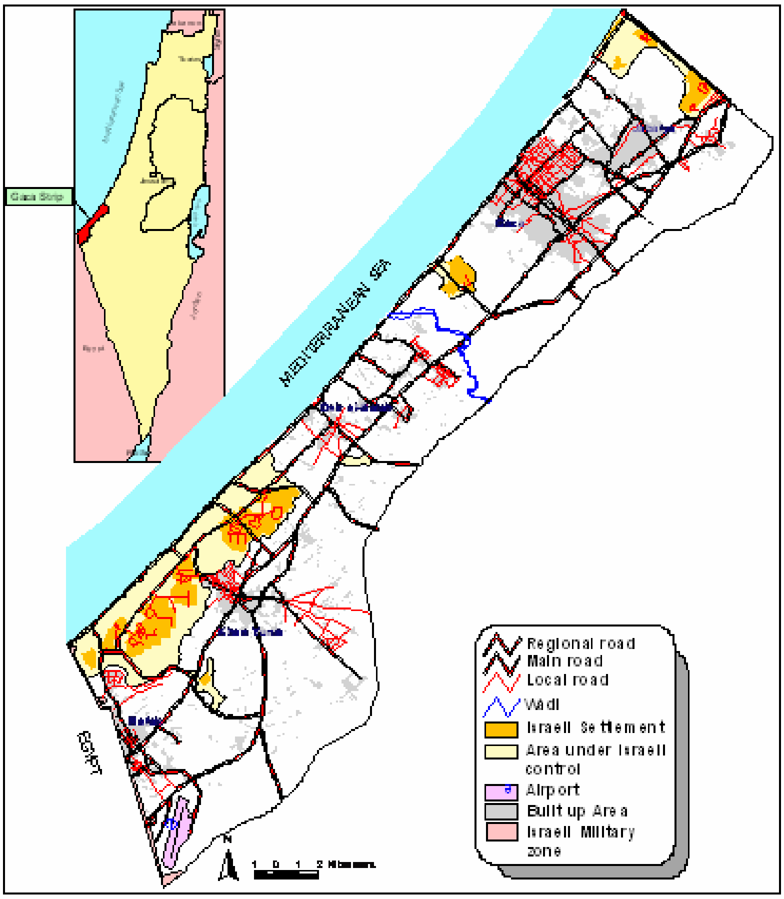

Fig.1.Location map of Gaza Strip

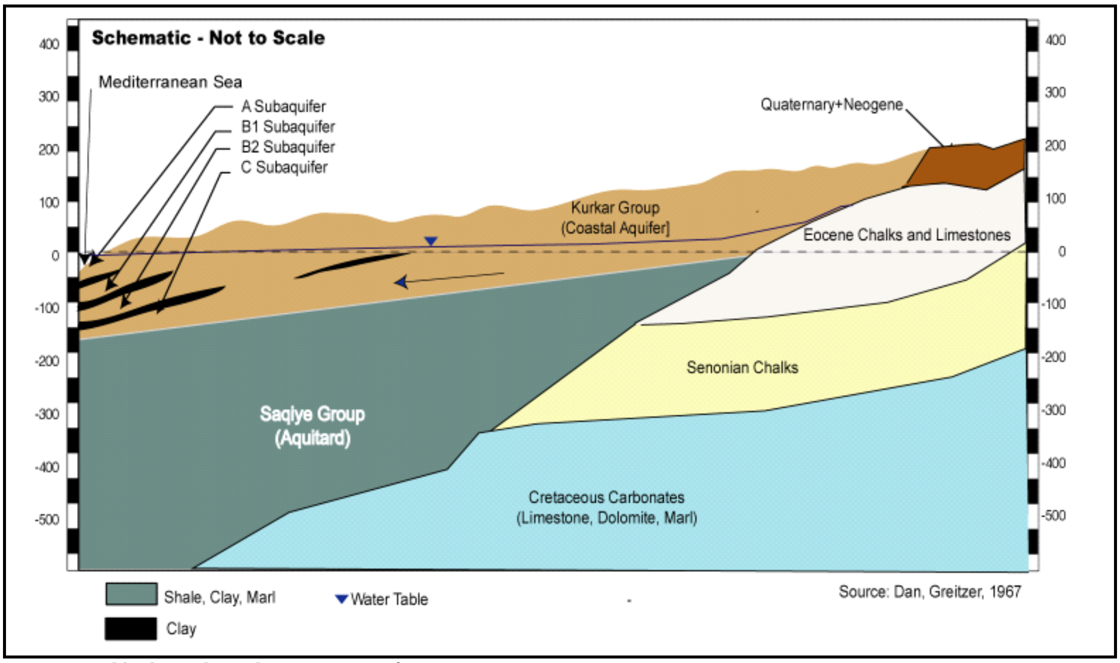

Fig.2.Typical hydrogeological cross section of Gaza Strip

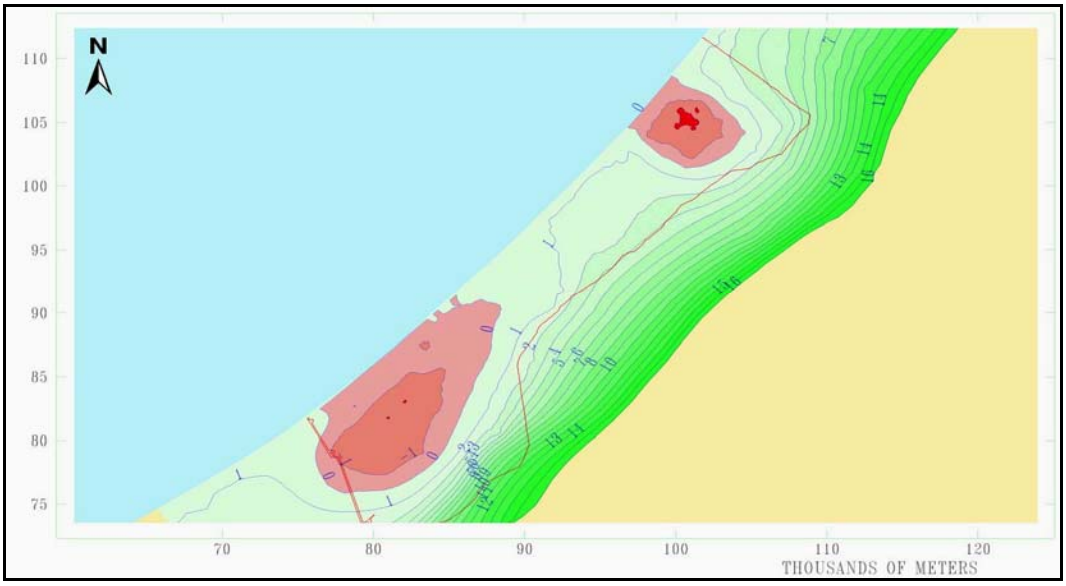

Fig.3. Calibrated Average Water Level Contour Map (1998)

Water Quality

More water was pumped from the aquifer than was recovered by the aquifer. This over extraction from the aquifer has resulted in drawdown of the groundwater with resulting intrusion of seawater and up-coning the underlying saline water. The major water quality problems are high salinity and high nitrate concentrations in the aquifer. Chloride concentrations in municipal wells in 1999 are shown in fig.4. The WHO drinking limit is shown by the red line.

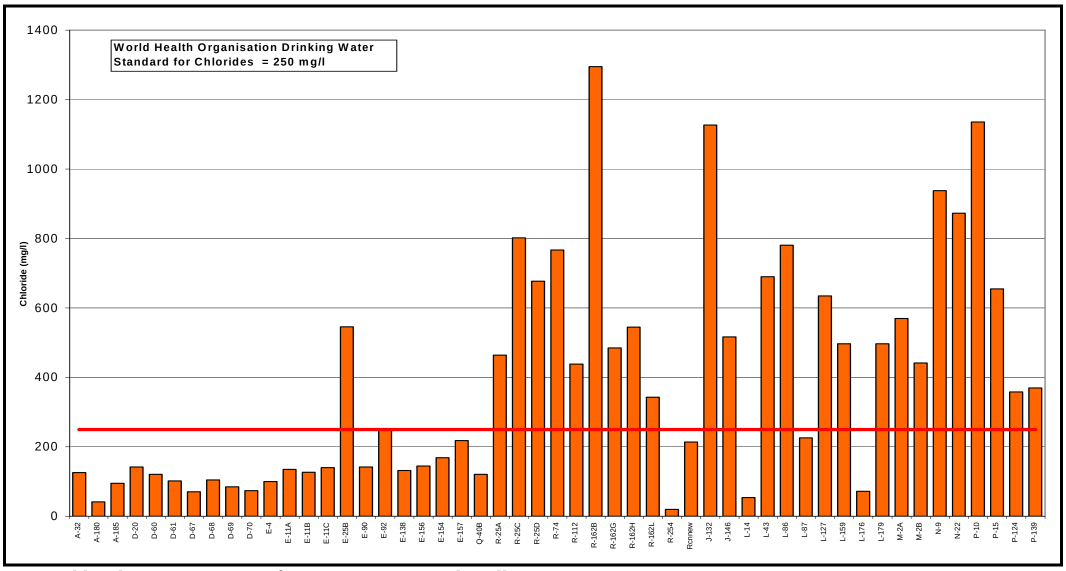

Fig.4. Chloride Concentration of Domestic Municipal Wells in Gaza

High levels of chloride in the groundwater cause high salinity in the water supply. Less than 10% of the aquifer's yield is water meeting the WHO drinking standard. Some agricultural are currently reporting salinity levels of more than 1200mg/l. Sources of high chloride content have been determined to be; sea water intrusion, lateral flow of brackish water from east in the middle and southern area and up-coning of the brine water from the base of the aquifer. Seawater intrusion and uplift the deep brine water are the direct consequences of over pumping, and represent the greatest threats to municipal and agricultural water supplies in the Gaza Strip. The lateral inflow of brackish water from the east is believed to be groundwater from the Eocene age rocks that underlie the coastal aquifer in the east and is therefore of natural origin.

Most municipal drinking wells in Gaza show nitrate level in excess of the WHO drinking water standard of 50 mg/l(fig.5). In urban centers nitrate concentrations are increasing at rates up to 10 mg/l per year. The main sources on are domestic sewage effluent and fertilizers. In contrast to salinity, groundwater flowing from east has relatively low nitrate levels.

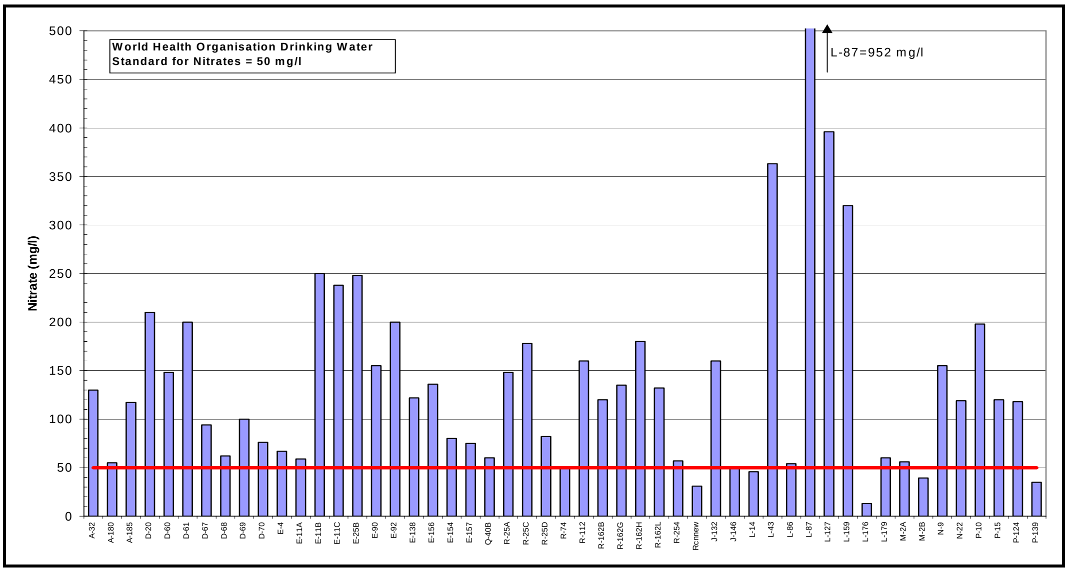

Fig.5. Nitrate Concentration of Domestic Municipal Wells in Gaza

Future Water Demands:

Mainly the population growth and socio-economic development control water demand for the different uses. The annual population growth rate in Gaza was recorded at 5.9and 6.8% between 1980 and 1996, by which time Gaza had a population of 963,000 inhabitants.

Based on Palestinian Central Bureau of Statistics census (PCBS) Dec 1997, Gaza population was recorded at 1,020,080. Using a conservative growth rate of about 3.5% and assuming an influx of 50,000 returnees by 2010, the estimated population in 1999 was slightly over 1,100,000 and forecast population of 2,140,000 by 2020. This means that population is expected to be double after 20 years.

In 1999, it was estimated that a proximately $140x10^6m^3/y$ of water was pumped from about 4000 wells. Of which, about $90x10^6m^3/y$ of water uses was used for irrigation and $50x10^6m^3/y$ were pumped for domestic and industrial from 90 municipal wells.

The World Health Organization (WHO) recommends an average of 100 liters per capita per day (l/c/d) as a minimum standard for individual water use. In 1999, it is estimated that 80 l/c/d were actually made available to consumers. On the other hand, only about 13 l/c/d meet WHO quality standards. As social development occurs, the demand for water will increase to meet the average WHO recommendation of 150 l/c/d in future years.

These facts make it evident that the Gaza Coastal Aquifer is in extreme danger of becoming unusable for drinking water and irrigation. Over exploitation of the aquifer has resulted in salt-water intrusion and continuous decline in groundwater levels has been observed in most of the areas of Gaza Strip since mid-1970s. The ability of the aquifer to sustain life for the increasing population and a basic agriculture industry will be destroyed in twenty years if no action will be taken.

Domestic and Industrial Water Demand (D&I)

Population growth, the changing water needs of households and industry and changing demands of agriculture will shape in the future (D&I) water demand.

The projected (D&I) demand for the next 20-years is graphically presented in Fig.6.

The D&I demand include net demand for domestic, industrial, public customers and livestock water supply. Water losses through transmission pipeline and water distribution system are included. Therefore, D&I demand presents quantity of water at water supply source that should be delivered to the D&I customers. It is clear that the total D&I water needs will reach to about 182mcm by 2020 assuming an overall efficiency of water distribution of 20%.

Agricultural Water Demand

If the demand for irrigation is calculated on the basis of the food requirements of the growing population, it appears that it will increase from the present usage of about 90 $x10^6m^3/y$ to $185x10^6m^3/y$ by2020. However that figure is not realistic projection for Gaza, because neither the water nor the land to support an increase in agricultural activity exists. Fig.3 illustrates the continuing trend in decreasing the agricultural water demand reflecting the decrease use of both irrigated and rain fed agricultural land area in Gaza.

That is occurring as result of the growth of urban areas, which expand onto agricultural land. This encourages farmers to bring what had been marginal land into production. It also means that farmers are turning to more intensive methods of agriculture, which require expensive inputs. In general, there is a trend to select crops of less water needs.

Generally, the overall water demand in Gaza Strip is estimated to increase from present of about $145x10^6m^3/y$ to about $260x10^6$ m^3/y in 2020, as shown in Fig.6. This includes D&I demand at water supply source and agricultural demand.

The effect on the water balance in the aquifer without any water resources management is dramatically illustrated in Fig.7. The figure shows that the water deficit will reach to about 100mcm/y by year 2020. The results will be continuing water level decline and water quality deterioration through seawater intrusion and saline water up coning.

Palestinian Water Resources Policy

Water resources must be developed and managed efficiently in order to meet present and future water needs, in an environmentally sustainable way. Wastewater reclamation and reuse, desalination and storm water recharge together with renewable aquifer capacity will provide quantity of the water that would satisfy water demands in the Gaza Strip for the next 20-years. However, comprehensive aquifer protection is necessary to maintain its sustainable capacity. Certain aspects of water demand management and water quality management should be considered to support management of the aquifer at its sustainable capacity.

The Palestinian Water Authority (PWA) has considered the following three principal objectives for sustainable water resources management:

- Provide quantity and quality of water for domestic purpose in compliance with WHO standards

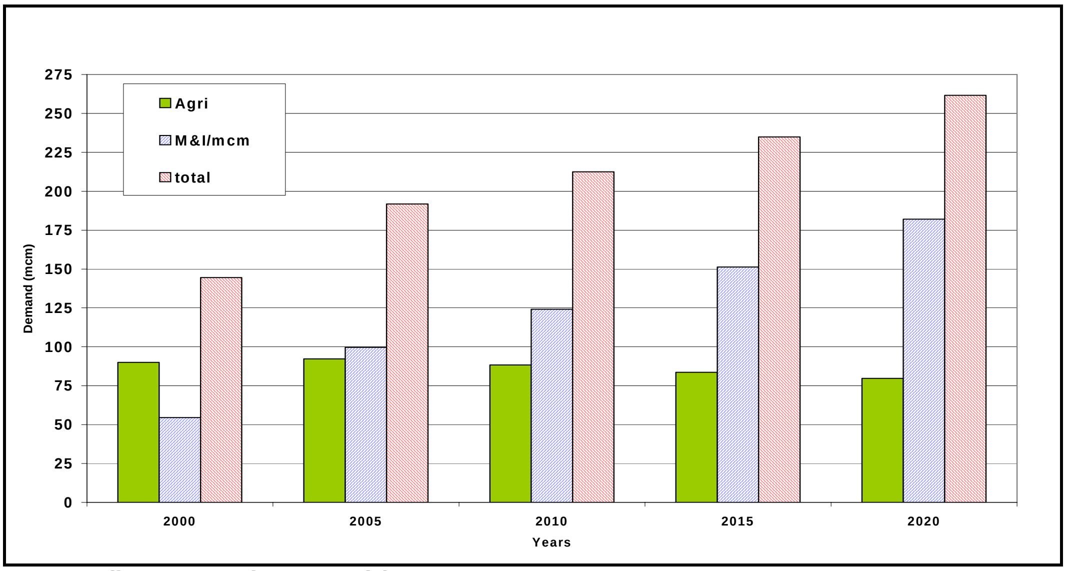

Fig.6. Overall Water Demand in Gaza until the Year 2020

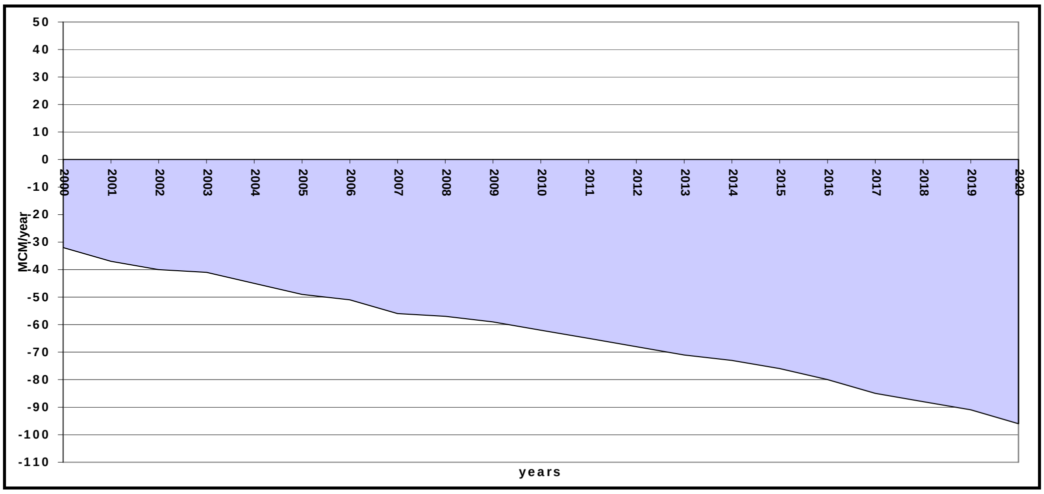

Fig.7. Overall Aquifer Balance without water resources management

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- Supply adequate quality and sufficient quantity of water that is required for the planned agricultural production in Gaza Strip.
- Managing the Gaza Coastal Aquifer at its safe yield and preventing further deterioration of the aquifer water quality.

Accomplishment of those principal objectives is based on the following fundamental promises:

- Reclamation of wastewater and maximum use of the reclaimed water for agriculture.
- Introduction of new water resource(s) into the Gaza Strip water sector as soon as possible to meet the projected water demands.
- Improve pumped groundwater quality needed for domestic use by desalination facilities.

The aquifer must remain the backbone resource for supplying water to the Gaza Strip. Over-drafting has led to a dramatic deterioration in the aquifer's water quality and immediate limits must be placed on extraction. In addition to meet the increased overall water demand and to reverse the process of saltwater intrusion, sustainable quantities must be added to the water cycle and wastewater should be used to the extent feasible.

Successful implementation of those issues will be able to maintain water balance and prevent further deterioration of the aquifer. In parallel, clear and precise legislation and strict water sector implementation policies are must for successful implementation.

Wastewater Reuse

Reclaimed water is a potential valuable water resource. All wastewater in the Gaza Strip should be made available for direct irrigation as needed or recharge into the aquifer during the off-season. Three regional wastewater treatment plants will be constructed in Gaza Strip in stages to reach capacities of about 120mcm/y in year 2020.

It is becoming evident from on-going model simulation that to protect the aquifer, pumping in the Gaza Governorate in particular must be severely restricted to prevent further rapid seawater intrusion. Given the future demands of population, priority must be given to municipal wells, which will require the staged closing down of many agricultural wells. To achieve the goal of maintaining an agricultural sector, irrigation water from other sources must be provided to replace groundwater. The reclaimed water can be distributed directly from the regional treatment plants to the farmers when needed for restricted crops. Therefore, its quality (class -C) must be established to satisfy the requirements of agriculture, both economic and cultural to encourage its acceptance by farmers. During the winter seasons the reclaimed water would be stored in the aquifer through the infiltration basins and can be reused by agriculture through recovery wells, particularly in the dry seasons. By that process the treated wastewater would be purified and filtered as it passes down to the aquifer and moves laterally to the recover wells to allow unrestricted use of crops and export (Tertiary class-D). In the other word, because the agricultural demand varies seasonally, while the municipal supply remains nearly constant, storage is needed for the water produced during low demand periods. This goal of options assumes that the peak agricultural demand for reclaimed water exceeds the supply, which is true only if the wastewater is of a quality that can be used on most crops.

Recovery of water and distribution back uphill to the agricultural areas will therefore require an extensive distribution network and considerable pumping energy and facilities.

It has been estimated that about 75% of the water used in irrigation are lost to the aquifer through evaptranspiration. Therefore, more efficient use of water for irrigation by encouraging the use of drip-type irrigation system wherever possible. Farmers should be educated on the need to conserve water by efficient management of the open-channel type irrigation for certain crops. The quality of the reclaimed water for irrigation must meet the

demands of modern irrigation systems, which require some level of filtration to remove solid particles that can clog emitters.
With the assumption of efficient comprehensive wastewater management in terms of the reuse of reclaimed wastewater for agriculture and recharge the surplus wastewater into the aquifer, the proposed water balance will be improved relatively and the total water deficit will be of about 45mcm/y in 2020 (Fig.8).

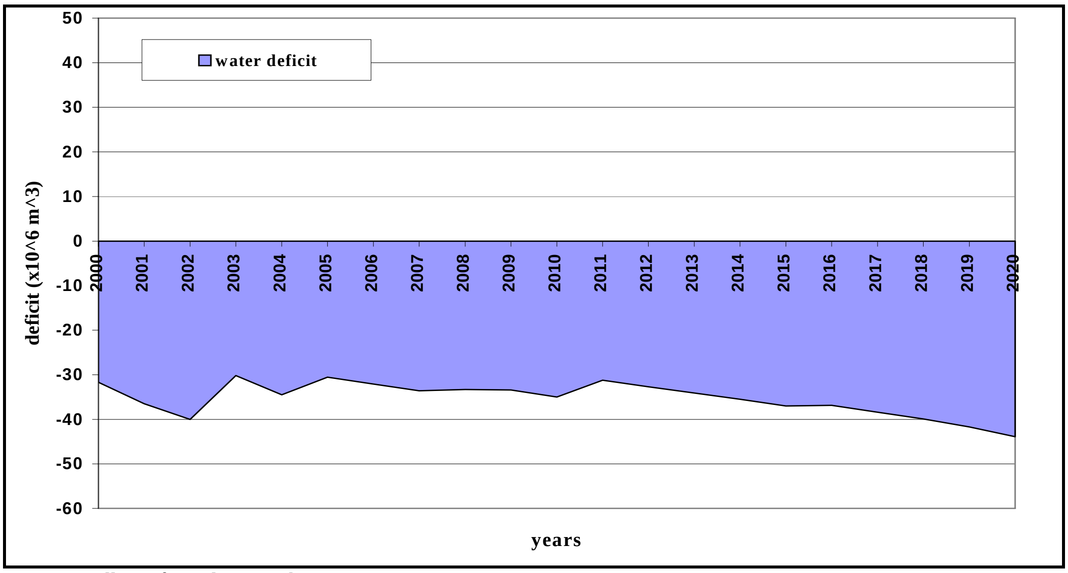

Fig.8.Overall aquifer Balance with Wastewater Reuse

Small improvement in the aquifer balance will occur because of the recharge of treated wastewater as well as reuse by 2002/2003 as planned. The continuing increase in demand will continue to reduce the balance. The result will be continuing seawater intrusion which will ultimately result in the salinity in the aquifer precluding the consumption of groundwater either by D&I or agriculture users without adding new water to the system.

To encourage the switch to using reclaimed water, metering of agricultural wells and implementation of different tariffs of the volume water extracted are recommended. In order for the agricultural sector to become more able to bear tariffs, the small farm must become more profitable. Thus the future for a sustainable agricultural sector in the Gaza Strip, given the pressure on land, will be a continuation of the trend from citrus and olive crops into more intensive value-added crops such as table vegetables and strawberries. Regional standards for wastewater to irrigate these crops must be achieved to permit safe consumption of the crops in the Gaza Strip and their export to regional markets.

New Water Resources

In order to maintain the water balance to the positive condition and to fulfill the domestic water demand in terms of quality and quantity, a new water resources should be introduced into the Gaza Strip water sector as soon as possible. Those new water resources will relief stress on the aquifer and prevent further deterioration of its water quality.

Many alternatives have been examined to minimize the water deficit and fulfill domestic water demand, but seawater desalination has been identified as the most realistic option. Following this concept large scale seawater desalination plant with four different production phases is proposed as follow:

- Phase-1: 60,000 m^3/d, in operation by 2004
- Phase-2: 60,000 m^3/d, in operation by 2008
- Phase-3: 20,000 m^3/d, in operation by 2014
- Phase-4: 10,000 m^3/d, in operation by 2017

Total desalination capacity will be by about 150,000 m^3/d (~$55x10^6$ m^3/y) by 2020.

The total seawater desalination quantity in conjunction with the brackish groundwater desalination, Mekerot water supply and beach well desalination plants will be able to cover completely the domestic water demand (D&I) and consistent with WHO guidelines in terms of quantity and quality.

With the option to construct large seawater desalination plant as described earlier (as new water resources), the aquifer over drafting will decrease. As a result, it is expected that seawater will be pushed back (transgression) toward the sea preventing further deterioration of the aquifer water quality. Ultimately, an approximation of about 10mcm/y-aquifer water surplus will be maintained starting by year 2008 as shown in Fig.9.

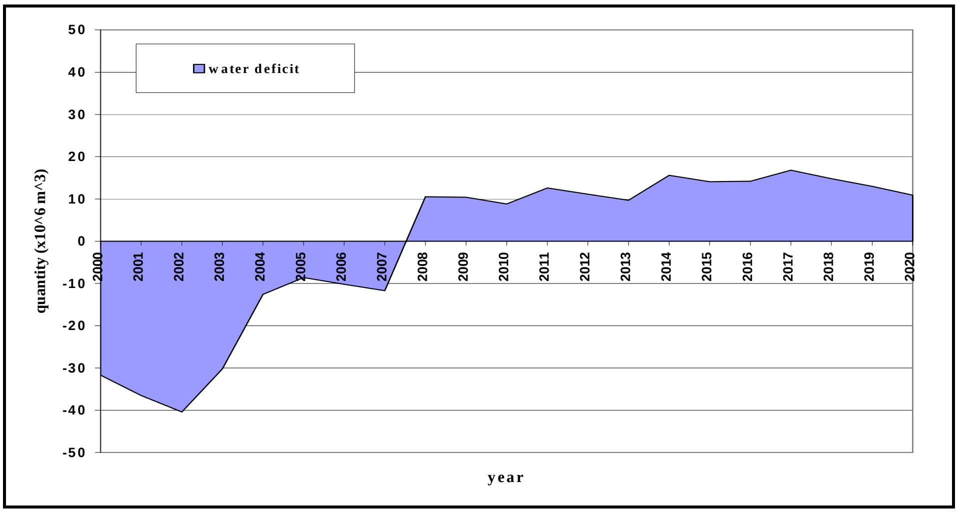

Fig.9.Overall Aquifer Balance with New Water Resources and Wastewater Reuse

The figure shows the improvement beginning when the first phase of the regional desalination plant comes on line in 2003/2004 and the positive balance achieved in 2007/2008 as the second phase of the desalination plant is brought into service. Additional smaller phased additions in 2014 and 2018 will succeed in maintaining the positive head of 10mcm/y required to keep seawater at bay during the planed period until 2020 despite the growing demand for water. However the downward trend in the balance indicates that additional "new" water must be added to the Gaza Strip water cycle after 2020 from other sources that may become available.

Model simulation of the water balance achieved by implementation wastewater reuse in efficient and comprehensive manner and with adding new water to the aquifer system there will be a recovery of groundwater level in the aquifer and consequent stabilization of intrusion in most areas of the Gaza Strip (Fig.10). The positive hydraulic head will in future reduce present and future intrusion by seawater and deep brines.

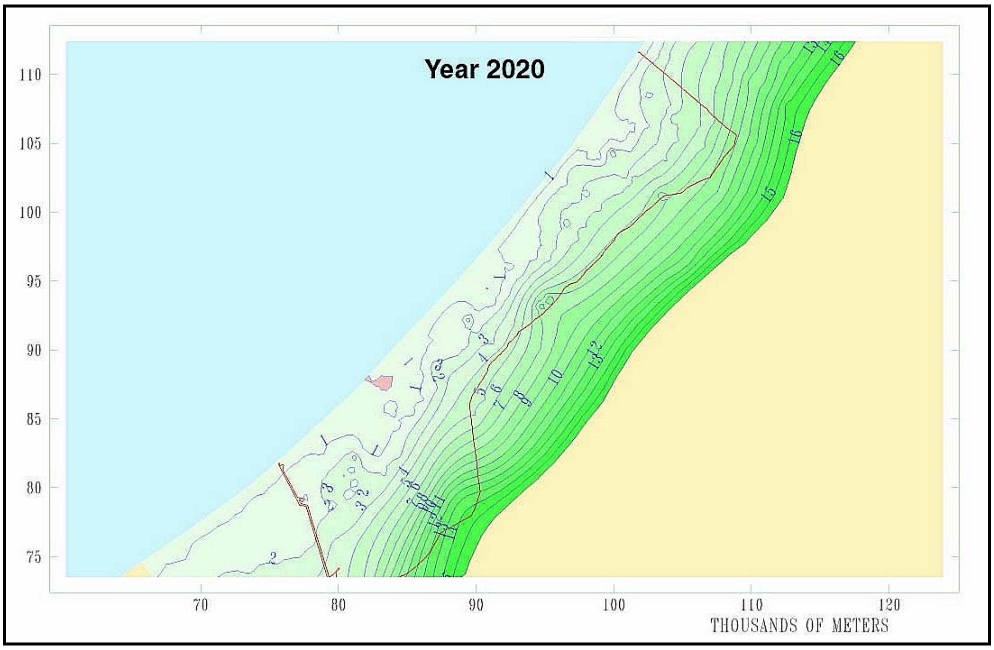

Fig.10.Simulated 2020 Water Level Contour with Implementation of Wastewater Reuse and Adding New Water to the Water Cycle

Cost Estimate

Costs for construction and for operation and maintenance of the different components of the water resources management plans that discussed before have been estimated for the next 20-years. The needed capital investment for the water sector including water resources development, water supply, water conservation and wastewater collection, treatment and reuse were estimated in yearly base with a total of about US$ 1500 million (Fig.11). While the total of operational and maintenance cost has been estimated at about US$ 90 million (Fig.12).

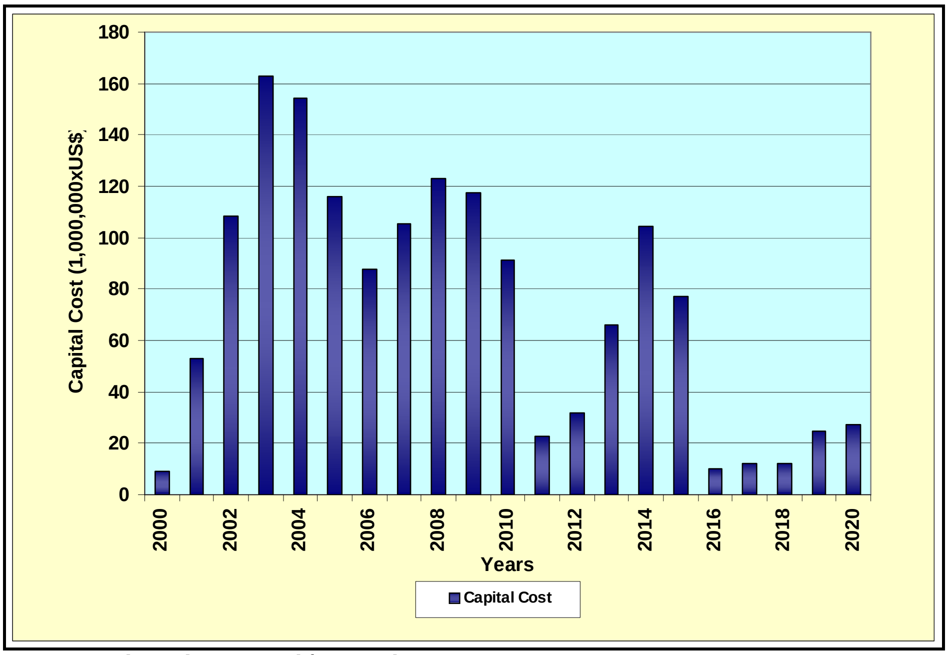

Fig.11. Annual Spending Required for Capital Cost

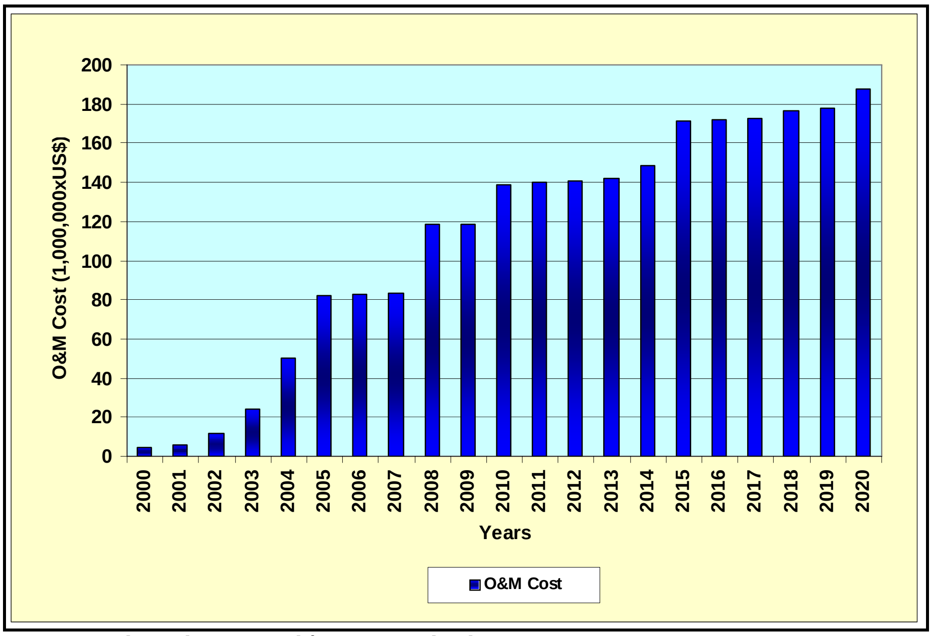

Fig.12. Annual Spending Required for Operational and Maintenance Cost

Sustainability

Sustainability of the water, wastewater and agricultural reuse water systems is a primary goal of PWA. To make these systems sustainable, there must be:

- Sufficient funds collected to recover costs: operations and maintenance, administration, depreciation and debt service.
- An organization of qualified personnel to operate, maintain, administer and manage all functions related to delivering the service.
- Appropriate legal authority for the operating organization.

The absence of any one element can lead to gradual deterioration of the effectiveness of service delivery to the users of the systems. A strong regulatory body is also necessary to protect the users from abuse of the powers and authorities of the operating organization. The regulator has three specific rules:

- Assure that the public has sufficient resources of money and a qualified workforce.
- Assure the public utility is charging the least price that will enable the utility to deliver the service.
- Assure that the utility is effectively delivering the service to the users.

Implementation of the recommended management plan will require sustainable sources of revenue for the operating organization(s) delivering water supply, wastewater collection and treatment, and delivery reclaimed water for agricultural irrigation. The sustainable level of tariff for cost recover includes sufficient funds to pay for operations and maintenance, system management and administration, depreciation or rehabilitation reserve, and repayment of debt.

Tariff structures and levels should be developed and approved so to eventually recover all costs of water services. Tariff levels and structure should be reviewed periodically whenever public policy regarding water is adjusted.

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الإدارة المستدامة لمصادر المياه في الخزان الساحلي لقطاع غزه / فلسطين

أحمــد ســعيد اليعقـــوبي

سلطة المياه الفلسطينية – قطاع غزه – فلسطين

يقع قطاع غزه نهاية الخزان الساحلي والذي يشاطئ البحر الأبيض المتوسط من الناحية الجنوبية الشرقية. لـيس هناك وفرة من الأمطار أو الأودية السطحية وان سكان قطاع غزه البالغ عددهم ما يفري من مليون ونـصف نـسمة يعتمدون اعتمادا كليا على المياه الجوفية القليلة المتوفرة في هذا الجزء من الخزان الساحلي الذي يقع ضمن قطـاع غـزه وبمساحة كلية حوالي 365 كم^2. وكنتاج طبيعي للاستتزاف الجائر للخزان الساحلي فان منسوب المياه الجوفيـة قـد انخفض إلى معدلات عالية وتدهور نوعية المياه. والمشاكل الأساسية التي أدت إلى هذا التدهور هو اندفاع المياه الأكثـر ملوحة من الطبقات السفلى وتداخل مياه البحر. هناك مشكلة تدهور نوعية مياه الخزان الساحلي في قطاع غزه حيـث انه اقل من 10% من المياه الجوفية المنتجة تتوافق ومواصفات منظمة الصحة العالمية لأغراض الشرب.إن تعـداد سـكان قطاع غزة سيصل إلى حوالي مليوني نسمة مع حلول عام 2020، وان الاحتياجات المائية ستفوق بصورة كبيرة قـدرة الخزان الجوفي. وان التطور العمراني والصناعي المستقبلي سيزيد من الضغوط على الخزان الجوفي مما يلزم معـه ضـرورة التخطيط والإدارة المتكاملة لهذا المصدر. ولا شك فان هناك إجراءات هامه يلزم أخذها بعين الاعتبار وبصورة سـريعة لضمان المحافظة على ديمومة واستمرارية عطاء هذا الخزان لسد احتياجات المواطنين من المياه سواء للأغراض الزراعيـة أو الآدمية.وإدراكا من سلطة المياه الفلسطينية لحجم هذه المشكلة المائية في قطاع غزة، فقد قامت بالتعاون مـع الوكالـة الأمريكية للتنمية (USAID) بتنفيذ دراسة لإدارة مصادر المياه في هذا الخزان بصورة متكاملة.

وهذا البحث يلخص بصوره كامله خطوات إدارة مصادر المياه حتى عام 2020 مع بيان حجم الاسـتثمارات المطلوبة والتي قدرت بحوالي بليون ونصف دولار لتنفيذ هذا المخطط. وخلال الدراسة تم عمـل جميـع الدراسـات الهيدروجيولوجية اللازمة للخزان الجـوفي وعمل نماذج رياضية سواء كانت الخاصـة بالسريـان أو بالتلوث. وقـد أوصت الدراسة انه مع تنفيذ خطة إدارة الخزان الساحلي المتكاملة سيكون له انعكاسات ايجابية على الخزان الـساحلي والحد سواء من تداخل مياه البحر أو اندفاع المياه المالحة السفلية.