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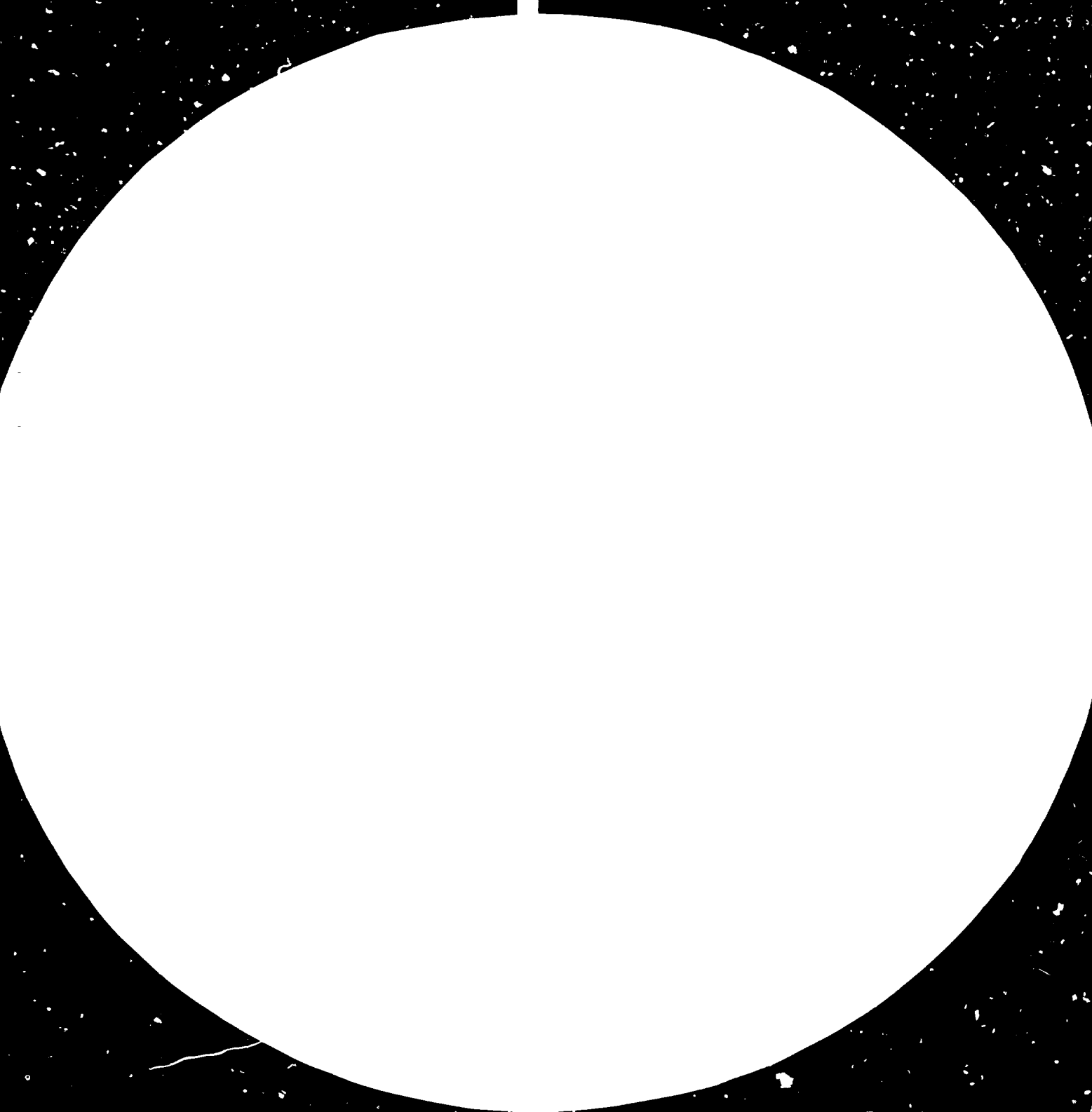
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WATER, SOIL AND LAND RECLAMATION IN IRAQ

presented by the

Government of Iraq

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PREFACE

This document, Water, Soil and Land Reclamation in Iraq, is one of 18 studies presented as supporting material to the Iraq country paper about the development of agro-industries and state of agricultural production and supplementary industries. We thought of presenting them to assist the reader in getting acquainted with the pioneering experiment in Iraq in the development of this field of our economic activities. This documentation reflects the great development achieved within the years that have already elapsed since the uprising of 17th July Revolution under the leadership of Arab Baath Socialist Party that aimed at achieving economic and social welfare for the people by rational use of the natural resources and elevating our country to the rank of advanced countries within a considerable period.

From the point of view of the Revolution leadership in Iraq, what has been achieved so far in the field of irrigation development, drainage, mechanization of agriculture, animal production, other agro-industries, and other infra-structural development in this field, are deliberate and effective steps towards reaching our aspiration.

In those studies we have tried to highlight the main development features, the negative sides as well as the positive results achieved so far with the objective of presenting our experience to brotherly and friendly countries in particular to those whose conditions and potentialities are similar to our country. This exchange of experience is not only a necessity but a duty imposed on us by our principles and the current international circumstance in which food weapon becomes one of the important weapons raised by imperialism in the face of developing countries. If those countries do not support each other and exchange national experience their task in achieving their food security will be, if not impossible, difficult to achieve.

We hope that our contribution together with that of other participating states and organizations will contribute to the success of this ministerial meeting on development of food industries in developing countries.

Preparatory Committee
for the Round-Table Ministerial Meeting
on Agro-Industry Development

WATER, SOIL AND LAND RECLAMATION IN IRAQ

Introduction

Iraq is a country of natural resources; its ancient civilizations depended on agricultural production, which is a well known fact. The history of these civilizations indicates that agriculture was a main reason of flourishing, as it was in their decline and vanishing. In almost every spot of Iraq, there are historical witnesses supporting this fact, without any doubt, that the conditions of agricultural production - the main material source for civilization - was the major factor in the geographical expansion of civilization in Mesopotamia. The most important reason for this expansion is the characteristics of Iraqi soils and waters and their salinization from two main sources. These are: irrigation water and subterground water. Agricultural exploitation in the absence of suitable water and salt balance could be provided by the establishment of irrigation and drainage networks, not merely irrigation networks which leads to salinity accumulation in the arid and semi-arid climatic conditions and deteriorates land productivity, gradually taking it out of the circle of agricultural exploitation. The effects of these conditions continued for thousands of years. Agricultural activities were carried out with primitive methods by keeping its social status without enriching its technical contents through the contact with modern scientific and technological factors or the national economic exploitation of the natural resources. Even during the first half of the twentieth century, no comprehensive planning existed to develop land and water resources in Iraq.

During the period 1911-1940, three important irrigation complexes were built on the Tigris, Euphrates and Diyala: the Al Hindya Dam on the Euphrates in 1913; the Kut Dam on Tigris in 1939; and the Diyala Dam in 1940. Their objective was to elevate and regulate water levels

in the main streams ramifying from the Tigris, Euphrates and Diyala Rivers and to ensure the irrigation of new lands in the basins of these rivers. During this period and until the late fifties, there was a concentration to establish the main irrigation canals and their branches without including the field irrigation networks. The process of establishing irrigation canals was not accompanied by the establishment of drainage networks until 1958, when few main drains were established in limited areas for surface drainage or to dry the edges of the marshes in order to increase the areas cultivated with rice.

The nature of land soil and irrigation conditions in Iraq, especially in the central and southern regions, have led to the emergence of crucial problems in the agricultural exploitation of land and water resources, namely: the salinity accumulation in the soil layers and the water logging. The feudal and semi-feudal regime before the Revolution of July 1958, have made efforts to combat these problems following the system of large-scale production. The distribution policy, which was adopted as a result of the application of Agrarian Reform Law No. 30 of 1958, has divided land properties into small units, without establishing irrigation and drainage systems and integrated reclamation works at the field level. This had complicated the situation and led to a review of agrarian reform policies as a whole, in order to establish new bases which could take into consideration the soil and water conditions. Furthermore, was the establishment of large programs to promote these resources by applying scientific methods, in order to serve the objectives of an integrated agricultural development in the country, which mainly depend on collective and cooperative distribution.

Land Resources

Most of the studies carried out indicate that the total estimated area of Iraq is about $(438.446) \text{ km}^2$, i.e. equal to (175.4) million donoums. Mountains cover about $(92) \text{ thousand km}^2$, (36.8) million

donoum; deserts (167) thousand km², (66.8) million donoum; terrain (42.5) thousand km², (17) million donoum; the plain, including marshes and lakes (132.5) thousand km², (53) million donoum; natural region and regional waters (4446) km², (1.8) million donoum. If water surfaces are included, then, the plain area will amount to (47.4) million donoum; rainfed plains cover (16.4) million donoum of this area and the sediment plains about (31) million donoums.

The main region of irrigated agriculture is the lower Rafidain plain, which is the wide plain for both Tigris and Euphrates rivers. It was created as a result of sedimentation and spreads from the north to the south at a length of about 600 km and width of 200 km approximately.

In this plain, most soils are deep sedimental and because of the dry climatic conditions and agricultural exploitation, in the absence of integrated irrigation-drainage systems, these soils are subjected to salinity and the appearance of subterranean waters which results in water logging. Salinity is a major problem for soil in the central and southern parts of Iraq. It is a historical problem of Lower Mesopotamia, which is due to the very slight slope of cultivated land and the existing subterranean water which is very near to land surface.

In most regions where it is dry or semi-dry climate, the non-scientific process of irrigation and water utilization becomes the main reason of salinity and its concentration in the absence of a drainage system and integrated reclamation projects.

The main sources of salinity in Iraqi soils are the existing salts in irrigation waters and the deep and high elevated subterranean waters.

Water Resources in Iraq

Historical Summary: Iraq depended for thousands of years on the water flow of the two rivers, Tigris and Euphrates and their tributaries which constitute the main water resources of the country and its development.

Since the downfall of civilizations on the bank of the two rivers (before about 6000 years), water resources of Iraq were utilized by man to satisfy his needs.

Ancient civilizations of Sumerians, Babylonians and Assyrians exercised many activities in water especially irrigation, drainage and pollution control.

A. History of Water Resources in Iraq

For thousands of years, Iraq has been dependent on the waters of two eternal rivers, the Tigris and the Euphrates. These constitute the principal source of its water resources for the various need of the country and its development.

Since the downfall of civilization on the banks of these two rivers (around 6000 years ago) Iraq's water resources have been utilized by man to satisfy his needs. The ancient Sumerian, Babylonian and Assyrian civilizations engaged in numerous hydraulic activities, especially irrigation, drainage and pollution prevention. Thus, the first historical appearance and application of irrigation engineering was in this country in the days of Babylonians. Its development reached a peak in the time of the Abbasid caliphate.

B. The Development of Water Resources in Iraq

The scientific utilization of water resources in Iraq began at the start of the present century, when William Wilco prepared a report in 1911 on the development of irrigation in Iraq dealing with flood control and other problems related to water resources and their utilization. On the basis of the proposals made in this report, the Hindiya Barrage was constructed on the Euphrates (1911-1914) and the Kut Barrage on Tigris River (1937-1939).

In 1918, a department of irrigation was established but its functions were confined to the collection of data on water levels, river discharges for flood control purposes and improvement of some canals. There was no plan for the construction of projects and its expansion in the sphere of agriculture except in limited regions.

Work was confined to the construction of an irrigation network without drainage systems and this eventually led to a wide-spread increase in the salinity. This situation continued until 1950.

After 1950, the establishment of major storage and irrigation projects were started, such as Samarra Barrage, Tharthar Regulator, Ramadi Barrage, Dukan and Derbandikhan Dams. No modern irrigation and drainage networks were initiated, only with the exception of the Great Mussaiyib Project.

After the revolution of 17 July 1968, the National Government formulated a five-year plan for irrigation, drainage and land reclamation, the implementation of a number of projects and the completion of already started projects, and in addition, the initiation of other long-term projects.

The main functions of the Ministry of Irrigation, after its foundation in the year 1969, were:

1. The control of the water resources of the Tigris and Euphrates Rivers and their tributaries by the construction of dams and reservoirs for the purpose of flood control and storage;
2. The generation of electric power;
3. The regulation and improvement of irrigation systems in a number of existing projects, together with the setting up of an integrated drainage network with a view to land reclamation;
4. The elimination of salinity and ensuring continued fertility and implementation of new irrigation and drainage projects based on the system of intensive and semi-intensive agriculture.

C. Present Water Uses

Storage Schemes:

The objectives of major storage schemes in the country are:

1. To store water in times of abundance and allocate it in accordance with agricultural requirements.
2. Flood protection.
3. Electric power generation.
4. Regulation of navigation in main rivers, fisheries and for tourism purposes.

At present, the available annual total capacity in the country is about 12 km³ (excluding storage in Tharthar Reservoir). There is a possibility to achieve maximum storage capacity by construction of Mosul, Bekhme, Hemrin and Fatha Dams in addition to the construction of some small dams such as Upper Fudhaim, Wand, Duhok and Colos...etc.

Present Storage Schemes:

These storage dams are:

1. Habbaniya Lake

The main works of this scheme were undertaken in 1956. It was constructed mainly for flood control and irrigation purposes with total storage capacity of 3.28 km³.

2. Dckan Dam

This dam was constructed on Lesser Zab River in the year 1956, for multi-purposes with total capacity of 6.8 km³.

3. Derbandi Khan Dam

This project was completed in 1961 on Diyala River for multi-purposes with total capacity of 3.0 km³.

4. Tharthar Project

This is one of the largest and most important storage schemes for flood control purposes and it has been used since 1956.

As a result of the diversion of excess water from the Tigris into Tharthar Lake over the past years, and especially in 1967, 1968 and 1969, when floods were high, the lake became full, thus, reducing its storage capability and its advantage from the point of view of flood control. Thought had to be given, therefore, to finding a radical solution to this critical problem by draining the lake to a level that would allow room for the storage of future flood water from the Tigris in order to avert serious damages. Therefore, it was decided to cut Tharthar-Euphrates canal from the south of the lake with a length of 37.5 km. The canal was completed in October 1976 as a first stage. The second stage is the construction of Tharthar-Tigris Canal (under construction). This canal is 65 km long. The total designed discharges of the main canal is 1100 cumecs.

Projected Storage Schemes

By 1990, a number of new large dams will have been completed and filled, thus, adding this amount to the present storage capability for meeting the country's water requirements, such as: Haditha on Euphrates River, Hemrin on Diyala (completed), Mosoul on Tigris and Bekhma on Upper Zab River...etc.

D. Ground Water

The utilization of ground water at the present time constitutes only a small proportion of the water resources in Iraq. Its uses are limited in the main to the domestic purposes and certain industries, with a small amount set aside for irrigation purposes in regions remote from surface water. A large number of wells have been sunk at an estimate of 5700 wells since 1933 and up to 1979.

There are many springs in Iraq, mostly in the northern regions, and some of them are hot or mineral springs. Present ground water resources are estimated at 1.2 km² per year.

The chemical characteristics of the ground water vary according to the geological structure. The degree of electric conductivity ranges from one to more than 10 milliomohs/cm, with total soluble solids (TSS) in order of under 2000 to over 10,000 ppm. Water with a solid content of around 1500 ppm is available for drinking and more than 3000 ppm for domestic use (if the nitrate content is less than 50 ppm).

E. Recent Trends in Water Uses

Iraq is dependent for the provision of its needs on its limited water resources from the Tigris and Euphrates and their tributaries. The government of Iraq has attached considerable importance to this issue and has called for strict economy measures in the transportation and utilization of water and for preservation of its quality through the application of modern methods of technology in the transportation and use of water for all purposes. In 1974, a decision was made that irrigation channels and networks in all parts of the country should be lined in order to reduce water losses. Some parts of the main and branch canals, as well as water courses, were lined in the Is-haqi Irrigation Project, north of Baghdad, and the irrigation networks in the northern and southern ROZ of the Diyala Project. The same decision is now being adopted in other schemes.

The government is also applying modern irrigation techniques such as sprinkler irrigation, in order to reduce water losses (transportation, absorption, evaporation...etc.). These are being applied on a wide scale in most of state farms, particularly in the northern region where the climatic, soil and water conditions are adequate. Trickle irrigation has been introduced since five years in the country and was used mainly for the purpose of horticulture.

The application of these methods would save a considerable amount of water. The government is also endeavouring to introduce modern technology including automatic operation of irrigation projects.

F. Water Policy

Iraq has a great potential for land utilization, agricultural and industrial development, which are dependednt on an adequate supply of water. All these give serious thought to the complete control of its limited water resources and their optimum utilization in a manner consistent with the planned aim of building an economically developed society.

Water policy is based on the long-range staged scientific planning for water and land resources. In this respect, the first stage of the General Scheme of Water Resources and Land Development was completed in 1975. The second stage was started in 1977 and it shall be completed in 1981. The study aims at getting detailed data and information to arrive at wide range and accurate planning for all water consuming economical activities. This planning will be continued throughout the next stages.

The inflow of water within the boundaries of Iraq depends to a great extent on the development of irrigation and agricultural projects in the neighbouring countries sharing common water. Therefore, water policy demands the continuous discussion with these countries to arrive at an equitable sharing of water, maintaining its quality, protection from harmful effects and to consume it in a proper manner, all in accordance with international standards. The proper planning of agricultural development in Iraq depends on the knowledge of Iraq's share of water and its quality.

G. General Rules for the Optimum Use of Water, Reduction of Losses and Waste and Preservation of Water Resources in the Country

Water resource studies have shown that the controlling factor for agricultural development is water. The economical return of this resource depends basically on using it properly without waste, and on the extent of basic changes in the present methods reducing wastes to minimum and,

therefore, using all water saved for reclamation and intensification of cultivation in the present projects and also in the projects that will be implemented in the future.

The maximum utilization of water resources requires the following:

1. Formulating an agricultural plan in a precise and integrated manner, taking into consideration all interacting factors to obtain maximum possible economical return of water used in agriculture in addition to other sectors of economy. Also allocating the quantities for each sector and accurately ensuring maximum utilization of this valuable resource - a value which is increasing day after day.
2. Concentrating the efforts now on a limited number of existing projects with clear potentials to reach maximum production capacity on the basis of specialization and vertical expansion, and the leading role of the socialist sector (state farms and collectives, cooperative farms) and developing these organizations to ensure the increase of crop intensity, yield per unit of area, and the prevalence of socialist relations in the countryside. It is also required in the existing projects to improve irrigation in the areas of high productivity and exclude others with low productivity as much as possible.
3. Studying the incorporation of bodies concerned with water management presently divided among a number of ministries and organizations into a unified administrative organization, taking advantage of the advanced countries expertise in similar field aiming at reaching to centralized control on water uses for the various sectors of economy and at the same time maintain the quality of water resources, protect them from detriment and ensure their utilization in proper manner.
4. Unification of existing water laws and regulations in a way which insures more protection for proper utilization of water.
5. Development of water quality control means, and avoiding discharging industrial waste and water from some drains into the main rivers.
6. Increasing of popular awareness programs for guidance of water users through various means, especially among those working in agricultural practices.

Land Reclamation in Iraq

A. Concepts and Trends

If we follow the concepts and trends of land reclamation in Iraq through the policies and plans to develop land and water resources, we can easily distinguish the reflection of the political, economic and social situation that the country lived in during the first half of this century until the 14 July 1958 Revolution and the period that followed, the 17 July 1968 Revolution and the radical, deep changes in every field of life including the development of land and water resources. Until the later first half of this century, the concept of land reclamation was a synonym of horizontal expansion in irrigated lands which meant retarded technical trends and policies with political/social and economic roots related to the nature of the political system which existed during that period.

The execution of drainage networks as a necessary and essential part in the study, designing and building of the agricultural projects was among the main factors neglected since the beginning of implementing horizontal expansion. The execution was carried out at the beginning, parallel to the main drainage in the main irrigation streams, only, and for other purposes without direct suitable water and balances in the agricultural projects. Then, the concept of water drainage was developed to include collector drains, providing that the density of drainage to this extent could care soil problems represented by salinity and water logging and to eventually stop their negative effect on the productivity of agricultural lands. This trend was clear especially in the projects of Euphrates Basin.

Naturally, the execution of irrigation networks only or the drainage networks only in the agricultural projects in the Lower Rafidain Basin with its well-known conditions of soil, water, climate and agricultural exploitation cannot be considered as complete reclamation process in

its scientific and practical concept. This concept was gradually developed after the 17 July Revolution and became a basic trend in the development of land, water resources and agricultural production. It took a practical aspect by the establishment of a specialized organization belonging to the public sector. The main purpose of executing reclamation projects in irrigated lands at the field level was to exploit land and water resources at economic and agricultural rotation to achieve not less than 120% recovery.

B. Planning and Investment Indicators to Develop Land and Water Resources

As we explained in the previous pages, the concept of the policies in the fields of developing land and water resources during the period before the 14 July 1958 Revolution, which did not have an aggregate planning for these basic factors, but were mostly due to partial studies done by foreign companies, the national scientific liberated thoughts had no effective role in their formulation. After the 14 July 1958 Revolution, Iraq adopted the principle of five-year plans for national development. In spite of the serious remarks on this attempt in its beginning, a considerable development could be observed in the following phases, so that the principles and indicators could depend upon analysing the philosophy and conditions laid on the period.

As for land and water resources, we could realize in the five-year plan, 1965-1969, that it concentrated on continuing the execution of irrigation projects and some drainage networks without completion of reclamation works in the agricultural project.

The project (Reclamation and Development of Agricultural Land) was first used in the development of agricultural and animal wealth. This project was completely separated from irrigation and drainage projects. The reclamation and development of agricultural lands included several activities, mainly, soil survey and land reclamation, applied research grading and the execution of pilot reclamation areas in some few projects without entering in large-scale projects. The

contrary was in irrigation and drainage projects, where the plan was including only a long list of them. The investment allocations for irrigation and drainage projects as compared to reclamation and land development reached (16) times approximately.

But the five-year plan, 1970-1974, adopted new planning policies and trends which appeared for the first time in the frame of the five-year plans. We can append below the most important points of the new policies:

1. To concentrate on a limited number of irrigation and drainage projects and to complete them in every aspect with all their requirements of irrigation and draining (except field drainage) and the buildings for each agricultural region included in the project in the same period.
2. To start the establishment of field drainage, land leveling, salt leaching in the projects, where the main irrigation and drainage networks were completed as explained in previous pages, taking into consideration the following:
 - a) The availability of water for intensive agriculture.
 - b) The availability of human and mechanical resources for intensive agriculture after the completion of drainage leveling and leading operations.
 - c) To establish an independent administration for the project to be responsible for the implementation and cultivation operations.
 - d) To return the cost of land reclamation by increasing agricultural production.
3. To demolish gradually the applied system in agriculture even if this will require not to reclaim some regions that have no sufficient water for intensive agriculture.

The plan had seriously and for the first time emphasized the preparation of clear water balance during the planning period, to be useful and utilized during the programmed time and execution of the projects.

These trends and policies of the five-year plan (1970-1974) made a new equilibrium between the continuity of execution of old plans which reached an advance phase, and the new policies which depend mainly on land reclamation method to build the agricultural project based on this new balance that guide to link the reclamation process with the investment method by emphasizing the importance of the gradual demolishing of the applied system and the trend to the economic intensive production.

These developments had affected the investment allocations of (land reclamation project) as compared to irrigation and drainage project. This had changed from (1) to (16) during the 1965-1969 plan to the ratio (1/1.4) in the plan 1970-1974.

These trends have been developed more clearly and comprehensively in the plan 1976-1980, which stated "To continue the activities of land reclamation and irrigation and drainage networks in the central and southern regions, considering that desalinization in these regions is a central issue in agricultural development, and requires direct and continuing cure to reach an increase in the field according to the established objectives. This requires gradual work according to a long term plan that exceeds twenty years".

Investment allocations were not limited to the areas of the projects included in the integrated land reclamation and it was about (2.5) million donoum expected to be completed during the next five-year plan 1981-1985, as well as other projects covering large areas that will be reclaimed during the mentioned plan period and the following; and to continue the implementation of irrigation and drainage networks in other projects as a first phase of the reclamation process according to the plans related to the great water reservoirs projects that ensure control over water quantities for agricultural crops.

One of the important objectives proposed for the next five-year plan (1981-1985) is to find a better coordination among the existing development activities in different sectors - cultural, health and other

infrastructures in the rural areas and the development activities in land and water resources in the reclaimed lands, so as to ensure all the necessary conditions for the success of the agricultural project and the development of the manpower in order to carry on the economic and social objectives. Thus, the agricultural sector can play an important role in the economic and social welfare; provide food security for Iraq and the Arab nations; and play an active role in supporting the political independence of the country.

