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# ASSESSMENT OF WATER QUALITY MANAGEMENT IN EGYPT

By

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## 1. BACKGROUND

Water is considered a natural wealth and has to be developed, protected and reused to guaranty sustainability and the satisfaction of all needs of the people and economic sectors. Governments all over the world today pay more attention to fresh water resources, as these either become increasingly scarce or they are a threat due to flooding. At the same time there is a growing awareness that the quality of water resources should be protected. Water of good quality and without risks for public health is nowadays considered to be a major asset.

Being an arid country with hardly any rainfall, Egypt is facing many water-related challenges. Population growth and related water demand increase for public water supply and economic activities, in particular agriculture are certainly among the most pressing challenges that Egypt is facing in its development.

Surface-water resources originating from the Nile are now fully exploited, while groundwater sources are being brought into full production. Available water per capita per year for all purposes in 1999 was about 900 $m^3$. This will decrease to 670 $m^3$ per year by 2017, and even further to 536 $m^3$/year by the year 2025, if the share of Egypt from Nile water remains at today's level, present cropping patterns prevail and levels of consumption per capita are maintained.

The agricultural sector is the largest consumer of water in Egypt accounting for more than 85 percent of the total gross demand for water. On a consumptive basis, the share of agricultural demand is even higher at more than 95 percent. Water consumption for irrigation has been steadily increasing from 29.4 Billion Cubic Meter (BCM)/ year in 1980 to 41.4 BCM/year in 1999/2000. This increase has been made possible by an increase in drainage water and treated wastewater use .

By far, the easiest solution to meet the growth in demand would be to increase the supply. However, possibilities to do so are limited. From a hydrological point of view the Nile has a huge potential. However, political, administrative and environmental constraints make it difficult to develop that source. There is potential for additional groundwater withdrawal, in particular in the Western Desert. The two other supply possibilities, rainfall/flash flood harvesting and desalinization provide only very local solutions.

## 2. SOURCES CONTRIBUTING TO POLLUTION OF WATER RESOURCES

Water scarcity is often accompanied by poor water quality. Degradation of water quality is a major issue in Egypt. The severity of water quality problems in Egypt varies among different water bodies depending on: flow, use pattern, population density, extent of industrialization, availability of sanitation systems, social and economic conditions and navigation activities. Major sources of pollution in Egypt originate from the domestic, agricultural and industrial sectors.

### 2.1 Industrial Wastewater

The industrial sector is an important user of natural resources and a major contributor to pollution of water and soil. Industrial use of water in the year 2000 has been estimated to be 3.6 BCM. By the year 2017 it is expected to reach 5.5 BCM. Consequently, an increase in the volume of industrial wastewater is expected (National Water Resources Plan 2002). Such an increase in water usage without proper controls (i.e. enforcement of laws regarding discharge,

improved recycling of water in plants, etc.) will most likely increase pollution loads discharged into receiving water bodies. This trend places the current strategy of reuse of agricultural drainage water in jeopardy and at the same time poses increased risk to human health and the environment. The constituents of concern in industrial wastewater are toxic organic and inorganic compounds.

### 2.2 Municipal Wastewater

Based on population studies and the rate of water consumption, the total wastewater flows generated by all governorates, assuming full coverage by wastewater facilities, is estimated to be 3.5 BCM/year. Approximately 1.6 BCM/year is receiving treatment. By the year 2017, additional capacity of treatment plants equivalent to 1.7 BCM is targeted (National Water Resources plan, 2002). Although the capacity increase is significant, it will not be sufficient to cope with the future increase in wastewater production from municipal sources and therefore, the untreated loads that will reach water bodies are not expected to decline in the coming years. To face this challenge, the government of Egypt allocated 20 billion Egyptian Pound (EGP) for the coming five years to improve coverage rates with appropriate sanitation systems all over the country.

The constituents of concern in domestic and municipal wastewater are: pathogens, parasites, nutrients, oxygen demanding compounds and suspended solids. In Greater Cairo and other cities, the sewerage systems also serve industrial and commercial activities. Therefore, instances of high levels of toxic substances in wastewater have been reported

### 2.3 Agricultural Drainage Water

Apart from being the largest consumer of water, agriculture is also a major water polluter. Drainage water, seeping from agricultural fields, is considered non-point source of pollution. However these non-point sources are concentrated through collecting agricultural drains to form point sources of pollution for the River Nile, the Northern Lakes or irrigation canals in case of mixing water for reuse. Assessment of the water quality of the drains indicated that only few are complying with the standards set by Law 48/1982 (Article 65) regulating the quality of drainage water which can be mixed with fresh water. The remainder of the drains exceeds the consent standards in one or more of the parameters. Major pollutants in agricultural drains are salts; nutrients (phosphorus & nitrogen); pesticide residues (from irrigated fields), pathogens (from domestic wastewater), and toxic organic and inorganic pollutants (from domestic and industrial sources).

## 3. WATER QUALITY ASSESSMENT

Since the construction of the Aswan High Dam, the water quality of the Nile in Egypt has become primarily dependent on the water quality and ecosystem characteristics of the reservoir (Lake Nasser), and less dependent on water quality fluctuations of the upper reaches of the Nile. Water released from Lake Nasser generally exhibits the same seasonal variation and the same overall characteristics from one year to another. Downstream changes in river water quality are primarily due to a combination of land and water use as well as water management interventions such as: (a) different hydrodynamic regimes regulated by the Nile barrages, (b) agricultural return flows, and (c) domestic and industrial waste discharges including oil and wastes from passenger and river boats. These changes are more pronounced as the river flows through the densely populated urban and

industrial centers of Cairo and the Delta region. In general, assessment of the available data indicates the following:

- The main Nile River ambient water quality does not exhibit high pollution levels that create health risks at present, except for some locations where the presence of Coli Bacteria indicates unsafe levels of pollution for direct use in irrigation and fisheries. This relative low level of pollution could be attributed to the high dilution factor and consequently high self assimilation capacity of the Nile water. However, special attention should be given to mitigate sources of pollution as their effects may become significant in the coming years.

- Major sources of pollution of the Rosetta and Damietta branches are due to municipal and industrial wastewater discharges.

- Delta drains receive high concentrations of organic and inorganic pollutants from industrial, domestic, as well as diffuse agricultural wastewater.

## 4. INSUTITUIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

Environmental Policy in Egypt is formulated and implemented by a number of national level institutions including the Egyptian Environmental Affairs Agency (EEAA) and central ministries such as the Ministries of Health and Population, Agriculture and Land Reclamation, Public Works and Water Resources, Housing, Utilities and Urban Communities, Tourism, Culture ...etc.

A new environmental policy was institutionalized in the early 1990s with the issuance of Law 4 of the Environment in 1994, which appointed EEAA as the highest authority in Egypt responsible for promoting and protecting the environment and coordinating adequate responses to these issues. In 1997, the Ministry of State for Environmental Affairs (MSEA) was established to introduce and integrate environmental issues into national policies, plans and programs.

The MOHP has a major mandate in monitoring water sources and industrial effluents. It has an extensive national network for monitoring water to carry out regular sampling and to report violations of permit conditions to concerned authorities.

At the central level, the Ministry of Public Works and Water Resources (MPWWR) is responsible for the management and administration of the national water resources: surface and groundwater including the River Nile, irrigation canals, agricultural drains, northern lakes, coasts and aquifers. It is concerned with planning of water resources use, operation of the water resources systems, and conducting research related to planning and operation.

The MPWWR is responsible for implementing Law 12/1984 concerning irrigation and drainage, and Law 48/1982 concerning protecting the Nile against pollution. According to Ministerial Decree 8/1983, the MPWWR is responsible for maintaining and protecting all water resources in Egypt.

## 5. THE LEGISLATIVE FRAMEWORK

Legislation in Egypt takes the form of laws, presidential and ministerial decrees addressing various aspects of environmental protection. The development of environmental regulations in Egypt

has followed the traditional regulatory approach, which focuses on end-of-pipe controls implemented through command-and-control regulations. Legislation in Egypt is the result of piece-meal and ad-hoc environmental policy. Environmental legislation is reactive to emerging environmental problems and enforcement oriented (emphasis is on process rather than outcome). The substance of Egyptian environmental regulations may be described as single based emission-limits, with little consideration for variations among point sources or for ambient carrying capacity, and with weak links to any land use planning regulations. Egyptian regulators concentrate on informing the polluter of a violation. However, there are little provisions for phasing in compliance measures after the violation has been announced.

## 5.TOWARDS INTEGRATED WATER QUALITY MANAGEMENT

In the year 2002, Egypt prepared a National Water Resources Plan based on a strategy that has been called "Facing the Challenge" (FtC). To face the challenge, Egypt has adopted an Integrated Water Resources Management (IWRM) approach. The proposed IWRM is based on the understanding of:

- The potential hazards to water quality,
- The pathways of these hazards to the environment, and their potential consequences.
- Reliable data for informed decisions
- Monitoring to ensure long-term sustainability.
- Development of Programs or Interventions for water resources protection Including among others, implementation of cleaner production technology, decentralized/ low-cost wastewater treatment, and reuse/recycling of wastewater as well as enforcement of laws and regulations..

## 6. WATER QUALITY INDICATORS

To monitor progress and trends in the use and management of water resources over time and space, internationally accepted indicators on different aspects of water management need to be developed. Indicators are used to simplify, quantify, classify and communicate complex data. They provide information in such a way that both policy-makers and the public can understand. Similarly, indicators can help users to compare results in different areas or countries and examine potential links between changing conditions, human behavior and policy choices. Because 'good' indicators are easy to understand, they offer a tool for raising awareness about water issues that cuts across social and political aspects.

Indicators can be descriptive, such as: water availability, water demand, or showing trends. Regular measurement of indicators provides time series, which can reveal trends that may provide information on the functioning of the system or its response to management.

Traditional water quality indicators used in Egypt are: dissolved oxygen, pH, water temperature, turbidity, E.coli, conductivity, nitrates, toxic organic compounds and heavy metals.

## 7. RECOMENDATIONS

- Better information about impacts of water quality is urgently needed.
- Scientific understanding of the eco-system must be promoted.
- Better health-related indicators are needed, including better understanding of the implications of different levels of exposure to pollutants.
- Water quality indicators should be classified according to different use.
- The use of bio-indicators should be encouraged
- Research and development funds must be channeled to catch up technological progress in this area.

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