JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION (CDR) and
MINISTRY OF ENERGY AND WATER (MEW)
THE REPUBLIC OF LEBANON

THE STUDY

ON

WATER RESOURCES MANAGEMENT MASTER PLAN

IN

THE REPUBLIC OF LEBANON

FINAL REPORT
SUPPLEMENTAL REPORT

January, 2004

SANYU CONSULTANTS INC.
YACHIYO ENGINEERING CO., LTD

2006, 5, 29
修錄済

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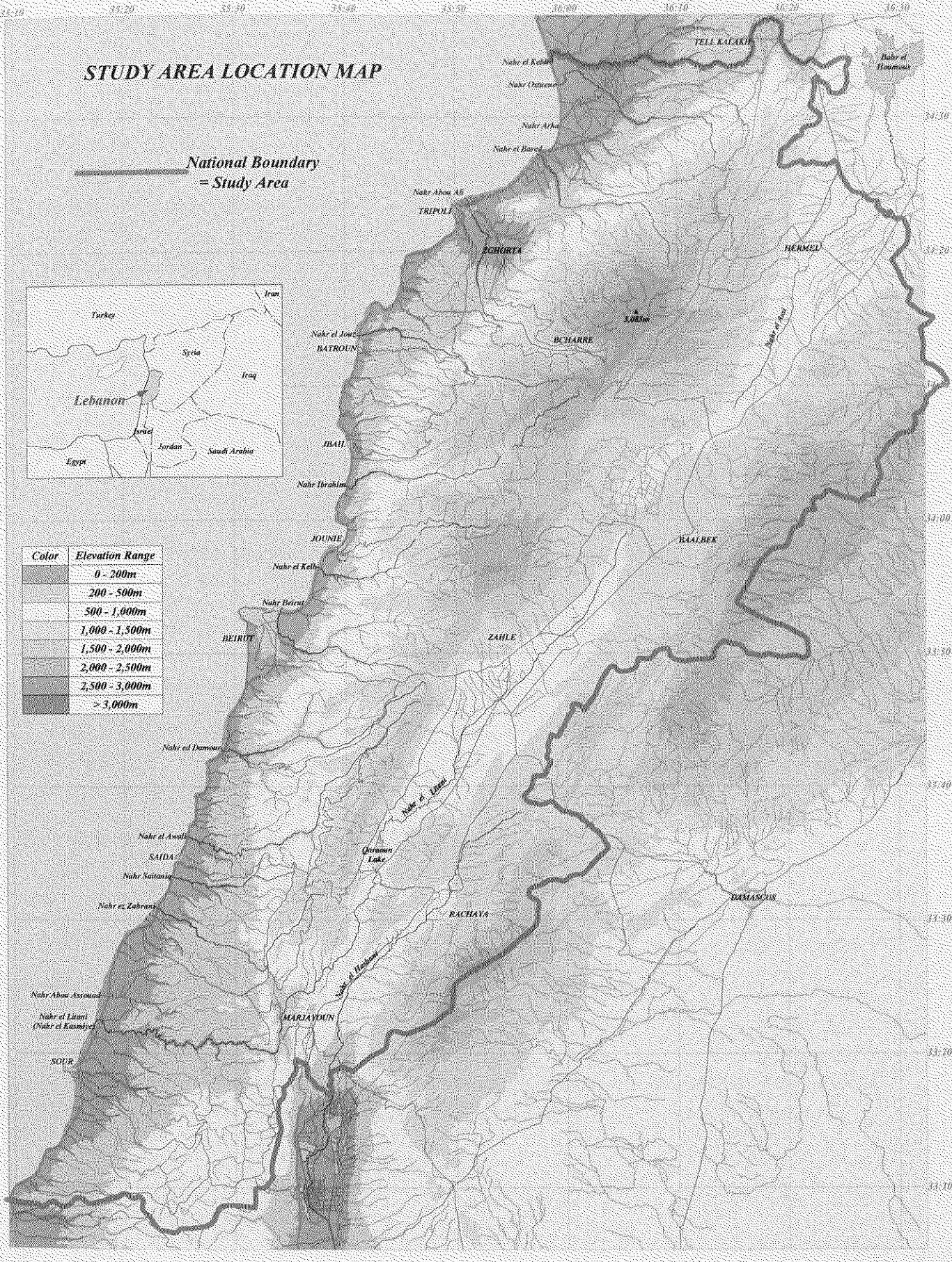
STUDY AREA LOCATION MAP
National Boundary
= Study Area
Iran
Turkey
Syria
Iraq
Lebanon
Israel
Jordan
Saudi Arabia
Egypt
Color
Elevation Range
0 - 200m
200 - 500m
500 - 1,000m
1,000 - 1,500m
1,500 - 2,000m
2,000 - 2,500m
2,500 - 3,000m
> 3,000m
35:10
35:20
35:30
35:40
35:50
36:00
36:10
36:20
36:30
34:30
34:20
34:00
33:50
33:40
33:30
33:20
33:10
TELL KALAKH
Nahr el Kebir
Nahr Ostuene
Nahr Arka
Nahr el Barid
Nahr Abou Ali
TRIPOLI
ECHORTA
HERMEL
3,083m
BCHARRE
Nahr el Jouz
BATROUN
Nahr el Assi
JBAIL
Nahr Ibrahim
JOUNIE
BAALBEK
Nahr el Kelb
Nahr Beirut
BEIROUT
ZAHLE
Nahr ed Damour
Nahr el Litani
Nahr el Awali
SAIDA
Nahr Sattanie
Nahr ez Zahrani
Qaraoun Lake
DAMASCUS
RACHAYA
Nahr el Hasbani
Nahr Abou Assouad
Nahr el Litani (Nahr el Kasmiye)
MARJAYOUN
SOUR

Terms

Integrated Water Resources Management means the adoption of a comprehensive approach with respect to the management of the water resources of every basin, simultaneously taking into consideration all aspect which are of relevance to these resources in terms of their sources, uses, and demands for various purposes... in such a way that all of these aspects are integrated with the goals, plans and programs of socio-economic development in the basin, and without undermining the sustainability of these resources or damaging their qualities.

Sustainable use of groundwater means the abstraction of groundwater which takes place during a specific period of time at quantities which at least equal the replenished quantities during the same period, and in such a way that neither the quantity nor the quality of available water are significantly affected on the long run.

Water policy means all principles, which are adopted by the State regarding the optimal use of water resources, their management and development to achieve certain economic, social and environmental goals.

Water resources management means all actions, procedures and measures, which are undertaken in the field, office or lab to achieve the water policy goals.

Water resources conservation means the rational management of the water resources so as to ensure their optimal use, utilization and the preservation of their sustainability, both quantitatively and qualitatively.

Water resources planning means the process of examining and evaluating all possible options on how to best use the waters of a given region or basin to satisfy the demand, and to increase availability of water resources and to protect their quality, and rationalize their uses.

Demand management means the use of measures and practices including education and awareness program, metering, water pricing, quantitative restrictions, and other devices, to manage and control the demand for water

Trans-basin water diversion means the physical transfer of water from one drainage basin to another

River basin means the land area from which water drains into a river

Runoff means that part of precipitation which appears in surface streams

Unaccounted-for-water means the difference between the volume of water delivered into a supply system and the volume of water accounted for by legitimate consumption, whether metered or not

Note: from Background information to Workshop on Groundwater Legislation Review and Water Tariff Analysis in Lebanon, 17 January 2003, by the Economic and Social Commission of Western Asia (ESCWA) in cooperation with the United Nations Development Program (UNDP)

Abbreviations

AUB: American University of Beirut
BCS: Bureau of Central Statistics
CAS: Central Administration of Statistics
CDR: Council for Development and Reconstruction
EIA: Environmental Impact Assessment
EDL: Electricity of Lebanon
ESCWA: Economic and Social Commission for Western Asia
FAO: Food and Agriculture Organization of the United Nations
GBA: Greater Beirut Area
GDP: Gross Domestic Product
GIS: Geographical Information System
GP: Green Plan
ARIL: Lebanese Agriculture Research Institute
LBP: Lebanese Pound
LL: Lebanese Lira
LRA: Litani River Authority
MOA: Ministry of Agriculture
MEHR: Ministry of Energy and Hydraulic Resource
MEW: Ministry of Energy and Water
MOE: Ministry of Environment
MOH: Ministry of Public Health
MOI Ministry of Industry
MOPT: Ministry of Public Works and Transport
MOT: Ministry of Tourism
MSA: Ministry of Social Affairs
NERP: National Emergency Rehabilitation Program
NGOs: Non-Governmental Organizations
NWMP82: National Waste Management Plan in 1982
NWRU: National Water Research Unit
PSP: Private Sector Participation
SIU: Sector Implementation Unit in MEW
UFW: Unaccounted for water
UNDP: United Nations Development Program
WA: Water Authority

Units

mm: Millimeters
m: Meter
km: Kirometer

ha:	Hectare
km^2:	Square Kirometer
l:	Liter
l/c/d:	Liter per capita per day
mg/l:	Milligram per liter (x 10^{-3})
ppm:	Parts per Million
m^3:	Cubic Meters
m^3/s:	Cubic Meters / Second
MCM:	Million Cubic Meters
MW:	Megawatt (x 10^6)
KWh:	Kilowatt hour(x 10^3)
GWh:	Gigawatt hour(x 10^9)
℃:	Degree Centigrade

1 US Dollar = 1,500 LL

Chemical Compounds

BOD:	Biochemical Oxygen Demand
$CaCo_3$:	Calcium Carbonate
CH_4:	Methane
CO:	Carbon Monoxide
CO_2:	Carbon Dioxide
NO:	Nitrogen Dioxide
NO_2:	Nitrogen Oxides
N_2O:	Nitrous Oxide
O_3:	Ozone
SO_2:	Sulphur Dioxide
SO_3:	Sulphur Trioxide
SS:	Suspended Solids

General Definition

Catchments Area (km^2):	Watershed Area (km^2)
Runoff (MCM):	Average Annual Flow in Volume (MCM)
Runoff (mm):	Specific Yield of Runoff (mm/year)
	= Average Annual Flow (MCM) / Watershed Area (km^2) x 1,000
Groundwater:	Underground Water
Service Population:	Subscriber of Water Supply
Dry Season:	April to October (7 months)
Wet Season:	November to March (5 months)

The Study
on Water Resources Management Master Plan
in the Republic of Lebanon

SUPPLEMENTAL REPORT

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CHAPTER 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 Background

Following the Taif Accord in 1989 that brought the peace over the country, the government of the Republic of Lebanon (Lebanon) has proceeded aggressively to rehabilitate, reconstruct and recover the national land. The 5-year public investment program so called the NERP was established in 1992 based on the damage survey supported by the EU to make urgent reconstruction of social infrastructures in the fields of water supply, sewage, electricity, communication, transportation, solid waste, insurance and sanitation. The NERP was then succeeded in 1994 by the HORIZON 2000 program along the same line, and a huge investment amounting to US$ 60 billion in 1995 price is being made during the period from 1995 to 2007 with water related sectors occupying a considerable part of the investment.

Lebanon is blessed with relatively rich water resources in terms of precipitation, 823 mm annually or some 8,600 million cubic meters in volume, as compared to other neighboring middle-eastern countries where extreme chronic shortage of water prevails. These relatively abundant water resources are, however, difficult to be utilized effectively due to unevenly distributed precipitation throughout a year, most rainfall occurring within a limited period of 80 to 90 days, or 50 to 60 days at least, during the wet season extending between the months of October and April, and topographical and geological characteristics of the national land. Surface waters concentrated into river channels flow down into the sea immediately because river bed slopes are too steep, and it is also difficult to impound such a water in the reservoir since geology of the most suitable sites of dam construction is of limestone. Surface water is also exposed to contamination due to improper management of sewage, industrial waste and municipal solid waste disposed into water courses without any treatment. Hydrometric measurements necessary for operational forecasting of water shortage and flood are incomplete due to the civil war. A delay in rehabilitating and reconstructing water use facilities destructed by the civil war has accelerated shortage of water especially in summer season in urban areas

along the coastal line where demand of water has concentrated, giving a serious damage to the people's living environment as well as to the national economy.

Water is diverted from surface, groundwater and spring water sources to serve urban, rural and industrial supplies as well as for irrigation in Lebanon. Extensive use of groundwater due to lack of surface water for irrigation and increasing population especially in urban areas has, however, accelerated intrusion of saline water in the coastal aquifers and drainage of wastewater into pits, wells and rivers has been allowing faster spread of water pollution. Urgent measures to prevent pollution by untreated wastewater are also required by the Protocol on the Prevention of Pollution of the Mediterranean Sea. Over-pumping of groundwater invites lowering of water level which would result in a shortfall of exploitable amount of spring water. Taking the above into account, it would be rather preferable to restraint use of groundwater and to promote exploitation of surface water of which utilization is not maximized due to delayed progress of dam and hill lake construction at present, and from the viewpoint that valuable water resources are to be preserved and managed for the most effective utilization, formulation of an integrated master plan of water resources management covering widespread water uses in the entire national land is required without delay.

In Lebanon, reconstruction and development projects after the war have been implemented by the Council for Development and Reconstruction (CDR) as a core, under the financial and technical support of the World Bank and foreign donor countries such as France and Italy. CDR, under the direct control of the Cabinet, plays the role to coordinate foreign donor organizations with the project implementation agencies of the Lebanese side, having jurisdiction over the projects that are implemented under the aid of foreign countries.

Superintending administrative organization in association with the field of water is the Ministry of Energy and Water (MEW), however, numbers of agencies such as the Ministry of Finance, Ministry of Environment (MOE), Ministry of Public Health (MPH), Ministry of Agriculture (MOA), through the construction of small scale hill lakes, participate in the implementation of water-related projects.

MEW, known formerly as the Ministry of Hydraulics and Electrical Resources (MHER, Art.1 of Decree 5469/66) is the competent authority responsible for water, electrical and mining affairs having supervision authority over organizations and institutions involved in the fields of water and electricity. MEW has been set up by the Law No.20/66 and its amendment. The Article 1 of the Law defines the power of the ministry as follows;

- To extend and generalize water and electricity projects throughout the Lebanese territory, implement them or supervise their implementation and operation,

- To apply laws and regulations related to the protection of public water resources and their use,
- To exercise administrative supervision over the autonomous offices and other organizations working in the fields of water and electricity,
- To exercise control on water and electricity concessions, and
- To apply laws and regulations related to mines.

There is still an urgent need to rehabilitate and reconstruct existing and to expand new water supply and wastewater treatment facilities, and various projects are under progress at this moment. Reconstruction and upgrading of meteorological and hydrological observation network have also been fairly under way. In parallel with these activities, annual demand of water is projected to exceed the readily exploitable surface and groundwater resources in near future. Potential and usable water resources are limited in Lebanon and it is therefore requested urgently to formulate a nation-wide master plan on water resources management in order to expect effective, sustainable and rational use and allocation of water among water-related sectors.

Under these circumstances, in response to the request of the Government of Lebanon, the Government of Japan has made efforts towards extending the technical cooperation to establish a rational and practical water resources management master plan through dispatching necessary experts of various fields. A Preliminary Study Team was sent and the Scope of Works was consented and signed by both governments in February of this year. In May 2002, the Japan International Cooperation Agency (JICA) decided to send a Study Team consisting of eleven (11) experts of various fields headed by Mr. Y. Kimura to conduct "the Study on Water Resources Management Master Plan in the Republic of Lebanon".

The objectives of the Study are:

1. To formulate a master plan for water resources management of the whole area of the Republic of Lebanon, and
2. To pursue technology transfer to counterpart personnel in the course of the Study.

The Study intended to cover the whole area of the Republic of Lebanon. However owing to security and safety restrictions imposed by the Government of Japan, the Japanese Study Team including Lebanese consultants and contractors employed by the Team will not enter a part of the country. Actual data collection in this area is done effectively by the Litani River Authority (LRA) and would be conducted by the Lebanese Counterpart Team following the criteria and methodology set by the Japanese Team.

In order to achieve the above objectives, the Study was planned to cover the following study items;

Phase I: Basic Survey

1. Review of related plans, programs and studies
2. Collection, review and analysis of related data and information
   (1) Social and economic conditions
   (2) Topographical data and maps
   (3) Hydrological and meteorological data
   (4) Soil and geological data
   (5) Land use
   (6) Laws, regulations, institution and policies
   (7) Existing hydro-meteorological stations and other related facilities
   (8) Surface water and groundwater potential
   (9) Water use
      a. Municipal and industrial water
      b. Irrigation
      c. Hydropower
      d. Treated wastewater
   (10) Water quality
   (11) Water supply and wastewater treatment system
   (12) Flood control
   (13) Environmental protection and conservation
   (14) Others
3. Clarification of present conditions of water resources development and management
4. Formulation of database compatible with Geographical Information System
5. Examination of water resources potential
   (1) Surface water
   (2) Spring and groundwater
   (3) Treated wastewater
   (4) Unaccounted water (physical loss)
   (5) Integrated water balance (quantity and quality)
6. Water demand prediction
   (1) Municipal and industrial water
   (2) Irrigation
   (3) Hydropower
   (4) Treated wastewater reuse

(5) Water for ecosystem conservation

7. Examination of water resources development alternative
   (1) Inventory of possible alternatives
   (2) Strategy and scenario
   (3) Digital water balancing model
   (4) Initial Environmental examination
   (5) Evaluation
   (6) Selection of priority alternatives

Phase II: Formulation of Water Resources Management Master Plan

8. Formulation of water resources management master plan
   (1) Water resources management plan
      a. Development plan
      b. Institutional management
         - Hydro-meteorological observation
         - Water quality monitoring
      c. Environmental conservation
      d. Watershed management
   (2) Preliminary project design
   (3) Preliminary cost estimation
   (4) Implementation plan
   (5) Evaluation
   (6) Selection of priority project(s)
9. Recommendation

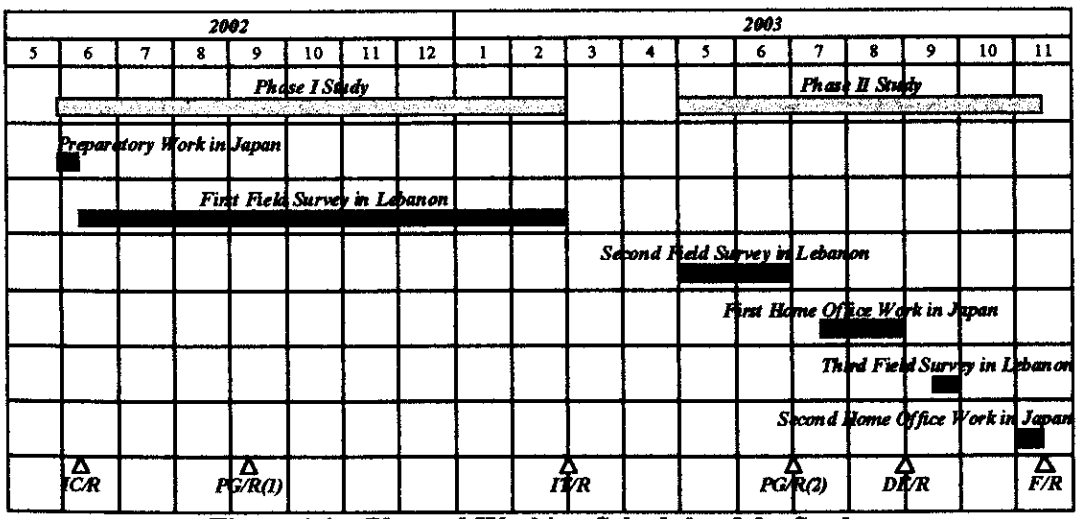

Figure 1.1 Planned Working Schedule of the Study

The Study was planned to be implemented in six (6) stages of two (2) phases as shown below;

Stage 1: Preparatory Works in Japan (Beginning of June, 2002)

Existing available data and information were reviewed and analyzed, and the Inception Report was prepared during this period.

Stage 2: First Field Survey in Lebanon (June, 2002 to February, 2003)

Collection of basic data/information and field survey/investigation is made during this stage of the Study in order to grasp the existing conditions of the study area. Water resources potential is evaluated for surface, spring and groundwater through simulation by a hydrological circulation model and water demand is projected for various water use sectors. Collected data are compiled in a database to be formulated in a form compatible with the GIS. Digital balancing model is constructed to output necessary information to support decision making for water resources development and management. Alternative plans for water resources development and management is extracted together with an inventory of possible alternatives, strategy and scenarios of development and management. Initial environmental examination are also done during this stage.

Observation of river discharge and spring flow, inventory survey of existing groundwater wells and sampling and laboratory testing for water quality are conducted entrusted to the consultants/contractors in Lebanon.

Technology transfer seminar on overall study finding and on-the-job training mainly for the digital balancing model are undertaken at the end of this stage. Progress report (1) and the interim report is prepared, submitted and explained.

Stage 3: Second Field Survey in Lebanon (May to June, 2003)

Supplemental field survey is conducted and a master plan of water resources management is finalized during this stage including water resources development and management plans, institutional management plan, environmental consideration, costs, benefits and implementation program for possible alternative plans. All of the study findings are compiled in the progress report (2).

Stage 4: First Home Office Work in Japan (July and August, 2003)

The draft final report is prepared compiling all of findings obtained since the beginning of the Study.

Stage 5: Third Field Survey in Lebanon (September, 2003)

The draft final report is presented and the technology transfer seminar will be held in Beirut.

Stage 6: Second Home Office Work in Japan (November, 2003)

Final report is prepared on the basis of the comments of the Lebanese government on the draft final report.

JICA has organized the Study Team comprising eleven (11) experts for the implementation of the Study. JICA also set up an Advisory Committee for the purpose of providing technical advices to the Study Team as listed below:

Organization of the JICA Study Team

Designation/Field	Name of Experts
Team Leader/Water Management Plan	Yoshiaki KIMURA
Deputy Leader/Hydro-geology	Ryoichi KAWASAKI
Hydrology/Meteorology	Toshinobu NAKANO
Topography/Geology/Remote Sencing	Takao FUJII
GIS/Database	Takeshi YOSHIDA
System Engineer	Makoto HOMMA
Water Use Planning	Kazuhiko OTANI
Water Supply/Sewage	Hirotaka SATO
Organization/Operational Management	Hiromasa MINAKAMI
Socio-Economy/Project Cost	Noboru OSAKABE
Water Pollution/Environment	Sanpei NAKANISHI
Coordinator	Norio SAKAGAMI

Organization of JICA Advisory Committee Team

Assignment	Name	Position
Chairman	Masahiro MURAKAMI	Professor, Infrastructure Systems Engineering Course, Graduate School of Engineering, Department of Infrastructure Systems Engineering, Kochi University of Technology
Member	Hiroyuki ITO	Senior Researcher, Water Environment Research Group, Public Works Research Institute

1.2 Progress of the Study

The time series of the study progress performed is as follows;

June 13, 2002	Study Team arrived in Lebanon, submission of Inception Report (IC/R) to the Ministry of Energy and Water (MEW)
June 18, 2002	Presentation of IC/R at MEW
September 6, 2002	First Technical/Coordinating Committee (T/C Committee) regarding the contents of Progress Report (1)(PR/R(1))
September 7, 2002	Counterpart Training on GIS
September 12, 2002	Submission of PR/R(1) to MEW
September 18, 2002	Presentation of PR/R(1)
November 11, 2002	First workshop on Digital Balancing Model (DBM)
November 25, 2002	Second workshop on Digital Balancing Model (DBM)
December 20, 2002	Second T/C Committee regarding the progress of the study
January 27, 2003	Third T/C Committee regarding the progress of the study
February 17, 2003	Submission of Interim Report (IT/R) to MEW
February 20, 2003	Presentation of IT/R
February 25, 2003	Seminar 2, outline of JICA study presented
February 27, 2003	Study Team left for Japan
March 17, 2003	MEW's comment on IT/R submitted to the Embassy of Japan (EOJ)
March 27, 2003	Above comment reached Study Team through EOJ and JICA
April 10, 2003	Discussion on the reply to MEW's comment prepared by Study Team
April 17, 2003	MEW's second comment on IT/R
May 28, 2003	Study Team arrived in Lebanon
May 29, 2003	Received detailed comment of MEW on IT/R
June 2, 2003	Submitted the reply to the comment at the MEW's Committee

June 4, 2003	Meeting in the Prime Minister's Office regarding the Scope of Work for the study
June 5, 2003	Participation of EOJ in the progress of the study
June 12, 2003	Discussion meeting in EOJ hosted by the ambassador
June 24, 2003	Discussion meeting in the Prime Minister's Office with the MEW Committee
June 25, 2003	Consulted with EOJ to meet the situation
July 9, 2003	Study's suspension and Study Team' return home advised by the Ministry of foreign Affairs through EOJ
July 10, 2003	Study Team left for Japan
August 8, 2003	Dr. Murakami, Chairman of JICA Advisory Committee, and Mr. A. Kagawa dispatched to Beirut to work out remedial measures, and discussed with MEW
November, 2003	Minutes of Meeting for above discussion arrived at mutual agreement

Notes: Black letters show activities taken while the Study Team was in Lebanon.
Blue letters show activities taken while the Study Team was in Japan.

Above procedures are described in detail in 和文報告書「レバノン国水資源管理計画調査、調査の経緯に関する補足説明書、2003年7月15日」submitted to JICA with a series of supporting materials such as Minutes of Meeting, record of discussion and other relevant documents.

As a general procedure to formulate the study towards a Final Report, the Study Team prepared and submitted several reports step by step. Inception Report, Progress Report (1) and Interim Report were submitted, and Progress Report (2), Draft Final Report and Final Report were intended to be drawn up in the future. Previous reports were reviewed and comments and remarks were incorporated and reflected always in preparation of the report of the next step. In order to steer and technically coordinate the study, the Steering Committee and Technical/Coordinating Committee at Lebanese side and the Advisory Committee at Japanese side were organized, and the progress of the study were reported occasionally to these committees. In fact, as concerns the actual procedure taken during the formulation of the Interim Report, the Study Team referred results of the study to the technical/coordinating committee twice on 20th December, 2002 and 27th January, 2003. All of the comments and

remarks given at the committee were not reflected to the Interim Report yet because of the limitation of the time, however, the remaining were going to be consider at the next step of the study.

Members of the Technical/Coordinating Committee nominated by the Lebanese Government at the commencement of the study are as follows;

- Mr. Hassan Jaafar, Head of Dept. of Environment, MEW
- Mr. Georges Makhoul, Head of Dept. of Groundwater and Geology, MEW
- Mr. Said Bitar, Head of Dept. of Irrigation, MEW
- Mr. All Khatib, Head of Dept. of Studies, MEW
- Mr. Andre Attallar, Head of Dept. of Search and Hydraulic Structure, MEW
- Mr. Zoghby Marwan, Heas of Dept. of Implementation, MEW
- Mr. Adib Geadah, Head of General Studies Service, LRA
- Mr. Hussein Rammal, Head of Exploitation Service, LRA
- Mr. Kamal Karaa, Head of Rural Development Service, LRA

After the termination of the Phase 1 Study (submission of the Interim Report on 17th, presentation on 20th and Study Team' return to Japan on 27th February, 2003), MEW organized a new Committee to review the Interim Report. The new Committee's members were 1) Ms. Randa Nemr, World Bank/Environmental Consultant, 2) Dr. Salim Makssoud, Professor in Irrigation, 3) Dr. Hyam Mallet, Special Expert in Institutional Law, 4) Mr. Zuheir El Hasan, CDR, 5) Dr. Wadji Najem, Dean of Faculty of Engineering at ESIB, 6) Dr. Selim Catafago, Professor of Hydrology and Hydraulic Studies at ESIB, 7) Mr. Adib Geadah, LRA, 8) Mr. Bassam Jaber, Previous DG of Exploitation of MEW, 9) Mr. Andre Attallah, Head of Hydraulic Works Dept of MEW, 10) Mr. Said Bitar, Head of Irrigation Project Dept of MEW, 11) Mr. Mazen Makki, World Bank Study Team, 12) Ms. Mona Fakih, Head of Section of Hydraulic Structure of MEW, where only Mr. Adib Geadah participated from the existing Technical/Coordinating Committee.

The new Committee summarized their opinion stating that "In conclusion, a general agreement was reached by all the present experts that the report is based on inaccurate and insufficient data that cannot by any means be used to reach the final conclusion reached by the JICA Team. For this reason, all experts agreed that with this data a Master Plan cannot be produced. In addition, the presented work was not in line with the Lebanese Strategy described in the 10 Year Plan of the Ministry of Energy and Water. For this reason phase 2 of the project should not take place before the Draft Interim Report is entirely reviewed, corrected and approved by the Lebanese counterpart."

At the commencement of Phase 2 Study at the end of May, 2003, a detailed set of comments on the Interim Report was given to the Study Team. MEW's comments are compiled in Annex 8 attached at the end of this report. The Team immediately prepared the Reply to the comments and distributed it to the all participants attended to the Committee meeting held on June 2, 2003 at the conference room of MEW.

Majority of MEW's comment to the Interim Report was relevant to inaccuracy and insufficiency of basic data on which the study is formulated. They argued that the data were not reliable and insufficient both qualitatively and quantitatively, and therefore the results of the study were not reliable and therefore not acceptable.

The Study Team objected stating that; JICA's study is conducted, in principle, on the basis of existing available data in the country. A series of data on which analyses rely may contain errors and may lack coherence and consistency. In the light of lack of reliable data in Lebanon in both qualitative and quantitative means, this kind of study for water resources master plan is ideal to be done after reliable data are consolidated for a considerable length of period. Lack of reliable data really causes majority of difficulties in executing the study, however, this cannot be imputed to the ability of the Study Team. Planning of water resources usually require a long-term record of meteorology and hydrology, that is, 20 years at least and more than 30 years preferable. Because of this constraint, the Team conducted the study employing full extent of expert's knowledge and experiences towards the best solution that can be achieved within a short time with limited information. The Master Plan of Water Resources Development and Management commonly needs periodical updating according to additionally available water-related data and changing socio-economic conditions. The study therefore intends to provide models as a tool to support formulation of a master plan, together with efforts to transfer technology so that Lebanese counterparts will be able to operate and maintain such tools.

List of participants to the various meeting with the Study Team is shown in Table 1.2-1.

It is also supposed that MEW's response to the result of JICA Study is highly influenced by the political sensitivity on the information control regarding water resources, which was caused by the international dispute between Lebanon and Israel on the use of Hasbani water located near the national border.

This confusion invited participation of both the Prime Minister's Office of Lebanon and Japanese Embassy in steering the study, and several meetings were held hosted by Mr. Fadi Fawaz, Special Advisor of the Prime Minister's Office or Mr. Naoto Amaki, Ambassador of Japanese Embassy in Beirut. At the technical meeting held on June 24th 2003 at the Prime

Minister's Office, hosted by Mr. Fadi Fawaz and attended by Mr. Naoto Amaki, Lebanese side finally rejected to accept the result of JICA study. The Study was forced to be suspended, and the Team returned to Japan according to the advise of the Ministry of Foreign Affairs of Japan through the Japanese Embassy, on the way of the Phase 2 time schedule.

After the return of the Study Team to Japan, JICA dispatched Mr. Akio Kagawa as a leader and Dr. Masahiro Murakami, chairman of JICA Advisory Committee to the Study, to Lebanon to devise remedial measures for the study. They discussed on August 8th 2003 with representatives of Lebanese Government, and Minutes of Meeting was signed at the end of November after several times modifications.

Table 1.2.1 Record of Attendance

	Scope of Work (Feb 2, 2002)	Inception Report (June 21, 2002)	T/C Committee (1) (Sep, 2002)	Progress Report (1) (Sep 20, 2002)	Workshop (1) ()	Workshop (2) ()	T/C Committee(2) (Dec. 20,2002)	T/C Committee (3) (Jan. 27, 2003)	Interim Report (Feb. 20,2003)	Seminar (Feb 25,2003)	Seminar for Inputs Report (Mar. 14, 2003)
CDR											
Mr. Jamel A. R. Itani	○										
Ms. Nada Mufarrij	○										
Mr. Zuheir el Hasan	○									○	○
Mr. Hisham Nasser		◎		◎							
MEW											
HE. Dr. M. A. H. Beydoun	◎										
Dr. Fadi G. Comair	○	◎		◎						○	
Mr. Andre Attallah										○	○
Mr. Bassam A. Jaber	○	○								○	○
Mr. Mohamad Mehdi	○										
Mr. Said Bitar		○		○					○	○	○
Mr. Zoghby Marwan		○		○							
Ms. Nada Mansour		○				○	○				
Ms. Mona Fakih		○		○	○		○	○	○	○	○
Ms. Mona Sleiman		○		○	○	○	○	○	○	○	
Ms. Antoinette Gattas		○		○	○	○	○	○	○	○	
Ms. Nazumie Beydoun		○		○	○	○	○	○	○	○	
Mr. Ali Ghorayeb		○		○	○	○	○	○	○	○	
Mr. Wisam Kanj		○	No		○	○	○		○	○	
Mr. Ghassan Mansour		○		○							
Mr. Mazen Makke		○		○					○	○	○
Mr. Ali el Khatib		○	Record	○							
Mr. Imad Menhem					○					○	
Mr. Abdo Tayar				○					○	○	
Ms. Muriel Choueiry			Available						○	○	
Mr. Mohamad Said Fatha									○	○	
Mr. Ziad Zakhour									○		
Ms. Sybil Tarazi							○		○	○	
Mr. Hassan Jaafar											
Mr. Gearges Makhoul											
LRA											
Mr. Nasser Nasrallah	○	○									
Mr. Adib Geadah	○	○					○	○	○	○	○
Mr. Kamel Awaydah	○									○	
Mr. Elias Hawi	○							○		○	
Mr. Hussein Rammal	○	○		○						○	
Mr. Ghasan Gebran	○										
Mr. Kamel Karaa	○			○			○	○	○	○	
Mr. Fakhreddin Daswoub	○										
Others											
Dr. Masaad Bernard		○									
Dr. Catafago Selem		○		○						○	○
Dr. Wadji Najem		○		○					○	○	○
Ms. Randa Nemr											○
Dr. Salim Makssoud											○
Dr. Hyam Mallet											○

Steering Committee T/C Committee Both

1.3 Contents of the Report

Minutes of Meeting for August 8th 2003 states that in the light of the concerns, which were described above, the Lebanese side strongly requested that the formulated regional water resources management master plan and the results of examination of water resources potential and water demand prediction in Lebanon should be excluded in the final report of the Study. Both sides agreed to compile the following outputs for the final report of the Study, which would be prepared in Japan.

(1) GIS Database
(2) Digital Balancing Model
(3) Hydrological Circulation Model (Synthetic Storage Model – SSM)

Following the above, the title and constituent of the final report as agreed by JICA are as under;

Title

The Study on Water Resources Management Master Plan in the Republic of Lebanon
FINAL REPORT

Constituent fo the Report

(1) MAIN REPORT

(2) SUPPORTING REPORT
- Volume 1: GIS Database
- Volume 2: Instruction Manual of DBM
- Volume 3: Operation Manual of DBM
- Volume 4: Programmer's Manual od DBM
- Volume 5: Technical Note for SSM
- Volume 6: Operation Manual of SSM

(3) SUPPLEMENTAL REPORT

Among the above reports, Supplemental Report contains all of findings obtained throughout the Study and is submitted to JICA only.

CHAPTER 2

GENERAL DESCRIPTION OF THE AREA

CHAPTER 2 GENERAL DESCRIPTION OF THE AREA

2.1 Socio-economy

2.1.1 Administrative Units

(1) Central Government

The political system of the Republic of Lebanon is based on the separation of legislative, executive, and judicial powers. The Legislative Branch consists of a single-chamber Parliament of 128 members. The members are elected for four-year terms in regional ballot. The Executive Branch consists of the President of the Republic and the Council of the Ministers (the Cabinet). The President is elected for a six-year term by Parliament. The President appoints the Prime Minister. The composition of Ministries is described in the Section 2.8. The Court System consists of the State Council Court and civil courts.

(2) Local Government

Table 2.1-1 Local Administrative Division of Lebanon and its Area

Mohafaza	Caza		Area	
			km^2	%
Beirut		-	19.8	0.2
Mount Lebanon	1	Aaley	268.6	2.6
	2	Baabda (Center*)	187.6	1.8
	3	Chouf	476.0	4.6
	4	Jbail	432.5	4.1
	5	Kesrwan	397.2	3.8
	6	Metn	272.1	2.6
		Total	2,034.0	19.5
North Lebanon	1	Akkar	811.8	7.8
	2	Batroun	290.2	2.8
	3	Bcharri	149.5	1.4
	4	Koura	183.4	1.8
	5	Minieh-Dinnieh	401.6	3.8
	6	Tripoli (Center*)	34.3	0.3
	7	Zgharta	185.8	1.8
		Total	2,056.5	19.8
South Lebanon	1	Jezzine	262.3	2.5
	2	Saida (Center*)	270.1	2.6
	3	Sour	419.8	4.0
		Total	952.1	9.1
Nabatieh	1	Bent Jbeil	274.3	2.6
	2	Hasbaya	254.6	2.4
	3	Marjaayoun	283.9	2.7
	4	Nabatieh (Center*)	315.1	3.0
		Total	1,127.8	10.8
Bekaa	1	Baalbek	2,276.1	21.8
	2	El Hermel	526.0	5.0
	3	Rachaiya	511.5	4.9
	4	West Bekaa	468.0	4.5
	5	Zahle (Center*)	480.1	4.6
		Total	4,261.8	40.8
Total	26		10,452.0	100.0

Note: 1) Center means the city where is located administrative center of the Mohafaza. 2) Area by Caza: Calculated by applying the Arcleb Data of Khatib & Alami Consolidated Engineering Company.

The Republic of Lebanon is divided into 6 administrative regions called Mohafaza. Beirut is the Capital of Lebanon. The Mohafazas, excluding Beirut, are sub-divided into 26 districts called Caza.

There are 2,449 municipalities in Lebanon, according to the Arcleb data of Khatib &Alami Consolidated Engineering Company. These municipalities constitute 624 municipal councils. The total area of Lebanon is 10,452 km^2. Table 2.1.1 shows the area and name by Mohafaza and Caza.

2.1.2 Population

(1) Population Survey

The comprehensive population census has not been carried out since year 1932 in Lebanon. However, Central Administration for Statistics (CAS) conducted a survey on all buildings and establishments in the country during 1996/1997. In this survey, CAS estimated the population by Mohafaza at 4,005,000 in the country in year 1997 as shown in Table 2.1-2, of which 92.4% were Lebanese and 7.6% were foreign inhabitants viz. Syrian 1.1%, Palestinian 4.9%, other Arabian 0.4%, and non-Arabian 1.2%. This figurer does not include seasonal workers such as construction and agriculture labor. The survey also revealed the household size by Mohafaza as presented in Table 2.1-2. The country average household size was 4.8 persons.

CAS divided Mount Lebanon in two regions; so-called Beirut suburbs and the rest of Mount Lebanon. Beirut suburbs are closely connected socially and economically with Beirut City. According to CAS survey, Beirut suburbs include 62 municipalities; 15 in Aaley, 16 in Baabda, 3 in Chouf and 28 in Metn. Thus CAS estimated the population of Beirut and its suburbs at 1,300,000 or 33 % of the country population.

CAS has published periodically the Statistic Bulletins that contain the national population movement from 1999 to 2001, in which net population increase was presented as shown in Table 2.1-2. Average population increase during the period was approximately 67,000 a year. However, these increases included only Lebanese, and were registered with local administrative office at their legal domicile, not at their present domicile. Consequently these figures of Beirut and Mont Lebanon came out significantly smaller than those of other Mohafazas compared to their actual population size.

Table 2.1-2 Population Statistics by CASA

Mohafaza		Population [1] 1997	Person / Household [1]	Net Population Increase 1999 [2]	2000 [2]	2001 [3]
Beirut		403,337	4.3	6,223	5,764	7,168
Mount Lebanon	Beirut Suburbs	899,792	4.5	n/a	n/a	n/a
	Rest of ML	607,767	4.4	n/a	n/a	n/a
	Total	1,507,559	4.5	10,136	10,136	9,918
North Lebanon		807,204	5.4	17,847	18,631	19,090
South Lebanon		472,105	4.9	8,997	9,684	8,673
Nabatieh		275,372	5.0	10,077	11,242	11,666
Bekaa		539,448	4.4	12,759	12,903	9,697
Total		4,005,025	4.8	66,142	68,360	66,212
Growth Rate (%)		-	-	1.79	1.78	1.70

Source: 1) Conditions de Vie des Menages en 1997, Etudes Statistiques, CAS
2) Bulletin Statistique, No.1 of year 2000 and 2001, CAS, 3) Preliminary information from CAS
Note: Net population Increase means the numbers of birth minus of death.

According to CAS, there is no plan to take census at moment, while the previous survey is now being updated.

(2) Population of Year 2002

The population of year 2002, a base year of the Study, is an essential data for the study, therefore was estimated based on the following premises;

1) Year 1997 population surveyed by CAS was a base population for this estimation.

2) Net population increase of the years from 1998 to 2002 was added as follows;

a. Year 1999, 2000 and 2001 increase by Mohafaza was estimated by applying the following country growth rate to rectify the distortion among Mohafazas arisen from registration place as previously discussed.

- 1999: 1.79%
- 2000: 1.78
- 2001: 1.70

b. Year 1998 increase was assumed equal to the growth rate of year 1999 (1.79%)

c. Year 2002 increase was assumed equal to average annual growth rate of the years 1997-2001(1.76%)

d. Foreigners' increase was also considered by applying the same criteria as a, b and c.

e. Foreigners were assumed to live based on 'Results of Population and Housing Data Base - 1995/1996' of Ministry of Social Affairs; 25% in Beirut, 30% in Mount Lebanon, 16% in North Lebanon, 19% in South Lebanon, 1% in Nabatieh, and 9% in Bekaa. Beirut suburbs were assumed to account for 80% of Mount Lebanon; that is 24% in the country.

Estimated net increase of both Lebanese and foreign inhabitants

	1999	2000	2001	2002
Lebanese	66,142	68,360	66,212	69,668
Foreigners	5,440	5,623	5,446	5,730
Total	71,582	73,983	71,658	75,398

3) No immigrant from year 1998 to date

4) Seasonal foreign workers were excluded for this estimation.

Table 2.1-3 Estimation of Year 2002 Population (in thousands)

Mohafaza		1997 Statistic	2000 Estimation	2001 Estimation	2002 Estimation	Average Annual Growth '02/'97	Density person/km^2
Beirut		403	425	432	440	-	22,179
Mount Lebanon	Beirut Suburbs	900	949	964	982	-	4,213
	Rest of ML	608	640	652	663	-	368
	Total	1,508	1,589	1,616	1,645	-	809
North Lebanon		807	851	866	881	-	428
South Lebanon		472	498	506	515	-	541
Nabatieh		275	290	295	300	-	266
Bekaa		540	569	579	588	-	138
Total		4,005	4,222	4,294	4,369	1.76%	418

Thus year 2002 population was estimated at 4,369,000 in the country as shown in Table 2.1-3. The country's population density was estimated at 418 person/km^2.

Table 2.1-4 Year 2002 Population by Region and by Urban/Rural (in thousand)

Region		Beirut & Suburbs	Mohafaza Center	The Rest			Total
Mohafaza	Caza			Urban	Rural	Total	
Beirut		440	-	-	-	-	440
Mount Lebanon	Aaley	76	-	83	8	91	167
	Baabda	492	-	95	2	97	589
	Chouf	28	-	145	15	160	188
	Jbeil	-	-	33	22	55	55
	Kesrwan	-	-	116	10	126	126
	Metn	386	-	127	7	134	520
	Total	982	-	599	64	663	1,645
North Lebanon	Akkar	-	-	46	102	148	148
	Batroun	-	-	39	55	94	94
	Bcharri	-	-	44	20	64	64
	Koura	-	-	51	35	86	86
	Minieh-Dinnieh	-	-	14	29	43	43
	Tripoli	-	336	3	0	3	339
	Zgharta	-	-	63	44	107	107
	Total	-	336	260	285	545	881
South Lebanon	Jezzine	-	-	31	55	86	86
	Saida	-	146	63	21	84	230
	Sour	-	-	113	86	199	199
	Total		146	207	162	369	515
Nabatieh	Bent Jbeil	-	-	39	35	74	74
	Hasbaya	-	-	22	20	42	42
	Marjaayoun	-	-	46	23	69	69
	Nabatieh	-	22	57	36	93	115
	Total	-	22	164	114	278	300
Bekka	Baalbek	-	-	111	80	191	191
	El Hermel	-	-	17	12	29	29
	Rachaiya	-	-	0	41	41	41
	West Bekka	-	-	47	39	86	86
	Zahle	-	135	88	18	106	241
	Total	-	135	263	190	453	588
Total		1,422	639	1,493	815	2,308	4,369

Note: Mohafaza Center; 1) Tripoli consists of Trablous and 4 surrounding municipalities such as Abou Halqa, El Mina, El Quaramoun and Qoubbe. 2) Saida is consists of Saida and 8 surrounding municipalities such as Bramiye, Dars es Silm, Ghaziye, Hajje, Hara, Hlaliye, Maamrlye and Miye Ou Miye

Incidentally population distribution by Caza and by urban/rural area is essential in order to conduct water demand projection for the Study. However, neither official data of population by Caza nor by urban/rural area exist in the country. No perimeters to divide urban and rural area exist either. Therefore, the distribution was conducted based on the following premises;

① Population by Caza

Each Mohafaza population was distributed into Cazas by applying population data projected by Khatib & Alami Consolidated Engineering Company (KACEC). This population by KACEC was derived from registered electricity subscribers of 2,449 municipalities in Lebanon and presented in municipality basis.

② Population by Urban and Rural Area

Urban and rural population by municipality was estimated based on the data of above ①, reflecting regional characteristics in it;

a. Mount Lebanon; municipalities of less than 1000 inhabitants were considered as rural area and of more than 1000 as urban area.

b. Other Mohafazas; municipalities of less than 3000 inhabitants were considered as rural area and of more than 3000 as urban area.

Thus year 2002 population was distributed by Caza and by urban/rural area as shown in Table 2.1-4. Accordingly the share of urban (including Beirut, Beirut Suburbs and Mohafaza Center cities) and rural population was estimated respectively at 82% and 18%.

(3) Workforce

CAS survey revealed the number of active workforce in 1997 to be 1,362,000 persons as shown in Table 2.1-5, and 1,246,000 or 91% to be engaged in some job. As for number of persons with job, Beirut and its suburbs accounted for 36% of total. Meanwhile, the jobless rate was 8.5%. Beirut and Mount Lebanon recorded at a level of 7%, while the other Mohafazas reached at higher than 9% level. North Lebanon hit the highest level of 11.5%.

Table 2.1-5 Workforce by Mohafaza in 1997

Region		With Job	Jobless	Total	Jobless Rate
Beirut		148,594	12,062	160,656	7.5 %
Mount Lebanon	Beirut Suburbs	302,100	26,701	328,801	8.8 %
	Rest of ML	209,506	15,487	224,993	7.4 %
	Total	511,606	42,188	553,794	7.6 %
North Lebanon		222,582	25,598	248,180	11.5 %
South Lebanon		137,861	12,583	150,444	9.1 %
Nabatieh		75,810	7,045	82,846	9.3 %
Bekaa		149,729	16,682	166,311	11.1 %
Total		1,246,173	116,058	1,362,231	8.5 %

Source: Conditions de Vie des Menages en 1997, Etudes Statistiques, CAS

CAS (1997) survey distributed workforce by economic sector as shown in Table 2.1-6. Agriculture sector accounted for 9.1%, industrial sector for 15.2%, construction sector for 11.5% and service sector 64.1%. It should be noted that services sector absorbed predominantly the workforce in the country.

Table 2.1-6 Workforce by Economic Sector and by Mohafaza in 1997 (%)

Region		Agriculture	Industry	Construction	Services	Total
Beirut		0.2	12.4	7.0	80.4	100.0
Mount Lebanon	Beirut Suburbs	0.6	20.8	9.9	68.7	100.0
	Rest of ML	5.3	14.1	15.2	65.4	100.0
	Total	2.5	18.1	12.1	67.3	100.0
North Lebanon		14.9	14.9	10.6	59.6	100.0
South Lebanon		16.8	12.2	14.9	56.1	100.0
Nabatieh		17.6	12.3	17.3	52.8	100.0
Bekaa		20.7	12.5	9.7	57.1	100.0
Total		9.1	15.2	11.5	64.1	100.0

Source: Conditions de Vie des Menages en 1997, Etudes Statistiques, CAS

(4) Household Income

CAS (1997) survey also revealed the household income as shown in Table 2.1-7. The household income was LBP1,540,000 on average in the county. However, the income among Mohafazas varied from LBP2,069,000 at Beirut to LBP1,089,000 at Bekaa. The households at Beirut gained double as much as those at Bekka.

Table 2.1-7 Household Income in Year 1997

Region		Household income (thousand of LBP/month)	persons/household	Income/person (thousand of LBP /month)
Beirut		2,069 (US$1,355)	4.3	481 (US$315)
Mount Lebanon	Beirut Suburbs	1,724 (US$1,129)	4.5	383 (US$251)
	Rest of ML	1,946 (US$1,274)	4.4	442 (US$289)
	Total	1,815 (US$1,189)	4.5	407 (US$267)
North Lebanon		1,235 (US$809)	5.4	229 (US$150)
South Lebanon		1,135 (US$743)	4.9	231 (US$151)
Nabatieh		1,089 (US$713)	4.4	248 (US$162)
Bekaa		1,264 (US$828)	5.0	253 (US$166)
Total		1,540 (US$1,009)	4.8	321 (US$204)

Source: Conditions de Vie des Menages en 1997, Etudes Statistiques, CAS
Note: LBP/US$ = 1,527.0 (as of December 1997)

2.1.3 Economic Profile

(1) Gross Domestic Product

Though official GDP was calculated in 1994 and 1995 for the first time after the end of civil war, no GDP calculations have been made officially since 1996 in the country. However, the Ministry of Finance and ESCWA revealed their estimates of GDP until 2001 as shown in Table 2.1-8.

Table 2.1-8 GDP and other Economic Indicators

Item	1994	1995	1996	1997	1998	1999	2000	2001
Nominal GDP								
-Billion of LBP	14,992	17,779	20,417	22,880	24,509	24,816	24,816	25,188
-Million of US$	8,924	10,968	12,996	14,867	16,167	16,462	16,462	16,708
-GDP/capita (US$)	n/a	n/a	n/a	3,710	3,970	3,970	3,900	3,890
GDP deflator (%)	5.8	11.4	10.4	7.8	4.0	0.25	0.0	0.0
Real GDP Growth (%)	8.0	6.5	4.0	4.0	3.0	1.0	0.0	1.5
1. Agriculture	23.6	11.1	-2.9	-2.4	-0.9	-1.0	-0.1	-0.8
2. Industry	7.9	5.3	-1.5	-4.2	-4.2	-6.0	-3.2	-0.9
- Manufacturing	4.2	5.4	7.7	-1.0	-1.3	-3.0	-3.3	0.3
3. Services	5.3	6.0	7.9	8.5	6.2	3.6	1.0	2.5
- Sale/Hotel/Restaurant	8.0	12.6	6.2	6.1	4.8	0.7	0.0	1.6
Sector Distribution (%)	100	100	100	100	100	100	100	100
1. Agriculture	12	13	12	11	11	10	10	10
2. Industry	27	27	25	23	22	20	20	19
- Manufacturing	12	11	12	11	11	10	10	10
3. Services	61	60	63	64	67	70	70	71
- Sale/Hotel/Restaurant	29	30	31	32	32	32	32	32
Exchange Rate (as of end December)								
LBP/US$	1,647	1,596	1,552.0	1,527.0	1,508.0	1,507.5	1,507.5	1,507.5
CPI at Beirut								
%	7.6	12.0	8.0	2.6	2.3	0.7	0.0	1.1

Source: 1) The Lebanese Republic Country Profile, Ministry of Finance, and 2) Reports and data of CAS and ESCWA
Note: 1) GDP/capita was estimated by the Study Team. 2) Real GDP Growth and Sector Distribution from 1999 to 2001 were estimated based on ESCWA data by the Study Team.

Real GDP grew remarkably during the first half decade of 1990's. However, the growth pace has slowed down since the second half of the same decade, supposedly due to construction sector's decrease. Average annual growth rate by sector during 7 years from 1994 to 2001 was estimated as follows;

1. Agriculture Sector	:	0.3%
2. Industrial Sector	:	-2.2%
- Manufacturing	:	0.6%
3. Services Sector	:	5.1%
-Wholesale/retail sales/hotel/restaurant	:	4.5%
4. Country Growth	:	2.8%

Note: Industry Sector consists of Manufacturing, Construction and Utility.

Regarding the Sector Distribution, agriculture and industry sector accounted respectively for 10% and 19% of GDP in 2001, which however continue to somewhat slow down from previous years. On the other hand, services sector accounted for 71%, which showed remarkable growth.

GDP per capita of year 2001 was assumed to be US$ 3,890 that declined slightly from previous years.

(2) Economic Sector Profile

(a) Agriculture Sector

Agriculture sector has contributed approximately 10% of GDP during these 7 years from 1994 to 2001. The real growth of the sector during the same period recorded a slight increase of 0.3% per annum. The sector absorbed 9% of country workforce in year 1997 according to CAS statistics.

Table 2.1-9 Agriculture: Cultivated Area and Production in Year 2001

Type of Products	Cultivated Area		Production		
	ha	%	1000 ton	LBP Billion	
1. Cereal	52,054	21	172.0	68.4	(US$45mil)
2. Vegetables	41,212	17	1,136.2	419.8	(US$279mil)
2.1 Pulses	6,655	3	61.3	43.5	(US$29mil)
2.2 Greenhouse	17,285	7	646.1	376.3	(US$50mil)
- Tomatoes	4,350	-	247.0		
- Cucumber	4,106	-	161.0		
2.3 Field Crops	17,272	7	428.8		
- Potatoes	11,943	-	257.0		
- Onion	4,120	-	144.2		
3. Fruits	71,843	28	858.7	476.8	(US$316mil)
- Orange	8,900	-	155.8		-
- Apple	9,460	-	112.0		-
- Citron	3,607	-	103.1		-
4. Olives	56,834	22	85.8	118.8	(US$79mil)
5. For industrial use	10,868	4	30.9	124.8	(US$83mil)
-Tabacco	9,110	-	12.8		-
6. Others	19,940	8	46.5	76.5	(US$51mil)
Total	252,751	100	2,330.1	1,285.1	(US$853mil)

Source: Agriculture in Lebanon 2000-2001, Ministry of Agriculture

Lebanon produces a wide variety of food crops. The cultivated area and production by type of agriculture products in 2001 was shown in Table 2.1-9. The table explicitly explains that vegetables and fruits are predominant agriculture products in Lebanon.

Agriculture products such as apples, potatoes, tomatoes, cucumber, onion, garlic, and other fruits and vegetables which exceed local demand are exported mainly to the neighboring Arabic countries. Citrus is produced mainly for exports. On the other hand, products such as cereals, dairy foods, meats, and fisheries are imported because the domestic production cannot reach the

domestic demand. And some vegetables and fruits are imported mainly from Syria.

(b) Industrial Sector

Industrial sector consists of manufacturing sector, construction sector and utility sector such as energy, gas and water. The GDP contribution of Industrial sector was 27% in 1994. However, this fell to 19% in 2001, mostly due to construction sector decrease. The real growth of the sector during the same period recorded negative, -2.2% per annum, also due to sluggish construction sector. Meanwhile, manufacturing sector registered a slight increase of 0.6% per annum over the period of 1994-2001. The industrial sector absorbed 27% of country workforce in year 1997 according to CAS statistics.

'A Report on Industry in Lebanon 1998-99' by Ministry of Industry revealed the number of establishments, workforce and value-added of Lebanese manufacturing industries as shown in Table 2.1-10.

Table 2.1-10 Industrial Establishments, Workforce and Value-added by Sector in 1998

Type of Industry	Number of Manufacturing-industrial Establishments							Work force	Value-added
	Beirut	ML	NL	SL	Nab	Bekaa	Total	(Person)	(US$ mil)
Food/Beverage	720	1,615	1,020	386	160	581	4,482	26,389	432.8
Tabacco	0	1	0	0	0	0	1	1,589	5.8
Textiles	76	500	115	38	19	56	804	3,671	41.1
Garments	534	1,302	286	17	28	95	2,262	10,560	91.5
Leather	143	969	117	17	25	21	1,292	6,481	45.1
Wood Products	208	1,185	151	309	83	310	2,246	6,933	52.8
Paper & Paper Prod.	17	60	8	0	0	80	165	2,944	64.4
Printing	193	493	39	19	0	38	782	4,818	79.3
Chemical/Petroleum	40	181	94	28	0	16	359	3,108	104.6
Rubber/Plastic	17	305	38	27	0	29	416	2,776	58.4
Non-metal	20	1,132	551	236	131	458	2,528	13,377	262.3
Basic Metal	1	4	0	1	0	0	6	417	30.0
Metal	287	1,946	477	274	199	371	3,554	14,492	185.1
Machinery /Equip.	43	173	46	26	22	79	389	2,773	48.0
Electrical Equip.	58	99	52	6	0	0	215	1,695	39.3
Transport Equip.	0	3	17	17	0	5	42	196	0.9
Other Goods	190	1,042	854	240	45	111	2,482	11,889	165.4
Total	2,547	11,010	3,865	1,641	712	2,250	22,025	114,108	1,706.8
Ref.) year 1994							21,609	139,073	1,704.0

Source: A Report on Industry in Lebanon 1998-1999, Ministry of Industry
Note: ML=Mount Lebanon, NL=North Lebanon, SL=South Lebanon, Nab=Nabatieh

According to the report, predominant types of manufacturing industry in terms of establishment number, workforce number and value-added are these 3 sectors; 1) Food/Beverage, 2) Textiles/Garments and 3)Metal/Non-metal. Moreover, it should be noted that, in terms of region, the number of establishments heavily concentrated in Mount Lebanon that accounted for 50% of the country.

(c) Services Sector

GDP contribution of services sector increased remarkably from 61% in 1994 to 71% in 2001. This contribution in 2001 was comprised of; 1) sales/hotel/restaurant 32%, 2) financial 13%, 3) public administration 18%, and 4) others 8%. Particularly financial sector contributed to the increase. The

real growth of the sector over the period of 1994-2001 recorded 5.1% per annum, mainly due to the financial sector growth. Services sector absorbed 64% of country workforce in 1997 according to CAS statistics.

Incidentally Ministry of Tourism revealed that GDP contribution of tourism sector was 7% in 1998. This might be growing larger at present due to constantly increasing foreign tourists visiting in Lebanon, chiefly from neighboring Arabic countries and European countries. Accommodation such as hotels also has been increasing in line with it as shown in Table 2.1-11. Table clearly explains that hotel as well as beds heavily concentrated in Beirut and Mount Lebanon; that is 75% of hotels and 80% of beds.

Table 2.1-11 Number of Hotel and Furnished Apartment in Lebanon

Region	1995 [1]		1998 [1]		2001 [2]			Beds Increase ('01/'95)
	Establishments	Beds	Establishments	Beds	Establishments	Rooms	Beds	
Hotel								
Beirut	37	3,324	50	5,696	68	4,877	7,292	+120%
Mount L.	154	12,165	164	13,600	155	8,237	12,463	+40%
North L.					52	1,568	2,895	
South L.					10	294	614	
Bekka					17	603	1,027	
Total	191	15,489	214	19,296	302	15,579	24,291	+57%
Furnished Apartment								
Beirut	n/a	n/a	n/a	n/a	42	1,469	2,748	-
Mount L.	n/a	n/a	n/a	n/a	11	375	639	-
Others	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-

Source: 1) Tourism Trends in Mediterranean Countries 2001, European Commission
2) Ministry of Tourism

Note: 2001 data was provisionally provided by Ministry of Tourism because the Ministry has started comprehensive nationwide survey this year and not completed yet at moment.

(3) External Trade

Table 2.1-12 presents external trade of Lebanon from 1997 to 2001. The figures in the table explain clearly that Lebanon is a predominantly importing country and is characterized by large trade deficits.

Industrial products such as petroleum/gas, food/beverage, machinery/electrical appliance, chemicals/plastics and transportation equipment largely depend on import from Middle East and industrial countries. As for vegetable, Lebanon imports mostly from Syria. On the other hand, Lebanon exports fruits to neighboring Arabic countries.

Table 2.1-12 External Trade of Lebanon

Item	1997	1998	1999	2000	2001
Export (US$ million) FOB	642	661	677	714	889
Import (US$ million) CIF	7,457	7,061	6,207	6,228	7,291
Trade Balance (US$ million)	-6,815	-6,400	-5,530	-5,514	-6,402
Export Composition (%)	100.0	100.0	100.0	100.0	100.0
-Food & Beverage	21.1	21.5	20.2	18.8	18.6
-Precious Stones	10.4	10.4	14.2	17.8	15.9
-Chemicals & Plastics	13.4	15.6	15.2	14.8	12.8
-Machinery & Appliance	10.4	9.5	10.8	10.5	12.8
-Textile & Footwear	15.3	13.8	9.6	7.0	10.3
-Others	30.4	29.2	30.0	31.1	29.6
Import Composition (%)	100.0	100.0	100.0	100.0	100.0
-Mineral Products	9.6	7.9	9.9	17.6	18.4
-Food & Beverage	20.0	20.2	19.8	18.2	17.4
-Machinery & Appliance	15.5	16.1	14.7	12.8	13.7
-Chemicals & Plastics	10.8	11.6	13.0	12.0	11.7
-Transportation Equip.	10.0	9.7	9.9	8.9	9.8
-Others	34.2	34.5	32.8	30.5	29.0
Destination of Export (%)	100.0	100.0	100.0	100.0	100.0
-Industrial Countries	32.9	37.0	40.4	35.4	36.2
-Middle East	54.0	43.4	43.2	45.2	44.6
-Others	13.1	19.6	16.4	19.4	19.2
Source of Import (%)	100.0	100.0	100.0	100.0	100.0
-Industrial Countries	68.2	66.8	66.4	62.3	57.4
-Middle East	9.4	8.7	9.4	12.5	13.2
-Others	22.4	24.5	24.2	25.2	19.4

Source: Ministry of Finance and Bank of Lebanon

2.1.4 Government Finance

Table 2.1-13 shows Government revenue/expenditure and public debt.

Table 2.1-13 Government Revenue and Expenditure (Billion of LBP)

Item		1999 (Actual)	2000 (Actual)	2001 (Actual)	2002 (Actual)
Budgetary Transaction					
Revenue (a)	Tax	3,321	2,938	2,961	3,995
	Non-tax	1,143	1,252	1,299	1,404
	Total	4,464	4,190	4,260	5,399
Expenditure (b)	General Expenditure	3,576	4,190	3,434	3,865
	Interest payment (c)	3,624	4,197	4,312	4,622
	Total	7,200	8,387	7,746	8,487
Budgetary Transaction Balance (d=a-b)		-2,736	-4,197	-3,486	-3,088
Treasury Transaction Balance (e)		-849	-1,673	-745	-1,205
Total Balance (f = d + e)		-3,585	-4,933	-4,231	-4,293
(Primary Balance = f + c)		(39)	(-736)	(81)	(329)
Net Public Debt at Year End		29,709	35,006	40,782	44,260
- External Debt (US$ million)		5,558	6,992	9,567	14,575

Source: Ministry of Finance and Bank of Lebanon

Outstanding public debt has soared every year, particularly by remarkable enlargement of external debt. Consequently, total fiscal balances have recorded huge deficits due to consecutive increase of interest payment, although primary balance (balance before interest payment) has been attained surplus since 2001 Fiscal Year as envisaged in "The Horizon 2000 Program" that predicted primary

balance surplus to commence from 1999.

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2.2 Topography and Geology

Two parallel mountain ranges, the Lebanon and the Anti-Lebanon, dominate Lebanon's topography. Between both ranges, the Bekaa valley lies about 600 –1000m above mean sea level (amsl), spreading over 130 km in length at NNE/SSE direction, with a width varying from 7 to 10 km. Near around Baalbek in the valley, there is a watershed sharing the Litani and the El-Assi rivers. El-Assi River flows north with an average decline of 0.76% and the Litani flows to the south with an average decline of 0.75%.

Both mountain ranges are spreading from the northern end to the deep south of the country, in NNE/SSW direction. The peaks of the Lebanon Mountain Range are mostly more than 2,000m high, with the highest peak (Qornet al Saoudaa) of 3,088m amsl. The mountains sides are generally steep and rough. The Anti-Lebanon Mountain Range lies along the eastern border with Syria, stands at around 2000m amsl, in parallel with the Lebanon Mountain Range. Mt. Hermon is located in the southern section of the Range and it reaches 2,814 m amsl. Side slopes are gradual and gentle compared with the Lebanon Mountains but also rough. In the Mediterranean Sea side of the country, the wide scale plain areas became rare and steep mountains slopes extends close to the sea. The wide scale low-lying plain can only be found near the northern border with Syria and around the estuary of the Litani in the south of Lebanon.

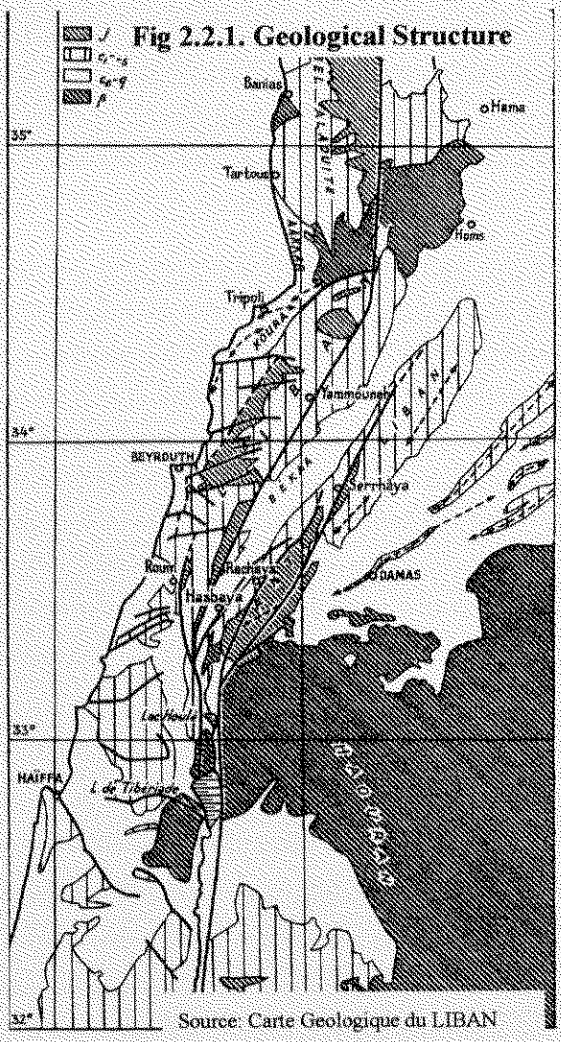
The alluvial plain in the north Lebanon was formed by the sediments of four major rivers: El Kebir, Ostuene, Arka and El Bared. The plain extends to Syrian side. Because of rather plenty rainfall and steep slopes, most of the rivers in the country formed very deep dissected valleys, and the depth of such canyons reaches 550 to 700 m. Along the Saida-Beirut-Tripoli stretch, the mountain extends toward west to very close to the sea. The slopes of mountains in this stretch are also quite steep. Structural basins of El-Yammouneh (el. 1,360m at the bottom), Ainata (el. 1,600mat the bottom) and Aayoun Urghouch (el. 1,850m at the bottom) range in the eastern side of Lebanon Mountain Range along to the NNE-SSW direction, almost in straight line.

A geological feature

Almost all of the country is underlain by three major limestone formations of different age. The base layer of the limestone is dating back to Jurassic Period. The second major limestone is Cretaceous in age and the third, the youngest limestone formation, is Neogene Tertiary in age. While, the minor formations distributing in the country are sandstone, marls, shale, conglomerates and their alternations. They are mostly Cretaceous in age but some are of Tertiary. Besides those sedimentary formations, three volcanic formations of different age, mainly Basalt, take an important role in geomorphology and hydrogeology of Lebanon. Volcanic activities that formed such Basaltic layers were happened in late Jurassic, Pliocene, and Quaternary.

Jurassic limestone forms the base or framework of both Lebanon and Anti-Lebanon Mountain Ranges, and widely crops out in western side of Lebanon Mountains and in southern half of Anti-Lebanon Mountains. Strike of the formation shows N20Eto N25E in El Barouk, N-S in Ehmej and N25W in Harmon. In Bikfaya area, the strike varies complicatedly due to the influence of many faults. Limestone of Cretaceous is broadly found in both Lebanon and Anti-Lebanon Mountains overlaying the Jurassic limestone. It covers approximately 50% of Lebanese land. Strike of the formation in the western side of Bekaa also varies due to the influence of many faults and folds. For Cenozoics, Tertiary systems are distributed over the southern part of the Bekaa Valley and in the southern part of Saida, then, Quaternary systems can be seen in the Bekaa Valley, coastal areas of north and south Lebanon. They are composed of alternations of limestone, marls and calcareous sandstone, and among them the limestone also occupies the greatest part.

Fig 2.2.1. Geological Structure



Source: Carte Geologique du LIBAN

Basalt

The volcanic activity began in the Jurassic period with the orogenic movements. This activity was resumed in Neogene Tertiary and in Pleistcene. Young Basalts of Cenozoic era distribute near Moonjez of north Lebanon, near Aamra of south Lebanon and on the right bank of the Assi River. Old Basalts of Jurassic crop out near Fnaideq. Some of old Basalts scattered near around Hiyata, in the Anti-Lebanon Mountain, and in Marjaayoun.

Faults and foldings

In Lebanon, a pair of major faults cross the country thoroughly in NNE-SSW direction. The faults set is a part of large tectonic line, coming from Syria and continued to Jordan Valley (See Fig.2.2.1). The

western fault of the pair is called "Yammouneh Fault" and the eastern one is called "Serrhaya Fault". The Bekaa Valley was formed by the tectonic movement of these pair faults, as a graben structure in between the faults. Yammouneh Fault passes through just eastern side of Lebanon Mountain Range and formed a typical fault valley.

Most of faults in Lebanon are of vertical type, and the followings are features of major faults:

- Yammouneh Fault varies its strike from N9W up to N32E.
- Serrhaya Fault strikes toward N22E and passes through the western side of Anti-Lebanon.
- Rachaya fault strikes toward N30E and passes through the western side of Mount Harmon
- Hasbaya fault is separate of Rachaya fault.

Furthermore, many faults range straightly near Tartij striking N80E to N85E, and a number of small faults exist in the eastern side of Beirut changing their strikes to various directions.

The following main folds in Lebanon can be found:

- Fold near Bazal (6 points geosynclines at N45E from the geosyncline's axis),
- Fold in the eastern side of Yammouneh (anticlines at N35E from anticline axis),
- Fold near Dedde (anticlines at N47E from anticline axis),
- Fold in the eastern side of Mlikh (where stratification of limestone is distributed at N45E from the geosyncline's axis).