

# **TECHNICAL AND ECONOMICAL ASPECTS OF THE WASTEWATER TREATMENT IN THE GAZA STRIP**

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## **ABSTRACT**

At present there is three wastewater treatment plants in the Gaza Strip. All of them have the same treatment process and problems. The effluent quality from the existing treatment plants is far away from the international standards and guidelines for safe disposal or reuse. As a result the existing wastewater treatment plants create many environmental degradation and health hazards.

To minimize these problems, the wastewater treatment plants should be upgraded and the treatment process should be changed to another one, more sufficient and flexible. That can produce effluent quality (BOD, COD, SS and total Nitrogen) matching quite high quality requirements for environmental conservation, according to the policy of the Palestinian Water Authority.

The paper presents and discusses the existing situation and the major constraints of upgrading the existing treatment plants and their treatment process. Moreover it will identify the major parameters, the technical and economical aspects for upgrading the existing treatment plant and building new ones that fits with Gaza conditions. In addition the paper will determine the appropriate treatment process that can be used with a good efficiency recognizing the living standards in the Gaza Strip.

**KEY WORDS:** Wastewater, Wastewater treatment

## **INTRODUCTION**

The Gaza Strip has a total area of about 365 km<sup>2</sup>. The population in the Gaza Strip at present time is about 960,000 inhabitants. It is expected to increase at an average growth rate of 4 % per year to be about 1.8 and 2.6 million in the year 2010 and 2020 respectively. The Ground water is the major source of water in the Gaza Strip, and has several problems regarding quality and quantity. Only 10% of the groundwater in the Gaza Strip complies with WHO standards for drinking purposes. The insufficient sanitation conditions and the absence of proper wastewater disposal and treatment systems are the major threats for public health and environment. In the absence of proper planning the problem is expected to escalate, due to increase in water consumption associated with the increase in population and living standards.

At present it is estimated that only 30% of the population in the Gaza Strip is connected to the wastewater collection and treatment systems. The remaining part of the population rely on cesspools, open channels and vaults for wastewater disposal, causing contamination of the areas and groundwater. By increasing the population and living standards in the Gaza Strip, the water consumption is expected to be increased from  $45 \times 10^6 \text{ m}^3$  in the year 1997 to be about  $80 \times 10^6 \text{ m}^3$  and  $136 \times 10^6 \text{ m}^3$  in the year 2010 and 2020 respectively. At the same time the wastewater production expected to be increased from about  $35 \times 10^6 \text{ m}^3$  in the year 1997 to about  $64 \times 10^6 \text{ m}^3$  and  $109 \times 10^6 \text{ m}^3$  in the year 2010 and 2020 respectively.

### **WASTEWATER TREATMENT PLANTS IN THE GAZA STRIP**

In the Gaza Strip there are three wastewater treatment plants designed and constructed 20 years ago. The first one located at Biet Lahya serves three cities Biet Lahya, Biet Hanoun and Jabalia. The second one located at Sheik Ejleen serves a part of Gaza City. The last one located at Tal Sultan serves only a small part of Rafah City. All of these wastewater treatment plants are already overloaded and have similar treatment process and the same problems. Moreover they suffer from weakness in design, operation and maintenance problems. As a result the effluent quality is far from the WHO standards for wastewater disposal or reuse. The bad quality effluents are discharged to the Wadis, sea or without any control to the sand dunes.

The Palestinian National Authority presented by PWA established and proposed many projects in the Gaza Strip to solve the problems of wastewater collection, treatment and disposal. The major constrain was to select the appropriate treatment process for upgrading the existing treatment plants and for constructing new ones that withstand Gaza conditions and requirements.

### **EVALUATION CRITERIA**

For evaluation and selection of the appropriate treatment process for the wastewater treatment plants in the Gaza Strip many parameters were taken into consideration. These parameters can summarized as wastewater quantity, land availability, land use, capital cost, flexibility of the system, operational and maintenance cost and it's availability, influent quality, required effluent quality for wastewater reuse or disposal, time of treatment and required environmental conservation.

The paper makes an evaluation of the treatment processes proposed by different projects and programs for upgrading the existing treatment plants and construction new ones at different locations in the Gaza strip. These treatment

processes are conventional activated sludge, Oxidation ditch, Trickling filters, aerated lagoons, Stabilization ponds, Modified extended aeration, Hybrid modified extended aeration and SBR. The paper presents an evaluation some of these options technically and financially. Evaluation of the advantages and disadvantages of each one, taking into consideration the social and economical situation in the Gaza Strip made the screening of the appropriate treatment process.

The appropriate treatment process in the Gaza Strip should fit with Gaza conditions and requirements, which can be summarized as below:

- The wastewater treatment process should be reliable to give an effluent that fit with WHO standards for disposal or reuse.
- Highly advanced technologies should not be considered at all or at least at this time due to its high investment (of equipment needed), high-energy requirements and the need of highly skilled operators.
- The availability of land is the major constrains for selection of the treatment process such as Stabilization ponds, although operation and maintenance are easy and economical.
- The selected wastewater treatment process should be designed for Gaza conditions and based on the flow measurements and analysis of the actual wastewater quality.
- The treatment process should guarantee the sustainability of the treatment system that has moderate mechanical equipments, energy consumption or chemicals and an easy operation.
- The selected treatment process should withstand variations in hydraulic and organic loads. It should also has a good removal efficiency regarding BOD, SS, and have advance Nitrogen removal. This protects the groundwater aquifer from increasing Nitrate concentration by infiltrated effluent. Moreover it should have simple operation and maintenance with low cost and the treatment process should include sludge stabilization
- Moreover the new wastewater treatment plants should be optimally located with regards to areas where the effluent can be reused for agriculture or aquifer recharge.

## **CONCLUSION**

The results of the evaluation technically and financially of the appropriate wastewater treatment process in the Gaza Strip indicated that a single stage nitrification/denitrification modification of the conventional activated sludge process (Oxidation ditch) is the most feasible treatment option in the Gaza Strip regarding the above requirements. This option accommodates widely known process all over the world, easy to operate. Through the denitrification stage,

BOD and nitrogen will be partially removed and accordingly the energy demand for aeration in the aerobic process will be low.

### **REFERENCES**

1. GHBN. (1998). The Wastewater as a Resource in the North of the Gaza Strip. Conference in the Islamic University- Gaza Strip- Palestine.
2. GHBN (1998). The Environmental Impact of the Northern Wastewater Treatment Plant in the Gaza Strip. Water Conference- Alexandria -Egypt.
3. MOPIC. (1997). Ministry of Planning Reports, Projects and Maps- Gaza Strip.
4. PESCODE. (1992) Wastewater Treatment and Reuse-London.
5. PWA. 1997/98.Palestinian Water Authority Reports and Projects - Gaza Strip.
6. NASHASHIBI. (1995). Wastewater Treatment in Palestine.
7. STAT. (1997). Statistical Department (president Office)-Gaza.
8. WHO, health guidelines for use wastewater in agriculture.