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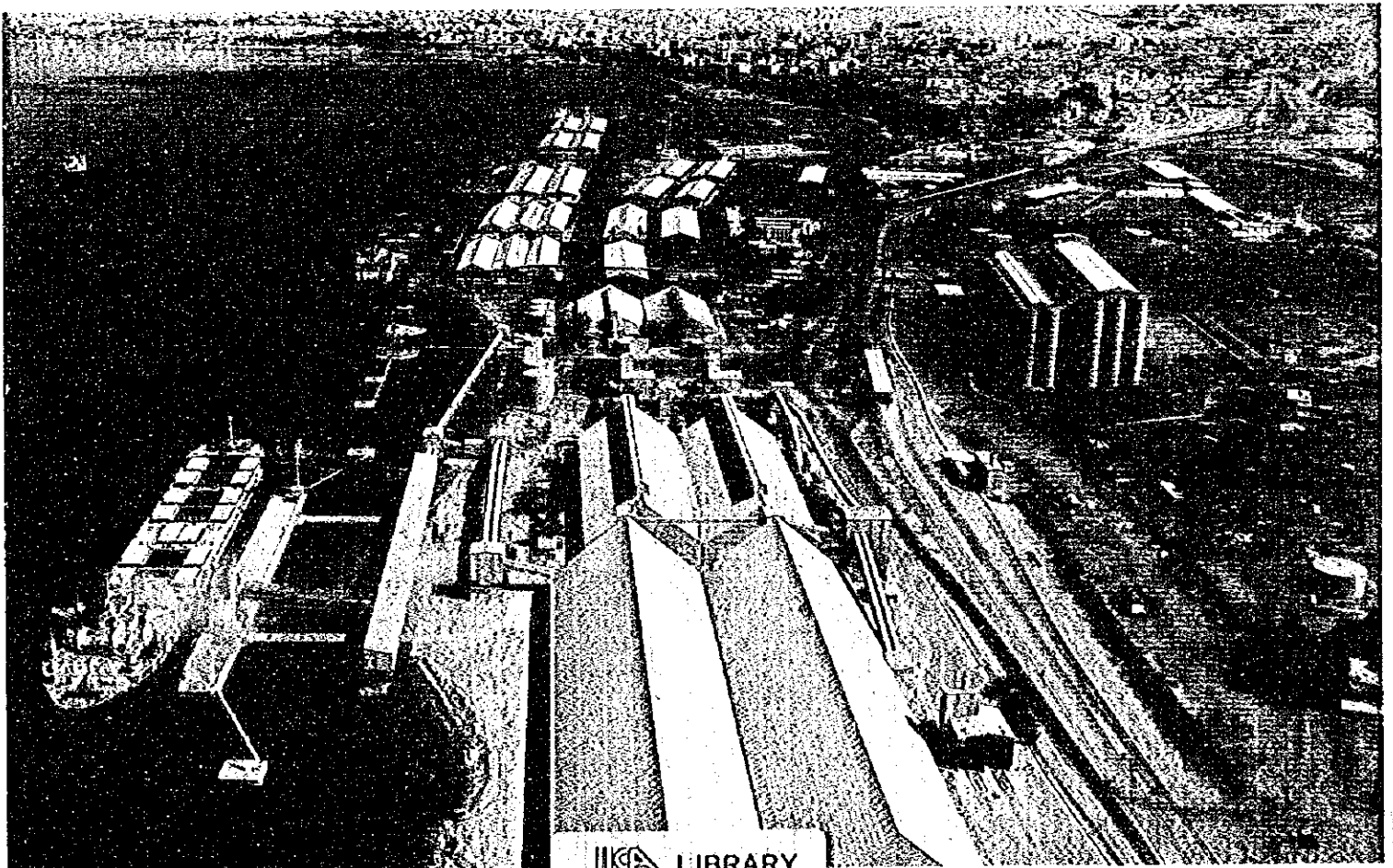
THE PORTS CORPORATION OF AQABA
THE HASHEMITE KINGDOM OF JORDAN

FINAL REPORT

THE STUDY ON THE IMPROVEMENT PLAN OF THE PORT OF AQABA IN THE HASHEMITE KINGDOM OF JORDAN

VOLUME (1)

FEBRUARY 1996



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THE OVERSEAS COASTAL AREA DEVELOPMENT INSTITUTE OF JAPAN(OCDI)
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**THE STUDY ON THE IMPROVEMENT PLAN
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CURRENCY EXCHANGE RATE

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(As of March, 1995)

PREFACE

In response to a request from the Government of The Hashemite Kingdom of Jordan, the Government of Japan decided to conduct a feasibility study on the Improvement Plan of the Port of Aqaba in The Hashemite Kingdom of Jordan and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent a study team to Jordan three times between December 1994 and December 1995. The study team was headed by Mr. Jiro Kano and composed of members from the Overseas Coastal Area Development Institute of Japan (OCDI), Ocean Consultant, Japan Co., LTD. (OCJ) and Pacific Consultants International (PCI).

The team held discussions with the officials concerned of the Government of Jordan and conducted field surveys in the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

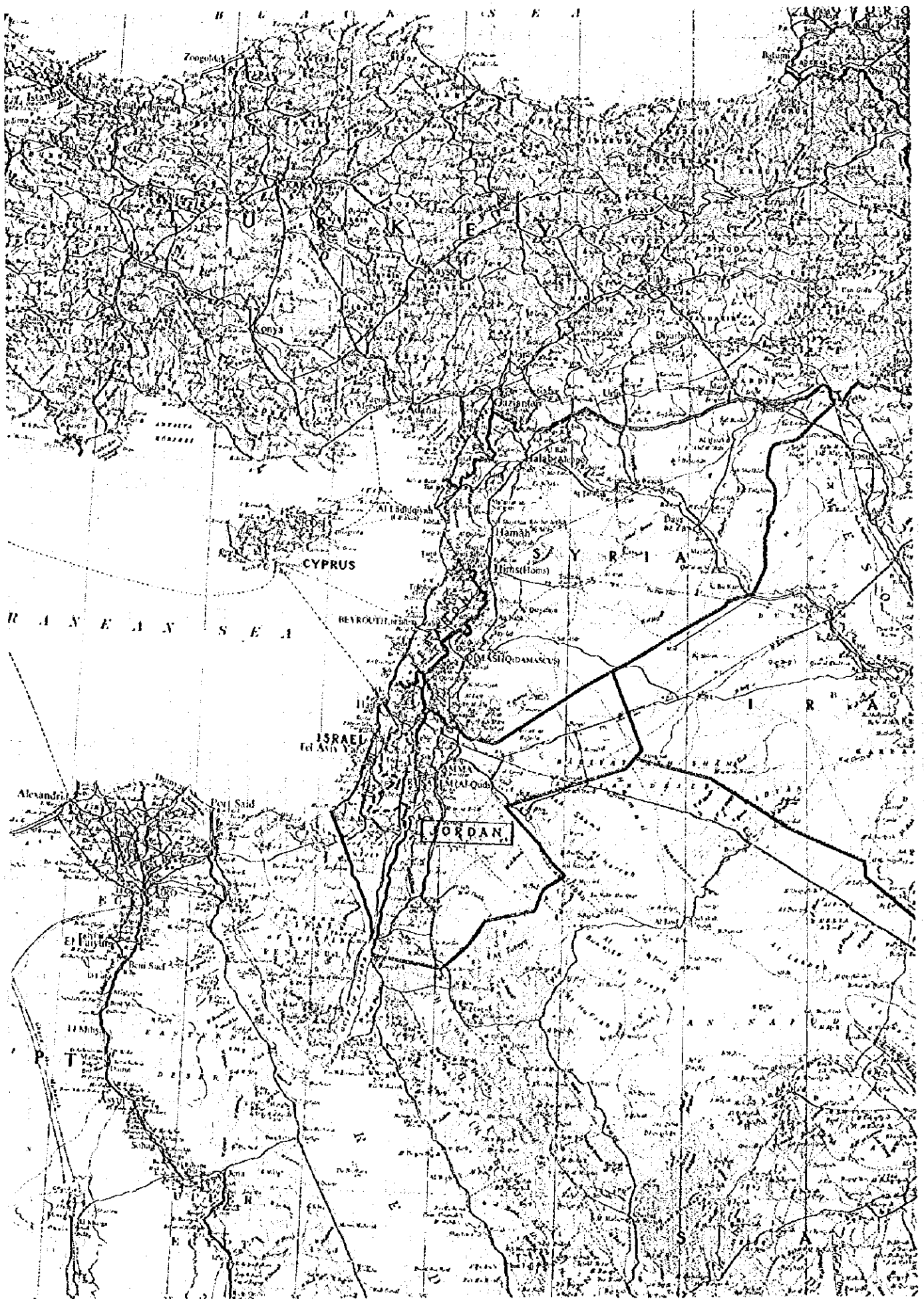
I wish to express my sincere appreciation to the officials concerned of the Government of The Hashemite Kingdom of Jordan for the close cooperation they extended to the team.

February, 1996

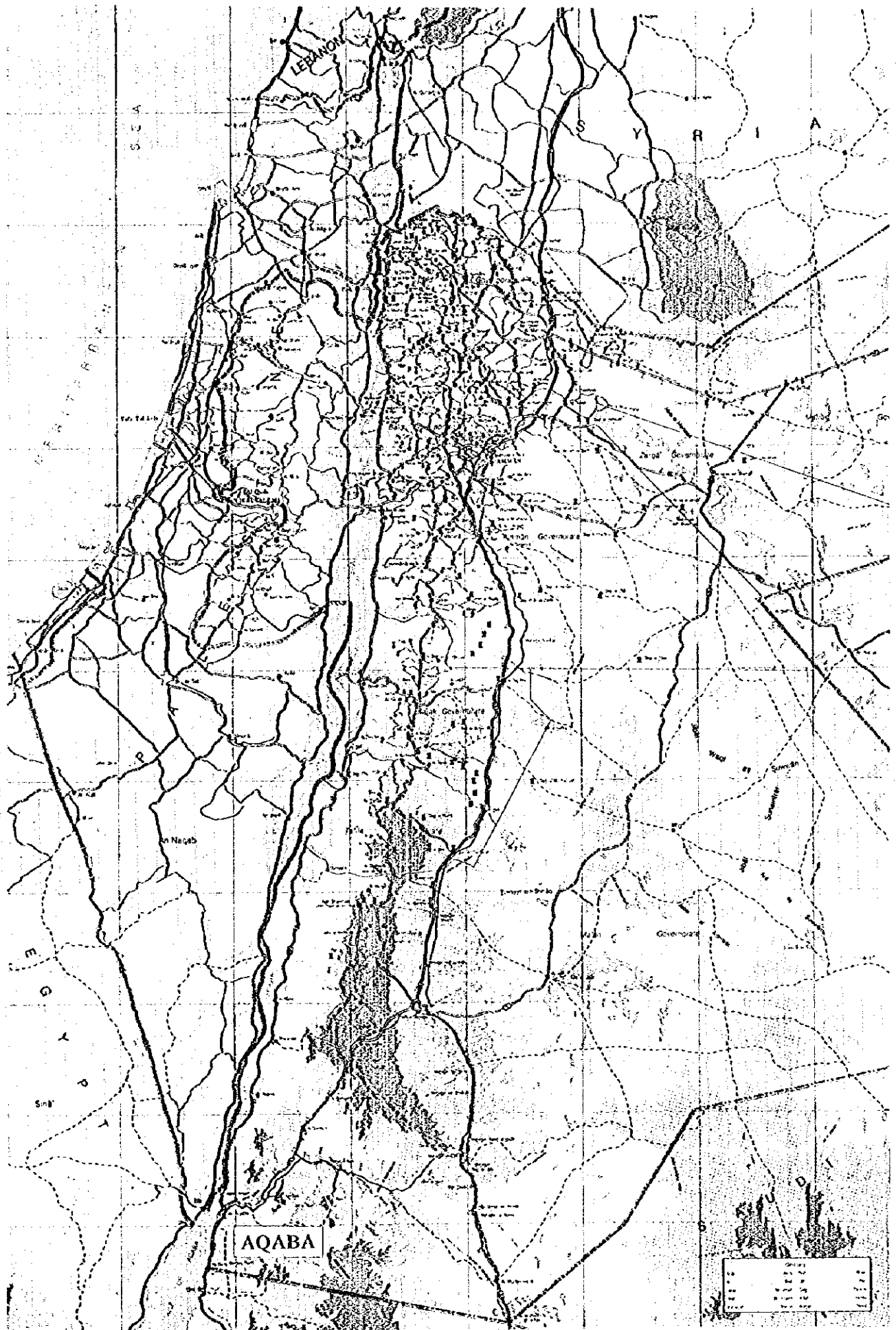


Kimio Fujita
President

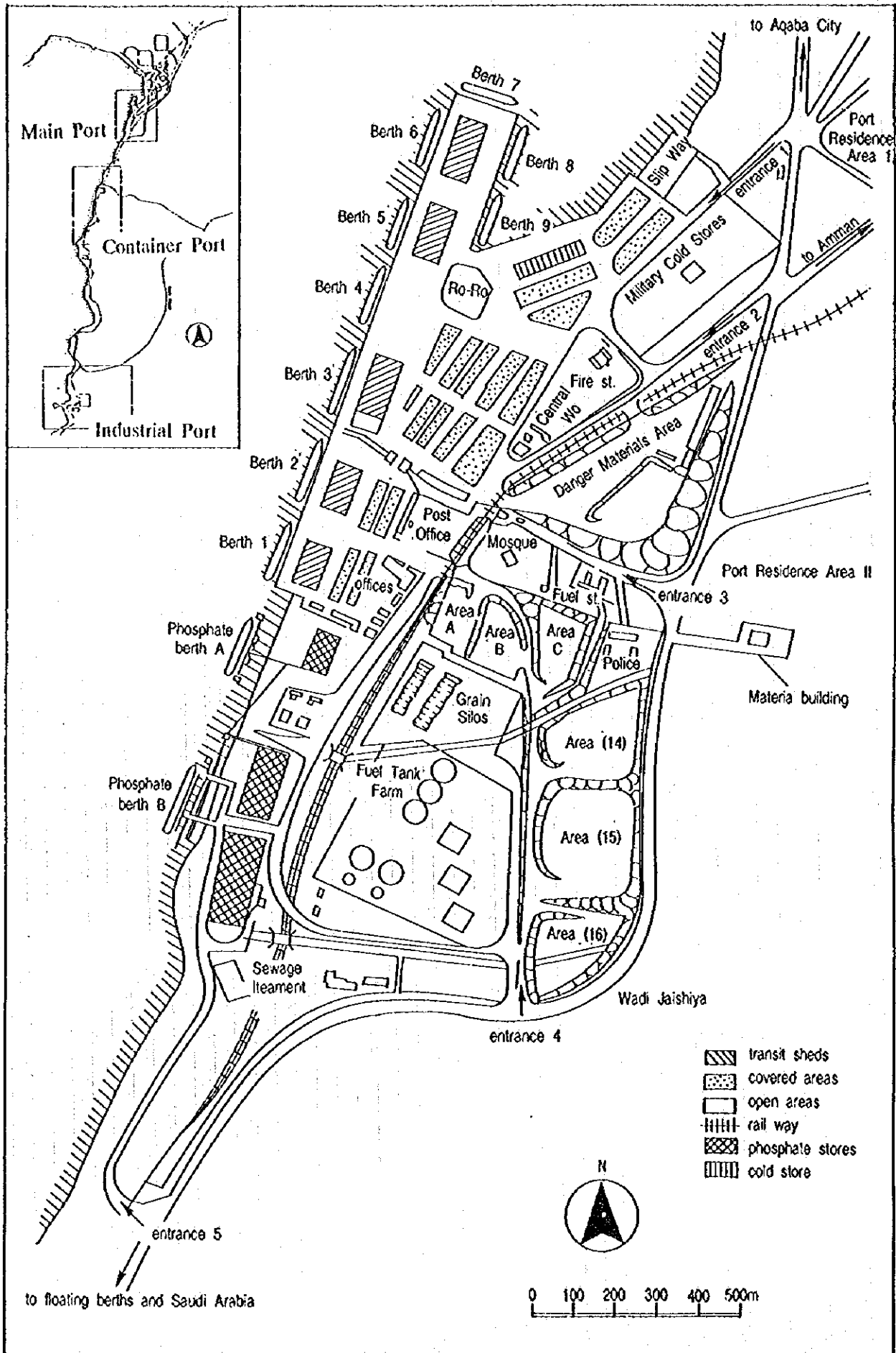
Japan International Cooperation Agency



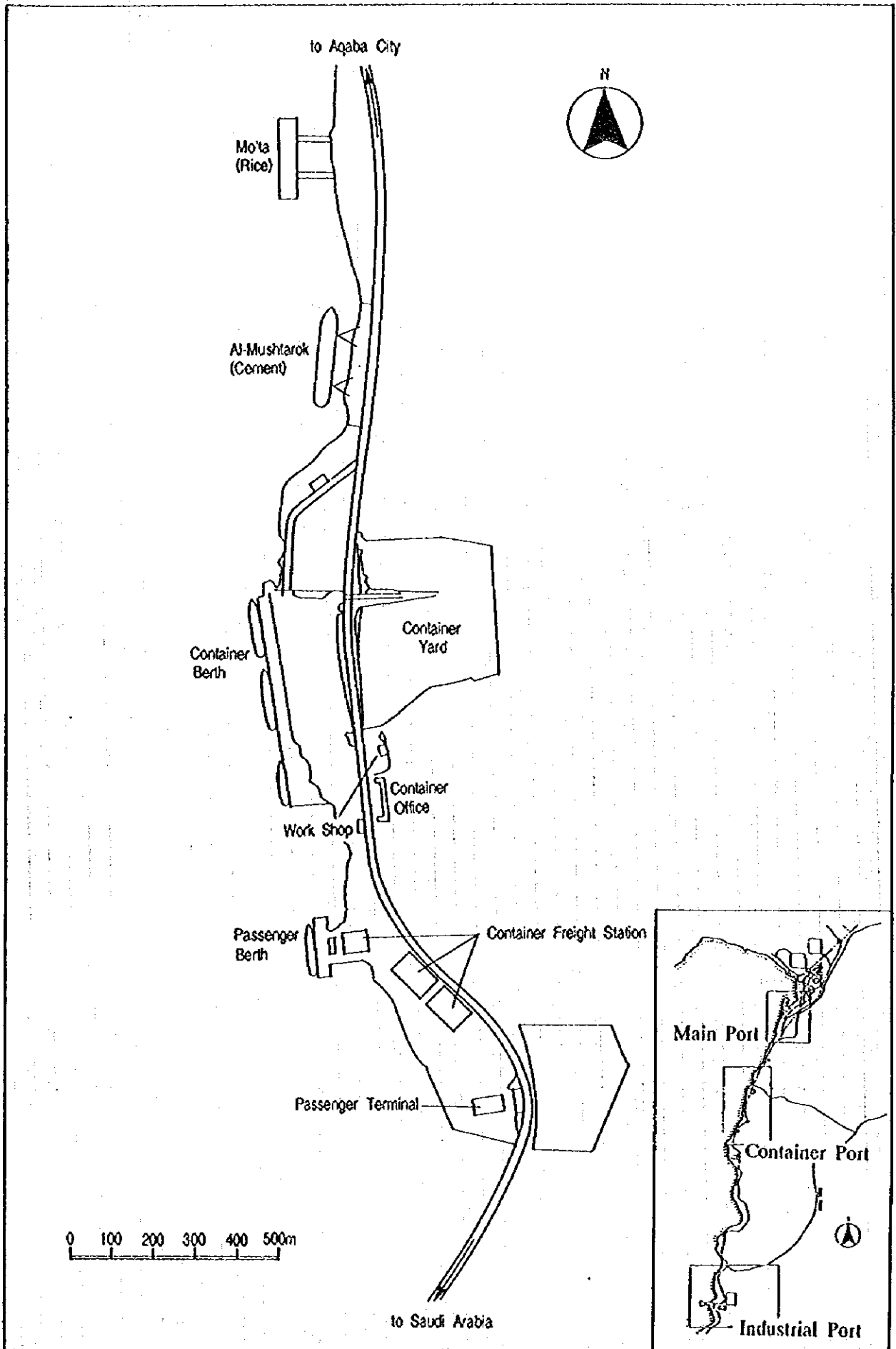
Location Map (1)



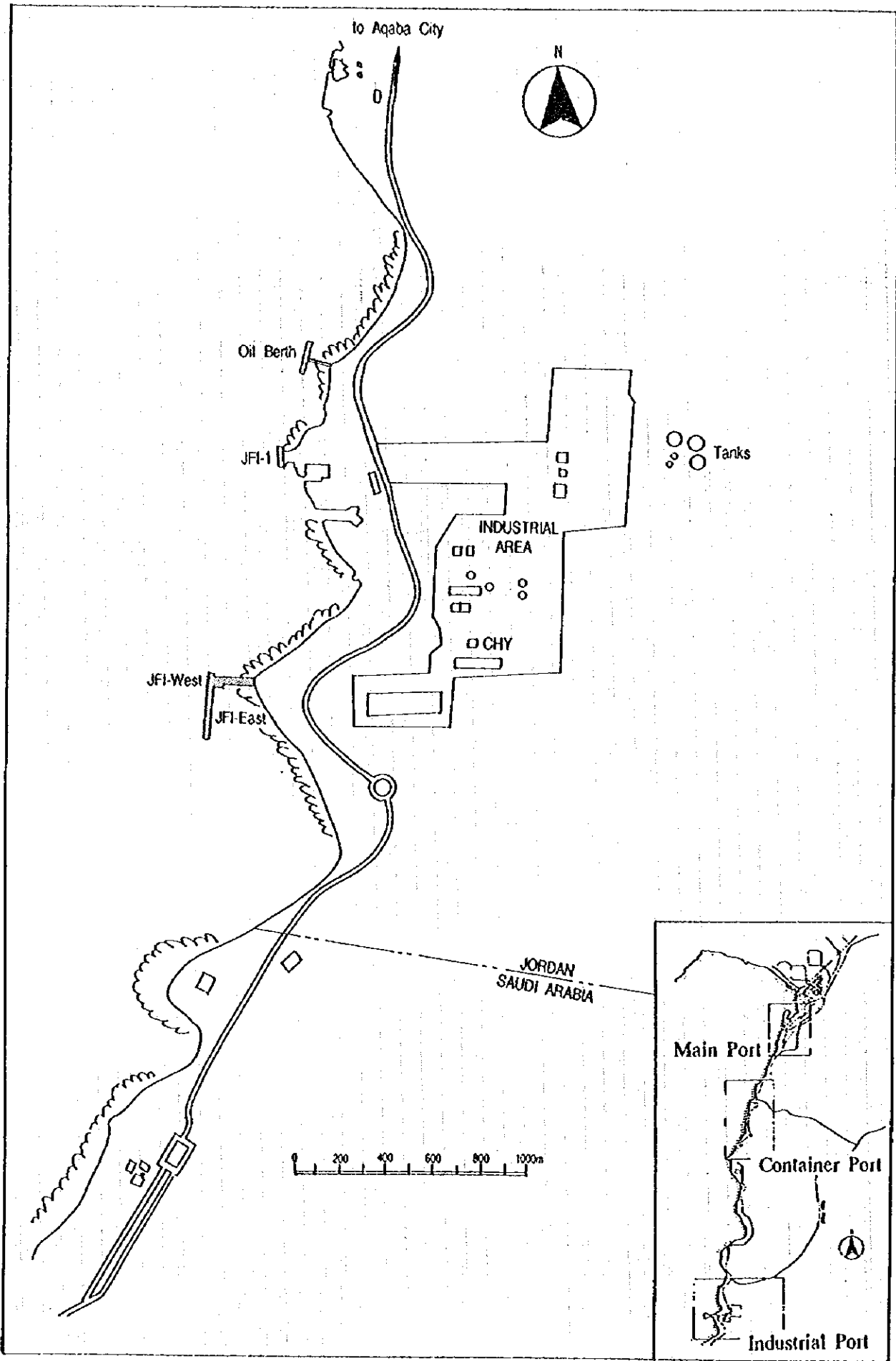
Location Map (2)



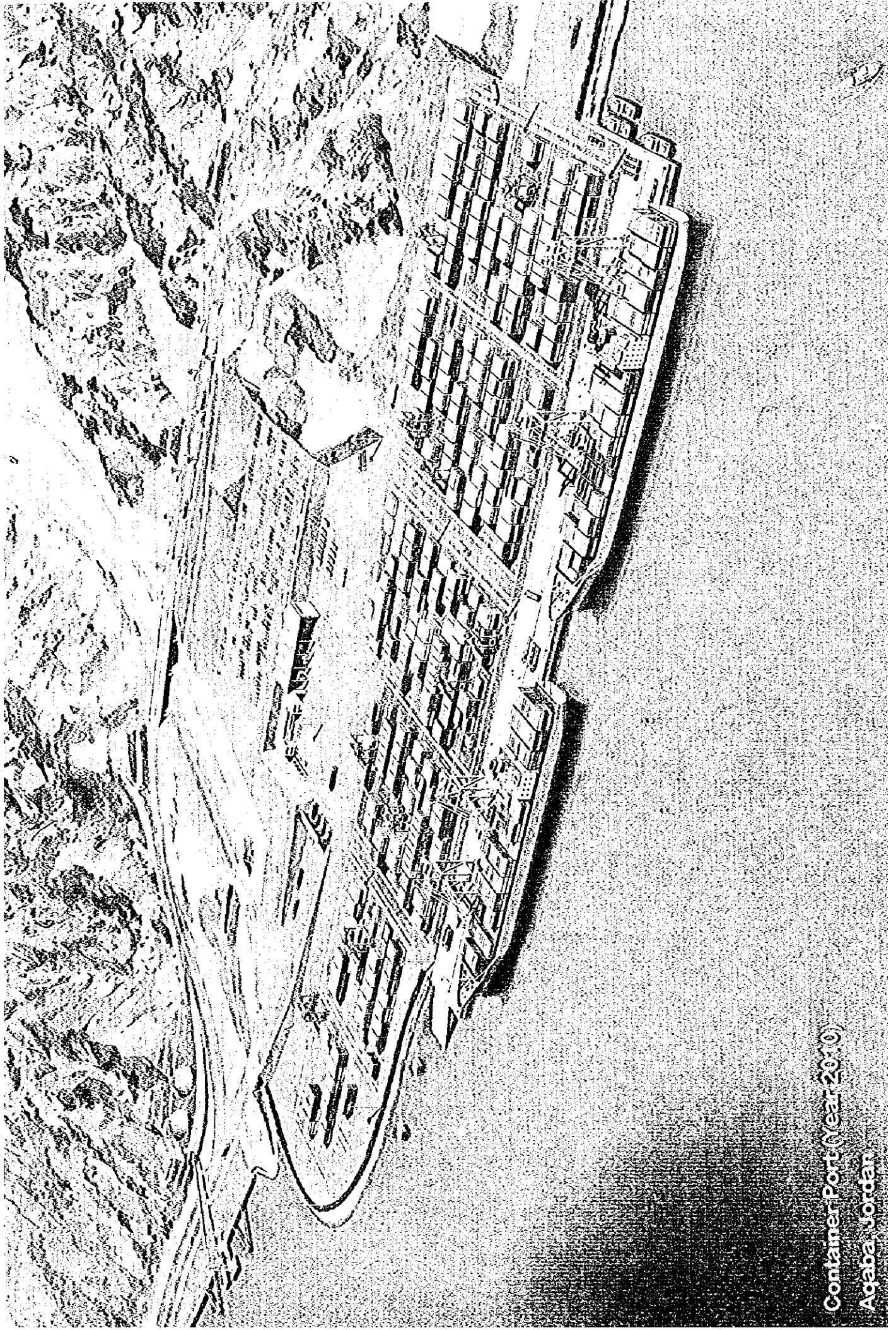
Layout of the Port of Aqaba (Main Port)



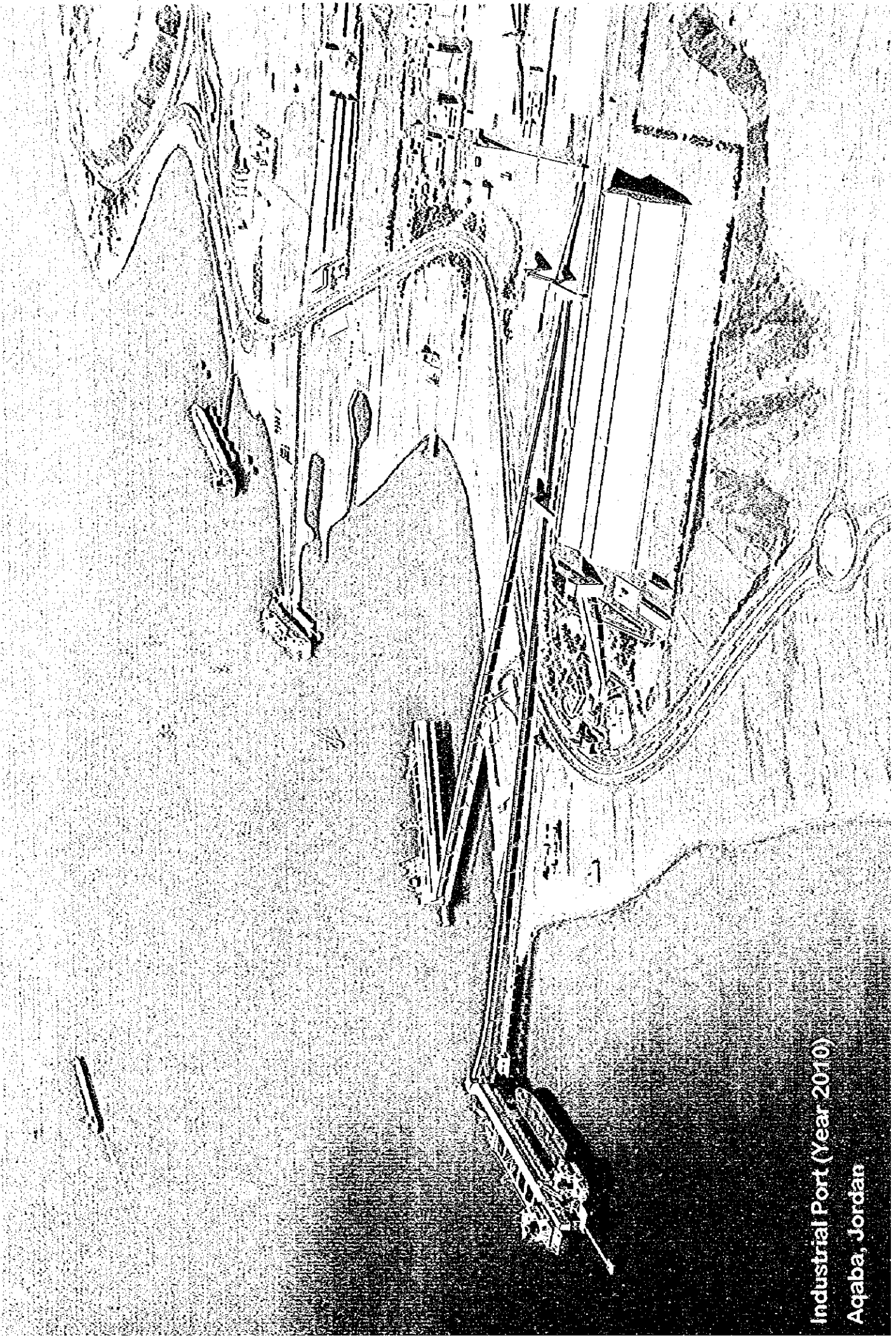
Layout of the Port of Aqabe (Container Port)



Layout of the Port of Aqaba (Industrial Port)



Container Port (Year 2010)
Aqaba, Jordan



Industrial Port (Year 2010)
Aqaba, Jordan

ABBREVIATIONS

APC	Arab Potash Company
ARA	Arab Region Authority
ARC	Arab Railway Corporation
BOT	Build, Operate and Transfer
B/L	Bill of Laden
CBR	Cost Benefit Ratio
CD	Chart Datum
CDL	Chart Datum Level
CFS	Container Freight Station
CIF	Cost, Insurance and Freight
CPU	Central Processing Unit
CY	Container Yard
CZMA	Coastal Zone Management Act
DAP	Di-Ammonium Phosphate
DG	Dangerous Goods
DO	Dissolved Oxygen
DOE	Department of Environment
DWT	Dead Weight Tonnage
EC	European Community
EIA	Environmental Impact Assessment
EIR	Equipment Interchange Receipt
EIRR	Economic Internal Rate of Return
EL	Elevation Level
ESCAP	Economic and Social Commission for Asia and the Pacific
EFA	Estimate Time of Arrival
ETD	Estimate Time of Departure
FEU	Forty-Foot Equivalent Units
F.C.	Factor Cost
FCL	Full Container Load Cargo
FIRR	Financial Internal Rate of Return
FOB	Free on Board
FTZ	Free Trade Zone
GAEAP	The Gulf of Aqaba Environmental Action Plan
GDP	Gross Domestic Products
GRT	Gross Registered Tonnage
GWh	Giga(one billion)-Watt hour
HP	Horse Power
IDECO	Irbid District Electricity Company
IEE	Initial Environmental Examination
IMF	The International Monetary Fund
ISO	International Standard Organization
JD	Jordan Dinar
JEA	Jordan Electricity Authority
JFI	Jordan Fertilizer Industry
JIEC	Jordan Industrial Estate Corporation
JPMC	Jordan Phosphate Mines Co. LTD.
JPRC	Jordan Petroleum Refinery Company
JTPI	Jordan Timber Products Industry

IMO	International Maritime Organization
LASH Ship	Lighter Aboard Ship
LCL	Less than Container Load
MARPOL	International Conference on Marine Pollution
MB	Mega Byte
MHZ	Mega Hertz
MMRAE	Ministry of Municipal and Rural Affairs and the Environment
MOF	Ministry of Finance
MOP	Ministry of Planning
MOP	Muriate of Potash
M.P.	Market Price
MOS	Ministry of Supply
MOT	Ministry of Transport
MPN	Most Probable Number
MSS	Marine Science Station
MT(M/T)	Metric Tons
NES	National Environment Strategy
NPK	Nitrogen(N)-Phosphatic(P)-Potassic(K) Fertilizer
NRT	Net Registered Tonnage
OC	Organic Substance
OECD	Organization for Economic Cooperation and Development
OECF	The Overseas Economic Corporation Fund
PC	The Ports Corporation
PLO	Palestine Liberation Organization
PSC	Port State Control
P.V.	Present Value
RO/RO Ship	Roll On / Roll Off Ship
RSS	Royal Scientific Society
SMB	The Sverdrup and Munk and Modified by Bretschneider
SS	Suspended Solid
T-H	Total Hydrocarbons
T-N	Total Nitrogen
T-P	Total Phosphate
TDS	Total Dissolved Salts
TEU	Twenty-foot Equivalent Unit
TS	Total Sulfide
TSS	Total Suspended Solids
UAE	United Arab Emirates
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America

**FINAL REPORT FOR THE STUDY ON THE IMPROVEMENT PLAN
OF THE PORT OF AQABA IN THE HASHEMITE KINGDOM OF JORDAN**

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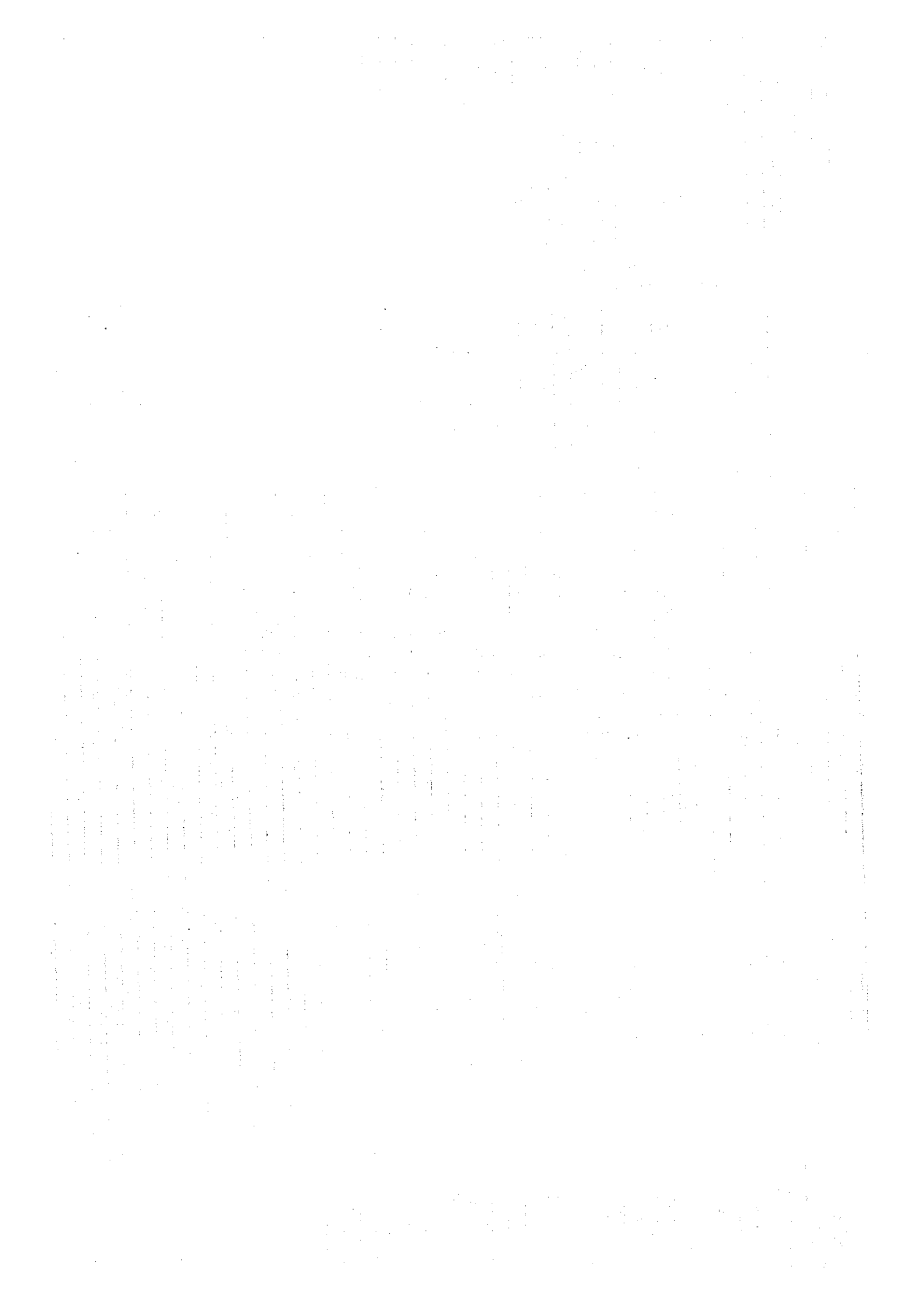
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CONCLUSIONS AND RECOMMENDATION

Through the course of the Study, the Study Team had many opportunities to hold discussions with counterpart personnel and has prepared various comments and suggestions on construction, maintenance, operation and management of the port of Aqaba to them. Conclusions and recommendations for the project prepared on the basis of the discussions are summarized herewith.

CONCLUSIONS

1) The Basic Concept of the Port Development

The port of Aqaba already has a lot of roles and functions. In addition, with the progress of the peace process in the Middle East, the port is to enjoy much prosperity. In order to meet such expectations and bring about prosperity of the port, the port development plan is proposed, aiming at the following basic concept:

- a) to ensure the role and function as the gateway of Jordan
- b) to realize efficient operation
- c) to coordinate with other activities in the Gulf of Aqaba including sufficient consideration of environment
- d) to prepare rational and economic design and implementation scheme

2) Numerical Target

In advance of setting numerical targets, future political and economic scenarios in Jordan were examined. Although the future situation in the Middle East (including Jordan) is affected by many elements, progress of the Middle East peace process and the U.N. sanctions against Iraq were thought most important. Three alternative Master Plans were proposed corresponding to three scenarios out of combinations of the above two elements. They were based on rapid progress of peace process and complete lifting of sanctions, slow progress and continuation of sanctions and an intermediate situation. After consultation with authorities concerned, the middle case was selected as the most likely and practical one, which became the basis of the feasibility study at the target year, 2000.

Under the above conditions, future perspective related to port activities is as follows:

Table 1 Future Numerical Target

	Unit	1993	2000	2010
Population of Jordan	Number (,000)	4,152	5,173	6,686
GDP of Jordan	million JD	3,596	5,966	13,181
GDP per capita	JD	866	1,153	1,971
Total Cargo Volume	million tons	12	22	29
of which Container	TEUs (,000)	111	227	416
Passenger	Number (,000)	1,247	1,490	2,150

3) Proposed Plan

In order to meet forecast demand, the following project is proposed:

Table 2 Major Contents of the Proposed Plan

Objectives	Project Component	Place	Implementation Period	Remarks
Receiving Panamax type vessel	Enlargement of the existing berth (depth 14 m, length 280 m)	Main Port	up to 2000	Mainly to accommodate grain vessels; necessary to relocate unloading system
Receiving large conventional general cargo vessel	Enlargement of the existing berth (depth 12 m, length 240 m)	Main Port	up to 2000	
Coping with Containerization	Extension of the existing container berth (60 m)	Container Port	up to 2000	
ditto	Development of container yard	Container Port	Southern half completed up to 2000	
ditto	Installation of two gantry cranes (one is Panamax and another over-Panamax)	Container Port	One (Panamax) up to 2000	Need to procure other equipment (transfer crane and tug master) and introduce new computer system
Receiving large livestock vessel	Improvement of JH.1 Berth (Timber Berth)	Industrial Port	up to 2000	JH.1 Berth to be assigned for livestock handling in a specific use for environmental consideration
Supporting Industrial Activity	Development of new berth for fertilizer export	Industrial Port	up to 2000	need to install cargo handling system
ditto	Installation of additional cargo handling system	Industrial Port	beyond 2000	one loader and one unloader

In the Plan, it should be understood that some important prerequisites are included as follows:

- completion of new bypass road instead of the existing coastal road around the Container Port in advance of implementation of container port development
- efficient operation by improvement of cargo handling productivity, in particular, shortening of cargo dwelling time
- increase of cargo, especially, exported container cargoes through active port sales to port users
- introduction of computer system and making best use of it

4) Cost Estimate

The total cost of the Master Plan is estimated at about 76 million JD over the coming fifteen years. Out of the total, two-thirds are for gantry cranes and other equipment procurement and installation. One-third is for civil works, which covers container berth extension and yard development in the Container Port, additional pier in the Industrial Port and the grain and general cargo berth improvement in the Main Port.

The total cost of the Short-Term Improvement Plan up to 2000 is estimated at about 50.5 million JD, of which about 5 % is used for the Main Port, 53 % for the Container Port and 42 % for the Industrial Port.

5) Results of Feasibility Analysis

According to the feasibility study, the proposed Short-Term Improvement Plan is, as a whole, judged to be viable from economic, financial and environmental viewpoints.

EIRR for the total project is 20 %. This means that EIRR of the proposed project fairly exceeds 10 %, which is employed as the yardstick of feasibility in many port development projects. Careful attention, however, should be paid to individual project components. The total project is comprised of four individual project components. There is a big difference between individual EIRR values. The EIRR in case of improvement of JFI.1 Berth is about 11 %. Judging from port capacity at the target year, 2000, forecast cargo volume of livestock could be handled without improvement of JFI.1 Berth. Considering environmental issues and desirable berth allotment in future, this project is proposed. EIRR would become higher if environmental merit could be calculated numerically. But revised EIRR would not, relatively speaking, be at a good level even if this merit were quantitatively considered. There is little relation between individual project components so that they can be separately executed. In this context, the result of EIRR calculation shows the priority among project components, that is to say, the priority in economic sense, is, in due order, enlargement of grain berth, improvement of cargo handling system at the Industrial Port, development of new container terminal and improvement of JFI.1 Berth.

FIRR is 8.0 % which exceeds 2 %, the weighted average interest rate for expected foreign aid. In this calculation, current tariff rate is adopted. The Ports Corporation has been actually making a profit from port activities and contributing to the national budget revenue. Such a situation is not considered in the FIRR calculation. The budgetary statistics indicate that the contribution by PC represents about 1 %. Although this does not seem so high, this calculation precondition should be examined from the viewpoint of the national budgetary system.

Due to the contribution, PC has almost no internal resources for future investment. Tariff is basically desirable at a proper level so that the port can make necessary investments. Accordingly, tariff level, if necessary, should be revised.

Environmental Impact Analysis shows that the proposed project will not cause serious problems on environment but that dust dispersion of phosphate should be reduced in due course through PC's scheduled countermeasures.

Recommendations

It is most strongly recommended that the proposed port development schemes should be realized in accordance with the proposed project implementation program. The following items should be taken into consideration for securing smooth and successful implementation.

1. General issues to be considered by the Government of Jordan

The port of Aqaba is located over 300 km from the political and economic centre of Jordan. Partly due to this fact, almost all ministries of the Government in Jordan are apt to ignore the port. The Ministry of Transport (MOT) does not usually take part in conferences on annual budget of The Ports Corporation (PC). PC only submits the same documents to MOT as it does to the Ministry of Finance (MOF). Sufficient and timely communication and coordination do not seem to be made between PC and The Ministry of Planning, which has a great influence on decisions of financial aid from foreign countries and authorities. As mentioned in section 1.9, the port of Aqaba already plays many important roles not only in terms of supporting lives of citizens and domestic industries but also in terms of contribution to regional economy and stability, in particularly, in the Middle East. Under these circumstances, the following items are essential:

- 1) First of all, The Ports Corporation should conduct more public relation activities with respect to current port activities and facilities, competitive situation surrounding the port, expected roles and so on for the central organization concerned as well as the whole country, because PC knows such matters best.
- 2) The Government of Jordan should properly evaluate and recognize current and expected significance of port activities.
- 3) On top of that, characteristics of port development should be understood. Implementation of port projects, in general, takes a long time and requires a lot of money to realize completion. Furthermore, people and organizations concerned have to work hard through port sales promotion activities to ensure port facilities are utilized.
- 4) As described in section 4.1, the proposed scheme is based on some fundamental conditions, of which new road bypassing the new container terminal is prerequisite for the Short-Term Improvement Plan and improvement of railway transportation system for phosphate rocks and Backroad with steep slope is urgently required. These infrastructure investments should be implemented by governmental authorities or agencies concerned. One desirable way to secure the above is for proposed scheme to be approved by all relevant ministries. In other words, the plan should, if possible, be vested with a certain legal power by the government to promote its development scheme.
- 5) Container terminal is of great relevance to the prosperity and development of the port of Aqaba in future. The most important and increasing cargo in the long run is thought to be container cargo, in spite of the regretful current situation that all the export containers are empty. The most important key factor is to promote earnest port sales as soon as possible so as to increase export container cargoes, which are highly related to industrial promotion in the hinterland. In this context, future prosperity of the port depends upon the overall economic situation in Jordan,

which is the responsibility of all ministries and relevant private sectors.

2. Establishment of practical and flexible implementation program

Implementation of the project depends on how The Ports Corporation will acquire the required funds. Considering the financial situation at the port of Aqaba, most of necessary budget for the project implementation will be attained through foreign countries or international assistance aid. The Government and The Ports Corporation should examine the following items for the introduction of foreign aid.

1) To establish sound financial system and tariff policy.

The Ports Corporation presently makes a profit in its account and pays surplus to the Ministry of Finance every quarter of the year. PC's account is thought sufficient to carry out daily maintenance works but not to allow for large scale port development. Taking one typical example during the Study Team's visit, the computer system at Operation Department did not work due to lack of software, because MOF did not assign necessary budget despite PC's request. In this sense, current financial system of PC does not cause serious problems for daily operation and management but it is not good for securing the large amount of funds required for improvement of the existing facilities, new construction investment and introduction of container crane. PC and the Government of Jordan have to try to secure the budget for project investment in advance on their own before requesting any foreign aid. PC has to make efforts to cover project investment cost by its annual revenue as much as possible and to establish new continuous budget expenditure system beyond individual fiscal year.

As well, PC should seek some measures to increase revenue through setting the tariff at a proper level. Although contents of tariff are necessary to be competitive and reasonable considering neighbouring ports' ones, they should be set, at least, at a level which revenue can guarantee management and operation cost and repayment for interest and principal of loans. Current tariff may be revised on the basis of the result of income/investment analysis, in particularly, for newly planned facilities and equipment.

2) To examine financial source for implementation for the project components.

Although all of the project components are proposed to meet the forecast cargo demand at the target year, there are some differences in major objectives and scenarios with respect to realization of future perspectives corresponding to these project components. Construction of New Grain Berth is to solve the present problem that grain vessels of Panamax type already call with full draught but cannot be accommodated at present berths. New Container Terminal is to cope with worldwide trend of containerization and establish itself as a transit port. Improvement of New Timber Berth (JFI. 1 Berth) is required mainly in consideration of environmental issues. New cargo handling system of Fertilizer Berth is to handle increased fertilizer products and materials, etc. Construction of a new fertilizer factory is already being executed on schedule. Taking the above into account, financial source from foreign aid may be diversified. Unless necessary funds for the whole project can be raised, implementation schedule for the project components might have to be re-examined, because some kinds of cargoes can be handled at the existing facilities for the time being judging from cargo handling capacity, although it is not desirable to continue such a situation from the long term point of view.

3) The project implementation plan, as a matter of course, corresponds to the proposed port plan. The port plan, in general, needs to be flexible enough to adjust to possible contingencies and schemes have to be reviewed and modified in accordance with the changing socio-economic situation surrounding the port. PC should, therefore, introduce a new section, port planning division, in charge of preparing port development policy as soon as possible. This division will revise project implementation plan in harmony with amendment of the existing port plan, if necessary, following up the political and economic movements in the Middle East, etc., always aiming at higher efficiency of the port.

4) BOT is a financial scheme often considered in development countries which find it difficult to raise investment funds of their own. Even at the port of Aqaba, introduction of BOT for implementation of some project components has been discussed. In this Study, however, BOT is not proposed. The reason is as follows:

- It is generally said difficult to find BOT investors for port projects.
- PC seems reluctant to promote privatization in the field of operation which PC presently carries out.
- Prior to introducing any form of privatization, PC should clarify basic policy of utilization of the whole port area, which is largely related to the utilization and management policy of the coastal area.
- The coastal area is very limited while diversified requirements such as tourism development or environmental conservation, etc. are many. At the very moment when comprehensive utilization and management policy of the whole coastal area is strongly required, introduction of BOT without prudent consideration for implementation of a part of projects will bring about problems such as confusion, unnecessary competition between public and private sectors, and may create environmental issues.
- After the approval of the basic policy of privatization through coordination and consultation, BOT could be acceptable as one means of development.
- For instance, some of port facilities are expected to mainly serve a specific use, handling fertilizer-related cargoes and livestock. BOT would be worth examining as a means to raise investment funds for facilities and equipment with the above characteristics.
- Otherwise, investment funds may be returned from users by charge through revised tariff at a proper level.

3. Employment of appropriate training system, personnel policy and other relevant issues

The proposed plan is made on condition that more efficient port management and operation will be realized in future. In addition, The Ports Corporation has to supervise construction works and equipment procurements during the project implementation. In light of this, well designed training system and personnel policy are crucial. Major objectives of training corresponding to the proposed plan are thought as follows;

- realization of efficient, safe and reliable operation
- enforcement of the management body through reform and slimming
- smooth execution of the proposed project
- sufficient inspection works of assets and timely maintenance works

Following methods or measures of these training courses are useful.

- receiving technical experts from overseas in the field to enhance ability or capacity from the long-term strategic point of view
- use of consultants and technical transfer through them
- dispatching selected staffs to overseas and utilization of their knowledge and experience
- promotion of computer use for various divisions as soon as possible

Training is one of means to provide knowledge and technical skill for personnel. More important matter to be recognized is to instill trainees with cost-consciousness and efficiency oriented mind through training courses. Such a matter is highly related to personnel policy. Following issues are recommended with respect to personnel affairs:

- Establishment of proper personnel evaluation
- Execution of personnel transfer system (proper job rotation system)
- Creation of incentive mechanism, (for instance, bonus) based on their performance

Other than the above, Training Center of PC is expected to play a more important role as the only department in charge of training course as follows:

- Training Center should enhance function of the Information Center where available records, documents, textbooks and so on will be sorted, arranged and easy to access. Some valuable engineering records and documents could not be found in any department which hindered the progress of this Study. Training Center should immediately improve filing system of engineering records and documents which can be applicable to maintenance, rehabilitation, preparation of plan and design of future project, etc. in cooperation with related technical departments.
- Training Center is responsible for statistics. Port statistics are essential for port planning and administration. In this sense, present statistic system should be expanded to include the following items:
 - 1) Commodity-wise cargo volume by origin and destination
 - 2) Cargo handling efficiency
 - 3) Dimensions of calling vessels (including DWT)
 - 4) Cargo turnover records

4. Environmental consideration in port related activities

Aqaba is the sole gateway to the sea in Jordan. Although the coastal line is just about 27 km, there are various demands such as tourism development and coral preservation. Moreover, Aqaba is located at the very heart of the Gulf of Aqaba. Due to its geography, topography, sea conditions, etc., the Jordanian territory is susceptible to environmental impact. The current environmental condition is at a rather good level. Aqaba is said to be endowed with rich coral that attracts many tourist.

Another issue caused by port activities is dust dispersion to the port area accompanied with phosphate rock handling. Phosphate rock is forecast to continue to be the largest quantity commodity at the target year. Phosphate is one of the most important goods as it earns foreign currency, while almost all goods (food, natural resources, industrial products)

have to be imported.

Under the above situation, compatibility between port activities, port development and environment has to be ensured.

As to coral preservation, port activities do not directly bring about problems because there is no coral reef at areas where usual port activities are carried out. Thorough site investigation is required when making port plan. In this case, although some coral is found at the extension area of container berth, the plan is assessed not to cause serious damage to them. A study to transplant the coral, if required, is said to be possible, though such a study has to cover various issues (transplant technic, transplant site, cost, etc.).

As to phosphate dust pollution, PC has already made efforts to reduce dust generation from the dispersion sources. This does not look to completely eliminate the problem. The most effective idea to solve the problem is to relocate the existing phosphate berth to the Industrial Port. To do so, authorities concerned have to make a decision which would raise the investment cost (relocation of berth, storage facility, cargo handling system, railway extension, etc.). At present, the most practical way for PC to proceed is to ensure complete closure of storage to prevent dust emission outside, and this should be done on schedule or sooner, if possible.

Accordingly, PC does not seem to have to take special action for environmental consideration in accordance with the proposed plan. In other words, serious environmental issues accompanied with the proposed plan will not be caused as long as PC performs its tasks within the established rules. PC, however, need not be totally idle in this regard.

First of all, people and organizations concerned should become conscious of significance of environmental protection and upgrading of the Gulf of Aqaba and thus be ready to take actions needed. PC should become the head of the movement.

Other than the above, PC should take the following steps:

- Preparation of contingency plan such as oil spillage (making contingency plan and training for enforcement at emergency)
- Establishment of regulation that contains prohibition on disposal (especially garbage) from vessels
- Regular inspection and monitoring of environmental condition in cooperation with other authorities (ARA, MSS, RSS, etc.)
- Conducting study on treatment of ballast water, bilge, etc. from vessels, if necessary, with the increase of calling vessels in future
- Raising public awareness of the need for environmental preservation

INTRODUCTION

This report is the result of "The Study on the Improvement Plan of the port of Aqaba in Jordan" which has been conducted from December 1994 to December 1995.

1. Background of the Study

The port of Aqaba is located at the north end of the gulf of Aqaba, which connects to the Red Sea through the Tiran Strait. It is the sole port in Jordan and the base to import daily necessities and to export phosphate rock, potash and fertilizer etc., which earn foreign currency. In addition, it substituted for the port of Basra during the Iran-Iraq war.

Since 1988 when the cargo handling volume peaked, port activities have not been very active and the cargo handling volume has continued to decrease, largely as a result of the economic sanctions on Iraq.

However, on the diplomatic front, there has recently been remarkable progress in the Middle East. The historic peace treaty between Jordan and Israel signed on 26th October 1994, ending 46 years of conflict and the Middle East/North Africa economic summit in Casablanca where many joint projects among neighboring countries were proposed are examples of this progress. These developments suggest that the political and economic situation in the Middle East is entering an unprecedented period of peace and prosperity.

While the port of Aqaba is expected to prosper from the events described above, several issues need to be resolved first.

- 1) The master plan for port development should be established, both to serve as a guideline for long-term investment and operational scheme, and to provide users, investors and other business entities with the prospect of a sound business environment.
- 2) To increase cargo handling productivity, some issues related to operation and management should be solved, such as inefficient cargo handling operation, insufficient use of computers, shortage of training programs and an inadequate communication system.

Under these conditions, the Government of the Hashemite Kingdom of Jordan requested the Government of Japan to conduct the following studies.

- 1) To evaluate the present situation of the port of Aqaba and propose urgent improvement measures
- 2) To formulate a master plan with a target year of 2010
- 3) To conduct a feasibility study of the short-term improvement plan with a target year of 2000 (date is tentative; it will be finalized after discussions with the Jordanian Government).

2. Study Objectives

In accordance with the above described and in response to a request from the Government of Jordan, the Study is carried out to achieve the following goals.

- 1) To formulate a Master Plan for the port of Aqaba for the period up to the year 2010
- and
- 2) To conduct a feasibility study on the Short-Term Improvement Plan for the port of Aqaba including a port management and operation plan for the period up to the year 2000 within the framework of the Master Plan

3. Study Components

The Study is comprised of the following major components.

1) Evaluation of Present Conditions

- To review, analyze and evaluate the present situation of the port of Aqaba through the investigation of socio-economic conditions, nation-wide transport system, relevant development plans, present activities of the port and the hinterland, natural and environmental conditions concerning the port and so on
- To identify problems on the basis of evaluation of present conditions of the port of Aqaba
- To recommend urgent measures to improve current port management and operation

2) Formulation of the Master Plan

- To formulate three scenarios on political and economic changes in the Middle East
- To propose the basic utilization and management policy of the coastal area
- To prepare cargo and passenger demand forecast up to the year 2010
- To formulate the basic layout plan for facilities of the port
- To prepare preliminary design of the port facilities and the implementation programs
- To estimate construction cost
- To propose a management and operation system from the long term point of view
- To conduct the initial environmental examination on the Master Plan
- To evaluate three alternative Master Plans comprehensively and select one as the case for the feasibility study

3) Feasibility Study on the Short-Term Improvement Plan

First, within the framework of the Master Plan, the Short-Term Improvement Plan is formulated. Major items are as follows:

- To carry out natural and environmental condition survey in order to formulate a Short-Term Improvement Plan and implement an environmental impact assessment for the Plan
- To prepare cargo and passenger demand forecast up to the year 2000
- To formulate a Short-Term Improvement Plan
- To prepare a preliminary design of port facilities and their implementation programs
- To estimate construction cost
- To conduct the environmental impact assessment on the Short-Term Improvement Plan

Second, a feasibility study on the above Short-Term Improvement Plan is carried out including the following items;

- economic analysis
- financial analysis
- necessary recommendations

4. Organization of the Team

The JICA study team is comprised of the following specialists.

NAME	RESPONSIBILITY
Jiro KANO	Team Leader, Overall Management
Kenichi OKUMURA	Port Planning, Environmental Consideration
Toshihiko KAMEMURA	Demand Forecast, Economic Analysis
Shinichiro USHIJIMA	Management and Operation, Financial Analysis
Takashi SAKURAI	Cargo Handling System
Sadamaru EMOTO	Regional Situation Study
Norio YAMAGUCHI	Information System
Masahiro YOKOGAWA	Design of Port Facilities
Nobuo ENDO	Construction Schedule, Cost Estimate
Takeaki HOSHINO	Natural Condition Survey
Yoichi KIMURA	Environmental Survey
Mitsunobu SHIBUYA/ Shingo SHIRATORI	Coordination

Chapter 1 Outline of Jordan

1.1 General

The Hashemite Kingdom of Jordan is located in the northwestern part of the Arabic Peninsula, 29° 11'-33° 22' North and 34° 59'-39° 18' East, surrounded by Syria, Iraq, Saudi Arabia, Israel and the West Bank (Figure 1.1.1).

The land area is 88,946 sq. kilometers, of which about 80 % is semi-desert or wilderness and only 6 % is cultivated, because its water resources such as rainfall, surface water and groundwater are scant and differ widely by region.

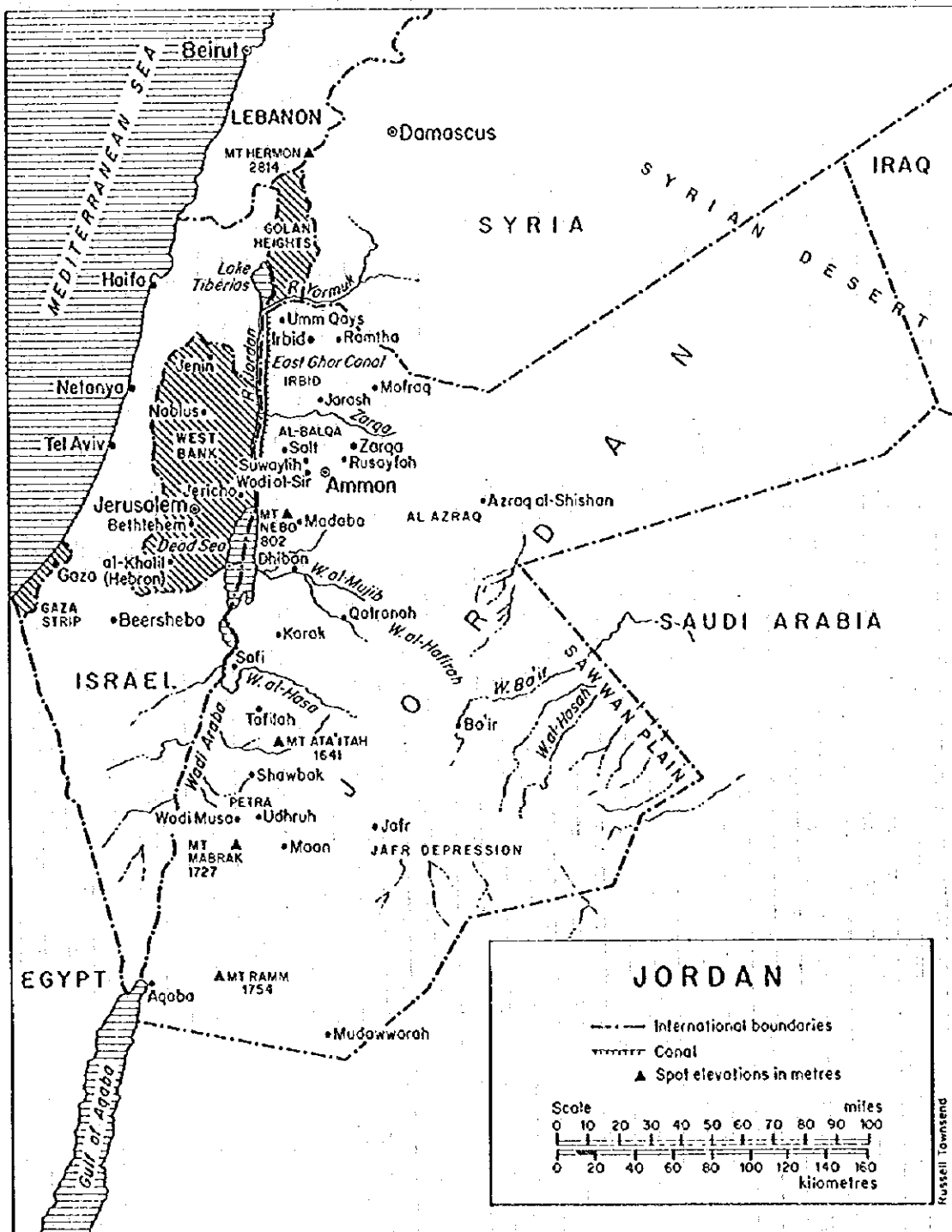
The population is over four million. The majority of inhabitants are of Arab origin, with approximately 90 % Muslim and 7 % Christian. About 70 % of the inhabitants live in urban areas and most of them are centralized in the north area, in particular, in Amman (around 50 % of the total population is found here), the capital, and the nearby Zarqa, the second largest and industrial center.

Jordan is a constitutional monarchy. The monarch is Head of State and he appoints the Prime Minister and cabinet's ministers under the Prime Minister's recommendation. The Senate and the Chamber of Deputies have legislative powers. Jordan's regional administrative structure increased from eight to twelve governorates after restructuring of regional zoning in 1993. At that time, Aqaba Governorate was established, independent of Ma'an Governorate. Each governorate, which is essentially an extension of the central government under supervision of the Minister of the Interior, has a governor who executes administrative authority with the advice of a board of council and exercises the powers of ministers in specific cases. The governorate is composed of districts, sub-districts and counties. There are 152 municipalities and 340 villages council. Local affairs are managed by city or village councils.

In terms of regional administration in Aqaba Governorate, Aqaba Region Authority (ARA) plays a powerful and important role. ARA was established in 1984 as an autonomous Government Institution. It belongs to Ministry of Cabinet and its responsibilities are defined in Law of The Aqaba Region Authority, Article 6, as follows;

- To design and execute directly the projects and works that it approves for the purposes of industrial, tourism, agricultural and services development of the region
- To plan and design other projects related to its objectives and supervise the execution of works carried out by the respective public and private agencies upon assignment from the Authority or in compliance with the legal proper authorities and responsibilities entrusted to the aforementioned agencies

ARA has some master plans on development or use of its jurisdiction while there is no nationwide land use plan. ARA's land territory, at present, corresponds to that of Aqaba Governorate and the President of ARA is the Governor as well.



Source : The Modern History of Jordan, Kamal Salibi

Figure 1.1.1 Location Map of Jordan

1.2 History

Any history book on Jordan is sure to chronicle the ancient facts and stories of Jordan and to describe the monuments, castles and ruins that attract the interest of archaeologists, historians and tourists.

No doubt, Jordan is a land of history. New details of its ancient civilizations are coming to light every year, as many archaeological teams probe into the Jordanian earth in search of the past.

In relation to the study on the improvement plan of the port of Aqaba, it is considered appropriate to summarize the history of Aqaba and modern history of Jordan rather than that of old periods.

It is noteworthy that in 1918 Aqaba became the headquarters of King Feisal during his revolt against Turkish rule, when Lawrence of Arabia acted as liaison between him and General Allenby at British General Headquarters at Cairo.

In 1923 Jordan gained its independence when the Hashemite leader, Emir Abdullah, established the Emirate of Transjordan, which became the Hashemite Kingdom of Jordan in 1946.

In 1951 the King was assassinated in Jerusalem and was succeeded by his son in short-term and succeeded by his grandson, the present King Hussein.

Aqaba is the only outlet for Jordan into the Red Sea and seaside resort. It was a fishing village set in a cultivated oasis. In 1949 it became an army camp, and a single jetty was built.

In 1965 Jordan and Saudi Arabia agreed to a territorial exchange, moving the border on the Gulf of Aqaba 17 km south. Aqaba's modern expansion dates from this time. Today it has become a prosperous town with a modern deep-sea port as well as commercial and tourist facilities, as described in other sections of this report.

In the meantime modern Jordan has witnessed enormous changes; in 1947 when Palestine was divided, followed by the Suez Crisis in 1956, the so-called Third Middle East War in 1967, the October War of 1973 and the Gulf Crisis of 1990/91, in all of which Jordan was directly or indirectly involved. Yet even in the most difficult circumstances the royal leadership has led Jordan to the stability and prosperity of today and its people have gained the reputation of offering warm hospitality to all visitors.

1.3 Topography

Although Jordan's area is not so large, the relief is rather diversified. Its topography is divided into the following three categories (Jordan Valley Region, The Mountain Heights Region and Eastern Desert).

(1) Jordan Valley Region

This is a part of the Great African Rift, stretching from East Africa to southern Turkey. The large fault, spanning two to three km along the border of Israel, leads from Lake Tiberias in the north to the Gulf of Aqaba in the south. The region from the meeting point of the Yarmouk River with the Jordan River to the Gulf of Aqaba is named the Jordan Rift and spans 370 km in length. This region is separated into two parts by the Dead Sea, the lowest spot on earth (392 m below mean sea level). The Jordan River flows in the northern part and its width varies from 20 to 30 m. The southern part is named Wadi Araba. The area below mean sea level, named the Chor region, is fertile and most of the crops in Jordan are produced here.

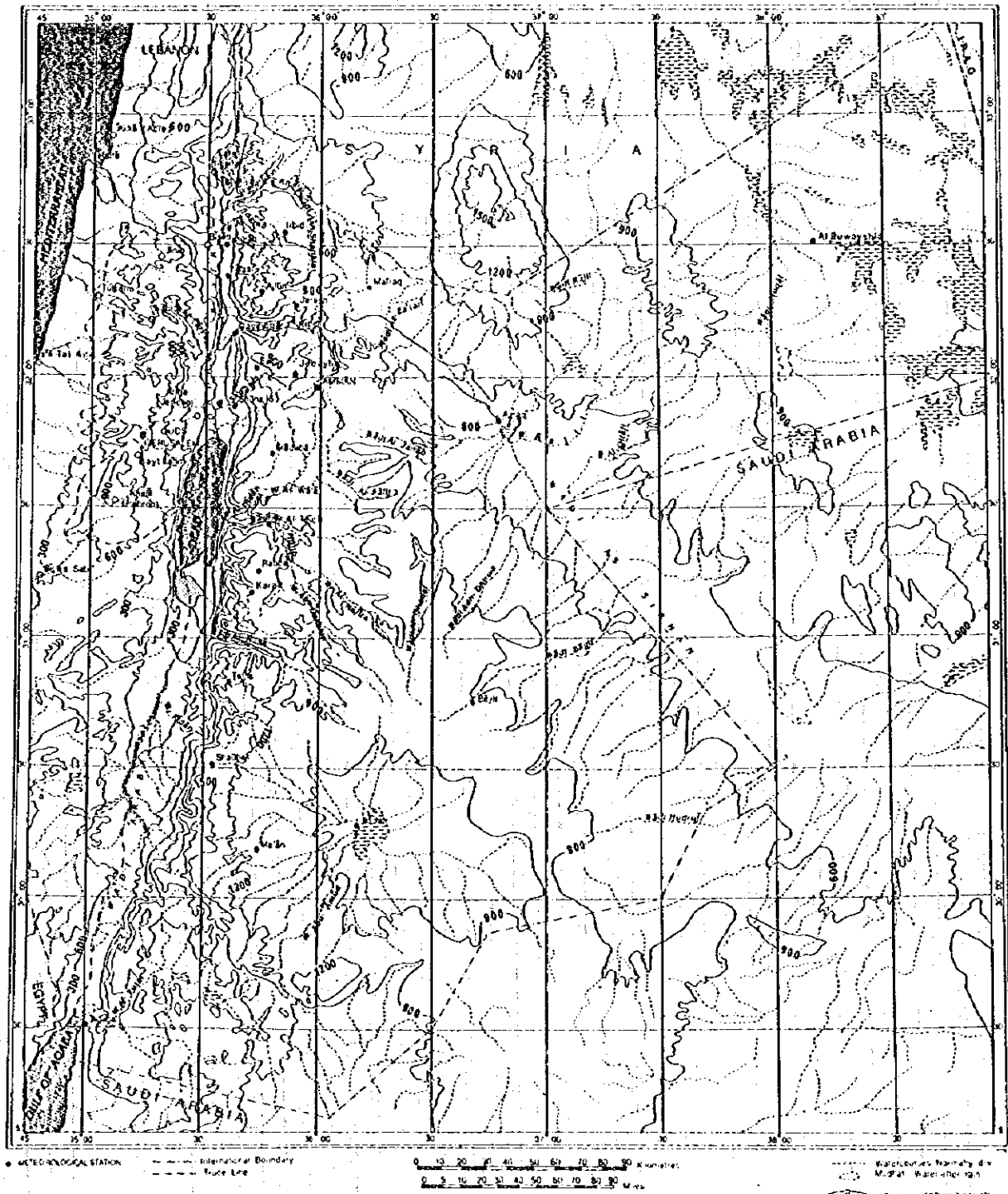
(2) The Mountain Heights Region

This region lies along the eastern side of the Jordan Valley Region, between the Yarmouk River and Syrian border in the north, the Chor and Wadi Araba in the west, Wadi Musa in the south and the Badia in the east and south. Towards the east, heights extend from Irbid in the north to Ras Naqab in the south but the region is dissected at several locations by incised wadis. The altitude increases going towards the south, ranging between 600 m and 1,500 m. Ramm Mountain is the highest in Jordan at 1,754 m. The maximum width of these heights is 50 km. Almost all major cities exist in this region, and thus political, economical, social activities etc. are concentrated here.

(3) Eastern Desert

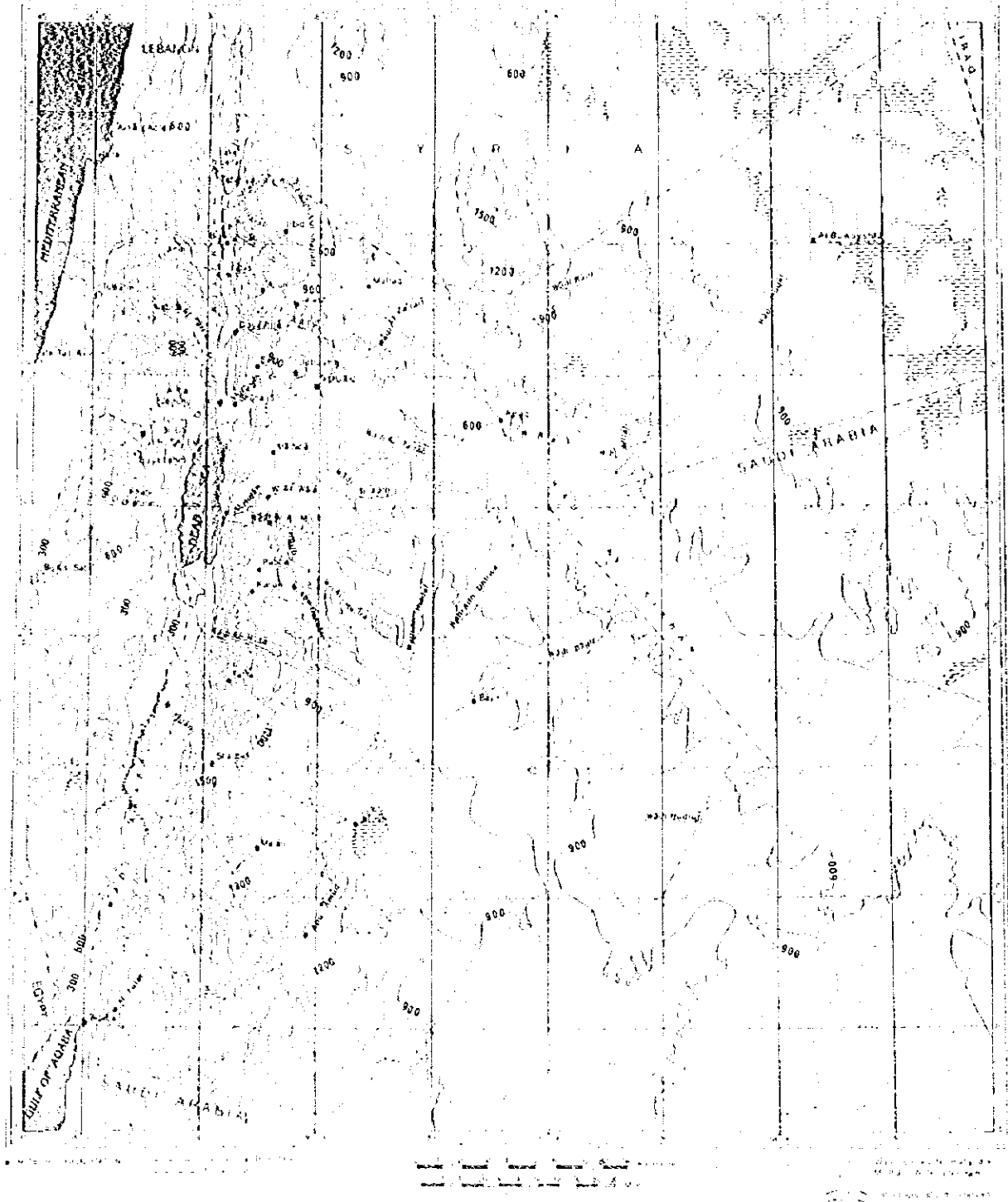
This region lies in the east and comprises most of Jordan's area. It is linked with the Arabian Desert at the borders of three countries, Syria, Iraq and Saudi Arabia. It is mostly an arid plateau with an elevation of 600 m to 900 m, extending eastward.

(See Figure 1.3.1 and 1.3.2)



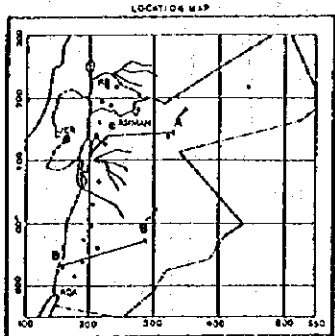
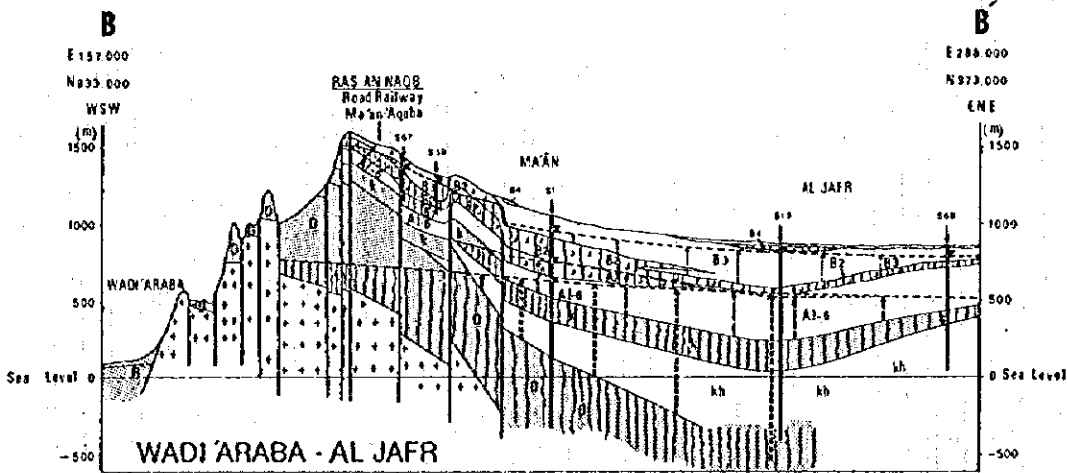
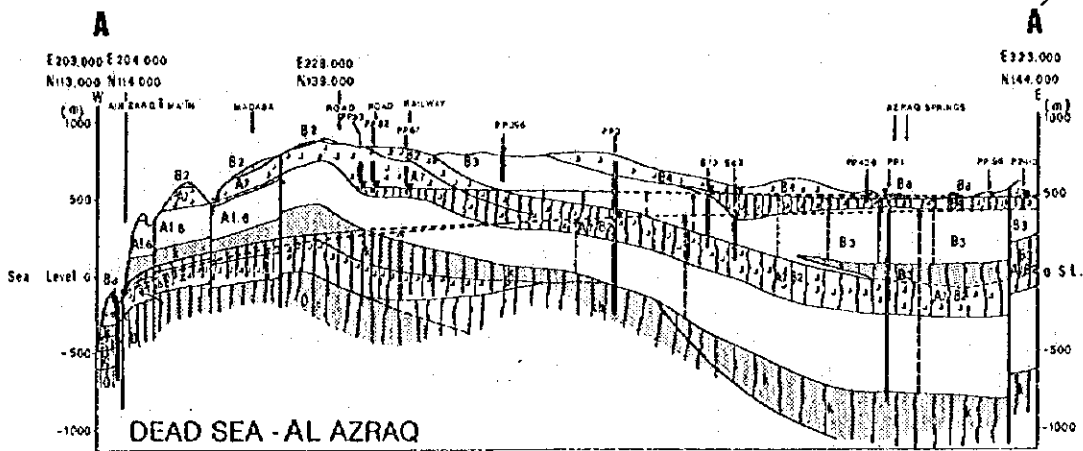
Source : National Atlas of Jordan

Figure 1.3.1 Topographic Map of Jordan



Source : National Atlas of Jordan

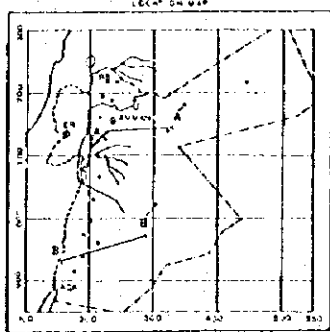
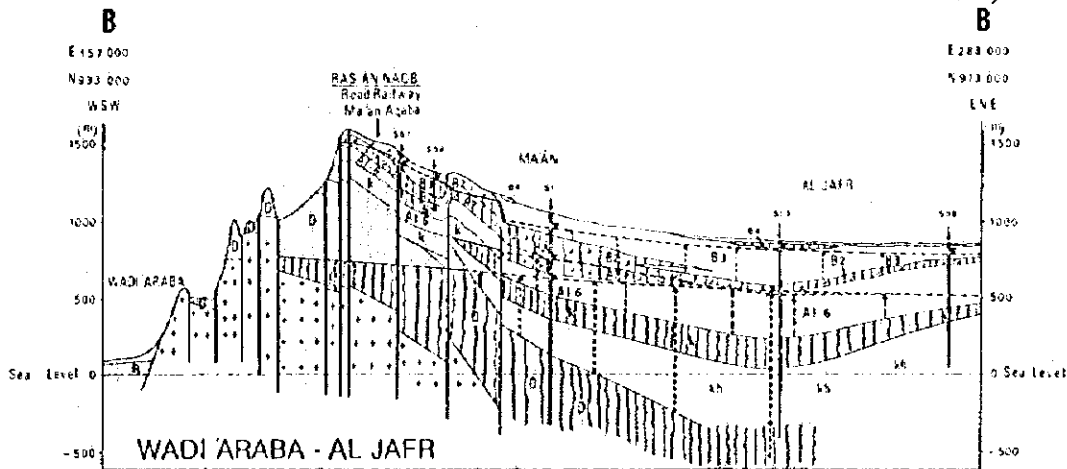
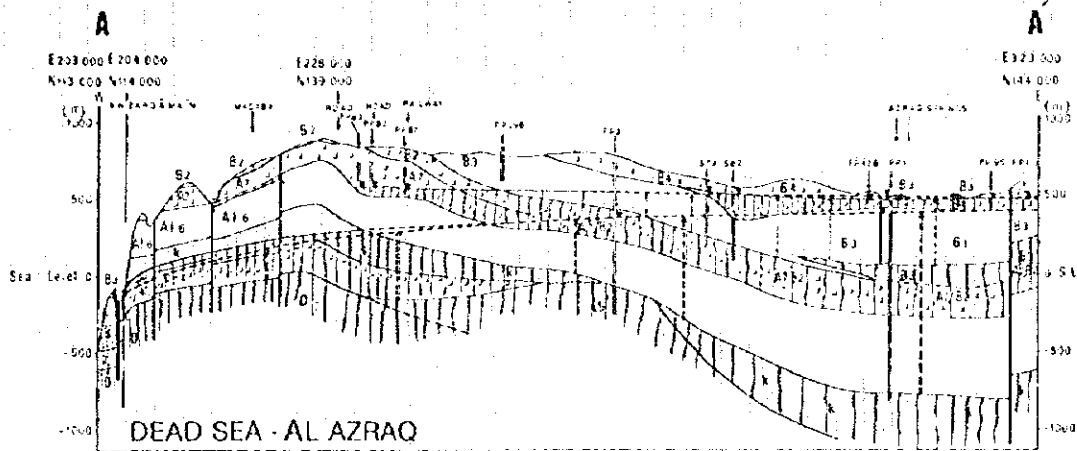
Figure 1.3.1 Topographic Map of Jordan



- Sand Stone Quartzite
- Limestone, Chert, Sandy Limestone
- Marl, Shale Siltstone, Silt
- Basement Complex
- Saturated Aquifer
- Water table
- Piezometric head of confined aquifer systems
- 1: Disi Group
- 2: Kurnub Group
- 3 A7 - B2 System

Source : National Atlas of Jordan

Figure 1.3.2 Simplified Hydrogeological Cross-Section



- Sand Stone Quartzite
- Limestone, Crin. Sandy Limestone
- Marl, Slate, Silstone, Silt
- Basement Complex
- Saturated Aquifer
- Water table
- Piezometric head of confined aquifer systems
- 1. Disi Group
- 2. Kurnub Group
- 3. A1 - B2 System

Source : National Atlas of Jordan

Figure 1.3.2 Simplified Hydrogeological Cross-Section

1.4 Climate

The diverse topography of Jordan makes it difficult to definitively categorize the climate. The climate of Jordan is, as a whole, predominantly that of the East Mediterranean type which is characterized by a fairly hot and dry summer and a moderately cold winter but it could be classified into three types (semitropical, the Mediterranean and desert climate) in correspondence with the topography.

The weather in the Ghor area is semitropical with a very hot summer and warm winter. The Mountain Heights Region is characterized by the Mediterranean climate, where summer is moderate and dry while winter cold and rainy. The Eastern Desert has a typical desert climate which is a hot and dry summer but cold and windy winter with a large range between day and night and very little precipitation.

(1) Temperature

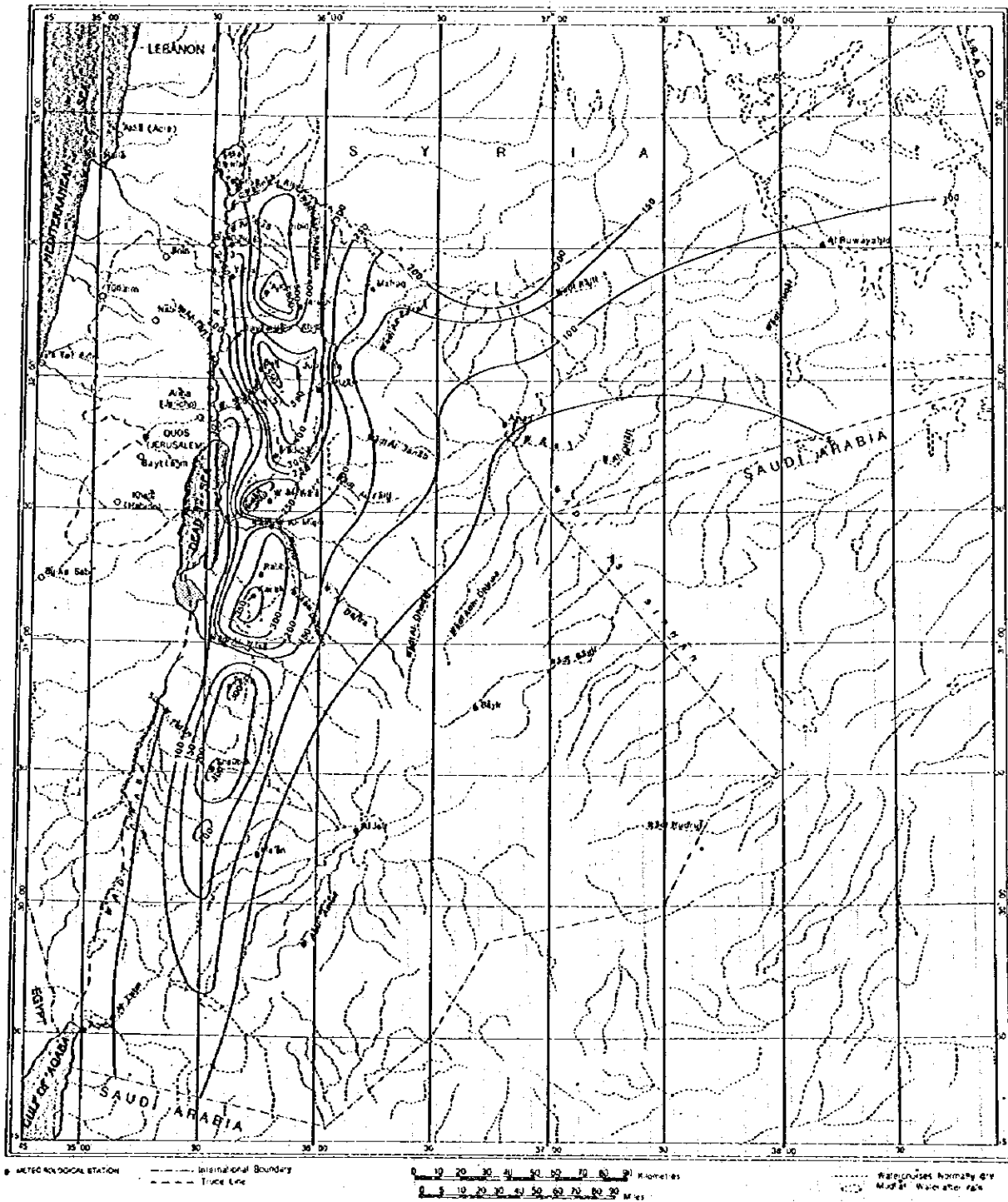
The temperature is highly affected by the topography and altitude. The hottest months of the year are generally July and August while the coldest are December and January. Aqaba and the Jordan Valley are the hottest areas in Jordan. The mean monthly maximum and minimum temperature for the period between 1966-1987 in Aqaba are 45.0 °C and 11.7 °C respectively. Those in Amman for the period between 1923-1987 are 42.8 °C and 3.5 °C.

(2) Rainfall

Jordan has a rainy season lasting six months which is caused by depressions coming from the west. The rain usually falls during winter and spring (from November to April), and, in particular, heavily in January and February. On the contrary, the summer season is hot and dry without precipitation. Generally speaking, the amount of rainfall decreases from west to east and north to south reaching approximately "nil" in the south east corner (See Figure 1.4.1). The amount and the period of rainfall are very variable and fluctuate from year-to-year. According to statistics, the annual average precipitation in Aqaba is just less than 50 mm.

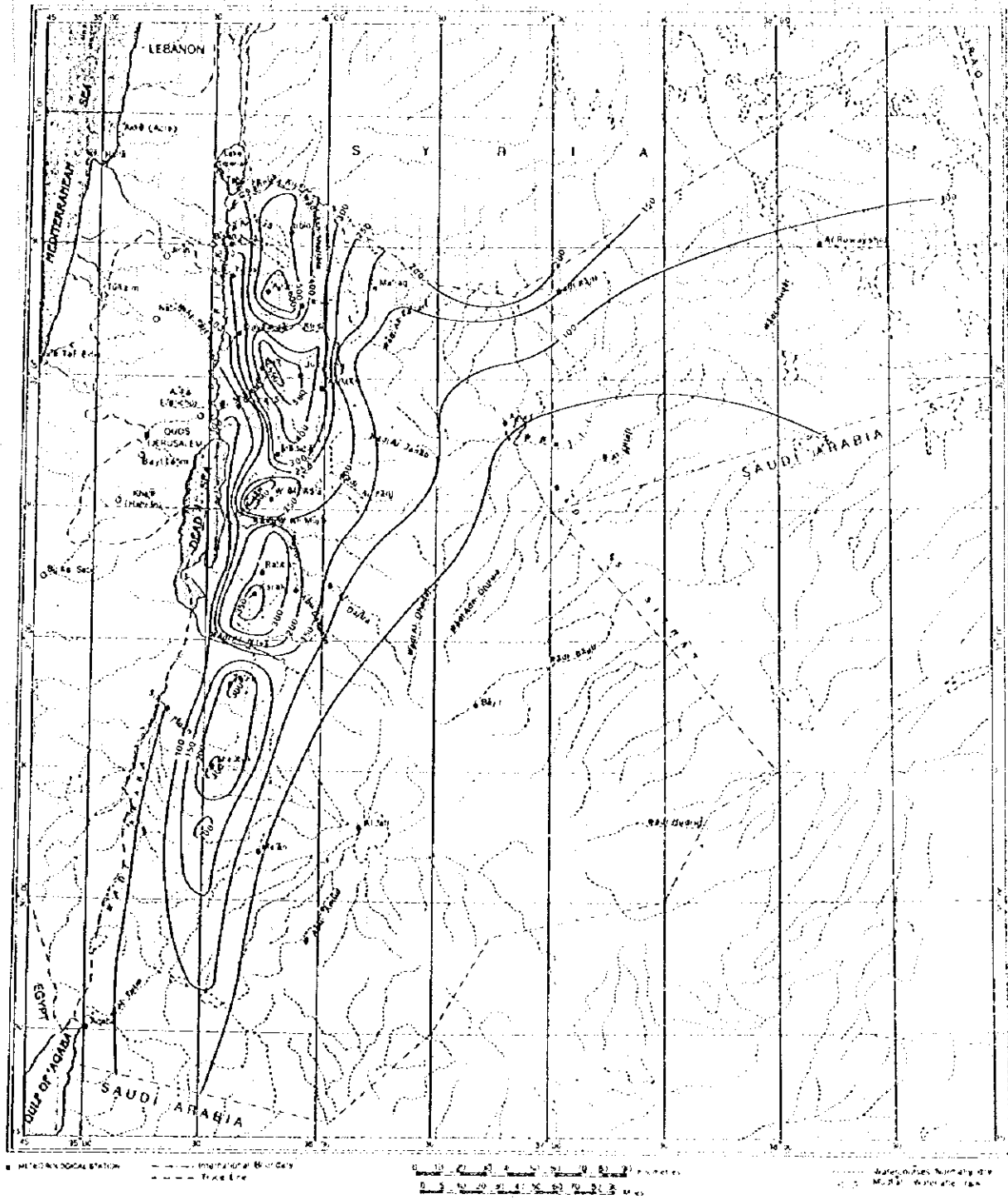
(3) Wind

Jordan is predominantly influenced by two wind patterns, that is, the north-west during summer and changing to the southwest-westerly wind during winter. In Aqaba, the prevailing wind is northerly 10-20 knots. Southerly wind is occasional and gale wind is seldom.



Source : National Atlas of Jordan

Figure 1.4.1 Rainfall Distribution (Normal Year)



Source : National Atlas of Jordan

Figure 1.4.1 Rainfall Distribution (Normal Year)

1.5 Population

(1) Population of Jordan

Population Censuses were carried out in 1952 and 1979. Populations of other years were estimated by the Department of Statistics.

The population of Jordan in 1993 was about 4.2 million across a land area of about 89,000 square kilometers(89,000 km²). The population density, then, was only 47 persons per square kilometer. Historical growth rates of population, from 1983 to 1992, are shown in Table 1.5.1. Average growth rate for the past 9 years is 5.5 %.

Table 1.5.1 Jordan Population

	(thousands)									
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Population	2,447	2,543	2,644	2,744	2,846	2,948	3,056	3,278	3,664	3,949
Growth Rate (%)	3.9	4.0	3.8	3.7	3.6	3.7	7.3	11.8	7.8	

NOTE : 1992 figure is an estimation

SOURCE: World Table 1994(World Bank)

Table 1.5.2 Population of Jordan by Sex

	(thousands)		
Year	Male	Female	Total
1983	1305.3	1190.0	2495.3
1984	1257.6	1237.5	2595.1
1985	1409.1	1284.6	2693.7
1986	1462.6	1333.5	2796.1
1987	1515.3	1381.5	2896.8
1988	1569.5	1431.5	3001.0
1989	1627.0	1484.0	3111.0
1990	1777.0	1676.0	3453.0
1991	2005.4	1882.6	3888.0
1992	2082.0	1930.0	4012.0
1993	2160.0	1992.0	4152.0

SOURCE: Statistical Yearbook 1993 (Department of Statistics)

Table 1.5.3 Population by Governorate and Others at the End of 1993

Total	4,152,000
Amman	1,582,600
Madaba	97,400
Zarqa	641,000
Irbid	790,000
Jarash	124,400
Ajloan	100,600
Mafrag	167,000
Balga	255,000
Karak	174,000
Tafiela	66,000
Ma'an	74,800
Aqaba	79,200
Land area	89,000 sq.km
Population density	47 person per sq.km
Natural increase	28 per 1000
Crude birth rate	34 per 1000
Crude death rate	6 per 1000
Urban population	3,238,000
Rural population	914,000

SOURCE: Jordan Figures September 1994 (Department of Statistics)

(2) Trend and Future Projection in Western Asia

Some of the world's highest population growth rates are found in Western Asia. For the period 1990-1995 Jordan's annual growth rate is estimated at 5.9 percent, the highest in the region. The Gaza Strip, the West Bank and Israel are among the top 10 fastest-growing countries. Israel, like the United States, Australia and Canada, has been the recipient of a large number of immigrants in the past few years; during the period 1990-1995, 600,000 immigrants are expected to enter the country. The Gulf war led to an exodus of people from Kuwait to Jordan, the Republic of Yemen and other countries in the area. Table 1.5.4 shows projected population in Mid-East and East-Africa during the period to be studied.

Table 1.5.4 Projected Population

Country, economy, or region	(thousands)				
	1990	1995	2000	2005	2010
Southwest Asia	133,410	152,565	172,690	193,773	216,229
Jordan	3,278	4,407	5,173	5,946	6,686
Gaza Strip	610	795	953	1,148	1,368
Iraq	18,080	21,038	24,548	28,422	32,540
Israel	4,645	5,628	6,104	6,465	6,829
Lebanon	3,635	4,005	4,345	4,630	4,903
Saudi Arabia	15,803	18,613	21,979	25,812	30,011
Syria	12,116	14,284	16,934	19,948	23,331
Turkey	56,098	61,284	66,130	70,562	74,897
West Bank	916	1,149	1,371	1,603	1,836
East Africa	273,216	314,835	361,416	412,908	469,402

SOURCE: World Population Projections 1994-95 (World Bank)

1.6 Economy

Jordan enjoyed unprecedented growth in its income (and expenditures) during 1973-1984, boosted by foreign assistance and loans, workers' remittances, and exports to regional markets. This ended in the mid-eighties as a result of the rapid decline in the price of oil and subsequent slowdown in regional economies. As a consequence, Jordan experienced a drastic slowdown in growth, which became more pronounced after 1986, and severe fiscal and external account deficits.

The Jordanian economy was highly dependent on regional economic developments. Until the recent crisis, about 75 percent of Jordan's exports of agricultural and manufactured products were marketed in neighboring countries. The neighboring Arab countries have provided employment for about 85 percent of the Jordanians working abroad, with more than half of the total working in Saudi Arabia. Finally, official grants from the Arab oil producing countries have accounted for about 90 percent of total foreign grants received by Jordan.

1.6.1 Gross Domestic Product

According to the Central Bank's Report, GDP grew at current market prices during 1993 by 11.2%, reaching 3595.7 million JD. GDP had thereby registered a real growth rate of 5.8%, against an unprecedented grow rate of 11.2% in 1992. It is worth mentioning that the real growth rate registered in 1993 came close to 6.0%, the rate targeted by the economic adjustment program. It should also be mentioned that the natural growth rate for 1992 would drop to 6.0-6.5% if the impact of exceptional factors of that period were excluded.

In considering expenditure on GDP, it will be noted that growth was concentrated in private and public final consumption expenditures which registered close growth rates averaging 10.2% this year over their levels in 1992. Expenditure on gross capital formation was 4.1%. At the same time, net external demand (imports of goods and services - exports of goods and services) whose growth rate slowed down noticeably this year (1.9%), as compared with 1992 (73.6%), exercised a negative impact on the economic growth movement but less deeply than in the previous year.

On the sectoral level, construction, agriculture and manufacturing sectors assumed a leading role in advancing economic growth although growth rates were slack in comparison with the previous year's level. These sectors registered growth rates of 12.0%, 10.0% and 6.0% in 1993 respectively, against 15.9%, 18.0% and 14.3% in 1992 respectively.

As a result of the economic growth experienced by all sectors with the exception of mining and quarrying sector, symptoms of relaxation in the domestic labour market continued this year (1993) for the second consecutive year.

Table 1.6.1 Main Economic Indicators

	1989	1990	1991	1992	1993
Population (thousands)	3,111	3,453	3,888	4,012	4,152
Jordanian Labor Force (thousands)	583.5	630.1	680.0	706.0	n.a.
GNP at Current Market Prices (M.P.)	2,206	2,376	2,559	3,136	3,459
GDP at Current M.P.	2,330	2,613	2,779	3,234	3,596
Growth Rate of GDP at Constant prices (%)	-13.5	1.7	1.8	11.2	5.8
Change in Cost of Living Index(%)	25.8	16.1	8.2	4.0	4.7
Change in GDP Deflator(%)	21.5	10.2	4.5	4.6	5.1
Ratio of Aggregate Consumption to GDP at Current M.P.(%)	93.2	102.7	99.9	103.6	102.6
Ratio of Aggregate Investment to GDP at Current M.P.(%)	25.9	28.8	24.0	32.1	30.1
Ratio of Domestic Saving to GDP at Current M.P.(%)	6.8	-2.7	0.1	-3.6	-2.6

Source: Central Bank of Jordan/Thirtieth Annual Report 1993

Table 1.6.2 Economic Growth Rates

	Current prices		Constant prices(1985=100)	
	GDP(F.C.)	GDP(M.P.)	GDP(F.C.)	GDP(M.P.)
1989	8.8	5.0	-10.5	-13.5
1990	10.0	12.1	-0.2	1.7
1991	6.4	6.4	1.7	1.8
1992	14.0	16.4	9.0	11.2
1993	11.5	11.2	6.2	5.8

Note: F.C.-factor cost

M.P.-market prices

Source: Central Bank of Jordan/Thirtieth Annual Report 1993

Table 1.6.3 Growth Rate at Constant Prices by Sector

	(%)				
	1989	1990	1991	1992	1993
Agriculture	-19.2	32.1	-13.4	18.0	10.0
Mining, quarrying	10.6	-12.7	-20.0	-0.6	-2.6
Manufacturing	24.0	9.6	-2.5	14.3	6.0
Electricity, water	10.0	-23.2	5.4	9.8	4.1
Construction	-18.3	3.9	10.5	15.9	12.0
Service sector	-15.2	-3.5	5.0	6.4	5.5
GDP	-10.5	-0.2	1.7	9.0	6.2

SOURCE: Central Bank of Jordan/Thirtieth Annual Report 1993

Table 1.6.4 Industrial Origin of Gross Domestic Product at Constant Prices
(1985=100)

	1989	1990	1991	1992	1993
Agriculture, Hunting					
Forestry and Fishing	113.4	149.8	129.7	153.0	168.3
Mining and Quarrying	77.4	67.6	54.1	53.8	52.4
Manufacturing	204.4	224.0	218.3	249.5	264.5
Electricity and Water	69.4	53.3	56.2	61.7	64.2
Construction	123.3	128.1	141.5	164.0	183.7
Wholesale and Retail Trade, Restaurant and Hotels	77.5	54.3	70.2	65.6	70.2
Transport, Storage and Communication	279.9	270.2	247.8	279.4	293.4
Finance, Insurance, Real Estate and Business Services	322.3	308.9	358.5	383.3	402.5
Community, social and Personal Services	29.8	30.9	40.1	38.0	39.5
Imputed Bank Service Charge	-44.5	-29.1	-37.5	-44.6	-46.7
Producer's of Govt. Services	385.5	383.6	390.0	414.6	439.5
Products of Private Non-Profit Services to Households	20.3	14.6	16.8	18.3	19.3
Domestic Services of Households	4.0	3.6	3.1	4.2	4.3
GDP at Factor Cost	1,662.7	1,659.8	1,688.8	1,840.8	1,955.1
Net Indirect Taxes	210.5	246.0	250.7	316.6	326.7
GDP at Producer's Prices	1,873.2	1,905.8	1,939.5	2,157.4	2,281.8

NOTE: 1989, 1990, 1991-Preliminary

1992-Estimated Figures

1993-Represent Estimates of the Economic and Financial Situation

Evaluation Committee Constituted under the Economic Adjustment Program

SOURCE: Department of Statistics

1.6.2 Prices

In the light of the foregoing, the living standard of the population this year exhibited steady progress. Annual per capita income at current prices rose to 866 JD, or the equivalent of 1250 US\$, exceeding its level in 1992 by 7.4%. At constant prices, per capita income registered a growth of 2.2%.

1.6.3 Employment

Employment opportunities increased and unemployment levels decreased. The rate of unemployment dropped from 18.8% in 1991, to 15.0% in 1992 and to 13.0% in 1993.

1.6.4 External Trade and Balance of Payment

The external sector in 1993 revealed a number of developments. In the first place, the deficit in the trade balance continued to widen for the second consecutive year. This was incompatible with the hoped for trends in this respect. Deficit rose to 1585.2 million JD, thereby exceeding the previous year level by 8.4%. Since the rate of growth of GDP at current market prices, the ratio of the former to the latter dropped to 44.1%, against 45.2% in 1992. The widened gap in the trade balance this year reflects a marked slowdown in total exports (4.3%), on the one hand, and a considerable growth in imports (10.8%), on the other.

The decline in the growth of exports this year was primarily due to the drop in the country's total revenues from traditional exports of phosphates and fertilizers as a result of the drop in their prices amidst intense competition in external markets, as well as the decline in the value of re-exports below their previous year level. This was over and above the continuing embargo on Aqaba Port that involved additional costs and created obstacles jeopardizing export operations, as well as Jordan's entire economy. As for imports, they were, as in the previous year, backed up by the high growth rate of economic activity in the country and the enhanced confidence of the business sector.

The weight of the increasing trade deficit on Jordan's economy this year was alleviated by improvement of the surplus in the services balance. This narrowed the deficit in the current account to 435.3 million JD, registering a drop of 23.5% of its 1992 level. Consequent upon this drop, the ratio of deficit in this account to GDP at current market prices dropped 12.1%, against 17.6% in the previous year. The marked increase in net workers' remittances and net travel income had a clear effect on improving the status of the services balance and, consequently, in narrowing the deficit of the current account in 1993, reflecting a similar pattern to that of the previous year.

Table 1.6.5 External Trade and Balance of Payments

	1989	1990	1991	1992	1993
Commodity Exports(FOB)	637.6	706.1	770.7	829.3	864.7
Commodity Imports(CIF)	1,230.0	1,725.8	1,770.7	2,297.0	2,453.6
Trade Deficit	-585.3	-1,008.6	-994.1	-1,461.7	-1,585.2
Ratio to GDP(%)	-25.1	-38.6	-35.8	-45.2	-44.1
Worker's Remittances	358.3	331.8	306.3	573.1	720.7
Current Account	104.9	-272.8	-288.1	-568.7	-435.3
Ratio to GDP(%)	4.5	-10.4	-10.4	-17.6	-12.1
Non-Money Capital Account	-212.1	-45.0	396.2	158.8	-122.0
Ratio to GDP(%)	-9.1	-1.7	14.3	4.9	-3.4
Change in Net Reserves	-317.8	-268.7	-734.1	-33.2	34.1
Net Foreign Reserves	695.3	96.0	1,698.1	1,731.3	1,697.2

Source: Central Bank of Jordan/Thirtieth Annual Report 1993

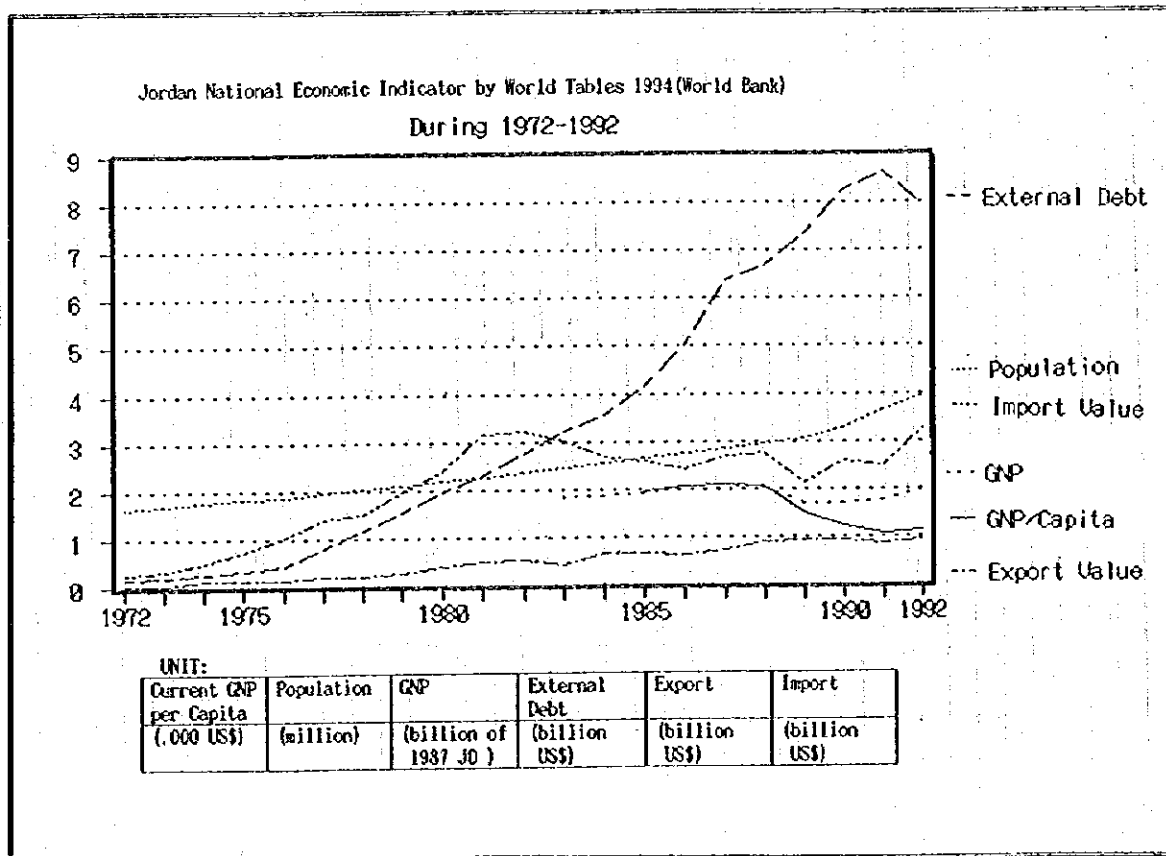


Figure 1.6.1 Historical Trend of Jordan Economy based on World Bank's Data

1.7 Structural Adjustment Program

One of the most fundamental issues surrounding the Jordanian economy is the repayment of external debt. Current economic balance of Jordan has remained unstable for the past several years.

After grants from Arab countries were discontinued, the value of the Jordanian dinar declined in the latter half of 1988. In February 1989, Jordan experienced a fiscal failure and sought the aid of the International Monetary Fund(IMF).

After examining Jordan's efforts to rehabilitate its economy, in October 1991, the IMF formulated an agreement with the Government of Jordan concerning Economical Structural Adjustment Program, which called for (1)decreasing of the fiscal deficit, (2)severe control of money supply, (3)decreasing of consumption by public and private sectors, and (4)expansion of exports and inflation restraints. This program applied for the years 1992-1998.

In February 1992, the IMF approved stand-by-credit that amounted to 44.4 million SDR (61 million US\$).

Furthermore, the Government of Jordan reached agreements with Paris Club and London Club concerning rescheduling of funds.

1.8 National Economic and Social Development Plans

Two plans are currently being followed in Jordan. One is "Economic and Social development Plan 1993-1997 (issued by Ministry of Planning)" and the other is "Tomorrow Has Arrived--Investing in People". The former plan which reflects the priorities of Jordanian society in an atmosphere of democracy was issued in September 1993. The latter one was submitted at the Middle East/North Africa Economic Summit in Casablanca, Morocco in October 1994.

1.8.1 "Economic and Social Development Plan 1993-1997"

(1) Economic and social objectives of the plan

The various policies and projects in the plan aim at achieving the following economic and social objectives:

- 1) Creating conditions conducive to sustainable growth;
- 2) Ensuring fiscal and monetary stability, eliminating production and price distortions etc.;
- 3) Attaining a high level of self-sufficiency and self-reliance;
- 4) Expanding and diversifying the income and employment;
- 5) Reducing disparities among social groups and geographical regions;
- 6) Enhancing the capabilities of all citizens and instilling in them a spirit of initiative and the work ethics;
- 7) Creating the proper conditions that would encourage citizens to invest in projects on individual initiative and self-employment;
- 8) Conserving the environment and preventing the deterioration of its component elements through regulating economic and human activities;
- 9) Ensuring wider participation and accountability in decision-making.

(2) General Framework

Objectives for the next five years consist of three items as follows:

- 1) Realization of sustainable growth in excess of population growth rate
The plan aims at realizing a GDP growth rate of 6% per annum at 1991 prices. This would raise real per capita GDP by about 3%.
- 2) Correcting structural imbalance and achieving fiscal and monetary stability
 - a) Gradual reduction in the budget deficit to GDP ratio, excluding grants, to no more than 3% by 1997;
 - b) Elimination of the balance of payments current account deficit by 1997;
 - c) Reduction of external debt to GDP ratio to a level not exceeding 100% by 1997;
 - d) Reduction of the external debt service as a percentage of exports of goods and services to a level not exceeding 25% by 1997;
 - e) Reduction of the ratio of consumption to GDP to a level not exceeding 89% by the end of the plan period;
 - f) Maintenance of the annual rate of inflation at 4% to 5%.

3) Realization of balanced social development

- a) Lowering the unemployment rate to 9.6% by realizing sustainable growth rates that would create 224,100 new job opportunities;
- b) Concentrating the public sector investment program in the fields of social services, and securing the delivery of these services to the various regions;
- c) Raising the level of educational, health, housing, and other social services during the plan period;
- d) Reducing poverty in the short run through the adoption of policies designed to promote the establishment of income-generating small projects for low income groups;
- e) Training and rehabilitating 72,800 trainees to help them acquire the skills needed for the jobs and to reduce dependence on non-Jordanian labour.

Actual target values in each year are listed in Tables 1.8.1 and 1.8.2.

Table 1.8.1 General Framework for the Next Five Years (1)
(JD million at 1991 constant prices)

	1992	1993	1994	1995	1996	1997	Growth Rate (1993-1997 %)
GDP(market price)	3,096	3,288	3,472	3,681	3,905	4,147	6.0
Import of goods and services	26,99	2,703	2,719	2,772	2,856	2,924	1.6
Total resources	5,795	5,991	6,191	6,453	6,761	7,071	4.1
Total consumption	3,178	3,503	3,498	3,537	3,571	3,652	2.8
-Private	2,425	2,732	2,711	2,735	2,754	2,816	3.0
-Public	753	771	787	802	818	835	2.1
Gross capital form.	988	782	828	900	968	1,033	7.2 ^a
Exports of goods and services	1,629	1,706	1,865	2,016	2,222	2,386	7.6
Total uses	5,795	5,991	6,191	6,453	6,761	7,081	4.1

Note: 7.2^a is the growth rate for 1994-1997

Source: Economic and Social Development Plan 1993-1997(MOP)

Table 1.8.2 General Framework for the Next Five Years (2)
(Annual growth rate at 1991 constant prices)

	1992	1993	1994	1995	1996	1997	average
GDP(market price)	11.3	6.2	5.6	6.0	6.1	6.2	6.0
Import of goods and services	17.3	0.1	0.6	2.0	3.0	2.3	1.6
Total resources	17.5	10.2	-1.1	1.1	1.0	2.3	4.1
Total consumption	17.5	10.2	-1.1	1.1	1.0	2.3	2.8
-Private	23.5	12.7	-0.8	0.9	0.7	2.3	3.0
-Public	1.6	2.4	2.1	1.9	2.0	2.2	2.1
Gross capital form.	49.8	-18.8	6.0	7.8	7.8	7.1	7.2 ^a
Exports of goods and services	-3.6	4.7	9.3	8.0	10.2	7.4	7.6
Total uses	17.5	10.2	-1.1	1.1	1.0	2.3	4.1

NOTE: 7.2^a is the growth rate for 1994-1997

SOURCE: Economic and Social Development Plan 1993-1997(MOP)

1.8.2 "Tomorrow Has Arrived--Investing in People"

"Tomorrow Has Arrived--Investing in People" was submitted by Jordan at the Middle East/North Africa Economic Summit in Casablanca. One hundred and twenty one (121) projects by 10 groups were proposed. Several port related projects are selected which are mentioned in Table 1.8.3.

Table 1.8.3 Estimated Impact on the Port of Aqaba by Project

Sector	Project	Estimated impact on the port activity
Energy-1	Aqaba Thermal Power Station	Transportation of fuel oil
Energy-2	Iraqi-Jordan Crude Oil Pipeline	Export Iraqi Crude Oil amounting to 1 million bbl/day through Aqaba
Energy-3	New Oil Refinery in Aqaba	Domestic consumption and export of products oil
Industry	Expansion of Potash production Production of Potassium Sulfate	Increasing of industrial products
Road-1	Jordan River Bridges and Access Roads	New distribution routes of port cargo between Mediterranean ports and Amman
Road-2	Aqaba coastal highway	Raising of traffic capacity

1.9 Transport

1.9.1 General

Jordan is situated at the heart of the Middle East, surrounded by Syria, Iraq, Saudi Arabia, Israel and the West Bank. Its coastline is only 27 km long.

Because of its topography, land transportation, in particular, road transportation, together with maritime transportation plays an important role in terms of international trade. In addition, one of the distinctive features in Jordanian transport is the large volume of transit cargoes passing through Jordanian territory into neighboring countries. This means that transportation is likely to be affected by the political and economic situation in neighboring countries, especially those in the Middle East.

Table 1.9.1 and 1.9.2 show the total international trade by means of transport in 1993 and the change of transit commodities during 1974-1993. They indicate the above mentioned.

According to the statistics, the transport sector accounted for 11 % of the GDP in 1992. The sector currently employs over 40,000 people, representing some 6.5 % of the labour force. That means that transport sector exceeds agricultural sector in terms of produced value.

Ministry of Transport is responsible for comprehensive transport planning but implementation of transport projects, administration and supervision for related business are executed by several departments of the Government of Jordan. Construction and maintenance of major roads are carried out by Ministry of Public Works and Housing. In Aqaba region, Aqaba Region Authority has made some master plans including land use and transportation.

Table 1.9.1 Traffic Cargo Volume by Means of Transport in 1993

(Unit: ,000 JD, ,000 Tons)

Means	Export		Import		Total	
	VALUE	WEIGHT	VALUE	WEIGHT	VALUE	WEIGHT
Train	187.5	0.1	28.6	0.0	216.1	0.1
Truck	412119.8	973.7	951142.2	4933.7	1363262.0	5907.4
Airplane	124483.7	10.7	334625.4	36.4	459109.1	47.1
Ship	329890.6	6405.6	1167066.7	3165.4	1494939.3	9571.0
Parcel Pos.			961.9	0.2	761.9	0.2
Total	864661.6	7390.1	2453624.8	8135.7	3318286.4	15525.8

Note : Export Value (CIF), Import Value (CIF)

Source : Statistical Yearbook, 1993

Table 1.9.2 Transit Commodities passing through Jordanian Territories

Year	Quantity (Ton)	Value (,000 JD)
1974	330,152	100,936.70
1975	489,989	198,162.30
1976	1,385,336	601,469.50
1977	919,376	573,571.00
1978	535,856	341,146.90
1979	446,801	280,928.30
1980	1,192,721	529,050.70
1981	3,190,081	1,427,592.80
1982	2,392,993	1,097,390.00
1983	665,941	346,866.60
1984	1,728,606	362,970.30
1985	1,827,154	329,808.60
1986	3,153,739	269,059.10
1987	2,298,958	235,279.70
1988	2,775,504	216,121.50
1989	1,514,985	186,837.90
1990	712,531	181,168.40
1991	609,577	591,769.10
1992	3,160,318	1,170,417.40
1993	2,145,549	1,097,668.40

Source : Statistical Yearbook, 1993

1.9.2 Road

(1) Road network

The road networks have been developed through the years, especially in the last 15 years. Paved roads length increased from about 1,000 km in 1950 to 6,678 km in 1993. Table 1.9.3 shows lengths of road network by type during 1985-1993. As shown in this table, roads in Jordan are classified into the following three categories:

- 1) Primary roads consist of two or more lanes, connecting the capital "Amman" with district centers, between district centers, Jordan with neighboring countries or two primary roads through district centers.
- 2) Secondary roads consist of two lanes, connecting two primary roads through cities other than district centers or serving a group of villages.
- 3) Village roads, branches from primary or secondary roads, consist of two lanes and serve a village or a small community.

Table 1.9.3 Lengths of Road Networks by Type

(Unit: KM)

Year	Primary Road	Secondary Road	Village Road	Total
1985	1928	869	2088	4884
1986	2005	879	2134	5018
1987	2352	1533	1428	5313
1988	2396	1606	1525	5527
1989	2548	1626	1691	5865
1990	2521	1664	1822	6007
1991	2550	1676	1898	6124
1992	2660	1810	1900	6370
1993	2765	1862	2051	6678

Source : Ministry of Public Works and Housing

Road network and distance between major cities are shown in Figure 1.9.1 and Table 1.9.4. "Proposed Road" in Figure 1.9.1 means that proposed at the middle East/North Africa Economic Summit in Casablanca in October 1994.

Current situation of the main artery

Because Jordan's socio-economic characteristics such as population, economy, industry etc. are centralized in the north area around Amman, Zarqa, roads connecting Aqaba with Amman are very important. In this sense, Route 15 and 25 (the Desert Highway) and Route 35 (the King's Highway) already function as the mainstream of cargo and passenger flow. However, these roads are rather steep in sections or else the pavement is partially damaged which makes it difficult for heavily loaded trucks to pass through smoothly. Another road, Route 65, runs alongside the border between Jordan and Israel. A part of it (between Ras el Ghor and Haditha) has just opened in March 1995.

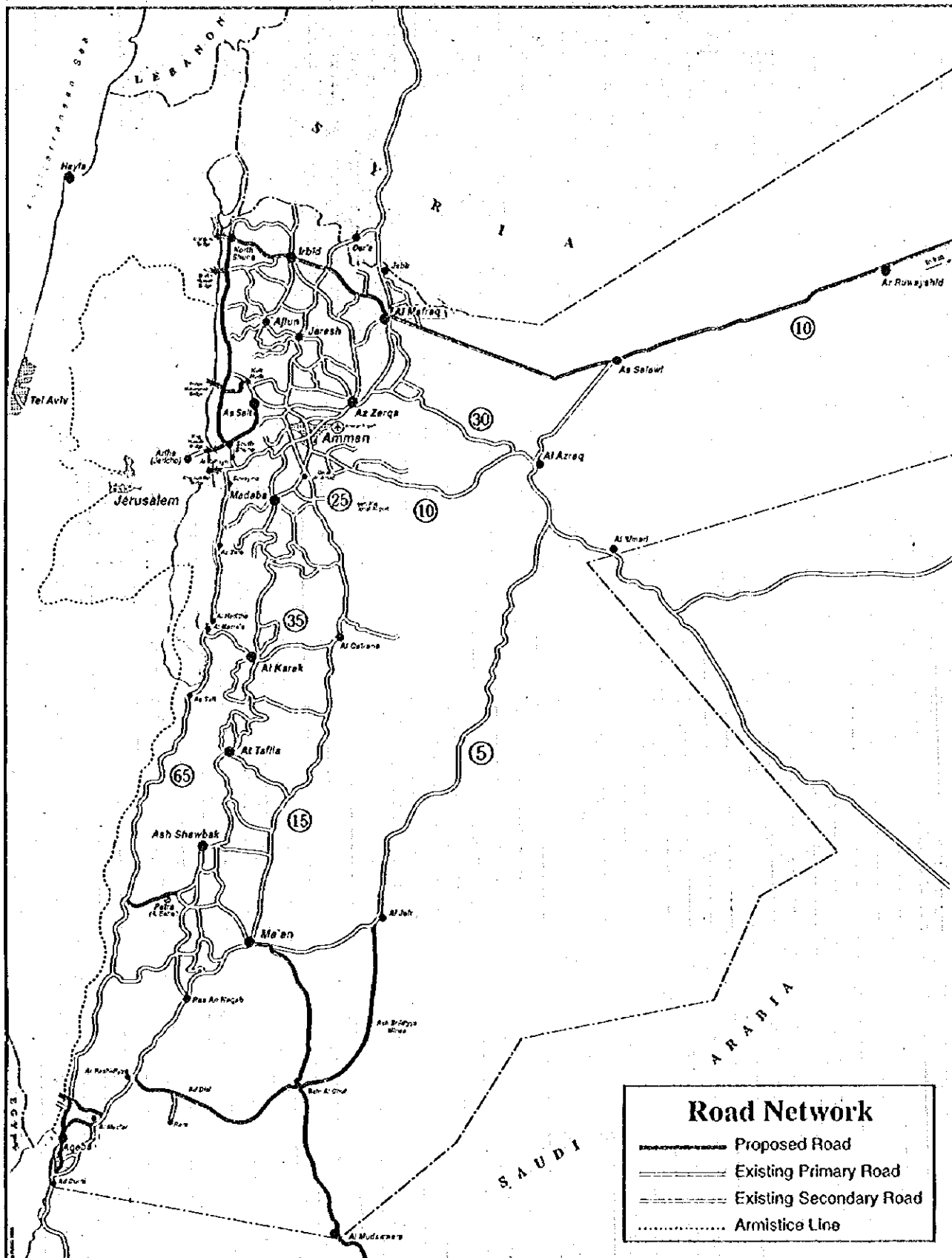
Roads to and from the neighboring countries

As to access to neighboring countries, primary roads are connected and they are thought not to have significant problems such as traffic congestion.

Route 15 leads to Syria via Zarqa and plays a role in carrying cargoes to Turkey as well as Syria.

To reach Saudi Arabia, Route 5, which diverges from Route 15 (the Desert Highway) in Ma'an, and Route 30, which has its starting point in Zarqa, are currently used.

By following Route 30 or Route 40, successively Route 5 in Azraq, in addition, Route 10 in Safawi, Jordan is connected with Iraq. Those road networks lead to Amman via Zarqa. The road map published by Royal Jordanian Geographic Centre indicates that a bypass (Route 5) is under construction between Azraq and Jafr which will allow traffic service between Aqaba and Iraq directly rather than via Amman. The time of completion is uncertain but according to an interview with a truck transportation company, this road can be used even now at a reduced load capacity.



Source : Jordan, Tomorrow Has Arrived
 TRANSPORTATION DEVELOPMENT OPTIONS

Figure 1.9.1 Road Network in Jordan

Table 1.9.4 Road Distance between Major Cities by Road Network

(Unit: KM)

Amman	88.10	Irbid	76.70	32.20	Ajlun	50.00	38.30	25.60	Jarash	85.70	23.40	55.60	35.90	Ramtha	69.40	50.90	67.50	42.00	34.20	Mafrag	22.20	88.50	71.10	45.60	86.30	45.00	Zarga	29.80	89.60	72.80	51.40	87.20	89.30	44.30	Salt	32.00	115.9	104.6	77.80	113.5	101.4	54.20	57.60	Madaba	118.8	202.7	191.4	164.6	200.3	188.2	141.0	144.4	86.80	Karak	183.1	267.0	255.7	229.0	264.6	252.5	205.3	208.7	151.1	63.40	Tafila	210.0	294.0	282.6	255.9	291.6	279.4	232.2	235.6	210.5	154.1	90.70	Ma'an	324.7	408.7	197.3	370.6	406.3	394.1	346.9	350.3	325.2	252.5	189.1	116.8	Aqaba	57.40	109.0	76.80	89.50	125.3	126.8	79.6	38.10	64.40	151.0	215.5	252.7	367.4	Bridge	P.Mah'd	60.60	83.30	51.10	87.40	103.2	125.3	80.30	36.00	86.00	172.8	237.1	265.4	380.0	38.70	Bridge	262.0	240.2	261.8	236.3	223.8	194.3	241.0	285.3	281.0	367.8	432.1	459.0	573.8	319.4	321.2	Ruwaisheed	331.1	309.3	330.9	305.4	292.9	263.4	310.1	354.4	350.1	436.9	501.2	528.1	642.9	388.5	390.3	69.10	(Treybezi)	90.30	28.00	60.60	40.50	4.600	38.80	91.00	91.80	118.2	205.0	269.3	296.2	410.9	130.0	107.2	228.4	297.5	(Ramtha)	322.4	406.4	395.0	368.3	404.0	391.8	344.6	348.0	322.9	266.5	205.1	112.4	228.8	365.1	377.6	571.4	640.5	408.6	(Mudawana Sandi border)	155.1	193.4	201.5	176.0	179.7	145.5	130.4	174.7	170.4	257.2	321.5	348.4	463.0	212.5	210.7	210.0	279.1	184.3	460.8	(Al-Uman Saudi border)	349.5	433.5	222.1	395.4	431.1	418.9	371.7	375.1	350.0	277.3	213.9	141.2	24.8	392.2	404.8	598.6	667.7	435.7	253.6	487.9	(Al-Dereh)
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Source : Ministry of Public Works and Housing

Future plan

Concurrent with the Middle East peace process, a lot of projects to improve transportation are being proposed and negotiations between Jordan and Israel or related countries have in some cases been entered. In regard to road projects, Jordan River Crossings and Access Roads and Jordan Rift Valley Roads are given high priority to step forward.

(2) Vehicle

As a general trend, the number of operating vehicles is increasing. As shown in Table 1.9.5, the number of vehicles is 255,500 in 1993 which corresponds to 62 vehicles per 1,000 people.

Based on a survey by the Ministry of Transport, cargoes are transported by a fleet of 7,680 trucks, 6,830 of which are registered in Jordan. The rest are temporary entry plates, which are given special permission to stay or to work in Jordan, without paying duties, for a limited period of time. In addition, 11,000 tons of crude oil and derivatives are carried daily from Iraq by a fleet of 1,100 tanker trucks.

(3) Traffic volume

Table 1.9.6 shows cargo volume and number of trips transported by trucks from 1988 to 1993. According to Table 1.9.1, the total cargo volume transported by trucks in 1993 is 5.91 million tons while that shown in Table 1.9.6 is 4.42 million tons. Clearly, the figures do not agree but the reason for this cannot be found.

Even though there is such a difference, Table 1.9.6 suggests that transit cargo volume largely affects the total cargo volume. According to Table 1.9.6, generally speaking, volume of Jordanian domestic goods was steadily increasing while that of transit goods was sharply decreasing. Transit cargo volume was bigger than Jordanian cargo volume till 1990 and the total cargo volume bottomed out in 1990.

These changes can be explained as follows; large portion of transit cargo was from and to Iraq so that the total transit cargo volume has been decreasing since the Gulf War as a result of the embargo by the U.N. In 1988 the transit cargo volume had recorded an all-time high. However, transit cargo to and from Iraq is currently the minimum level. On the other hand, Jordanian economy has been gradually progressing and cargo traffic is growing as well.

Therefore, cargo traffic volume is expected to largely increase when the sanctions on Iraq are lifted.

Table 1.9.6 provides other information: cargo volume per trip. There is a big difference between that of Jordanian goods and transit goods. The former is about 22 tons while the latter about 35 tons. It is guessed that transit cargo is carried a long distance with rather heavy load, resulting in a high load factor.

Table 1.9.5 Number of Vehicles

Year	No. of Vehicles	Increase Rate
1974	37131	20.50
1975	47243	27.23
1976	60455	27.97
1977	79493	31.49
1978	97402	22.53
1979	117250	20.37
1980	135271	15.37
1981	156924	16.00
1982	177849	13.33
1983	197783	11.20
1984	211657	7.01
1985	221454	4.63
1986	232361	4.93
1987	242216	4.24
1988	249590	3.04
1989	251447	0.74
1990	254777	0.01
1991 *	247518	- 0.03
1992	262502	6.05
1993 *	255484	- 2.75

Note : The decrease is due to elimination of previously cancelled vehicles.
 Source : Traffic Department

Table 1.9.6 Movement of Transported Goods by Trucks
 for the Period (1988-1993)

YEAR	JORDANIAN GOODS				GOODS IN TRANSIT				TOTAL			
	No. of Trips	%	Weight (Ton)	%	No. of Trips	%	Weight (Ton)	%	No. of Trips	%	Weight (Ton)	%
1988	65951	28%	1482518	20%	169920	72%	6022757	80%	235871	100%	7505275	100%
1989	54719	26%	1240580	18%	153676	74%	5692081	82%	208395	100%	6932661	100%
1990	88786	47%	2340816	42%	99580	53%	3253443	58%	188366	100%	5594259	100%
1991	121357	71%	2582689	59%	50531	29%	1819512	41%	171838	100%	4402201	100%
1992	122733	62%	2880816	53%	74842	38%	2561758	47%	197575	100%	5442574	100%
1993	131402	75%	3011361	68%	43836	25%	1405383	32%	175238	100%	4417244	100%

SOURCE : MINISTRY OF TRANSPORT

1.9.3 Railway

There are two railway companies, Hedjaz Railway Corporation and Aqaba Railway Corporation, in Jordan. The railway network is shown in Figure 1.9.2.

(1) Hedjaz Railway Corporation

The construction work of the Hedjaz Railway to connect Damascus with Medina started in 1900, with the main objective to transport pilgrims. After the completion between Damascus and Amman in 1903 and between Amman and Ma'an in 1904, the first train arrived in Medina in 1908. As the result of damage and destruction suffered during World War I, the line from Ma'an to Medina has been out of operation since 1917. At present, the railway is operated for passenger transport once a week between Damascus and Amman while a portion of the remainder is leased and operated by Aqaba Railway Corporation.

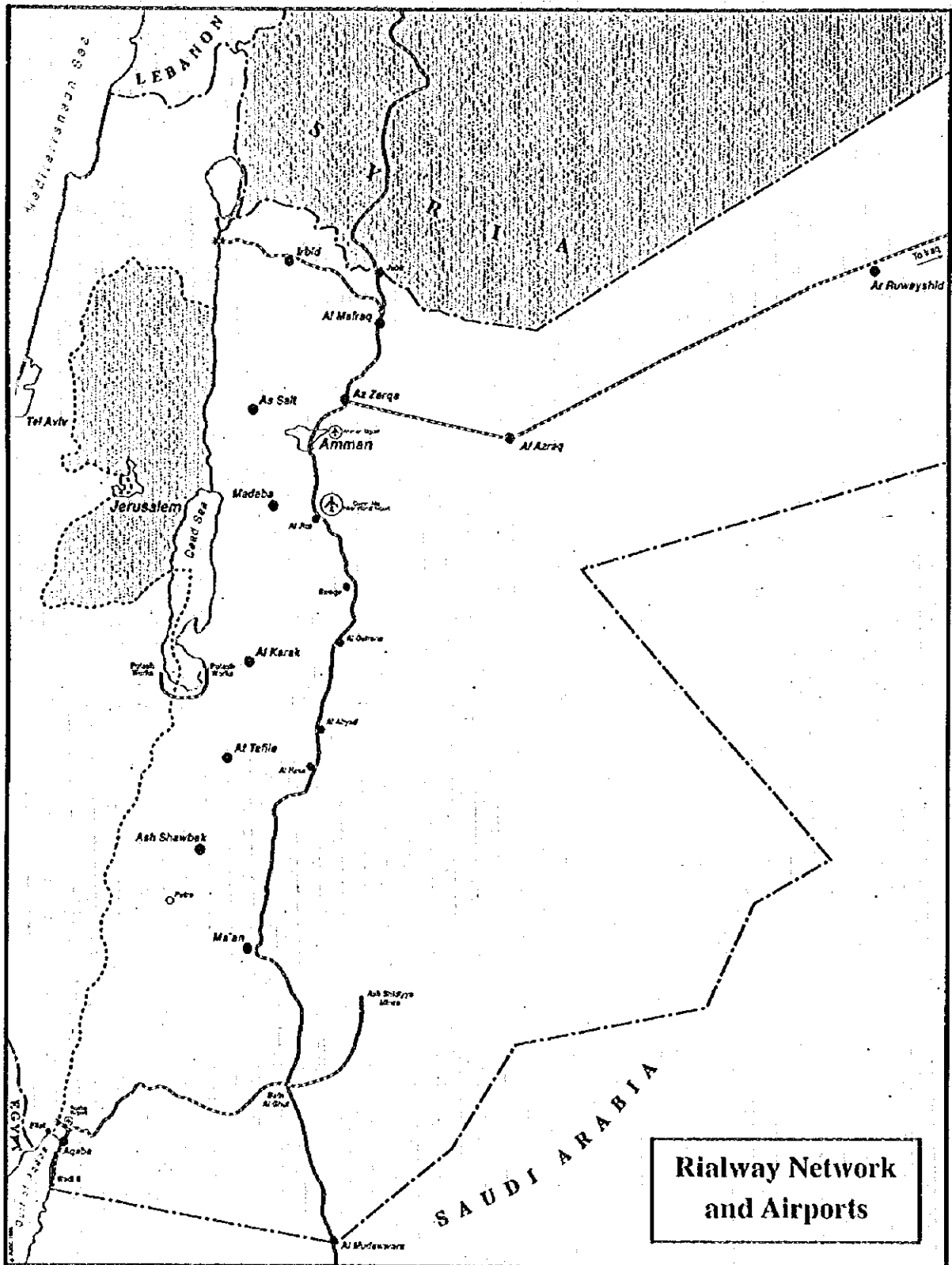
(2) Aqaba Railway Corporation

Current situation

Aqaba Railway Corporation (ARC) started its operation in 1975. The function was mainly to transport phosphate from the mine to the port and imported goods through the port of Aqaba. Currently, it does not carry imported goods at all. Following the contract with Jordan Phosphate Mines Co. Ltd., ARC transports phosphate rocks from El Abiad Mine and El Hassa Mine to the port, about 300 km away. ARC owns 22 locomotives and 450 wagons. One train fleet regularly consists of two locomotives and 30 to 33 wagons with about 43 tons of phosphate rock loaded per wagon. Seven fleets a day are operated. This means about 3.5 million tons of phosphate rock can be transported a year. It takes 17 hours for one trip (including loading and unloading).

Future plan

Both railways have several future plans. Some of them have already been studied and negotiated. Two projects at the detailed engineering stage, named Shidiya Mines Rail Link and Wadi II Link in Aqaba, are deeply concerned with port activities. The former is the connection project between the Shidiya Mine and the existing railway line. The latter is the connection of a fertilizer complex, cement storage, container port to the rail network. Other than the above projects, link projects with neighboring countries have been proposed. The completion of Irbid-Haifa link will probably bring about the changes of traffic flow to and from Europe and America through the Mediterranean. This project is given high priority but it seems that it will be rather difficult to implement due to the topography.



Source : Jordan, Tomorrow Has Arrived
 TRANSPORTATION DEVELOPMENT OPTIONS

Figure 1.9.2 Railway Network and Airports in Jordan

1.9.4 Aviation

Current situation

There are three major airports in Jordan; Queen Alia International Airport and Amman Airport (Marka) in Amman and Aqaba Airport in Aqaba. They are managed, operated and controlled by the Civil Aviation Authority. Queen Alia International Airport opened in 1983 and has two runways with 3,660 m length. Aqaba Airport is equipped with a runway with 3,000 m length. Other than the above airports, Amman Airport is sometimes used but the number of passengers per annum is negligible.

Airline services are provided by Royal Jordanian Airline, a state-run company, and connected with over forty cities, extending to Singapore and Jakarta in the Far East and New York and Chicago in America (See Figure 1.9.3). The only domestic airline serves passengers moving between Amman and Aqaba on a daily basis; the flight time is approximately 50 minutes. Once a week, Aqaba Airport accommodates an international line to and from Cairo. Chartered airlines fly tourists directly to Aqaba from Europe.

Table 1.9.7 shows carried passengers and freight during the latest 10 years, from 1984 to 1993. There is a fluctuating trend. In particular, U.N. sanctions imposed on Iraq are thought to have contributed to the decrease in 1991.

Table 1.9.7 Passenger and Freight carried by Royal Jordanian Airline

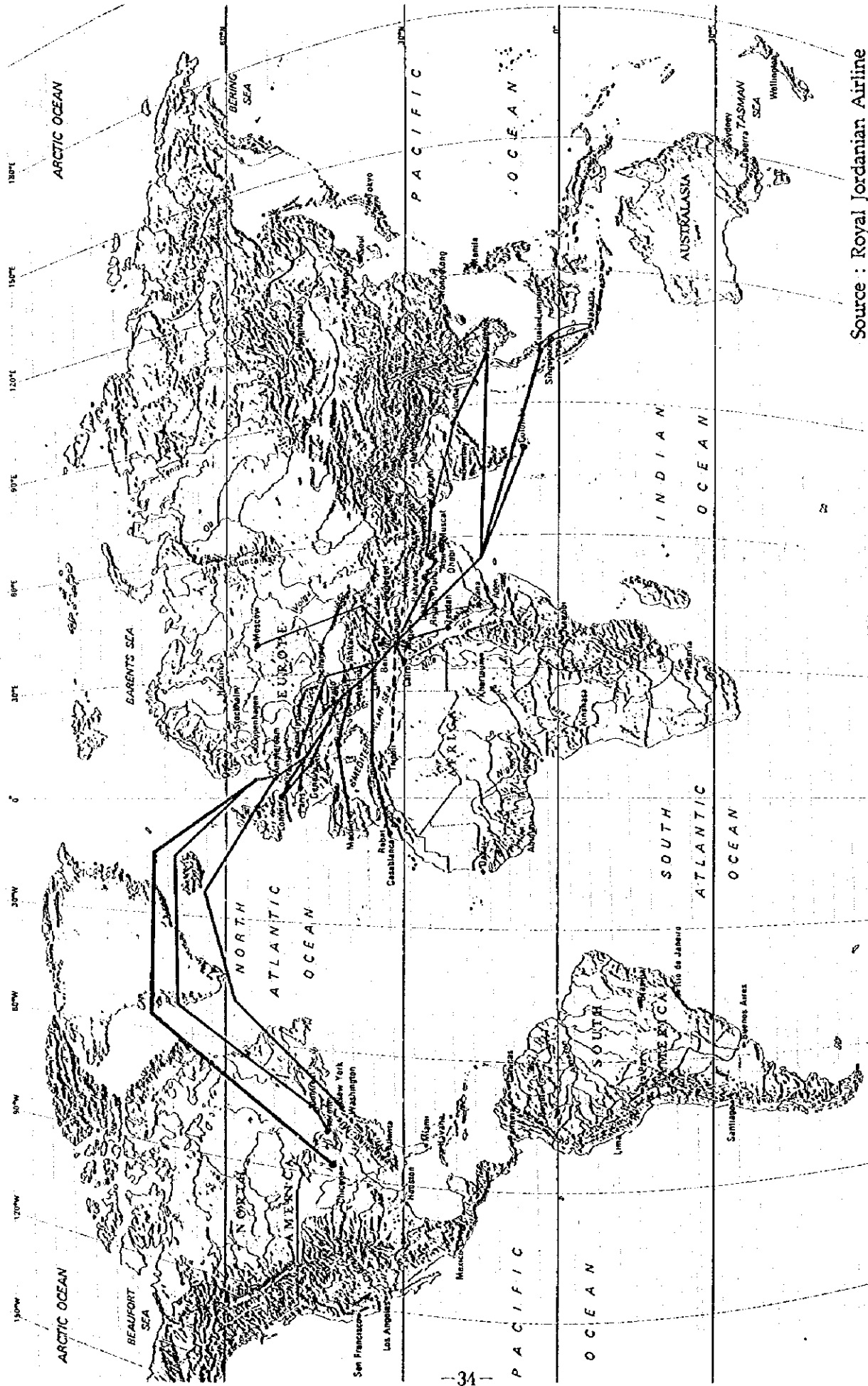
Year	Passenger ('000 person)	Freight (tons)
1984	1346.8	37879
1985	1290.3	43095
1986	1132.0	43301
1987	1119.7	48562
1988	1225.9	49995
1989	1204.0	49715
1990	963.9	53162
1991	797.9	41637
1992	1109.8	44452
1993	1185.9	54062

Source : Royal Jordanian Airline

Table 1.9.8 and 1.9.9 show the number of Jordanian departures and arrivals during the latest five years. Over one million Jordanians arrived or departed every year except 1991, which represents one fourth of the Jordanian population. Airline shares about 20 % of the total traffic while shipping line only about 1 %.

Future plan

There are future plans of airport expansion, one of which, named Aqaba Airport project, proposes to accommodate Israel traffic together with Jordanian traffic.



Source : Royal Jordanian Airline

Figure 1.9.3 Flight Service by Royal Jordanian Airline

Table 1.9.8 Jordanian Departures by Point of Entry

POINT OF ENTRY YEAR	Q.A.I. & AMMAN AIRPORTS	AQABA AIRPORT	AQABA PORT	SYRIA	IRAQ	SAUDI ARABIA	RAIL	TOTAL
1989	281866	222	18750	237439	193035	460656	368	1192336
1990	261453	131	18024	294817	251354	315701	1758	1143238
1991	157027	95	14326	384426	210351	90758	1758	858741
1992	205707	131	15945	402860	248025	205361	1074	1079103
1993	231673	203	14652	441372	222143	216627	1414	1128084
% SHARE 93	20.54%	0.02%	1.30%	39.13%	19.69%	19.20%	0.13%	100.00%

Source: Ministry of Tourism, Statistic Section

Table 1.9.9 Jordanian Arrivals by Point of Entry

POINT OF ENTRY YEAR	Q.A.I. & AMMAN AIRPORTS	AQABA AIRPORT	AQABA PORT	SYRIA	IRAQ	SAUDI ARABIA	RAIL	TOTAL
1989	262667	122	15566	203773	190934	434384	485	1107931
1990	264472	21	15882	274166	276087	444012	1973	1276613
1991	161425	31	12658	370696	246747	99323	2790	893870
1992	215307	82	13298	401642	260113	198570	1512	1090524
1993	209465	173	13371	424392	227220	213388	1530	1089539
% SHARE 93	19.23%	0.02%	1.23%	38.95%	20.85%	19.59%	0.14%	100.00%

Source: Ministry of Tourism, Statistic Section

1.9.5 Maritime Transport

The port of Aqaba is the only access to the sea for Jordan. It has been playing an important role for Jordan and for its neighboring countries as well. Detailed port activities are analyzed later. Current roles and functions of the port are summarized here.

- To deliver daily necessities for domestic consumption

Jordan imports almost all necessity goods excluding some kinds of vegetables and fruits. Major imported cargoes are foodstuffs (grains, sugar, rice, vegetable oils, forages etc.) and general cargoes. They are indispensable to everyday life. They are delivered from the port of Aqaba through the year.

- To support the industrial activities in Jordan

Jordan's major industries are chemical products, petroleum refineries and mining and quarrying.

Jordan is endowed with abundant phosphate and potash which are exported through the port of Aqaba. Both quantities share about 80 % of the total export commodities in 1993.

Besides petroleum refineries, a lot of industries import raw materials and export some of their products. Phosphate, potash, fertilizer and cement, which earn valuable foreign currency, share about 40 % of the total domestic export commodities in terms of value (F.O.B.) in 1993.

In addition, some commodities, for example, steel/iron, are used as materials of construction works, to manufacture metal or machinery etc.

It is obvious that such industries could not exist without the port, that is to say, the port of Aqaba is supporting such major industrial activities in Jordan.

- To function as the gateway for transit cargo

Jordan has always been a transit country for the neighboring countries so that its transportation sector is one of the most important industries. In the past, there were a lot of transit cargoes passed through Jordan from Europe, Turkey and Syria by road but a large amount of them has been replaced by transit cargo via the port. At present, due to the embargo accompanied with the sanction on Iraq by U.N., the volume of transit cargo has largely decreased.

The total transit cargo volume recorded about 2.5 times the total Jordanian imported cargo in 1989 before sanctions were imposed on Iraq.

It is expected that the cargo handling volume of the port of Aqaba will recover as the activity from and to the Indian and the Far East region, where economic growth is very high, increases in the near future due to the port's advantageous location. In other words, the port of Aqaba has the potential to become the distribution center in the Middle East.

- To accommodate passenger boats

Regular lines transporting passengers, vehicles and goods are operated between the port of Aqaba and Nuweiba in Egypt by the Arab Bridge Maritime Co. which was established in 1985. The lines contribute to the exchange of people and goods among the Arabic countries and the output has been increasing year by year. In 1993, over 1.2 million people, about 80 thousand and over 300 thousand goods were carried. It is said that about 90 %

of passengers are Egyptian migrants.

Passenger boats cruising from Europe or America also call the port of Aqaba, because Aqaba has good weather, particularly in winter, and splendid sight seeing spots nearby like Petra. The number of cruising passengers reached 5,420 in 1994, the highest since 1988.

- To contribute to the regional prosperity and provide an opportunity of employment

Aqaba city is a port city and a resort city as well. Ten percent of the city's population work for the Ports Corporation. The Ports Corporation employs 0.85 % of the entire Jordanian population and 13 % of those in the transport sector. In addition, there are many port-related industries such as shipping agents and land transportation companies. As the history of Aqaba indicates, the city has been growing with the development of the port. The population in the city increased from 5,000 in the sixties, to 39,000 in 1981, and to 62,000 in 1993. The port activities greatly affect the regional socio-economy.

Therefore, to create regional prosperity, progressive port activities, in harmony with other matters such as tourism, environment etc., will be of great importance.

Chapter 2 Current Situation of the Port of Aqaba

2.1 Natural Conditions

At the first field survey period from January to March, 1995, data necessary for natural conditions were collected at Amman and Aqaba area.

Most of the data and information were obtained from government offices, university institutes and private companies concerned.

2.1.1 Geography

(1) Geographical Situation

The Gulf of Aqaba, 98 miles long, is a continuation of the deep, narrow and long depression of the Rift valley. Both, the valley and the Gulf are protected by relatively high mountains on both sides, the East and West.

The port of Aqaba is located in the southern part of Jordan at the northeastern end of the Gulf of Aqaba, namely latitude $29^{\circ} 31'N$ and longitude $35^{\circ} 00'E$.

The Aqaba Bay is deep, in excess of -200m at a distance of 1.5 km far from shore line.

Along coast of the Aqaba town, a sandy and coral shelf is found in the water depth from 4 to 10m.

On the northern part of the bay, towards the west, a sandy beach with a gentle slope appears, in direct continuation of the Aqaba rift valley from which sand is blown into the sea by the prevailing northern winds.

To the south of the town, water depth is very deep around area near shoreline due to a steep slope of seabed.

(2) Geological Situation

The geological formation existing within the southern part of Jordan are mainly terrestrial and fluvial deposits resting irregularly upon the precambrian basement complex.

The main formation sequence is as follows:

1) Recent Deposits

Composed of wadi deposits screen Aeolian sand and Beach conglomerate and sands.

2) Pleistocene (Alluvial Terraces)

Composed of weakly and strongly cemented sand conglomerate and weakly cemented siltstone and coral.

3) Palaeozoic

Palaeozoic is mainly weakly cemented sandstone.

4) Pre-Cambrian

Pre-Cambrian is mainly igneous and metamorphic rocks.

All of the deposits are mainly products of weathered rocks (basement complex) consisting of granite and formation like rocks. They form wide and bulky fans. Marine growth formations are also existing. Cohesive soils were sometimes found.

2.1.2 Meteorology

The climatological data are collected from Meteorological department and the port of Aqaba cooperation.

The data on temperature, rainfall, humidity and wind are obtained from Aqaba port and airport weather station which is located about 6 km north from the city center of Aqaba.

The elevation of Aqaba airport is +51m above sea level with latitude and longitude of 29° 33'N and 35° 00'E.

The short term climatological data from 1992 at Aqaba port or Aqaba airport are shown as follows:

(1) Temperature

The mean monthly temperature and the highest maximum and the lowest minimum temperature at Aqaba port are shown on Table 2.1.1.

Table 2.1.1 Temperature at Aqaba Port 1992

Month	Mean Monthly Temp. C	Highest Maximum Temp. C	Lowest Minimum Temp. C
Jan	13.0	21.4	5.6
Feb	13.6	30.0	6.0
Mar	16.1	30.0	8.4
Apr	22.1	35.0	13.0
May	26.4	43.2	16.0
Jun	30.4	41.6	20.2
Jul	31.9	43.5	21.0
Aug	33.0	42.0	25.0
Sep	31.6	43.5	19.0
Oct	28.8	40.5	20.0
Nov	19.6	34.5	6.0
Dec	15.2	26.5	3.5
Yearly	23.5	43.5	3.5

(2) Rainfall

The monthly rainfall amount and the highest rainfall amount in 24 hours and the number of rainfall days at the Port of Aqaba are shown on Table 2.1.2.

Table 2.1.2 Rainfall at Aqaba Airport 1992

Month	Monthly Rainfall Amount (mm)	Highest Rainfall Amount (24 hrs)	No. of days Rainfall
Jan	6.4	3.0	5
Feb	1.6	1.6	1
Mar	0.0	0.0	0
Apr	0.0	0.0	0
May	0.0	0.0	0
Jun	0.0	0.0	0
Jul	0.0	0.0	0
Aug	0.0	0.0	0
Sep	0.0	0.0	0
Oct	0.0	0.0	0
Nov	7.0	7.0	1
Dec	0.2	0.2	1
Yearly	15.2	7.0	8

(3) Humidity

The mean monthly relative humidity and the number of days with mean daily relative humidity over 80% and number of days with mean daily relative humidity below 30% at Aqaba port are shown on Table 2.1.3.

Table 2.1.3 Humidity at Aqaba Port 1992

Month	Mean monthly Relative Humidity %	No. of days Humidity over 80%	No. of days Humidity below 30%
Jan	71	2	0
Feb	76	5	0
Mar	62	0	0
Apr	63	0	0
May	56	0	0
Jun	54	0	0
Jul	62	3	0
Aug	60	2	0
Sep	58	0	0
Oct	65	0	0
Nov	68	3	0
Dec	69	2	0
Yearly	64	17	0

(4) Wind

The mean monthly wind speed and prevailing wind direction from true north and the highest mean wind speed at Aqaba airport are shown in Table 2.1.4.

The mean monthly wind speed and prevailing wind direction and the highest mean wind speed at Aqaba container berth in 1994 are shown on Table 2.1.5.

Table 2.1.4 Wind at Aqaba Airport 1992

Month	Prevailing Wind Direction (Degree)	Highest Mean Wind Speed (M/S)
Jan	335	14.4
Feb	285	14.4
Mar	256	12.3
Apr	336	12.3
May	345	13.4
Jun	344	11.3
Jul	340	11.3
Aug	245	13.4
Sep	4	12.3
Oct	360	13.4
Nov	360	11.3
Dec	343	10.3

Table 2.1.5 Wind at Aqaba Container Berth 1994

Month	Wind speed Average (M/S)	Wind direction Average (%)	Wind speed Maximum (M/S)
Jan	4.8 (NE)	NE (84)	13.5 (NE)
Feb	4.6 (NE)	NE (83)	15.0 (NE)
Mar	7.0 (NE)	NE (71)	15.0 (WN)
Apr	6.7 (NE)	NE (71)	16.5 (NE)
May	3.4 (NE)	NE (81)	23.0 (SW)
Jun	6.0 (NE)	NE (93)	17.0 (NE)
Jul	5.5 (NE)	NE (69)	12.5 (NE)
Aug	7.5 (NE)	NE (91)	15.0 (NE)
Sep	5.7 (NE)	NE (77)	17.0 (NE)
Oct	5.2 (NE)	NE (59)	18.0 (WN)
Nov	4.6 (NE)	NE (52)	15.0 (SW)
Dec	8.0 (NE)	NE (87)	16.5 (NE)

2.1.3 Oceanography

Winds normally blow from North to South, that is from land to sea in Aqaba, as a result, the wave in the Aqaba bay is calm.

Only in winter, the wind directions sometimes change and heavy southern storms occasionally occur, but not more than 2 to 4 times a year, lasting one or two days on each occasion, that cause the wave to be pushed against the northern end of the bay, making waves up to 2 meters high.

Ample anchorage areas are available at a distance of 500 to 1000 meters from shore, in a depth of water ranging from -20~60 meters.

According to the British Admiralty Chart of 1986, the sea depth of -50 meters contourline is about 150 meters distance from existing berths of main port and about 120 meters from the existing container berths and about 350 meters from the existing Fertilizer Jetty of industrial port.

(1) Tide

The tide information of Aqaba port will be obtained based on the Tide Table Red Sea-Suez.

Suez	MHW	MLW	MHWS +1.9m	MHWN +1.6m	MLWN +0.7m	MLWS +0.4m
Aqaba	-0500	-0505	-0.8 +1.1m	-0.7 +0.9m	-0.2 +0.5m	-0.1 +0.3m

The tidal information of existing ports is as follows:

Eilat port:	MHW	Springs	+0.8m
	MHW	Neaps	+0.7m
	MLW	Springs	±0.0m
		Neaps	+0.2m

Aqaba New Coastguard Harbours:	LAT	±0.00m
	MSL	+0.80m
	MWH	+1.10m
	HAT	+1.50m

(2) Current

The tide range at Aqaba port is relatively small and the location of Aqaba lie at the Northeast end of the Red sea, as a result, the estimated current speed will be relatively low.

During the second field survey period from June to August 1995, current observation was conducted.

The maximum current velocity was recorded 0.15m/s at Main Port Area.

(3) Wave

Wave observation data does not exist at present.

Wave observation for the long and short term and the analysis may be recommended in future.

Sea conditions of the Port of Aqaba are relatively calm throughout the year.

So, there is no breakwater in the Port of Aqaba.

During winter season, approximate 50 cm wave heights are sometimes observed.