Environmental Assessment of Safe Drinking Water Supply Systems in the Rural Communities within the Nile Delta Region

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Abstract

Safe, clean drinking water and sanitation are a human right. Improved drinking water for human consumption should be free from pathogens such as bacteria, viruses, protozoan parasites and chemical contaminants to meet biological, physical and chemical criteria. However, inadequate sanitation, waste treatment and disposal are responsible for pollution of water resources. The large proportion of the population in developing countries, especially in villages where there is no safe drinking water supply and suffering from water-borne diseases, especially diarrheal diseases. Egypt has made significant progress in terms of direct access to safe drinking water at the household level (92.4%) and basic sanitation (92.9%). Unfortunately, there are many rural villages in Egypt that are still dependent on water delivery and waste disposal systems are outdated, unhealthy and therefore unsafe, and as a result, the situation with regard to safe drinking water. The objective of the research is to assess the water supply especially by hand pump system in rural communities within the Nile Delta region in order to protect the water quality at the hand pump. Also highlights the areas that have a problems related to the bad sanitary conditions around hand pumps used for drinking purposes in urban and rural areas through monitoring the deep and shallow wells near to sanitation systems may affect by it . The selected governorates are: (El Sharkya – El Menofya and El Gharbia). Laboratory analytical procedures will include chemical, biological, and microbiological, these analyses will carried out on a number of up-to-date and fully automated analytical instruments that are capable of handling large number of environmental parameters. A socio economic survey will implement from the three governorates will study by Meetings (local community, students, women, and men), Formulation of an action group, and Questionnaire-based analyses. It concluded that rural communities within the selected pilot areas provided with an environmentally safe, socially accepted, and sustainable water supply source through shallow ground water hand pumps. In addition, public awareness within the pilot areas rural communities improved regarding the environmental aspects and safety protection measures for the hand pumps installed on the top of shallow groundwater wells.

Keywords: Water and Health, Water Borne-Diseases, Hand Pump in Egyptian Rural Areas, Safe Drinking Water Supply system.

1. Introduction

In Egypt, the percentage of population serving water supply and sanitation is generally higher in urban areas than in rural areas. About 20 per cent of Egypt’s total population lacks access to safe drinking water supplies. In those communities that do not have access to water supply, the main source of fresh water supplied is from shallow hand pumps that may contaminated by poor protection. On the other hand, 23 per cent of the urban population and 74 per cent of the rural population have no access to public sewerage systems or disposal of health waste.

This situation makes domestic waste a source of widespread proliferation Microbiological contamination of shallow groundwater prevails in those villages that lack adequate means of collecting sewage. This resulted in raw sewage and leachate infiltration into groundwater from cesspits. Microbiological contamination is responsible for water-related diseases such as typhoid, infectious hepatitis, cholera and diarrhea. Other sources of pollution stem from agricultural and industrial activities that cause chemical contamination of groundwater. Chemical contamination poses cumulative and chronic health risks. The relationship between water and human health is clear, and in many cases, pollution recognized only after groundwater users exposed to potential health risks. Water contact and ingestion are major causes of health risks and diseases in Egypt. Despite significant improvements in health services, infant and child mortality remains high.
The vital importance of groundwater for human wellbeing and ecosystem integrity is obvious. For many years, it thought that layers of rock and soil, which act as filters, naturally protect groundwater from pollution, but contaminants do not reach their groundwater and affect their quality. Unfortunately, it seems that we can no longer take high quality ground water for granted.

An increasing number of soluble chemicals are now a threat from urban and industrial activities and from modern agricultural practices. These chemicals not completely removed by filtration as groundwater passes through the aquifer. The quality of groundwater can affect not only our health but also society and the economy; moreover, once pollutants enter the aquifer, environmental damage can be severe and long-term.

Groundwater protection approaches mainly involve intervention by raising social awareness through community participation and education. Awareness and appropriate action by community groups needed where public participation processes can greatly improve public understanding of the need to protect groundwater. This will result in the adoption and implementation of actions and measures to develop through project activities. The deterioration of water quality in Egypt can assessed in terms of water-related diseases such as typhoid, infectious hepatitis, cholera and diarrhea in infants and children. Despite significant improvements in health services, infant and child mortality remains high. Surface water pollution from human waste continues to prevail in rural areas. This reflected in the spread of schistosomiasis (Bilharzias). In addition, contaminated water has introduced a number of aquatic habitat diseases transmitted by disease vectors. Water contaminated with heavy metals and explosive can have a negative impact on humans, animals, fish and crop production. Although the fight against water pollution has begun, Egypt faces enormous development challenges:

- The population plays a fundamental basis in the questions of water availability, use and quality in the future. In the last 30 years, the population has doubled from 33 million in 1965 to more than 61 million in 1997 with an average annual growth rate of 2.1 per cent, far exceeding the growth of municipal services;
- Biological and chemical pollution of surface and groundwater is a growing problem. Thus, available water is at risk because of water pollution, so public health is at risk.

The recharge of the Nile Delta water layer occurs mainly through direct leakage from irrigation channels and banks. In the central and southern parts of the Nile Delta flood plains, leakage to groundwater is between 0.25 and 0.80 mm / day (RIGW 1980). In desert margins, high leakage rates of 1.25 mm / day recorded for basin irrigation while rates of 0.1-0.5 mm / day were low for drip irrigation (RIGW 1980). Groundwater discharged through four components: flow to the drainage system, direct evaporation, and extraction of groundwater from groundwater. The discharge of groundwater into the drainage system in the northern parts of the delta occurs through an upward leakage at a daily rate of 0.2-0.9 mm/day (RIGW 1980). Groundwater discharges can occur through evaporation in lowlands with a shallow groundwater table. In Wadi Al Natroun, Depresses, Lakes and Sebhons, groundwater naturally discharged by evaporation. The flow of groundwater is a small component of discharge, which occurs between the aquifer in the Nile Delta on the one hand, and the seductive groundwater and the Natroun Valley on the other.

In 2003, the annual extraction rate was 0.9, 2.0 and 0.6 in the 3 regions of the delta, RIGW (2004). From the above, it is clear that the extraction of groundwater has been increasing annually since 1981 in a linear manner of 0.1 billion cubic meters

### Water-related Health Hazards

Water-related diseases may already transmitted in four different ways:

- Water-borne, especially through water used by people as drinking water (cholera, typhoid, infectious hepatitis, diarrhea and dysentery).
- Wash water, using an insufficient amount of water for personal and household hygiene.
- Water-based path, through nurses spending part of their lives in aquatic animals (Belharzias)
- Insect vector (malaria, sleep sickness and river blindness).

The impact of water quality and sanitation on child health and mortality in Egypt is limited. S.K. Ashour & M.E. Ahmed (1994) Study in urban and rural areas randomly selected in Dakahlia governorate in Lower Egypt and Sohag governorate in Upper Egypt. About 1,000 women interviewed in the study areas. Using logistic regression, the risk of diarrhea found to be high
among children whose families disposed of waste near home or in surface water. The risk of diarrhea has decreased with family ownership of the land, maternal knowledge of the symptoms; causes of diarrhea and prior use of oral rehydration therapy.

The Ministry of Water Resources and Irrigation (MWRI) is formulating water quality priorities and strategies for the Ministry of Water Resources and Irrigation. In priority setting criteria, the Task Force has declared, health is the highest priority for all agencies operating in the water sector. The priority areas identified as the largest urban clusters in the country, where the high levels of bacterial and chemical contamination encountered in densely populated areas increase the chances of communication between health risks and population. The Nile River not seriously polluted to create a health hazard, with the exception of the Nile Delta, which exhibit high levels of pathogens and toxic substances. The drainage system in Egypt is becoming a matter of high concern. High priority areas are:

- Within the Eastern Delta: Greater Cairo and Greater Mansourah,
- Within the Middle Delta: Tanta, Mansourah, Mahalla and Samanoud,
- Within the Western Delta: Greater Alexandria.

2. Materials, Methods, and Discussions

2.1. Research problem

The problem of pollution, health and environmental hazards in rural areas of Egypt is the discharge of most of the sewage in rural areas to the environment with little or no treatment. The number of wastewater treatment plants in rural areas may not exceed 500, while the total number of villages exceeds 5,500. A large number of state-funded village sewage systems collapse without the construction of treatment facilities to solve the pressing problems of street and home areas. Public sewerage, compared to 37 per cent in rural areas, covers an estimated 89 per cent of households in urban areas. Only 6% of Egyptian villages provided wastewater treatment services (UNICEF / WHO, 2011). Children in rural households are more likely to have 8.5 times more time than their urban counterparts with no toilet facilities, and approximately 10% of households in rural areas use shared toilet facilities (UNICEF / WHO, 2011). An unspecified number of villages, especially in high water areas exposed to these types of wastewater, have used self-help to solve their problem by installing informal sewage on a family or neighborhood or where sewers are discharged Public to agricultural banks, but may discharge Informal organization to banks or channels. The problem of sanitation in modern rural areas in Egypt in general and especially in villages is that population growth, scarcity of water, and expansion of the residential area make wastewater disposal points closer to water points.

Table 2 Annual average of water pollution indicators in Nile River in some governorates (2004–2013)

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Regarding drinking water supply utilizing hand pumps within different areas in the Delta Region. In order to protect the water quality at the hand pump. Also highlights the areas that have a problems related to the bad sanitary conditions around hand pumps used for drinking purposes in urban and rural areas through monitoring the deep and shallow wells near to sanitation systems may affect by it. The selected governorates are: (El Sharkya - El Menofya and El Gharbeya). Laboratory analytical procedures will include chemical, biological, and microbiological. These analyses will carried out on a number of up-to-date and fully automated analytical instruments that are capable of handling large number of environmental parameters. A socio economic survey will implement from the three governorates and studied by Meeting’s (local community, students, women and men), also, formulation of an action group, and questionnaire-based analyses. Based on these various implemented activities within this research, several outputs produced that can be listed as follows:

- Identification of demonstration sites where hand pumps and groundwater affected by pollution from septic tanks & surrounding drains.
- Public awareness on the relation between water and human health.
- Suggest mitigation measures

**Expected Outputs**

Several outputs, expected as follows:

- Improve national informational experience for shallow groundwater pollution and social behavior regarding drinking water supply utilizing hand pumps within different areas in the Delta Region.
- Development of sustainable scientific applied and environmentally sound procedures for shallow ground water hand pumps within the Delta Region.
- Public awareness within the pilot areas rural communities improved regarding the environmental aspects and safety protection measures for the hand pumps installed on the top of shallow groundwater wells.

### Table (2) represents the annual average of water pollution indicators in Nile River in some governorates (2004-2013), and it is highlighted the water pollution indicators in El Gharbia and El Menoufia.

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Note: The allowed limit for the following:

(DO) Dissolved Oxygen: must be not less than 5 milligram / liter

(BOD) Biological Oxygen Demand: must be not more than 6 milligram / liter

(COD) Chemical Oxygen Demand: must be not more than 10 milligram / liter

(TDS) Total Dissolved Salts: must be not more than 500 milligram / liter

Source: Environmental Observatory Center - Ministry of Health & Population

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2.3. Research implementation process

2.3.1. El-Sharkya Governorate Data Collection and Analysis

El-Sharkya Governorate is located in the northeastern part of Egypt and in the eastern part of the delta region, with an area of 4911 km², equivalent to 1169285 feddans. The population of the Governorate is about 53,4058 capita, and it is the third governorate in terms of population. Its population is 23% urban, 77% rural, and the cultivated area is 8240098 feddans. Figure 1 represents the geological map of El-Sharkya Governorate.

Figure 1: Geological map of El-Sharkya Governorate

Surface water plays a major role in influencing the distribution and quantity of groundwater in El-Sharkya Governorate. It bordered by the Damietta Branch in the west, the Manayef Canal in the north, the Sea of Mois, the Sea of Faqus and the South of Ismailia Canal. Semi saline water represented in the bank of Bahr al-Baqr and to the north in the bank of Al-Muhassam. The salt water is located to the east of the province, namely the Suez Canal, Lake Marsa and Lake Tamsah, Lake Manzala at the north. Figure 2 shows the surface water in El-Sharkya Governorate.

El-Sharkya Governorate depended on groundwater as an integral source of drinking water and other daily uses, and not considered a major source of irrigation water. Through the geological information of drilled wells in the governorate, a range of hydrogeological cross sections been carried out in different directions. These sectors have shown that Quaternary Aquifer is the main reservoir of the governorate. Its thickness ranges from 30 to 250 m with an average capacity of 120 m. The bottom of the Lower Miocene aquifer is located mainly in the southern part of the governorate. The structural map shows that the southern part includes several plains that take the northeast direction and north-west, with the lower slope in the north, east and west directions. Figure 3 represents a cross section showing the subterranean rock sequence.

Figure 2: Surface water in El Sharkya Governorate

As for sanitation, the problem lies in the lack of access to sanitation services for many villages. For industrial drainage, the problem lies in the absence of industrial wastewater treatment plants in some facilities, which have been disposed of on the ground. This may negatively affect the environment. The canals and banks in the governorate, which has shown a great deterioration due to pollution of many pollutants, including sewage, agricultural and industrial waste, there are several programs to cleanse and maintain. As for the agricultural banks have deteriorated due to the abuse of sewage due to the lack of access to sanitation service for many villages and cities in the governorate and there are some governmental efforts to deliver the sanitation service to some villages.

Meet El Ezz – Faqous Village - El Sharkya Governorate

It has been visiting different areas in El Sharkya governorate, including the village of Meet El Ezz –
Faqous. We met the manager of local unit of Faqous and it shown that the village used drinking water from the station Al Abash, as it is one of the largest stations in the Delta. It has proposed drilling water wells is online to feed the village in case of shortage of water from the station Al Abash. The committee decides to search in other villages, which are in bad need to safe drinking water.

Figure 4: Map of Delta Egypt-Map of El Sharkya Governorate

Figure 5: Map of Saft drain–Photos of Meet El Ezz Village

El Haswa and Awlad Moussa Village – Abou Kbeer – El Sharkya Governorate

It has been oriented to El Haswa and Awlad Moussa Village – Abou Kbeer – El Sharkya Governorate and found that the people in the village Awlad Moussa transported water from different places and it found that the quality of water was very bad and really needs another source of water. There was an old well with a depth of about 70 meters at village El Ghaba – El Sharkya Governorate and the water quality for this well is not fit for human consumption. Therefore, it decided to drill a well with depth more than 150 meter to serve the area of Meet El Haswa and Awlad Moussa villages. In addition, it has been taking water samples for chemical analysis, as well as full bacteriological analysis at central laboratory for environmental quality monitoring NWRC, MWRI. Figures (7, 8, 9, 10, and 11) represent the water quality analysis through (2014-2015) for water samples of different sites in the village for deep and shallow wells near to sanitation points. The quality analysis show that most of the samples meet the WHO, Law 108 for year 1995 unless in some places as shown in the water analysis figures.

In the search for alternative sites, it was visiting the village Basateen Barakat – Belebes – El Sharkya Governorate. Moreover, taking water samples for analysis to identify the water quality and then determines the need for drilling wells. The results of the analyses show that the water quality is good and identical with the general criteria for drinking water.
2.3.2. El-Gharbeya Governorate Data Collection and Analysis

A survey was done in El-Gharbeya Governorate, and collect a data from a local unit of the village Nahtai and

Figure 6: Map of faqous Village – Map of Haswa Village

Figure 7: Water analysis for wells at El Sharkya Governorate July 2015

Figure 8: Water analysis for wells at El Sharkya Governorate March 2014

Figure 9: Water analysis for wells at El Sharkya Governorate June 2015

Figure 10: Water analysis for wells at El Sharkya Governorate 10June 2015

Figure 11: Water analysis for wells at El Sharkya Governorate Dec.2014
other villages including the village of (Kafr Aish (about 7 thousand people) and Kafr El Deeb, kafr Noway (about 10 thousand people), Kafr Shaheen (about 7 thousand people)) which need to clean waters. Figure 12 shows the map of El Gharbya Governorate, and layout of Zefta Village. Also, Figure 13 shows a layout of Nahtay Village, and ground water well at Nahtay. In addition, we visited (Kafr El Zaytoon) to study their needs. It the questionnaire at Kafr El Zaytoon reported that the drinking water source is underground water at Kafr Noway (4 wells - two of them not working at this time, the other 2 wells has been constructed since about 4 years to feed four villages) . For Kafr El Zaytoon the source of drinking water from underground wells from Riyadh well, but it linked to the village of Riyadh this result to decrease the water quality of Kafr El Zaytoon. It recommended implementing a well in this area. The population of meet el azz village not convinced with the groundwater to be a safe sources of drinking water because of previous problems linked to deterioration of water quality in shallow hand pump surrounding. A water samples collected from water wells and shallow hand pumps from this area. Figures (14, 15, 16, 17, and 18) represent the water quality analysis from the study area. And the analysis shows that the quality of these well especially with low depths suffer from water quality, and this area need to deep investigations to construct a wells with depths between 100-150m below ground water table to away from domestic and sanitary pollution.
2.3.3. El-Menofya Governorate data collection and analysis

The governorate of Menofya is one of the governorates of the Central Delta region. It is located in the middle of the delta between the two Nile branches (Rasheed and Damietta). Figure 19 shows El Menofya governorate map. The total area of El-Menofya Governorate is 2760 km². The governorate population is 3365057 inhabitants. Agriculture is the main activity of the governorate's population; a total cultivated area is 326046 feddans. The governorate also known for its variety of agricultural crops, vegetables and fruits. The industrial activity is currently one of the components of economic and social development. There are major industries such as spinning, weaving, iron, steel and ceramics. Many small industries that are unique to Menofya, such as the psoriasis industry and the silk carpet industry in the village of Saqiet Abu Shaara that exported abroad. The main sources of pollution in the villages are sewage waste, garbage, solid waste and industrial waste disposal. There is a relationship between environmental pollution and the number of people infected by environmental pollution, and the most important environmental pollutants sewage, which in turn lead to pollution of water, air and soil. All urban residents affected by air pollution but poor people the most affected because of the severity of these effects on people with poor health and because the poor have limited opportunities to protect themselves or to move to less polluted areas.

Figure 16: Water analysis for wells at El Gharbya Governorate July 2015

Figure 17: Water analysis for wells at El Gharbya Governorate June 2015

Figure 18: Water analysis for wells at El Gharbya Governorate March 2014

Figure 19: El Menofya Governorate Map

Drinking water service: The governorate relies on two main sources of water, surface water and groundwater, where the surface water rehabilitated to make it suitable for use through conventional purification plants with capacities ranging from 800 to 1000
m³/day. The number of stations is currently four stations in Shebin El Koum, Ashmoun, Monouf, and Tala with a total capacity of 36240 m³/day. As for the groundwater, it considered the main source of drinking water in the governorate, especially the rural areas. The total capacity of the stations that depend on groundwater is 281352 m³/day, equivalent to about 77% of the total available capacity. The sewage network covers all the cities of the governorate as well as some villages. The number of stations reached 65 stations serving the different governorate centers, including 43 stations currently operating and 22 substations under construction.

This increased the incidence of parasitic diseases, which eliminated by dealing with polluted water, increasing the incidence of liver diseases. With the medical academic community, a liver disease institute established at the regional level in the governorate. The highest percentage of liver diseases found in Menofya Governorate. The main reason for this is the pollution of the Nile water.

Surface water quality: Most of the canals that flows through the governorate have a good or fair water quality. Drains are highly polluted and have high amounts of pollutants, including types of industrial wastewater, oils and waste from floating Nile boats. In general, drains do not comply with surface water quality standards set out in Law 48 of 1982 and in many cases may pose health risks to the population as a result of possible contamination of pathogenic (bacterial and viral) waste from sewage. The most common diseases recorded in the governorate caused by water pollution such as (Cedifalpftifod).

Groundwater Resources: Groundwater is the main resource for water needed for industry and agriculture in the new urban areas away from the Nile such as the city of Sadat. In addition to the importance of withdrawal from the reservoir located in the delta areas, which has finally proved the rise of water level due to the change of the means of irrigation as well as increased the population activities in the Delta and increased the sewage disposal inside the reservoir. Table (3) represents the Salinity distribution in El Menofya Governorate and the volume of the two reservoirs in the area.

Table 3 Salinity distribution – El Menofya Governorate

<table>
<thead>
<tr>
<th>Type</th>
<th>Volume</th>
<th>Salinity PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nile Valley Reservoir</td>
<td>Thickness layer (100-200 m)</td>
<td>600</td>
</tr>
<tr>
<td>El Maghara Reservoir</td>
<td>Thickness layer (100-900 m)</td>
<td>500</td>
</tr>
</tbody>
</table>

Possibility of groundwater development: It been noted that the rates of pollution of the ground reservoir increased because of drainage problem, which led to increased pollution of agricultural drains. Therefore, there was a great interest in solving this problem, as the expansion of drinking water supply to the villages. A plan put to reduce the rate of leakage of sewage water into the groundwater by expanding the sewage networks, where the villages of the governorate completely covered. Salinity of this water reaches its lowest levels in the governorate of El Menofya, which is 320 ppm increasing as we go to the middle of the delta where it reaches 640 ppm and salinity increases to its lowest rate in the north where it reaches 45000 ppm. Table (4) represent the Salinity and Static water level at Menofya wells location.

Table 4 Salinity and Static water level at Menofya Wells Location

<table>
<thead>
<tr>
<th>Well No.</th>
<th>Location</th>
<th>Static Water Level (m)</th>
<th>Salinity PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tala</td>
<td>5.0</td>
<td>467</td>
</tr>
<tr>
<td>2</td>
<td>Sheben El Koum</td>
<td>5.7</td>
<td>452</td>
</tr>
<tr>
<td>3</td>
<td>El Shohada</td>
<td>5.3</td>
<td>302</td>
</tr>
<tr>
<td>4</td>
<td>El Bagour</td>
<td>5.5</td>
<td>252</td>
</tr>
<tr>
<td>5</td>
<td>Quesna</td>
<td>3.93</td>
<td>249</td>
</tr>
<tr>
<td>6</td>
<td>Berket El Saba</td>
<td>3.8</td>
<td>408</td>
</tr>
</tbody>
</table>

The Delta aquifer is a renewable reservoir where it replenished by the leakage from the Nile. The water is easily accessible by drilling the deep wells or by withdrawing them with pumps. The Nile reservoir is also located below the coastal plain. Several areas depend on the water of this reservoir in agriculture and drinking. The amount of agricultural drainage water entering the drainage from the cultivated land is relatively high and comes from three main sources: Agricultural drainage and leakage of canals, Surface water running from the fields to irrigated, Land leakage of agricultural land in the soil. Agricultural drainage water represents a large proportion of water reused in irrigation. The reuse of treated wastewater (resulting from domestic uses and in many cases industrial use) is also an effective measure of water supply, especially in areas where these treated water is lost outside watercourse systems. Wastewater used for the cultivation and irrigation of green spaces; it can also be used to irrigate crops that are not eaten, such as trees, petals, flax, jute, kitten, ornamental plants. The governorate relies on two main sources: surface and groundwater, where the surface water rehabilitated to make it suitable for use by conventional purification plants with capacities ranging from 8000 to 10,000 m³ per day. As for groundwater, it considered a major source of drinking water in the governorate, especially in rural areas where the total capacity of the stations that depend on groundwater is 281352 m³ days, equivalent to 77% of the total capacity available to the governorate.

Disposal of wastewater: The treated wastewater disposed to sub-drains, which in turn disposed its water to the Nile River. Unreserved areas, either cities
or villages, are disposed of untreated sewage, by local residents’ directly in sub-drains or closed areas or in injection wells.

**Environmental problems in the sanitation sector:**

The discharge of sewage waste into wells or reservoirs leads to leakage into the surface groundwater reservoir, leading to a rise in the level of underground water, especially in the residential areas. Contamination of groundwater with this water is not valid and contain bacteria, and chemicals containing heavy elements and other harmful substances. This water move to groundwater and then to human, especially as many people are still using hand pumps in drinking or washing clothes and kitchen utensils and groundwater, which is the only source of drinking water in most villages and some cities of the province. The dumping of sewage waste on rivers without treatment or limited treatment makes them a source of infection, and these infectious bacteria to humans either By skin, wounds, mouth, or when eating fish and infected aquatic organisms. Sewage known to be very rich in organic matter. The increase in organic matter leads to increased photosynthesis of algae. Bacteria also activate and increase biodegradation of algae, reducing dissolved oxygen in water, resulting in the killing of large quantities of fish and aquatic organisms. Which causes the water to rot foul odors and become unusable. The dumping of sewage waste without treatment in desert land, although far from residential areas, but over time, these soil can be transformed into places that are not suitable for agriculture as these wastes contain high concentrations of harmful substances such as heavy metals.

**Table 5 Relationship between health risks and quality of life**

<table>
<thead>
<tr>
<th>Life Type</th>
<th>Health Risks</th>
<th>Causes of disease</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rural Areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilharzia</td>
<td>Contamination of canal water</td>
<td></td>
</tr>
<tr>
<td>Parasitic diseases</td>
<td>- Soil contamination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pollution of canal water used in irrigation</td>
<td></td>
</tr>
<tr>
<td><strong>Beside Industrial Areas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire</td>
<td>As a result of agricultural residues on surfaces</td>
<td></td>
</tr>
<tr>
<td>Pollution of watercourses (industrial waste)</td>
<td>an enemy source</td>
<td></td>
</tr>
<tr>
<td>Diseases of the hearing system</td>
<td>Noise which is an audio pollutant</td>
<td></td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td>- Automobile exhaust</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Suspended dust in the air</td>
<td></td>
</tr>
</tbody>
</table>

Source: Health Affairs Directorate.

**Shnway and Kafr Hamma – Menofya Governorate**

During the survey at El Menofya Governorate, we study Shnway and Kafr Hamma Villages as shown in figure 20 that represents the map of El Menofya Governorate, and photos from these villages. A water sample taken during the period (2014-2015) from several palaces from these villages, and Laboratory analysis done in deep and shallow wells samples. Figures (21, 22, 23, 24, and 25) represent the water quality analysis for the water samples that show most of the samples meet the WHO, Law 108 for year 1995.
Conclusions and Recommendations

El Sharkya Governorate

By studying the water use of agriculture by applying the SAR ratio, water samples in the central and western parts of the governorate found to be cultivable for all types of soils and plants. While about 56.5% of water samples, need good treatment and drainage as well as adding some organic materials for use in agriculture. Samples of the eastern and northern parts characterized by high salinity, and required their use in special soils and plants with the ability to cultivate in highly saline water. The distribution of water samples also indicated that most of them are within the acceptable range for drinking and daily purposes except three wells in the eastern part where the salinity ratio (TDS) increases from 1500 ppm.

Environmental degradation is an important contributor to the spread of disease, affecting the quality of life and economic activities of many people. Early death and diseases caused by environmental factors account for 20% of the burden, costs of the disease, and can compared to mortality due to malnutrition. The main environmental risks include:

- Water-related diseases caused by inadequate access to water.
- Clean and adequate sanitation - Unprocessed industrial drainage - Agricultural drainage.
- Exposure to indoor air pollution caused by fuel combustion in non-functioning furnaces and insufficient ventilation system.
- Exposure to urban air pollution due to the fine particulate matter emitted by burning fuel.
- Burning of agricultural waste and self-ignition of garbage.

Water Pollution

As for the aquatic environment, which represented by the canals and banks in the governorate, which showed a great deterioration because of pollution of many
pollutants, including sewage, agricultural and industrial waste, there are several programs to cleanse and preserve them. As for the agricultural drains, it has deteriorated due to the violations of sewage due to the lack of access to the sewage service for many of the villages and cities in the governorate. There are some efforts and governmental efforts to introduce the sewage service to some villages.

Problems related to drinking water

It is necessary to reach the average per capita drinking water at the governorate level to 120 liters / day according to the rates of the General Authority for drinking water and sanitation by:

- Establish drinking water plants in areas deprived of drinking water.
- Centers that need support: (Minya wheat / Bilbis / Hehia / Ibrahimeya / Abu Bakr / Husseiniya / Derb Najm / Mashtoul Souk).
- Paying attention to the maintenance of drinking water networks and renovating existing dilapidated networks at the level of the governorate centers to reduce the percentage of water losses produced in order to provide quantity of water so that the per capita level can reach 120 liters / day at the governorate level.

It recommended establishing stations for drinking water in villages deprived of drinking water and the statement as follows:

- The center of Abu Hammad, and the number of (26) village.
- Followed by the center of Zagazig (16) village.
- Then the center of Husseiniya (12) village.
- Then the center of Minya El Kamh (5) village.
- Then Mashtoul Market Center (3) village.
- Then the center of Faqus one village.
- Then the center of Awlad Sakr, one village.

It is necessary to set up drinking water plants by drilling artesian wells or by establishing new water stations on fresh waterways to supply the deprived areas with drinking water.

Environmental degradation / Environmental pollution

The environment varies with the governorate. There is the aquatic environment, the desert environment and the agricultural environment. The agricultural environment in the governorate has deteriorated because of the buildings on the agricultural land and the use of pesticides. The governorate has made an effort through the Directorate of Agriculture to rationalize the farmers. As for the desert environment, we are going towards the rehabilitation and utilization of some desert lands for agriculture.

El Menofya Governorate

The sewage network covers all the cities of the governorate as well as some villages. The number of stations reached 65 stations serving different governorate centers, 43 stations currently operating and 22 stations under construction. The extension of canals, drains near the villages increased the proportion of the population of these areas with these channels and in daily uses, which increased the incidence of parasitic diseases, which eliminated by dealing with contaminated water, and thus increased rates of liver diseases. The highest percentage of liver diseases found in Menofya governorate. The main reason for this is pollution in the Nile waters (Damietta and Rashid branches). For this reason Directorate of Health Affairs, the Directorate of Housing, and the Directorate of Irrigation cooperate in the following areas:

- Analysis of the waters of the canals and banks, especially the drinking water outlets and the work of a permanent record of these results with the establishment of rules for the treatment of sources of pollution in the case of existence.
- Covered by canals and banks that penetrate the mass population and converted to parks or parking lots outside the population mass or added to the road to expand.
- Implement non-traditional projects to limit the direct treatment of the residents with the canals and the banks by implementing public washrooms that are built near the banks and supplied with a clean water line with the work of sedimentation pond to collect the wastewater for this room and treat it firstly and then spend it on the bank.

In addition, health awareness programs should addressed through the social services provided by the hospitals and health units for the residents. Cooperation between the social units, the child libraries, to provide guardianship and guidance to the residents of the areas that need it. In addition to the environmental awareness programs adopted by the governorate to spread environmental awareness and focus, the spotlight on the expected health benefits from environmental awareness programs are being organized, where environmental awareness programs are organized in the youth centers located in the villages targeting different age groups.

Groundwater quality

Salinity of this water reaches its lowest levels in the governorate of El Menofya, which is 320-ppm increases as we go to the middle of the delta where it reaches 640 ppm and salinity increased to its highest rate in the north, reaching 45000 ppm. That the decline in the level of groundwater as a result of excessive clouds in the desert areas, the province of Sadat will have a causal effects in the rate of salinity.
Unconventional water resources renewable groundwater

The Delta aquifer is a renewable reservoir, where it renewed from the leakage from the Nile and the irrigation network that covers the area, and it is easy to access the water by drilling the deep wells or by withdrawing them with the pumps. There is also the Neolithic reservoir below the coastal plain in which the surface water infiltrates Irrigation and water leaking from the Nile and the canal to the layers carrying the groundwater and several areas depend on the water of this reservoir in agriculture and drinking.

Reuse of agricultural wastewater

The amount of agricultural drainage water entering the drainage from the cultivated land is relatively high and comes from three main sources:

- Agricultural drainage and leakage of canals.
- Surface water running from the fields to irrigated.
- Land leakage of agricultural land in the soil.

The first and second type of fresh water is the third type and is more saline. Agricultural drainage water represents a large proportion of water reused in irrigation.

Reuse of treated wastewater

The reuse of treated wastewater (resulting from domestic uses and in many cases industrial use) is also an effective measure of water supply, especially in areas where these treated water is lost outside watercourse systems. For the surrounding area as well as for irrigation of unsaturated crops such as timber, kale, linen, jute, cotton, ornamental plants.

Environmental problems associated with the drinking water sector / Environmental problems associated with artesian wells

- The urbanization of the urban space until most of the water operations within the residential block.
- The absence of sanitary drainage for the villages and the adoption of these villages on the homes of drains for drainage not clear periodically, which displays water produced from wells for bacterial contamination.

Environmental problems in the sewage sector

The discharge of sewage waste into wells or reservoirs leads to leakage into the surface groundwater reservoir, leading to a rise in the level of underground water, especially in the residential areas, in the silver plain and its negative impact on buildings and foundations.

Pollution of groundwater with this water is not valid and the contents of the bacteria, chemicals containing heavy elements, and other harmful substances which transferred to groundwater and then to human. Especially as many people are still using hand pumps in drinking or washing clothes and kitchen utensils and spread Groundwater operations, which are considered the only source of drinking water in most villages.

The dumping of sewage waste on rivers without treatment or limited treatment (including the presence of pathogenic bacteria and chemicals) makes them a source of infection and live species of these bacteria in the waters. Where the food is available in the waste and breathe dissolved oxygen in water, either by skin, wounds or mouth, or by eating fish and infected aquatic organisms. Sewage known to be very rich in organic matter. The increase in organic matter leads to increased photosynthesis of algae. Bacteria also activate and increase biodegradation of algae, reducing dissolved oxygen in water, resulting in the killing of large quantities of fish and aquatic organisms. The dumping of sewage waste without treatment in desert land, although far from residential areas, but over time, these soil can be transformed into places that are not suitable for agriculture as these wastes contain high concentrations of harmful substances such as heavy metals.

General Conclusion and Recommendations

The objectives of environment assessment of well-hand pump community water supply system in developing countries should state in terms of quantitative targets relating to intended consumption, time and effort spent in water collection, quality at point of use, source reliability, and cost.

In order to achieve such objectives, water supply systems should include the following activities: well site selection, drilling and well completion, establishment of maintenance and cost recovery systems, health and hygiene education, and monitoring. It should realize that health and hygiene education and other community work aspects have to operate on a significantly longer time scale than the engineering aspects of such systems. Beneficial impacts of well-hand pump system in public health and time saving can expected, but the level of expectations should be realistic. Family, and especially child, health should improve, and the burden on women should reduce; nevertheless, water and excreta-related disease will still be prevalent, and women will continue to use significant amounts of time and energy on water collection. Rapid evaluations of well-hand pump water supply system should; (a) measure the extent to which the quantified targets set out in this paper have been achieved, and (b) observe, and attempt to quantify, behavioral changes in water use brought about by the provision of improved water supply.
The following tasks urgently needed in order to achieve the objective of better health for people living in the Egyptian rural areas

- Improvement projects necessary for wastewater collection, conveyance, and treatment in rural Egypt.
- Operate wastewater projects in rural Egypt effectively and in a sustainable manner.
- Implement projects necessary for collection, transfer, and safe disposal of solid waste generated in rural areas of Egypt.
- Operate rural solid waste management projects effectively and in a sustainable manner by rural local administration units.
- Support the role of institutions responsible for environmental monitoring and enforcement of environmental health criteria.
- Enable civil community to play a role in solving problems of rural sanitation and solid waste.
- Support the role of institutions responsible for providing and development of human forces and conducting applied research that serve the implementation of this strategy.
- Raising family awareness on better hygiene and environmentally-friendly by practices, with special focus on handwashing with soap, proper disposal of wastewater and home waste, food hygienic behavior, rational use of water and preservation of the environment. This intervention could carried out through community mobilization efforts such as, community gathering, festivals; women group child approaches, and women-to-women approaches as well as house visits.

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