C GEOLOGY AND SOIL

1. Geology

1-1 General Geology

The sediments of Tertiary to Quaternary are mainly distributed in and around Ismailia (Fig. III.C.1)

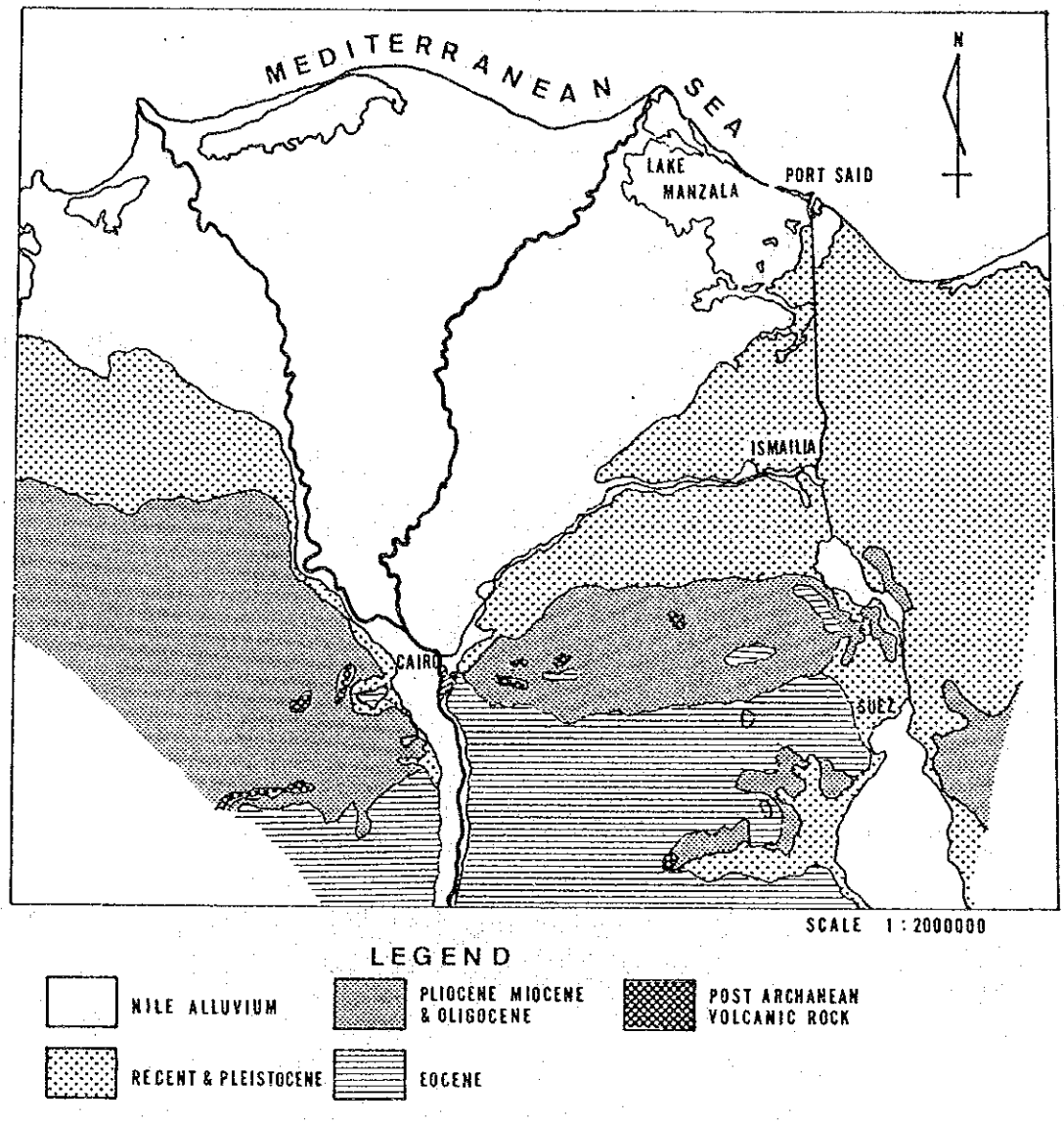


Fig. III·C·1 Geological Formations of Nile Delta

Tertiary constitutes hills of 100 m - 300 m in altitude at Gebel el Hamza, Umm Gidam to the south of Ismailia. On the Cairo-Ismailia Desert Road, limestone, doromite, sandstone and shale which are marine deposits of Miocene to Pliocene are exposed. These are east-west in dip and slope gently in a northward direction.

The Quaternary disconformably overlies the Tertiary in its northern part and constitutes the Nile Delta and its fringe plain. Diluvium is constituted by fluviatile and/or fluvio-marine deposits. Deposits in Holocene make sand dunes as aeolian deposits on upland and capclay layer which overlies loose sediments of Pleistocene.

The thickness of Pleistocene sediments increases from the southward to the northward generally and ranges from 100 m - 500 m (Fig. III·C·2).

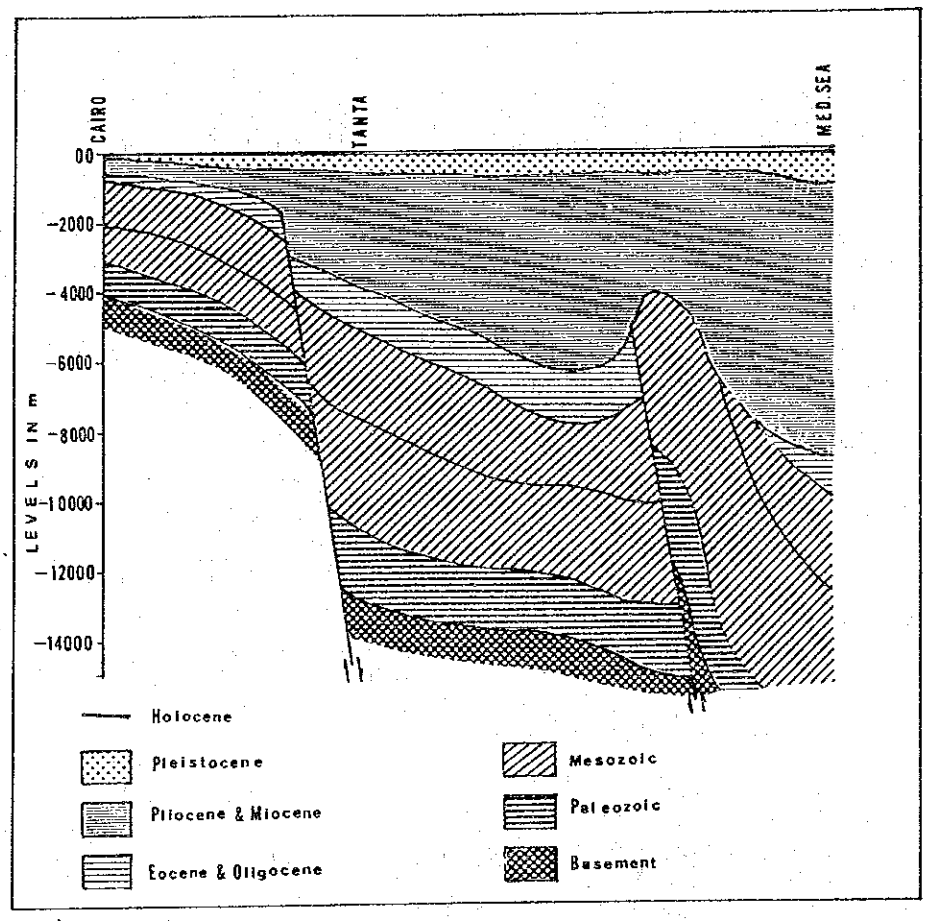


Fig. III·C·2 North-South Geological Cross Section in Delta

The Pleistocene deposits looks like a huge convexed lens with its maximum thickness at the central part of the Delta and its thickness decreases to the east and west and becomes from 100 - 200 meters around Ismailia (Fig. III·C·3)

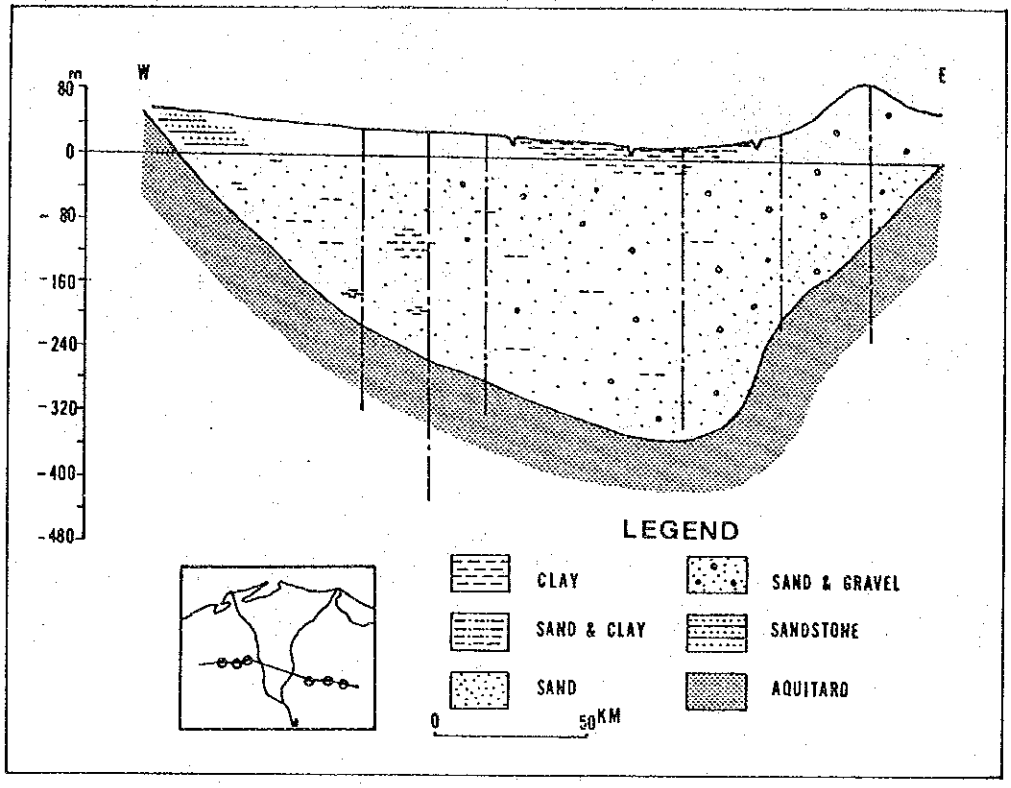


Fig. III·C·3 East-West Geological Cross Section in Delta

1-2 Project Area Geology

(1) Topographical Features

The Project area is located in the northern fringe of the Eastern desert, and on the Diluvium upland which extends between the Nile Delta and Suez Canal.

The area is bounded on the south by the Aluvium lowland - El Tumilat depression - along the Ismailia Canal and on the east by the Port Said Canal.

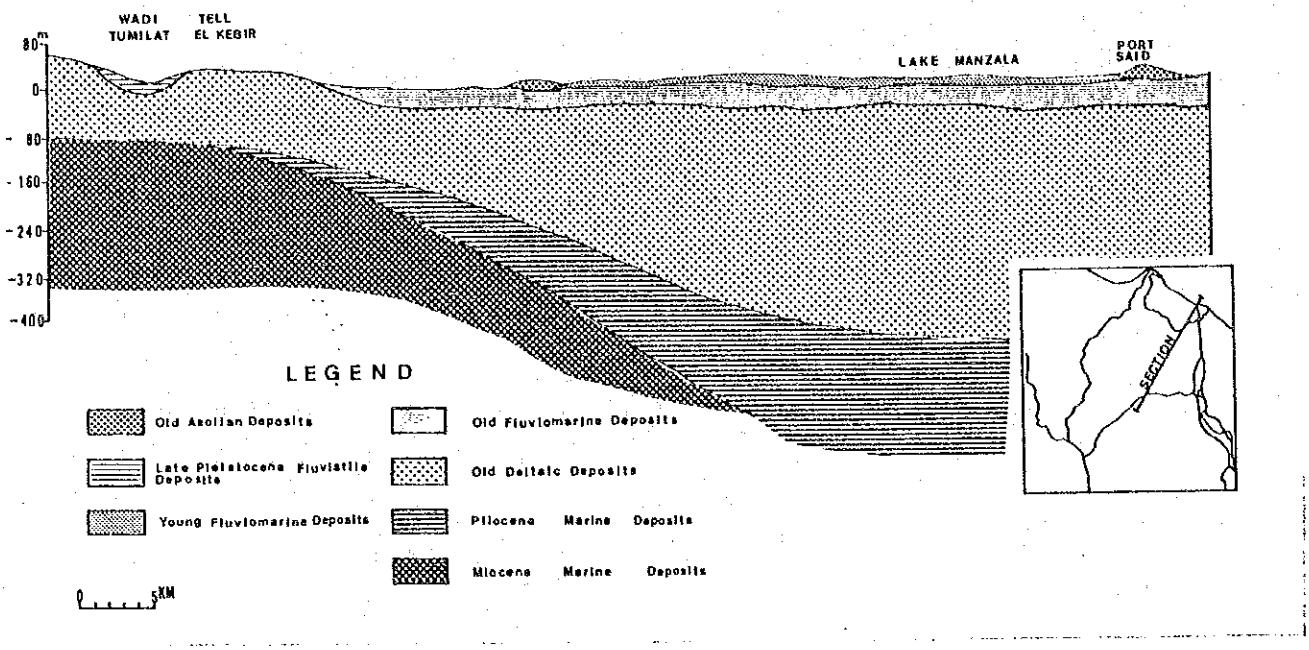


Fig. III·C·4 Geological Cross Section of Ismailia

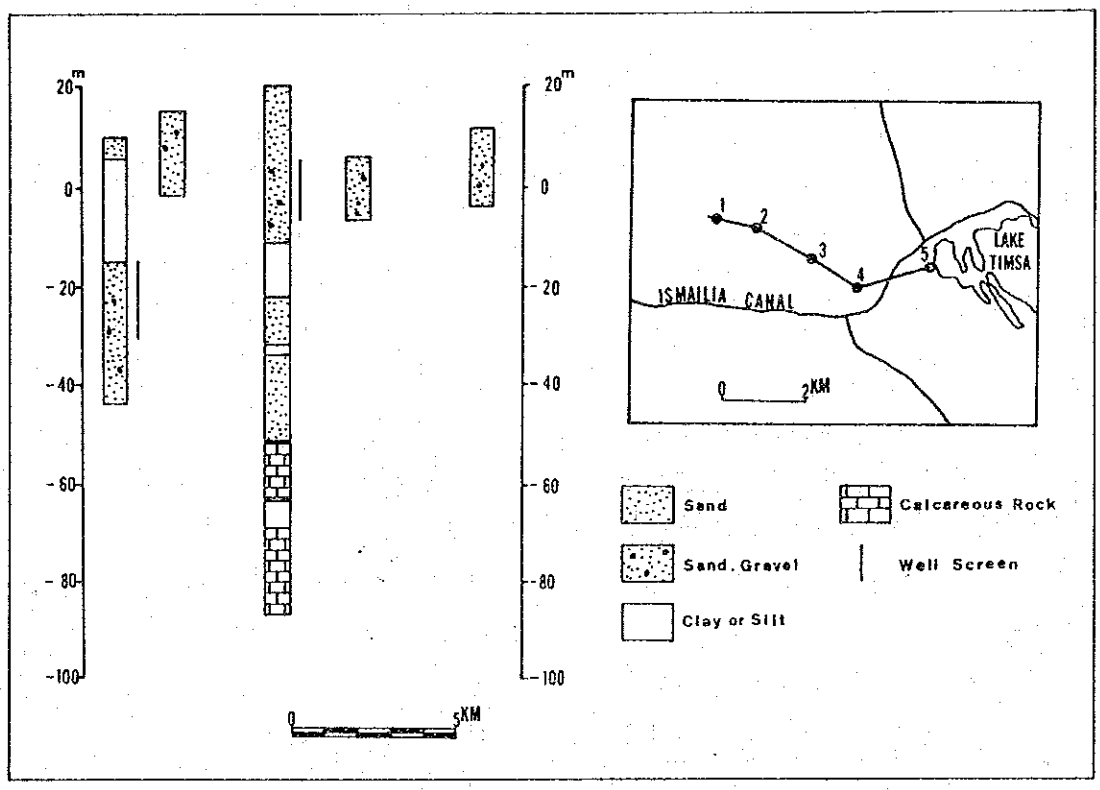


Fig. III·C·5 Subsurface Geology in Ismailia

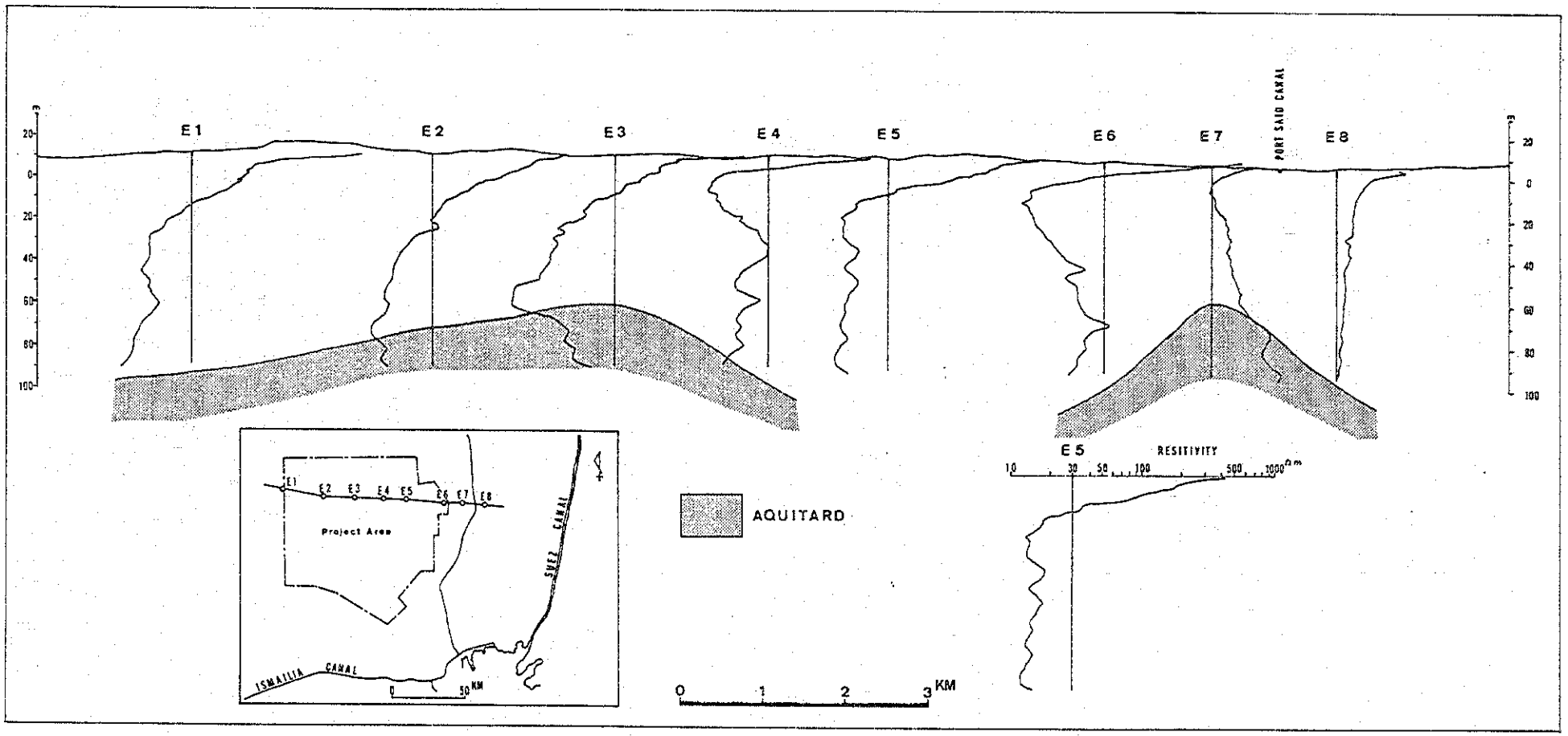


Fig. III·C·6 Subsurface Geology of the Project Area

The topographical features in the area are represented by sand dunes. The highest point is in the southern part, where it is about 27 meters in altitude, while the lowest point is in the north, and its elevation is about 6 meters. The overall slope is from south to north and its gradient is 1 in 500 to 600. There is a difference between the northern section and the southern section of the area. The relief is fairly smooth like Gozes and the copes occaisionally occurs in the south of the area while in the north a relief is not gentle and its highest difference is 8 meters and also a depression like sabkha partly occurs.

(2) Subsurface Geology

The study area consists of sediments from the period of Pleistocene to Recert. Pleistocene sediments are mostly constituted by the fluviotile and/or fluvio-marine sands and gravels interbeded with a thin clay lens. To the south of the area, a terrace gravel layer which is from 30 cm to 50 cm in thickness occurs. Holocene sediments which are mainly composed of aeolian sand deposits irregularly overlay Pleistocene sediments.

The aeolion sands are consisted mostly of quartz grain of about 0.5 mm in dia. and its deposits give more irregularity in features. Occasionally serir deposits, lagoonal-lacustrine deposits and sabkha deposits occur to the north of the area.

As previously mentioned, Quaternary is from 100 to 200 m in thickness around Ismailia (Fig. III·C·4). One well, located to the south of the Project area, reached calcareous rocks of Miocene at a depth of 70 m. Tertiary rocks are encountered at a relatively shallow depth (Fig.III·C·5).

Electric prospectings reaching a depth of 100 m were carried out in the area and high resitivity layers being assumed to be Miocene calcareous rocks, are recognized at a depth of 60 to 80 m (Fig.III·C·6).

These facts indicate that the thickness of Quaternary is more than 60 m.

1-3 Aquifer Characteristics

The most important aquifer in the study area consists of Pleistocene deposits constituted by loose sands and gravels. The deposits are distributed under the Nile Delta and its fringe and are called Nile Delta aquifer (A.A. KHAFAGI, 1981).

Pumping out tests were not carried out at wells in the Project area. But there are some data available from outside the area and pumping out tests have been carried out at several wells. These data are shown in Table III·C·1.

Table III·C·1 Hydrological Coefficient

Locality	Transmissibility	Permeability	Coefficient of Storage	Source of Data
Abu Hammad	236 m^2/d	8.2 m/d		Reference (5)
Tell el Kebir	520 m^2/d	17.2 m/d		"
Qantara	146 m^2/d	18.0 m/d		"
"	1,660 m^2/d	83.0 m/d		"
"	1,760 m^2/d	117.0 m/d		"
10th of Ramadan	770~2800 m^2/d	25~1405 m/d	0.04	Reference (7)
Ismailia		9 ~ 90 m/d		"
Ismailia		32.0 m/d		Reference (6)
Adelia	17,120 m^2/d	100.0 m/d	0.048	Reference (9)
"	18,890 m^2/d	115.0 m/d	0.048	"
"	17,120 m^2/d	100.0 m/d	0.042	"

Such data indicate that the overall range of permeability of Pleistocene aquifer is 8 to 117 m/day, and that the permeability varies widely in the same aquifer. The storage coefficient ranges from 0.04 to 0.048.

The Research Institute for Groundwater (RIG) estimated from the analysis of test data that the average permeability of the Nile Delta aquifer is 100 m/day. The RIG also assumed that the storage coefficient is 0.2 in the unconfined aquifer and ranges between the order of 10^{-4} to 10^{-3} in the confined aquifer (M.S. Farid et al 1979).

1-4 Groundwater

(1) Existing Wells

Existing wells located in and around the Project area are divided by depth into two types, i.e., shallow wells and deep wells. In this report, wells which are about 10 m in depth are called shallow wells, and wells which are more than 30 m are called deep wells.

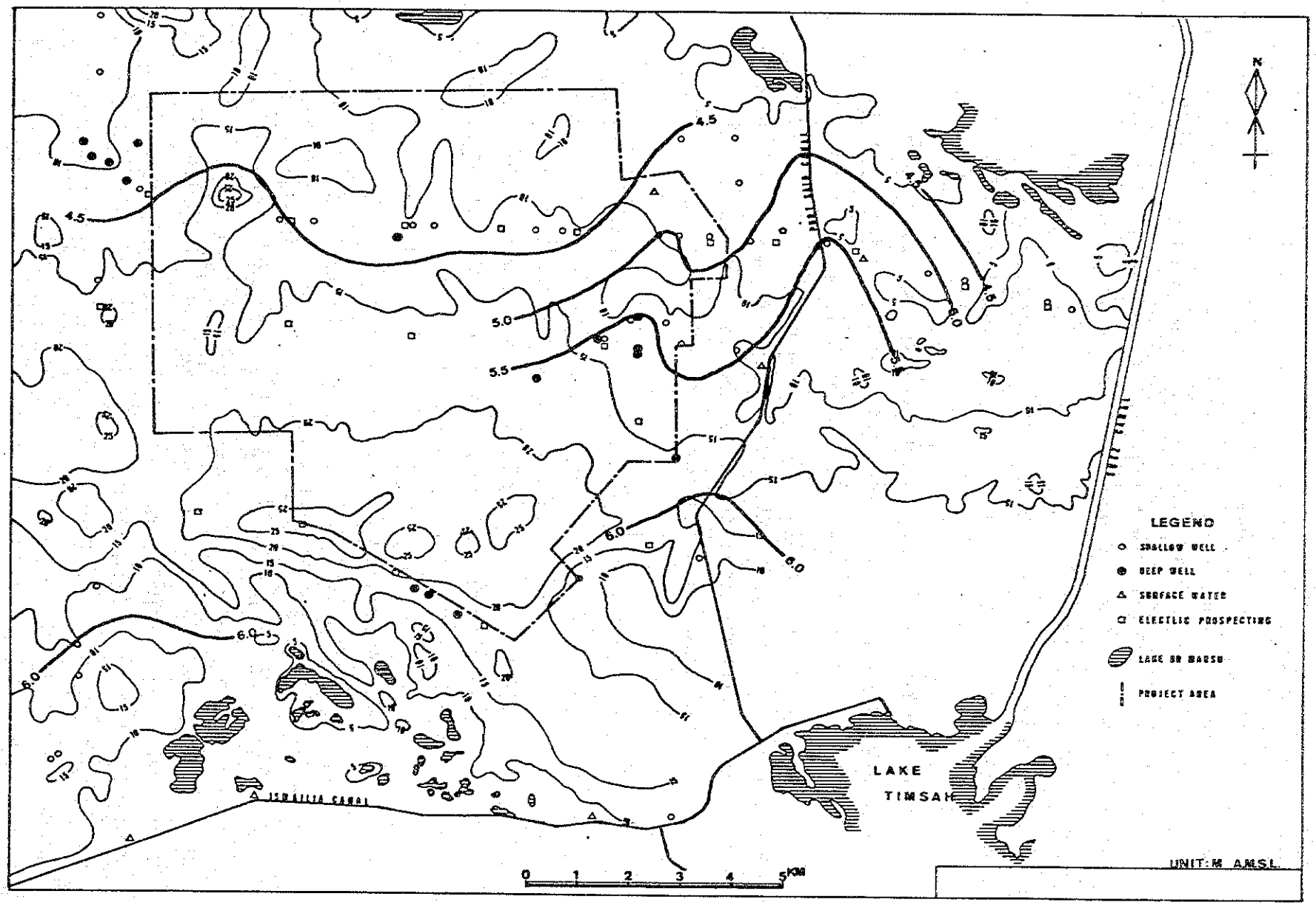
These wells are situated along the Ismailia Canal, the Port Said Canal and the Salhya road and also within the pilot farms of the Project area.

The shallow wells are penetrated by a steel pipe with a diameter of 2" and are used for individual households with hand pumps.

The depth of the deep wells ranges from 30 m to 65 m. These wells are generally drilled by local hand percussion/ bailing methods and are cased with 8" to 10" steel pipe. The screen is a perforated or slotted pipe wrapped with cupper woven gauze.

A centrifugal pump is used where the groundwater level is higher while a vertical turbine pump is generally used where the water table is lower. Generally in the case of installing the centrifugal pump, the upper part of the well is dug several meters in depth and a pit with a diameter of 3 to 5 m is made in order to prevent the intrusion of aeolian sands.

Fig. III.C.7 Project Area Groundwater Level



(2) Water Table Configuration

Groundwater level measurements were carried out on wells which were located in and around the Project area. The location of the wells is shown in the Appendix. The results of measurements are shown in the Appendix. The elevation of wells is based upon the topographical map with a scale of 1 to 25,000.

Groundwater of the Pleistocene aquifer is wholly unconfined although it is confined by a clay lens in some areas.

Groundwater level in the Project area ranges from 0.5 to 10.4 m below the ground surface. It has a tendency to be deeper in the south and shallower northward.

The water table ranges from 2.2 m to 7.9 m above mean sea level. The shape of the water table is mostly conformable to the topographical features and the groundwater moves to the north with a gradient of 1 in 2000 to 1 in 4000 (Fig. III.C.7).

The water table map shows a high water level along the Port Said Canal and it suggests that there is recharge from the canal to the aquifer in this region. The water level of the Ismailia Canal ranges annually from 6.8 m to 7.5 m and it is estimated that the recharge to the aquifer occurs along the canal.

(3) Groundwater Quality

Parallel with the groundwater level measurements, sampling of surface and groundwater and water quality measurements on temperature, pH and EC (Electric Conductivity), were carried out. Eleven samples of water were analysed on the following contents; Na^+, K^+, Mg^{2+}, Ca^{2+}, HCO_3^-, Cl^-, SO_4^{2-}, SiO_2. The results are shown in the Appendix Table III.C.3, sampling points in Fig. III.C.1 in the Appendix. Total salinity in table in the Appendix is converted as NaCl (ppm) from the value of Electric Conductivity.

(a) Water Temperature

Water temperature of swamp or sabkha ranges from 21.4 to 23.5°C while sweet canal water ranges from 15.0 to 18.3°C. The groundwater temperature varies from 20.0 to 25.3°C and there is no difference between the shallow wells and deep wells. The contour map of water temperature shows that the groundwater temperature in the Project area ranges from 23 to 24°C and is low in the northern part (Appendix).

(b) pH

The surface water is over 8.0 in pH and it is alkaline. It is considered that the surface water is affected by calcareous rocks which are exposed in the upper reach area. The groundwater is also alkaline ranging from 7.6 to 11.0 pH. The pH of shallow wells mostly exceed 8.0 while the pH of the deep wells are between 7.0 and 8.0. (Appendix)

(c) Salinity (NaCl)

The total salinity of sabkha exceeds 10,000 ppm. The sweet water canal indicates a good quality ranging from 170 to 220 ppm in total salinity. The total salinity of the groundwater varies from 200 to 10,000 ppm. The salinity is less than 1,000 ppm along the Ismailia Canal and the Port Said Canal and increases to over 1,000 ppm away from the canals. This tendency suggests that the groundwater in the area is recharged by sweetwater from the canals. The salinity in the Project area ranges from 1,500 to 2,000 ppm but some wells which have over 2,500 upto 3,500 ppm in salinity occur in a limited area. (Appendix)

(d) Water Quality Composition

In 11 water samples among the 49 water samples taken

a water quality analysis was carried out on main 8 ions, Na, K, Ca, Mg, Cl, HCO_3, SO_4, SiO_2.
The results are shown in Table III.C.3 in the Appendix. The breakdown is 8 samples for shallow wells and 3 samples for deep wells.

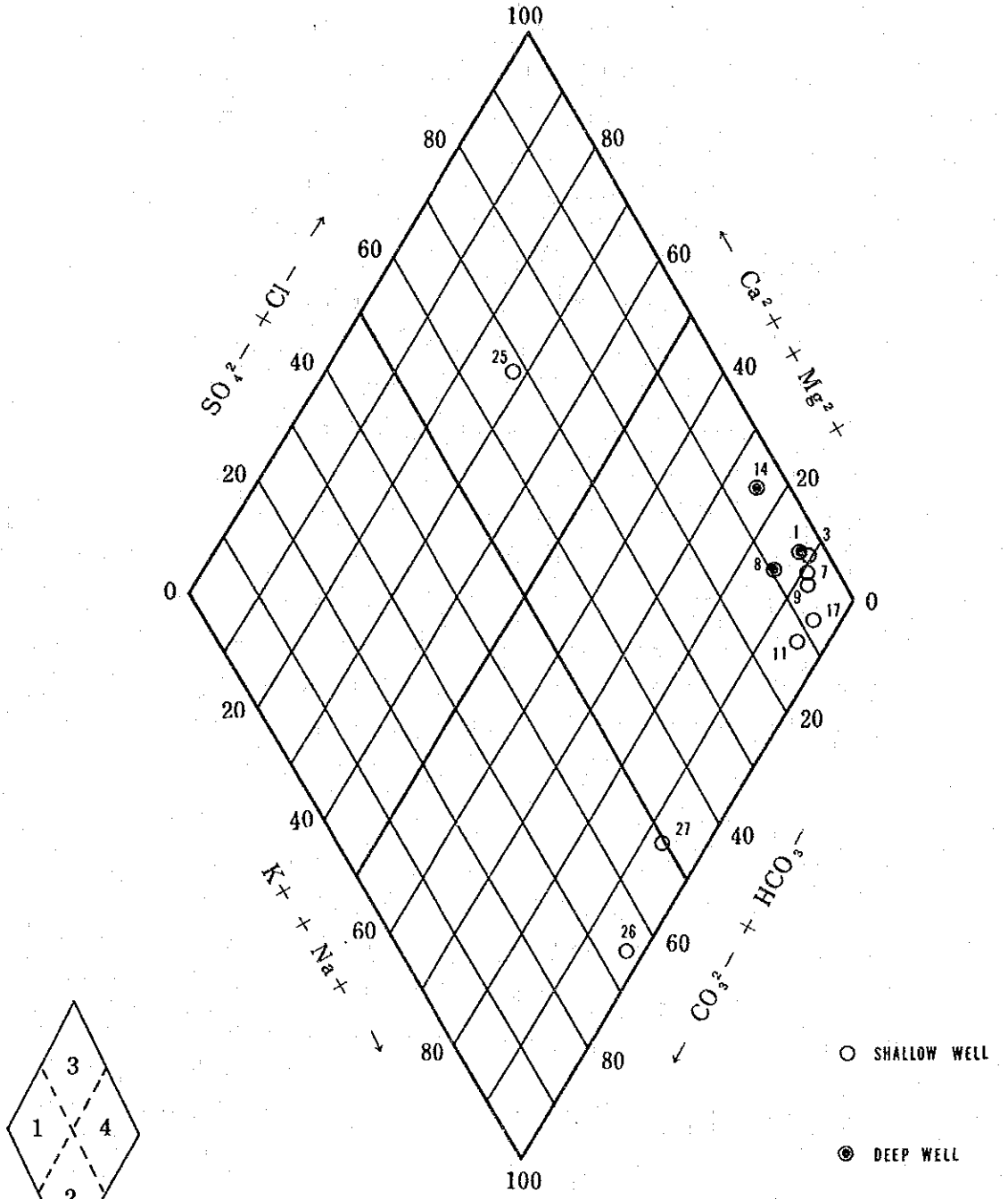
In general, groundwater quality is divided into four types as shown in Fig.III.C.8, assuming $(SO_4 + Cl)$. $(HCO_3 + CO_3)$ as anion and (Na + k).(Ca + Mg) as cation remain in chemical equilibrium.

Classifying the eleven samples according to this classification, the samples are divided as Fig.III.C.8 Among the eleven samples, two samples belong to the carbonate alkali type, one sample to the noncarbonate hardness type and eight samples to the noncarbonate alkali type respectively. The two samples which belong to the carbonate alkali type are located within 1 km of Port Said Canal and are probably affected by sweet water. The well which belongs to the noncarbonate hardness type is situated on the right bank of the Port Said Canal and is different from the groundwater system of the Project area.

All groundwater quality of wells in the Project area belongs to the noncarbonate alkali type and it is considered that their quality is similar to sea water quality.

In Fig.III.C.9 the quality of the eleven samples is presented by a hexa diagram. These diagrams are divided into three patterns and each pattern nearly corresponds with three types which are divided on the key diagram.

The eight samples which belong to the noncarbonate alkali type have a high concentration in Na^+ and Cl^-. Na^+ concentration varies from 820 to 1,660 ppm and Cl^- concentration ranges from 964 to 2,250 ppm.



1 : $Ca(HCO_3)_2$ TYPE
2 : $NaHCO_3$ TYPE
3 : $CaSO_4$ OR $CaCl_2$ TYPE
4 : Na_2SO_4 OR NaCl TYPE

Fig. III.C.8 KEY DIAGRAM

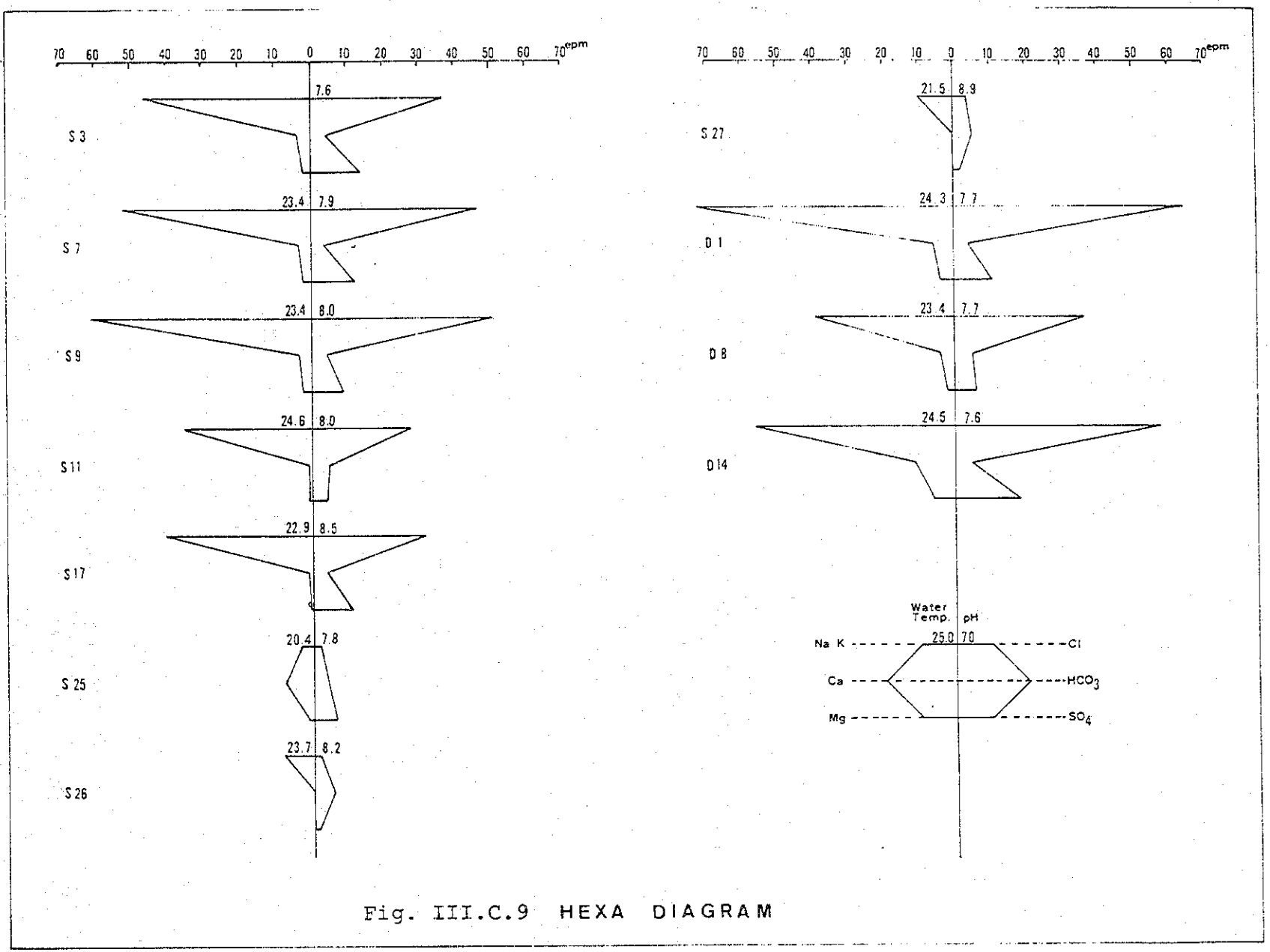


Fig. III.C.9 HEXA DIAGRAM

1-5 Recharge-Discharge Relationships

Before the Ismailia Canal and the Port Said Canal were built the groundwater of the Diluviam Upland where the Project area is situated was most likely recharged by the underflow from near the Umm Gidam slopes and from the Nile Delta aquifer. And the outflow of groundwater to Lake Manzara, Suez Canal and drainages has occured.

In recent times, the recharge of groundwater has been provided by the seepage of the Bahr el Bakar Drain to the west, the Ismailia Canal to the south and the Port Said Canal to the east respectively.

Another main resource for the recharge is the infiltration of irrigation water. Recharge from precipitation is slight due to the small amount of annual rainfall and the high evaporation rate. If any, the amount is minimal. Discharge occurs through sediments to the open water area of Lake Manzara and to the Suez Canal Region in the east. Other groundwater losses are from extrusion of existing wells and evaporation where the groundwater level is shallow.

In the case of considering the water balance in an area, it is required to quantify the above mentioned items. But, at the present stage, quantifying data is not available. Some estimate of the seepage from the canals has been attempted. Hammad (1958, quoted by Binnie & Partners, 1978) estimated that the recharge northward from Ismailia Canal along its entire length was 18.1 m^3/sec. On the other hand, Metcalf and Eddy (1979) estimated that the seepage from Port Said Canal was at a rate of 0.4 m^3/sec. along its 15 km reach.

Fiarid (1978, quoted by A.A. Khafagi, 1982) attempted to calculate the water balance of the fresh water in the Nile Delta aquifer as follows:

The Inflow

- the downward flow	2.27 x $10^9 m^3$/year
- seepage from Ismailia Canal	0.03 x $10^9 m^3$/year
Total inflow	2.60 x $10^9 m^3$/year

The Outflow

- the total pumped water from Delta aquifer (estimated by R.I.G.W. 1975)	1.6 x $10^9 m^3$/year
- outflow to Wadi El-Natrun	0.05 x $10^9 m^3$/year
- seepage to Rosetta and Damietta branches	0.212x $10^9 m^3$/year
- upward flow through the zone in the north of Delta	0.097x $10^9 m^3$/year
Total outflow	2.0 x $10^9 m^3$/year

The difference between inflow and outflow equals 0.6 x $10^9 m^3$/year

From this calculation, Farid assumed that the potentiality of the Nile Delta aquifer was equal to 0.6 x $10^9 m^3$/year.

This amount is considered to be a standard for the groundwater exploitation from the Nile Delta aquifer.

1-6 Groundwater Potentital

(1) Salinity

The salinity in the groundwater of the Project area, ranges from 1,500 to 2,000 ppm and there are several wells varying from 2,500 to 3,500 ppm in a limited area.

A phenomenon of increasing salinity with depth is recognized in several areas. At Qantara, the salinity ranges from 4,000 to over 8,000 ppm within an interval of 70 m in depth and near Tel el Kebir the salinity increases from 300 to 10,000 ppm within a depth varying from 30 to 220 m (Metcalf & Eddy, 1979). In the Project area, there is no difference in the salinity between shallow wells and deep wells. Therefore, there is no increase of the salinity with depth, at least up to a depth of 50 to 60 m.

The Project area is near Suez Canal and the groundwater is high in salinity. Therefore, the groundwater in the Project area has a possibility of being contaminated due to sea-water intrusion. Table III.C.2 shows the comparison between groundwater and sea-water and their ratio of equivalents from the water quality analysis.

Table III.C.2 Ratio of Equivalents of Ground Water to Sea Water

	Ratio	S-3	S-7	S-9	S-11	S-17	D-1	D-8	D-14
Na/Cl	0.85	1.24	1.14	1.21	1.31	1.31	1.14	1.09	0.98
K/Cl	0.18	0.01	0.01	0.01	0.01	0.003	0.01	0.01	0.01
Mg/Cl	0.20	0.06	0.05	0.05	0.03	0.02	0.06	0.07	0.11
Ca/Cl	0.038	0.104	0.072	0.068	0.030	0.04	0.10	0.13	0.21
SO4/Cl	0.10	0.39	0.27	0.17	0.16	0.35	0.16	0.16	0.32
HCO_3/Cl	0.0043	0.12	0.07	0.08	0.17	0.13	0.06	0.13	0.08

The results are as follows:

Na/Cl : While the ratio of sea-water is 0.85, the ratio of groundwater ranges from 0.98 to 1.31.

K/Cl & Mg/Cl : the ratio of groundwater is smaller than the sea-water and varies from a sixtieth to a half of the sea-water.

Ca/Cl SO_4/Cl: the ratio of the groundwater is several times as large as the sea-water.

HCO_3/Cl : the ratio of the groundwater is from several times to dozens of times larger than the sea-water.

These facts indicate that the groundwater quality of the Project area is mostly different from the sea-water although both qualities have partial similarity.

Next, Simpson (1946, quoted by T. Murashita, 1975) classified the degree of the groundwater contamination due to sea-water intrusion based on the ratio $Cl/(CO_3 + HCO_3)$ in equivalent. His classification is shown in Table III.C.3 .

Table III.C.3 Degree of Contamination

$Cl/(HCO_3 + CO_3)$ in groundwater		Degree of Contamination
0.5	I	Not contaminated
1.3	II	Slightly contaminated
2.8	III	Moderately contaminated
6.6	IV	Greatly contaminated
15.5	V	Very greatly contaminated
200±	VI	The same as sea-water

The results of applying the Project area groundwater are shown in Table III.C.4.

Table III.C.4 Degree of Contamination by Sea Water

Number of wells	S-3	S-7	S-9	S-11	S-17	S-25	S-26	S-27	D-1	D-8	D-14
$Cl/(HCO_3+CO_3)$	8.3	13.7	12.6	5.7	7.9	0.5	0.3	0.7	17.9	7.7	13.3
Degree or Contamination	IV	V	V	IV	IV	I	I	I	V	IV	V

This Table indicates that the groundwater of the Project area is hardly contaminated except for the groundwater along Port Said Canal.

Thus, the causes of indicating high salinity in the groundwater of the Project area are the depositional condition of the aquifer has been under the fluvio-marine and/or the sea-water intrusion due to over-pumping of groundwater.

Considering groundwater usage in the Project area, direct usage for irrigation is not appropriate but usage for leaching is suitable. If groundwater is mixed with sweet water from the canal, it can be used for irrigation.

(2) Safe Yield of Groundwater

In planning groundwater usage it is necessary to assess the annual variation in groundwater levels in the area, in order to establish the water balance and to make clear the safe yield of groundwater. However, in the Project area there is not enough data available to calculate the water balance. Therefore, in this section the limits of groundwater exploitation will be roughly estimated by tentative calculation of seepage from the canals based on some references.

Hammad (1958, quoted by Binny and Partners, 1978) estimated the recharge northward from Ismailia Canal along

its entire length (= 230 km) at 18.1 m^3/sec. Assuming that the reach concerned with the Project area is 10 km, the recharge from the canal is estimated at about 68,000 m^3/day.

On the other hand, Metcalf and Eddy (1979) inferred the seepage from Port Said Canal along its 15 km reach to be 0.4 m^3/sec. If a half 0.4 m^3/sec is recharged to the Project area along its 13.5 km reach, its amount is equal to about 16,000 m^3/day.

Applying these figures to the Project area, the total amount of the recharge to the aquifer is roughly estimated at about 84,000 m^3/day.

Actually this amount minus groundwater outflow, existing pumpage, evaporation and fluctuation in the amount of groundwater storage is the permitted quantity for groundwater development. However, in this section the above mentioned 84,000 m^3/day will be dealt with as the safe yeild. Another restriction must be considered in groundwater exploitation. This is prevention of increasing salinity due to sea water intrusions. In this restriction the groundwater level may not be drawn-down less than sea level applying Herzberg's formula. The groundwater level of the Project area is within 2.2 to 7.9 m a.m.s.l. This amount is equal to the available thickness for pumpage. The specifications of one well are as follows:

Diameter : 0.15 m
Depth : 50 m
Length of screen: 20 m

And, assuming that maximum draw down, saturated thickness, permeability and radius of influenced area are equal to 4 m, 45 m, 50 m/day and 1 km respectively, and applying these figures to the next equation the pumpage of one well would be about 2,720 m^3/day. This amount is the safe yield not to down the groundwater level less than the sea level.

$$Q = \frac{\pi . (\frac{b_1 + b_2}{b_1}) . T . S}{\ell n (\frac{R}{rw})}$$

where, Q = pumpage (m^3/day)

T = transmissibility (m^2/day)

S = draw down

R = radius of influenced area

rw = radius of well

b_1 = saturated thickness of aquifer before pumping

b_2 = saturated thickness of aquifer during pumping

$\ell n = \frac{1}{\log 10}$

(3) Groundwater Development

From these considerations the following conclusions are drawn on groundwater development in the Project area.

From a viewpoint of water quality;

(a) Direct usage for irrigation is not appropriate.

(b) Usage for leaching is suitable.

(c) In the case of usage for irrigation it is required to be mixed with sweet water.

From a viewpoint of water balance;

(a) The permitted extraction is within 84,000 m^3/day.

(b) The number of wells is about 30 with a diameter of 300 mm and a depth of 50 m. The pumping rate is about 110 m^3/hour each.

(c) The maximum draw-down in each well should be less than 4.0 m to prevent sea-water intrusion.

(d) The wells should be spaced at least 1 km apart in order to reduce interference in the well field.

(e) Usage of groundwater will require close monitoring of water levels and quality so that the aquifer may be managed within safe limits.

2. Soil

2-1 Introduction

A series of soil surveys on the Project area were conducted from February 2nd up to March 31st, 1982. They include overall exploration involving 320 stick boring surveys and 56 soil profile surveys in the field, laboratory analysis on physical and chemical properties of the soil, and a review of the contract analysis performed by the Ismailia Agricultural Research Station, Department of Soil and Water Research.

The main soil units in the Project area were identified to be composed of Dystric Regosols (Rd), Haplic Yermosols (Yh) and Calcic Yermosols (Yk). Dystric Regosols are distributed over shifting sand dunes and occupy most of the Project area, 13,750 feddan (63.9%) stretching from the central to the northern part. Both Yermosols are largely distributed over the old riverine terrace along the eastern and southern part of the Project area. These soils are partly found in conjunction with desert pavement along the northern border line. The total acreage of Yermosols is 7,485 feddan (34.7%).

The details of the soil survey are shown in the Appendix attached to this report. Some principal characteristics by soil unit are described here.

2-2 Dystric Regosols (Rd)

Dystric Regosols are distributed in shifting sand dune areas and their parent material is wind blown sand. It is not residuum,but is originally derived from fluvio-marine alluvium. Topographical features of the sand dune area are diverse, ranging from nearly flat to gently undulating to gently rolling. Besides that, there are some shifting sand dune areas without any vegetation and other areas with specific desert plants. Furthermore, there exist 298 feddan of Gravel Land (1.4%).

The soil profile survey of this unit was conducted on 28 profiles. Soil profile description of these profiles are shown in tables in the Appendix. The details of the physical and chemical analysis totalling 36 profiles and 146 soil horizons are presented in tables and figures in the Appendix.

As found out in the figure and description of soil profile No.3 as an example (Table III.C.5), the fine aeolian sandy lamina is recognized from the surface of the profile to a 100 cm depth. There does not appear to be any horizon differentiation, or if any, it is very weak. Also, it does not contain humus or gravelly pebbles. The soil texture is S and LS. An obvious point concerning textural composition is that soils with 0.2 - 1.0 mm coarse sand occupy an overwhelmingly large portion of the soil unit as shown in soil profile No.16 in Fig.III.C.10. The matrix color ranges from bright brown (7.5 YR 5/8) to yellow orange (7.5 YR 7/8), of which the latter is rather dominant. Soils of this unit are structureless and represent single particles, also mottling is absent.

Observing 15 profiles and 62 soil horizon made in the survey, the three phase distribution at pF 1.5 was calculated as follows: 61.5 - 71.8% solid ratio (Sv), 5.1 - 14.9% water ratio (Mv), 17.3 - 30.8% air ratio (A), 28.2 - 38.5 porosity (P) and 162.9 - 183.7 g/100 cc volume weight (S) (see Table III.C.6). The frequency (F) of solid, water and air ratios, and porosity is 83.9% for 62.0 - 68.0 Sv, 85.5% for 6.0 - 14.0% Mv, 88.7% for 20.0 - 30.0% A, 92.6% for 30.0 - 38.0% P, and 84.0% for 165.0 - 180.0 g/100 cc S respectively. Fig.III.C.1 shows an example about the three phase distribution of profile No.16. The details of the distribution are indicated in tables and figures in the Appendix.

Although the solid ratio represents a relatively high value and the porosity slightly low, compactness of the profile is often loose. It seems to come from the fact that, although the packing of soil particles is compact resulting from the soils with a coarse texture and in a non-moisture state,

the cohesion between soil particles is low. Judging by a degree of air ratio at pF 1.5, the water permeability of the profile seems to be very high.

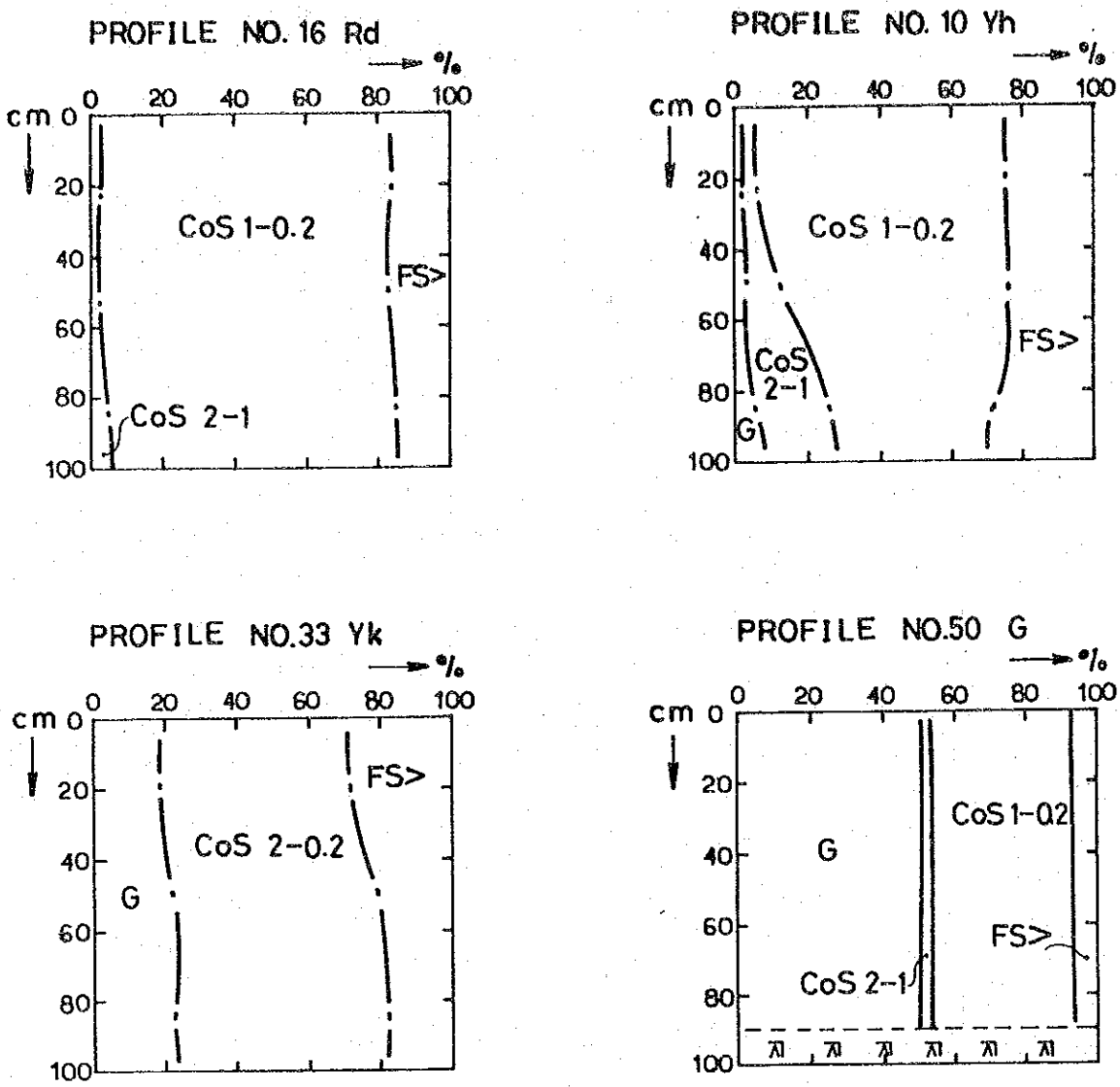
Moisture retention after 24 hours measured on the spot yielded a water ratio of 3.1 - 10.8%. This figure can be regarded as the field capacity (FC). The available water capacity (AWC) whose water ratio upper limit is pF 1.5 becomes to 3.2 - 9.8%, when the wilting point (WP) is a half of the field capacity (FC). It is possible to expect 3.2 - 9.8 mm of available water per 10 cm of the soil depth.

The electric conductivity (ECe) of soil solution at a state of 14.5 - 22.5% of saturated percentage is calculated 0.8 - 3.6 m mhos/cm·25°C and that at pF 1.5 represents 1.0 - 6.3 m mhos/cm·25°C. Frequency appears 88% for EC3 1.0 - 2.8 m mhos/cm·25°C and 78% for $EC_{1.5}$ 2.5 - 5.5 m mhos/cm·25°C. These figures are unexpectedly low as for arid desert soil. It means that salt elimination from the soil should be relatively easy.

The distributional range of chemical properties by soil unit is shown in Table III.C.7 and its detailed results by soil profile are described in the tables in the Appendix. The following are the main points: pH (H_2O) 6.5 - 7.6, CaO 0.07 - 0.20%, MgO 5 - 20 mg/100 g·soil, and K_2O 3 - 15 mg/100 g. soil. The frequency of a certain degree of chemical properties are: 67% for 0.15% of CaO (rich), 58.3% for 5 mg/100 g. soil of MgO (poor), 30.6% for 15 mg/100 g.soil (rich) and 47.6% for 3 mg/100 g. soil (fairly poor) of K_2O, and 33.3% for 0.05% (moderate), 36.1% for 0.10% (fairly rich) and 14% for 0.15% (profuse) of NaCl.

The frequency of 14% for NaCl 0.15% mentioned above suggests lower salt content and it should be easier to eliminate salts than expected. This seems to derive from the coarsely textured soil with low capillary rise and relatively deep groundwater level.

Fig. III.C.10 Textural composition of soil profiles



Note: Rd : Dystric Regosols
Yh : Haplic Yermosols
Yk : Calcic Yermosols
G : Gravel
CoS: Coarse Sand (Numeral: particle size mm)
FS : Fine Sand

Fig. III.C.11 Three phase distribution of soil profiles under pF1.5

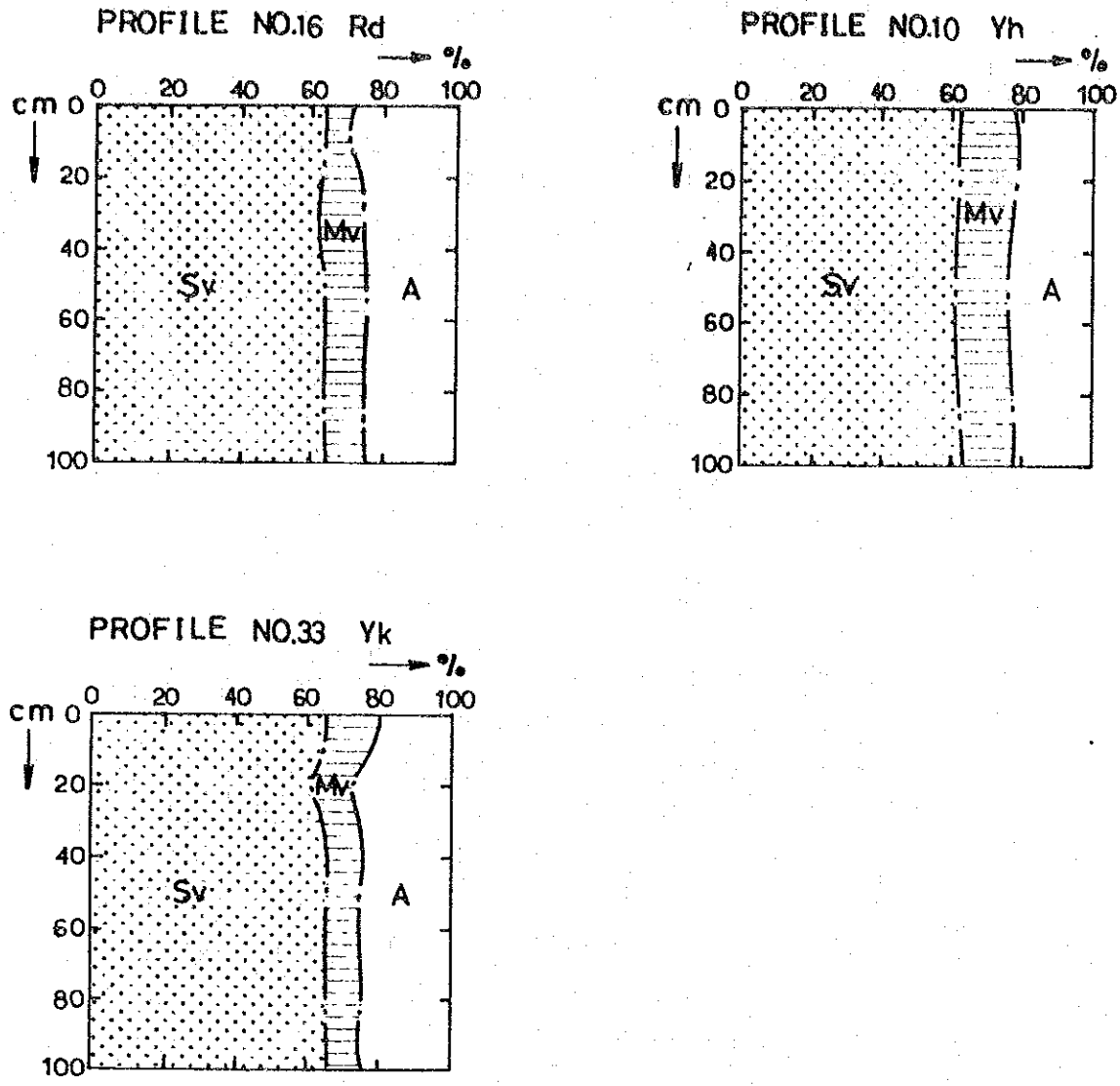


Table III.C.5 PROFILE 3

Date of Survey	:	11 Feb., 1982
Location	:	Center, 1000 m south site from pilot farm No. 2
Phsyiographic position	:	Shifting sand dunes
Surrounding land	:	Gently undulating
Land use	:	Desert
Parent material	:	Aeolian sand originated alluvium
Great soil group	:	Dystric Regosols (Rd), deep sandy phase
Soil series	:	Mdl, Shifting sand dunes

Profile description :

0 - 100 cm No horizon development throughout 100 cm depth, texture S - LS, no gravel, no humus, matrix color 7.5 YR 8/8 yellow orange, structureless single particle, no mottle, many fine pores, porosity P34.7 - 36.8%, three phases under pF 1.5 are solid ratios Sv 63.2 - 65.3%, water ratios Mv 11.5 - 14.4% and air ratios 25.0 - 25.3%. Saturated percentage SP16.1 - 19.3%. Electric conductivity under pF 1.5 $EC_{1.5}$ 3.9 - 4.5 m mhos/cm. 25°C and under saturated condition ECe 1.1 - 1.8 m mhos/cm·25°C.

Table III.C.6 Distributional Range of Soil Physical Properties of Soil Units

Items / Soil Units	3 Phases under PF1.5					24 hours moisture (F.C) %	Available water capacity AWC %
	Solid ratio Sv %	Water ratio Mv %	Air ratio A %	Porosity P %	Volume weight S g/100cc		
Dystric Regosols Rd	61.5 ~ 71.8	5.1 ~ 14.9	17.3 ~ 30.8	28.2 ~ 38.5	162.9~183.7	3.1 ~ 10.8	3.2 ~ 9.8
Haplic Yermosols Yh	60.7 ~ 67.6	6.1 ~ 22.7	9.7 ~ 28.5	32.4 ~ 39.3	160.8~179.2	3.1 ~ 13.8	5.1 ~ 12.5
Calcic Yermosols Yk	62.8 ~ 71.3	6.2 ~ 21.1	10.2 ~ 28.1	28.7 ~ 37.2	166.4~189.0	3.7 ~ 15.9	3.2 ~ 13.0

Items / Soil Units	Particle size distribution					Electric Conductivity m mho/cm.25°C		Saturated percentage SP %
	Gravel %	Coarse sand			Less than Fine Sand			
		2.0~0.2mm %	2.0~1.0mm %	1.0~0.2mm %	0.2 mm> %	EC 1.5	ECe	
Dystric Regosols Rd	0 ~ 5.7	71.0~90.4	1.0~ 6.5	64.5~75.0	9.2~25.8	1.0 ~ 6.3	0.8 ~ 3.6	14.5 ~ 22.5
Haplic Yermosols Yh	2.3~13.2	61.7~89.4	4.1~19.1	42.6~85.4	8.1~30.9	1.2 ~ 6.1	0.9 ~ 3.9	14.9 ~ 22.8
Calcic Yermosols Yk	1.6~32.0	56.3~86.2	8.2~30.7	36.9~75.6	5.0~25.1	2.5 ~ 8.0	1.2 ~ 4.6	15.7 ~ 23.7

Table III.C.7 Distributional Range of Chemical Properties of Soil Units

Soil Units \ Items	PH (H_2O)	CaO %	MgO mg/100g.Soil	K_2O mg/100g.Soil	NaCl %
Dystric Regosols Rd	6.5 ~ 7.6	0.07 ~ 0.20	5 ~ 20	3 ~ 15	0.01 ~ 0.15
Haplic Yermosols Yh	7.0 ~ 7.8	0.10 ~ 0.20	5 ~ 20	3 ~ 15	0.01 ~ 0.10
Calcic Yermosols Yk	6.5 ~ 7.6	0.15 ~ 0.20	5 ~ 20	3 ~ 15	0.05 ~ 0.15

2-3 Haplic Yermosols (Yh)

This soil unit is distributed in the riverine terrace at 7 to 15 m above sea level and is located from east of the central area to the northern part. The parent material is considered to be deltaic in origin.

The soil profile survey of this soil unit was conducted on 13 profiles, of which 12 profiles are described in the tables in the Appendix. The details of physical and chemical analysis totalling 15 profiles and 55 soil horizons are also shown in the tables and the figures in the Appendix.

As found in Table III.C.8, examples of soil profile descriptions, there is a thin surface soil on the sandy horizon. This surface soil is LS - SL and contains various amounts of round gravels ranging from fine to small diameters. Its matrix color is from dull reddish brown (5 YR 5/4) to dark reddish brown (5 YR 3/4). This surface soil exhibit weakly developed medium subangular structure, but not exhibit any mottles. The sub-horizon is a lake of structure, with single particles only and without any mottles. Its matrix color is from dull yellow orange (10 YR 7/4) to yellow orange (10 YR 7/8).

As indicated in Table III.C.6 a distributional range of soil physical properties about this soil unit, 42.6 to 85.4% of particle size distribution is coarse sand with a content ratio in the 0.2 - 1.0 mm size, similar to the soil unit of Dystric Regosols mentioned before. A main difference between Rd and this unit is that the gravel content of the former is nearly 0 - 5.7%, but that of the latter is 2.3 - 13.2%. The three phase distribution at pF 1.5 is figured as follows: solid ratio (Sv) 60.7 - 67.6%, water ratio (Mv) 6.1 - 22.7%, air ratio (A) 9.7 - 28.5%, porosity (P) 32.4 - 39.3%, and volume weight (S) 160.8 - 179.2 g/100 cc. An example of the three phase distribution of the profile No.10 (Fig.III.C.11) indicates that the basic feature resembles profile No.16 of Rd described before. However, the frequency of figures representing this soil unit is not characteristically noticed as in the case of Rd with different accumulation of parent materials (see the tables, Appendix).

Table III.C.8 PROFILE NO. 7

Date of Survey	:	11 Feb., 1982
Location	:	East (middle), 1000 m south site from pilot farm No. 1
Physiographic position	:	Old riverine terrace
Surrounding land form	:	Gently undulating
Land use	:	Desert
Parent material	:	Alluvium
Great soil group	:	Haplic Yermosols (Yh), common phase
Soil series	:	Mol, Mollak soil series
Profile description	:	

0 - 20 cm	Weakly developed A horizon, texture LS, common fine round gravels 7%, no humus, matrix color 5YR 5/4 dull reddish brown, weakly developed medium subangular blocky structure, many fine pores, no mottle, permeability fairly free, somewhat compact, smooth abrupt boundary
20 - 100cm	C horizon, texture S, no gravel, no humus, matrix color 10YR 7/8 yellow orange, structure-less single particle, no mottle, many fine pores, permeability free, compactness loose

Retained moisture after 24 hours measured in the field is 3.1 - 13.8%. Regarding the lower limit of available water as half of 24 hour moisture retention and the upper limit as the water ratio at pF 1.5, the available water capacity (AWC) of this unit ranges from 5.1 to 12.5%. Namely, it is possible to expect 5.1 - 12.5 mm of available water per 10 cm of the soil depth, which is 2 - 3 mm more than the soil unit Rd. The whole soil horizon seems to keep a large water permeability in connecting with its high value of air ratios at pF 1.5. The value of SP is 14.9 - 22.8%, ECe 0.9 - 3.9 m mhos/cm·25°C and $EC_{1.5}$ 1.2 - 6.1 m mhos/cm·25°C nearly coincides with the case of Dystric Regosols.

As for the chemical properties of this unit, its distributional range is as follows (Table III.C.7): PH (H_2O) 7.0 - 7.8, CaO 0.10 - 0.20%, MgO 5 - 20 mg/100 g·soil, K_2O 3 - 15 mg/100 g·soil and NaCl 0.01 - 0.10%. The frequency of these values are: 50% for 0.15% (rich) and 38.9% for 0.20% (profuse) of CaO; 61.1% for 5 mg/100 g·soil (scanty) and 33.3% for 10 mg/100 g·soil (fairly poor) of MgO; 55.6% for 3 mg/100 g·soil (fairly poor) and 33.3% for 8 mg/100 g·soil (moderate) of K_2O; and 38.9% for 0.05% (fairly rich) and 38.9% for 0.10% (rich) of NaCl. This soil unit has a little richer content of CaO than Rd, but almost the same content of the other salts. This does not appear to indicate an example of profuse 0.15% NaCl.

2-4 Calcic Yermosols (Yk)

This soil unit is mainly distributed on the old riverine terrace located in the southern part of the Project area and ranging from east to south and also on the desert pavement of the northern part of the Project area. The parent material of this unit seems to be deltaic in origin.

The soil profile survey of this unit was conducted on 10 profiles. Soil profile discriptions of these profiles are shown in the tables in the Appendix. The results of the physical and chemical analysis totalling 17 profiles and 69 soil horizons are presented in the tables and the figures in the Appendix.

As found in the description of soil profile No.33 for example (Table III.C.9), there exists an A horizon with weakly developed structure followed by a B and C horizon. The A horizon is about 30 cm thick, LS - SL in soil texture, and diversified gravel content. Its matrix color ranges from orange (5 YR 6/8) to reddish brown (2.5 YR 4/6). The soil unit consists of weakly developed medium subangular structure and often contains some amount of gray colored and powdery $CaCO_3$ segregations. The B horizon is diverse in thickness, LS in soil texture, and has various degrees of gravel content. Matrix color ranges from dark reddish brown (2.5 YR 3/6) to dull reddish brown (2.5 YR 4/4). Its structure is weakly developed coarse subangular, it is often gray in color (7.5 Y 8/1) and contains many powdery $CaCO_3$ segregations. The C horizon is LS - S in texture and has various degrees of gravel content. Matrix color of this horizon ranges from reddish brown (2.5 YR 4/8) to bright reddish brown (5YR 5/6) and orange (5 YR 6/6). There does not exist any developed structure.

As indicated in Table III.C.6 the distribution of physical properties analyzed on 11 profiles and 52 horizons, a distinctive feature of the particle size distribution for coarse fractions is that a large portion, 36.9 - 75.6%, of this soil is concentrated in a particle size of 0.2 - 1.0 mm just as the Dystric Regosols and Haplic Yermosols. Gravel content of this unit is 1.6 - 32.0%.

The three phase distribution at pF 1.5 is as follows: solid ratios (Sv) 62.8 - 71.3%, water ratios (Mv) 6.2 - 21.1%, air ratios (A) 10.2 - 28.1%, porosity (P) 28.7 - 37.2%, and volume weight (S) 166.4 - 189.0 g/100 cc. The frequency of these values nearly coincides with the case of soil unit Yh. Fig. III.C.11 shows the three phase distribution at pF 1.5 of the soil profile No.33. Regarding the lower limit of available water as half of the 24 hour moisture retention (3.7 - 15.9%) and the upper limit as the water ratio at pF 1.5, the available water capacity (AWC) of this unit becomes 3.2 - 13.0%.

Table III.C.9 PROFILE NO. 33

Date of survey	:	19 Feb., 1982
Location	:	South (middle), 300 m north site from Zagagig road
Physiographic position	:	Old riverine terrace
Surrounding land form	:	Nearly flat
Land use	:	Desert
Parent material	:	Old alluvium
Great soil group	:	Calcic Yermosols (Yk), gravelly phase
Soil series	:	Mo2 Mollak soil series

Profile description :

0 - 30 cm Weakly developed A horizon, texture LS, few fine round gravells 3%, no humus, matrix color 5YR 6/8 orange, weakly developed medium sub-angular blocky structure, no mottle, porosity P33.8 - 37.0%, three phases under PF1.5 are solid ratios Sv 63.0 - 66.2%, water ratios Mv 10.5 - 12.8% and air ratios A21.0 - 26.5%, 24 hrs moisture FC8.7 - 10.0%, saturated percentage SP 17.8%. Electric conductivity under pF1.5 $EC_{1.5}$ 2.5 - 4.6 m mhos/cm.25°C and under saturated condition ECe 1.2 - 1.4 m mhos/cm.25°C. Smooth clear boundary.

30 - 60 cm B Horizon, texture LS, many small round gravels 10%, no humus, matrix color 2.5 YR 3/6 dark reddish brown, weakly developed coarse sub-angular blocky structure, many $CaCO_3$ segregation (7.5 Y 8/1 light gray), porosity P33.3 - 35.3%, three phases under pF1.5 are solid ratios Sv 64.7 - 66.7%, water ratios Mv 8.6 - 11.2% and air ratios A 24.4%. 24 hrs moisture FC 7.2 - 10.0%, saturated percentage

SP 15.7%. Electric conductivity under pF1.5 $EC_{1.5}$ 3.4 - 5.6 m mhos/cm·25°C and under saturated condition ECe 2.0 - 3.2 m mhos/cm·25°C. Smooth clear boundary.

60 - 100 cm C horizon (subhorizons C1 60 - 80 cm, C2 80 - 100 cm), contents of gravel C1 10% and C2 20%, respectively, no humus, texture LS -S, matrix color 2.5 YR 4/8 reddish brown and 5 YR 6/6 orange, porosity P 33.9%, three phases under pF1.5 are solid ratio Sv 66.1%, water ratio Mv 9.5% and air ratio A24.4%. 24 hrs moisture FC 6.4%, saturated percentage SP 17.3%. Electric conductivity under pF1.5 $EC_{1.5}$ 5.6 m mhos/cm·25°C and under saturated condition ECe 4.0 - 4.6 m mhos/cm·25°C.

This implies 3.2 - 13 mm of available water per 10 cm of soil depth, which roughly coincides with the case of Yh and is 2 - 3 mm larger than that of Rd. Judging from the value of air ratios at pF 1.5, the water permeability of this soil seems rather large. 15.7 - 23.7% of the saturated percentage is slightly larger than Yh and both values of ECe 1.2 - 4.6 m mhos/cm·25°C and $EC_{1.5}$ 2.5 - 8.0 m mhos/cm·25°C are remarkably larger than those of Yh.

The distributional range of chemical properties is shown in Table III.C.7 : PH (H_2O) 6.5 - 7.6, CaO 0.15 - 0.20%, MgO 5 - 20 mg/100 g·soil, K_2O 3 - 15 mg/100 g·soil and NaCl 0.05 0.15%. The frequency of these values shows: 35.3% for 0.15% (rich) and 64.7% for 0.20% (profuse) of CaO; 70.6% for 5 mg/100 g·soil (scanty) and 29.4% for 10 mg/100 g·soil (fairly poor) of MgO; 58.8% for 3 mg/100 g·soil (fairly poor), 17.6% for 8 mg/100 g·soil (moderate) and 23.5% for 15 mg/100 g·soil (rich) of K_2O; and 41.2% for 0.05% (fairly rich), 35.3% for 0.10% (rich) and 23.5% for 0.15% (profuse) of NaCl. Compared with Yh, it contains noticeably much more CaO and NaCl.

2-5 The Results of Contract Analysis

A contract analysis was made on 7 profiles and 20 horizons, of which 2 profiles and 6 horizons belong to Rd, 3 profiles and 9 horizons to Yh, one profile and 3 horizons to Yk and 2 horizons of soil profile No.24 to Gravel Land.

The items analyzed as physical properties of soils are size distribution of particles of gravel and fine soil, content of $CaCO_3$, saturated percentage, and electric conductivity at a state of saturated percentage, and such chemical properties as PH (H_2O), PH (KCl), cation (Na^+, K^+, Ca^{2+}, Mg^+) and anion (Cl^-, HCO_3^-, SO_4^{2-}). The results for each soil profile are attached in the Appendix.

The common feature of size distribution of particles to the three soil units is that these contain an overwhelmingly large portion of coarse sand. Gravel content is richer in Yk than Yh, whereas scarce in Rd. The content of silt plus clay is

Table III.C.10 Distributional Ranges of Physical and Chemical Properties of Soil Units (Contract Analysis)

Items / Soil units	Particle size distribution						Saturated percentage	Electric Conductivity
	Gravel	Coarse sand	Fine sand	Silt	Clay	$CaCO_3$	SP %	m mhos/cm.25°C
Dystric Regosols Rd	0 ~ 0.08	73.9~90.4	9.2~24.9	0.08~1.3	0 ~	0.19~0.38	14.0~17.9	1.1 ~ 1.8
Haplic Yermosols Yh	0 ~19.9	55.3~84.6	10.5~34.7	1.5 ~5.0	1.0~2.5	0.09~1.73	12.8~19.0	0.9 ~ 4.9
Calcic Yermosols Yk	20.0~23.5	53.2~58.6	7.1~26.6	3.3 ~6.0	2.0~4.0	2.88~4.23	13.8~15.3	1.2 ~ 4.2

PH		Cations meg/100g.soil				Anions meg/100g.soil		
(H_2O)	(KCl)	Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	HCO_3^-	SO_4^{2-}
7.1~7.6	6.1~6.8	0.13~0.18	0.09~0.13	0.03~0.06	0.02~0.08	0.12~0.22	0.01~0.02	0.006~0.05
7.0~7.8	6.0~6.2	0.13~0.48	0.03~0.23	0.03~0.19	0.01~0.09	0.14~0.81	0.01~0.03	0.007~0.08
7.5~7.6	6.0~	0.13~0.39	0.03~0.07	0.01~0.09	0.01~0.10	0.11~0.56	0.01~0.02	0.01 ~0.03

rather small in all three units, and especially small in Rd, which lacks clay. Even in the case of Yk with large contents of clay, the silt and clay content does not surpass 10%. $CaCO_3$ content of YK reaches to 3 - 4%, because of its $CaCO_3$ segregation. ECe is small in Rd and large in Yh and Yk. No differentiation of pH distribution exists among the three soil units. As for water-soluble cations, Yermosols have more content than Regosols, though a common fact to the three units is that there are more Na^+ than other ions. Ca^{2+} is the smallest in Yk with $CaCO_3$ segregation. Anion is small in Regosols and large in Yermosols, though the common phenomenon is that Cl^- is larger than the other ion.

2-6 Soil Classification

Besides using the soil unit classification as a standard unit in soil classification, soil slope for Regosols and gravel contents for Yermosols was also applied.

The explanation concerning the establishment of the classification standards is included in the Appendix.

Classification by soil slope is f: 0 - 3%, flat - nearly flat, u: 3 - 8%, gently undulating - undulating, r: 8 - 16%, gently rolling - rolling. Yermosols are mainly distributed in riverine terrace, therefore, soil slope classification was not applied. In the gravel contents classification, soil horizons within 60 cm of the ground surface and having a gravel content of more than 10% that is more than 20 cm thick were classified as gravelly phase. Places where gravel content was less than 10% or more than 10% but the soil horizon was less than 20 cm thick were classified as common phase. Regosols are mainly distributed in shifting sand dune areas, since the parent material is primarily aeolin sand there is hardly any gravel content, therefore, this classification was not utilized.

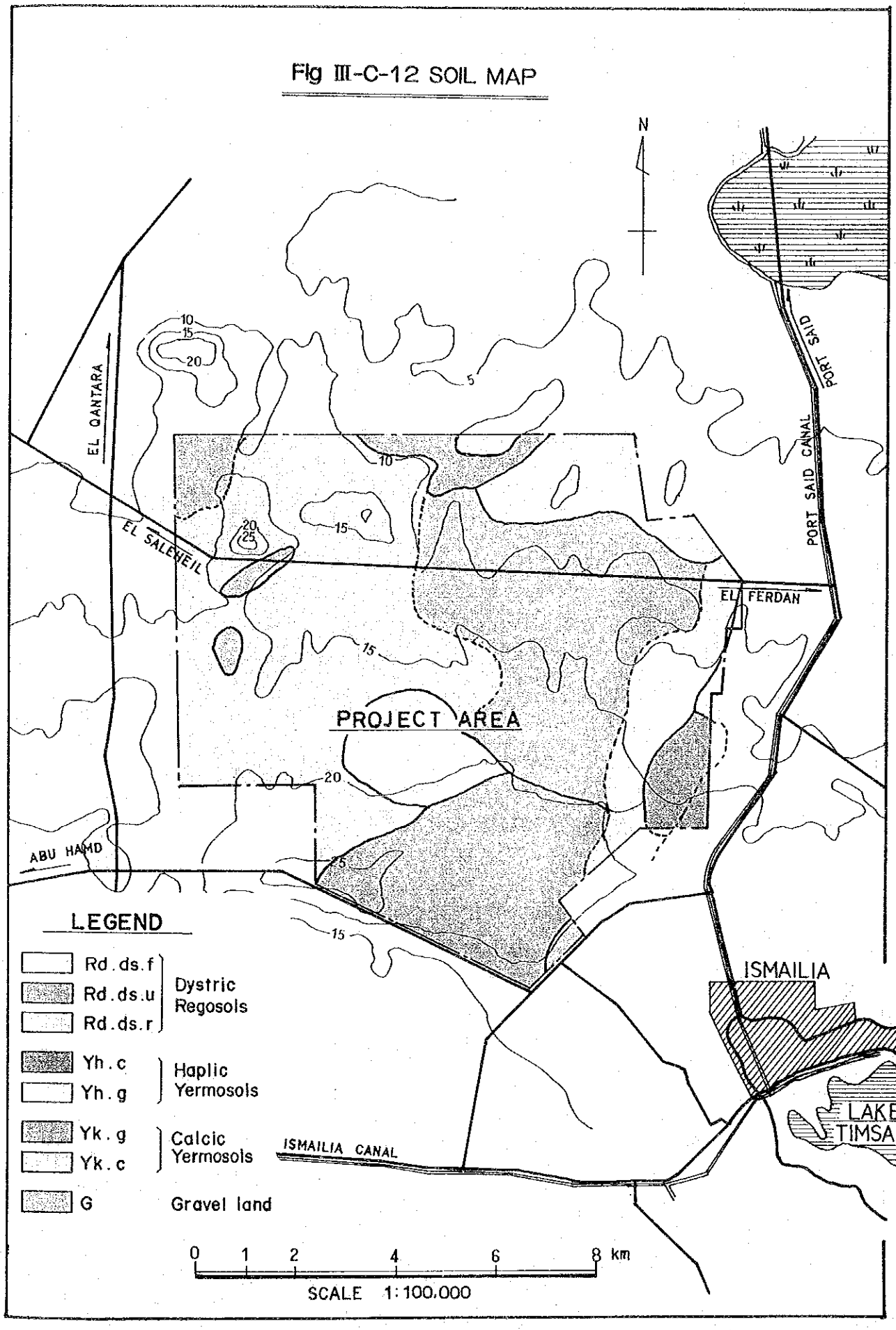
In further classification of the gravelly phase, gravel content of 10 - 20% was labeled g, and as g_2 for 20 - 50%. For gravel content over 50% the label G (Gravel Land) was used but gravelly soil was dealt with separately.

In accordance with the results of the soil classification survey, the various soil phases distributed throughout the Project area were defined and a soil map of the scale 1:25,000 was produced, (Refer to Appendix).

The results of the soil classification survey showing the distribution areas is as follows:

Total Project Area		21,524 feddan	9,044 ha	100.0%
Dystric Regosols (Rd) (deep sandy phase)		13,741	5,771	63.9
nearly flat	(f)	1,281	538	6.0
gently undulating	(u)	4,450	1,869	20.7
gently rolling	(r)	8,010	3,364	37.2
Haplic Yermosols (Yh)		2,871	1,206	13.3
common phase	(c)	476	200	2.2
gravelly phase	(g)	2,395	1,006	11.1
Calcic Yermosols (Yk)		4,614	1,938	21.4
common phase	(c)	298	125	1.4
gravelly phase	(g)	4,316	1,813	20.0
Gravel Land (G)		298	125	1.4

Fig III-C-12 SOIL MAP



D. AGRICULTURAL CONDITIONS

1. Agricultural Production

(1) The Egyptian agricultural year commences in October when farmers begin cultivating of winter crops. Throughout the year, arable land is sown with two major groups of crops, one consisting of winter crops and the other of summer crops. Apart from the perennial orchard area, there still remains the lands along the River Nile where so-called Nili crops are grown after the flood season. The cropping pattern, however, underwent a considerable change in the quarter-of-a-century from 1952 to 1978 which is known from the shift of land-distribution under each group of crops: 46.8% to 45.1%, under winter crops; 32.5% to 44.5%, under summer crops; 19.6% to 7.4%, for Nili crops; and 1.0% to 3.0%, for orchards. In the meanwhile, taking into consideration an increase of the land under cultivation by 20% from 9.31 million feddan to 11.15 million feddan, the expansion of the shares for the summer crops and orchards is noteworthy, both relatively and absolutely, against a sharp decline of that for the Nili crops.

(2) 5,025 thousand feddan is put under the winter crops such as berseem (55.4%), wheat (27.5%), pulses (6.8%), and vegetables (4.5%) which together occupy 94.2% of the winter crop acreage. The more diversified cropping is made of the summer crops (4,967 thousand feddan): maize (28.3%), cotton (23.9%), rice (20.6%), vegetables (9.3%), and sorghum (2.4%). Maize (824 thousand feddan), being followed by vegetables (30.5%) and sorghum (2.4%). Crop-wise distribution of all the agricultural land put under cultivation is as follows: berseem (25.0%), maize (17.0%), wheat (12.4%), cotton (10.7%), rice (9.3%), and sugar-cane (2.2%). 951 thousand feddan grown with vegetables is occupied upto 60% by the three principal items of tomatoes (32.7%), potatoes (13.5%), and watermelons (12.7%). Orchards which extend over 332 thousand feddan are mainly

made up of citrus (56.3%), grapes (15.1%) and mangoes (8.1%).

(3) The cropping situation in the Governorate of Ismailia does not reflect what is prevalent all over the country and is characterized by much higher cropping ratio in general due to an absence of the Nili crops and particularly by an intensive cultivation of fruits and vegetables which has had a reputable history since olden times. According to the 1981 survey by the Department of Agriculture, 136,685 feddan was put under the following crops: winter crops on 61,530 feddan (45.0%), summer crops on 57,613 feddan (42.2%), and 17,539 feddan as orchards whose ratio is as high as 12.8%. Product-wise distribution was: field crops (39.3%), fodder crops (21.0%), vegetables (26.8%), and fruits (12.8%), the last two items occupying nearly 40% of all, far exceeding the national average of 11.5%. No cotton is grown in this Governorate and the land devoted for cultivation of wheat and rice is very small at 7.5% and 2.1%, respectively. Tomato and watermelon are the two major vegetables each occupying 46.4% and 33.9% of the total production, while citrus and mango are predominant among the fruits, respectively comprising of 61.9% and 32.5%. Farmland in Ismailia Governorate is just a fragment as small as 1% of the national total and yet its position in the entire production in Egypt is spectacular as far as the four items referred to in the above are concerned (though the figures do not correspond to those of 1981):

Item of Production	Percentage in Total National Production
Tomatoes	5.4%
Watermelon	10.3%
Citrus	5.8%
Mangoes	21.1%

This unmistakably indicates the Governorate's specialization in agriculture such as vegetables and fruits.

(4) Winter crops by order of land put under their cultivation are: berseem (37.1%), tomato (21.5%), wheat (16.3%), barley (15.3%), alfalfa (4.8%), and pulses (1.7%). Summer crops are made up of: maize (30.0%), watermelon (22.2%) and groundnut (18.1%) plus tomato (6.7%), alfalfa (5.3%), rice (5.0%), sesame (5.0%), cucumber (4.3%) and melon (3.9%). Thus vegetables, especially tomato, are adopted as important items among the winter crops, side by side with potato grown as winter crop which is harvested in April for export. Cultivation of strawberry which has been recently introduced (1981) is rapidly expanding because it fetches lucrative price, and such popularity of strawberry cultivation is also urging experiment with its new varieties which would ensure all-the-year-round harvesting.

(5) Because of the above-said specialization in vegetable and fruit, the 3-year rotation system centerring around cotton, wheat and rice, which is commonly adopted by the Agrarian Reform Co-operative Societies, is not made compulsory in this Governorate. On the other hand, scarcity of land made available for production of fodder crops obliges the local farmers to procure a large amount of rice straw and wheat straw from the Deltaic area to be used as fodder and litter in rearing their cattle.

(6) Food crops are marketed through the systematized channel established between the local agricultural co-operatives and the Single-Purpose Central Society specializing at handling of the field crops at the Governorate-level, but the vegetables and fruits are almost exclusively shipped out to the market through the merchants. Although they are mostly meant for domestic markets, parts of orange, mango, potato and tomato are diverted for export. The State-operated "KAHA" Company is processing farm products including that of tomato into paste. Collection of its material which amounts to about 1% of the total tomato production in the

country is undertaken by the merchants, though it is not clear how much of such material-tomato supplied to this Company comes from the local products in the Governorate of Ismailia. Fresh tomato available during February and March exceeds the domestic demand all over the country causing a considerable rotting and disposal of its stocks so much so that counter-measures including its processing are seriously studied in this Governorate. The horticultural products find their principal home markets in Cairo, Port Said, Suez and Ismailia itself which assumes the position of advantage for their distribution among these centers of consumption.

2. Livestock

(1) 1979 Year Book contains country-wide statistics of the kinds and numbers of the cattle and the fowl as follows: cows (2.59 million), buffaloes (2.54 million), sheep (2.54 million), goats (1.44 million), camels (93,000), pigs (15,000), chickens (26.99 million), ducks (3.39 million), geese (2.69 million). Among the cows, the native Baladi stock originating to Sebu strain to a large extent is reared for meat, and the Friesian stock which was introduced long ago, for milk. Multi-purpose Brown Swiss is being introduced in recent years. Buffaloes are meant for both milk and meat. Food supply is rather tight in Egypt today, and meat is no exception being available in the market only 3 days a week. Cattle slaughtering is restricted to cows above 5 years old and bulls over 300 kg in actual live weight. There is no restriction to the slaughtering of buffaloes. Agricultural mechanization is being encouraged, in a way, to avoid man-animal competitions for land under fodder crops. To cope with the demand increasing in degree to the elevation of the living standards of the countrymen, cattle for meat, milk and the both need to be improved of their stocks and altogether multiplied in greater numbers,

hand in hand with betterment of their breeding methods including considerations towards fodder crops.

(2) As of 1981, the kinds and strength of the livestock in this Governorate are reported as follows: milk cows 750, Egyptian cows 38,460, buffaloes 9,777, donkeys 8,822, sheep 15,688 and goats 19,115, totalling 92,612. When all the large cattle are put together, their percentage in the national total comes to 1.0%: the combined strength of milk cows and Egyptian cows representing 1.5% and that of buffaloes alone, 0.4%. The ratio of its farmland to the national total is likewise 1.0% as already mentioned. When these ratios are considered in association with its farmland ratio, it may be concluded that a conversion of the kind of cattle to those meant for better-quality milk and meat (from baffaloes to cows) has reached a more advanced stage in this Governorate compared with others. Out of the keen interest for introduction of the improved stock of multi-purposed variety, the Governorate of Ismailia started importing Brown Swiss first from Austria in 1975 and thence from West Germany, and is said to be intending to increase its strength to 10,000 heads in the future. At about 30 km south of Ismailia city, there is Ismailia MISR Company for Chickens which is intended to be a large-scale poultry farm with 12 farms in total, 6 for breeding and 6 for broiler, every farm consisting of 10 sheds each containing 16,000 birds. It will have a feed factory mixing 20 tons of ingredients per hour, a slaughterhouse handling 1,500 birds per hour, and a hatchery incubating 78,000 chicks per day. A part of the above-said facilities is already in operation; and the young chicken meat is being packed and sent out to Cairo. This is a self-supporting broiler complex, independent from the local poultry industry but is no doubt stimulating the agriculturists in the Governorate to start producing chickens for meat and eggs in a bigger way. As for the chicks, however, they have to largely depend on the supply from the neighbouring Sharkia Governorate.

(3) Milk cows are mostly reared in small number of one or two and exceptionally in a large herd of 100 by loose barn system, and the scale of their breeding is generally inclined to expand. The rearing scale of meat cows roughly corresponds to the size of the holdings, though that under shed-fattening system is not uniform. Mixed rearing of milk cows and beef cattle is the common practice, but specialization will gradually come to take place as the number of milk cows increase in the future. The scale of poultry-keeping is also turning bigger for production of both egg and broilers. It is feared, however, that the organized husbandry of large animals will be facing the problem of fodder supply particularly during summer season which will have to be solved through expansion of the acreage under alfalfa and Napier grass now being introduced.

(4) The environmental conditions for development of dairy and cow meat production have so far been qualified. As for cow milk, there is a plant for treatment and processing of 50 tons per day, although it is far from being fully operated at the present. There are an artificial insemination station and a veterinary clinic, too. Furthermore, completion of a large slaughterhouse capable of handling 600 cattle a day, being equipped with processing and storage facilities, is also near at hand.

3. Agricultural Research and Extension

(1) Agricultural research system in Egypt was previously organized by the Ministry of Agriculture with 7 research divisions and 11 crop-wise regional experiment stations (6 in Lower Egypt, 3 in Middle Egypt and 2 in Upper Egypt). In 1971, these research divisions were reorganized and 10 specialized research institutions, including the Desert Research Institute, were established. Agricultural Research Center (ARC) was also newly founded. The research activities

taken up by the Ministry of Agriculture are being carried on by the task-forces made up of 210 researchers (Ph.D.) and associate-researchers (M.Sc.), 2,400 assistant-researchers (B.Sc.), and 15,000 technicians, office-workers and field operators. In addition, the Ministry of Irrigation has the Water Research Center and the Ministry of Land Reclamation has the Desert Institute. They are respectively engaged in study on the water requirements and the technical problems relating to desert development. Research and study on agricultural development is also taken up by the National Research Center as well as the Agricultural Colleges of the Universities.

(2) For a long time in the past, agricultural research work was not taken up at the Governorate-level, and no regional experiment station was located in Ismailia until 1980 when ARC decided to commence research centerring around the water requirements and nutrients of the desert crops by opening its branch in this Governorate by the name of Ismailia Agricultural Research Station. Experimental study has been started recently by 16 scientists and 20 other staff on its 300 feddan-wide farm. High hopes are placed on its future performances as the research work of the Station is expected to grow along with the replenishment of its facilities. Ismailia Agricultural Research Station can be reached within a short distance of 500 m only from the village site of the Tenth of Ramadan Project Area, and this assures an immediacy of applicability of the results obtainable there to the Project and many other benefits.

(3) Agricultural extension services in Egypt are systematized throughout the country in a pyramidal order from the Center down to villages. At the Governorate-level, there is the Extension Division under the Department of Agriculture, and in the Township are Agricultural Units each attached with a demonstration farm and attended by an Extension worker who is given responsibility of extension services among the villagers both directly and indirectly.

(4) Governorate of Ismailia is made up of 5 Townships on the western side of the Suez Canal and 1 Township on its eastern bank. Out of some 800 officials belonging to the Department of Agriculture, 100 are engaged in extension work, 52 of them working at the Department itself and the remaining 48 stationed at the outposts (32 are attached to the village co-operatives and the rest attending at demonstration farms). Most of the demonstration farms are less than 10 feddan in size, but some of those in the Township in Sinai Peninsula are as large as 50 feddan. Extension services are being given in diversified manner such as the public relations activities by the medium of pamphlets and monthly bulletins which are prepared at the Center, the dealings with the visitors at the demonstration farms, the movies, and the technical guidance of the agricultural co-operatives which are the terminal points of the extension activities. For example, much emphasis was being put on strawberry cultivation through its experimental production on the demonstration farm when the Survey Team visited the Township of Ismailia.

4. Farm Input Materials and Rural Credit

(1) Distribution of farm input materials and rural credit is handled by a national network of the Agricultural Development Credit Bank which has its branch in the Governorate, sub-branch in the Township and village banks at the lowest level. In the Governorate of Ismailia, there is the Co-operative Agricultural Credit Bank Ismailia which has 4 Township branch-offices each bearing the name of the Township where it is established (not yet established in the Township of East Quantara in Sinai Peninsula), besides 5 village banks. Abu Sower Village Bank and Dablhia Village Banks are in the Township of Ismailia, Abu Khakfa Village Bank in West Quantara, Cuasassin Village Bank in Tel El Kebir, and Abu Sattan Village Bank in Fayed. Each village bank

keeps accounts opened by the customers and has a large store-house to facilitate for smooth distribution of agricultural necessities. In each of 32 villages where the multi-purpose agricultural co-operatives are organized, there is maintained one store-house-cum-branch-office manned by a clerk to cater for filing of applications for distribution of farm materials among the member-farmers. These institutions referred to in the above provide banking services to non-members of the agricultural co-operative societies also.

(2) The main lines of banking services are the provision of short-, medium- and long-term loans as well as the acceptance and repayment of deposits. Short-term loan is available in kind with such as fertilizers, agro-chemicals, seeds, etc., on security of the crops harvestable at the end of the season; different rates of interest are charged for winter crops (2.0%) and summer crops (3.5%). Poultry fund is obtainable on the loan in between the short-term and the medium-term loans (17 months) at the interest rate of 6%. Medium-term loan extending for 4 - 5 years is generally made for purchasing of tractor and/or milk cow, at the annual interest rate of 8%. Long-term loan (10 years) is offered for land reclamation and its interest rate is 3% per annum. Beside these loans meant for agricultural purposes, 6 year loan is made available to the agriculture-related enterprises at the annual interest rate of 6%. Though threatened for discontinuation by the claim raised against it by the Center, a short-term loan by the name of "village development fund" is also obtainable for purchasing of durable consumer goods.

(3) The short-term loan was the mainstay of the agricultural credit made available all over the country, occupying more than 95% of the entire loan through the Agricultural Banks, until 10 years ago. Along with the progress of "modernization" of agriculture, short-term loan has been

decreasing relative to the gradual increase of the medium-termed one. The outstanding balances in the Governorate of Ismailia in 1981 show 2.0 million pounds under short-term and medium-term loans, 0.2 million pounds as reclamation fund, and 2.0 million pounds in terms of the medium-termed agri-business loan. Breakdown by purposes of the agricultural loans, short and medium put together, is: 50% for short-termed seasonal cropping, 30% for poultry, 15% for medium-termed machinery and livestock procurement, and 5% for purchasing of durable consumer goods. Long-term reclamation loan is expected to increase in the future. On the other hand, the amount deposited totalled 6.73 million pounds at the end of 1981.

5. Agricultural Labour

(1) 1976 census registered the total population of the Governorate of Ismailia as 353,337 which corresponds to a little less than 1% of the entire population of Egypt. Their sex-composition is 51.28% male and 48.8% female, and urban-rural ratio is 49.2% to 50.8%. Although male-female composition remains almost the same in both urban and rural areas, male percentage is slightly higher in urban area. Absolute majority is made up of Muslim 97.3% and the rest consist of Christians and others. 51.0% of the Governorate population, or 37.3% of the urban population and 65.5% of the rural population, are reported to be illiterate.

(2) Sector-wise comparison of the employed labour in this Governorate with that in the country as a whole brings to light the particular role being played by its labour force in the national efforts devoted to socio-economic development of Egypt. Distribution of the workers employed in the Governorate of Ismailia totalling 92,320 among different sectors as compared with that in the country is as follows:

Sector	Ismailia Governorate	Egypt
Agriculture & Fishery	38.1%	42.2%
Construction	11.7%	5.2%
Transportation & Communication	11.0%	4.6%
Mining & Manufacturing Industry	5.6%	12.8%
Miscellaneous	33.6%	35.2%

While the ratio of Agriculture & Fishery is somewhat smaller and that of Mining & Manufacturing Industry is very much smaller than the national average, very heavy weight is given to Construction combined with Transportation and Communications. This phenomenon can be explained by the fact that this Governorate holds a pivotal position in the traffic and transport routes of national importance such as the Suez Canal, Cairo - Port Said and Cairo - Suez Highways and, at the same time, is assigned a duty to serve as a base for rehabilitating the previously occupied area in Sinai. The employed labour is dominated by male workers 94.7% as a whole and by the overwhelming percentage of 98.5% in agriculture. Participation of female workers in field work or non-domestic duty is extremely limited.

(3) The workers employed in the agricultural sector include landless farmers, though it is rather difficult to identify their strength. Many of them were favoured with distribution of land through a series of Agrarian Reform in 1952, 1961 and 1969. Most of the landless labourers are living with their family members in humble cottages built in the fringe area bordering the villages or on farms belonging to their landlords or their surroundings. They are employed either permanently or temporarily, being paid LE40 per month in the former case and LE2 per day in the latter case (minimum wage specified under the law is LE1/day).

A tractor operator receives LE5/day. 32 agricultural labourers being housed along Ismailia - Quantara Road were visited in a course of the Survey Team's study. They were living in sun-baked brick buildings, roofed by hurdle made of reed-mat and most were supplied with electricity. Being 47.6 years old on an average, they were earning a monthly income of LE51.1 to sustain a 6.4 member-family. Their household effects and their prevalence are as follows: kerosene cooker, 93.8%; T.V., 37.5% electric washing machine, 12.5%; and bicycle, 6.3%. 18.8% of them had donkeys. 15.6% of the houses were latrine-less. A few fowls such as chickens, ducks, geese, pigeons, etc., were being kept inside their houses or enclosing walls could also be counted among the remaining assets.

(4) These agricultural labourers are not necessarily fully employed and their aspirations for more gainful employment opportunities and particularly posession of land to till by themselves are quite strong. It is widely admitted that most of the settlers arriving from the Delta and the Nile Valley in the West have little knowledge or experience of cultivating more than a few kinds of crops which causes not a small problem to the settlement authorities. The local labourers who are engaged in agricultural activities are more inclined to horticultural production, however, they have enough experience in dealing with other crops and animals, and are believed to be available as powerful reserve forces to be deployed for reclamation operations inside the Governorate.

6. Land Ownership

(1) According to the Department of Agriculture's 1981 survey, the total acreage put under cultivation in this Governorate is reported to be 66,634 feddan being divided among 20,838 farms, that means 3.2 feddan per farm or 1.9 feddan per agriculturally employed person. This is wider than the national average. Interesting information

is made available through a comparative study between the scale-wise holdings in this Governorate and that in the country as a whole, though at varying points of time, as follows:

Scale of Holdings	Ismailia (1981)	Whole Country (1975)
5 feddan	52.2%	49.7%
5 - 10 "	22.9%	11.1%
10 - 20 "	22.9%	10.5%
20 - "	6.2%	28.5%

While polarization of land holding patterns into the two extremes was undeniable all over the country inspite of a series of Agrarian Reforms, 42% of the farms are comprised of medium-scale holdings between 5 - 20 feddan in this Governorate. It will not be totally irrelevant to mention here that 5,450 or one-fourth of the total farm households were registered in 1971 as members of the Agrarian Reform Co-operative Society.

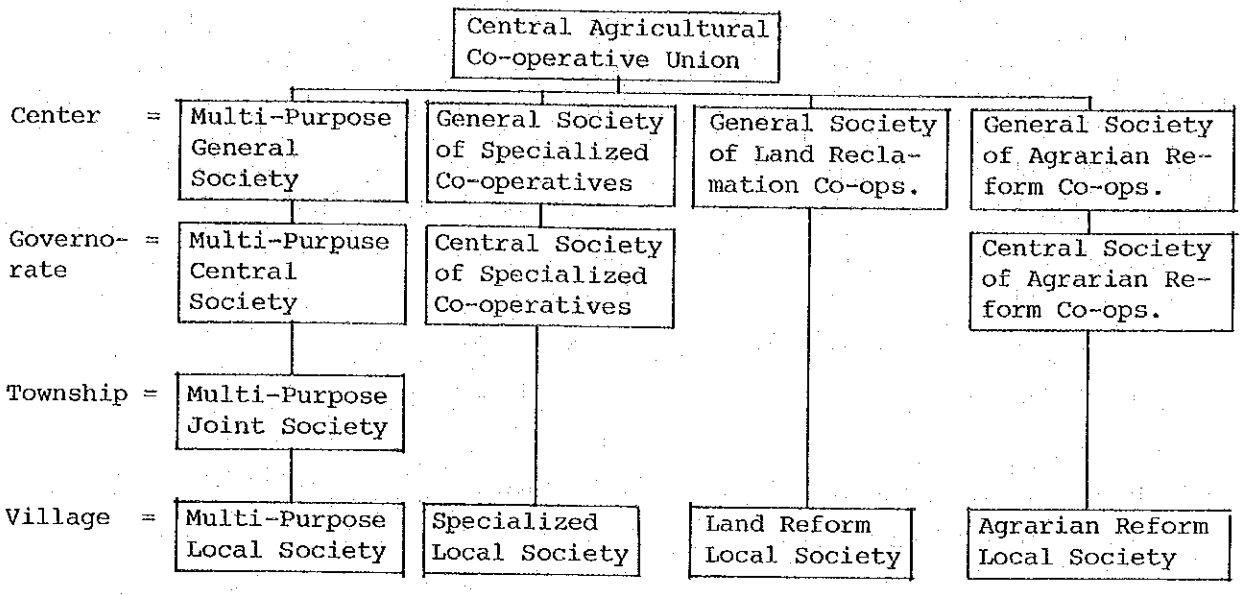
(2) In a transitional period of farming from pairs of oxen to tractors and under the circumstances where 26% of the total farmland is occupied by orchards, owner-farming of a fairly sizable land by the proprietors themselves through employment of permanent labourers or managers, side-by-side, with seasonal tenancy of land for vegetable cultivation is not uncommon in this Governorate. So much so that a considerable concern is being held among the non-agricultural families residing in urban area towards agricultural ventures which promise lucrative income compared with white-collar jobs which are often less rewarding compared to their toilsomeness. Agriculture is thus being re-evaluated by the citizens from such angles as the alternative occupation, second source of income, target of capital investment, and stability and comfort in old age.

7. Farmers Organization

(1) The co-operative Movement in Egypt has been under the strong influence of Britain and the first Agricultural Co-operative Law enacted in 1923, following the establishment of a grass-roots agricultural co-operative society in 1910. This Law has been amended from time to time until it came to assume its present shape in 1980. The number of the primary co-operatives increased in the recent past from 763 in 1942 to 1,703 in 1956, 4,465 in 1961, 5,055 in 1971 and 5,086 in 1977. In the initial period, agricultural co-operatives were organized in a concentrated manner in the Delta and the Nile Valley. There is no record of one having been organized in this Governorate until as late as 1942, and their advent to this part of the country is assumed to be sometime during 1956 and 1961 when organization took place all over the country in succession on the heels of the Revolution.

(2) The Agricultural Co-operative Law in current force covers multifarious kinds of co-operative organization not only those directly dealing with farmers and their agricultural production such as the multi-purpose co-operatives and the specialized co-operatives but also Agrarian Reform Co-operatives (Law No. 178 of 1952), Land Reform Co-operatives (Law No. 100 of 1964) and the fishery co-operatives. Agricultural co-operatives as stipulated for in the said Agricultural Co-operative Law can be broadly divided into two types, the multi-purpose and the specialized, as illustrated below:

Fig. III.D.1 Organization of Cooperative in the R.A.E.



Agricultural co-operatives are given various privileges including exemption of import duties on the farm requirements including machinery which are imported by them, plus 25% discount of their local transportation cost, and 10% discount of the charges on electric power consumed by them. Delegation of the Government officials to take up full-time posts or additional office in the co-operative is also allowed.

(3) The Governorate of Ismailia being relatively small is made up of 5 Townships, the system of agricultural co-operatives is somewhat different from that in other Governorates. For instance, the multi-purpose local societies at the village level are directly affiliated to the Central Society at the Township level. There are 32 multi-purpose local societies being distributed among 4 Townships (excluding Sinai) by 12 in Isamilia, 8 in Quantara, 7 in Fayed, and 5 in Tel El Kebir, altogether organizing 19,674 farmers which roughly correspond to the number of farms. Each multi-purpose local society has a Board of 5 to 7 Directors, according to its size, and a General Manager who is an agricultural expert delegated from the Governorate. The Central Society is organized by 32 local societies as its members. As for the specialized

agricultural co-operatives, there are two Central Societies, the one dealing with field crops and the other, horticultural products, at the Governorate level. Each one of them is organized by 190 Directors of the multi-purpose societies and managed by 11 of them who are elected from amongst the membership as its Directors. These Central Societies are mainly for marketing of their specialized crops raised by the local multi-purpose societies. There are also 7 Agrarian Reform Co-operatives and 7 Land Reclamation Co-operatives which are affiliated to the respective Central Societies. More detailed sutdy will be made in the following Chapter on the Land Reclamation Co-operatives.

(4) One multi-purpose local society at the village-level which was visited by the Study Team had 7 Directors elected by the general membership, 4 employees, a General Manager who was delegated from the Department of Society, 2 officials of the Department of Agriculture attending at extension services, and 1 sprayer operator from the Department of Co-operatives. This local co-operative society was mainly handling delivery of farm input materials, distribution and testing of chicks, and offering service such as spraying and general technical guidance on behalf of its member-farmers. It also had a grocery store for sales of daily necessities of the member-farmers and their families.

8. Livelihood Environments in the Villages

(1) The Governorate of Ismailia has three freshwater canals passing through it and the railway lines paralleling them, which are jointed together in the shape of the letter "T" at the city of Ismailia. They are: (i) Ismailia Canal which takes in the Nile water at the north of Cairo and runs eastward until it meets the other two canals, (ii) Port Said Canal which runs northward from the joint until it reaches

Port Said, and (iii) Suez Canal which starts from the joint and runs down southward to Suez. It is said that the city of Ismailia was founded in 1869 at the time of construction of the Suez Canal (sea water) and the Suez Canal Company ("Compagnie Universelle du Canal Maritime de Suez") had its office in this city. Today it is the center for navigation and control of the Suez Canal being sited by the Suez Canal Authority. The city of Ismailia, its suburbs and the rural area surrounding it are put under the umbrella of the Township of Ismailia, with a total population of 165,698. It is not only the administrative center of the whole Governorate with the headquarters of the local Government and the outstations of the Ministries of the Central Government but also the pivot of traffic, economic activities, education and culture of the entire region.

(2) 5 Townships which constitute the Governorate of Ismailia are: (i) Ismailia centerring around the city of Ismailia; (ii) Tel El Kebir, along Ismailia Canal; (iii) Fayed, along the Suez Canal (freshwater); (iv) West Quantara, along Port Said Canal, and (v) East Quantara which is a narrow strip of land extending along Suez Canal (sea water), which once prospered with a population of 30,000 but is now only thinly populated and is on its way toward rehabilitation. Each Township has a city or town which serves as its administrative center functioning around the local agencies of the Governorate, and such city or town is usually the core of economic activities there.

(3) Grades and terms of education in Egypt are: primary (6 years), preparatory (3 years), secondary (3 years), and university (4 years). There are also training schools of college grade. Insufficient facilities sometimes oblige a number of primary schools to adopt double-shift teaching. Secondary school is located at the center of each Township, while there are also the French and English schools in Ismailia. Co-education is carried on in these schools.

Suez Canal University, the recent-most addition to the 11 older National Universities, is situated at Ismailia, with one branch university each at Port Said and Suez. The total number of the students enrolled is 7,192, still a small segment of the national total of 477,000. A College of Agriculture is also provided at Ismailia.

(4) Medical facilities consist of both publicly maintained general hospitals and private hospitals. Included in the former are each one general hospital run by the Governorate and the State in Ismailia, and two Governorate hospitals in the Township of Tel El Kebir. Because of a linear extension of the habitation, most of the houses have electric light except for economic reasons (electric light rate being LE1.5/month). Supply of water is made through pipes in the cities and from shallow wells in the villages. The city water made available among the citizens of Port Said and Suez is taken from the Nile water running along Port Said Canal and Suez Canal, respectively. In the City of Ismailia, although scavengery is done publicly, sewage is left for seepage into the ground or flown into the drainage running parallel to Ismailia Canal.

(5) Public wholesale and retail markets are maintained besides general stores and shops handling varieties of commodities in the city of Ismailia. In the rural area, however, regular markets held once a week provide for the venue of transactions such as perishables, livestock, sundry goods for daily use, etc., and the middlemen also take advantage of this opportunity to conduct their business.

E. CONCERTED EFFORT FOR DESERT DEVELOPMENT IN ISMAILIA

1. Desert Development in Ismailia

(1) Agriculture in the Governorate of Ismailia is believed to date back to the excavation of Ismailia Canal which commenced in 1863, prior to the completion of Suez Canal (sea water) in 1869, and the Governorate itself came to take its present shape on the desert land through its development of comparatively recent origin. Three freshwater canals, i.e., Ismailia, Port Said and Suez Canals, which are jointed together at Ismailia city in a "T" shape are the important sources of irrigation water to the farmlands spreading along them. All of them are helping to bring a considerable acreage of alluvial land along their courses as long as they are running inside the territory of the Governorate of Ismailia: Ismailia Canal, a narrow strip of land spreading on both banks; Port Said Canal, an oblong belt running along the fringe of the diluvial projection into the sea; and Suez Canal, most of the alluvial land spreading along its route. Once enterring the neighbouring territories, Port Said Governorate in case of the Port Said Canal and Suez Governorate in case of the Suez Canal, however, the situations are quite different. The former has to pass, before it reaches its destination (Port Said), through salty swamp of so little agricultural use that the Governorate authorities were not encouraged until quite recently to take up agricultural development in seriousness, and the latter has to run along the edge of diluvial plateau before arriving at Suez, leaving the Governorate almost barren except for about 5,000 feddan.

(2) These three Canals were originally dug with the purposes of boat-transport, supply of livelihood water, and irrigation. The purpose first-mentioned was abandoned since boat-transport had been almost completely taken over by land-transport and today irrigation is becoming more important than livelihood water supply. However, utilization of

groundwater for irrigation purposes was not forgotten in the meanwhile: a 550 feddan-wide orchard which is still bearing fruits was developed 45 years ago on the alluvial land along Ismailia Canal by use of groundwater. Agricultural development in Isamilia Governorate was badly handicapped by the outbreak of the Suez War in 1956 and also by continuation of the Middle East War from 1967 to 1973 which prevented the reclamation drive taken up by the State during the 1960's to reach this part of the country. Systematic agricultural development efforts came to be made rather recently.

(3) Farmland in this Governorate which was identified at 54,000 feddan has increased to 66,000 feddan as confirmed by the most recent survey. Individual reclamation which was started on alluvial land around the established farmland is now gradually being extended toward the neighbouring desert land made of diluvial soils. Alluvial land is made irrigable by pumped-up canal water, groundwater, or the combination of the two, while the irrigation of the diluvial plateau in the desert is done by digging wells. Desert-land can be individually held through payment of its worth after reclamation will have been successfully completed. Value of such land depends on its own conditions, and reportedly amounts to more than LE3,000/feddan on the high side. The acreage individually reclaimed is not known.

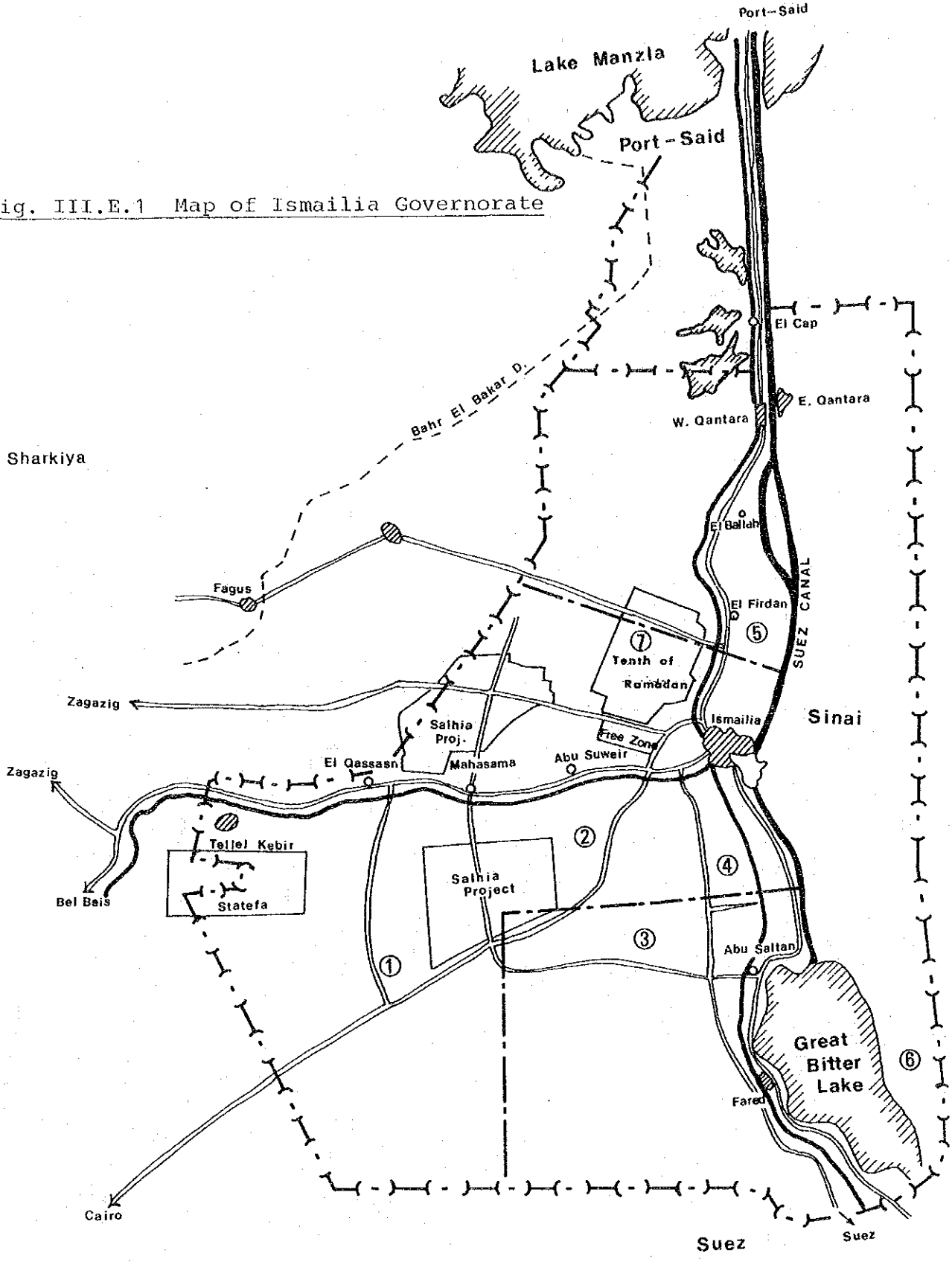
(4) Desert development has also been or is going to be undertaken by the State, Company and Land Reclamation Co-operatives. It has been brought to the Survey Team's knowledge that the State Farm in the western part of the Governorate has so far reclaimed 10,000 feddan out of its planned acreage of 19,000 feddan, and Salhia Project by the Arab Contractor Company covers 56,000 feddan which is split in two parts. The reclamation programmes which are going to be taken up by the Land Reclamation Co-operatives

are as follows:

1)	Salam Society	5,300 feddan
2)	Reclaiming Desert Society	5,000 feddan
3)	Ismailia Society for Agricultural Development	5,000 feddan
4)	Arabia Society for Tree Development	3,000 feddan
5)	Obor Society	2,800 feddan
6)	East Islands Society	3,000 feddan
7)	Tenth of Ramadan Society	21,524 feddan

The total acreage to be developed by the above 7 Land Reclamation Co-operatives totals 45,624 feddan, to which the existing farmland of 66,000 feddan, individually reclaimed 10,000 feddan (tentatively), and the previously mentioned State and Company reclamation may be added to make a grand total of nearly 190,000 feddan, out of which the share of the Land Reclamation Co-operatives is fairly large. As shown in Fig. III.E.1, these seven Land Reclamation Co-operatives are located as follows: (1) northern side of Cairo Desert Road, much closer to Cairo; (2) on the same Cairo Desert Road, but nearer to Ismailia; (3) 30 km to the south of Ismailia; (4) 15 km to the south of Ismailia, bordering to the established farmland; (5) on Suez Canal side along Port Said Road, at about 10 km away from Ismailia; (6) location not yet finally decided except that it will be opened in eastern part of the Great Bitter Lake in Sinai far away from the existing settlement, and (7) study area of this Survey Team, being located closest to Ismailia among all the candidate areas, adjacent to the Industrial Development Zone and the Free Zone Area which is open to the incoming foreign entrepreneurs.

Fig. III.E.1 Map of Ismailia Governorate



2. Land Reclamation Co-operative Societies

(1) The articles of association of the Land Reclamation Agricultural Co-operative Societies unanimously follow the set model prepared at the Center, the difference between those of one from the other being the designation of the specific Society and the location of its office. The institutional mode as prescribed in such model articles of association will be as follows:

(2) The aim of its incorporation is the procurement, reclamation, development and cultivation of the land coming under its command, and its distribution on sale among the membership in view of "raising the socio-economic level of the members." The command area of the Society may be either less or more than 5,000 feddan, less if the plot of land distributable per member is 5 to 10 feddan, and more if it is 10 to 20 feddan. The activities by the Society are pinpointed in the following 19 items:

i) To reclaim the land, develop it and cultivate suitable crops thereon;

ii) To expand the arable land and construct a new modern village;

iii) To reclaim at least 25% of its command area for distribution among the peasantry and the cost and expenses incurred for this specific purpose will be borne by the Governorate;

iv) To devote 5% of its command area for building of residences and other infrastructures, and the relevant drainage, sewage, pumping station(s), electric supply network, etc., need to be completed undr the direct supervision of the Governorate;

v) To collaborate with the planning agencies of the Governorate in formulation of the cultivation programmes and cropping cycles;

vi) To organize and support the membership in obtaining the required funds on loan and to be entitled for various privileges;

vii) To supply modern machinery, equipment and facilities;

viii) To co-ordinate and organize the works on the land belonging to the Society;

ix) To assist farm products processing in collaboration with the Governorate;

x) To provide its membership with necessary marketing services and collaborate with the Governorate agencies toward this end;

xi) To develop animal resources, or introduce improved varieties of breed and stock from abroad;

xii) To arrange for collective marketing of the produce of the membership and to develop its own marketing system;

xiii) To satisfy the needs left among its membership and the peasantry it employs in such aspects of social, economic, health, physical training and co-operation;

xiv) To supply at appropriate prices the consumer goods required by its members;

xv) To produce and keep in storage the farm input materials in as many kinds and amounts as possible;

xvi) To develop villages and build houses in a planned manner by use of modern techniques;

xvii) To satisfy the needs of the membership for machinery, equipment, fund, fertilizers, agrochemicals, etc.;

xviii) To provide loans with the membership for the

above purposes, and to accept deposits and savings on their behalf;

xix) To borrow the land for a long period of time and to let it upon completion of its reclamation.

The difference between the general agricultural co-operatives and the land reclamation agricultural co-operatives lies at the procurement, development and sales of the land by the latter which also has other characteristics including the construction of new village, undertaking reclamation of not less than 25% of its command area for distribution among the farmers with the cost borne by the Governorate, construction of infrastructure including residences under the direct supervision of the Governorate.

(3) Membership is open to anybody who is qualified to such conditions as: i) normal in character, ii) holding Egyptian nationality, iii) making capital investment by buying more than 2 shares, iv) non-affiliation to other land reclamation society, and v) enterring in contract with the society for marketing of his products. Members can be elected as directors by fulfilling such qualifications as: i) non-criminal record, ii) non-defaulter of any financial obligation to banks, etc., iii) residency in the neighbourhood of the society, iv) no monetary interest nor professional rivalry with the society, and v) membership with the society for more than 1 year.

(4) The society is managed by its Board of Directors according to the resolutions adopted in its general meeting. Distribution of land among the residents of the Governorate shall be not less than 30% of that among the non-residents or the employees of the society. Reclamation work shall be completed within 10 years after irrigation water is made available. The member can start developing the land allocated to him by first paying 25% of its

reclamation cost, paying at least 50% of it at the time of land-distribution and the rest in 10 year installment at 9% annual interest.

3. Tenth of Ramadan Society

(1) The Tenth of Ramadan Society is one of the land reclamation agricultural co-operative societies, having a total area (21,524 feddan) which is half of the combined acreage of the remaining 6 societies, with the total membership of 900. Being organized in 1976, this Society was legalized by the Minister of Agriculture in the following year (1977) with the registration No. 4177. It was ratified and given ratification No. 202 under the Law which was amended in 1980. Its official designation is "The 10th of Ramadan Co-operative Society for Reclaiming and Developing Land" and its office is located in "Ismailia Governorate".

(2) The aim of incorporation of this Society is the upliftment of its members socio-economic level, in general, as prescribed in its articles of association but, more directly, is procurement, development, improvement and cultivation of the land which will be disposed on sale among its membership at 20 feddan per member, and to establish a co-operative system for effective production, marketing and processing of farm products.

(3) Its non-farmer membership consists of various circles including merchant, entrepreneur, physician, judge and advocate, Suez Canal pilot, company employee, government officials of the Governorate and the State, etc., who are mostly residing in the Township of Ismailia, belonging to upper-middle and upper classes of the local society. Information obtained through interview with 76 of them was that they are 41.6 years old with 4.6 family members, getting income, excluding that from secondary sources,

amounting to LE207/month, on an average. This-much monthly income may be compared to LE40 of the starting salary of the university-graduate, LE100 of the public servant with 10 years' service experience after obtaining diploma of university graduation, and LE200 usually paid to a Director of a Department of the Governorate. 17.1% of the membership is already in possession of 6.1 feddan of arable land, on an average. With a considerable number of agricultural technicians and experts among them, the level of agricultural knowledge acquired by its membership as a whole is fairly high.

(4) 67% of its members joined the Society within 2 years after its organization (by 1978), and almost all of the present members have paid-up the share capital of LE10 each and 50% of the land purchasing fund amounting to LE1,500 (@LE150 per feddan). The land for distribution is predetermined in order of member's registration, but 2 groups of the members numbering 84 received, as early as 1978, allocation of their land with the sanction to start developing it prior to implementation of an overall development plan. 15 of them have entered the second and third year of cultivation after digging wells and planting windbreaks. Administration-sheds costing LE50,000 and a 10,000 broiler house are among those which are made for operation built by a few of such pioneer-members. Their efforts are taking tangible shape today in terms of the so-called "Pilot Farm" on the site. They have been undertaking these jobs in full knowledge that re-allocation of their land may become necessary once the overall development work covering the entire command area of the Society will be started.

(5) The Board of Directors, an executive organ of the Society, is composed of 7 directors. They are the Secretary General of the Governorate, the Director of Veterinary Department and the Chief Accountant of the Department of

Health of the Governorate, a military officer in charge of conciliation between officials and citizens, a senior pilot of the Suez Canal Authority, the representative of the farmers, and the President of National Transport Company who is the chairman of the Board of Directors. They are apparently eager to launch this large-scaled reclamation and development work in a planned manner, by putting in order the heterogeneous members hailing from upper- and middle- classes of the local society and through successful conciliation with the authorities of the military base.

IV THE PROJECT

IV. THE PROJECT

A. NATURE AND TASK OF THE UNDERTAKING

1. The Nature and Characteristics of the Project

(1) Under the increasing population pressure, Egypt has been adhering to a policy to raise the level of self-sufficiency in cereals at home while depending on food imports by earning foreign exchange through export of commercial crops. Trade balance of the farm products and the agriculture-based processed goods for export has been deteriorating very badly in the last couple of years to such a large degree that its improvement is urgently required. The contributions which this Project is expected to make in solving the above problem would be more in production-increase of the export-oriented farm products by utilizing the traditional horticultural techniques and the position of advantage in traffic and transport conveniences for shipment abroad, rather than in raising of the level of self-sufficiency in food-cereals. Increased production of livestock products and green vegetables and fruits should also contribute to a more stable supply of the animal protein and vitamin-rich foodstuff which have been rather scarce in the local markets.

(2) Reclamation of waste land has been pursued as one of the important national policies with the purpose of absorbing surplus population and providing them with gainfaul employment opportunities. This Project is going to be implemented exactly on this policy-line of the State, and will also help in mitigating the difficulties arising from the unemployment or under-employment problem in the Governorate as it will create new jobs for at least 2,000 persons on the assumption that one person will need to be employed on each 10 feddan, thus contributing to the socio-economic improvement of the local community.

(3) The State is determinedly encouraging the organization and operation of an increasing number of land reclamation co-operative societies as the most dependable method of mobilizing idle private capital for investment in land reclamation. This Project does not fail to positively answer such expectation cherished by both the State and the concerned Governorate, as will be judged from the composition of the membership of the Society which is held responsible for the venture and is thereby worthwhile for all-out encouragement by the authorities of the Governorate. It is being realized, at the same time, that land development by the reclamation co-operative society is just at its start and, therefore, this Project shall be so planned and implemented as to establish a good sample to be followed by the others as a model.

(4) The Project-site is situated, naturally, in the desert-land lacking productive function if left unattached but, economically it is occupying a position of vantage from the viewpoints of traffic, communication and transportation and, being adjacent to the city of Ismailia, is amenable to various socio-economic benefits which urban function can only provide.

(5) As with other land reclamation co-operative societies, construction of a new village is envisaged under the Project. It will be so planned and implemented that the accessibility to the land to be developed may be increased, thereby facilitating for a smooth management, but also in the hope to demonstrating a cultural style of community living adoptable for the new urban planning of the ever-expanding city of Ismailia.

(6) The Project-site will ultimately be developed into an aggregate farm of 20 feddan plots which will be individually managed with co-operative principles. 20 feddan is believed to be a scale of farmland which stimulates as

well as satisfies the desire to invest in agriculture to a fairly high degree, while allowing full play to managerial capacity of the individual, and this helps quicken maturing of the reclaimed land and augmentation of its productivity. As for its co-operative system and function, it is both possible and necessary, irrespective of the current criticism as to the existing agricultural co-operatives having been as ever inefficient and dormant, to start writing a new chapter on co-operative movement on 'carte blanche'.

2. Specific Nature of and Course Open for Desert Agriculture

(1) The phenomenon which definitely characterizes desert-land is its lack of rainfall. The Meditteranean Sea coast in the north apart, rainfall in the neighbourhood of Ismailia which takes place sporadically during winter season is as small as 30 mm/year which is almost negligible for agricultural purposes. This results in dryness all through the year: monthly relative humidity at noon-time averages at 25 - 50%, 35% all through the year, and daily evaporation is 5 mm during winter season and 10 mm during summer season, averaging at 7 - 8 mm throughout the year. Only a few kinds of persevering desert plants are allowed to exist on its surface, and dust-storms darken its horizon in early spring. The temperature rises to 29°C during July - August and falls to 14°C in January throughout the year.

(2) On the other hand, it is seldom cloudy all year round, Oktas at noon-time being 3.1, with very long sunshine hours. There is a distinction between summer season and winter season when no frost falls. The range of daily temperature is wide. Consequently, water provided, botanical life can enjoy extremely favourable climatological conditions in Ismailia desert. Choice of crop can be made from amongst many alternatives spreading in a wide range and the

scope of shift of farm labour with a specific crop can also be quite big. This makes the potentiality for artificial remedy fairly large from the crop cultivation point-of-view.

(3) The elevation of the Project site is mostly between 10 to 20 m high but at places rises to 27 m and falling to 6 m. Its topography is generally even, with some undulation. This makes land-levelling necessary for surface irrigation. As groundwater level mostly remains at 6 - 8 m, rising to 1 m or so in lowland, it can be utilized to a certain extent.

(4) Soils are mostly made up of coarse sands, sometimes, gravels, containing little clay and no organic matter at all. Accordingly, its holding capacity of moisture and fertility is poor and natural supply of nitrogen and phosphoric acid is hopeless, the soils as a whole being inferior physically, chemically and biologically. What remains is only its special value and potency to hold plants rooted and fixed. Remedial measures required for soil improvement include application of organic matter and replenishment of mud: breeding of livestock is inevitable for answering the former question and the piles of dug-out from Port Said Canal may be utilized for the latter. Sandy formation of land makes trafficability poor and large HP tractors are required for its ploughing, etc. Being the desert-land coming under cultivation for the first time, the site is free from any inherent pests and diseases, and is believed to be exempted from their damages for a time being after its development.

(5) In short, agriculture in the desert-land around here depends on supply of water by which the climatological conditions favourable to crop cultivation can be fostered while those detrimental to it neutralized. In this connection, it is very important that the techniques which have been traditionally developed through cultivation of

horticultural crops will be fully adapted to new situations arising from water supply. Input of organic matters will largely improve its physical properties, if not chemical properties at the same time, of the soils by increasing their fertilizer holding capacity and making application of chemical fertilizers highly effective and responsive to yield increase. This explains the reason why animal husbandry forms an inevitable part of desert agriculture. This is also justifiable in consideration of the current scarcity of livestock products in the national market.

(6) In constructing such farms as visualized in the above, up-to-date techniques can be used to pump-up irrigation water and to distribute it through pipelines instead of the surface irrigation method which demands very much labour and cost in land-levelling, and finally to feed the crops with irrigation water by means of various kinds of modern apparatus.

(7) Intensive commercial agriculture through a highly advanced water control system is not feasible without harmonious co-operative activities among all the persons engaged in farm-management. Co-operative action is therefore very much hoped for not only in the post-harvest marketing phase but also in the pre-harvest water-use phase also. This will be the new aspect of co-operative function of the Land Reclamation Society.

3. The Task and Scope of the Undertaking

(1) This undertaking will be broadly divided into three stages of: i) Planning, ii) Construction, and iii) Farm-management.

(2) The planning stage covers all kinds of preparatory works in the pre-construction phase. They include, for instance,

the mapping of schemes on the basis of the survey-results obtained beforehand, clarification of pre-requisites, chalking out of the basic plans and programmes concerning land-use, water-use, and farm-management, detailed construction designing and preparation of construction schedule geared to financial schedule, its breakdown to annual construction programmes, etc. The basic design of new village and land-distribution will need to be done in this stage.

(3) The construction stage covers actual implementation of the construction works as planned and designed in the preceding stage, as well as the preparatory works for the succeeding stage. Construction works which will be taken up include, among others:

i) construction of roads and bridges;

ii) planting of windbreaks;

iii) construction of the main pumping station;

iv) installation of regulating pond and booster pump house;

v) installation of pipelines;

vi) equipment of field irrigation facilities;

vii) construction of establishments for co-operative pattern of farming.

viii) construction of settlement village facilities

Preparatory works for the Farm Management stage include:

i) construction of Pilot-Farm and its operation;

ii) installation of joint- or common-nursery farm and its operation;

iii) construction and operation of training-cum-demonstration farm, etc.

(4) Cultivation activities on each allocated plot of land will be started upon completion of the above-mentioned construction works. Side by side with sowing and planting, individual production facilities will start to be constructed or installed.

B. ACREAGE AND LAND-USE

1. Land Classification

(1) There are three main soil types, Dystric Regosols (Rd), Haplic Yermosols (Yh), and Calcic Yermosols (Yk) in the Project area. The first soil type (Rd) which covers 63.9 percent (13,741 fed) of the Project area, contains a high-ratio of coarse sand, and a little silt and sand.

Rd contains almost no gravel.

Comparatively, there are several undulations and a land slope of over 8% in this area. Yh and Yk soil types originate from riverbanks and hills and topographically have only a few undulations. These soil types contain from 3 to 4 percent silt and clay, and a gravel content of over 20% in places. The total area of Yh is 2,871 feddan (13.3 percent), and of Yk is 4,614 feddan (21.4 percent). Besides in Regosols there are one meter deep gravel lands. Such land covers 298 feddan (1.4%) of the Project area.

There is low elevation land located to the north of the Salhia road. It is about 6 ~ 10 m above sea level and the groundwater level is about 1.0 m below ground level. Soil of this area contains all three types, Yh, Yk and Rd.

(2) Land classification and farming are influenced by soil types and topographic factors, undulation, slope, gravel and groundwater level.

Land type classification as follows below can be obtained by taking note of such factors.

(a) Rd

Classifying by undulation, there are nearly flat (1,281 fed), gently undulating (4,450 fed) and gently rolling (8,010 fed). Gently undulating land involves a high groundwater level (120 fed). Gently rolling land includes steep land (120 fed).

(b) Yh

Classifying by gravel contents less than 10% or 476 feddan are common phase and more than 10% or 2,395 feddan are gravelly phase of which 1,235 feddan experience a high groundwater level.

(c) Yk

Using the same classification as for Yh, gravel contents less than 10% or 298 feddan are common phase and more than 10% or 4,316 feddan are gravelly phase of which 215 feddan experience a high groundwater level.

(d) Gravel

There are 298 feddan of which, excluding gravel, 150 feddan are very similar to Rd nearly flat.

(3) Land capability classification from the viewpoint of production capability is as follows: (Fig. IV.B.1)

(a) First Grade Land (10.2%)...consists of a total of 2,005 feddan; 1,281 feddan of Rd nearly flat, Yh and Yk common phase 476 feddan and 298 feddan, respectively and 150 feddan of gravel excluding gravel content. For Rd it is preferred to dress the soil with mud but there is no problem in cultivation using it as.

(b) Second Grade Land (20.1%)... excluding the 120 feddan of swamp the remaining 4,330 feddan of Rd gently undulating have a slight undulation and slope which should not affect cultivation. Where necessary soil dressing is preferred.

(c) Third Grade Land (61.0%)...excluding the 150 feddan steep slope Rd the remaining 7,860 feddan of gently rolling Rd, the 1,160 feddan and the 4,101 feddan of the Yh and Yk gravelly phase which excludes the 1,235 and 215 feddan of swamp, respectively are included in this grade. For Rd soil dressing is effective.

(d) Fourth Grade Land (7.3%)...comprises the 1,570 feddan of swampy land of Rd, Yh and Yk. However, the groundwater level is high and gravel is profuse, although it is applicable for vegetable cultivation its use will necessarily depend upon crop selection.

(e) Fifth Grade Land (1.4%)... this includes the 148 feddan of sloping gravel land and the 150 feddan of steeply sloping Rd giving a total of 298 feddan in this classification. This grade is improper for agricultural use.

Table IV.B.1 Land Classification

Soil	Rd			Yh		Yk		G	Total
Grade	NF	GU	GR	CP	GP	CP	GP		fed
I	1,281	--	--	476	--	298	--	150	2,205
II	--	4,330	--	--	--	--	--	--	4,330
III	--	--	7,860	--	1,160	--	4,101	--	13,121
IV	--	120	--	--	1,235	--	215	--	1,570
V	--	--	150	--	--	--	--	148	298
Total	1,281	4,450	8,010	476	2,395	298	4,316	298	21,524

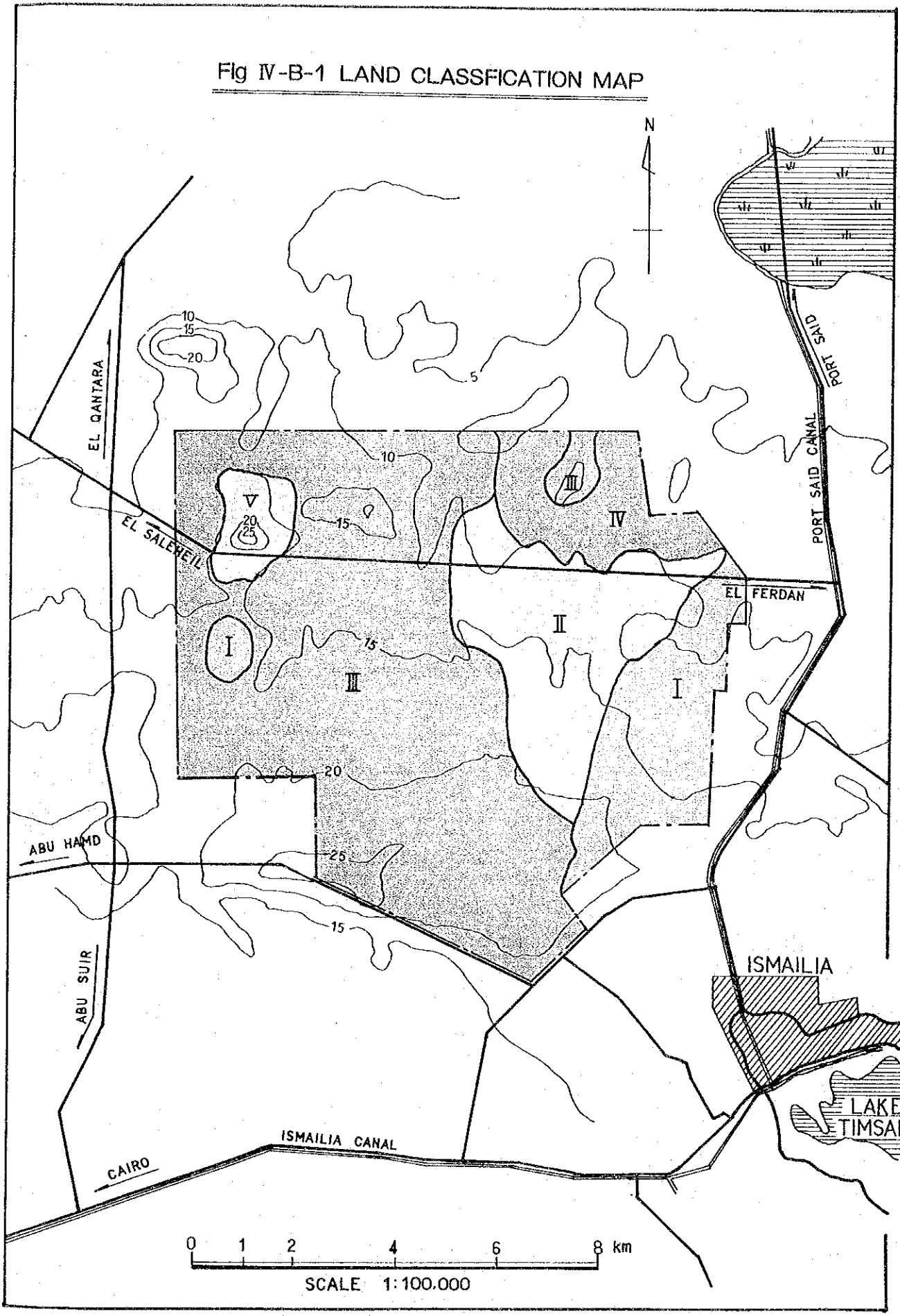
Note: NF = nearly flat. GU = gently undulating.
GR = gently rolling. CP = common phase.
GP = gravel phase. G = gravel.

(4) Through the application of irrigation and organic matter the soil capability of grades I, II and III mentioned above will become homogeneous and crop selection and production will show no great difference. Although the slight undulation and slope occurring within the 20 feddan farming units and their smaller plots is nearly balanced the gravel content in grade III will slightly reduce workability by causing abrasion, etc. to agricultural machinery. The overall production capability of these three different grades is only minimal.

Grade IV will experience some limits to crop selection since it has a high groundwater level and contains gravel but is the same or superior to grades II and III in workability.

Grade V has a steep slope with gravel occurring in the surface layer, therefore, making it inappropriate for agricultural use.

Fig IV-B-1 LAND CLASSFICATION MAP



2. Land-use Classification

(1) The land-use breakdown which has been designed for the Project is as follows:

a) The lands to be distributed to the Cooperatives' members shall be of grades I, II or III inclusive. (18,000 feddan)

b) The settlement area is located as near as possible to Ismailia City along the Cairo-Port Said Bypass Road which will create easy access to public utilities. The main office facilities will be situated next to the settlement area. Land in this area is classified as grade I and grade III. In one part there are the remains of a gravel quarry which will be refilled and used. (550 feddan)

c) The grade IV land lies to the north of the Salhya Road in the main part of the Project area and for the time being will be under direct management of the Cooperative. Among the land, 462 feddan will be devoted to such cooperative use as introduction of livestock raising, agricultural propagation, establishment of an experimental farm for vegetable crop, training farm and model farm, and the remainder will be reserved as farm land to be distributed to the pesants and the new members. (1,550 feddan)

d) The grade V land is situated in the gravel land on both sides of the Salhya Road. After extracting gravel for building construction purposes, dates, etc. will be planted for afforestation and in future one part will be used for laborers' housing. (298 feddan)
The land remaining of the total Project area which applies to every grade will be under direct management of the Cooperative for the cultivation of dates and vegetables. (206 feddan)

e) The land required for infrastructure such as canals, roads, etc. is 920 feddan.

(2) The land-use breakdown of the total Project area (21,524 feddan) is shown below;

		Feddan	Percent (%)
Settlement area	b)	440	2.1
Cooperative facilities	b)	110	0.5
Land for cultivation	a)	18,000	83.6
Land for training, research, etc.	c)	462	2.1
Infrastructure	d)	920	4.3
Cooperative management	e)	504	2.3
Reserve area	c)	1,088	5.1
Total		21,524	100 %

The main irrigation acreage consists of Land for cultivation, Reserve area and Land for training, research, and etc.

3. Farm Type and Land Utilization

(1) According to the results of the interview poll taken among 76 cooperative members, it is hoped that after 10 years the Project will concentrate on the introduction of the major crops in the district such as fruits and dairy cattle or beef cattle or both.

Also, in large-sized domestic animal production 78% responded they preferred dairy or beef cattle or both, 7% said only dairy cattle and 15% replied beef cattle only. For small-sized domestic animal breeding 78% replied they were contemplating layer or broiler raising.

Besides this, the great majority are planning the cultivation of vegetables but in general the members intending fruit cultivation plan only to cultivate vegetables in the interim until the trees produce fruit and exclude them afterward.

(2) Although there exists some difference between the cultivated area and the number of head of cattle the 900 households can be roughly classified into the following four types of farm.

a) Compound Type (630 farms, 70%)
b) Fuirt Type (135 farms, 15%)
c) Dairy Type (68 farms, 7.5%)
d) Vegetable Type (67 farms, 7.5%)

(3) Of these, the fruit type which has as its main crop mangoes, lemons, oranges, etc. shall apply inter tree cropping of vegetables until the trees reach the fruit bearing stage. Also, for trees, such as mangoes, etc., whose maturation periods are very long (10 to 15 years), shall be inter cultivated between orange trees. Winter vegetable crops are tomato and potato for export and summer vegetable crops are tomato, cucumber and as for special crops the main crop will be water-melon. The cultivation of strawberries which is becoming common is considered. In addition the cultivation of ground-nuts will also play an important role.

The Governorate is promoting the production of dairy and beef cattle such as Brown Swiss, and beef cattle such as bull calves of dairy cattle and Egyptian cows, this is surely to become an issue.

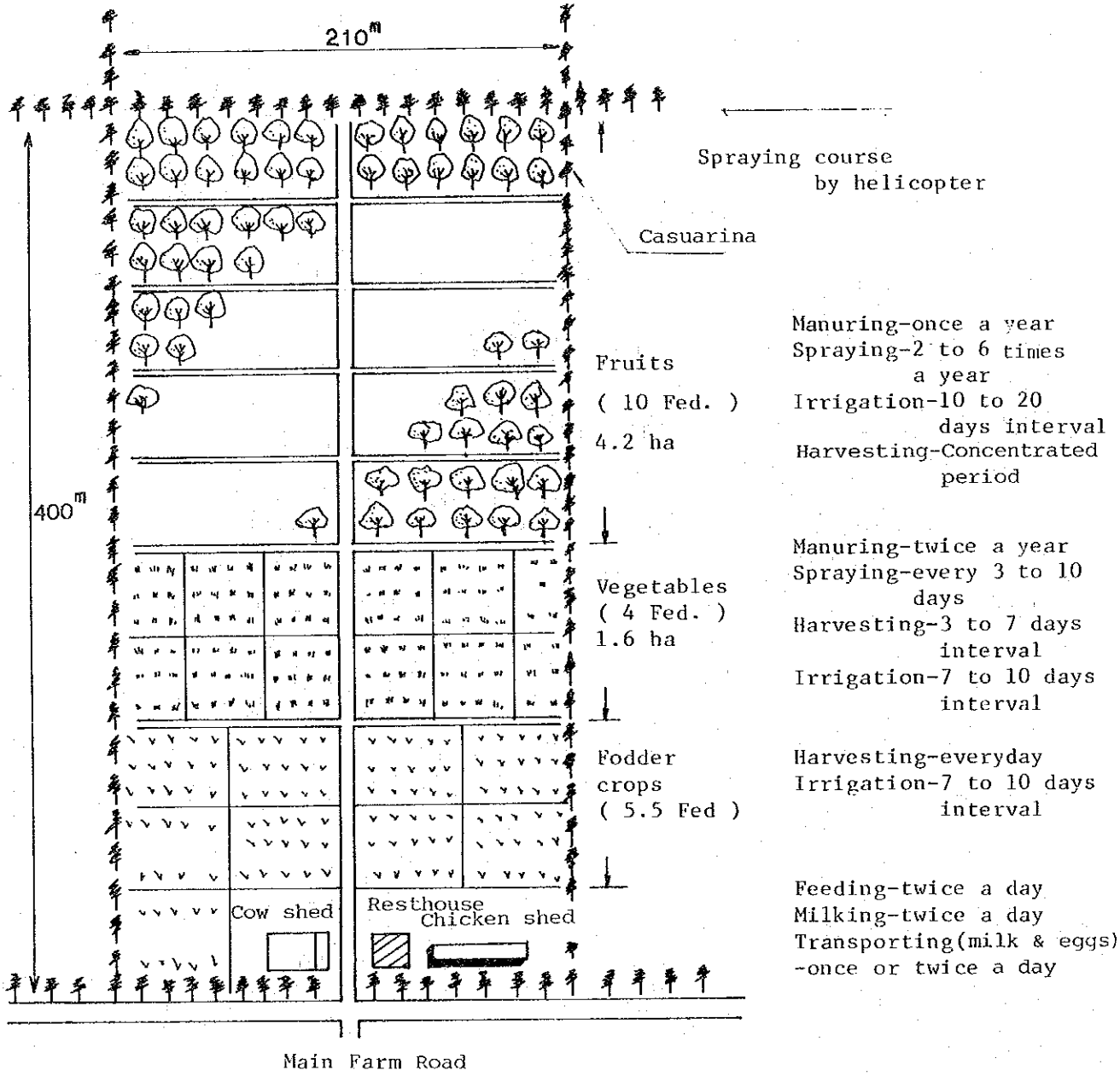
Poultry includes both layers and broilers. At present, broilers require consideration as their integration is still under way.

Fodder crops are winter Egyptian clover and perennial crops such as alfalfa and Nepia grass. Also, green maize and green sorghum should be considered.

(4) A total study of the detailed items of each farm type will be necessary in order to determine; irrigation water availability, water requirements for each crop, production of stable manure for the maintenance and improvement of soil capability and the benefits from crop and livestock production.

For example the breeding scale of the compound type of farm is fruit trees 10 feddan, vegetables 5 feddan, fodder crops 5 feddan and dairy cattle 7 head and poultry 1,000 layers. The land-use layout model for the type shown in Fig. IV.B.2 takes into consideration the distance between work areas, the future utilization of surplus areas and new technology such as air spraying, etc.

Fig. IV.B.2 LAND USE MODEL OF EACH FARM (COMPOUND TYPE)



4. Production Organization Model

(1) A project such as this that follows the trend in cash crop production and requires the marketing of large quantities of crops; not only demands cooperation in production but also an overall management program for the organized use of a set amount of irrigation water at the booster pump station and secondary pipeline level.

Also, the temperature in the Project area needs to be maintained at normal levels as the farmers must commute to their farms which are considerably detached from the settlement area. Operation and maintenance must be carried out individually at the field level. Furthermore, a field of 20 feddan is considered too small for the efficient use of modern agricultural machines and equipment, therefore, it will be necessary to jointly own and use machinery and equipment to increase economic efficiency.

(2) The scale and aspects of cooperation at the farm level are established as follows.

a) Organization for joint use of agricultural machinery --- 6 farms (120 feddan) unit for tractors and attachments. For fodder crop mowers (small-sized) --- 3 farms (60 feddan)

b) Organization for joint use of speed sprayers --- 36 farms (720 feddan)
720 feddan includes about 300 feddan of fruit trees, therefore, a simple chemical mixer and sprayer should be attached.

c) Organization for joint use of bulk coolers --- 108 farms (approximately 600 head of dairy cattle)
For the storage of the estimated 3,000 kg of milk to be produced per day, and includes the recording of milk produced per household and examination of fat content.

d) Organization of Sorting Houses --- 108 farms (2,160 feddan)

At the interim stage sorting should be carried out individually and a collecting house should be established at the farm block level to protect crops from direct rays of the sun.

e) Organization for farm road maintenance --- 108 farms

The Projects branch roads and farm roads are 131 km and 43 km in length, respectively, giving a total length of 144 km. Except for major repairs, daily maintenance should be carried out by block.

f) Organization for water management --- 108 farms

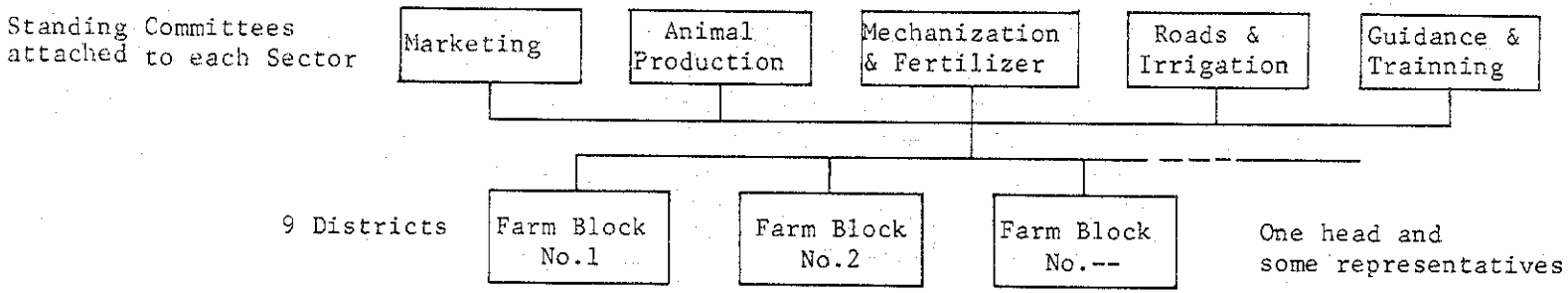
In general, one generator and one booster pump station are installed for every block (108 farms) and from there water is conveyed to each farm by secondary pipeline. Although generator and pump maintenance will be the responsibility of a higher level organization, control of each block's water use and pipeline maintenance will be carried out by lower organizations consisting of 36 farms and the block organizations.

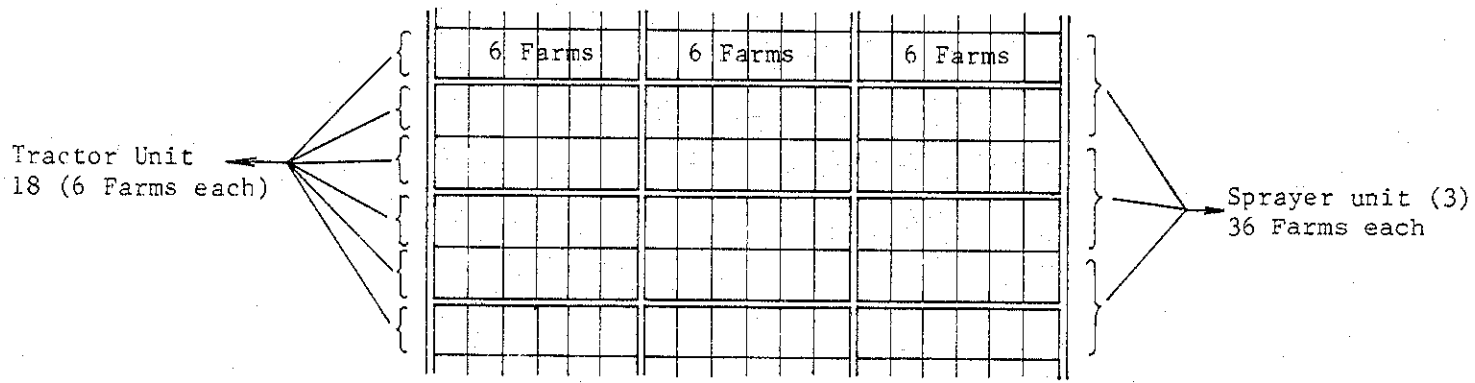
(3) From the viewpoint of water usage, the total Project area is divided into 10 blocks, as previously mentioned, and the relationship between the blocks is shown in Fig. IV.B.3. A systematically arranged internal organization for each block is to be established according to its scale of activities and at the same time the relations and activities between blocks are controlled through democratic process by a cooperative level committee.

(4) The numbers of machinery and facilities to be used jointly by the blocks and individual farms are as follows.

1	Farm Machinery	150	1 per 6 farms
	Tractor (65 ps)	150	"
	Trailer	150	"
	Ridger	150	"
	Disc harrow	150	"
	Tooth harrow	150	"
	Cultivator	150	"
	Grader	150	"
	Power mower (small-scale)	300	1 per 3 farms
2	Bulk cooler (4,500 kg)	20	2 per block
3	Speed sprayer	30	3 per block including mixing attachment
4	Storage (Sorting house)	10	1 per block
5	Meeting hall	10	1 per block

Fig. IV.B.3 Farm Organization of the 10th of Ramadan Agri. Complex





Milk Cooler
Irrigation Unit
Marketing Unit
Roadwork Unit

108 Farms

One Farm District

108 Farms
1 F.P. & 3 pump. 3 secondary pipeline
1 Selection house (for marketing)
1 Milk bulk coolers
3 Speed sprayers
18 Toractor sets (harrow, trailer, etc.)
36 Self-driving small sized mower
(3 farms each)

5. Cooperative Organization Model

(1) In planning the future style of this reclamation co-operative's organization and activities, there are a few existing examples which can be followed, however, in accordance with judgements based on the local agriculture conditions, outside knowledge and opinions of the Board Members of the Cooperative, the following ideas have arisen. (Fig. IV.B.4)

(a) The general meeting of the Cooperative, the Board's decisions and the organization of the top management are in accordance to the laws of Egypt. According to the law governing multipurpose agricultural cooperatives only agricultural engineers may be employed as managers.

(b) Since the scale of the cooperative is large and the size of the administration increases to meet requirements making it appropriate for the internal organization of the cooperative to be divided into sections such as administration, accounts, guidance, marketing, purchasing, materials, irrigation, livestock, etc.

(c) For the joint activities, blocks as previously mentioned will be established, communications between the office and the farms and joint activities between the blocks should be carried out in an organized manner. Considering items which require control between the blocks, a management committee which consists of block representatives in each section will be established. The sections are marketing, livestock, irrigation, roads, agricultural society, etc.

(d) Special attention should be paid to the fact that the cooperative, whose main activity is business management and the residents organization of the new village, whose main activity is social affairs are to be established separately.

(2) Division of the Internal Organization of the Cooperative's Administration is as follows:

(a) Administration Division - to take care of administrative affairs.

(b) Accounting Division - under jurisdiction of the Agriculture Development and Credit Bank a savings and loan program will be carried out.

(c) Guidance Division - to carry out technical training and guidance concerning agricultural production. Communication between the Cooperative and the Department of Agriculture should be deepened and at the same time a guidance and training management committee should be established. In addition, as one form of guidance and training an exhibition farm, a trial farm and a training center are to be set up.

(d) Marketing Division - to take charge of the cultivation plan, supply of seeds and marketing of products. Setting up a marketing management committee to control cultivation and harvesting. Additionally, management of cold storages, seed storage, nursery, etc.

(e) Purchasing Division - to purchase and distribute daily commodities to the Cooperative's members and manage the settlement village's shopping center.

(f) Supply Division - to purchase and distribute agricultural equipment, fertilizer, insecticides, pesticides and additional agricultural supplies to the Cooperative's members. Optionally, the division would also repair and service certain types of agricultural machines and equipment.

(g) Irrigation Division - this division is in charge of controlling the usage and management of irrigation water, roads, etc. and setting up steering committees for both irrigation and roads.

(h) Livestock Division - under the supervision of the Governorate's Departments of Agriculture and Veterinary Science the introduction of superior breeds of domestic animals, care of animals, shipping, etc. will be carried out and a livestock steering committee shall be established.

(3) The Facilities of the Cooperative's Main Office are as follows:

(a) The main office building and accounting division office will be located in the settlement village's socio-cultural center. The marketing division office and storage will be located in the settlement village's shopping center.

(b) The facilities to be located in the cooperative's facilities area (110 feddan) are as follows:

i)	Cooling facilities (including seed storage)	100m^2	(Marketing Division)
ii)	Sorting House	300m^2	(Marketing Division)
iii)	Maintenance Garage (including spare parts store)	500m^2	(Supply Division, Irrigation Division)
iv)	Fertilizer storage		(Supply Division)
v)	Insecticide and pesticide storage		(Supply Division)

The details of the pilot farm of 20 feddan to be established during the construction period shall be stated hereafter.

(c) The facilities to be established in the fields managed by the Cooperative are as follows:

i)	Exhibition farm	100 feddan	(Guidance Division)
ii)	Trial farm	10 "	(")
iii)	Training center	50 "	(")
iv)	Stock breeding farm	500 "	(Livestock Division)
v)	Nursery	2 "	(Marketing Division)

The Project also requires a research laboratory, office and storage space facilities and for the livestock breeding farm a barn and feed and grain store.

(d) Besides a booster pump station each block will require the following equipment.

i) Bulk cooler (including facilities)

ii) Machines, equipment and tools for one workshop

iii) Agricultural machinery is as follows:

	Exhibition farm (Trial farm)	Training Center	Stock Breeding Farm	Total
Tractor	1	5	2	8
Trailer	1	1	2	4
Ridger	1	1	-	2
Disc harrow	1	1	2	4
Tooth harrow	1	1	2	4
Cultivator	1	1	1	3
Plow	-	1	2	3
Chisel plow	-	1	2	3
Leveller	1	1	2	4
Small mower	-	2	-	2
Large mower	-	-	1	1

(4) Also, a grader for road maintenance and trucks for transportation purposes are required.

Fig. IV.B.4 Organization of the Tenth of Ramadan Cooperative Society