



Sustainable Water
Integrated Management (SWIM) -
Support Mechanism



Project funded by
the European Union

Water is too precious to waste

**Cost Assessment of Water Resources Degradation
(CAWRD) of the Litani Basin**
**The Litani River Basin
Consultation Meeting**
Sherif Arif
Beirut, December 12, 2013

Lebanon Water Resources

- ❑ Population: 4.4 million (2012)
- ❑ GDP total : US\$ 43 billion (2012)
- ❑ Per Capita Water Availability : 926 m³/year
(Average MNA : 1000)
- ❑ Water Resources Availability : 2.7 billion cubic meter (BCM)
 - ❖ Surface Water : 2.2 BCM
 - ❖ Groundwater 0.5 BCM
- ❑ Water Resources Distribution :
 - Irrigation: 0.8 BCM (53.4%)
 - Domestic Water : 0.5 BCM (33.4%)
 - Industry : 0.2 BCM (13.2%)

Agricultural Sector : 5% of the GDP (2009), 2% of the population is employed , and is a source of income for 20-30% of the population

Cultivable Land

- Cultivable land is limited to 250,000 ha of which approximately 100,000 ha is irrigated.
- Lebanon's per capita land availability is among one of the lowest in the world at 0.24 ha/capita.
- The most fertile areas are located in the Bekaa valley and along the narrow coastal strip in Akkar. Main crops include cereals (mainly wheat and barley), fruits and vegetables, olives, grapes, and tobacco, along with sheep and goat herding.
- The irrigation sector is characterized by inadequate water storage capacity, lack of proper maintenance and a heavy reliance on hydropower cross-subsidies
- Dam capacity accounts for only 6% of total renewable water resources in Lebanon and is a constraint for irrigation water demand, which accounts for more than 50% of total water consumption

Potable Water and Waste Water

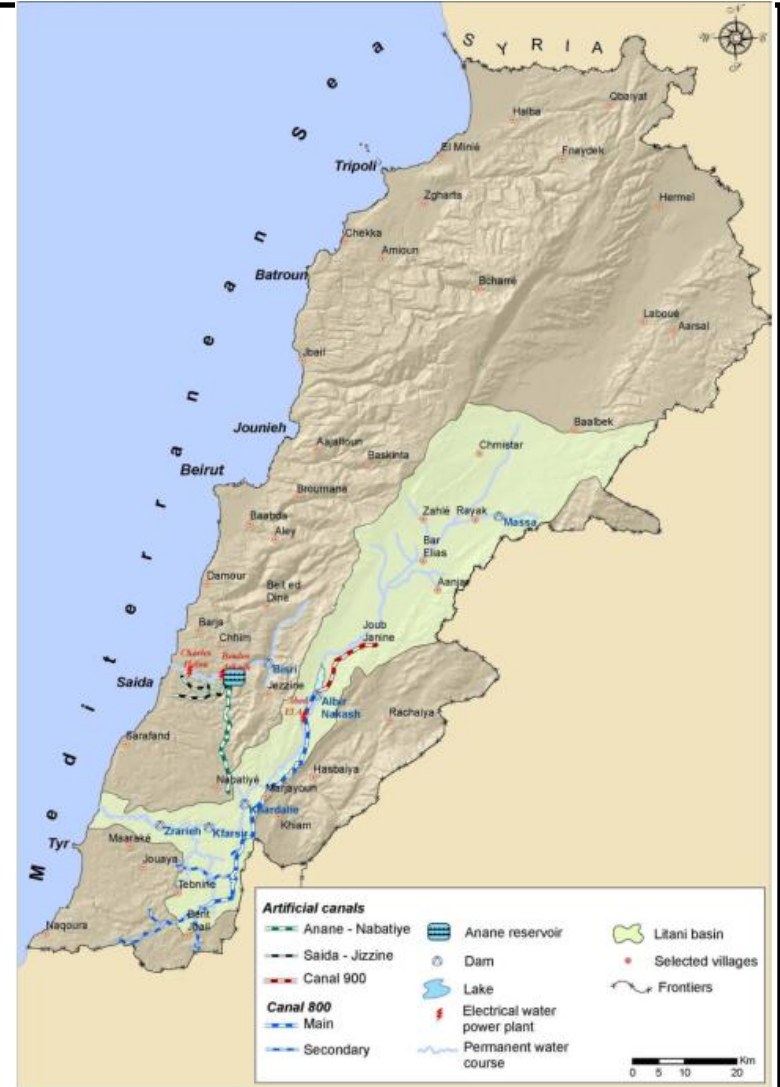
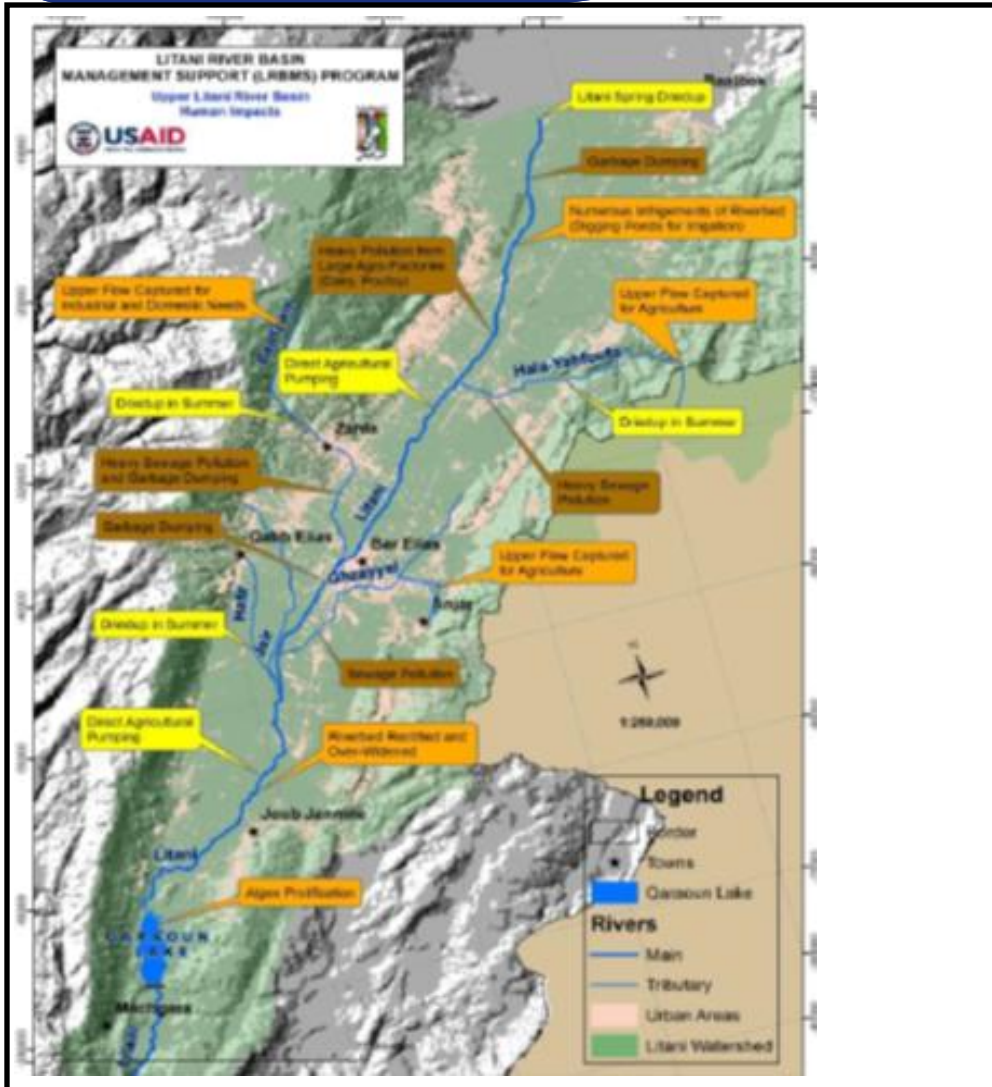
Potable Water

- ❖ Connection rate: 100 % urban areas
- ❖ Water Supply in Beirut and Mount Lebanon: 3 hours a day
- ❖ Household pays three times more the price of water from private suppliers than from the water provided by Government
- ❖ Water Losses are as high as 40%
- ❖ The seasonal water imbalance is primarily caused by the very low water storage capacity, the high amount of water lost to the sea, the growing demand for water and the deficiency of the existing water networks

Waste Water

- ❖ Connection rate: 65.7% connected to old or undersized sewers
- ❖ Domestic and Industrial Waste Water: 348 MCM (2010) 92% is untreated
- ❖ No of WWTPs operating: 11 out of 52 WWTPs planned.

The Litani River Basin



Litani Basin Characteristics

- ❖ Length of the river: 170 km.
- ❖ Surface area: 2,168 km², 20.6% of the Lebanon's area and reached 2,371 km² when the Baalbeck region and the Yammouneh are added to the basin.
- ❖ Population of ULB: 1.04 million in 2010 and approximately 1.06 million in 2012 when Upper Litani Basin extends to Yammouneh and the Baalbeck area.
- ❖ Dam : The Qaraoun Dam with an artificial lake covering a 12.3 km² area where the total static volume is 220 MCM of which 160 MCM is dynamic with 10 MCM for Canal 900, 20 MCM for the Qasmiyeh for irrigation and 130 MCM for hydropower.
- ❖ Hydropower plants (190 MW): through a system of tunnels, conveyors, canals and small lakes,.
- ❖ Agriculture : 87,720 ha of which 57,000 ha are actually used for agriculture in the Upper Litani Basin; and 36,000 ha in the South of Lebanon, and it is the most fertile region in Lebanon.
- ❖ Potable Water: Major source of potable water for 1.04 million habitants in the Litani Basin in 2012.
- ❖ Wastewater Treatment Plant: 5 are operational in ULB but not at full capacity 6 are under construction

The Socio -Economic Activities of the Litani Basin

- ❖ Most of the population and their socio-economic activities are situated in the Upper Litani Basin (ULB)
- ❖ The ULB sub-basin covers an area of 1,468 km² (67% of the basin area) and includes 99 towns and villages distributed among the four districts of Baalbeck, Zahleh, West Bekaa and Rachaya
- ❖ The population range in the ULB is approximately 1.04 million people in 2010 (1.06 in 2012) of which 77% are rural and 23% are urban with a total number of the households in the range of 107,110
- ❖ The Litani region has a prevalence of poverty ranking third after Tripoli -Akkar and Sour regions respectively: 25% of the population is considered poor or very poor, and unemployment is higher than 60%.
- ❖ The main activities in the basin are services, trade, agriculture and industry. Agriculture contributes to 20% of incomes.

The Upper Litani Ecosystems

The ULB is home to 4 protected areas:

- ❑ Kfar Zabad wetland is a 60 ha wetland characterized with a mixture of marchland, constant springs, riparian woodland and pine woodlands and a designated bird area
- ❑ The Yammouneh area notably known for its juniper trees
- ❑ The Qaraoun Lake's LRA self proclaimed protected area (12.3 km²)
- ❑ The Aammiq wetland (253 ha) is the largest remaining freshwater wetland in Lebanon. It is an important bird area, and was declared a Ramsar Site

Pollution in the ULB: Industrial and Agricultural

- ❖ The total amount of industrial was estimated at 4 MCM in 2011 and generated from about 294 water industrial medium and small scale establishments of which half are situated in the industrial zones of Zahleh and Taanayel
- ❖ The type of industries include agro-business (dairy, olive oil, wine, livestock, poultry, fruit and vegetable processing) as well as manufacturing of plastics, synthetic rubber, detergents and cosmetics, non metallic mineral products such as paper mills manufacturing dyeing and tanning as well as manufacturing of batteries.
- ❖ Untreated industrial wastewater includes organic pollutants which are mostly biodegradable, such as oil, fats, hydrocarbons, phenols and detergents and inorganic pollutants which are mostly non biodegradable, containing inorganic salts and chemicals (such as chlorine, ammonia, phosphates and nitrates).
- ❖ Their untreated wastewater which is either discharged into the sewer network or directly into the river. There is little incentive for the industries to pre-treat their wastewater either before its release in the waterways or before reaching the treatment plant.

Pollution in the ULB: Industrial and Agricultural

- ❖ Agricultural run-off is also an important source of pollution due to primarily of the overuse of fertilizers and pesticides.
- ❖ Fertilizer applications were estimated to be 1.5 to 3 times the needed doses and pesticides applications are twice the required doses.
- ❖ Most of the agricultural practices are not neither regulated nor monitored.
- ❖ The famers do not receive technical support as to the proper use of the pesticides and fertilizers.
- ❖ Agricultural runoffs do not only pollute the surface water but percolate also the ground water, reducing agricultural productivity and causing the formation of algae in the river bed and in Canal 900.

Pollution in the ULB: Municipal and Industrial Waste

- ❖ The ULB generates a total of 680 t/day disposed mostly in 60 dumps sites and in which the leachate containing heavy metals and organic chemicals could either percolate the soil and the groundwater and be discharged in the river
- ❖ Industrial, municipal and stone cutting waste are mixed and thrown either in the river or scattered in the basin or in the banks of the river
- ❖ In some places the river has been totally clogged from lime coming from large number of quarries and stone processing industries
- ❖ The main dump sites exerting pressure on the Litani River are: Temnine El Tahta, Saadnayel, Qabb Elias, Barr Elias, Hawch El Harimi, El Khiyara, Ghazze and Jeb Jennine
- ❖ Zahleh is the only city that has one operational sanitary landfill of 200 t/day; another landfill is under construction in Baalbeck

Water Quality Assessment of the Upper Litani River

- ❖ The Upper Litani River is under great environmental stress with degraded water quality that varies from good to bad to very bad in several places along the river.
- ❖ The highest contamination is in the mid upper Basin of Barr Elias which included the largest population and the major industries
- ❖ The water quality has deteriorated since 2005 and showed the same levels of fecal coliforms in surface, lake and underground water as tested by USAID in 2010
- ❖ BOD and dissolved oxygen could be as low as 3.6 kg/day and as high as 2,000 kg/day
- ❖ Total petroleum hydrocarbons compounds as well as heavy metals such as barium, chromium, vanadium and zinc were also found in the Litany river before the Ghazayel river.
- ❖ The river is also polluted with high concentrations of ammonia and nitrites from waste eater and industrial discharges as well with high concentration of phosphates and sulfates due to agricultural pollution

Water Quality Assessment of the Upper Litani River and Qaraoun Lake

The Qaraoun lake is also polluted with fecal coliforms and traces of metal and contains a high level of ammonia

The quality of the groundwater shows high levels of concentrations of fecal and total coliforms as well as nitrates, chloride and sulfates

Bio-indicators derived from fish during the 2000 MOE study revealed low levels of metals (As, Cd, Co, Cr, Cu, Hg, Mn, Ni, Pb, Zn) accumulated in the food chain. By contrast, the USAID BAMAS study revealed heavy metals in all fish samples with levels exceeding the US Food and Drug Administration (FDA) standards for cadmium (70 mg/kg against 3 mg/kg for the FDA).

Analysis of the sediments in the river beds shows the presence of Total Petroleum Hydrocarbon, heavy metals as well as concentration of cadmium which is a trace element found in pesticides.

The highest frequency of metal concentrations exceeding international acceptable standards include: across the catchment's sediments Cadmium (Cd), Lead (Pb), Arsenic (As), Zinc (Zn) Vanadium (V), Chromium (Cr) and Copper (Cu); and within the Qaraoun Lake sediments Arsenic (As), Cadmium (Cd), Mercury (Hg), Nickel (Ni) and Vanadium (V)

Pollution in the ULB: Wastewater

- An estimated amount of 45.4 MCM of untreated wastewater is discharged into the ULB with a BOD load of 16,600 tons/year. It is expected that the wastewater volume will increase to 72.9 MCM/year
- About 71% of the household (76,350) are connected to a sewer, while the remaining 29% (30,674) discharge in the private cesspools where non-maintained septic tanks and open discharges contribute to the fecal contamination of the ULB.
- Only 3.8% of ULB total municipal waste effluents are treated in 2012 , as the wastewater sector is still constrained by a low network density, network clogging, poor WWTP management and unfinished WWTPs.
- Five wastewater treatment plants (WWTP) have been constructed with a total installed capacity of 21,500 m³/day in the ULB working at 10-50% of their capacities
- The situation becomes aggravated during the summer months in which untreated wastewater concentration increases in view of the dishing flow of the surface water discharge in the river transforming the river into “an open sky sewer
- Untreated wastewater is being used in irrigation in many areas in the basin.
- . Untreated wastewater is a major cause of diseases as it was estimated that 7.5 cases annually per 10,000 population suffer from dysentery, typhoid and hepatitis A in the Bekaa which is twice the national average

Water Quality Assessment of the Lower Litani River

- ❖ The water quality is good when compared to the Upper Litani River despite Faecal Coliform exceeding drinking water standards
- ❖ Nitrate concentrations are high compared to drinking water standards, due to increasing fertilizer application
- ❖ Water salinity for irrigation along the southern coast has been reported as the Litani surface water is complemented with underground water where salt intrusion is a growing concern

The Institutional Framework Related to the Litani Basin

There are several government agencies involved to varying degrees in water resource management in the Litani with overlapping functions. The main agencies are:

At the national level

- ❖ The Ministry of the Energy and Water (MOEW)
- ❖ The Ministry of the Environment (MOE)
- ❖ The Council for Reconstruction and Development (CDR)

At the Regional Level

- ❖ The Litani River Authority (LRA)
- ❖ The Bekaa Water Establishment (BKWE)

At the Local level

- ❖ The local water committees
- ❖ The municipalities

The Ministry of Energy and Water Resources

The Ministry of Energy and Water (MOEW). The MOEW has the following mandate to :

- ❖ Protect develop, and assume jurisdiction of water resources;
- ❖ Develop policies and strategies in water resources;
- ❖ Determine water supply and demand as well as conservation of water resources;
- ❖ Design, implement and operate large hydraulic facilities; and
- ❖ Administratively supervise the WAs and the LRA.

MOEW has two general directorates involved in the Litani :

- ❖ The Directorate General of Hydraulic and Electric Resources (DGHER) which is responsible for research, studies and implementation of large-scale projects and;
- ❖ The Directorate General for Operations which is responsible for overseeing the public establishment, for administration and financial aspects as well as administratively supervising as the Water Authorities and the local autonomous water boards and local committees

Ministry of the Environment and CDR

The Ministry of the Environment (MOE) is the environmental regulatory arm of the country. Its major roles and functions is to

- ❖ formulate laws, regulations, standards and guidelines;
- ❖ prepare environment policies and strategies, monitor,
- ❖ control and enforce water, air, and soil quality;
- ❖ providing the necessary environmental conditions for issuing permits and;
- ❖ implement environmental projects

For the Litani , the MOE was asked to take the lead by the Council of Ministers, for the preparation of a comprehensive report on the combating pollution of the Qaraoun Lake which it completed with UNDP support

Council of Reconstruction and Development (CDR)

Its major functions are:

- ❖ the preparation of the investment plans for the country;
- ❖ the design, planning and implementation of programs and projects for reconstruction and development;
- ❖ the mobilization of external financing from development partners

CDR is the major implementing agency for the WWTPs

The Litani River Authority

The Litani River Authority (LRA) is responsible to

- ❖ Develop the necessary domestic, irrigation and hydropower schemes for the Litani,
- ❖ Develop a national interconnected power grid, and build electrical power stations and distribution networks in all Lebanese territory.
- ❖ Operate and exploit all Litani River Basin related projects.
- ❖ Prepare water development plan for all the Litani/Awali basins and the area between the international Beirut-Damascus road and the southern Lebanese border.

The LRA conducts and publishes monthly water quality surveys and monitors and prevent pollution by the Litani River Basin Management Support Program that was supported b USAID

Despite the establishment of the regional water establishments as per the water Law 221, LRA has still maintained its responsibility to develop and manage the irrigation water and associated works in the Southern Bekaa and South Lebanon.

The Bekaa Water Establishment (BKWE)

- ❑ The establishment is located in Zahleh is governed by a Board consisting of six members and a president appointed by the Council of Ministers
- ❑ The responsibility of the establishment is inter-alia
 - ❑ To set the water fees for potable, irrigation and industrial uses,
 - ❑ To monitor the quality of the potable and irrigation water, and carry out studies, and the necessary exploitation, operation and maintenance of the potable water, wastewater and irrigation projects (except the except the irrigation water In the Southern Bekaa and the South which is the LRA responsibility).
- ❑ The BKWE is supposed to take over the management of irrigation, potable water and sewerage schemes, but due to the technical, administrative and financial constraints, it is currently not able to undertake these tasks bestowed upon them by the law.
- ❑ Although the BKWE is meant to be have legal autonomy to select the most appropriate level of service delivery, it cannot yet operate on a commercial basis.

The Municipalities and the Local Committees

The Municipalities are responsible for

- preparing general plans for water, sanitation and solid waste projects,
- undertaking operations and maintenance of municipal waste collection and for general matters concerning protection of the environment and pollution control.

The Local Committees were established by ministerial decree from the MOEW, under the tutelage of the Regional Water Establishments.

- Their responsibilities are the operation, maintenance, rehabilitation and renovation of the water and sewerage networks and equipment.
- In the Bekaa, they are 58 local committees, of which 14 are for potable water, 41 for irrigation, and 3 for irrigation and potable water

General Conclusions

- Water pollution is the major issue in the Litani and is responsible for the degradation of natural resources and is affecting public health.
- Several governmental, autonomous and semi-autonomous agencies are involved in the water sector. Their responsibilities overlap and it is difficult to distinguish a clear responsibility system linking the appropriate ministerial decrees to their corresponding agencies.
- Institutions and agencies each works on programs and technical reports in the Litani Basin in well- defined areas; however, coordination and exchange of information and experience on the basin are low and horizontal reinforcement among these institutions should be considered..
- Qualitative and quantitative assessments of impacts on natural resources are generally understood from a technical point of view, however, the economic assessments of these impacts are almost nonexistent.

مع خالص شكري
وامتثاني

Thank you
for your attention

Merci pour
votre attention



For additional information please contact:

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