



Wastewater Master plan and treatment management in Lebanon

Eng. Ismail Makki
Head of the Environment and agriculture Department
Project Division at CDR

1

Current situation of the wastewater sector

- Lack of wastewater treatment means before discharging into the natural environment
- Existence of sewer networks in some regions, and the untreated effluents are discharged into the natural environment thus giving rise to dispersed or localized pollutions in the sea sides, rivers and ground water
- In the regions where networks do not exist, the discharges are carried out directly into the natural environment, due to various means, polluting as well the ground water and the surface water

2

Taken actions in the wastewater sector

- The specifications of the wastewater projects have been based on a Master Plan worked out in 1982 by the CDR in collaboration with the concerned ministries and updated in 1994
- A Master Plan has been carried out for the treatment of sludge ensuing from WWTPs
- A study has been launched, in a national context, to determine the importance of **industrial discharges** in addition to their location

3

WWTPs necessary for wastewater treatment

- Wastewater problem will be resolved for 80 % of the population in the horizon 2020 through about twenty three Plants :
 - ✓ 65% due to fifteen treatment plants all along the Lebanese coast to guarantee the wastewater treatment of the main agglomerations and their suburbs
 - ✓ 15% due to 8 treatment plants located inside the country
- For the remaining regions, representing 20 % of the population, the wastewater treatment necessitate the construction of about a hundred of treatment plants with small to medium capacities

4

Detailed designs of regions affected by wastewater projects

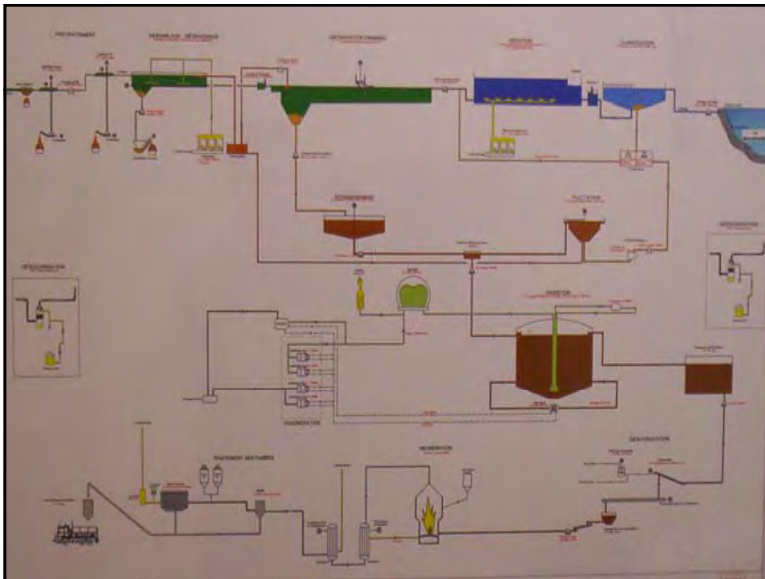
- Specify the potential sites for setting up the treatment facilities (water and sludge)
Biological Treatment (activated sludge, biofilters,...)
- Specify the various areas supplied by treatment plants and design the transmission sewer networks independently from the storm water networks
- Specify the characteristics of the sea outfalls for the plants located all along the Lebanese coast
- Carry out the tender documents to award the contracts of works and operation and maintenance as well as the assessment of the cost of works

5

Treatment processes used in Lebanon

Activated Sludge Biofiltration

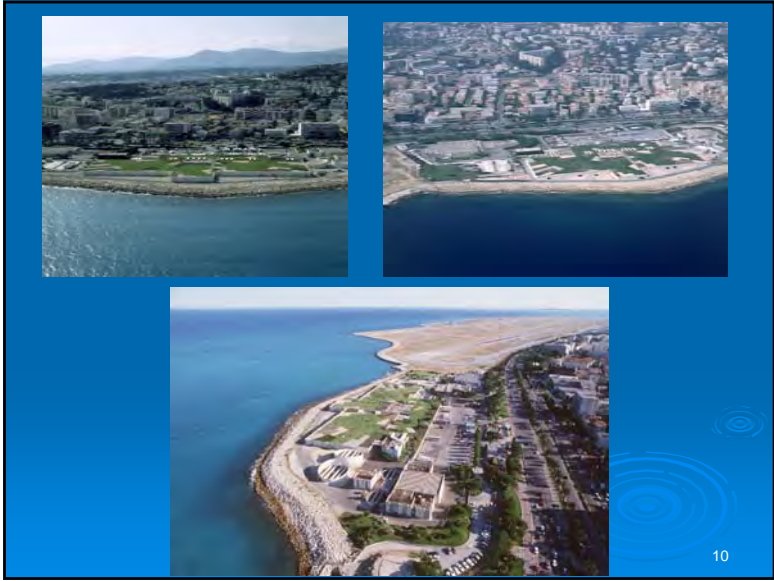
6



The Importance of Site Location

Nice (France) WWTP

8



Carry out and operate the projects require

- ✓ Availability of funds
- ✓ Award and follow up works execution
- ✓ Operation and maintenance and staff training from the Water and wastewater Establishments to carry out these tasks later on
- ✓ Hand over these Plants to the Ministry of Energy and Water and consequently to the Water Establishments

13

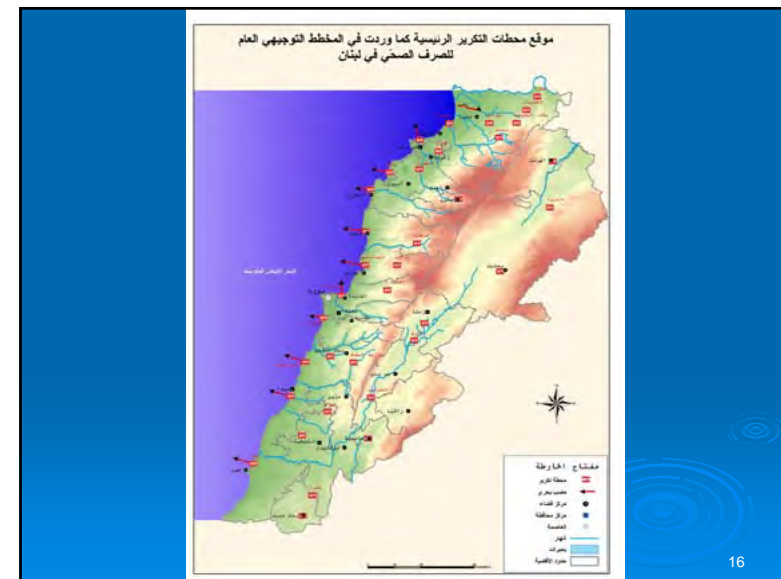
The main objectives of the Master Plan for wastewater management

- ✓ Anxiety about safeguarding the **public health**,
- ✓ Safeguard of ground and surface **water resources**, of the Mediterranean sea and the environment from the pollution,
- ✓ Involvement in **the organization of wastewater sector** by ensuring technical and financial capacities to assist public needs and to improve the current situation of this sector.

14

Wastewater Treatment Plants in Lebanon

15



Progress of work and financing

Facilitated Loans from:

- ❑ The Islamic Bank (Western Bekaa)
- ❑ The European Bank (EIB) (Tripoli, Tyr, Northern Beirut)
- ❑ The World Bank (Baalbeck)
- ❑ The Japanese Bank (JBIC) (Saida)
- ❑ The German Fund (KfW) (Southern Beirut - El Ghadir)
- ❑ The French Government (Chekka, Batroun, Jbeil, Coastal Chouf, Nabatiyeh and Koura)
- ❑ The Italian Government (Zahleh and 8 mid size plants)
- ❑ The Arab Fund (Abdeh, Bcherry, 5 mid-size plants)
- ❑ Abou Zaby Fund (El-Khenchara)
- ❑ Iranian Government (El-Laboueh)

In addition to the funds financed by the Lebanese Government

17

Chekka WWTP

18





Coastal Chouf WWTP

22





Coastal Chouf WWTP **Sea Outfall**

26





Nabatiyeh WWTP

31





Tripoli WWTP





34

Tripoli WWTP



35

Operation & Maintenance of the Plants

- Incorporate the operation and maintenance of the Plant in the contractor's contract for several years
- During this period the Contractors will train the Lebanese staff to be able to take over this operation later on
- The good operation of the plants depends on the quality of the influent, hence it's essential to separate storm waters from waste waters and to guarantee a good maintenance and reduce rain waters infiltration into the wastewater networks
- Request from the factories to construct their own treatment plants to guaranty the treatment of the resulting water before being discharged into the sewer networks

36

Treatment of sludge ensuing from wastewater treatment plants

- A Master Plan for the treatment of sludge resulting from the various treatment plants has been carried out in collaboration with the concerned ministries in 2003
- This Master Plan has studied mainly two options:
 1. Using sludge in the agricultural field
 2. Elimination of sludge by incineration or burying in controlled dumps or landfills

37

Main Objectives

- Examine deeply and assess the alternatives of disposal and valorization by quantifying the agricultural surfaces able to receive these sludge,
- Identify the different sludge processing units needed for each treatment plant,
- Determine the quantities of sludge destined for valorization, drying or incineration,
- Sludge storage units,
- The cost of disposal and valorisation alternative versus the alternative of non-valorisation of sludge

38

Key Numbers

- 1000 inhabitants generate 73 000 m³ of wastewater per year which produce after treatment, 15 to 25 tdM
- 50 to 70 g of dM are treated by mean of one capita and per day

39

Alternative of valorization of sludge

1. Stabilization and valorization
2. Composting of sludge
3. Co-composting of sludge with solid wastes
4. Thermal drying

40

Alternative of non-valorization of sludge

1. Incineration
2. Burying of sludge with solid wastes in controlled dump areas or landfills

41

Cost of treatment processes

- The alternative of valorization of sludge remains the most efficient nevertheless the size of the plant
- The Costs of both drying and incinerating alternatives are similar and the difference is less than 10%
- For capacities of about 8 tdM/d, the alternatives of both composting and drying are very similar and drying of sludge becomes more economical as this capacity is being exceeded.

42

Residue of pre-treatment

- Cannot be valorized, nor recycled
- To be buried in controlled dump areas or landfills or co-incinerated with sludge
- The total production of the whole country is estimated to be at almost 1000 m³/week

43

Sludge Production

- The totality of the 120 treatment plants of the country will produce 333 tdM/d in 2010 and 426 tdM/d in 2020
- Horizon 2020
 - ✓ The 5 biggest treatment plants will produce 257 tdM/d or the equivalent of 60% of sludge generated in the whole country
 - ✓ The 10 biggest plants will produce 316 tdM/d hence 74% of sludge production

44

Outcome of valorized fields

- A total of **51481 hectares** of valorized cultures is available for spreading “stabilized” sludge
- Proportional distribution of surfaces:
 - ✓ North Lebanon 39.6%
 - ✓ Bekaa 29.6%
 - ✓ South Lebanon 23.2%
 - ✓ Mount Lebanon 2.2% whereas the plants located in its territory produce along with Beirut about 52% of all the generated sludge of the country.

45

Extent of valorized sludge

- With an average **used rate** of **30 %** of valorized fields:
 - ✓ **108 tdM/d** of sludge could be valorized thus **25.4%** of sludge produced at year 2020

46

Selection of the alternative

- The choice of the processing unit of valorization has been based, taking into account the environmental and economical advantages that such an option could brought
- The ministry of agriculture disagreed the alternative of using sludge, (valorized sludge), in agricultural environments due to the following reasons:
 - ✓ The industrial discharges into the sewer networks are not controlled sufficiently: sources of contamination for sludge,
 - ✓ Environmental and social hazards due to the spread of sludge of bad quality.

47

The choice of incineration

- A big incinerator is more viable economically than small incinerators having the same capacity
- Gathering sludge coming from different treatment plants to one common incinerator has been encouraged for this alternative at condition:
 - ✓ Not to increase unduly the capacity of this incinerator respectively to the size of the plant
 - ✓ Maintain minimum distances to travel through

48

Foreseen incinerators

- Bekaa : Zahlé, Timnine el-Tahta, El Marj, Baalbeck and Beit Ismail
- North Lebanon: Aabdé, Tripoli
- Beirut and Mount Lebanon: Borj Hammoud and Ghadir
- South Lebanon: Saida, Sour

49

Conclusion

- The Lebanese territory is relatively small, with a high density of population and with an irregular surface shape
- Wastewater treatment will generate significant quantities of sludge
- The environmental and social benefits of wastewater treatment could not be achieved if a neat plan of the methods of disposal of sludge ensued from the wastewater treatment plants was not considered thoroughly.

50

Facts

Ongoing or performed projects: 700 million USD
Will operate progressively throughout the four upcoming years

Cost of the remaining projects: Depends on the Master Plan that will be adopted for the remaining Plants

51

Foreseen results

Safeguard of ground and surface water resources, the Mediterranean sea and the environment from the pollution

Improve the environmental situation currently resulting from the direct discharge of wastewater in the runways and valleys

Create employment opportunities for managing, maintaining and operating this sector

Develop the university researches on subjects relative to treatment and wastewater

52

Complexities

Employ and train technicians and experts in both fields: Wastewater and treatment Plants

Ensure adequate maintenance and operation for the Plants and Networks

Apply and Collect a tariff for sewage

53