3. PERSONNEL ENGAGED IN THE FEASIBILITY STUDY

Advisory Committee

1.	Chairman Mr. Shigetaka TANIYAMA	Director Project Planning Div., Agricultural Structure Improvement Bureau, Ministry of Agriculture, Forestry & Fisheries (MAFF)
2.	Irrigation/Drainage Expert Mr. Kazumi UEDA	Assistant Director, Land Development Div., Agricultural Structure Improvement Bureau, MAFF
3.	Meteorology/Hydrology Expert Mr. Akira TAMURA	Development Advisor, Agricultural, Forestry & Fisheries Div., Hokkaido Development Agency
4.	Soil/Agriculture Expert Mr. Yuji GOTO	Land Improvement, Environment Officer, Natural Resources Div., Planning Dept., Agricultural Structure Improvement Bureau, MAFF
5.	Agro-Economist Mr. Shogo TAKEMURA	Section Chief, Regional Planning Div., Agricultural Structure Improvement Bureau, MAFF
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14.	Rural Planning	Mr. Sumio SHINDO
15.	Cost Estimate	Mr. Toshiyuki YUMINO

Officials of the Government of Egypt

1.	Mr. Abdel Wahab Selim	Chairman
2.	Mr. Maher Bahaa Eldin	Vice Chairman
3.	Mr. Zaki Arnaout	Director of Planning & Follow-Up Sector (MLR)
4.	Dr. Samir Nagmoush	Technical Councellor
5.	Dr. Rifki Anwar	〃 〃
6.	Eng Moris Kamel	〃 〃
7.	Mr. Ahamed Fahmy	〃 〃
8.	Eng. Yussef Amin	〃 〃
9.	Eng. Helmy Mohmoud Ibrahim	Under Secretary, Ministry of Irrigation
10.	Eng. Hassan Ab El Nasr	General Manager, Civil Eng. Dept.
11.	Eng. Salled Zahran	General Manager, Department of Plant Production
12.	Ms. Elham Hamdi El Khamly	Agro-Economist
13.	Eng. Badr Hafez	Agro-Economist (Farm Machinery)
14.	Eng. Mohmoud Ez El Din Fahmy	Head, Agricultural Dept.
15.	Dr. Fayez S. Hanna	Soil Scientist
16.	Eng. Mohamed Rihan	Civil Engineer (Counterparts)
17.	Eng. Fathalla Shaker	Agro-Industry (〃)
18.	Eng. Goma El Azazi	Soil (〃)
19.	Eng. Salah Raslan	Coordinator
20.	Eng. Emad El Bourgy	Animal Husbandry Expert

21.	Eng. Ezzet Nagib	Farm Machinery Expert
22.	Mr. Emad El Deen Ibrahim	Animal Husbandry Expert
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CHAPTER II EGYPTIAN ECONOMY

CHAPTER II EGYPTIAN ECONOMY

1. NATIONAL LEVEL ECONOMY

1–1 General

(1) *Land*

The Arab Republic of Egypt (ARE) is located in the northeastern corner of the African Continent, and is contiguous to the Western Asia through the Sinai and to the European Continent across the Mediterranean Sea.

ARE borders upon Sudan in the south at 22° N. Lat., Libya in the west at 25° E. Long., the Mediterranean Sea in the north, and the Red Sea in the east. The total national land is about one million square kilometers and is in a desert which stretches over the Arabian Peninsula to Northern Africa.

The areas presently developed and utilized as arable land or permanent residences account for only 3.5 percent of the total national land, or about 36,000 square kilometers, and most of these are situated along the Nile river valley.

(2) Population

A series of population census was taken in ARE in 1937, 1947, 1960, 1966, and 1976.

The total population as revealed in the 1976 census was 38.20 million, of which Egyptians account for 36.51 million, foreigners 0.11 million, Sinai people 0.15 million, and migrant Egyptians abroad 1.43 million. The estimated population of 1981 is 44.00 million, which is 2.9 times as large as that of 1937 (15 million) (the population in 1882 was 6.71 million).

The population of the Eastern Nile Delta Region exclusive of the Greater Cairo urban area (6.7 million) is only 17.5 percent of the total population of ARE.

Remarkable rural-urban migration in the recent years is reflected in the proportion of urban population in the respective censuses, the rate of which increased from 37.4 percent in 1960, to 40.5 percent in 1966, and to 43.9 percent in 1976.

In terms of religion, Muslims occupy 93.8 percent of the total population and the remainder includes Copts, Chrestians, Judaists and others.

1–2 Economic Situation

(1) General

Since the introduction of "Open-Door Policy" in 1972, the Egyptian economy has grown to a considerable extent owing to both the production of petroleum

and the increased output in such industrial sectors as metal goods, textile goods, foods, and so on. On the other hand, in spite of the increased investment through import of capital and intermediate goods, the growth rate of production remains comparatively low and so does the export growth rate.

Furthermore, the increasing demand for public welfare along with the annual population growth of 2.5 percent calls for more import of consumer goods, and therefore, the foreign trade deficit worsens.

(2) Gross Domestic Product

Gross Domestic Product (GDP) at market price in 1981/82 was 20,490 million LE at current prices (9,277 million LE at constant 1975 prices).

The real average GDP growth between 1974 and 1981/82 was 9.9 percent per annum. The agricultural sector grew 3.2 percent per annum over the said period.

The GDP per capita at constant 1975 prices was 213 LE or 260 US$ using the 1981/82 market exchange rate, and its real growth in the same period was 7.1 percent per annum.

(3) Price Indices

Annual increase of price indices inclusive of both consumer prices and wholesale prices between 1973 and 1980 is summarized as follows:

Prices	Annual Increase (%)
Consumer Prices (urban)	12.1
Consumer Prices (rural)	13.1
Wholesale Prices	12.0

2. ROLE OF AGRICULTURE

2–1 Present Condition of Agriculture

The agricultural sector plays a major role in the structure of the national economy, due to the fact that agricultural production is closely connected with the livelihood of people and it represents the major source of income of the majority of the population i.e. agriculture occupied 17.3 percent of GDP (2nd), 36.2 percent of employment (top), 29.7 percent of export (2nd) and 21.5 percent of income (top) in 1981.
On the other hand, it is also a fact that a low productivity of agriculture hinders the national economic growth, as it occupies 49.8 percent of the trade deficit, 34.3 percent of import and the domestic food sufficiency is only 53 percent in spite of the fact that Egypt is an agricultural country.

There are many reasons for the slow growth of agricultural production, the followings are probably the most important;

(1) The continuous decline in the land/man ratio from 0.25 feddan in 1955 to 0.15 feddan in 1980 due to slow expansion of the cultivated area and the diversion of arable land to non-agricultural purposes.

(2) The deterioration in land quality due to waterlogging, increased salinity, the removal of the fertile crust for brick-making and the inadequacy of fertilizer ratios.

(3) The small-holding structure which hinders the use of advanced farming techniques and causes a loss of land, water, fertilizers, mechanical power, labour power and animal rearing.

(4) The losses in agricultural output due to poor transportation, storage and distribution facilities and lack of sufficient facilities for conservation and processing of farm products.

(5) The low productivity of livestock and inadequacy of fodder.

(6) The insufficient application of the findings of scientific research.

2–2 Government's Policy

National total area is about 238 million feddan (1,000 thousand km^2), however, the cultivated area is no more than 6.3 million feddan (2,650 thousand ha) which is insufficient at all. It is believed that 2.8 million feddan (1,180 thousand ha) could be reclaimed up to the year 2,000.

Available water resources in the country are estimated at 60.7 billion m^3 at present, of which 49.7 billion m^3 are used for agriculture, leaving a surplus of 1.2 billion m^3 after subtracting domestic water supply which may increase to 12.9 billion m^3 by the year 1990.

Of this expected surplus in 1990, 7.9 billion m^3 is believed to be adequate for meeting the requirement of an additional 1.58 million feddan of reclaimed land.

The Government has an drastic strategy for agricultural development as follows:

(1) Integration of vertical and horizontal expansion projects, in particular horizontal expansion, is indispensable for improving the land/man ratio and increasing the security of food. The target for land reclamation is 636.7 thousand feddans over the plan period.

(2) Increasing agricultural productivity through vertical expansion and higher cropping intensity.

(3) Reduction of the losses in agricultural output due to inadequate or poor facilities for packing, processing, storage, transportation, etc.

(4) Regional specialization for cash crops in a limited number of crops.

(5) A system for the pricing of agricultural products and inputs.

(6) Rural reconstruction and control of population movements from rural to urban areas.

2--3 Agricultural Production

Government's target for agricultural production in the new five year plan is shown in Table 2–1. According to the target in the vertical expansion, the expected cropping area is 11,730 thousand feddan and the cultivated area is approximately 6,300 thousand feddan, therefore, the cropping intensity of 186 percent is aimed for.

On the other hand, the GDP of agriculture sector is 4,822.5 million L E. in 1981, therefore, the five year plan aims at an increased production of 122 percent with the vertical expansion.

In the horizontal expansion, the target of new land reclamation is 636,700 feddan, therefore it represents 1,508,000 feddan of cropping area with 237 percent of cropping intensity.

According to the horizontal expansion, finally, new production of 539 million L E i.e. 11 percent of GDP in 1981 is aimed for. Total new production with the vertical and horizontal expansions will improve the self food sufficiency to 71 percent in the new five year plan period from 53 percent in the year 1981. However, the drastic food shortage can not be solved for some time.

Table 2–1 Expected Agricultural Production in the Five Year Plan

(feddan '000) (in 1981 price LE '000)

Classification	Vertical Expansion		Horizontal Expansion		Total	
	Cropping Area	Value	Cropping Area	Value	Cropping Area	Value
Grains	5,045	1,138,459	425	58,173	5,470	1,196,632
Legumes	418	107,514	66	10,559	484	118,073
Fibers	1,077	431,235	55	14,830	1,132	446,065
Oil seeds	308	104,045	120	24,325	428	128,390
Sugar crops	280	192,045	91	29,051	371	221,096
Vegetables and onions	1,164	747,340	236	108,827	1,400	856,167
Fodder	3,004	833,836	420	70,490	3,424	904,326
Fruits	360	351,120	60	23,440	420	374,560
Timber and others	74	121,114	35	16,900	109	138,014
Animal production	–	1,756,477	–	183,040	–	1,030,517
Fish production	–	116,600	–	–	–	116,600
Total Agricultural Production	11,730	5,899,785	1,508	539,635	13,238	6,439,420

CHAPTER III PROJECT AREA

CHAPTER III PROJECT AREA

1. LOCATION AND GENERAL FEATURES

1–1 Geographical Location

The Project Area is located in the north-eastern part of the Nile Delta; about 200 kilometers from Cairo, the capital of the Arab Republic of Egypt, along the national road (highway). The area measures 27 km east to west and 20 km north to south.

1–2 Transportation

There is one national highway running between Port Said and Ismailia, parallel to the eastern boundary of the project area. Also, one provincial road runs in the north-western direction, reaching Matariya through Mansura.

There are two branch roads: one branches off from the Port Said – Ismailia highway to Assam Village in the southern part, and the other connects Hadous with Matariya, in the western part; the former is asphalted and about 10 km in length and the latter is unpaved for its entire length of 6 km.

Out of the two motorable roads running in the project area, one is running along Baqar Drain through Assam Village and the other is running along Hadous Drain; both roads are unpaved and extending for about 5 km each.

2. PHYSICAL CONDITIONS

2–1 Topography and Vegetation

The Project Area consists of a part of Nile Delta and is topographically situated on the sloping land; and the dryland area is estimated less than 8 percent of the total of this Project Area.

The remaining 92 percent includes the swamp and the lake. The dryland is scattered among a few points in Kom Tinnis, Kom Ibn Salam and along the three drainage canals of Hadous, Ramsis and Baqar. The highest land is found at the Kom Ibn Salam ruins and has an elevation of about 8 meters above the sea level. On the other hand, the lowest place is minus 1.6 meters and is located at the bottom of Lake Manzala.

The present agricultural land is used to plant paddy rice, some kinds of fodder crops and vegetables. The cropping intensity is estimated at about 75 percent. Furthermore, several kinds of veggetation are planted in the Project Area, i.e., blueberries are grown on the surrounding agricultural land, Cypress and Imperata thrive on the swamp borders and Eichhornia grow thick along the existing waterways.

However, most of the land consist of saline soil covered with Karsa.

2–2 Geology

The geology of the Project Area is characterized by fluvio-marine alluvium deposits of fine textured soil transported by the River Nile.

The alluvium deposits are of recent origin and are very deep. The depth of these clayey deposits is not very clear within the Area, but in the north-west of Bahr El Baqar Drain it was observed that they are overlying a medium textured substratum. Most of the profiles are composed of several heavy or light textured layers, suggesting the past history of big floods of the River Nile. Therefore, profile development is very little except for few gray mottling phenomena. The soil thus became Solonchaks through the quaternary lagoonal and lacustrine processes of soil formation.

Matrix, i.e. origin of soil materials, depends on the geological strata of upper stream of the Nile. Strata of sandstones are partly interspaced with limestones and granites have been transported through a long weathering process to form the Nile Delta.

The texture is composed of clay and silt mixed with organic matter of about 13 m in depth, and sand and gravel materials beneath.

2–3 Soil

(1) Introduction

Field survey for feasibility study was carried out on two stages, i.e. from 17th May to 13th August and 18th October to 14th December. Soil survey, permeability test and boring survey were carried out on the first stage, some supplementary soil surveys on the second stage, and meteorological and hydrological surveys over the both stages. Soil analysis was carried out in GARPAD's Laboratory and boring survey was practiced by a local soil research company on contract.

(2) Soil Classification

The present soil classification is made in conformity with Soil Taxonomy System compiled by U.S. Soil Survey Staff, in 1975. In reference to the Soil Taxonomy System, the following soil features are particulary taken into consideration for soil classification and mapping in the Project Area.

a) Dry Land

The Project Area belongs to arid region where annual average rainfall and evaporation are 67 mm and 2,000 mm, respectively. Natural vegetation Karsa which has strong tolerance to salt is sparsely scattered on uncultivated land in the Project Area. Soil profiles in the Project Area have an ocric (light colored) or anthropic (mollic-like) epipedon and a salic horizon. The Aridisols was defined as orders.

They commonly have a salic horizon of accumulation of soluble salts. The Orthids was defined as sub orders.

Soil profiles have a salic horizon whose upper boundary is within 75 cm of the soil surface and are saturated with brackish water to a depth of 1 m for one month or more in most years. The Salorthids was defined as great groups.

Soil profiles have a shallow salic horizon and little organic matter. The Typic Salorthids was defined as sub groups.

All profiles were classified into 6 family classes as follows:

Clayey, montomorillonitic, thermic soils with very shallow reduced zone
EBA–AR1

Light clayey, thermic, montomorillonitic soils with shallow reduced zone
EBA–AR2

Silty clayey, montomorillonitic, thermic with moderatily deep zone
EBA–AD1

Clayey, montomorillonitic, thermic with deep zone

EBA–AD2

Silty Clayey, montomorillonitic, thermic soils with very deep zone

EBA–AD3

Clayey over hard clay, montomorillonitic, thermic soils with very deep zone

EBA–AD3–H

b) Inundated Area

The Team member on soils has some reservation as to soil classification of the inundated area.

The comments say under Draft Final Study Reports that the inundated area could not be classified according to soil taxonomy because this area is submerged with water. In this connection, he likes to call attention of the GARPAD's soil experts to Chapter 1: The Soil That We Classify of SOIL TAXONOMY, Agriculture, December 1975.

Profiles are mineral soils showing little or no evidence of development of pedogenic horizons. The Entisols was defined as orders.

Profiles are permanently saturated with brackish water and all have horizons below 30 to 150 cm. The Aguents was defined as orders.

Profiles have N value of 1.5 and at least 8 percent clay in all subhorizons between the depth of 20 and 50 cm, with a mean annual soil temperature higher than 15°C. The Hydroaquents was defined as great Group.

Profiles have pH 4.5 (1:1 water) in all horizons after drainage. The Sulfic Hydroaquents was defined as sub group.

All profiles are classified into 5 family groups as follows.

Clayey, montomorillonitic, thermic with hard clayey soils	JAC–aw1
Loamy, thermic soils	JAC–aw2
Loamy over clayey, thermic soils	JAC–aw3
Clayey, Montomorillonitic, thermic, sub soil brown soils	JAC-aw4
Clayey, Montomorillonitic, thermic, with deep zone	JAC–aw5

(3) Characteristics of Soil Mapping Unit

a) Dry Land

i) Clayey, montomorillonitic, thermic, soils with very shallow reduced zone; EBA–AR1

These lands occupy the cultivated and uncultivated land in the Project Area. The reduced zone ranged 25 to 30 cm up to the surface soil. Natural vegetation Karsa was often found in uncultivated land. These soils are clayey in texture. These are moderately to highly saline soils, in which no diagnostic horizon was observed.

ii) Clayey, montomorillonitic, thermic soils with Shallow Reduced Zone; EBA–AR2

These lands occupy the cultivated and uncultivated land in the Project Area. The reduced zone ranges 30 to 60 cm up to the surface soil. Natural vegetation Karsa was often seen in the uncultivate land. These soils are clayey in texture.

iii) Clayey, montomorillonitic, thermic soils with Moderately Deep Zones; EBA–AD1

These lands occupy the cultivated and uncultivated land in the Project Area. Natural vegetation and cropping pattern in these land are similar to those of AR1 and AR2 family soils. The reduced zone ranges from 60 to 90 cm up to the surface soil and deep clayey in texture. Physical and chemical properties of this family of soils are similar to those of the AR1 and AR2 family soils.

iv) Clayey, montomorillonitic, thermic Soil with Deep Zone; EBA–AD2

These lands occupy the cultivated and uncultivated area. Landscape and vegetation in this family soils are similar to those of the previous family soils. The depth of reduced zone ranges from 90 to 120 cm up to the surface soil forming a deep clayey zone.

v) Silty Clay, Montomorillonitic, thermic, Soils with Very Deep Zone; EBA–AD3

In this type of soil profile, the reduced layer ranges from 150 to 200 cm or more. Profiles have surface soil having brownish black color, silty clay, subsoil having brownish black color, heavy clay blocky structure.

vi) Clay over Hard Clay montomorillonitic, Thermic, Soils with Deep Zone; EBA–AD3–H

These soils occupy the uncultivated land which spread along the El Salam Canal. In this type of land natural vegetation of Karsa, a thin salt crust and white salt plain are often seen. This family of soil profiles

have surface soil reddish gray color, light clay, blocky structure, sub soil having hard clay at a depth of 80 cm up to the surface, reduced zone ranging 150 to 200 cm up to the surface. As for the deep clayey soils *having hard clay, subsoil-breaking and shorter distance underdrainage is* much in demand.

The cause of the hardness of hard clay must be further investigated.

b) Inundated Area

i) Profiles have surface soil clayey texture, dark greenish gray color, sub soils having hard clay, dark greenish gray color.

ii) Loamy Montomorillonitic, thermic, Soils; JAC–aw2

This type of profile is loamy in texture. These soils occupy the northern side of the Project Area. Profiles have surface soil, dark greenish gray color, sandy loam with some shell, subsoil dark greenish gray, loamy texture with some shell. These soils are perennially covered with brackish water. These soils are saline and have certain pyrites.

iii) Loamy over Clay, montomorillonitic, thermic, Soil; JAC–aw3

This soil also has fluvio-marine deposits and inundated soils developing over South Port Said. These soils are saline and have pyrites. Surface soils have a loamy texture. Soil profiles have reduced color.

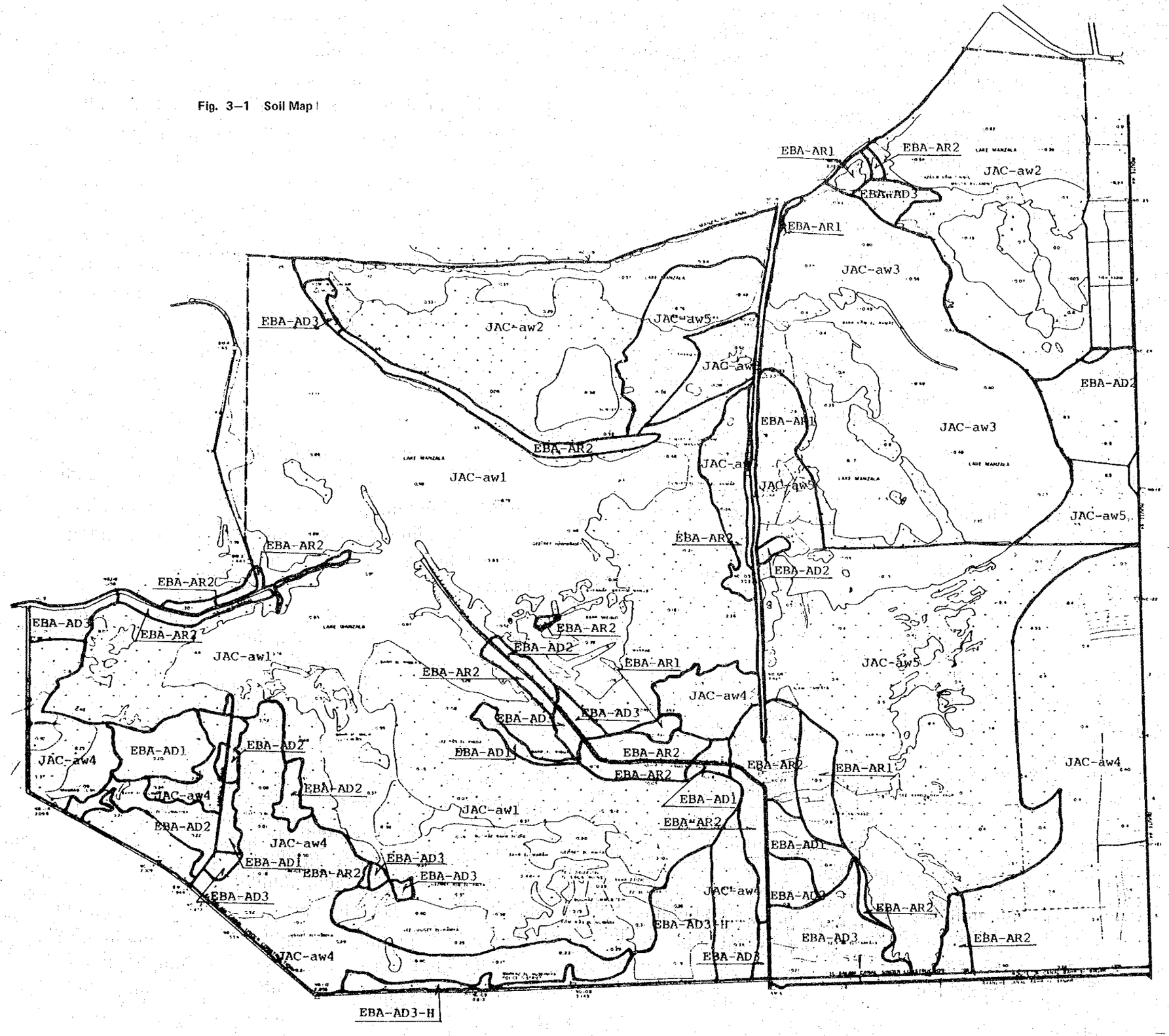
iv) Clayey Subsoil Brown Montomorillonitic, thermic, Soils; JAC–aw4

This land is also covered with brackish water continuously. However the water depth is relatively small. No vegetation is found on these lands. These profiles are clayey in texture and have yellow-brown subsoil.

v) Clayey, montomorillonitic, thermic, Soils, with Deep Zone Clayey Soil; JAC–aw5

This type of soil profiles have deep zone clayey in texture. Surface soils, dark greenish gray, soft, silty clay, subsoils having dark greenish gray color heavy clay. These soils are continuously covered with brackish water.

Fig. 3–1 Soil Map



2-4 Meteorology and Hydrology

The Project Area is defined as the coastal division and includes part of Lake Manzala and the seashore of the Mediterranean Sea.

The mean annual temperature is fairly constant at approximately 21°C. The highest mean monthly rainfall appears in winter, while there is no rain in the summer season. The annual rainfall is 73 mm in Port Said and 33 mm in Ismailia, and the mean annual relative humidity is 72 percent and 62 percent, respectively.

The Project Area partly covers the north-eastern shore of the Lake Manzala containing brackish water and having an average depth of 0.80 meter. Two outlets to the Mediterranean Sea are provided; these are the Gamile outlet and the Junction Canal outlet. These outlets are located at the northern shores of Lake Manzala and the eastern outskirts of Port Said.

The waterlevel of the lake is 0.50 meter on an average by the topographical surveying however, it may change by weather, season, etc.

ANALYSIS AND PLANNING

CHAPTER Ⅳ PRODUCTION PLAN

CHAPTER IV PRODUCTION PLAN

1. LAND USE

1–1 Soil Improvement

The fact that 90 percent of the proposed area is under the brackish water of Lake Manzala requires such measures as to eliminate obstacles to a smooth process of agricultural land building and to prevent the occurrence of various problems arising from arid and high atmospheric temperatures and/or continous non-precipitation days after land draining. Two stages including land reclamation and farming should be considered. The major fields of soil improvement are irrigation, drainage, desalting, acid neutralization, subsoil improvements, fertility improvement etc. Focussing on the reclamation stage, necessary measurs to be taken will be described in the below.

1) Drainage

It is desirable for growing crops, especially deep-root crops, to lower the groundwater table 100 cm below ground surface (130 cm is more desirable if possible) where the high groundwater table exists in the proposed area. On the other hand, execution of effective desalting requires the provision of appropriate drainage facilities. Soils in the proposed area are mainly of clayey type, whose mineral composition is montmorillonite and the high swollen trait tends to reveal a low permeability.

In consideration of these soil characteristics, it is indispensable to provide drainage system consisting of the well distributed open ditches and tile drains.

2) Desalting

Three desalting methods are suggested. The first method is to leach out salt by flooding with water from the formerly-provided drainage facilities. The second is to scatter gypsum (CaSo4) as soil improvement material which improves the soil texture and increases soil permeability by exchanging Na in the salt with Ca in gypsum. The third is to periodically practice desalting through continuous planting of rice in the flooded fields side by side with the particular irrigation method.

3) Subsoil Improvement

Hard-pan underlying the soils needs to be broken by use of a pan-breaker; otherwise, it is necessary to disturb subsoil layer by use of a subsoil breaker. This is to assist plants to grow their roots more briskly.

4) Acid Neutralization

In land draining, the lake bottom mud should be neutralized of its strong acidity by scattering chemicals such as calcium carbonate etc., to eliminate obstacles to proper crop growth.

5) Improvement of Soil Fertility

Soils in the proposed area have poor capability for crop growth because of their particular physical, chemical and biological characteristics. Therefore, soil fertility improvement is required. Since organic materials are not available in adjacent area, animal husbandry has been introduced into the project in view of improving soil's productivity by continously supplying good-qualities organic manures.

1–2 Land Capability Classification

(1) Introduction

The Project Area may as well be classified of its land capability at three stages of: (i) pre-reclamation; (ii) post-drainage, and (iii) post-construction. First stage represents the existing land conditions in which a great majority of the area is under the lake-water of the Manzala and the remaining dryland is agriculturally unproductive except 4% of the total which has been so far put under plow. Second stage envisages the land conditions which may be obtainable in the Project Area immediately after the lake-water will have been drained by use of pumps. Under such circumstances, the land would remain agriculturally unproductive because of an excessive salinity, poor permeability and hydraulic conductivity and inadequate aeration of soils. Third stage is put in such a situation as that appropriate drainage facilities should have been provided and desalinization could have been carried out through leaching combined with soil permeability improvement. The land capability classification in this report will be made on the assumption of the conditions obtainable in the above-said Third Stage.

(2) Criteria of Land Capability Classification

Capability of the Project land in the "post-construction" stage has been classified by 7 specifications of (i) soil texture; (ii) depth to hard pan or to barrier layer; (iii) salinity (EC); (iv) alkalinity (pH and ES)P; (v) slope; (vi) drainage hydraulic conductivity, and (vii) ground-water table, in general pursuance of the style adopted by the USBR (See Table 4–1).

(3) Land Capability Classification and Project Implementation

Analytical results given in the above would be summarized as follows:

1) In reference to the class-distinction into 1 to 5 major classes, the Project Area predominantly consists of Classes 2 and 3 which can be further sub-divided into 2-a, 2-b, 3-a and 3-b with respective characteristics as shown in the below.

Table 4–1 Specifications of Land Capability Classification

Land Characteristics	Class 1	Class 2	Class 3	Class 4	Class 5
Soil					
Texture	SL, SCL, L	CL, L, SiCL, SiL	SiC, C, SiCL	C, SiC	C
Depth to hard pan or to barrier layer	>2.0 m	2.0 – 1.5	1.5 – 1.0	<1.0	<1.0
Salinity (EC) (1)	0 – 4 mmhos/cm	4 – 8	8 – 15	15 –32	>32
Alkalinity (pH)	<8	<8	<8.5	<8.5	<8.5
" (EPS)	0 – 5%	5 – 10	10 – 15	15 – 20	20<
Topography (2)					
Slope	<3°	3° – 8°	8° – 15°	15° – 25°	>25°
Drainage					
Hydraulic conductivity	moderately well	moderate	moderate	moderately poor	poor
Groundwater table	>2.0 m	2.0 – 1.5 m	1.5 – 1.0 m	<1.0 m	

(1) Salinity (EC) is presumed to be lowered to the value which is not detrimental for growth of the recommended crops after the primary leaching. At places, however, EC may rise again through percolation of groundwater, if not properly controlled from desalinization viewpoint.

(2) Soil erosion, disadvantageousness of location and exchangeable cation of Ca and Mg may also be listed as detrimental factors but will be ignored since their influences are not as decisive in the Project area.

2) The Project Area can be almost entierly used for agricultural production, but stable output is conditional to careful soil management all through crop cultivation, particularly in the problematic areas which are distinguished by suffix of R in the below.

Characteristics of Two Major Land Classes

2–a: Relatively stable agricultural production is expected through improvement of drainage capacity by execution of the primary soil amelioration work; however, careful drainage management is required where deep-root crops are to be introduced since this area is spreading on low elevation nearby the Lake Manzala.

2–b: Equally stable production as in 2–a is expectable by controlling the supply of irrigation water to avoid excessive soil moisture content because this area is spreading on clayey subsoil.

2–bR: High salt content is detected (32 mmhos/cm)since it is spreading on clayey subsoils.

3–a: Poor drainage capacity inherent to this area need to be improved through amelioration of its soil texture by means of additional supply of humus which would also facilitate smooth plowing operations. The range of suitable crops will be somewhat restricted.

3–aR: Having similar characteristics as 3–a above, but its salt content is very much higher than 3–a.

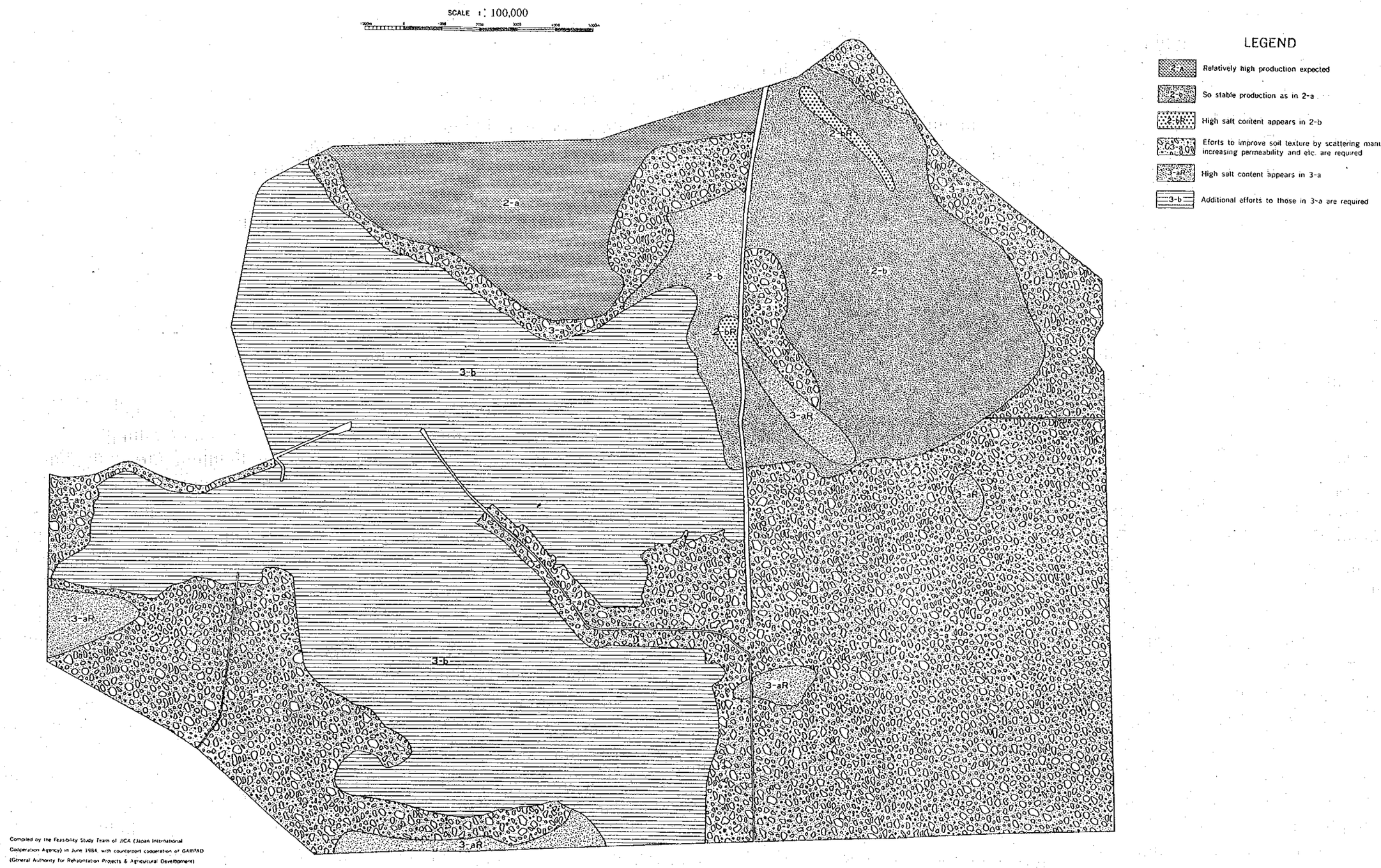
3–b: Additional efforts to those in 3–a are required in avoidance of an excessive soil moisture including breaking of hard clay layer if it is spreading at shallow depth, otherwise the same crops as in 3–a cannot be introduced.

The area falling into each class of land will be as follows:

Table 4–2 Area Falling into Each Class of Land (feddan)

Classification	North Hussinia	South Port Said	Total
2–a	7,240	–	7,240
2–b	2,090	11,050	18,140
2–bR	100	400	500
3–a	16,880	29,030	45,910
3–aR	1,320	520	1,840
3–b	41,370	–	41,370
Total	69,000	41,000	110,000

Fig. 4–1 Land Capability Classification Map



2. AGRICULTURE

2–1 General

The agricultural policy of Egypt was to export profitable crops such as paddy rice, vegetables, cotton, etc., and to import low priced main food crops such as wheat, maize, etc., for efficiently using the small arable land. However, the rapid rise in population has caused the exports of rice to decline, imports of food crops to rise and the balance of international payments to worsen.

This project selects the suitable crops for the area, including main crops, vegetables and others having a great demand for subsistence, and profitable vegetables, fruit trees, industrial crops and others with a great export demand.

Furthermore, mechanization focusing on cultivation and pest control, etc., was planned to assist a quick agricultural development in the newly reclaimed land where most of the plots will be sub-divided among poorly equipped small-size farm families. Accordingly, systematization of the agricultural activities by farm groups was planned to efficiently utilize the machinery.

2–2 Selection of Crops

Selection of crops for introduction in the proposed project area has been made from the suitability to the given soils and climate, demand at home and abroad, marketability, etc. Much has been learned from experiences obtained in the neighbouring Deltaic region. A general evaluation of crops is given in Table 4–3, and the specific descriptions are as follows:

(1) Cereals and Industrial Crops

Paddy rice presupposes much water supply, but helps to reduce various constraints on crop-growth wich arise from unfavourable properties of the soils, and assists leaching by flooding, thus it will need to be established as a mandatory crop in determining the crop rotation. Furthermore, rice has potential importance as an export item. Barley has a high salt tolerance and could have been included in the crop rotation during a period right after the project completion but for insignificant profitability. Wheat is one of the main food crops in Egypt, being imported in large amounts due to insufficient production at home, but its salt tolerance is lower than barley and the high atmospheric temperatures in the project area may not guarantee a high quality product. Maize is also imported though it is one of the chief food items of the Egyptians.

As to oil crops, sesame which is extensively grown in desert regions is not suited to heavy clay soils. Sunflower is more suitable to highly permeable soil than to heavy clay, and good qualitied products are not obtained with the high temperatures at harvest. Soybeans are suited to somewhat clayey type soils and the

Table 4–3 Evaluation of Selected Crops

Crop	Domestic Demand	Export	Salinity tolerance	Drought resistance	Water requirement	Applicability to heavy clay soil
Berseem	a		b	b		b
Sorghum	b		a	a	c	c
Sudan Grass	b		a	a		c
Wheat	a		a	b	b	b
Barley	b		a	a	b	b
Rice	b	a	b	c	a	a
Cotton	b	a	a	b	b	a
Maize	a		c	b	b	a
Soybeans	a		a	c	c	b
Sesame	a		b	b		c
Sun Flower	a		b	b		c
Sugar Beet	a		a	b	b	a
Beans	a		c	c	c	b
Peas	a		c	b	b	b
Tomatoes	a	a	b	a	b	b
Onions	a	a	c	b	c	c
Cabbages	b		c	b		b
Broccoli	b		c	b		b
Lettuce	b		c	c	c	b
Spinach	b		b	a	c	b
Cucumber	a		b	b	c	b
Dates	a	b	a	b		c
Guava	b		c	b		b
Grapes	b		c	b		b
Lemon	b	a	c	b		b

a	Big	Big	High	High	Much	High
b	Medium	Medium	Medium	Medium	Medium	Medium
c	Small	Small	Low	Low	Little	Low

oil processed has a good quality although the yield is not high because of high temperature.

Cotton is extensively grown in the delta region and has a high salt tolerance and can be a typically suitable crop to the area. However, the extremely labor-intensive trait in harvesting imposes a big problem on farming, and thus, mechanization in harvesting is mandatory. However, machinery-intensive harvesting method suitable to Egypt has not yet been found.

Sugar beets have a great root depth (about 2 m as the maximum) and are suited to the proposed area, since they can grow in any type of soil, and have an extremely high salt tolerance trait. However, they suffer easily from disease/insect, and thus, three-year crop rotation should be paddy rice. The neighbor crops of rice/beans suffer from few disease/insect common to sugar beets. Otherwise, careful pest control should be provided. The time of sowing and harvesting depends on temperature, because the sugar content in the root increases with low temperature and decreases with high temperature, while the root weight increases for high temperatures and decreases for low.

(2) Fodder Crops

Berseem is a winter crop suited to the area and is extensively grown in the delta region and having a high salt tolerance trait. For Summer crops, sorghum and the related sudan grass are suggested. These are suited to well permeable soil, and can also be grown in heavy clay soil if not submerged. About the applicability to fodder crops, they have priority to maize for their high salt tolerance trait and several harvests. Sorghum is somewhat more productive than Sudan grass.

(3) Vegetables

Winter crops include tomatoes, cabbages, broccoli, lettuce, spinach, onions, beans, peas, etc., and summer crops include tomatoes, cucumbers, kidney beans, okra, corn, etc. Generally, vegetables suffer easily from salinity. Tomatoes and melon-neighbors have a relatively high salt tolerance but should not be planted in the soil having an excess of salinity. Furthermore, careful protection against disease/insect should be provided to eliminate any adverse effects on sugar beet which is adopted in crop rotation.

Extension of vegetable growing is limited because of labor-force. The variety of vegetables grown changes according to the large demand elasticity. Thus, in this project, not only fresh vegetable but also processed/preserved ones were chiefly chosen. Furthermore, tomatoes harvested in winter are expected to be exported.

(4) Fruit Trees

The proposed area is not suited for growing fruit trees as it is mostly covered with

heavy clay soil, and has a high ground water table. Grapes, guava, etc., are in farmers garden and can be grown in heavy clay soil. Date palms are also grown despite their being not very suitable to the heavy clay soil, the reason seems to be that it has a high salt tolerance. However, it was not chosen because it is not grown extensively.

2–3 Cropping Patterns

The arable land within the proposed area occupies a total area of 85,800 feddan, including 65,406 feddan (about three-fourths of the total) in the southern section of clay soil type, and 20,394 feddan (about one-furth of the total) in the northern section of loamy soil type. The market accessibility of the northern section suggests the priority of labor-intensive crops such as vegetables, etc. to the southern.

Heavy clay soil is predominant in the area, including high salinity content. For leaching, paddy rice and berseem should be cultivated for the first three years in rotation. After three years, the salinity content will have declined, so that middlelevel strong salt tolerance crops can be grown. The cropping patterns starting from the fourth year have been decided in three-year rotation, as follows:

Cropping pattern – 1

Summer crops	Winter crops
Paddy rice	Berseem
Soybeans	Sugar beet
Sorghum	Vegetables

Cropping pattern –2

Summer crops	Winter crops
Paddy rice	Berseem
Soybeans	Sugar beet
Sorghum (1/2) + Vegetables (1/2)	Vegetables

In the above patterns, winter vegetables include tomatoes, onions, cabbages, beans, peas, spinach, etc. Summer ones include tomatoes, corn, french beans, okra, etc. These are traded as fresh or processed products, and the tomatoes and onions are partly exported.

Cropping pattern–1 is established for the southern clay soil section, and the pattern–2 is established for the northern loamy soil section. Natural soil improvement for drainage by cultivation in several years may extend labor-intensive farming within the existing manpower ceiling.

Fig. 4–2 Cropping Pattern No. 1

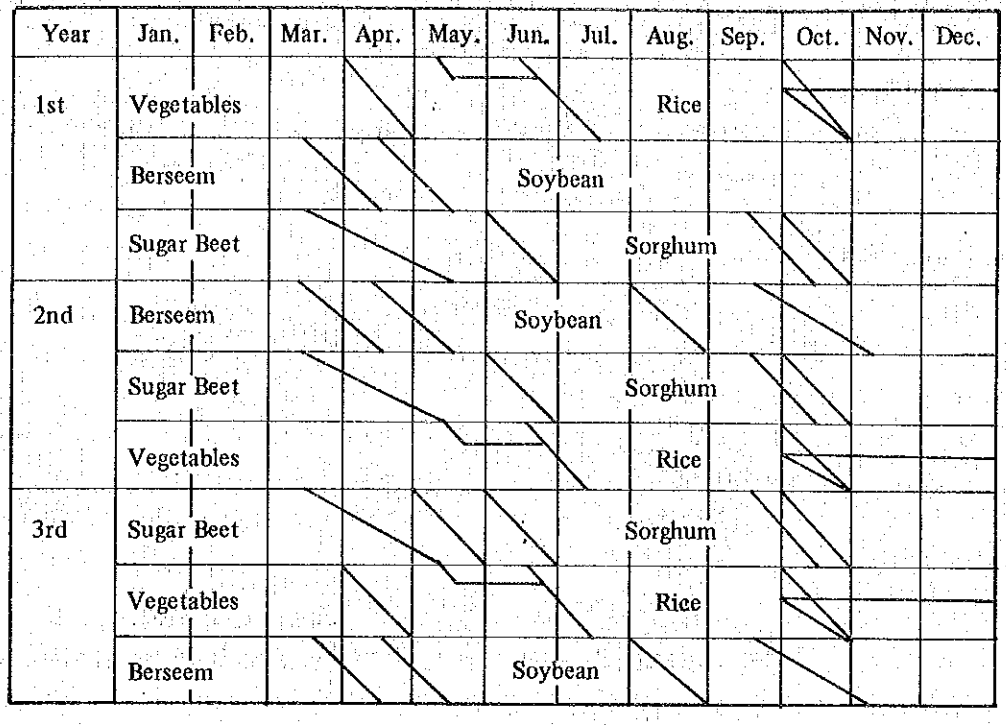
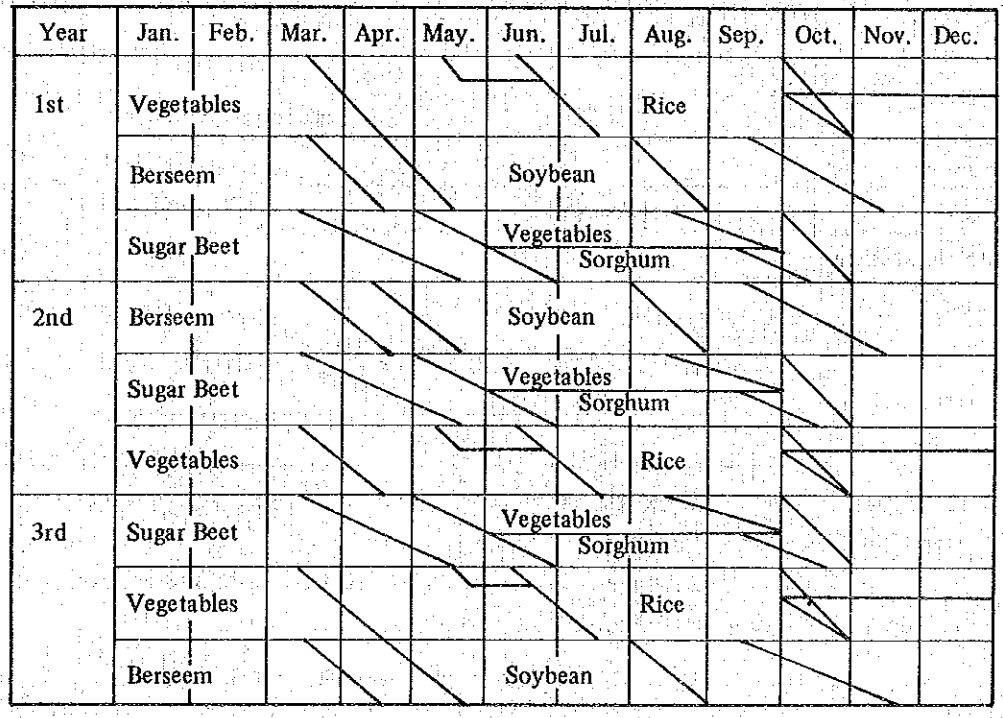


Fig. 4–3 Cropping Pattern No.2



2–4 Farm Production

The time of planting and way of growing for each crop are shown in Table 4–4.

Probable trends in increases in yield, output of each crop for the area as a whole after starting the planned farming and the trends in output for each construction section are shown in the Annex C.

2–5 Farm Mechanization

Present mechanization among the farms in the proposed area is that 27 farms out of 34 of the total (79 percent) are using plows, and 13 farms (38 percent) are using threshers. Most of the farms do not possess them and so a contract system by big farms or cooperatives has been developed. Based on the existing high crop intensity of 200 percent,extension of labor-intensive crops as vegetables, etc. and the difficulty of hiring additional labor, this project will assist the development of efficient mechanization.

Most of the area is covered with heavy clay, which cannot be cultivated by light-weight tractor when dried. Thus, 90 Ps tractors for cultivation, and 40 Ps tractors for farming such as leveling and others were suggested. The utilization of machinery for each crop is shown in Table 4–4.

Table 4–4 Utilization of Machinery for Each Crop

	Sugar beet	Rice	Soybeans	Berseem	Sorghum	Tomato
Primary Plowing	Tractor >90 Ps, Chisel plow					
Manure Spreading	Trailer					
Harrowing		Puddler	Tractor 40 Ps, Disk harrow, Leveller			
Fertilizing and seeding	Tractor, Broad Castor					
Transplanting		Transplanter				
Weeding and thinning	Sprayer, Hoe					
Protection	Sprayer, Trailor					
Cultivating	Tractor, Cultivater, Ridger					
Harvesting	Harvester	Combine				
Transportation	Tractor, Trailer					

Utilization of transplanters for paddy rice is limited to those who are well educated or have much experience in farming, because of the technology required in operation. Heavy and middle-weight machinery is managed by the cooperatives, and light-weight machinery is handled by the individual farmers.

The planned machinery for this project is shown in the following Tables 4–6 and 4–7.

Table 4–5 Planted Area, Yield per Feddan, and Production by Crop

Whole Area: 110,000 feddan
Gross Area Owned by Farmers: 88,200 feddan (80 %)
Net Cultivable Area: 85,800 feddan (78%)

Soil-wise Distribution of Cultivable Area
Clayey Soil: 65,406 feddan
Loamy Soil: 20,394 feddan

	Clayey Soil ; 65,406 feddan				Loamy Soil: 20,394 feddan				Total: 85,800 feddan	
	Ratio	Area (feddan)	Yield (ton)	Production (ton)	Ratio	Area (feddan)	Yield (ton)	Production (ton)	Area (feddan)	Producton (ton)
Rice	1/3	21,802	3.0	65,406	1/3	6,798	3.0	20,394	28,600	85,800
Berseem	1/3	21,802	25.0	545,050	1/3	6,798	25.0	169,950	28,600	715,000
Sugar beet	1/3	21,802	25.0	545,050	1/3	6,798	25,0	169,950	28,600	715,000
Soybeans	1/3	21,802	1.2	26,162	1/3	6,798	1.2	8,158	28,600	34,320
Sorghum	1/3	21,802	18.0	392,436	1/6	3,399	18.0	61,182	25,201	453,618
Winter Veg.	1/3	(21,802)			1/3	(6,798)			(28,600)	
– Tomatoes	(15%)	3,270	15.0	49,065	(15%)	1,019	15.0	15,285	4,289	64,350
– Onions	(15%)	3,270	10.0	32,710	(15%)	1,019	10.0	10,190	4,289	42,900
– Cabbages	(5%)	1,090	20.0	21,800	(5%)	339	20.0	6,780	1,429	28,580
– Beans	(30%)	6,541	1.5	9,812	(30%)	2,040	1.5	3,060	8,589	12,872
– Peas	(20%)	4,361	1.0	4,361	(20%)	1,360	1.0	1,360	5,721	5,720
– Spinach	(15%)	3,270	8.0	26,168	(15%)	1,019	8.0	8,152	4,289	34,320
Summer Veg.					1/6	(3,399)			(3,399)	
– Tomatoes					(20%)	680	15.0	10,200	680	10,200
– Corn					(50%)	1,700	8.0	13,600	1,700	13,600
– French Beans					(10%)	340	4.5	1,530	340	1,530
– Okra					(20%)	680	6.0	4,080	680	4,080

Table 4–6 Machinery Plan of the Project

		Agricultural Coop	Agr. Coop for Land Reclamation	Total
Tractor	90 Ps	168	72	240
Tractor	40 Ps	137	59	196
Chisel Plow	3 m	51	22	73
Disk harrow	18" x 24	39	16	55
Leveller		39	16	55
Puddler	3 m	29	12	41
Seeder	8 rows	31	14	45
Sprayer	600 ℓ	18	5	23
Transplanter	8 rows	20	8	28
Cultivater	3 rows	28	12	40
Ridger	8 rows	31	14	44
Combine	135 cm	23	10	33
Broadcaster	4.5 m	8	3	11
Trailer		37	16	53
Truck		37	16	53
Beet harvester	4.5 m	17	8	25

Table 4–7 Machinery Efficiency

	Ope. Width (m)	Ope. Speed (km/hr)	Field Efficiency (%)	Field Ope. (hr/ha)	Capacity (hr/fed)
Chisel Plow	3.00	5	70	1.05	0.41
Disk Harrow, 14" x 36	3.66	7	80	0.49	0.21
Puddler, 40 Ps	2.70	4	80	1.16	0.49
Broadcaster, 40 Ps	10.00	5	60	0.30	0.13
Transplanter, 8 rows	2.40	2.5	50	3.00	1.26
Cultivater	1.50	6	80	1.72	0.72
Combine	1.35	4	55	3.36	1.41
Sprayer				0.29	0.12

2–6 Commodities

The requirements per feddan for selected seeds, fertilizers and weeding chemicals are shown in the Annex C.

Herbicides are applied only to the first stage of growing, and mechanical weeding is applied to the following stages. The agro-chemicals were selected only from those which are not highly toxic to men and animals.

2–7 Farm Management

The proposed agricultural development plan envisages a new pattern of farm management which adopts mechanization and its incorporation with animal husbandry. The aggregate labour requirements for such a mechanized and animal husbandry-combined farm management of 5–feddan farm are shown in Table 4–8. Some differences in the labour requirements occur between milk cow breeding family and beef cattle rearing family.

On the assuption that each family settling into the project area will generally consist of a couple of man and his wife with one child, each family is assumed to self-supply two full adult labourers (adult female or a child is supposed to attain a labour efficiency equivalent to one-half of an adult male). With a 25–day month, each family is expected to self-supply labour equivalent to 50 man days per month or 600 man days per year.

As will be known from appendices, the proposed animal husbandry-combined farming is not very tight from the labour distribution point of view, thanks to mechanization, for 5–feddan management. Any surplus labour made available to the 5–feddan farmers is expected to be gainfully employed by 15–feddan and 20–feddan farmers.

Table 4–8 Labour distribution by cropping pattern

(Unit: man-day/month)

Pattern	Crops or Animals	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept.	Oct.	Nev.	Dec.	Total
Pattern No. 1	Crops	12.0	6.4	17.6	29.6	38.4	24.8	14.4	15.6	11.2	12.8	4.8	33.6	221.2
	Animals	11.5	10.4	11.5	11.3	11.5	11.3	11.5	11.5	11.3	11.5	11.3	11.5	136.1
	Total	23.5	16.8	19.1	40.9	49.9	36.1	25.9	27.1	22.5	24.3	16.1	45.1	357.3
No. 2	Crops	12.0	7.2	18.4	44.5	37.9	24.8	19.2	25.6	21.8	12.8	4.8	33.6	262.6
	Animals	11.5	10.4	11.5	11.3	11.5	11.3	11.5	11.5	11.3	11.5	11.3	11.5	136.1
	Total	23.5	17.6	29.9	55.8	49.4	36.1	30.7	37.1	33.1	24.3	16.1	45.1	398.7

3. ANIMAL HUSBANDRY

3–1 General

In the project planning, animal husbandry would play an important role such as: convertion of a sizeable production of fodder crops into various livestock products, helping reduce the rapidly increasing imports of meat and dairy products; provision of raw materials for agro-industrial development; production of a considerable amount of animal manure for improvement of heavy clayey soils which are predominant in the Project Area.

3–2 Breeding Plan

(1) Selection of Livestock

For the selection of livestock, the following criteria are taken into consideration:

a) to reduce the increasing demand for imported meat and dairy products,

b) to efficiently utilize a sizeable fodder production resulting from the proposed cropping patterns,

c) most of heavy on-farm work like land preparation will be done by agricultural machineries from the viewpoint of soil condition prevailing in the Project Area.

On the basis of the above criteria, dairy cattle in terms of the Friesian breed are recommendable as a mainstay of the proposed animal husbandry plan under this project, in combination with the local Baladi and reasonable percentage of buffaloes.

(2) Breed of Selected Livestock

a) Friesian

Friesian breed is recommendable for both dairy cattle and beef cattle because of the largest milk production and superior meat quality. Currently it occupies a considerable portion of dairy cattle in Egypt having been raised for over 50 years.

b) Baladi

Baladi of local variety produces a high quality meat and milk, being commonly raised in Egypt together with buffalo.

c) Buffalo

Most commonly bred among Egyptian farmers for meat and milk apart from as draft animal.

(3) Feeding Unit and Nutrients Requirement

a) Feeding Unit of Cattle

Feeding unit for this Project is composed of an adult cow (delivered cow) and its fattening cows of both dairy and beef cattle. Details of the composition of feeding unit are presented in Annex D.

b) Nutrients Requirement

Feeding standard for the Project employs SE (Starch Equivalent) and DCP (Digestable Crude Protein) which are adopted by Animal Production Research Institute, Ministry of Agriculture, Egypt.

Feeding standard required for adult cow, fattening cow, and raising cow, the chemical content of various crops are presented in Annex D. Based on the items, nutrients requirement per feeding unit is estimated in Annex D.

(4) Forage Production and Availability of Nutrients

All roughage shall be self-supplied from the farmers' own field and the nutrients not supplied by the roughage will be supplemented by the concentrate (mixed feed).

Berseem (Egyptian Clover) cropped during the winter will be fed between the autumn and the spring while the sorghum, rice straw, and hay will be fed between the summer and the autumn. In the winter and the summer, mixed feed will be fed whenever neccessary by making use of beet pulp produced as "by-product" at the sugar beet plant in the Area.

Forage production in the Project Area at the full development stage and its nutrients production are presented in Annex D. Availability of total nutrients per annum is estimated at SE of 129,800 ton and DEP of 23,000 ton.

(5) Farming Type and Method

It is planned that all farmers to be settled in the Project Area shall manage crop cultivation as well as animal husbandry from the following viewpoints:

a) fodder resources to be produced by the proposed three year crop rotation will be efficiently utilized and thus maintain soil conservation.

b) every farmer can supply animal manure to the respective farm for soil improvement.

c) he can pay more attention to their feeding and breeding animals.

d) every farmer will be assured of stable income.

(6) Livestock Introduction Plan and Annually Feedable Number of Livestock

The proposed livestock introduction plan will have to be co-ordinated with the annual plan of forage crop production in order to realize stable animal husbandry income at an earliest time.

Friesian breed which constitute the main livestock will need to be introduced since the initial stage of the Project development to attain high economic efficiency. Considering, however, the foreign exchange reserve situations as well as the readiness of supply on the part of the countries of origin, three alternative cases of animal introduction centering around Friesian have been studied as follows:

Table 4–9 Three Cases of Livestock Introduction Plan

(Unit: Head)

Case	Friesian				Baladi			Buffalo		
	Total	Year			Year			Year		
		1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
I	3,000	1,000	2,000	–	1,000	2,000	–	1,000	–	–
II	5,000	2,000	3,000	–	1,000	1,000	3,000	1,500	–	–
III	6,000	2,000	2,000	2,000	1,000	3,000	2,000	1,800	–	–

The quantam and timing of animal introduction in these 3 cases may be summarized as follows:

Case 1: 3,000 heads of Friesian and 3,000 heads of Baladi will be introduced in 2 years (1,000 each in Year 1 and 2,000 each in Year 2), with 1,000 heads of buffalo to be introduced once for all in Year 1.

Case 2: 5,000 heads of Friesian to be introduced in 2 years (2,000 in Year 1 and 3,000 in Year 2), together with 5,000 heads of Baladi in 3 years (1,000 each in Years 1 and 2, and 3,000 in Year 3); 1,500 heads of buffalo will be introduced once for all in Year 1.

Case 3: 6,000 heads of Friesian to be introduced in 3 years at equal instalment of 2,000 per year, side by side with 6,000 heads of Baladi (1,000 in Year 1, 3,000 in Year 2 and 2,000 in Year 3); 1,800 heads of buffalo will be introduced once for all in Year 1.

In Year 12 when forage production is expected to reach full development stage, the number of Baladi and buffalo would combinedly represent 10 – 15% of the total number of cattle. Baladi, the local variety, would occupy about 30 percent of the total cattle population between Year 6 and Year 9, and since Friesian's lactescent period lasts for 7 years, Baladi would be largely replaced by Friesian in Year 13 with Case III, Year 14 with Case II, and Year 17 with Case I. The stage where Baladi would

be largely replaced by Friesian corresponds to the full development stage from animal husbandry point-of-view. Animal husbandry products in Year 12 when forage production reaches its full development stage and those in different years of animal husbandry full development stage among Cases I, II and III are estimated as per Table 4–10.

Table 4–10 Animal Production at Different Stages (Tons)

Case	Year 12				Animal Husbandry Full Development				
	Friesian+Baladi		Buffalo		Year	Mostly Friesian		Buffalo	
	Meat	Milk	Meat	Milk		Meat	Milk	Meat	Milk
I	2,952	84,715	204	2,370	17	5,948	187,425	402	3,604
II	4,651	141,048	305	3,555	14	5,011	183,619	515	4,759
III	5,376	157,405	367	4,266	13	5,316	175,170	589	5,440

Consequently, Case II has been adopted as the most balanced animal husbandry development plan from both financial as well as economic effciency viewpoints. As regards sheep or goat, each household can keep 1.5 heads per year by the fodder left over after consumption by Friesian, Baladi and buffaloes.

3–3 Facilities Plan

(1) Facilities for Livestock Breeding

Loose housing barn 1 unit (20 m^2 per head) and hay storage space – open type with trough and water – trough, being surrounded by fence and roofed with slate.

Small truck: 1 unit for transportation of soilage, milk, etc.

(2) Milk Collecting Center

It is planned to establish a milk collecting center in each village (51 in total) with a bulk cooler, which will be operated and managed by agricultural cooperatives. Farmers bring their milk to the milk collecting center by themselves after milking, which will be kept in the bulk cooler at a low temperature to prevent spoilage. The factory shall be in charge of transporting milk from the center to its facilities.

It is recommended that every 30 farms or so shall organize a king of inspection association by themselves, in which farmers themselves shall carry out checking of milk quantity, quality anf fat percentage, etc.

(3) Cattle Breeding Center

a) Function and Management

In consideration of that a large number of cattle (Friesian and Baladi) will be

bred and fed in the area after full development stage, it is proposed to establish a cattle breeding center of which main objectives are to produce frozen semen for artificial insemination by breeding and maintaining both bulls of Friesian and Baladi in good quality as well as to raise bulls for replacement and supplement. The proposed breeding center shall belong to and be managed by the public sector.

b) The center will periodically collect semen and preserve frozen semen. Artificial insemination will be carried out by veterinarians visiting farmers' houses. Friesian frozen semen may be imported whenever neccessary in order to produce superior gene.

It is anticipated that the center will provide a forum for and conduct experiments in transplantation of fertilized ovum and artificial pregnance.

The dimension of the center will be as follows:

Item	Dimension	
No. of Sires (Bull)		13 heads
Staff	15 persons	
Building Lot	Office	0.05 Fed
	Cattle Shed	0.2 Fed
Lot Requirement	1.5 Fed	

3–4 Institutional Set-Up

In order to smoothly operate the proposed animal husbandry plan, it is needless to say that farmers' utmost efforts and positive action by livestock growers' cooperative are required, furthermore guidance and cooperation given by the central government as well as Governorate are equally very important. The following items are considered to be essential;

a) Exention Services

It is necessary to sufficiently mobilize the extension workers who can give guidance to farmers technically in terms of hygienic milking, checking system of milk quality, fodder cultivation and harvesting and so on. Especially dairy cattle farmers must be well attended to by the extension workers.

b) Epidemic Prevention

For attaining the goals of the animal husbandry plan, it is a basic requirement that all cattle to be fed in the Project Area be maintained in good hygiene and have satisfactory productivity. For this reason, it is recommended to establish an Animal Hygienic Service Center possibly managed by Governorate, in which necessary veterinarian services and assistance will play an important role in pre-

venting infectious diseases and Egyptian fever, guiding and implementing artificial insemination, extending animal hygienic principles and so on.

c) Guidance for Introducing Breeding Cattle

It is recommended that when importing Friesian cattle, a quarantine officer and an official buyer shall be dispatched to export countries for checking quality of cattle as well as epidemic diseases, and shall select satisfactory cattle.

In case of introducing Baladi cattle, the same selecting system mentioned above should be applied, except that the necessary cattle shall be procured domestically through assistance and cooperation from the central government and Governorate.

4. FISHERIES PLAN

4–1 Influence of Reclamation on Existing Fisheries

A new fishing ground having the same level of productivity will be formulated in Bashtir water area outside of the proposed area by using the agricultural discharge involving high nutrient, after present fishing ground in El Genki water area is to be all reclaimed (See Fig. 4–4).

Building a new ground and wasting the present ground will change existing fisheries. The influence of reclamation to existing Fisheries is estimated by studying on five items:

Aquatic plant distribution boundary,
Nutrient inputs,
Lag period of normal production in the new fishing ground,
Change in type of fishery, and
Remaining productivity in existing ground.

From the above analyses about 75 percent of total loss in the present fishing ground was estimated to be covered with the additional production in the new ground, as shown in Table 4–11.

4–2 Feasibility of Fish Farming in Reclamation Area

Egyptian government's policy indicates all the reclaimed area is utilized for agriculture except where the soil characteristics are not suitable. By considering this statement, the required study for the feasibility of fishery development in the proposed area was limited to three discussions:

Applicability of non-cultivable land for fish farming,
Possibility of fish farming in paddy farm basin, and
Possibility of fish farming in canals.

From the above discussions, it was judged that any type of fishery development in the reclamation area such as in paddy farm or in canals was not feasible.

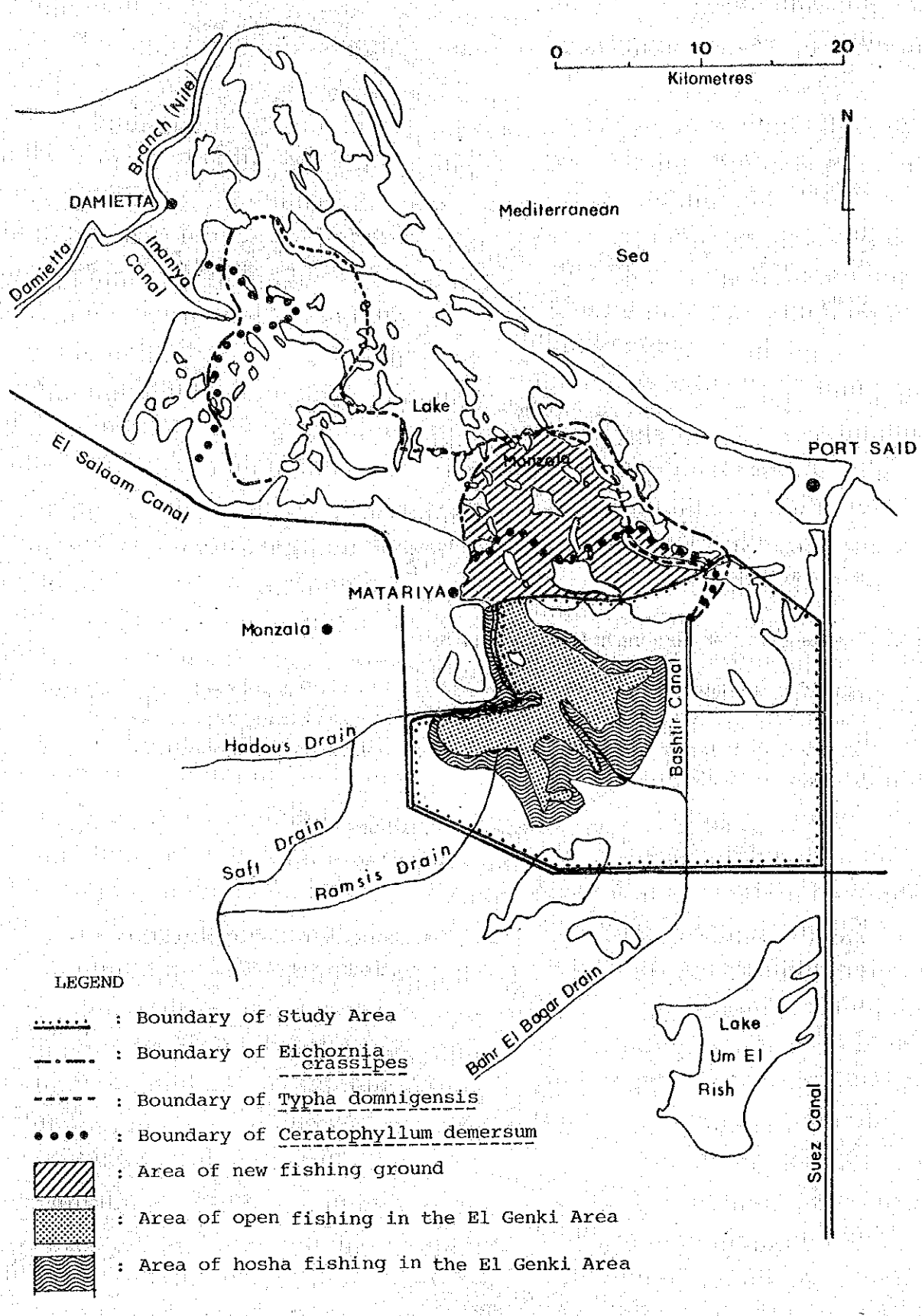


Fig. 4–4 Boundary of New Fishing Ground

Table 4–11 Comparison of Production Structure between Existing and New Fishing Grounds

Item [1]		New Fishing Ground		Existing Fishing Ground		Balance	
		1st yr.	2nd yr.	N.H	S.P.S	1st yr.	2nd yr.
Open Fishing							
1) Area	(10^3 fed.)	24.1	24.14	12.19	8.25	3.70	3.70
2) Yield	(10^3 kg/ fed.)	0.45 [2]	0.70 [2]	0.85	0.15	–	–
3) A.P.	(10^3 t/Yr.)	10.86	16.90	10.36	1.24	–0.74	5.30
4) Ave. F.P.	(LE/kg)	0.50	0.50	0.50	0.54	–	–
5) A.R.	(10^6 LE/Yr.)	5.45	8.45	5.18	0.67	–0.42	2.60
6) A.P.C.	(10^6 LE/Yr.)	1.57	2.44	1.50	0.25	0.18	0.69
7) A.N.B.	(10^6 LE/Yr.)	3.80	6.01	3.68	0.42	–0.24	1.91
Hosha Fishing							
1) Area	(10^3 fed.)	3.70	3.70	7.50	0.70	–4.50	–4.50
2) Yield	(10^3 kg/ fed.)	0.40 [2]	1.20 [2]	2.00	0.80	–	–
3) A.P.	(10^3 g/Yr.)	1.48	4.44	15.00	0.56	–14.08	–11.12
4) Ave. F.P.	(LE/kg)	0.50	0.50	0.50	0.55	–	–
5) A.R.	(10^6 LE/Yr.)	0.74	2.22	0.50	0.31	–7.07	–5.59
6) A.P.C.	(10^6 LE/Yr.)	0.27	0.81	2.74	0.12	2.59	2.05
7) A.N.B.	(10^6 LE/Yr.)	0.47	1.41	4.76	0.19	–4.48	–3.54
Fish Farming							
1) Area	(10^3 fed.)	–	–	17.69	7.40	–25.09	–25.09
2) Yield	(10^3 kg/fed.)	–	–	0.05	0.10	–	–
3) A.P.	(10^3 /Yr.)	–	–	0.88	0.74	–1.62	–1.62
4) Ave. F.P.	(LE/kg)	–	–	0.50	2.50	–	–
5) A.R.	(10^6 LE/Yr.)	–	–	0.44	1.85	–2.29	–2.29
6) A.P.C.	(10^6 LE/Yr.)	–	–	0.18	1.20	1.38	1.38
7) A.N.B.	(10^6 LE/Yr.)	–	–	0.26	0.65	–0.91	–0.91
Grand Total							
1) A.R.	(10^6 LE/Yr.)	6.17	10.67	13.12	2.83	–9.78	–5.28
2) A.P.C.	(10^6 LE/Yr.)	1.84	3.25	4.42	1.57	4.15	2.74
3) A.N.B.	(10^6 LE/Yr.)	4.33	7.42	8.70	1.26	–5.63	–2.54

Remarks/1.: A.P. = Annual production, Ave. F.P. = Average fish price,
A.R. = Annual revenue, A.P.C. = Annual production cost, and
A.N.B. = Annual net benefit

/2: (target fish yield, fish yield of existing fishing ground) – (original fish yield of new fishing ground)
Exploitation rate of the 1st year of new fishing ground is assumed to be 60% of the target fish yield.

5. AGRO-INDUSTRY

5-1 Introduction

As regards agro-industrial development in the proposed project area, the Egyptian Government (GARPAD) expressed the strong desire which might be briefed as follows:

(1) Various agricultural and animal husbandry products expected to be raised should be turned for processing as far as possible to increase the added-value begotten in the Project Area;

(2) Since two areas, the one under the North Hussinia/South Port Said Project and the other under the South Hussinia Project, for which feasibility study has been conducted through the Japanese Government's technical assistance, are proposed to be amalgamated into a new Governorate, agro-industries to be planned there should preferably be such that are conceived from the viewpoint of "economy of scale", and be equipped with modern highly efficient facilities.

Thereupon, the Feasibility Study Teams decided to treat these two project areas as an integral whole in projecting appropriate agro-industries and in determining their optimal scales which should ultimately stem from the availability of materials and the products' marketing perspectives.

5-2 Availability of Materials

Since the cropping patterns suggested for each one of these two project areas have been determined by the same policy and through the same approach in view of agricultural development combined with encouragement to animal husbandry, agro-industrial planning toward the combined area has been facilitated by the fact that the kinds of farm products and building-up of their yields have had little difference between them and the cropping patterns themselves have been so adjusted as to reflect various requirements from the agro-industrial development point-of-view.

It was originally designed that the materials for processing might as well comprise the three categories: (a) agricultural products, (b) animal husbandry products, and (c) by-products obtainable through processing of (a) and (b). Agricultural products would consist of sugar beet, rice, soy bean and vegetables, while animal husbandry products would comprise cattle and milk. Rice bran, soy bean cake, animal blood and bone have been visualized for compounding into feedstuff, especially for chicken. Intestines and hides were also taken into accout in identifying the technical feasibility and economic viability of the slaughter-houses. The inter-relationship or linkage between different (material)–(product)–(by-product) was thus assumed as shown in Table 4–12.

Integrated agro-industrial planning, however, has never been free from difficulties, particularly in identifying the scale of respective factories or plants. While it has to be designed to deal with the amount of material expected to be made available at its full-

-development stage, such a stage arrives at only gradually; thus during each crop's yield build-up period the plant will remain underfed with material or, in other words, its capacity will have to remain under-utilized. This problem has been made less easy to solve due to the difference in the project construction period between the two projects plus post-construction leaching and trial cropping schedule (5-year construction period to be followed by 2-year leaching and 2-year trial cropping in case of the South Hussinia Project and total 9-year construction period including 1 year primary leaching and 3-year trial cropping in case of the North Hussinia/South Port Said Project.) Moreover, the construction work and the succeeding leaching-trial cropping is scheduled block by block in both cases, giving the irregular build-up of various crops.

Since such a problem would remain somewhat unavoidable in every reclamation project as long as agro-industry planned there would be asked to utilize never less nor more than it produces, the agro-industrial development plan toward the given project-areas could not adhere to 'one plant for each industry' policy and, with some specific industries two alternative methods have been used: the one is to arrange for a gradual build-up of the factory capacity line after line until the full-development stage will be reached and the other is to assume supply of ex-territorial materials until the local production remains below an economic operation of the plant.

Table 4–12 Inter-relationship or Linkage between Different Agro-Industries

Materials	Products	By-products	Category III: Feedstuff
(1) Sugar Beet	White Sugar	Molasses and Pulp	Rice Bran Oil ↑
(2) Rice	Polished Rice	Rice Bran →	(Extraction) →
(3) Soy Bean	Soy Bean Oil and Soy Bean Flour	Soy Bean Cake →	
(4) Vegetables			
– Tomatoes	Tomato Paste		
– Cabbages	Canning, bottling, dehydration and freezing		Corn ↓ FEED
– Beans			
– Peas			
– Spinach			Fish-meal
– Okra			
– Broccoli			
(1) Cattle	Meat	Blood and Bone →	
		Intestines & Hide	
(2) Milk	UHT Milk, Butter and Cheese		

5–3 Demand and Marketing Perspectives

Since cane-sugar refining has been discouraged in the country, the marketing potential of beet-sugar turned very bright and, though soybean oil still remains a new product, it will enlarge its share in the edible oil market in the country and become a substitute for imported ones. Again, the demand for meat has been considerably increasing in the recent past and its potential for future increases through import-substitution is quite large.

Marketing prospects of milk products are exactly the same with those of edible oil, though they may be very much influenced by the standards of quality of what will be produced at home as well as the rationalization of the subsidy policy towards imported ones.

As far as vegetable processing is concerned, the size of the potential market both at home and abroad is measurable by the performance of two Government Companies (KAHA and EDFINA). They have the established market in the country with the canning and bottling of vegetables and fruits. Some of these products are finding an export market, also. These two Companies have recently embarked on dehydration and freezing businesses in full expectation of increasing demands in Europe and oil-producing Arab countries.

A demand-increase for feedstuff, particularly for chicken, is quite conspicuous in the recent years mainly due to a rapid expansion of the broiler business.

Demand or marketing prospects of the products envisaged from the agro-industries originally planned for the combined project-areas thus seem to be quite favourable.

5–4 Agro-Industries Eventually Taken Up for Implementation

Through the survey period extending over Phase I and Phase II, study has been made with those 6 kinds covering 16 product-items as discussed under 5.2: Availability of Materials. Eventually, it has been concluded that rice-milling which would bring along rice bran for oil-extraction and feedstuff material in terms of rice-bran-cake is not very promising on the ground that rice is one of the Government controlled items and the farmers are asked to deliver their rice crop in the form of paddy to the Government agency concerned. This conclusion also resulted in the cancellation of the feed venture.

Vegetable processing, and freezing in particular, has been dropped since it has been disclosed that KAHA Company is seriously working at the development of a large-scale freezing programme through an international technical co-operation. Under these circumstances, duplication of efforts would simple result in excess investment and fruitless competition.

A soya bean processing plant for both North and South Hussinia was under study, side by side with a rice-mill and a feed plant (by use of soya bean cake and rice bran cake as the main ingredients), during the field survey period. However, ricemill and feed plant were dropped due to the reasons as mentioned in the above and the soya bean processing plant was suspended because of the following reasons:

Reason No. 1

Since the build-up of soya bean production in the two project areas to the full development stage takes a long period of time, construction of a soya bean processing plant with capacity to handle the optimal soya bean production at full development stage would result at capacity under-utilization for many years, or use of imported raw material in the meanwhile. Starting with smaller capacity and enhancing it with additional capacity as raw material supply increases (as in the case of the milk processing plant) means technical as well as financial burden in the case of semi-automated soya bean processing plant.

Reason No. 2

JICA F/S Team obtained a reliable information in the final stage of its survey period in Egypt that six (6) oil and soap factories, all of them belonging to the Government Company, had decided to start construction of soya bean processing plant in combination with feedstuff plant in a few years' time, and one of them (Cairo Oil & Soap Factory at El Badrashan, Giza) has recently completed such a set of soya bean + feedstaff plant which was personally visited and inspected by the Team's Agro-industry Expert.

If the remaining 5 sister-factories are going to follow the same course, one by one, construction of a soya bean processing factory (primarily for extraction of soya bean oil and its by-product – soya bean cake – as ingredient of feedstuff) would result at "duplication of investment" or "overall capacity under-utilization" from the national economy point-of-view.

Reason No. 3

El Badrashan Oil & Soap Factory entirely depends on the imported soya bean (from USA) as raw material for its 200 T/day plant, and the remaining 5 factories will have to do so since soya bean production in the country is insignificant. Under these circumstances, it might be worthwhile to arrange for a long-term consignment cultivation agreement with soya bean between the agricultural co-operative which would have to be organized by the project area farmers and the Oil & Soap Company to the effect of a regular supply of standardized soya bean by the former to the latter. Assuming that the financial price of the imported soya bean (cif. Alexandria) is L.E 300/ton and the farmgate price of the equal-qualitied soya bean produced in the project area is 260 LE/ton and further that there should be little difference in their transport and handling costs between the imported one and the project area product, the former from

Alexandria and the latter from the North/South Hussinia, to respective Oil & Soap Factories, the price of the project area soya bean could be fixed at L.E 280/ton payable on delivery to the Company at a specific point in the project area. This would mean an economy of 7% in procurement of material soya bean on the part of the Oil & Soap Company, and 8% increase in income from soya bean production on the part of the project area farmers.

Eventually, the following 4 kinds of agro-industry involving 6 product-items have been selected for concrete planning; 6 by-products thereof will be disposed of without being utilized for further industrial process or processes:

	Main Product	By-Products
1) Sugar Beet Processing	White sugar	Molasses and pulp
2) Milk Processing	UHT Milk, Butter and Cheese	
3) Vegetable Processing	Tomato Paste	
4) Slaughtering	Meat	Blood, Bone, Intestines, Hides

All the important particulars of these 4 kinds of agro-industries as regards their factory capacities, capital and operating costs, productions and returns are given in Annex F dealing with Agro-Industry in Vol. 2, in which their organization and management as well as financing problems are being discussed in necessary details. The results of their financial analyses will also be found there.

5–5 Purchase Prices of Materials and Ex-Factory Prices of Products

The following unit prices have been assumed for procurement of materials and estimation of the output values of the plants:

Kind	Price (LE)	Kind	Price (LE)
Sugar Beet	20/ton	White Sugar	400/ton
		Molasses	150/ton
		Pulps	125/ton
Milk	0.20/litre	UHT Milk	0.40/litre
		Butter	3,000/ton
		White Cheese	1,500/ton
Tomato	80/ton	Tomato Paste	1,200/ton
Soybean	260/ton (local)	Soybean Oil (crude)	180/ton
		Soybean Oil (refined)	300/ton
	300/ton (imported)	Soybean Flour	100/ton
Cattle	100/ton	Meat	350/ton
		Blood	250/ton
		Bone (pulverized)	70/ton
		Intestines (liver, spleen, lung, etc.)	150/ton
		Hide	25/Piece

6. SUPPORTING SERVICES

6–1 Research and Extension

Since this Project is a large scale land reclamation project involving additional agricultural problems which may not require as-much attention elsewhere, increased emphasis of research and extension is imperative for irrigation and drainage, timeliness of production, improved disease control, mechanization, better and new seed varieties, changes in soil nutrient requirements, etc. It would be quite risky to permit settlers to place the land into production without guidance. Anticipating this requirement, the Pilot Farm is proposed for not only conducting the necessary research and experiments but also for carrying out field training and short courses on behalf of the Government extension staff to update their skills so that they would take the lead by initiating production and providing successful demonstration operations and sound advice. The extension service in the project area should have the facilities to provide farmers with market and commodity marketing information, too. It is therefore strongly recommended that the Project Management Body should have a direct control on the operation and management of the Pilot Farm so that it would serve as an efficient ground for both research and extension services.

6–2 Farmers' Organization

The agricultural supporting services include credit, input supply and marketing, in a linked-up manner among each other, on behalf of the farmers in the project area. This will be provided through the co-operative system. It may be advisable to make it semicompulsory on the part of the farmers to become members of the multi-purpose agricultural co-operative to be organized in each and every satellite village.

Since multi-purpose agricultural co-operatives are expected to provide their members with services concerning credit, input supply, and marketing required for production of the "controlled food items" primarily rice (plus collection and delivery of sugar beet to the Sugar Beet Factory), it is suggested to encourage the members of the satellite village agricultural co-operative to simultaneously form groups for livestock raising and vegetable production. These groups will be affiliated to their respective "specialized" co-ops. at the central village level which attend at credit, input supply, extension, and marketing services peculiar to each line of activities.

This will imply double or sometimes triple affiliation to different kinds of co-operative by a single farmer but is unavoidable to foster animal husbandry and cash crop production in the project area, since the process of cultivation, post-harvest procedures such as, in case of vegetables, sorting, packing processing and shipment are rather different from that of "controlled" crops.

Detailed arguments are being made in the corresponding part of the Annex F.