JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

GENERAL DIRECTORATE OF RURAL SERVICES (GDRS)
REPUBLIC OF TURKEY



# STUDY
# ON
# NATIONAL SMALL-SCALE IRRIGATION
# AND
# RURAL DEVELOPMENT PROGRAM
# IN
# THE REPUBLIC OF TURKEY

## FINAL REPORT

**MARCH 1998**



**SANYU CONSULTANTS INC.**

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## CURRENCY EQUIVALENTS

(As of July 15, 1997)

Currency Unit = Turkish Lira (TL)

US$ 1.00 = 155,000 TL

US$ 1.00 = 115.00 J¥ (Japanese Yen)

## WEIGHTS AND MEASURES

Metric System

# PREFACE

In response to a request from the Government of the Republic of Turkey, the Government of Japan decided to conduct a Study on National Small-Scale Irrigation and Rural Development Program and entrusted the study to the Japan International Cooperation Agency (JICA).

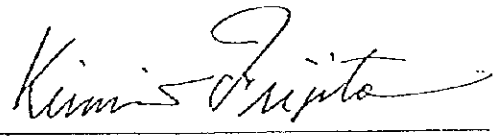
JICA sent to Turkey a study team headed by Mr. Hironori Takahashi, Sanyu Consultants Inc., three times between December 1996 and March 1998.

The team held discussions with the officials concerned of the Government of Turkey, and conducted field surveys at 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 Republic of Turkey for their close cooperation extended to the team.

March, 1998



Kimio Fujita
President
Japan International Cooperation Agency

March, 1998

Mr. Kimio Fujita
President
Japan International Cooperation Agency (JICA)
Tokyo, Japan

**Letter of Transmittal**

We are, herewith, pleased to submit the Final Report for the Study on National Small Scale Irrigation and Rural Development Program in the Republic of Turkey, upon completion of the study works. The Report, which describes a development plan of irrigation and drainage as well as consolidation plan for agricultural infrastructure, is compiled in reflecting the advices and suggestions for the formulation of development plan by the authorities concerned of the Government of Japan and your Agency as well as comments made by GDRS during the meetings with the Study Team.

In this program, a master plan formulation for the entire small scale irrigation and rural development schemes and a feasibility study for the selected priority projects were carried out, covering 56 provinces, excluding 24 provinces located in south-eastern part of the country. The study program comprises two phases. In Phase I, a long list inventory was prepared and also a short list inventory was extracted from the foregoing long list through selection criteria including priority factors and maturity of project provision. Further, ten priority projects were selected through a set of sorting standards regarding types of schemes, scale, farming patterns, agro-ecological division, availability of basic data etc. During Phase II feasibility study, a development plan of irrigation and drainage as well as consolidation plan for agricultural infrastructure were formulated for these ten priority projects.

Turkey has called for "restoration of inter-regional disparity between urban and rural communities" as one of the political targets, and in this context agricultural promotion constitutes the most important task in rural areas. The studied projects will bring about increased crop and livestock production, leading to higher income levels of beneficiary farm households, thus eventually contributing to improved rural living standards as well as restorating inter-regional disparity. In view of such a series of envisaged advantages of the projects, an early implementation thereof is sincerely expected.

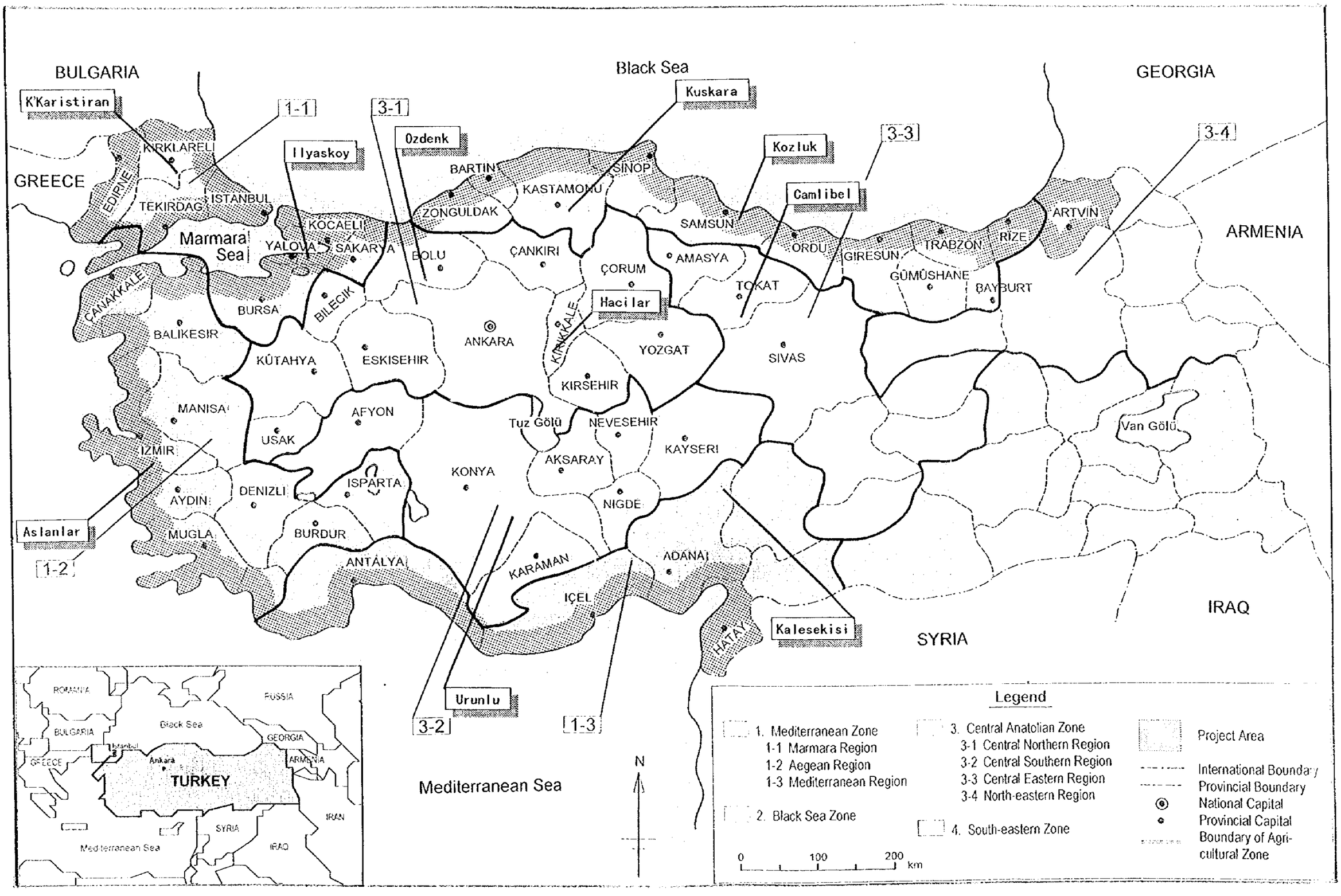
Finally, we take this opportunity to express our sincere gratitude to GDRS, and Ministry of Foreign Affairs, Ministry of Agriculture, Forestry and Fishery of the Government of Japan, and Japan International Cooperation Agency for close cooperation to the Study Team.

Respectfully yours,

高橋宏徳

Hironori Takahashi
Leader of Study Team

# Location Map



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## PART I MASTER PLAN STUDY



## PART II FEASIBILITY STUDY

# Abbreviations and Glossaries

| Abbreviation | Turkish Equivalent If Any | English Equivalent |
|---|---|---|
| 1. Name of Official Agencies and State or Parastatal Organizations | | |
| DSI | Devlet Su Isleri | General Directorate of State Hydraulic Works |
| | Bayindirlik Bakanligi | Ministry of Public Works and Settlement |
| GDRS | Koy Hizmetleri Genel Mudurlugu | General Directorate of Rural Services |
| MARA | Tarim ve Koyisleri Bakanligi | Ministry of Agriculture and Rural Services |
| MOE | Cevre Bakanligi | Ministry of Environment |
| MOF | Orman Bakanligi | Ministry of Forestry |
| D.M.I. | Devlet Meteorology Isleri | State Meteorological Service |
| D.P.T. | Devlet Planlama Teskilati | State Planning Organization |
| E.F.T.A. | | European Free Trade Association |
| E.T.U. | | European Tariff Union |
| G.D.A.R. | Tarimsal Arastirma Genel Mudruligi | General Directorate of Agricultural Research |
| G.D.A.P.A | Tarimsal Uretim ve Gelis Mudriligi | General Directorate of Agricultural Production and Development |
| S.E.E. | Devlet Ekonomi Isleri | State Economic Enterprise |
| T.I.G.E.M. | Tarim Isletmeleri Genel Mudrulugu | General Directorate of Agricultural Enterprises |
| T.K.K. | Tarim Kredi Kooperatifleri | Farm Credit Cooperative (Union) |
| T.M.O. | Toprak Mahasulleri Ofici | Soil Product Office ( = Grain Marketing Board ) |
| T.C.Z.B. | Turkiye Cumhuriyeti Ziraat Bankasi | Agricultural Bank of Turkey |
| T.Y.M. | Tarimsal Yayim Merkezi | Agricultural Extension Center |
| W.U.A. | Sulayici Birligi | Water User's Association |
| W.U.G. | Sulayici Grubu | Water User's Group |
| T.A.F.A.S. | Turkiye Seker Fabrikarali Birligi | Turkish Sugar Factory Inc. |
| T.A.R.I.S. | Tarim Satis Kooperatifleri | Farm Sales Cooperative |
| 2. Technical and Economic Terminology | | |
| GNP | | Gross National Product |
| GDP | | Gross Domestic Product |
| BHN | | Basic Human Needs |
| B/C | | Benefit Cost Ratio |
| CAP | | Common Agricultural Policies |
| DCP | | Digestible Crude Protein |
| DD | | Detailed Design |
| EIRR | | Economic Internal Rate of Return |
| FIRR | | Financial Internal Rate of Return |
| Ea | | Field Application Efficiency |
| Ed | | Field Distribution Efficiency |
| Ec | | Conveyance Efficiency |
| Ep | | Project Efficiency |
| $ET_0$ | | Standard Evaporation |
| FS | | Feasibility Study |
| IEE | | Initial Environmental Examination |
| K | | Hydraulic Coefficient |
| Kc | | Crop Coefficient |
| OM | | Operation and Maintenance |
| PR, P/R | | Planning Report |
| PTT | (originally French) | Post, Telephone and Telegram Office |
| SEI | | Serious Environment Impact |
| SMEP | | Soil Moisture Extraction Pattern |
| SR | | Survey Report |
| TDN | | Total Digestible Nutrient |
| TRAM | | Total Readily Available Moisture |
| 3. Units | | |
| cum | | Cubic Meter |
| d. | | Dünun |
| ha | | Hectare |
| kg | | Kilo-gram |
| km | | Kilo-meter |
| l | | Liter |
| Kwh | | Kilo-watt hour |
| MCM | | Million Cubic Meter |
| m | | Meter |
| MTL | | Million Turkish Lira |
| mm | | Milli- meter |
| PS | | Horse power |
| ppm | | Part per Million |
| sqm | | Square meter |
| t | | Tonne |
| TL | Turk Lirasi | Turkish Lira |

# SUMMARY, CONCLUSION AND RECOMMENDATION

# SUMMARY

## PART I MASTER PLAN STUDY

### 1. Introduction

### 1.1 Authority

At present, the food production in Turkey is under self-sufficiency. The government plans to raise and stabilize the agricultural production to meet the growing population. However, the conversion of agriculture land to other land use has been accelerated. Consequently, in order to increase agriculture production, it is necessary to improve the productivity per unit area through irrigation development that plays a key role in the entire rural development.

Under these circumstances, Turkish Government requested Japanese Government to provide an inventory survey for small-scale irrigation and rural development program, to conduct a feasibility study over selected areas and to prepare guidelines for the establishment and evaluation of projects related to these fields.

The Scope of Work (S/W) for the Study on National Small Scale Irrigation and Rural Development Program in the Republic of Turkey (hereinafter referred to as 'the Study') and the Minutes of Meeting for the said S/W were agreed upon and signed between the Japan International Cooperation Agency (hereinafter referred to as 'JICA') and General Directorate of Rural Services (hereinafter referred to as 'GDRS') on August 21, 1996. This report is the Draft Final Report prepared in accordance with the Scope of Work.

### 1.2 Objective and Scope of Study

The objectives of the Study are as follows:

1) To formulate a master plan on the field of small-scale irrigation and rural development.
2) To conduct a feasibility study on the project for small-scale irrigation and rural development in the areas that have high priority.
3) To compile the guidelines for counterpart personnel in conducting projects in future. To carry out technology transfer on the methodology of the study and the procedures of planning.

The Study area, which covers 56 provinces out of 80 provinces in the whole country (except 24 provinces) commands a total beneficial area of about 170,000 ha.

The Study is composed of two phases as follows;

(1) Phase I Master Plan Study

a) Preparatory Home Office Work (2 Dec 1996 – 7 Dec 1996)

b) Phase I Field Work (8 Dec 1996 – 19 Mar 1997)

c) Phase I Home Office Work (1 May 1997 – 29 Jun 1997)

(2) Phase II Feasibility Study

a) Phase II Field Work (6 Jul 1997 – 3 Oct 1997)

b) Phase II Home Office Work (4 Oct 1997 – 2 Dec 1997)

## 2. Socio-economic Background

### 2.1 National Economy

Characteristics of national economy are summarized as follows ;

- International trade value is fairly small as compared with that of domestic production
- Western part of territory develops more vigorous economic activities than those found in eastern part due mainly to differential urbanization, thus interior disparity tends to widen. Similar tendency is observed between coastal and inland areas due to the same reason.
- Urbanized areas can accept population exodus from rural areas, but so far as labor absorbing capacity is concerned, agriculture and service sectors contribute much, while industry can do little and urban unemployment has raised a new problem
- Turkey has suffered from bulky foreign debt and fiscal expenditure including budget for subsidies imposing heavy burden on the Government fiscal balance.

After 1994's fastest development, the rate of inflation has settled to milder, more stable trends. The role to be played by agriculture lies in food security, self-absorption of rural population, stabilization of rural living standard and expansion and consolidation of local job opportunities. Aiming at minimizing the disparity between agriculture and other industrial sectors, the following policy objectives are addressed for earlier materialization.

- Ensuring an adequate agricultural growth rate
- Increasing productivity and diversifying farm production by improved technology
- Ameliorating nutritional level of the nation
- Raising the standard of living for those employed in the agricultural sector and reducing underemployment/unemployment
- Improving agricultural structures and ensuring better utilization of production resources/factors
- Reducing intra-sectoral income disparity by controlling exodus of labor force from rural areas.

## 2.2 Seventh Five-Year Development Plan

Basic agricultural sector principles are to safeguard balanced and adequate nutrition of an increasing population, to increase production and exports by placing emphasis on those products that Turkey has a relative advantage, and to ensure increase and stability in producers' revenues. Agricultural sector's share in value added GDP is set at 13 to 13.5 % and the production's share in sectoral developments at 10.7 to 11.2 % at the end of the Plan term. Annual average growth rate of value added for agriculture is projected at 2.9 to 3.7 %, and the production is expected to grow by 2.9 to 3.7 % at constant price basis.

## 2.3 Policy on Agriculture

Basic principles for Rural Infrastructure Development Sector are to create the infrastructure necessary for a balanced, sustainable and environmentally friendly agricultural development in line with the current agricultural policies. Land development activities will be promoted through building a new irrigation system over a 735,000 ha area and maximizing benefits from the area under irrigation, whereby on-farm development services are expected to cover 290,000 ha. Also, physical and financial participation of the beneficiaries for the execution and management of agricultural infrastructure investments will be promoted to create resources for new investments and to ensure effective use of the existing infrastructure.

# 3. The Study Area

## 3.1 Physical Features

### (1) Meteorology

The country is broadly divided into four climatic zones; namely, 1) Central zone (Anatolia Plateau), 2) Mediterranean zone, 3) Black Sea zone, and 4) Eastern Anatolia zone, each of which is further divided into five to seven sub-zones. The Study area straddles mostly over the first three zones, and the table below is a summary of their major climatic conditions:

| | Annual Pre.(mm) | Mean. Temp., °C | Min. Temp., °C | Max. Temp., °C | Humidity, % |
|---|---|---|---|---|---|
| Central | 330 to 840 | 9 to 18 | -35 to -12 | 38 to 47 | 49 to 72 |
| Mediterranean | 390 to 1200 | 11 to 19 | -28 to -5 | 38 to 46 | 61 to 76 |
| Black Sea | 460 to 2300 | 10 to 15 | -27 to -7 | 38 to 41 | 70 to 77 |

### (2) Hydrology

Turkey is divided into 26 basins, of which 22 basins fall in the Study area. While the country's annual surface water potential is about 186 $km^3$, Study area accounts for 126 $km^3$. Mean annual water yield varies from 2 to 18 $\ell$/sec/$km^2$ and runoff to rainfall ratio is between 14 and 67 % with an average of 37 % (34% for the Study area).

### (3) Geology and Hydrogeology

Turkey is totally placed on the Mediterranean part of Alpine Mountain formation movement belt. The belt passes through Russia and Siberia blocks at the north, and Africa and Arabia blocks at the south. The part of the belt that includes Turkey is divided into two main

sides with east and west directions. These are the North Anatolia fold zone which straightly lies and South Anatolia fold zone having a few bends. These main zones correspond to the major mountain ranges which have Alpine characters in terms of topography.

A feasibility level hydrogeological survey was started in 1966 and an area of 132,000km$^2$ has been covered by means of about 970,000m of research borings as of 1995. According to the survey, an amount of about 12 km$^3$ is annually exploitable over Turkey and the Study area's is about 9 km$^3$, by each of which about 600,000ha and 450,000ha could be annually irrigated respectively. Provinces well-known for groundwater irrigation are Konya (41,039ha as of Jan. 1, 1995), Nigde (10,420ha), Karaman (18,968 ha), Hatay (12,742 ha), Kayseri (11,091ha), and Afyon (19,694 ha).

(4) Soil

Soil varies widely in Turkey, and classified into the 23 soil groups. Among these soils, main soil groups are Brown Forest Soils, Brown Soils and Non-Calcarious Brown Forest Soils, that occupy about 51 % of entirety. The land is eroded by loss of vegetation by cattle and forest felling in a long time. It is said that most of the soil erosion is caused by water runoff.

### 3.2 Socio-economic Condition

(1) Administrative Division

The study area consists of 56provinces, and the total number of districts in these provinces are counted at 253.

GDRS has 22 regional offices in the whole country, of which 13 regional offices are in the study area.

(2) Population

In the study area, the population and density are 45,072x10$^3$ (80% of total population) and 84 person/sq.km. A peak population growth, 2.85%, was observed in 1950-1960 period, then declining after the peak. During a period of 1985-1990, 4.1% and -0.6% of growth rate in urban and rural area were recorded respectively. The ratio of rural population has been constantly decreasing, and the urban population (53%) became larger than rural population (47%) since 1985.

About 7.7% of the total population inhabits in Central Eastern Anatolia, and 5.5% of population in Black Sea region migrated to Marmara and Aegean region.

(3) Land Tenure and Land Holding

Land Tenure and Land Holding is mostly "cultivate owned land" (92%) type farm household.

In the study area, arable land holding per farm household is averaged at 5.4 ha. About 1.3%of farm household has 2.7 ha which falls in "cultivate leased land only" type farm household.

## 3.3 Agriculture

### (1) Land Use and Cropping Pattern

Total agricultural land in the study area constitutes around 19 million ha including the fallow area. The area of field crops occupies about 72.6 % of the total area. The land area under pasture, vegetables, fruit trees and fallow area account for 0.8%, 3.2%, 9.6%, and 13.7%, respectively. Irrigated area in the study area was 2,750,000 ha in 1991 including 1,890,000 ha of field crops, 380,000 ha of vegetables and 480,000 ha of fruit tress. The corresponded rates of irrigated area to the total of these crops are 17.8%, 79.6%, and 26.2%, respectively.

In the areas with mild climate such as Aegean Sea region, a double cropping system is adopted with barley and fast growing crops such as peas and leafy vegetables. However, single cropping predominates over most of the Study area.

### (2) Farming Practice and Farm Input

Average cultivable area per farm household in the Study area is 4.94 ha in 1991. Over 69 % of the total farm household hold the area smaller than 5 ha, accounting for only 27.6 % of the total agricultural area. According to the 1994 Census, the amount of chemical fertilizers of nitrogen used in the cultivating field was 52 kg/ha, and that of phosphate was 22 kg/ha. Farming machines are increasing in number in recent years. Cultivation and harvesting of wheat and barley are mostly practiced by big machines.

### (3) Crop Yield and Production

Average yields of wheat and barley are 2- 2.5 ton/ha in the Study area. Increase of the yields of field crops in recent two decades are very small except some crops such as maize, sunflower and cotton. Leafy and fruit vegetables are produced sufficiently in the Study area. Cultivation of fruit vegetables such as tomato and cucumber in greenhouse have been rapidly increased especially in the sea coast regions. Many kinds of fruits, such as nuts, pome fruits, stone fruits, citrus fruits and grapes are produced in the Study area. Kinds and species of fruit trees vary by region reflecting the different climate and soil conditions of the region.

### (4) Livestock Production

Domestic animals and poultry are raised in large number. However, the total number of sheep and goat have been slowly decreased for the last two decades, in contrast with increasing number of egg-laying and broiler hen. Productivity of meat, milk and egg by these livestock are low. The meat production is insufficient to meet domestic demand, and some of meat are imported from abroad.

Stables are located in villager's farm yards, emitting vile odor especially during summer season, bringing about insanitary condition. Therefore, these stables are recommended to move to a feeding quarter outside the villages, separated from the village residential area..

### (5) Distribution, Market and Prices of Farm Products

Distribution systems of farm products comprise two major types, i.e., controlled and free marketing. The former constitutes a monopoly system for officially controlled commodities through a governmental price intervention mechanism, covering wheat, sugar beet and cotton. Wheat and other cereals under pricing control by the government are generally sold to TMO

(Grain Authority Branches) after harvesting. The other marketing system has developed in private sector subject to free market mechanism. It consists of minor routes of direct sale from producers to consumers within rural communities, and major ones through commercial media where large wholesale marketing agents meet large scale domestic (urban) and export demand.

As to the commodities like cereals and industrial crops serving as processing materials, to which price supporting measures are applied, the kinds of commodities, intervention prices are officially decided annually by assessing them through a parity system, and finally prices and conditions of government purchase are bulletined on official gazettes.

(6) Production Values of Principal Crops

In principle, arable land with favorable cropping conditions has marked better yield response to input application, leading to higher crop production values, because yields can be raised considerably irrespective of the past investment. The estimation reveals that cases are often encountered in which increment of production values by irrigation remains at conservative levels in spite of high net gain ratio. Profitability of industrial crops (sugar beet, fiber crops and oilseeds) and of paddy is not so attractive as expected though it is highly variable with their yield levels, as shown in the following table.

Unit : million TL per ha

| crop | wheat | Barley | Alfalfa | Sugar-beet | Sunflower | Cotton | Tomato |
|---|---|---|---|---|---|---|---|
| rain-fed plot | 44 | 21 | -24 | - | 21 | - | 82 |
| irrigated plot | 107 | 115 | 2 | 176 | 50 | 2 | 1,726 |
| increment | 63 | 94 | 26 | - | 29 | - | 744 |

Source : estimated from GDRS farm production cost survey, based on farm-gate prices as of July 1997

(7) Farm Economy

Agricultural GNP accounts for one seventh of the total GNP, whereas population who depends on agriculture counts 35% of the state total, so per capita income of dependable population on agriculture amounts to only one third of the average per capita revenue in the whole nation. It follows that a pure farm in Turkey can hardly sustain livelihood by single farm income, but needing off-farm income to supplement farm income. National per capita GNP in 1997 is estimated at 91 million TL, while the mean annual income of the households interviewed stays 91 million for four family members, hence recent rural household revenue remains at less than half of the national average.

(8) Agricultural Support Services

The agricultural extension service belongs to the General Directorate of Development of Agricultural Production of MARA. The branch offices with specialists locate in all provinces. There are two agricultural research organizations in Turkey. One researching the fundamental subjects belongs to MARA, and another belongs to GDRS with one central and 10 regional institutes researching the practical and regional subjects such as irrigation methods and soil conservation. Credit services by Agricultural Bank and other funds are supporting the development of crop and animal production, fishery, irrigation facilities and rural industries. Agricultural cooperatives are contributing to the development of agriculture through supply of farming materials to farmers.

## 3.4 Irrigation and Drainage

### (1) General

Two organizations are in charge of irrigation development; namely, GDRS and DSI. GDRS is responsible for developing of small scale irrigation which exploits water not more than 500 *l/s*, applying on-farm development to the areas which have been opened for agriculture by DSI, as well as soil conservation, land consolidation, drainage and land reclamation, rural road, village water supplies, and village electrification.

### (2) Water Resources

A total 107.2 $km^3$ of water potential was identified as of 1995, which is composed of 95 $km^3$ (89%) of surface runoff and 12.2 $km^3$ (11%) of groundwater. The total development of water resources by public institutions reached 33.5 $km^3$ as of 1995. This means that 31 % of technically usable potential has been developed, and it is estimated that in the year of 2000 it will reach as high as 38 %. Almost 75 % of those developed water resources are being used for agricultural purposes.

### (3) Irrigation

A total of 8.5 million ha, out of 25.9 million ha irrigable area, have been identified to be economically feasible to irrigate with major and minor irrigation works (Statistics with Map Bulletin, 1995, DSI). The feasibly irrigable area consists of 7.9 million ha with surface water and 0.6 million ha with groundwater. Already opened to irrigation are, as of end of 1995, 3.7 million ha for surface water (47%) and 0.4 million ha for groundwater (67%). The total opened area of 4.1 million ha engrosses half the feasibly irrigable area.

GDRS has carried out numerous small scale irrigation projects, total of which amounted to 1.15 million ha in gross; viz., 0.90 million ha for surface water and 0.25 million ha for groundwater, as of January, 1996. In summary, GDRS has opened about 33 % of the total state area opened for surface irrigation and 74 % for the groundwater.

### (4) Drainage

GDRS has also implemented about 1,200 drainage projects, as of January 1996, covering 319,000 ha, most of which have been conducted by means of open ditches in wet lands and water-logging areas, thus accompanied reclamation works.

### (5) Operation and Maintenance

Upon completion of surface irrigation projects by GDRS, the irrigation system is handed over to the Muhtar (village chief) who, as the farmers' representative, applied the irrigation development. The farmers are not obliged to bear any amount of the construction cost as long as it concerns surface irrigation. The responsibility of the operation and maintenance is solely left on the beneficiary farmers. Though farmers who benefited from groundwater development are also exempted from any reimbursement of the construction cost of on-farm irrigation system undertaken by GDRS, they have to reimburse 25 % of the investment cost of well(s) and pump(s) which are installed by DSI.

## 3.5 Inland Fishery

### (1) Outlines

Quantities of both production and consumption of fresh water fish are limited to such an extent that annual catch of fresh water fish accounts for only 40 thousand tonnes, or 7% of the total annual fishery landing, or 600 thousand tonnes. In the sub-sector of fish farming, major species include sea bass, bream, sole and sea trout, but as minor ones fresh water trouts and carps are also cultured, though the fresh water aqua-culture activities are stagnated reflecting low domestic demand. Fish farming in relation with GDRS irrigation projects has so far been planned in 55 projects, equivalent to only 3.8% of the long list inventory totaled at 1,418 projects. Of which 53% are concentrated in Adana and Izmir. As for fish species, the most common is fresh water trouts, distributed in 7 regions, followed by mirror carp found in 5 regions, then common carp in 4 regions and bass/perch in one region.

### (2) Target Water Body for Aquaculture

As stated above, farming of inland fish has been in slack, the promotion measures therefor was initiated just from 1981. In 1994, MARA and DSI liberated 21 reservoirs and 6 lakes to the private culturing activities, but the real activities over these water bodies are limited to only 1% of the water surface. MARA has granted the permission for 25 aquaculture projects with the annual capacity of producing 2,500 tons in ten reservoirs until the end of 1996. Distribution of fresh water aquaculture shows that 30% of the total locations are found in Marmara Sea Coast, another 30% in Mediterranean, 15% in Black Sea, 10% in central Anatolian plateau and 10% in eastern plateau.

### (3) Production System

As of 1996, 710 fresh water aquacultural projects with the annual production of 35 thousand tonnes have been registered throughout the country. Of which 399 trout farming units (with an increasing trend) and 40 carp farming (with a declining trend) are now in operation. Extensive aquaculture activities predominates over minor intensive ones. The former is mostly operated by the local petty scale enterprises with the limited size of fishing ponds ranging 0.5 - 1.0 ha each. In these activities, fingerlings of fresh warm-water species are grown. Fish farming under intensive management of rainbow trout annually produces 1 - 8kg per sq.meter of pond surface in the case, with farm sale price of 300 thousand TL per kg. The gross revenue of a trout farm with an average capacity of 4,000 sq. meter and annual sale of 20 tonnes amounts to about 6 billion TL, with production cost of 250 thousand TL, remaining the net gain of 0.5 billion TL only.

### (4) Institutional Framework

Institutional framework of promoting inland fishery by liberalizing public water body was commenced since 1959, the major fish species of which are dominated by common carp, mirror carp and hard-scale carp, but there are also such minor species as perch-pike, trouts, cray-fish and grass carp are included. This promotion program is sponsored by three related agencies (MARA, Ministry of Forestry and Ministry of Resources and Energy), each of which is responsible for its own experimental stations and sub-sector of fry producing .

## 3.6 Social Status in Rural Area

### (1) Rural Community

The Turkish statute provides a term " village" as a rural community with population not bigger than 2000. The rural survey conducted in 305 sample villages on the course of this Study shows; 1) regarding the average population per village the smaller size prevails in the Black Sea region as 429, while in the Mediterranean region it is 2.6 times as much as the national average, 2) national statistics show the 93.5% of farm household operate the compound agriculture with stock breeding, 3) inland water fishery is operated in 24 villages, and 4) the average income per household in the Marmara region is 2.3 times as much as that of the Black Sea region (130 million TL).

### (2) Public Organizations responsible for Agricultural Development

The following ministries and agencies are directly or indirectly related to the agriculture development project.

- MARA
- GDRS
- Ministry of Public Works and Settlement, DSI
- Ministry of Forest/Forestry
- Ministry of Environment

### (3) Farmers Organization

There are two types of farmers organizations existing in the country. One is Farmers Union and the other is agricultural cooperative. The purpose of both organization is to assist farmers activities and to promote farmers welfare.

The agricultural cooperative is classified into three types, agricultural development cooperatives, agricultural credit cooperatives, and agricultural sales cooperatives. The agricultural development cooperative is subdivided into three sub-groups; village development cooperative, irrigation cooperative, and water products cooperative.

Irrigation projects are jointly managed by GDRS and DSI. All of these irrigation systems utilize the ground water and none of the cooperative under GDRS has surface water sources. Any agricultural extension services, including modern irrigation practice, is not carried out by GDRS. The responsibility of extension services resides exclusively with MARA., while MARA does not take charge of any type of irrigation development. In conducting extension services, what is required are either coordination between the both organizations, or establishment of a department in charge of extension within GDRS.

### (4) Public services

Public service media, including rural electrification, tap water supply, education and communication, have almost been made available to rural population. However, it is likely that rate of consolidating facilities for waste-water treatment and waste disposal still remains low. In the rural sociological survey, village chiefs or villagers have not called for any strong demand requiring such consolidation. Accordingly, this feasibility study deals mainly with the planning of basic infrastructure for farm products.

(5) Gender Issues

Economically active female population within the Study area accounts for about 34 % on the whole. Regional characteristics are; the Black Sea region has the highest rate, 45 % and the Marumara region has the lowest, 24 %. The female labor force in farm household plays a dual role such as the supplemental work force in cultivation and the "house keeping" workforce including cooking, childcare and washing. When the project planners recognize the importance of female role in farm household as mentioned above, the involvement of female into irrigated farming can not be neglected and need to be seriously considered in the project.

According to the village survey, female group has so far never been associated within villages in observance of Islamic custom. In this respect, however, participation of female to operation and maintenance organization in charge of smooth operation and management of facilities is planned in this project formulation.

## 3.7 Environment

(1) Institutional Framework for Environment Administration

The Ministry of Environment(MOE) was established in 1991 (Official gazette No.20967, 21 August 1991). The main authorities are following.

- Coordination of land use and resources control among the ministries
- Establishment of environmental planning and law and/or regulation
- Examination of report for environmental impact assessment
- Environmental education

The Environmental Law of no. 2872 was enacted in 1983. The Law serves as a basis of controlling rules concerning atmosphere, water quality, noise, and industrial wastes. Based on the Article 10, Regulation on Environmental Impact Assessment was instituted in Feb. 1993. The purpose of this Regulation is to provide the administrative and technical principles to be followed during the process of Environmental Impact assessment, and to evaluate all possible impacts on environment of investment decisions of all public or private organizations, institutions and agencies whose proposed activities may cause environmental problems.

(2) Policy and Guideline for Environmental Impact Assessment

The project are classified into 2 types, one is the type to make environmental impact estimation reports and the other preliminary investigation reports. In the preliminary investigation reports, the project is to be examined by the check matrix for preparation, construction and operation stage.

# 4. Basic Development Concept

## 4.1 Basic Concept of Agriculture Development

The role to be played by Turkish Agriculture was already stated in Chapter 2, where the basic concept of the development stems from the future orientation directed from the review of the current status, the efforts to seek for the solution or mitigation of the currently faced

problems. The following are the articles to be regarded in implementing agricultural development plans:

- to formulate the so-called "sustainable" context,
- to design the plan in which local characteristics are taken into account as well as in a diversified rather than in uniform way,
- to foster an agricultural system capable of flexibly responding to the changes in demand,
- to aim higher productivity so that agriculture may be oriented to an efficient one fully competitive in the international market.

## 4.2 Necessity of Small Scale Irrigation and Rural Development Program

High attention is given to mitigating regional imbalances and to improving income distribution among various sectors of society. Urban population grows by about 4.5 % every year, while the share of rural population has been decreasing as a result of substantial migration to the urban areas. Thus, the promotion of *"small scale irrigation and rural development"* is recognized to be a most effective instrument for improving rural standards currently affiliated with poverty, creating employment in the rural areas, and arresting the migration trend of rural population to the urban areas. This approach gives an additional advantage that could also mitigate urban problems caused by over-migration in search of elusive job opportunities.

## 4.3 Target Area

(1) Long List Inventory

GDRS implements a number of rural development projects as mentioned above, and it has a great many in the waiting list. Out of these, 1,418 projects have been proposed as the long list inventory, for which the inventory items as agreed between GDRS and the study team are filled. Majority of these are located in Anatolian plateau, and the projects distributed in five regions, namely Sivas, Trabzon, Konya, Ankara and Kastamonu, account for two thirds of the total inventory.

The following provides a summary of long list inventory of the projects for major study items:

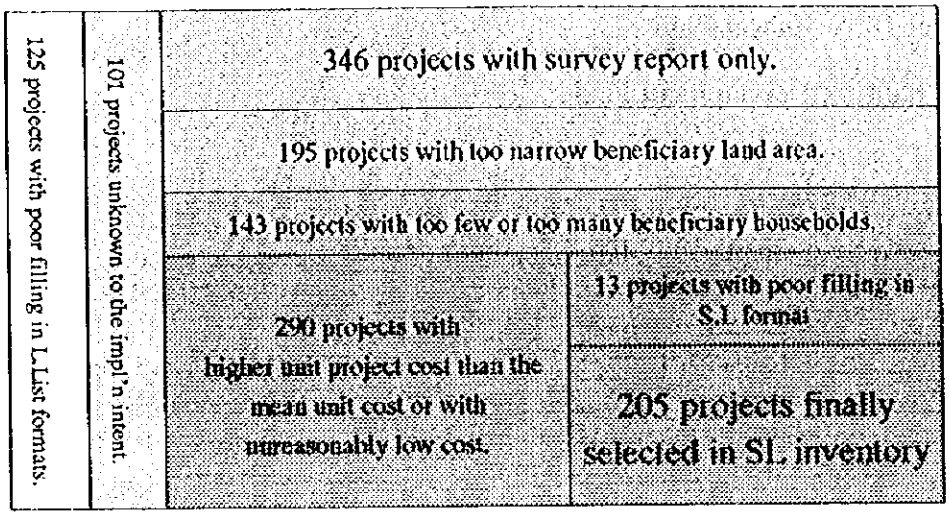
- Number of projects with completed detailed design (DD) accounts for below 43%, lower than initially expected, while those with completed preliminary design (PR) does around 29% and those with only reconnaissance survey has the share of over 29% of the total projects.
- As to the number of projects by type of works and their distribution, irrigation projects account for 90% of the total inventory, with the share of weir about two thirds, followed by ground-water use (15%), and reservoir representing only 8%.
- Number of beneficiary households per project often reaches over thousand in drainage and land consolidation projects with wider area coverage, but in the cases of small scale irrigation only a few households comprise a project. The average number of the total

inventory counts 232 households per project. Acreage per project averages at 121 hectare for the total inventory. Acreage per household comes to 0.93 ha.

(2) Selection Criteria of Short List Inventory

Discreet consideration is required to select the projects for short list inventory not biased in particular regions, since the objective of providing it lies in the preparation of priority projects. To this end, all thirteen regions were covered as in the spectrum of project screening, and criteria were employed so that all types of projects are selected in the short list inventory. It is desirable that the projects to be selected in the short list inventory ought to have the content of planning as a representative of the long list, to be readily implemented. Various criteria were examined as to whether these preconditions are satisfied by applying them for screening out the short list inventory, and finally an eliminatory selection method was employed in which beneficiary area, number of beneficiary household and unit project cost as per ha cost were adopted as elimination factors. Any projects with deviated figures from the standard ranges are excluded from the short list inventory, as shown below:

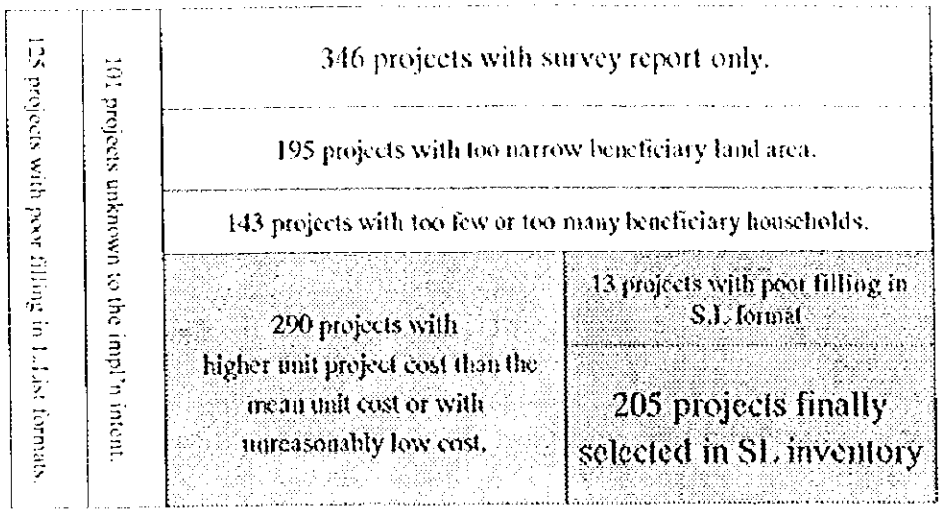
- Around 12% of the projects in the long list inventory fail to complete the filling formats and most of them fall in the category of only survey report (SR). In the first stage of selecting the short list inventory, those with poorest filling could not help sorting out.
- Willingness of the beneficiary for project implementation, maturity of the project in the preparatory stage, beneficiary acreage of projects, number of beneficiary households and per ha project cost.
- Maturity of the preparatory stage: the short list inventory is limited to those which completed reconnaissance survey and further accomplished preliminary design or detailed design.
- Area of beneficiary farmland: basically, only the projects were selected the beneficiary area of which lies within the range from the regional average for each type of projects to + sigma (standard deviation).
- Number of beneficiary household: those projects were selected which has the number of beneficiary households within the range around the regional average by type from minus sigma to plus sigma.
- Project cost on "per ha" basis: basically, only the projects were selected the project cost "per ha" basis of which stays below the regional average by type, but within normal and acceptable level.




(3) Short List Inventory

The application of the criteria as mentioned above for the extraction of short listed projects has allowed survival of 205 projects, equivalent to about one seventh of the total long list inventory. The short list formats, items mainly covering present farming conditions and status, were provided for all these projects, and the data were processed. The major findings from data processing are summarized as follows:

- As for the distribution of the short list inventory projects, 205 or 23% of the total projects are located in central and southern Anatolia, about 20% in Aegean coast, another 19% in central to northern Anatolia, 15% in Black Sea coast, and only 10% are situated in eastern part of Anatolian plateau. More than half of projects fall in Anatlian areas though these areas occupy about one-third of the Study area in population.
- Summary on number of projects by water source and by type of project components shows that the share of irrigation projects reaches 84%, of which those of surface water source accounts for 40%, ground-water irrigation does for 31% and those of reservoirs does for 13%. The share of soil conservation projects comes to 8% and others, including drainage and land consolidation projects account for each 2%, respectively. In comparison with the project type composition in the long list inventory, those with groundwater and dams have relatively higher share.
- In land use, the average of the total short list gives a high cultivated land ratio, 73%, and in plateau the average comes to higher than this grand average, while in coastal areas, particularly in Aegean and Mediterranean coasts the ratio is lower. In the crop composition on the cultivated land, the rate of annual crops, perennial ones, grass land and fallow land constitutes 38%, 17%, 10% and 8%, respectively.

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## 5. Basic Development Plan

### 5.1 Agriculture Development Plan

(1) Land Use Plan

Expansion of irrigation area is proposed by employing the irrigation facilities, and by promoting effective use of water. Introduction of promising crops into the irrigated area is also proposed to enhance the effect of irrigation. Irrigation area projected by GDRS is 123,847 ha in the Study area. The area is cultivated under field crops, vegetables and fruit trees in each of seven agro-ecological zone. Effective land use plan based on rotational cropping with summer and winter crops, mobilization of fallow area, and the double cropping in warm regions are proposed together with effective use of rain fall and ameliorating the soil fertility by leguminous crops.

(2) Cropping Pattern and Farming Plan

Promising crops with high productivity and high income are selected by region. Increased cropping intensity of the vegetables and industrial crops using the early spring rain in the Sea Coast regions, expansion of the acreage under rice, maize and potato by the utilization of abundant rain water in Black Sea region and more intensive land use and higher yield of wheat by incorporating leguminous crops in Central Anatolia are proposed. Present and proposed cropping patterns are briefed below:

| Zone | Present | Proposed |
|---|---|---|
| Marmara, Aegean | Sunflower–Wheat–Potatoes | Wheat–Sugarbeet–Sunflower–Wheat |
| Mediterranean | Vegetables–Wheat–Wheat | Fruit vegetables–Wheat–Dry bean |
| Black Sea | Maize–Wheat–Wheat | Paddy–Maize (Potatoes)–Wheat |
| Central Anatolia | Wheat–Wheat–Fallow | Cow-vetch–Wheat–Sugarbeet |

For the development of small sized farm household, effective cropping of summer field by employing higher productive and lucrative crops, and integrated agriculture based on a material cycle between crop and animal husbandry sections are advised. For the development of livestock husbandry, increased acreage and higher yield of fodder crops/pasture are proposed. Control of over grazing and too-early grazing in natural grassland are also taken account of, thus trying to revive self-sufficiency of meat.

### 5.2 Irrigation Plan

(1) Crop Water Requirement

In this Study, modified Penman method is used for estimating the reference crop evapotranspiration (ETo). Minimum annual ETo shows up in Black Sea zone with 737mm, while the maximum in Mediterranean zone with 1430mm. The average ETo, weighted by service area of each province, ranges between 846 and 1300 mm, and tends to increase as one goes to south due to warmer climate and longer sunshine duration.

(2) Effective Rainfall

There are several methods estimating effective rainfall, among which USBR method is very conventional and used in this Study. Log-Pearson Type III Distribution is employed in

calculating probabilities. The rainfall is firstly calculated on a provincial basis, and then weight-averaged in the 7 agro-ecological zones by the service areas of the provinces. The weight-averaged annul effective rainfalls are 318-600 mm with P50%, 265-518 mm with P80%, and 242-485 mm with P90%. Central Southern area has the least rainfall, while Black Sea area has the most rainfall.

(3) Irrigation Efficiency

The efficiencies presented below applies to this Study. The Master Plan employs an efficiency of 0.60 as the overall efficiency since sprinkler system, currently only 5 % being employed, is becoming popular, thereby leading to better efficiency.

| Project Scheme | Basin | Furrow | Sprinkler | Drip | Remarks |
|---|---|---|---|---|---|
| Surface/Dam | 0.49 | 0.53 | 0.64 | 0.73 | Open Canal |
| Surface/Dam | | | 0.68 | 0.77 | Closed Pipeline |
| Groundwater | 0.51 | 0.56 | 0.71 | 0.81 | |
| Overall | 0.60 | | | | For Master Plan |

(4) Diversion Requirement

The all long and short listed projects, which total service area is 123,847ha, require a total of 920MCM (743mm), 962MCM (777mm), and 982MCM (793mm) diversion requirement in gross under the condition of rainfall probability of 50%, 80%, and 90%, respectively. Although the requirement increases as rainfall decreases, the requirement does not increase much, showing 105% for P80% and 107% for P90% to P50% requirement. This can be explained by the fact that the requirement shows up mostly during dry season (summer season), the rainfall of which is very limited, thereby less affecting the requirement despite the probability.

(5) Diversion Potential

Regarding diversion potential in terms of water availability, only Marmara and Black Sea zones yield enough diversion water throughout year to irrigate all service areas planned in the long and short listed projects. Surface irrigation hardly meets the required diversion water during summer season in such zones as Mediterranean (52-35%), Central Southern (12-9%), and Central Eastern (10-8%), while overall irrigable percents are 73%, 70% and 68% corresponding to rainfall probability of 50%, 80% and 90%, respectively.

## 5.3 Drainage Plan

Long and short lists identified 51 drainage projects with a total service area of 26,890ha. Those drainage works are usually associated with reclamation projects which are to be implemented in wet and marsh areas, or otherwise planned in already opened areas by DSI. The drainage projects, planned in DSI opened areas, had been assisted by the World Bank under "A Core Program of Drainage and On-farm Development", a new phase of which is currently under negotiation with the WB.

GDRS has carried out a total of 318,756 ha of drainage works over the country as of end of 1995. The average annual new opened area for the country is 2,784ha and the figure for the Study area is estimated at about 2,200ha. Taking into consideration the average annual opened area, the total project area of 26,890ha identified in short and long lists would need about 12

years to complete. However, excluding the large scale drainage projects in Adana, Samsun and Antalya regions which could be assisted by the World Bank as were the cases previously arranged, the remaining about 10,000ha could only require from four to five years to be completed.

## 5.4 Agricultural Infrastructure Plan

According to Seventh Five Years Development Plan for 1996~2000, major development policy of rural infrastructure in the agricultural area is mentioned below;

- To execute resource management and effective use of soil and water resources as important element of development.
- To promote the participation of beneficiaries in public services to ensure improvement, operation, maintenance and management of those investments.
- To increase efficiency in irrigation areas, land consolidation and on-farm development.

Based on the policy above, following agricultural infrastructure development projects are executed by GDRS.

- Development of irrigation project
- On-farm development
- Land consolidation
- Soil conservation
- Drainage project

## 5.5 Management Plan of Agricultural Infrastructure

(1) Management of Soil and Water Resources

In order to use the resource effectively, Management should be pursued with the policy and plans mentioned below;

- Long term land use plan
- Balanced water use plan
- Conservation of natural environment
- Adequate water management with monitoring

(2) Management Plan for Developed Facilities

- Inspection and repair of facilities
- Collection of O/M cost and repayment
- Accurate operation and control of facilities with monitoring

## 6. Implementation

### 6.1 Target Year

Target years shall be set up in implementing the projects identified in the long and short lists. Three target years are to be set as follows, covering short, medium and long terms:

| | |
|---|---|
| Short-term target year (3 years): | 1998 to 2000 (set within current Five-Year Plan) |
| Medium-term target year (5 years): | 2001 to 2005 (spanning next Five-Year Plan) |
| Long-term target year (5 years): | 2006 to 2010 (over the next Five-Year Plan) |

### 6.2 Project Prioritization

A criteria stipulating project prioritization shall be prepared for implementing numerous projects in line with a budget ceiling within the framework of the target years. Following are the prioritizing criteria to be applied for the listed projects:

| No. | Weight, % | Item of Prioritization | Remarks |
|---|---|---|---|
| 1 | 30 | Project investment cost per area | to the less of which |
| 2 | 15 | Out-migration rate from the province | to the higher rate of which |
| 3 | 15 | GDP per capita of the province | to the less of which |
| 4 | 10 | Average size of the farm holdings | to the less of which |
| 5 | 10 | Year the project was planned | to the older of which |
| 6 | 10 | Year programmed for the implementation | to the earlier of which |
| 7 | 10 | Willingness of the farmers | to the higher of which |

The major issues are criterion 1, referring to the project performance, and criteria 2 and 3 which refer to a poverty level consisting of 60 % weight.

### 6.3 Project Ceiling

Budgetary ceiling has to be projected in programming the implementation of any projects. Referring to GDRS during the last five years average investment growth rates of 2.2 % and 3.8 % which is derived from the current Five-Year Development Plan, this Study takes the 3.8 % growth rate to project future investment over current 1997. This higher growth rate, proposed here, is so justified on condition that either enough domestic budget or external funds or both would be available as the result the Turkish Government recognize the importance of small scale irrigation projects.

### 6.4 Relevant Levels of Investment

The reasonable investment cost per hectare for the implementation vary with regions reflecting local characters such as farming plans and local conditions for farming.

It is proposed that the indicative standard for estimating reasonable amount of capital to be invested to land improvement projects lies at around the value of benefit increment per unit area multiplied with a weighted average of project life and acreage of the beneficiary concerned. Table below shows the estimated, viable per hectare cost for agricultural infrastructure

improvement based on crop profitability. The relevant level of investment per ha is estimated at about 3 thousand US$ as of mid 1997. Assuming the average area of planned projects, 120 ha is deemed as the standard.

| Project Type | 1 | 2 | 3 | mean |
|---|---|---|---|---|
| weir | 353 | 310 | 433 | 366 |
| reservoir | 394 | 347 | 485 | 408 |
| ground-water | 415 | 365 | 510 | 430 |
| land consolidation | 477 | 420 | 586 | 494 |

unit : million TL (July 1997) / ha

### 6.5 Project Implementation

The implementation is to start in 1998, the following year of this Study's completion. The short and long listed projects are prioritized in accordance with the criteria mentioned above and put in order starting with the highest priority. The budgetary ceiling specifies the number of the projects that can be implemented in a year. Based on the ceiling, short-listed projects are to be completed by the year of 2000 and all short and long listed projects be completed by the year of 2006.

GDRS had already opened 13% of the state potential in the end of 1995, and is to open 14.8%, 15.7% and 16.3% in the years of 2000, 2005 and 2010 respectively. The area to be opened by the year of 2010 could be about 153,000ha and the required budget is to be 83,800,000 MTL at 1997 constant price.

## 7. Project Evaluation

### 7.1 Project Cost

Usually, the unit (per ha) project costs of ground-water development are cheaper and those of reservoirs tend to be higher. Those of land consolidation and soil conservation are highly variable but their average come to comparable levels to those of irrigation projects. Those of drainage projects are apt to have lowest unit cost because they cover vast beneficiary areas. The grand average of unit cost as of July 1997 of GDRS projects comes to 283 million TL/ha, and this is equivalent to per farm household burden of 512 million TL assuming that all the cost is met by the beneficiary farmers.

### 7.2 Project Benefit

As to methodology of benefit estimation, the project life is determined from the life of facilities, and it is proposed that the period of benefit generation be set at 30 years for small scale irrigation projects in Turkey. Assuming that the implementation period lasts for 1 - 3 years except for the facilities already constructed, the unit yield development of crops and cropping of the proposed rotation is estimated to follow gradual increase after their construction, and cumulative benefits are estimated from the difference between "with project basis" and "without project basis". The latter has lower level than current performance in the case of soil conservation.

## 7.3 Economic Evaluation

The increment of per household income by irrigation projects has been roughly estimated at 1997 price as annual value at 107 - 280 million TL, while the benefit increment per ha amounts to 31 - 44 million TL per annum. In the case of ground-water irrigation 197 - 382 million TL/ha at 1997 price, for weir 85 - 873 and in the case of reservoir 76 - 724 or in between the former two cases are required in addition to farming cost. On the other hand, the mean benefit increment during the same period is estimated at 1,073 in south-western zones, 913 in the central, and 1,275 in north eastern zones. If the difference can be interpreted as a milestone of benefit brought about by the GDRS projects, then the benefits amounting to 531 - 1,078 for ground-water projects, 189 - 1,199 for reservoirs and 40 - 1,192 for weir irrigation can be envisaged during the project life.

## 7.4 Environmental Impact

(1) Method of Initial Environmental Examination (IEE)

IEE was carried out on the 285 projects including the short listed 205 projects based on the " Guidelines of Environmental Assessment" prepared by JICA. The check list was composed of 47 items, including both social aspects and natural ones.

(2) Result of Initial Environmental Examination

As the results of investigation, the main points are summarized as follows;

Regional areas where significant environment impact is unquestionably induced by the project (evaluated class A), were recognized only in Izmir and Bursa. The item of the problem is only identified about "increased use of agrochemicals".

Regional areas where significant environment impact is likely to be induced by the project (evaluated class B), were recognized in Ankara, Konya, Adana, Samsun, Antalya, Izmir, Bursa and Istanbul. The items of the problem cover mainly three on "increased use of agro-chemicals", "residual toxicity of agro-chemicals", and "soil contamination by agro-chemicals and others". It is pointed out that agro-chemicals having strong poisonous effects be prohibited in use, and even common agro-chemicals be restricted to as minimum as required, and be refrained from use in use during harvesting season.

On the other hand, the total items of the positive impacted items by project (evaluated class D) and the item excluded items by discussion with GDRS, accounted for 91.4 % of the total items. .

The short listed projects where affected significant environmental impact, couldn't be identified for selection of the priority projects. Environmental impacts by implementation arise from mainly water-related problems and large quantities investment on fertilizers and agro-chemicals.

## 8. Selection of the Priority Projects for Feasibility Study

### 8.1 Criteria of Selection

The 10 priority projects for feasibility study is to be selected from short list inventory. The following criteria are employed in choosing these.

(1) Beneficiary Area: Sizable projects are selected taking account that representative nature of the priority projects should constitute a pilot one for each area. In practice, for irrigation projects consisting of such water source as weir, small scale dam and groundwater those with the beneficiary area larger than 120ha or the average size should be selected. In soil conservation projects, the main work of which predominates terracing with limited tract of field, a range size is proposed as a criterion as 80ha at the minimum and 200ha at the maximum, so that the planning can avoid cumbersome works. As for land consolidation, that actually and basically constitutes the terminal consolidation of irrigation facilities for large scale DSI irrigation projects with larger beneficiary area. Taking these into account, and in the light of the term of this study to select small scale irrigation schemes, a criterion of selecting those with 200 ha at least but 1,200ha at the maximum is proposed. In the total, the following criteria for area coverage for priority projects are employed:

| | Irrigation | | | Soil Conservation | Land Consolidation |
|---|---|---|---|---|---|
| | Weir | Dam | Groundwater | | |
| Beneficiary (ha) | 120<A | | | 80<A<200 | 200<A<1,200 |

(2) Beneficiary Household: It is considered important for prioritizing the projects that the projects have sizable number of beneficiary households. Here, the minimum numbers of beneficiary households are proposed as follows, as a condition for employing priority projects:

| | Irrigation | | | Soil Conservation | Land Consolidation |
|---|---|---|---|---|---|
| | Weir | Dam | Groundwater | | |
| Minimum Household | 50 | | | 30 | 80 |

(3) Year Planning: Those planned quite a few years ago may accompany such problems as a drastic change in the background socio-economic status or some development has been made in a part of the planned area. Therefore, these are subject to a radical review. In the light of this possibility, obsolete project plans established before 1990 should not be employed.

(4) Willingness of the Project Implementation: Selecting those with acute needs and willingness of the project implementation of beneficiary farmers and GDRS.

(5) Availability of Basic Data: Those for which data (covering natural conditions, socio-economic status, topography maps etc.) are provided for site survey are selected.

(6) Initial Environment Examination (IEE): Those should be selected for which IEE has been conducted and the result guarantees no serious environmental impact is arisen from the project implementation.

(7) Type of Project: They should include various types of projects covering those with reservoir, weir, ground water, land consolidation, soil conservation etc.

(8) Agro-ecological Zone: They should cover all the agro-ecological zones, or at least one from each of the seven different agro-ecological zones should be chosen.

(9) Regional Offices of GDRS: The Study area is divided into 13 GDRS regions, for it is avoided to select more than two projects from the same jurisdiction under particular regional GDRS office.

## 8.2 Candidate Priority Projects

With a view to selecting 10 priority projects for feasibility study, the following process is followed based upon the criteria as stated in 8.1.

Process No.1 : As the result of applying the criterion of beneficiary area (1) 90 projects fail to meet the criterion and eliminated. 115 projects are passed. (205 projects to 115)

Process No.2 : Applying the criteria of household (2) to the remaining 115 projects, it is found that 13 projects fail to satisfy it, and 102 survive. (115 projects to 102)

Process No.3 : After the application of the criterion of plan age, 14 drops failing to meet the requirement and 88 are selected. (102 projects to 88)

Process No.4 : Thorough review is made for the selected 88 projects up to the procedure 3 on the willingness of project implementation, the 19 projects, shown in Table 8.2.1 in Part I "Master Plan Study", have been found greatest willing to the implementation.

Process No.5 : Further examination is imposed on the candidate projects selected through the process shown above, checking the criterion (4) or the data availability, to have identified that all the candidates have provided the basic data for feasibility study, then requirement of the criterion (5) or the result of environmental assessment is also cleared.

Process No.6 : Taking account of the number of projects with different types, as well as the exigency needs of ground water development, the following distribution is proposed to cover as many kinds of projects as possible:

| Project Type | S.S.Weir | S.S.Dam | Groundwater | Soil Conservation | Land Consolidation | Total |
|---|---|---|---|---|---|---|
| Proposed Number | 3 | 2 | 3 | 1 | 1 | 10 |

(s.s. stands for small scale)

Process No.7 : Finally, these 10 projects are proposed so that these meet the requirement of the criterion (7) or the coverage of agro-ecological zones and the criterion (8) or pursuing equity among regional GDRS offices.

## 8.3 Priority Project for Feasibility Study

Ten priority projects for feasibility study, which have been selected from the candidates as stated in 8.2, are shown below. Each of these projects is selected from the different regions, all

types of projects except drainage are represented by these ten projects, covering all agro-ecological zones found in the study area, all the selected ones are recently planned, in 1992 or later and the beneficiaries of which have expressed willingness to project implementation. Besides, in these projects all types of major target crops for irrigation with all irrigation systems have been designed.

| Name of Project | Region | Province | District | Village | Agro-Economic Zone | Study Stage | Beneficial Area (ha) | Project Type |
|---|---|---|---|---|---|---|---|---|
| HACILAR | ANKARA | KIRIKKALE | KESKI | HACILAR | 3-1 | PR | 200 | Small Scale I. |
| URUNLU | KONYA | KONYA | CUMLA | URUNLR | 3-2 | DD | 465 | Groundwater |
| KALESEKISI | ADANA | ADANA | SAIMBEYLI | KALESEKISI | 1-3 | PR | 210 | Small Scale I. |
| CAMLIBEL | SIVAS | TOKAT | MERKEZ | CAMLIBEL | 3-3 | PR | 1,100 | Land Consolid. |
| KOZLUK-KUSCA | SAMSUN | SAMSUN | TERME | KOZLUK | 2 | PR | 580 | Small Scale I. |
| KUSKARA | KASTAMONU | KASTAMONU | MERKEZ | KUSKARA | 2 | PR | 80 | Soil Conserv. |
| OZDENK | ESKISEHIR | ESKISEHIR | ALPUYENICE | OZDENK | 3-1 | PR | 172 | Small Dam |
| ASLANLAR | IZMIR | IZMIR | TORBALI | ASLANLAR | 1-2 | PR | 244 | Groundwater |
| ILYASKOY | BURSA | YALOVA | CIFTLIKK | ILYASKOY | 1-1 | PR | 137 | Small Dam |
| K.KARISTIRAN | ISTANBUL | KIRLARELI | LULUBURGAZ | K.KARISTI. | 1-1 | DD | 120 | Groundwater |

# PART II FEASIBILITY STUDY

## 1. The Study Area

### 1.1 Physical Features

(1) Location and Topography

Shown in the "Location Map" are the 10 priority projects undertaken for this feasibility study, scattering almost over the whole study area from Marmara to Black Sea and to Mediterranean. The villages, beneficiary of the projects, are connected with each province's center by means of paved road (some are trunk road), and accessible throughout the year. Also easy access all the year round from the village to the project area is secured in K. Karistiran, Ilyaskoy, Aslanlar, Ozdenk, Hacilar, and Urunlu, while Kuskara, Kozluk, Kalesekisi and Camlibel sometimes may have some difficulty during winter season due to snowfall.

Most projects are characterized with those very gentle topographic conditions; namely, less than 2% in slope dominates such project area as Urunlu, Camlibel, Ozdenk, Aslanlar, and K. Karistiran. Mildly sloped are Ilyaskoy, Hacilar, Kuskara, and Kozluk, among which western parts of Ilyaskoy and Kuskara have relatively steep parts. Project site of Kalesikisi develops over the eastern side of a slope of a valley stretching towards south. The elevation ranges from as low as 800m up to as high as 1300m, with fairly steep inclination as much as 10%.

(2) Meteorology and Hydrology

Central Anatolian Continental Climate, characterized with little rainfall specially during summer season, prevails in and around such project areas as Hacilar, Urunlu, Camlibel, Kuskara, Ozdenk, and Ilyaskoy, while Mediterranean Climate in and around Kalesekisi, Aslanlar, and K. Karistiran, giving more rainfall and warm temperature than Central Anatolian Continental Climate. There is a project area dominated by Black Sea Climate; namely, Kozluk project, enjoying considerable rainfall throughout year.

The source of Kalesekisi project is Kirkok River with a catchment area of 42.7 $km^2$. Though no flow measurement has been conducted, it is well-known that the river flows throughout year, originating in a Karst geological formation, and the runoff even during summer season could be more than hundreds litters per second. Kozluk project takes water from Akcay River with a catchment area of 213 $km^2$. The 16 spot measurements during the last 8 years show that the minimum runoff among the measured and minimum in July, requiring peak irrigation water requirement, are 470 $\ell$/s and 850 $\ell$/s respectively.

Ozdenk dam is to be constructed at Ozdenk River that is seasonally flowing. According to a measurement once done between November in 1995 and May in 1996, the summed discharge was 808,000 $m^3$, arriving at 93.8 mm taking into consideration the catchment area of 8.612 $km^2$. The source of Ilyaskoy dam project is Orencik River. There is a continuous flow throughout the year though summer season's flow is very little amount often less than 1 $\ell$/s. The river has no runoff measurement record.

(3) Geology and Hydrogeology

Urunlu, groundwater project, is formed with limestone in its aquifer laying 45 m to 120 m deep. This aquifer gives 50 ℓ/s discharge as the design well yield. Aslanlar project has two formations, which can yield water, such as Neogenic aged conglomerates and Paleozoic aged marbles. Both formations create a suitable aquifer, the yield of which ranges 10 ℓ/s to 50 ℓ/s. The groundwater around K. Karistiran project area is found in alluvium and in Corlu formation composed of fine sand, coarse sand, fine gravel, clay and silt in a form of layers. The aquifer gives yields ranging between 35 ℓ/s and 50 ℓ/s.

Ozdenk dam site geologically consists of red silt clay with sand and gravel of Neocene origin. There is an alluvium with variable thickness between 5 to 14m in the river-bed. Strata are nearly impermeable except alluvium, giving $K=10^{-5}$cm/sec order. Iliyaskoy dam site has Miocene aged semi-terrestrial deposits, where clay stone and silt stone alternatively stratify with sand and gravel stone forming deposites close to the surface. Miocene aged deposits show impermeable or little permeable with K values ranging $10^{-4}$ to $10^{-8}$ cm/s though its shallower foundation has more permeable value.

Volcanic origin agglomerates form the foundation of the site where Kozluk weir is to be constructed. The foundation seems to have enough bearing capacity for the planned weir. A series of volcano sediments cover the foundation with a thickness of 3 to 4m that are found as mudstone, sandstone and tuff formations.

(4) Soil

The soils in the ten priority projects were classified into six soil groups. There are 1) Alluvial Soils, 2) Colluvial Soils, 3) Brown Forest Soils, 4) Non Calcarious Brown Soils, 5) Brown Soils, 6) Vertisol Soils. These correspond to the area of the soil groups in the whole country.

Most of the areas except Kalesekisi project do not have any problem in terms of such farming factors as land capability, soil erosion, and soil limiting factor for crop growth. The only Kalesekisi project area has low land capability with severe erosion, shallow soil depth and higher gravel contents caused by the steep topography.

## 1.2 Socio-economic Condition

(1) Demography

The population, population density, house hold, number of family, farm house hold, and ratio of farm house hold in the study area are shown in following table:

| Project | Population | Area (ha) | Population Density | Household | Number of Family | Farm Household | Ratio of F.H.H | 90-96 Annual increase rate |
|---|---|---|---|---|---|---|---|---|
| Hacilar | 4,903 | 4,200 | 116.74 | 600 | 8.17 | 550 | 92% | 4.1% |
| Urunlu | 316 | 350 | 90.29 | 70 | 4.51 | 65 | 93% | 2.6% |
| Kalesekisi* | 4,699 | 29,426 | 15.97 | 1170 | 4.02 | 270 | 23% | 0.0% |
| Camlibel | 1,235 | 2,510 | 49.20 | 160 | 7.72 | 158 | 99% | -2.5% |
| Kozluk | 4,068 | 2,800 | 145.29 | 700 | 5.81 | 700 | 100% | -0.2% |
| Kuskara | 222 | 2,800 | 7.93 | 35 | 6.34 | 35 | 100% | -4.2% |
| Ozdenk | 486 | 1,000 | 48.60 | 130 | 3.74 | 126 | 97% | -3.9% |
| Aslanlar | 1,559 | 1,115 | 139.82 | 477 | 3.27 | 400 | 84% | 1.7% |
| Ilyaskoy | 533 | 875 | 60.91 | 150 | 3.55 | 150 | 100% | 2.3% |
| K. Karistiran | 1,037 | 2,550 | 40.67 | 190 | 5.46 | 170 | 89% | -0.3% |

Note: * Kalesekisi is a seasonal village, whose population live in Saimbeyli. The ratio of FHH is against the whole population of Saimbeyli.

(2) Land Tenure and Land Holding

Total acreage of proposed cultivable farmland of ten priority projects is around 4.1 thousand hectare, where 3,834 ha as net acreage is cultivated by 2,624 farm households engaged in farming, so average holding size comes to approximately 2.1 ha. Generally, villages in Anatolian plateau have larger acreage than those in other regions, as seen in Camlibel and Urunlu. Projects in the western provinces have smaller holding size and this is common character among Marmara and Mediterranean coastal zones. Tenancy was observed in Urunlu, Ozdenk and Ilyaskoy and in lesser degree in Aslanlar and K.Karistiran, but the percentage of rent to total holding gives lower figures at maximum 26 %, implying that cultivated land is basically owned by cultivators themselves.

(3) Rural Infrastructure

The selected 10 districts as priority projects are all located in rural area. Though the rural infrastructure such as road network, domestic water supply and sanitary sewerage system remains low as compared to that level of urban areas, the rural population do not give much dissatisfaction against the current level, reflecting a situation satisfying the minimum livelihood demand for the villagers.

## 1.3 Agriculture

(1) Land Use and Cropping Pattern

Existing agricultural land is used as follows; 77.32 % to field crops, 2.92 % to vegetables, 7.32 % to fruit trees, 12.44 % to fallow and others, and total species of crops in the area count over 26. Among crops, wheat occupies about one-third of the total planted area. Barley, sugar beet and sunflower account for comparatively large area. Pulses, oil seed and tuber crops have little area. Vegetables and fruit trees occupies about 3-7 % of the area. Cropping intensity in the study area are under 1 even in milder regions because of the shortage of water, and the systems consist of mostly rotational single cropping.

(2) Crop Yield and Production

Cultivated land holding per farm household varies by area from as small as 0.5-1.0 ha to as large as 5-10 ha. However, even in small holding area, agricultural production is markedly mechanized. On the procurement of seed, wheat seed is provided in every three or four years

from the government. Sugar beet seed is provided from factory. Seed of many vegetables is obtained usually in city markets.

As to chemical fertilizers, ammonium-nitrate, di-ammonium phosphate, urea and compound fertilizers are commonly used. Fertilizers and agricultural chemicals are used abundantly for industrial crops, vegetables and fruit trees; in such rates as 62 to 450 kg/ha nitrate for sugar beet, while winter cereals are less manured with nitrate at a rate of 44 to 132 kg/ha.

Farmers cultivate some summer crops and vegetables under partly irrigated conditions installing the irrigation equipment by themselves. Crops are expected to bring as 100 MTL/ha as big benefits by irrigation. Existing yields of crops vary by region and conditions on water supply. Sugar beet and some fruit vegetables give 30,000 kg/ha to 60,000 kg/ha or more under irrigated conditions.

(3) Livestock Production

Milk cows are kept in every Study site, beef cattle and sheep are also fed comparatively in large number in many study sites, but breeding of goat has smaller size and found in only a few areas. Average number of beef cattle and milk cow per farm household are 10 and 6 heads in a site. However, most of other sites are 1 to 5 heads per household. Milk production of dairy cow in the Study area is mostly in 3,200- 4,200 kg per head per year for improved varieties, but they are 1,000-1,500 kg per head per year in indigenous varieties.

Forage production is insufficient to meet the demand of livestock. So, wheat straw and whole crops of other winter crops are dried and packed as whole-crop silage and used for excellent feeds especially in winter. Leaves, harvest residue as well as pulp of sugar beet are also used for feed.

(4) Marketing System and Prices

TMO, a state marketing agency plays an important role in purchasing and storage of grains and pulses. Processing mills, like state run or private sugar mills, private sunflower oil mills and cotton ginneries, have their networks in collecting materials from farmers. Sugar-mills are distributed throughout the country covering major producing areas so that growers can deliver beet root up to their collecting depots. Farmers make a habit to sell their products to middlemen.

As regards input supply, agricultural credit cooperative (TKK) has by far the major function with a state-wide network for providing member farmers with their basic needs and farm inputs at uniform prices throughout the state for price-supported inputs. Official support prices for cereals and other gazetted commodities have contributed much to income of farm households producing them.

(5) Production Values of Principal Crops

Generally, official procurement prices of price-supported commodities keep higher levels than international market prices. Production values of the same products vary with areas, season, quality and cost inputs and sometimes take negative values especially for fruits harvested from immature orchards, highly labor-intensive crops that farmers want to convert into other profitable but less labor consuming ones. Cereals, for which farm gate prices are

supported by the state, have comparatively low values but if their by-product is counted in, the values turn out from negative to positive, or to rise to higher levels.

(6) Agro-economy

125 sample households were interviewed in the Farm Economy Survey. 1996-97 total annual income per family member reached 260 million TL (equiv. to 1,630 US$) on average in 1996 - 97, of which off-farm income accounts for only 15%. Annual farm budget balance has surplus except for a project site, among which Hacilar recorded revenue/expense rate of 2.5. Annual household income ranges 1.1 - 3.3 billion, of which crop income constitutes largest share. Annual household expense ranged 260 - 920 million TL, while the rate of crop production cost to gross benefit stayed around 20 - 25%. Number of persons engaged in farming in a farm household counts 2.8, equivalent to less than half of family members, but farm households hire labor during peak period of labor at the rate of 0.5 persons equivalent to family labor.

(7) Agriculture Support Services

Though extension offices in provinces and regions under MARA are conducting the guidance to farmers in villages on weed control and new techniques for crop cultivation and so on, it is observed that the guidance do not satisfy individual farmers mainly because their activities are categorized specialty by specialty, not giving comprehensive guidance. On the cultivation techniques of sugar beet, sugar beet factories and their cooperatives give the active guidance to the farmers joining to the cooperatives along with the distribution of seeds and materials. On the irrigation techniques of field crops, irrigation cooperatives have also positive role on the guidance for irrigation techniques of field crops, collect irrigation fee in proportion to the operated hours of the pumps.

## 1.4 Irrigation and Drainage

(1) Past Work Implemented

Wells, to serve the 3 groundwater projects, were constructed between 1993 and 1997, and already equipped with pumps. In these projects farmers already started irrigating their farms despite the fact that the irrigation system has not yet been completed. Camlibel project aims at land consolidation, accompanying an irrigation system that diverts water from a DSI dam now under implementation and expected to complete in 1999. Hacilar project takes water from a dam named Kapulukaya that currently serves for hydro-power and domestic water, which was constructed by DSI and started the operation in 1989.

(2) Present Irrigation Practice

Camlibeli and Kuskara projects have irrigation system completed with open canal system. In Ozdenk village, some villagers have drilled wells with a depth of about 5m, from which the groundwater is pumped up by a diesel engine driven suction-pump, practicing sprinkler irrigation with hand-move type. Villagers in K. Karistan once store pumped groundwater into a depletion, and then operate sprinkler by an additional booster.

(3) Water Resources and Quality

Looking into the water quality tested, no high attention is required at present but should keep in mind with 1) salinity level for Hacilar (700ppm) and Urunlu (500ppm) projects, and 2) water temperature for Kuskara (11.9°C), Kalesekisi (13.3°C) and Urunlu (14.0°C) projects. Those are not decisive but should be monitored.

## 1.5 Social and Rural Area

The rural survey was carried out not only to collect information on the agriculture practices but also to provide the qualitative understanding of village life.

(1) Family Structure

Daily life in village conforms to Islamic discipline. Patriarchy has an important bearing to daily life, regulating family clan, maintenance and heritage of family properties and fame. General norm to control rural household and communities functions under a patriarchal system. Average family members count 5.5 among priority project sites. In urbanized communities in Hacilar, Saimbeyli, and Aslanlar, matrimonial system with the chief, wife and children predominates, abiding under the same shelter. The following table gives the average family member by the project

| | Hacilar | Urunlu | Kalesekisi | Camlibel | Kozluk | Kuskara | Ozdenk | Aslanlar | Ilyaskoy | K.Karistiran |
|---|---|---|---|---|---|---|---|---|---|---|
| Family size | 3.8 | 6.7 | 4.0 | 7.8 | 6.5 | 6.3 | 5.6 | 3.2 | 5.6 | 5.5 |

(2) Family function

Villagers are pious Islam and their life is consistent with Islamic doctrine. It is most important for patriarch to keep fame, genealogy and property.

(3) Farmers organization

GDRS and DSI handle irrigation projects nationwide. There are 5 irrigation cooperatives in the study area, the outline of which are as follows.

| | Urunlu | Kalesekisi | Kuskara | Aslanlar | K.Karistiran |
|---|---|---|---|---|---|
| Establish (year) | 1989 | 1997 | 1990 | 1974 | 1993 |
| Member (house hold) | 55 | 15 | 34 | 120 | 87 |
| Planted area (decar) | 5000 | 0 | 1000 | 2500 | 2300 |
| Number of well | 8 | 0 | 2 | 9 | 4 |

(4) Social Services

Every village in study area has primary school. One hundred percent of households in the study area now have electricity and television. There is no police office in the village. The details are shown as follows.

| | | Hacilar | Urunlu | Kalesekisi | Camlibel | Kozluk | Kuskara | Ozdenk | Aslanlar | Ilyaskoy | K. Karistiran |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Health | Eith Center | Exist | No | Exist | Exist | Exist | No | No | Exist | Exist | Exist |
| Education | J. high school | Exist | No | Exist | No | Exist | No | Exist | No | No | No |
| Comunica | PTT | Exist | No | Exist | No | Exist | No | No | No | No | No |
| Public Safety | Gendarme | Exist | No | Exist | No | No | No | No | No | No | No |

## 2. Formulation of Basic Development Plan

### 2.1 Agriculture Development Plan

(1) Land Use Plan

Land use in the study area is projected so that farm land is utilized more intensively according with the seventh-five year development plan and fundamental concept on the project. The biggest change of land use by projects is the conversion from the winter cereals such as wheat and barley to summer industrial and beneficial crops; namely, Hacilar and Camlibel employ sugar beet, Urunlu and Kozluk, and Aslanlar do fruit vegetables by replacing present wheat and tobacco, and Kalesikisi and Ilyaskoy adopt fruit trees by reclaiming bush areas or replacing barley.

(2) Proposed Cropping Pattern

The cropped acreage under wheat, barley and other winter cereals is proposed to decrease, while planted area of sugar beet, vegetables and fruit trees are expanded. The area under alfalfa is also planned to increase for the development of livestock production. With the mobilization of fallow and increase of planted area of green soiling crops after harvesting first crops, cropping intensity in the total Study sites is expected to rise form existing 0.876 to proposed 1.051 as a whole.

(3) Crop Production Plan

Crop production plans in each Study site are proposed referring to the results of soil analysis by the study team and the study on fertilization by soil conditions and irrigation plans proposed by the water resources and facility plan for irrigation. Farming types in the areas change from the winter cereal type to the field crop types combined vegetables and fruit trees and the field crop types combined livestock breeding. The results of soil analysis by the study team show that the soils in the sea coast plain are relatively fertile, but the soil in the Central Anatolia and mountain side are relatively poor. So, in the project, supply of organic matter and compost from dung and manure are advised and the introduction of soiling crops are proposed. Target yields of crops in the Study sites after projects are determined based on the performance in various research institutes under improved cultivation techniques of each crops.

(4) Livestock Breeding Plan

Because livestock productivity in the area remains in low level in general, the selection of high yielding dairy cow by their milking ability, selection of beef cattle by productivity, promotion of artificial insemination of cattle and dairy cow used high productive bull are proposed with the improvement in the disposal of excretion and breeding pen. For the improvement of breeding pen, a model is proposed, in which the breeding pen is translocated from individual farm households to a feeding quarter outside the village.

Production of forage crops is insufficient to satisfy the demand of livestock in the area. So, expansion of acreage under alfalfa and the utilization of by-product such as straw of cereals and leaves of sugar beet are proposed. To sustain the high crop yields for years under irrigated condition, the sustainable agriculture based on a substance cycle between crop and livestock production is proposed as the most recommendable ways in the irrigated agriculture. Given below is a milk production plan in the seven project sites:

(Unit: kg/head/year)

| Project Area | Hacilar | Canlibel | Kozluk | Kuskara | Aslanlar | Ilyaskoy | K.Karistiran |
|---|---|---|---|---|---|---|---|
| No. of milk cow | 500 | 200 | 300 | 200 | 250 | 250 | 455 |
| Existing Production | 4,000 | 1,500 | 3,000 | 1,000 | 3,300 | 3,150 | 4,200 (1,000) |
| Proposed Production | 4,800 | 4,000 | 4,500 | 4,000 | 4,500 | 4,500 | 4,800 |

(5) Marketing Plan

Radical innovation for marketing systems and channels needs a long time where fragmental reform would not be valid but a state-wide revolutionary improvement can meet its modernization. This is equal to say that gradual, phased development is required to change current systems into rational and efficient channels with relevant investment to logistic facilities like storage houses, auction yards, marketing intelligence centers and packaging, transporting and other systems. Increment of grain output is scheduled to deliver to T.M.O. Increased quantity of sugar-beet, amounting to 51,000 ton, in Hacilar, Camlibel and four other sites is planned to deliver to near-by sugar mills. Production increment of vegetables, 15,000 ton and that of fresh fruit, 7,000 ton, as well as another 7 thousand tons of potatoes are marketed to urban markets, partly for export, from seven sites including these two and Kozluk and Aslanlar.

(6) Agricultural Supporting System Fortification Plan

In parallel with the project implementation, a liaison committee is advised, that is established between on-going provincial agricultural extension wing of MARA and provincial office of GDRS to realize efficient use of consolidated infrastructure. Likewise, it is proposed to create an extension service unit in GDRS. It acts as task force of technical transfer to the beneficiary farmers through Provincial GDRS Offices. In liaison with general organizing activities for farmers, it offers extension/training curricula programs including where to buy and how to utilize, repair and maintain irrigation equipment, to efficiently use irrigation networks, how to apply rotational irrigation methods to crops, water requirement and its applying method to a crop, and multi-purpose use and other courses directly related to irrigation practices for farmers.

## 2.2 Irrigation and Drainage Plan

(1) Water Requirement

Modified Penman method gives such crop reference evapotranspiration (ETo) that maximum daily ETo shows up in July, ranging between 4.07mm in Kozluk and 6.28mm in Aslanlar, and annual ETo amounts to from 725mm in Kuskara to 1,195mm in Aslanlar. In estimating net water requirement, this Study considers probability 90% effective rainfall calculated based on USBR method. Then, gross water requirements are estimated taking into consideration project irrigation efficiencies ranging from 0.49 to as high as 0.81 depending on the irrigation scheme applied. The calculated requirement ranges 0.607 $\ell$/s (Kuskara) to as much as 0.823 $\ell$/s (Ozdenk) in net unit ha.

(2) Water Resources

There are three groundwater projects: namely, Urunlu with 8 wells, Aslanlar with 7 wells and K. Karistiran with 4 wells, all of which had been already opened by DSI. The yield is 50 $\ell$/s each for Urunlu, ranging 20 to 50 $\ell$/s for Aslanlar, and 30 $\ell$/s each for K. Laristiran. The farmers

had already started irrigation, and no noticeable over-pumping getting groundwater-table down has shown up to date.

Hacilar project takes 3.7 MCM under the probability of 90%, and this constitutes about 15% of the total allocated 25 MCM from the water source of Kapulukaya dam having reservoir's total capacity of 282 MCM. Kalesekisi project takes water from Kirkok River by means of pump with the maximum design intake of 153 ℓ/s. Though no measurement has done, the flow apparently surpasses the design intake even during dry season since it comes from Karst geological formation that gives relatively stable discharge.

The water source of Kozluk project, Akcay River, gives minimum runoff of 850 ℓ/s in July with reference to the flow measurements, while the design intake is 420 ℓ/s. The water source of Camlibel project, Guzelce dam, is to irrigate total land of 4,337 ha, of which 1,438 ha is for Camlibel. The reservoir capacity is 34.68 MCM, and 33.24 MCM is the usable (available) volume. Kuskara project has two wells which are the source of the irrigation water. Those yields are 50 ℓ/s and 45 ℓ/s, both of which are located just beside a river flowing near the village.

Ozdenk project stores water flowing during winter season only in Ozdenk River. The reservoir capacity is to be 0.80 MCM (including evaporation and seepage losses), with which 126 net ha (gross: 140ha) can be irrigated with a probability that about 7 times water shortages could show up in every 36 years. Ilyaskoy dam, to be constructed in Oracik river, is designed to have reservoir capacity of 0.56 MCM with irrigable area of 108 net ha (gross: 130ha) This design would give about 7 times water shortages in every 38 years.

(3) Water Conveyance System

The irrigation areas for the groundwater projects are not so large, therefore pump direct conveyance system applies to except Aslanlar project in Izmir. Wells in Aslanlar project are closely located each, thus distribution tank method applies to avoiding interference among the wells. Distribution tank is also provided in such projects as Hacilar, Kalesekisi, and Ilyaskoy. The conveyance system after the tank is to be gravity-pressure-pipeline. Ozdenk project provides the stored water through gravity-pressure-pipeline system. The pipeline is to be directly connected to the dam. Kozluk project will employ open gravity conveyance that is the most conventional system.

(4) On-farm Irrigation Application Method

Such projects as Kalesekisi, Aslanlar, and Ilyakoy are to irrigate fruits trees mostly and drip irrigation can be applied. Sprinkler irrigation is to apply to such projects as Urunlu, K. Karistiran, Hacilar and downstream irrigation area of Ozdenk. For the sprinkler system, hand-move type is preferred since it requires the least capital cost. Kozluk project will practice paddy irrigation, and basin irrigation suitable for paddy is introduced. Irrigation applications for Camlibel and Kuskara projects are to be same as the existing furrow and flood scheme.

## 2.3 Development Plan for Rural Infrastructure

In the rural districts of Turkey, there are number of problems to be solved such as migration of the rural youth to urban districts, dispersion of land holding and lack of on-farm facilities. In this respect, land consolidation schemes are now being considered to solve these

problems. The Camlibel district in Tokat province has been selected to serve as the model district for the land consolidation scheme. As to the implementation of the farm land conservation scheme, it aims to prevent soil erosion in the sloped area and, to develop on-farm facilities. The Kastamonu-Kuskara district has been selected for the farm land conservation scheme.

The land consolidation and farmland conservation schemes will be designed with road networks, whereas, for the other irrigation projects, as a principle, existing roads will be used.

There are no village with sewerage system, except for Kirikkale-Hacilar and Kastamonu-Kuskara Villages. Among the villages having problems of sewerage, face budgetary constraint as they have other public works project in line, which is delaying the implementation..

## 2.4. Operation and Maintenance Plan

(1) Organization for Operation and Maintenance

a) Organization

The group, called Water Users Association (WUA),for operation and maintenance will be established at each irrigation system, mostly at village level, comprising the beneficial farmers. Besides operating and maintaining the irrigation system, following major roles of WUA are pointed out:

- To develop and implement operation plans for irrigation schedule and regular facilities maintenance,
- To improve water use management through improve irrigation schedule and other useful irrigation practices
- To develop roles and responsibility of the WUA's members and local rules for resolving water - related conflicts,
- To develop and maintain close coordination and good working relationships with organization for essential services such as banks, equipment firms, public and private lessor, local village councils, and GDRS agriculture extension services.
- To develop and maintain an official and functional information linkage with GDRS

b) Committee members

The WUA, proposed in this Study, is to be composed of 5 committee members, who are elected in every 3 years. The committee consists of 1) chairman, 2) vice chairman, 3) committee member 4) treasurer 5) irrigation advisor. WUA hire a person who is dam operator, gate keeper, canal operator, and facility staff as occasion demands. A pump attendant is required in case of pump irrigation system.

The best type of organization for 10 priority projects is to be selected from type of conveyance canal and type of distribution canal.

(2) Operation and Maintenance Work

The selected 10 districts as priority projects are comprised of many sort of projects such as irrigation/drainage, land consolidation, farmland conservation project and so on, therefore, operation and maintenance works will be characterized by the different project facilities to be managed and scale.

The following O & M works by projects are described taking into account the type of main facilities and canal systems.

i Spray irrigation project with pumping system.
ii Dam irrigation project.
iii Diversion dam irrigation project with open channel network.
iv Land consolidation and farmland conservation project.

Following operation and maintenance works by each project are described,

1) O & M work for spray irrigation project with pumping system

- The head of operation and maintenance office will be fully responsible for overall operation and maintenance of the project facilities under the control personnel in charge of office work, pumping operation and distribution of water.
- The water masters assigned to the pumping station and entire area will be responsible for ;
  - To collect the information for irrigation by canal.
  - To prepare the pumping operation program and execute the program.
  - Distributions practice of water and inspection of facilities.
  - Maintenance of facilities. and,
  - Other O & M works.
- The following staffing will be required for O & M works.
  - Head of O & M office
  - Mechanical engineer (concurrently service)
  - Electric engineer (concurrently service)
  - Water master and pump operator
  - Common irrigator

2) Dam irrigation project

- The head of operation and maintenance office will be responsible for overall operation and maintenance of the project facilities under the control personnel in charge of office work, dam and reservoir management and distribution of water.
- Duty of responsible person for dam and reservoir
  - Discharge control based on dam operation rule.
  - To execute the maintenance of dam body.
  - Forecast of flooding and discharge control from the reservoir.
  - Sediment and water quality control.
  - Maintenance of facilities.
  - Other O & M works.

- Canal tender will be responsible for following task
  - To prepare the irrigation program.
  - Distribution practice.
  - Inspection of canal system by patrol.
  - Maintenance of facilities. and,
  - Other O & M works.
- The staffing
  - Head of O & M office
  - Dam manager
  - Water master and Common irrigator

3) Diversion dam irrigation project with open channel network.

- The head of operation and maintenance office will be responsible for overall operation and maintenance of the project facilities under the control personnel in charge of office work, diversion dam and distribution of irrigation water.
- Duty of responsible person for diversion dam
  - Diversion dam management during flooding and ordinary condition.
  - To maintain the facilities with thorough inspection and observation.
  - To maintain the record for operation and management.
- Water master and canal tender will be responsible for following task
  - To prepare the irrigation program.
  - To distribute the water in accordance with irrigation program.
  - Inspection of canal system by patrol.
  - Maintenance of facilities. and,
  - Others
- Staffing
  - Head of O & M office.
  - Division dam manager
  - Water master and Common irrigator

4) Land consolidation and farmland conservation project

- Management of major facilities
  The farmer's cooperatives organized by village will be responsible for O & M works of main and secondary irrigation/drainage canal and farm road.
  - Operation and maintenance of irrigation facilities.
  - To maintain the drainage canals.
  - To maintain the farm road.
  - Others.
- Maintenance of on-farm facilities
  User's groups are, in principle, responsible for operation and maintenance of on-farm facilities,
  Major task are as follows;
  - Operation and maintenance of on-farm irrigation canal.
  - Operation of relief well to control the underdrain and maintenance of drainage system.

- To maintain on-farm roads

## 3. Proposed Project Works

### 3.1 Hacilar Project

(1) Location and the Project Area

The Hacilar Project will deal with an agricultural land area of 522 ha in Hacilar town, Kirikkale Merkez. The Area is located at about 17 km to the south of Kirikkale city. This province is situated in the north of Anatolia plain. The averaged land elevation, annual mean temperature and annual mean rainfall are El. 754 m, 12.1°C and 386 m, respectively.

The Area lies in the right bank side of the Kizlirmak river with a channel length of 1,140 km. The water source for irrigation will be arranged by applying this river.

(2) Objectives of the Project

The Project will be formulated to introduce the irrigated agriculture to the Area by providing the pumping irrigation facilities.

(3) Major Project Works

a. Irrigation area ; A=552 ha
b. Irrigation method ; Spray irrigation
c. Major Facilities
- Pump ; $\phi$300 m/m x 190 kw x 5 units
- Pumping discharge ; 428 (lit/sec)
- Discharge tank ; Storage capacity v = 520 $m^3$
- Delivery Pipe ;
Diameter $\phi$550 m/m
Length L = 2,250 m
- Pipe line ; Main pipe
Diameter $\phi$550 - 350 m/m
Length L = 6,535 m
; Lateral pipes
Diameter $\phi$300 - 100 m/m
Length L = 31,434 m
- On-farm facilities ; 522 ha

### 3.2 Urunlu Project

This Project is to irrigate 465 net ha (gross 490) by means of groundwater which will be supplied from 8 wells. The project components are 8 wells, already opened by DSI, pipeline, and on-farm facilities of sprinkler. The sprinkler is to be hand-move sprinkler, since the system is the least costly and has mostly been popular over Turkey. The irrigation system is to be of independent, for which each well will have its own command area. Irrigation system, starting at the well and up to hydrant, will be constructed by GDRS, while on-farm facilities will be born by the farmers themselves.

### 3.3 Kalesekisi Project

This Project is to irrigate 210 net ha (gross 233), stretching on a relatively steep hill, by means of pump. The project components are pumps, rising pipeline, regulating pond, distribution pipeline, and on-farm facilities of drip. To economize the operation cost and to reduce the project risk, the project implementation is to be divided into two phases, composed of 100ha irrigation for phase I and another 110ha for phase II. The phase I is to irrigate the lower part with about 150m static head, and the phase II for the upper part between 150 to 250m in static head.

### 3.4 Camlibel Project (Farmland Consolidation)

(1) Location and Present Condition

The Project Area is located in Guzelce and Kervansary villages, Camlibel district, Tokat province and at about 25 km to the south of Tokat city. The alluvial plain extends along the Finege river which traverse the central part of Camlilel province. The river brings about the flood damages frequently to the plain due to the snow-fed stream. On the other hand, the lands in Guzelce village are irrigated by using the said river water partly. The averaged land elevation, annual mean temperature and annual mean rainfall in the Project Area are EL. 1,140 m, T = 8.8°C, and R = 385 mm, respectively.

The Guzelce irrigation project have been implemented by the DSI, which aimed at flood control and irrigation for the land area of 4,337 ha along the Fineze river.

The Camlibel Farmland Consolidation Project will be implemented by the GDRS, in a line of the Guzelce irrigation project.

(2) Objectives of the Project

The Camlibel Farmlnd Consolidation Project, in line with the area development, aims to improve the agricultural environment through enhancement of agricultural productivity, providing comprehensive improvement of farmland conditions which make main component of agricultural production and agricultural environment.

(3) Major Project Works

The component of the Camlibel Farmland Consolidation Project consists of the followings.

| | |
|---|---|
| - Project area | A = 1,438 ha |
| - Major crops | ; Wheat, beet, feeder crops, vegetables |
| - Major works | |
| • Land grading works | A = 1,398 ha |
| • Soil improvement works | A = 40 ha |
| • Drainage canal works | L = 19,700 m (h = 1.0 - 1.8 m) |
| • Under-drainage works | A = 15 ha |
| • Irrigation canal works | L = 20,850 m |
| • Farm road works | L = 47,600 m |

- Improvement of village environment
  - Stock farm land development A = 23 ha (Terracing 10 ha)
  - Living environment improvement A = 11 ha

### 3.5 Kozluk Project

(1) Location and Present Condition

The Project area is located in Akcay, Kozluk and Dumantepe villages, Terme district, Samsun province, and at about 75 km to the east of Samsun city. The Area fronts on the Black sea on the north, so that the climate is influenced by the sea. The averaged land elevation, annual mean temperature and annual mean rainfall in the Project area are EL. 20 m, 14.4°C, and 1,089 mm, respectively. The crops, such as paddy, corn, hazel nut, etc., are planted without irrigation water, for the rainfall is comparatively favored as compared to the Anatolia area, but lower in the yield.

The Akcay river, located alongside the Project Area on the east, stream throughout the year and is utilized for irrigation water source.

(2) Objectives of the Project

The Project will provide an irrigated agriculture in the area and contribute to the provincial area development through improved agricultural production.

(3) Major Project Works

- Project Area ; A = 550 ha (For irrigation)
- Major Crops ; Hazel nut, Potato, Corn and Rice
- Irrigation Water Requirement ; Q = 500 lit/sec
- Irrigation Method ; Furrow and Flooding Irrigation
- Water Source ; Akcay River
  ; Catchment Area C.A. = 220 $km^2$
  ; Drought Water Discharge Qd = 620 lit/sec
- Major Facilities
  - Head Works ; Weir Length L = 50 m
    ; Weir Type Floating Type
    ; Flood Discharge Q = 800 $m^3$/sec
  - Main Canal ; L = 20,200 m
  - Lateral Canal ; L = 12,100 m

### 3.6 Kuskara Project

(1) Location and Present Condition

The Project area is located in Kuskara village, Merkez district, Kastamonu province, and at about 20 km to the north of Kastamonu city. The averaged land elevation, annual mean temperature and annual mean rainfall in the Project area are EL. 680 m, 9.8°C, and 452 mm, respectively.

In the Project area, an irrigated farmland area of 80 ha have been open up in 1994 by constructing deep well under the DSI, but be ineffective due to land slope with 6 - 10 % and the following reasons.

- Difficulty in irrigation;
- Remarkable water losses for water supply; and
- Notable soil erosion.

As a countermeasure to such present conditions as listed above, the land terracing works will be proposed.

(2) Objectives of the Project

The Project aims to protect the farmland from devastation due to soil erosion and deterioration, to maintain the productive capacity and enhance productivity of the farmland as well as improvement of irrigations efficiency.

(3) Major Project Works

| | |
|---|---|
| a. Farmland conservation area | A = 117 ha |
| b. Irrigation area | A = 117 ha |
| c. Irrigation water source | Groundwater |
| d. Terracing | |
| A block (with averaged slope of 6 %) | A = 44.1 ha |
| B block (with averaged slope of 8 %) | A = 72.8 ha (≒117 ha in total) |
| e. Canal construction | |
| Length | L = 3,325 m (Q = 50 lit/sec) |
| f. Road construction | |
| Length | L = 4,100 m (B = 3.0 - 8.0 m) |

### 3.7 Ozdenk Project

This Project is to irrigate 126 net ha (gross 140) with the water released from a dam. The project components are Ozdenk dam, distribution pipeline connecting between the dam and the farms, and on-farm facilities of either furrow or sprinkler. The irrigation system is to be of gravity distribution flow, for which the dam water comes to the farms by gravity thanks to the elevation difference. The dam dimension is as follows:

| | |
|---|---|
| Usable volume: | 800,000 cum (including evaporation and seepage losses) |
| Dead volume: | 100,000 cum (sedimentation: 47,000cum + supplement) |
| Total volume: | 900,000 cum (newly designed) |
| Full water level: | 22.4m (with 900,000 cum reservoir capacity), EL1000.400m |
| Dead water level: | 8.6m (with 100,000 cum dead volume), EL987.000m |
| Dam height: | 22.4 + 2.50 (Normal free board: 1.0 + 1.5) = 24.9 m |
| Dam type: | Zone type earth fill dam |

### 3.8 Aslalar Project

This Project is to irrigate 250 net ha (gross 263) by means of groundwater which will be supplied from 7 wells. The project components are 7 wells, already opened by DSI, boosting pumping station, rising and distribution pipelines, and on-farm facilities of drip. The irrigation system is to be of collective, for which the irrigation water to be extracted from the 7 wells is to be once stored in a collecting pond, and then boosted to a regulating pond that will be constructed on a hill located northern side of the Project area. After the regulating pond, the water is gravity-distributed to hydrants.

### 3.9 Ilyaskoy Project

The project components are Ilyaskoy dam, boosting pumps, rising and distribution pipelines, regulating pond, and on-farm facilities of either drip or sprinkler. The water released from the dam is to be lifted up onto a hill by a boosting pumping station. Then after storing the water into a regulating pond, the irrigation water is to be distributed by gravity. Irrigation system, from the dam and up to hydrant, will be constructed by GDRS, while on-farm facilities will be born by the farmers themselves. Based on the reservoir, the dam dimension is as follows:

| | |
|---|---|
| Usable volume: | 560,000 cum (including evaporation and seepage losses) |
| Dead volume: | 40,000 cum (sedimentation: 5,000 + fishery: 35,000cum) |
| Total volume: | 600,000 cum (newly designed) |
| Full water level: | 14.3m (with 600,000 cum reservoir capacity), EL240.300m |
| Dead water level: | 4.8m (with 40,000 cum dead volume), EL230.800m |
| Dam height: | 14.3 + 2.50 (Normal Free Board: 1.15 + 1.35) = 16.8m |
| Dam type: | Zone type earth fill dam |

### 3.10 K. Karistiran Project

This Project is to irrigate 120 net ha (gross 126) by means of groundwater which is supplied from 4 wells. The project components are 4 wells, already opened by DSI, pipeline, and on-farm facilities of sprinkler. The irrigation system is to be of independent, for which each well will have its own command area. Though the present wells are equipped with pumps, those pumps are to be replaced to submersible ones that can yield enough pressure for operating sprinkler. The on-farm irrigation system, which is prepared by the farmers themselves, is to be hand-move sprinkler.

## 4. Implementation Plan

### 4.1 Project Implementation Schedule

The implementation is to be packaged in such way of containing core projects, the 10 priority projects in case of the first package, as well as number of representative projects to follow. One package presumably is to cover 5 years duration. With a prospective budget of 60 MUS$ in an assistance from foreign organ(s), the 10 priority projects will be completed within 3 years with an amount of 13.4 MU$ (excluding on-farm cost and Kalesekisi Phase II cost), and other projects would be implemented in such way that the projects be selected on basis of

project priority covering all short and long listed projects and be of fairly large scale (bigger than the mean).

### 4.2 Construction Schedule

Taking the construction amount into consideration, one-year-construction period is enough to complete for such projects as Urunlu, Kalesekisi, Kuskara, Aslanlar, and K. Kalistiran. Hacilar and Kozluk are relatively large in construction amount, thus requiring two years construction period. Also, two dam projects such as Ozdenk and Ilyaskoy will need two years construction period. Camlibel, covering 1438 ha, would require three-year-construction to complete.

### 4.3 Project Implementation Organizations

Organization networks involved in the project formulation, design of construction works, budgetary affairs, tendering and contract, construction management, organization of beneficiaries and operation/maintenance of facilities. As to role of GDRS headquarters, regional and provincial offices, the former is responsible for general implementation planning, financing provision and technical advice, while regional and provincial offices concern local request for project formulation, operation works after completion, instruction for creating water users' cooperatives and general operation and maintenance affairs. Provincial offices are authorized in the supervision of construction works based on the contract agreed between GDRS headquarters and ordered construction agents. On the other hand, the contracted consultant offers technical services and management of construction works at the sites concerned, on the employment contract basis.

## 5. Project Cost Estimation

The current unit prices for construction work and materials, as of July 1997, were utilized for estimating project costs. The total project cost was estimated at 2,577,791,651,000 TL (excluding on-farm cost is 2,174,572,962,000 TL) composed of local currency of 1,945,253,906,000 TL (or 75 percent of the total project cost) and foreign currency of 632,537,749,000 TL.

The condition of cost estimation is basically as follows, and the project costs are shown in the following:

- Unit prices of GDRS are used in cost estimation,
- The exchange rate between Turkish Lira and US dollar has been adopted at 1.00 US$=155,000TL,
- The design and supervision cost is 15~20% of the construction cost,
- The contingency cost is 5% of the total of construction cost, design, and supervision,
- Maintenance cost is 0.1~0.2% of construction cost,
- Electric fee is annual pump working hours × electric price per kwh,
- Operation cost consist of electric fee, pump attendant, irrigation engineer, and
- Replacement period is decided by the GDRS criteria.

(Project Cost : 1,000,000TL, O&M Cost : 1,000,000TL/year)

| Project name | Hacilar | Urunlu | Kalesekisi | Camlibel | Kozluk | Kuskara | Ozdenk | Aslanlar | Ilyaskoy | K.Karistiran |
|---|---|---|---|---|---|---|---|---|---|---|
| Project cost | 489,484 | 190,132 | 268,374 | 298,080 | 275,607 | 55,535 | 413,228 | 239,237 | 278,229 | 69,885 |
| Operation and maintenance cost | 1,196 | 10,632 | 6,107 | 719 | 557 | 1,876 | 906 | 5,620 | 1,210 | 3,643 |

## 6. Project Evaluation

### 6.1 Financial and Economic Evaluation

(1) Basic Preconditions

Financial evaluation for ten individual priority projects is based on the following basic preconditions :

1. project life is set at 30 years for groundwater projects and 50 years for other priority ones, according to the longest life the facilities to be constructed by the project,
2. construction period is set at reasonable duration for normal time-spun for completing construction, i.e., one year for ground-water projects and two years for others,
3. replacement costs of the facilities are put into expense at the fixed interval during the project life, counted in the year when the life of the facility concerned has just expired,
4. costs are accounted as annual expense during the whole project life,
5. expected benefits including those from by-products are estimated as of July 1997,
6. benefits from soil conservation are estimated from assumed yield reduction caused by soil erosion on without project basis, employing current yields as with-project basis,
7. benefits of land consolidation includes saving effects of farming practices, especially reduction of farm labor and fuel requirement for farm machinery,
8. initial construction cost, facility replacement cost, O.M. cost, annual crop production cost and all benefits are evaluated by the price as of July 1997.

Past expense for the facilities already constructed (by DSI etc.) in the project sites prior to the implementation of the priority projects is not counted in the financial evaluation.

(2) Economic Benefit

Economic benefit is derived from the border prices based on the mean international market prices multiplied by planned acreage and yields of crops, subtracting production costs. In principle, different prices should be estimated for each project, but in this report the same economic prices are applied, because there exist so many international ports in Turkey, and relative share of inland transportation is substantially lower judging from the location of the priority projects. Financial prices have been set at higher levels than import prices for price supported commodities, leading to cheaper economic prices, whereas those of free marketed ones tend to have higher export prices than those domestically prevailed, resulting too often to higher economic ones as compared to financial prices.

(3) Economic Cost

The cost estimation is performed firstly by disintegrating costs of works, materials, fuel, wage etc. into foreign and domestic currency portions. Economic prices of costs are derived from a conversion of these portions, by multiplying the former, or imported components with 1.000, the latter, or domestically procurable components with three kinds of conversion factors according to their price components, viz., 0.888 as standard conversion factor applied to pure material and engineering service, 0.836 as the factor for consumable goods, fuel and skilled labor, fuel and 0.630 for the factor of un-skilled labor wage applied to manual labor. After these factors are multiplied to the domestic currency portion of the project costs, the converted portions are again integrated to obtain cost prices as the term "economic price". The economic costs are applied to initial investment costs, replacement costs of facilities and operation/maintenance as well as crop and livestock production costs where water fee is excluded avoiding overlapping.

(4) Evaluation by Economic Prices

Considerably high project benefits are estimated for all the projects, among which three projects with orchard as major crops have marked rates above 50%, higher than other ones, reflecting higher level of international market prices of fruits. Since they accompany with longer embryonic periods, leading to rather conservative range of B/C ratio not larger than 5 because of sluggish benefit appearance. In contrast, indicators of Ilyaskoy and Ozdenk show poor values by the reasons that not only the initial cost is prohibitive but they have higher rate of crop acreage the supply of which in the world market has been affluent. I.R.R. for the projects with higher rate of grains among irrigated crops show intermediate levels.

unit of benefits : 1,000 US$

| Project | Life spun | Mean annual B. | Net Benefit/year | B/C ratio | E.I.R.R. |
|---|---|---|---|---|---|
| Hacilar | 50 | 582.7 | 1.12 | 2.67 | 41.4% |
| Urunlu | 30 | 553.7 | 1.19 | 3.17 | 36.7% |
| Kalesekisi | 50 | 1,452.7 | 6.92 | 4.13 | 55.6% |
| Camlibel | 50 | 3,672.0 | 2.69 | 5.07 | 30.6% |
| Kozluk | 50 | 1,347.8 | 2.45 | 1.84 | 43.8% |
| Kuskara | 30 | 83.9 | 0.72 | 2.15 | 26.5% |
| Ozdenk | 50 | 555.5 | 4.40 | 3.64 | 15.7% |
| Aslanlar | 30 | 1,480.6 | 5.92 | 2.29 | 50.4% |
| Ilyaskoy | 50 | 101.6 | 0.94 | 1.94 | 18.5% |
| KucukKaristiran | 30 | 420.3 | 3.50 | 2.49 | 52.6% |
| aggregated | - | - | 2.99 | 2.86 | 34.9% |

Note : B stands for benefit, C for cost, E.I.R.R. for economic internal rate of return

As an aggregate, the total project has B/C ratio at 2.86 and E.I.R.R. at 34.9%, and it still keeps B/C at 1.86, E.I.R.R. at 16.2% even when construction and O.M. costs increase by 30% coupled with failure of target production by 30% take place.

(5) Evaluation by Financial Price

What differs most from evaluation result by economic price lies in the point that the rate of contribution by industrial crops keeps high levels, hence higher cost-effectiveness is observed in the project sites where acreage covering rate of such crops remains high. Two projects planned with dams as water source except for Hacilar has lower cost-effectiveness where benefit can barely offset cost. Likewise, in two others with weirs serving water source operation costs for water pumps stay at a prohibitive level affecting project return, leading to

lower rate of return. In the case of Camlibel, though it does not have much lucrative crops in its crop composition, economy of scale comes into effect in a way to bring higher rate of return. No project has such higher rate of return above 50% as observed in the evaluation by economic price, since horticultural produce does not contribute so much as done in the case of economic price to benefit output. Projects with their water source relying on ground-water have higher return despite shorter life span. In three projects with ground-water source and already irrigated Kuskara past payment for DSI water source is omitted as sunk cost.

unit : trillion TL million TL/ha (figures in brackets in trillion TL)

| Project | Life spun | Mean annual B. | Net Benefit/year | B/C ratio | F.I.R.R. |
|---|---|---|---|---|---|
| Hacilar | 50 | 1,250(200) | 2.4(0.38) | 1.90 | 18.7% |
| Urunlu | 30 | 449(72) | 1.0(0.16) | 2.32 | 33.3% |
| Kalesekisl | 50 | 604(97) | 2.9(0.46) | 2.71 | 25.3% |
| Camlibel | 50 | 1,367(219) | 1.0(0.16) | 1.87 | 33.8% |
| Kozluk | 50 | 365(58) | 0.7(0.11) | 1.42 | 17.7% |
| Kuskara | 30 | 111(18) | 1.0(0.15) | 2.59 | 28.2% |
| Ozdenk | 50 | 82(13) | 0.7(0.10) | 1.39 | 4.4% |
| Aslanlar | 30 | 440(70) | 1.8(0.28) | 1.63 | 25.7% |
| Ilyaskoy | 50 | 51(8) | 0.5(0.08) | 1.36 | 4.2% |
| KucukKaristiran | 30 | 183(29) | 1.5(0.25) | 1.70 | 28.6% |
| AggrigateProject | 42 | 601(96) | 1.6(0.25) | 2.10 | 26.9% |

## 6.2 Environmental Impact

The socio-economic conditions in the project areas will improve, and population growth is expected, and the income levels of the local population are expected to rise. Improved farming practices using modern irrigation techniques will result in a higher productivity and better quality agricultural products. These are highly compounded with animal husbandry hitherto prevailed, and enable sustainable land use. On the other hand, project is induced increasing fertilizer and chemical application for crop production, but there might be of concern that soil salinity and salt accumulation to surface layer may occur.

Therefore, environmental mitigation measures to minimize possible negative effects are advised in the implementation planning.

## 7. Guideline for Project Planning

A guideline, concerning project planing and operation and maintenance, was prepared and incorporated in the Main Report. This guideline is composed of land use, cropping planning, water resources development, irrigation, farm economy, and project evaluation. Also, included in the operation and maintenance are regulatory maintenance rule for irrigation-related-facilities, operation and maintenance for machinery, as well as environmental impact assessment, soil environmental investigation, environmental analysis, and environmental conservation.

# CONCLUSION AND RECOMMENDATION

## 1. Conclusion

(1) Although Turkey accomplished at a time food self-sufficiency in the past, now the state food imports outweigh exports and necessity is arising to increase national food production to improve food balance. Nevertheless, expansion of farmland has lately leveled off, meanwhile farm land turned to decrease at the annual rate of 100 thousand hectare. This has lead to acute need of crop productivity by expanding and consolidating infrastructure of agricultural production, especially through irrigation schemes. In this program, a master plan formulation for the entire small scale irrigation and rural development schemes, and a feasibility study for the selected priority projects was carried out, covering 56 provinces, excluding 24 provinces located in south-eastern part of the country. The study program comprises two phases. In Phase I a long-list inventory was provided covering 1,418 schemes identified in the study area. Phase I also covers the extraction of a short-list inventory consisted of 205 schemes from the foregoing long list through selection criteria including priority factors and maturity of project provision. Further, ten priority projects were selected among these 205 through a set of sorting standards regarding types of schemes, scale, farming patterns, agro-ecological/meteorological divisions, availability of basic data etc. During Phase II feasibility study, preliminary designs of irrigation and drainage facilities were provided, as well as consolidation plans for agricultural infrastructure were formulated for these ten priority projects with the beneficiary area of 3,834 ha.

(2) In the consolidation plans of irrigation and drainage facilities, as well as agricultural infrastructure, cost estimation, formulation of project implementation plan and economic evaluation based on the estimated benefits and costs were provided. As regards economic evaluation, economic rate of return (E.I.R.R.) of the priority projects were estimated, where the maximum rate of 55.6% is forecast for Kalesekisi, while the minimum one of 15.7% is estimated for Ozdenk, as individual projects but 34.9% for the aggregated ten projects. From these results it can be concluded that all the priority projects have economic viability with high levels of project return. Feasibility of these projects can also be deduced from the technical readiness of implementing proposed works, from little negative but ample positive environmental impacts towards natural environment, the contribution to improve social environment in such a way as minimizing economic disparity between urban and rural areas and curbing exodus from rural areas, safeguarding state food security and increased value-addedness to products through crop diversification and so on.

(3) With regard to cropping system, acreage under wheat that currently accounts 33% is planned to reduce to 17.7%, that under barley and other winter cereals is also cut out from 15.1% to 2.5%. Whereas, sugar-beet with lucrative margin and stable demand is planned to expand doubly from 10.1% to 19.9%. Acreage under vegetables and fruit trees are positively planned to increase since they have higher yield gain by irrigation and larger economic benefits. In addition, acreage under alfalfa is proposed to augment in order to promote livestock sub-sector. These improvement in cropping system will be possible to elevate cropping intensity from the present level of 86.7% to 105.1%.

(4) No particular issue is pointed out as to planning, design, and implementation of the proposed projects except for these of Kalesekisi, because they are technically easy to provide. Only the exception, Kalesekisi has a plan to irrigate 210 hectare, a tract of table cherry orchard developing on relatively steep slope. It consists of pumps, water diversion pipelines, regulating ponds, water delivery pipelines, drip-irrigation networks etc. Since the project has to lift up water 250 meters of maximum difference of static head, a deliberate and careful technical consideration is essential in the stage of detailed design especially for a risk-analysis of water-hammer and measures to prevent it. Much more alertness for the maintenance of higher head pumps is required even after the completion of works as compared with ordinary low-head ones. On account of this necessity, Kalesekisi project is proposed to implement into two phases. The first phase covers 110 hectare that extends within the maximum height difference up to 150 meter. Nine years later, with the accumulated performance and experiences, and the second 100 hectare. The second phase is planned to start covering the rest 110 hectare with a height difference ranging 150m~250m.

(5) Among ten priority projects, the three groundwater schemes including Urunlu, Aslanlar and K. Karistiran already have wells and pumps drilled and installed by DSI, the earlier use of which is earnestly desired by the farmers in these sites. Kuskara, a soil conservation project, has also been installed with groundwater irrigation facilities, but soil erosion has already taken place by irrigated water so severely that immediate countermeasures are requested. Camlibel, a land consolidation project, is positioned as one of the terminal beneficiary schemes belonging to Guzelce irrigation project where a dam and a main canal are under construction, the completion of which is scheduled in 2000. Hence, the land consolidation works in this scheme have to be completed within this term. Also, in other five priority projects, constituting quite newly planned, beneficiary farmers have long been longing for their implementation. The implementation of proposed priority projects, accompanying with creation of irrigation facilities and other basic rural infrastructure, provides them with increased farm products, entailing to improved farm income for individual beneficiary farmers in the project sites. At the same time, their implementation will also bring about more job-opportunities and new income sources for inhabitants therein.

(6) Turkey has called for "eradication of inter-regional disparity between urban and rural communities" as one of the political targets, and in this context agricultural promotion constitutes the most important task to be addressed in Anatolian and Black Sea regions. Number of GDRS projects located in these areas accounts for over 80% in the long list inventory, implying that the proposed projects are in compliance with the core state policies.

## 2. Recommendation

Taking account of the envisaged advantages of their proposed projects, i.e., free from particular technical problems, increased production and farm income, possible improvement in rural living standards as well as minimization of inter-sectoral disparity, the implementation thereof is herewith proposed paying attention to the following policy orientations;

(1) GDRS, the responsible agency of the proposed projects, has implemented for years small scale irrigation and rural development projects, however, its volume of implementation has recently staggered due to budgetary limitation. The GDRS organization is considered fully capable of expanding annual implementation volume judging from current size of organization

and staff number. Therefore, it is recommended that GDRS procures fund(s) enabling early implementation of the projects.

(2) The ten projects, undertaken in the feasibility study, are given top priority for the early implementation. Both long and short list inventories are very useful in preparing the implementation program. These two types of inventories are informative as a base of information to formulate the entire detailed design in response to fund availability. In selecting priority projects and conducting feasibility study, it is advised to pay full observance to the guidelines proposed in this report.

(3) For the purpose of making the agricultural development projects fully sustainable, it is as a matter of course required to duly regard to both natural and social environment and to arrange a participatory system to realize farmers voluntary participation. However, far more imperative is that efficient utilization and proper operation and maintenance after the completion of works be secured through the creation of water users associations and other farmers organizations, strengthening functions thereof along with improvement in ability of the staff concerned.