THE ARAB REPUBLIC OF EGYPT

GENERAL AUTHORITY FOR REHABILITATION
PROJECT AND AGRICULTURAL DEVELOPMENT

MINISTRY OF DEVELOPMENT, STATE
FOR HOUSING, AND LAND RECLAMATION

FINAL REPORT
ON
FEASIBILITY STUDY
FOR
THE SOUTH HUSSINIA VALLEY
AGRICULTURAL DEVELOPMENT PROJECT PHASE II

(APPENDIXES-D,E,F)
VOLUME-3

MAY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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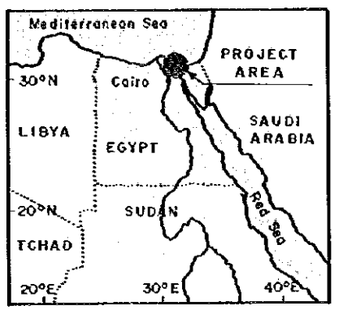
GENERAL PLAN

KEY MAP



Bahr Hadous Drain

M1 A = 15,830 feddan (6,650ha)
Q = 19.55 m³/sec

Bahr El Saft Drain

Lake Manzala

NORTH HUSSINIA PROJECT AREA

M2 A = 23,020 feddan (9,670ha)
Q = 28.43 m³/sec

M3 A = 16,890 feddan (7,090ha)
Q = 20.84m³/sec

El Salam Canal

Tell Dibgu

Ramsis Drain

Tell Sanhur

Tell Bilein

SOUTH PORT SAID
SOUTH PROJECT AREA

San El Hagar

Bahr El Baqar Drain

PROJECT AREA

DIVISION FACILITY
IRRIGATION CANAL
DRAINAGE CANAL
TRUNK ROAD
VILLAGE ROAD
SATELLITE VILLAGE
SERVICE VILLAGE
CENTRAL VILLAGE
PUMPING STATION FOR DRAINAGE
PUMPING STATION FOR IRRIGATION
AGRO-INDUSTRY FACILITIES
BREEDING CENTER

TOTAL PROJECT AREA (NET)
55,740 feddan
(23,410 ha)

SCALE 1 : 100,000
0 1 2 3 4 5 Kilometres

VOLUME III

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D.1. Sugarbeet Processing

D.1.1. Introduction

A beet factory normally produces white sugar directly from sugarbeet in a single integrated manufacturing process and molasses and beet pulp can be obtained as the principal by-products. There are two major alternatives to increase sugar yield, viz: by reprocessing the molasses, and by extending the annual operating period through storage of the partially processed products taken off after evaporation of the thick juice stages and completing the processing later. These alternative procedures are not taken up for techno-economic study in this report.

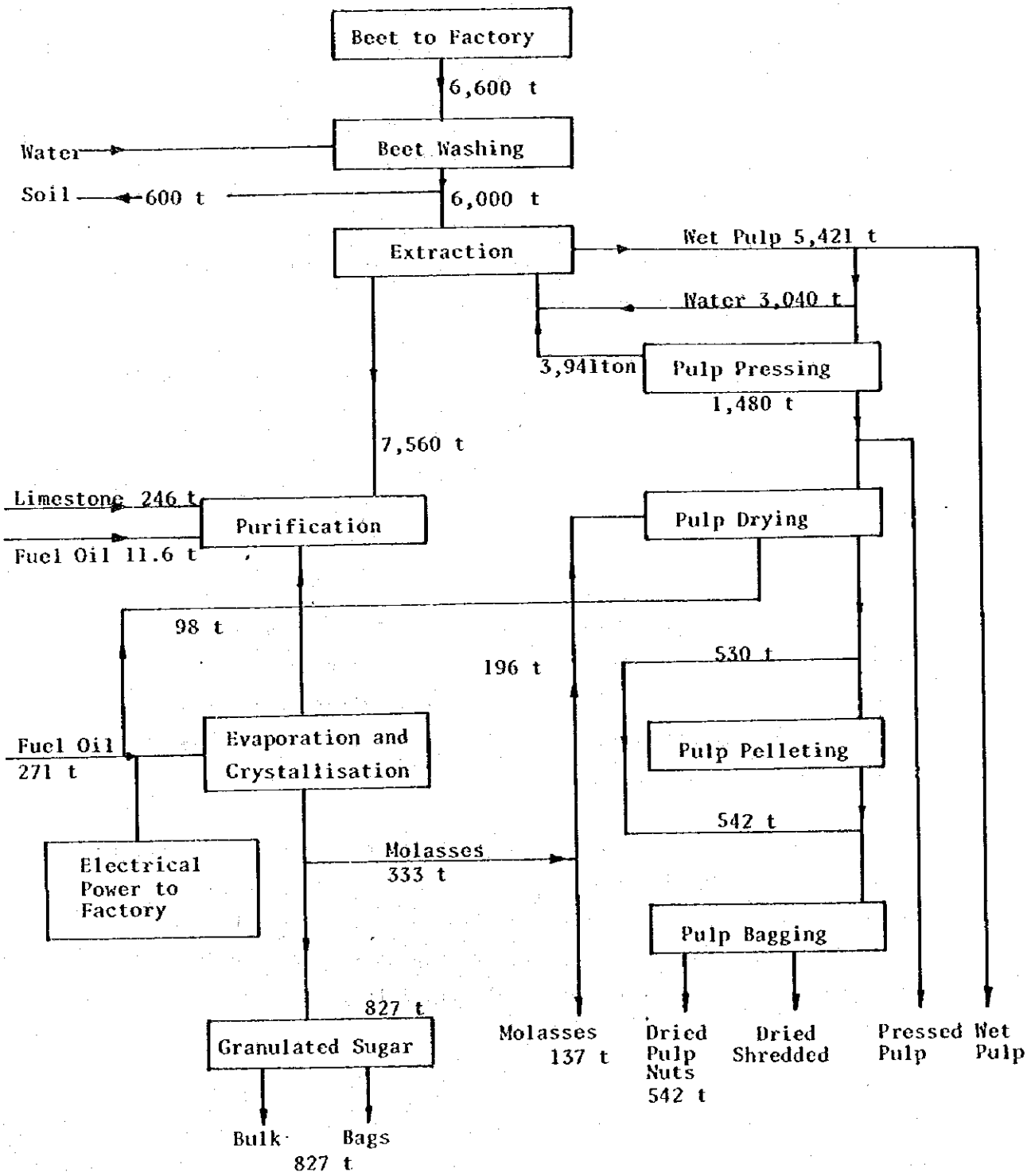
This proposal for a sugarbeet processing plant is made on the assumption that it will be a joint-venture by international and Egyptian entrepreneurs.

D.1.2. Factory Capacity

The capacity of the proposed beet sugar factory has been designed at 6,000 tons/day of washed beet sliced prior to the extraction stage. The sugar content of the material-beet has been taken as 17% and the thickness juice purity after evaporation at 90°C. Major inputs and outputs for beet processing are shown in Figure D-1.

The size of factory beets to the duration of processing period that is 900-100 days beginning in March and ending in May. The factory operation starts with the first harvesting of the beet and ends before the very high temperature begins ruling from June onward to make the handling and storage of beet rather difficult.

Figure D-1 Major Inputs and Outputs for 6,000 tons Beet Processed



At the full development stage, the material-beet obtainable in the project area is expected to reach a level of 455,210 tons per annum, the product of 18,580 feddans at a per-feddan yield of 25 tons. However, from the Factory Year 9, the proposed beet sugar factory would start purchasing additional material-beet from the North Hussinia Valley (715,000 tons at the full development stage). Factory production is shown briefly in Table D-1.

D.1.3. Factory Location

The supply of beet to the factory will be the most costly and complex operation to be arranged for. The relatively high temperatures prevent the storage of more than a 24 hour beet supply at the factory or on the farms and the shortest possible transport distance would therefore be advantageous to both beet quality and cost.

Other important considerations called for selecting the factory location include:

- a good road system to handle up to 100 vehicles/hour
- an electrical power supply of around 2 megawatts
- a supply of fresh water for processing and site irrigation
- a supply of drinking water
- staff amenities close to the factory
- telephone and telex facilities

D.1.4. Factory Layout

A practical factory layout is normally fixed after taking into consideration the location of incoming roads and services, the prevailing wind, site gradients etc. The layout of a typical beet sugar factory is shown in Figure D-2. Each square dividing the envisaged factory site would represent approximately 5 feddans.

FIGURE D-2 LAYOUT OF TYPICAL BEET SUGAR FACTORY

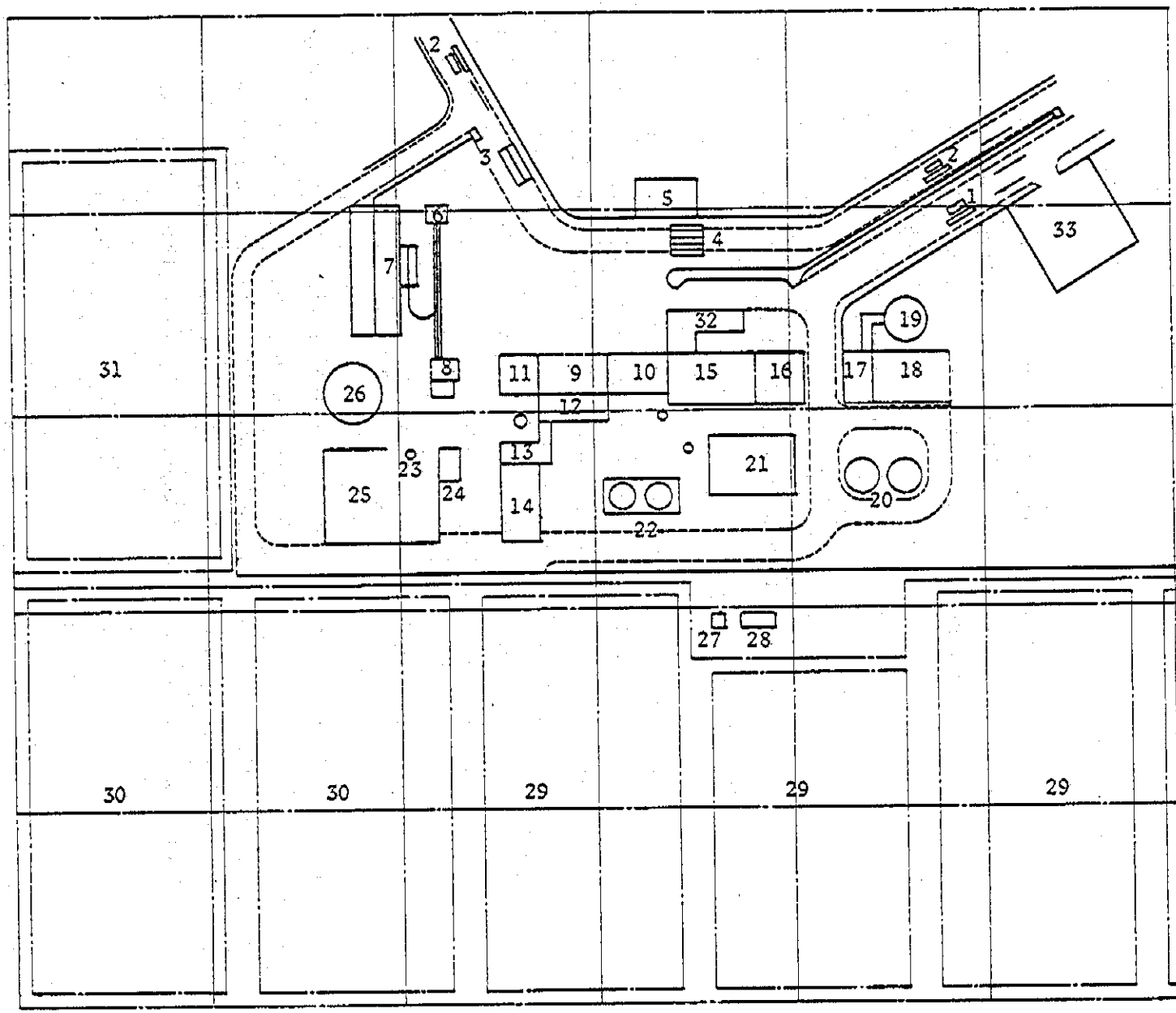


Table D-1 PRODUCTION OF WHITE SUGAR, MOLASSES, DRIED MOLASSED PULP AND PULP

YEAR / PROJECT FACTORY	4	5	6	7	8	9	10	11	12	13*
Sugar Beet Purchases ('000 tons)	265.1	298.3	331.4	381.1	414.3	447.4 (33.2)	480.5 (66.3)	480.5 (66.3)	480.5 (66.3)	480.5 (66.3) 1/
Requirement of dried molasses beet pulp ('000 tons)	4.64	5.40	6.40	7.24	7.87	8.23	9.25	9.54	9.76	9.90
Physical Production (1st Stage) ('000 tons)										
White Sugar Sold	36.50	44.42	49.35	56.75	61.69	66.62	71.55	71.55	71.55	71.55
Molasses @ 82% D.S.	18.85	17.84	19.80	22.79	24.78	26.75	28.73	28.73	28.73	28.73
Dried Pulp	16.14	19.09	21.19	24.39	26.52	28.63	30.75	30.75	30.75	30.75
Physical Production (2nd Stage) ('000 tons)										
Molasses included in dried @ 82% D.S. molsaased beet pulp @ 36.1%	1.68	1.95	2.31	2.61	2.84	2.97	3.34	3.44	3.52	3.57
Dried pulp included in dried molasses beet pulp @ 63.9%	2.96	3.45	4.09	4.63	5.03	5.26	5.91	6.10	6.24	6.33
Balance of molassed available for sale	17.17	15.89	17.49	20.18	21.94	23.78	25.39	25.29	25.29	25.21
Molasses sold	18.03	16.68	18.36	21.19	23.04	25.00	26.66	26.65	26.65	26.47
Balance of dried pulp sold	13.18	15.64	17.10	19.76	21.49	23.37	24.84	24.65	24.51	24.42

1/ Figures in the parenthesis denote the quantity of the material-beet available from the North Hussinia Valley.

The factory itself would be of two stories, with the major processing plant sited in the second floor, 8 m above ground level. Pumps, tanks etc. would be on the ground floor.

D.1.5. Factory Processing Equipment

The main process stages and the sequence of operations are shown in the flow sheet as per Figure D-3.

i) Beet Reception and Storage
ii) Beet Intake and Washing
iii) Slicing and Diffusion
iv) Juice Purification
v) Evaporation
vi) Crystalisation
vii) Sugar Packing and Storage
viii) Pulp Pressing, Drying, Pelleting
ix) Water and Effluent
x) Plant Service
xi) Seam and Power

D.1.6. Capital Costs

Tables D-2 and D-3 give details of the capital cost split into the main plant areas.

FIGURE D-3 SIMPLIFIED BEET SUGAR PROCESS FLOW DIAGRAM

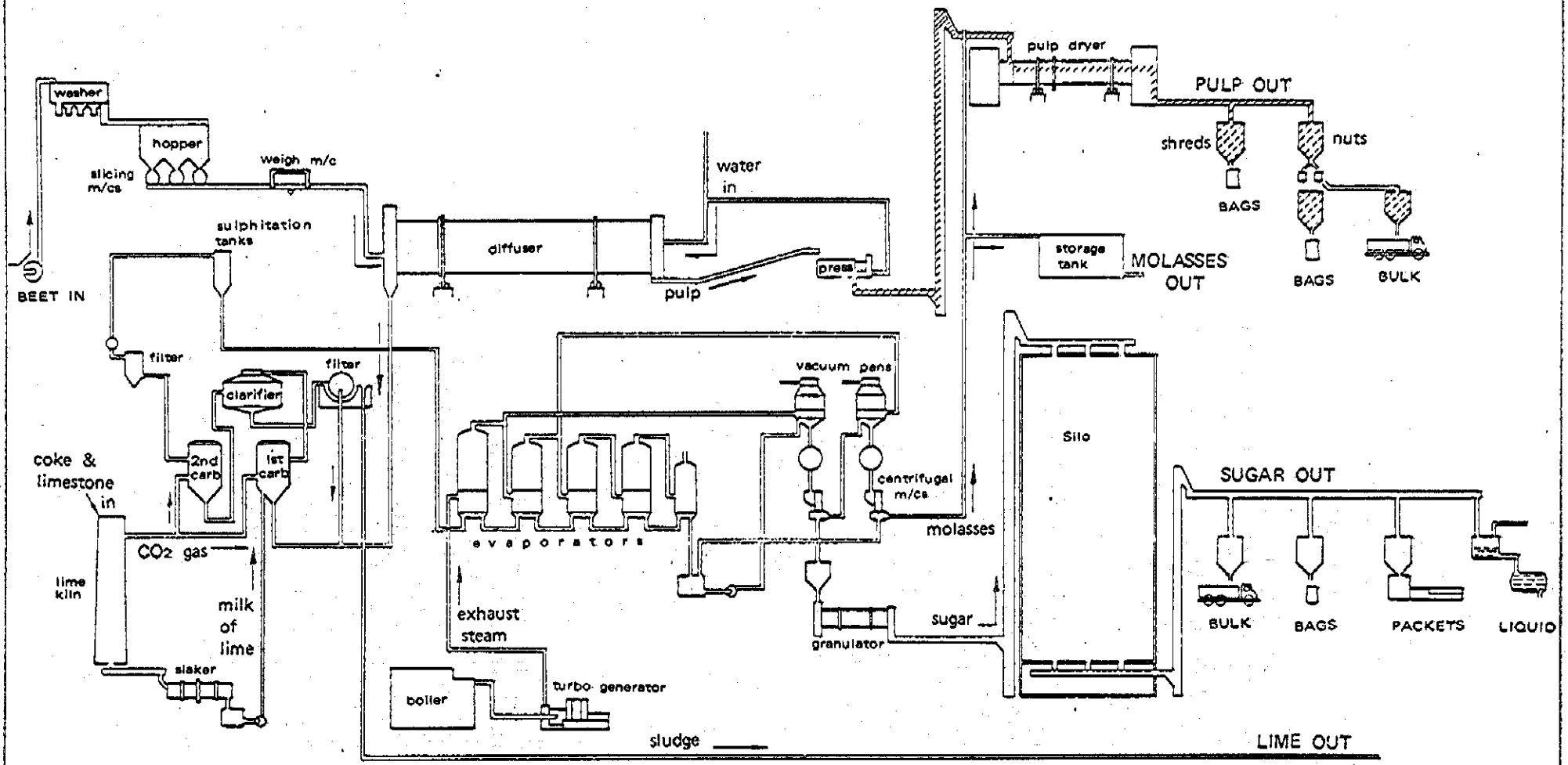


Table D-2 Total Capital Cost of 6,000 TPD Sugerbeet Factory

Items	Cost in Hussinia Valley LE. Million
Main Plan (see Table 3 attached)	34.67
Less Saving by part local manufacture	5.33
Total Main Plant	29.34
Piping and Valves (part local)	5.59
Structural Steel	1.35
Building and Civil	17.65
Electrical	8.89
Instrumentation and Control	3.13
Plant Spares	2.08
Management and Design Fees	2.76
Commissioning	1.10
Staff Housing and Amenities	3.91
Vehicles and Equipment	0.18
Total Capital Cost of Factory Complex	

The total factory cost, excluding contingencies, is LE 75.98 m and the foreign exchange requirement is estimated at LE 63.0 m.

Table D-3 Capital Cost of Main Plant Items for 6,000 TPD Surgareet Factory

Plant Items	Cost in Hussinia Valley LE. Million Incl. Transport & Installation
Beet Handing and Laboratory	1.89
Diffusion and Ancillary Plant	2.90
Pulp Processing and Bagging	6.66
Juice Purification	1.54
Evaporators and Heaters	1.33
Sugar End Plant	4.11
Sugar Drying, Bagging and Storage	6.34
Boiler House and Power Generation	5.93
Lime Kiln	1.13
Water and Effluent	0.81
Others	2.03
Total	34.67

The total weight of the equipment is around 11,500 tons. There are two or three Egyptian firms who are able to undertake the manufacture of the less complicated mild steel pipework, tanks, vessels, etc., to the extent of about 3,500 tons in total weight.

The weight of structural steel required is about 2,600 tons and a recent large contract of a similar type (Delta Sugar Co.) was fixed at a price of LE 470/ton including erection costs.

D.1.7. Material Supplies

Sugarbeet available for processing has been estimated as below:

Factory	Annual Acreage (feddans)	Yield tons/ feddan	Total Production ('000 tons)	Obtainable from North Hussinia ('000 tons)	Total Beet for Processing ('000 tons)
4	810	16.0	12.7	-	12.7
5	5,843	18.0	163.2	-	163.2
6	5,843	20.0	261.7	-	261.7
7	10,933	23.0	323.1	75.3	398.4
8	15,400	25.0	348.7	131.8	480.5
9	15,400	25.0	369.6	110.9	480.5
10	18,580	25.0	401.0	79.5	480.5
11	18,500	25.0	432.7	47.8	480.5
12	18,580	25.0	448.9	31.6	480.5
13	18,580	25.0	455.0	25.5	480.5

Note: Acreage projected is 16,100 feddans. This slight difference is caused from the time lag of study.

As for the other materials, Table D-4 has been prepared assuming average usage figures of the chemicals and supplies for the full anticipated slice. Actual amounts of many of the chemicals used vary from year to year and depend upon the purity and general condition of the beet. All the material supplies required possibly except Antifoam oil are available locally.

Table D-4 Material Supplies Required by Beet Sugar Process

Material	Quantity Used (tons/annum)	Price (LE/ton)
Fuel Oil	24,391	156.0
Lime-stone	22,403	5.0
Sulphuric Acid	106	66.0
Hyrochloric Acid	25	295.0
Soda Ash	323	184.0
Caustic Soda	25	295.0
Salt	155	11.0
Antifoam Oil	depends upon type used	
Stick Sulphur	93	75.0
Filter Aid	103	450.0
Formaldehyde	103	47.0

Fuel - It is assumed that fuel oil would be used for boilers, pulp driers and for the lime kiln. Since the project is likely to be subject to international funding, the cost of the oil would not be subsidised and the expected future world market price of LE 156/ton has been used. This can be supplied by the Misr Petroleum, Alexandria.

Limestone - This is readily available near the site of the sugar factory but the locally available limestone should be checked particularly with respect to its quality, that is, the requisite hardness for a shaft kiln.

Chemicals - Except Antifoam Oil which is normally imported from Germany, all other chemicals are available in Alexandria, Cairo and Kafr El Zayat (sulphuric acid).

The factory would generate its own electricity requirements during the campaign as the use of oil fired boilers and a turboalternator would be cheaper as well as more reliable then purchasing electricity from the national grid.

Labor costs are based upon continuous 7 day week/3 shift working, and the wage rates have been fixed b taking into consideration those offered at the new sugarbeet factory in the Delta. Labor associated overheads have been taken as 20% of direct salary charges.

In the overhead cost, an allowance has been made for the cost of providing water, electricity and housing and amenities labor for the factory housing estate.

An allowance has also been made for an agricultural service in terms of providing technical assistance to beet growers in the project area. One staff member would be allocated to each of the small holder divisions and 9-10 fieldmen would be held responsible for assisting and advising outgrowers.

The maintenance total allows for the employment of all the regular skilled engineering technicians and process operators during the non-operating period, together with an allowance for the use of materials in the ratio of 40:60 on a cost basis. This ratio is definitely higher than the normal materials cost ratio but is believed to be justifiable because of the manufacturers' countries of origin.

D.1.8. Operating Costs

The operating costs at full development are presented in Table D-5. The costs include all activities up to the production of white sugar in 100 kg jute bags, dried beet pulp in 50 kg paper bags and molasses in store in the factory bulk tank. The data is presented in two sections. The first section sets out variable operating costs based on campaign production, and the second covers the annual establishment overhead costs.

Tables D-6 thru D-11 contain breakdowns of some important items of the overhead costs.

Table D-5 Annual Factory Operating Cost Data at Full Development

Cost Center	Cost LE'000
A. CAMPAIGN OPERATING COSTS	
Fuel oil (boilers, pulp driers, lime kiln) - 24391 T x LE 156	3805.0
Limestone - 22.400 T x LE 5.0	112.0
Chemicals	125.6
Other supplies (knives, filter cloths, maintenance mats, etc.)	117.2
Bagging materials	682.7
Temporary labour	55.3
Start-up and shut-down costs (labour supplies)	30.0
Co-operative handling sharges (@ LE 2/ton of sugar beet)	961.0
TOTAL A	5888.8
B. OVERHEAD COSTS	
Permanent labour, management and/ clerical salaries (1)	549.8
Services (water, electricity, etc.)	153.7
Administration (telephone, post, office supplies, etc.)	30.0
General (travel, training)	120.0
Maintenance materials	292.6
General off-season services (sugar, molasses, cleaning, etc.)	150.0
Vehicles and equipment/ (operation and maintenance) (2)	37.0
Housing and amenities/ (3)	78.3
Rates - provincial government	14.0
TOTAL B	1425.4
TOTAL COSTS	7314.2

(1) See Table 6
(2) " Table 8
(3) " Table 9

Table D-6 Sugar Beet Factory - Permanent Management and Labour Costs (LE)

Project Year, Factory Year		3	4	5	6	7+
Position/Title	Salary per annum (LE)					
General Manager	17,650				17,650	17,650
Works Manager	14,120				14,120	14,120
Accountant	14,120	14,120	14,120	14,120	14,120	14,120
Production Manager	10,240				10,240	10,240
Personnel Manager	8,830	8,830	8,830	8,830	8,830	8,830
Mechanical Engineer	8,830			8,830	8,830	8,830
Electrical Engineer	8,830	8,830	8,830	8,830	8,830	8,830
Chemist	7,060	7,060	7,060	7,060	7,060	7,060
Shift Managers	5,300	15,900	15,900	15,900	15,900	15,900
Asst. Mech. Eng.	5,300				5,300	5,300
Asst. Elect. Eng.	5,300				5,300	5,300
Agricultural Manager	8,830			8,830	8,830	8,830
Dep. Manager (Out-growers)	5,830		5,830	5,830	5,830	5,830
Divisional Fieldsmen	2,650		5,300	10,600	15,900	15,900
Outgrower Fieldsmen	2,650		23,850	23,850	23,850	23,850
Chief Clerk	4,410	4,410	4,410	4,410	4,410	4,410
Office Dept. Heads	1,765	7,060	14,120	14,120	14,120	14,120
Clerks	1,325		14,575	14,575	14,575	14,575
Process Operators	1,590	66,780	154,230	154,230	154,230	154,230
Technicians (Mech.)	1,590	31,800	79,500	79,500	79,500	79,500
Techinicians (Elect.)	1,940	15,520	31,040	31,040	31,040	31,040
Medical Officers	8,830		17,660	17,660	17,660	17,660
First Aid Staff	1,325		5,300	5,300	5,300	5,300
Maintenance Technic-ians	1,765		10,590	10,590	10,590	10,590
Shop/Club Staff	1,500		10,500	10,500	10,500	10,500
Timekeeper	1,5-0	1,500	1,500	1,500	1,500	1,500
Canteen Staff	1,060	4,240	8,480	8,480	8,480	8,480
Cleaners	800	4,800	7,200	7,200	7,200	7,200
Secretaries	1,765	3,530	5,295	5,295	5,295	5,295
Typists	1,410	2,820	4,230	4,230	4,230	4,230
Dribers	1,235	2,470	4,940	4,940	4,940	4,940
Office Juniors	700	1,400	2,800	2,800	2,800	2,800
Watchmen	700	1,400	2,800	2,800	2,800	2,800
Total Cost per Annum		202,470	468,890	491,850	549,760	549,760

Table D-7 Sugar Beet Factory - Phasing of Capital and Oeprating Costs for Staff Vehicles and Equipemnt for Technical Assistance

Type of Vehicle[1/]	Factory Year 3	4	5	6+	Total (LE)
C1.	4,960				
C.2	8,600		4,300	4,300	
Pickups (PU)	3,640	43,680	7,280	10,920	
Pool Cars (C2)	12,900	8,600			
Total	30,100	52,280	11,580	20,180	114,140
Allowance for equipment for technical assistance	33,090	330,90			

Table D-8 Vehicle and Equipment Operating Costs - Cumulative

Type of Vehicle	3	4	5	6+	Total (LE)
C.1	660	660	660	1,320	
C.2	1,265	1,265	1,898	2,530	
Pickups	590	7,670	8,850	10,620	
Pool Cars	19,980	19,610	19,610	19,610	
	21,495	29,205	31,018	34,080	
Allowance for operation of technical assistance	2,900	2,900	2,900	2,900	
	24,395	32,105	33,918	36,980	

Note: / Type of Vehicle = see SUGAR BEET FACTORY proposed for the North Hussinia Valley.

Table D-9 Sugar Beet Factory - Phasing of Staff Housing and Amenity Costs (LE '000)

Position/Title	House Type[2/]	Factory Year 2	3	4	5	Total
General Manager (1)	A_1	44.1				
General Manager	A_1				44.1	
Work Manager (1)	A_2	33.8				
Works Manager	A_2				33.8	
Accountant	A_2	33.8				
Production Manager (1)	A_2		33.8			
Production Manager	A_2				33.8	
Personnel Manager	A_2	33.8				
Mechanical Engineer	A_2					
Mechanical Engineer				33.8		
Electrical Engineer	A_2	33.8				
Chemist	A_2	33.8				
Shift Managers	A_2	74.1				
Asst. Mech. Engineer	A_3				24.7	
Asst. Elect. Engineer	A_3				24.7	
Agricultural Manager	A_2	33.8				
Agricultural Manager	A_2			33.8		
Dept. Managers (Outgrowers) (1)	A_3	24.7				
Dept. Managers (Outgrowers)	A_3		24.7			
Divisional Fieldsmen	B_1		25.9	25.9	25.9	
Outgrowers Fieldsmen	B_1		116.5			
Chief Clerk	A_3	24.7				
Office Dept. Heads	B_1	51.8	51.8			
Clerks	B_3		51.8			
Process Operators	B_2	331.0	382.5			
Technician (Mech.)	B_2	147.1	22.1			
Technician (Elect)	B_2	58.8	58.8			
Medical Officer	A_3		49.4			
First Aid Staff	B_3		18.8			
Maintenance Technician	B_1		77.7			
Shop/Club Staff	B_2		51.5			
Timekeeper	B_2	7.4				
Canteen Staff	B_3	18.8	18.8			
Drivers	C_1	2.5	2.5			
Cleaners	C_1	7.4	3.7			
Temporary Process Operators Hostel			247.1			
Temporary Technicians (Mech.) Hostel			58.8			
Guest House		58.8				
Club		88.3				
Supermarket		88.3				
Sub-total		1,220.5	1,296.2	93.6	187.1	2,797.4
Plus: Infrastructure @ 40%[1/]		488.2	518.5	37.4	74.9	1,119.0
Totals		1,708.7	1,814.8	130.9	262.0	3,916.4
Maintenance Change @ 2%			34.3	70.5	73.1	78.3

Note: 1/ Roads, gardens, sports field, fencing etc.
2/ House Type = For details, see Sugar Beet Factory proposed for the North Hussinia Valley

Table D-10 Sugar Beet Factory - Temporary Labour Costs (LE)

Position/Title	Monthly Salary (30 days) (LE)	4	5	6	7+
Village Buying Supervisors	135.0	1,650	9,265	11,700	18,180
Process Operators	67.5	22,920	29,310	37,575	37,950
Technicians	90.0	330	330	330	330
Total Cost per Annum		24,900	34,905	49,605	56,460

Table D-11 Sugar Beet Factory - International Staff Costs (LE)

Position/Title	Recommended Salary per Annum (LE)	3	4	5	6	7 8 9+
General Manager	52,500	52,500	52,500	52,500	52,500	52,500
Works Manager	45,000	45,000	45,000	45,000	45,000	45,000
Production Manager	37,500		37,500	37,500	37,500	
Mechanical Engineer	37,500	37,500	37,500	37,500	37,500	
Agricultural Manager	37,500	37,500	37,500	37,500	37,500	
Dept. Manager (Outgrowers)	30,000	30,000	30,000	30,000		
Total Costs per Annum		202,500	240,000	240,000	210,000	95,500

D.1.9. Gross Cash Flow

Gross Cash Flow of the proposed sugarbeet processing factory is shown in Table D-12.

D.1.10. Financial Internal Rate of Return

The financial Internal Rate of Return of the proposed sugarbeet factory is shown in Table D-14.

Table D-12 Sugarbeet Factory (480,000 TONS) - Cash Flow at Financial Prices

(Unit: 1,000 LE)

Project Year / Factory Year	2	3	4	5	6	7	8	9	10	11	12	13
Sugarbeet Purchases ('000 tons)	-	-	-	163.2	261.7	398.4	480.5	480.5	480.5	480.5	480.5	480.5
						(75.3)	(131.8)	(110.9)	(79.5)	(47.8)	(31.6)	(25.5)
PHYSICAL PRODUCTION ('000 tons)												
White Sugar	-	-	-	24.30	38.97	59.33	71.55	71.55	71.55	71.55	71.55	71.55
Dried Molasses Sugar Beet Pulp	-	-	-	2.95	5.05	7.57	9.25	9.54	9.25	9.54	9.76	9.90
Dried Unmolasses Sugar Beet Pulp	-	-	-	8.56	13.50	20.66	24.84	24.65	24.84	24.65	24.51	24.42
Molasses	-	-	-	9.13	14.50	22.15	26.66	26.55	26.66	26.55	26.55	26.47
INCOME												
White Sugar @ LE 400/ton	-	-	-	9,720.0	15,588.0	23,732.0	28,620.0	28,620.0	28,620.00	28,620.0	28,620.0	28,620.0
Dried Molassed Sugar Beet Pulp @ LE 100/ton	-	-	-	295.0	505.0	757.0	925.0	954.0	925.0	954.0	976.0	990.0
Dried Unmolassed Sugar Beet Pulp @ LE 150/ton	-	-	-	1,284.0	2,025.0	3,099.0	3,726.0	3,697.5	3,726.0	3,697.5	3,676.5	3,663.0
Molasses @ LE 150/ton	-	-	-	1,370.0	2,175.0	3,322.5	3,999.0	3,982.5	3,999.0	3,982.5	3,982.5	3,970.5
Total Income	-	-	-	12,669.0	20,293.0	30,910.5	37,270.0	37,254.0	37,270.0	37,254.0	37,255.0	37,243.5
Sugarbeet Purchases (A) @ LE 20/ton	-	-	-	3,264.0	5,234.0	7,928.0	9,610.0	9,610.0	9,610.0	9,610.0	9,610.0	9,610.0
CAMPAIGN OPERATING COSTS (B)												
Fuel Oil	-	-	-	1,389.0	2,173.4	3,177.4	3,805.0	3,805.0	3,805.0	3,805.0	3,805.0	3,805.0
Limestone	-	-	-	42.1	65.9	93.9	115.4	115.4	115.4	115.4	115.4	115.4
Chemicals	-	-	-	45.9	71.6	102.2	125.6	125.6	125.6	125.6	125.6	125.6
Other Supplies	-	-	-	46.7	70.8	97.7	117.2	117.2	117.2	117.2	117.2	117.2
Bagging Supplies	-	-	-	226.7	369.6	567.1	679.3	679.3	679.3	679.3	679.3	679.3
Temporary Labour	-	-	-	18.8	38.5	57.8	55.3	55.3	55.3	55.3	55.3	55.3
Start-up and Shut-down Costs	-	-	-	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Co-operative Handling Charges	-	-	-	326.4	523.4	796.8	961.0	961.0	961.0	961.0	961.0	961.0
Sub-Total (B)	-	-	-	2,125.6	3,343.2	4,922.9	5,888.8	5,888.8	5,888.8	5,888.8	5,888.8	5,888.0
OVERHEAD COSTS (C)												
Perm. Labour, Management & Clerical Salaries	-	-	202.5	491.9	549.8	549.8	549.8	549.8	549.8	549.8	549.8	549.8
International Staff Costs	-	-	202.5	240.0	210.0	97.5	-	-	-	-	-	-
Serviced	-	-	75.0	153.7	153.7	153.7	153.7	153.7	153.7	153.7	153.7	153.7
Administration	-	-	15.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
General	100	100	375.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0
Maintenance	-	-	-	292.6	292.6	292.6	292.6	292.6	292.6	292.6	292.6	292.6
General Off-season Services	-	-	-	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0	150.0
Vehicles and Equipment O&M	-	-	24.4	33.9	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0
Housing and Amenities	-	-	34.3	73.1	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3
Rates	-	-	-	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Sub-Total (C)	100	100	928.7	1,599.2	1,635.4	1,522.9	1,425.4	1,425.4	1,425.4	1,425.4	1,425.4	1,425.4
Total Costs (A + B + C)	100	100	928.7	6,988.8	10,212.6	14,373.8	16,924.2	16,924.2	16,924.2	16,924.2	16,924.2	16,924.2
Cash Flow	(100)	(100)	(928.7)	5,680.2	10,080.4	16,536.7	20,345.8	20,329.8	20,345.8	20,329.8	20,330.8	20,319.3

Table D-13 Sugarbeet Factory (480,000 tons) - Internal Rate of Return

Calculation at Financial Prices (LE '000)

Factory Year	Gross Cash Flow	Plant & Piping	Struct.[1] & Bldg.	Elctr'l[2] Eqpm't	Inst. &[3] Controls	Plant Spares	Dsgn. &[4] Project Manage.	Staff[5] Accommd'n	St.Veh.&[6] Eqpm't for Tr'l	Av. Add'l[7] Work'g Cap. & Comm'g	Total[8] Invest.	Total Inv.[9] Incld'g 10% Contingency	Net Cash Flow
1		3,493.0	1,900.0	889.0	313.0	-	460.0	-	-	-	7,055.0	7,760.5	(7,055.0)
2	(100.0)	10,479.0	5,700.0	2,667.0	939.0	-	920.0	1,705.9	-	-	22,410.9	24,652.0	(24,752.0)
3	(100.0)	13,972.0	7,600.0	3,556.0	1,252.0	1,040.0	920.0	1,811.9	63.2	-	30,215.1	33,236.6	(33,336.6)
4	(928.7)	6,986.0	3,800.0	1,778.0	626.0	1,040.0	460.0	130.2	85.4	1,675.2	16,580.8	18,238.9	(19,167.6)
5	5,680.2	-	-	-	-	-	-	262.0	11.6	432.6	706.2	776.8	4,903.4
6	10,080.4	-	-	-	-	-	-	-	20.2	508.8	529.0	581.9	9,498.5
7	16,536.7	-	-	-	-	-	-	-	-	204.5	204.5	225.0	15,311.7
8	20,345.8	-	-	-	-	-	-	-	30.1	192.6	222.7	245.0	20,100.8
9	20,329.8	-	-	-	-	-	-	-	52.3	125.2	177.5	195.3	20,134.5
10	20,345.8	-	-	-	-	-	-	-	11.6	108.0	119.6	131.6	20,214.2
11	20,329.8	-	-	-	-	-	-	-	20.2	85.4	105.6	116.2	20,213.6
12	20,330.8	-	-	-	3,130.0	-	-	-	-	15.6	3,145.6	3,460.2	16,870.6
13	20,319.3	-	-	-	-	-	-	-	30.1	-	30.1	33.1	20,286.2
14	20,319.3	-	-	-	-	-	-	-	52.3	-	52.3	57.5	20,261.8
15	20,319.3	-	-	-	-	-	-	-	11.6	-	11.6	12.8	20,306.5
16	20,319.3	-	-	-	-	-	-	-	20.2	-	20.2	22.2	20,297.1
17	20,319.3	-	-	-	-	-	-	-	-	-	-	-	20,319.3
18	20,319.3	-	-	-	-	-	-	-	30.1	-	30.1	33.1	20,286.2
19	20,319.3	11,643.3	-	8,890.0	-	-	-	-	52.3	-	52.3	57.5	20,261.8
20	20,319.3	-	-	-	-	-	-	-	11.6	-	11.6	12.8	20,306.5
21	20,319.3	-	-	-	-	-	-	-	20.2	-	20.2	22.2	20,297.1
22	20,319.3	-	-	-	-	-	-	-	-	-	-	-	20,319.3
23	20,319.3	-	-	-	-	-	-	-	30.1	-	30.1	33.1	20,286.2
24	20,319.3	11,643.3	-	-	3,130.0	-	-	-	52.3	-	14,825.6	16,308.2	4,011.1
25	20,319.3	-	-	-	-	-	-	-	11.6	-	11.6	12.8	20,306.5
26	20,319.3	-	-	-	-	-	-	-	20.2	-	20.2	22.2	20,297.1
27	20,319.3	-	-	-	-	-	-	-	-	-	-	-	20,319.3
28	20,319.3	-	-	-	-	-	-	-	30.1	-	30.1	33.1	20,286.2
29	20,319.3	-	-	-	-	-	-	-	52.3	-	52.3	57.5	20,261.8
30	20,319.3	-	-	-	-	-	-	-	11.6	-	11.6	12.8	47,476.8[10]
Terminal Value		8,738.5	4,750.0	6,519.3	1,878.0	2,080.0	-	977.5	56.88	2,176.1	(27,170.3)	-	-

Final Internal Rate of Return : 17.5 %

Note:
1/ : Structures and Buildings
2/ : Electrical Equipment
3/ : Instruments and Controls
4/ : Design and Project Management
5/ : Staff Accommodation
6/ : Staff Vehicles and Equipment for Trials
7/ : Average Additional Working Capital & Commissioning.
Average Aannual working capital calculated as total costs + 365 x days processing.
8/ : Total Investment
9/ : Total Investment Including 10% Contingency
10/ : Includes terminal value

Table D-14 Project Financial Cost and Return

(Unit: Million LE)

Year	Project Cost			Incremental Benefits	Project Return	Present Worth Value (3) *Discount Rate	
	Capital	O & M	Total (1)	(2)	(3) = (2) - (1)	17%	18%
1	7.76	0.0	7.76	0.0	-7.76	-6.63	-6.58
2	24.65	0.0	24.65	0.10	-24.55	-17.93	-17.63
3	33.24	0.0	33.24	0.93	-32.31	-20.17	-19.66
4	18.24	0.0	18.24	5.68	-12.56	-6.70	-6.48
5	0.78	0.0	0.78	10.08	10.02	4.57	4.38
6	0.58	0.0	0.58	16.54	15.96	6.22	5.91
7	0.23	0.0	0.23	20.35	20.12	6.70	6.32
8	0.25	0.0	0.25	20.33	20.08	5.72	5.34
9	0.20	0.0	0.20	20.35	20.15	4.90	4.54
10	0.13	0.0	0.13	20.35	20.22	4.21	3.86
11	0.12	0.0	0.12	20.33	20.21	3.59	3.27
12	3.46	0.0	3.46	20.33	16.87	2.56	2.31
13	0.03	0.0	0.03	20.32	20.29	2.64	2.36
14	0.06	0.0	0.06	20.32	20.26	2.25	2.00
15	0.01	0.0	0.01	20.32	20.31	1.93	1.70
16	0.02	0.0	0.02	20.32	20.30	1.65	1.44
17	0.0	0.0	0.0	20.32	20.32	1.41	1.22
18	0.03	0.0	0.03	20.32	20.29	1.20	1.03
19	0.06	0.0	0.06	20.32	20.26	1.03	0.87
20	0.01	0.0	0.01	20.32	20.31	0.88	0.74
21	0.02	0.0	0.02	20.32	20.30	0.75	0.63
22	0.0	0.0	0.0	20.32	20.32	0.64	0.53
23	0.03	0.0	0.03	20.32	20.29	0.55	0.45
24	16.31	0.0	16.31	20.32	4.01	0.09	0.08
25	0.01	0.0	0.01	20.32	20.31	0.40	0.32
26	0.02	0.0	0.02	20.32	20.30	0.34	0.27
27	0.0	0.0	0.0	20.32	20.32	0.29	0.23
28	0.03	0.0	0.03	20.32	20.29	0.25	0.20
29	0.06	0.0	0.06	20.32	20.26	0.21	0.17
30	0.01	0.0	0.01	20.32	20.31	0.18	0.14
Total	106.35	0.0	106.35	521.13	415.50	3.73	-0.04

FIRR = 18 ..... 17 + 3.731 (3.73 + 0.04) = 17.99 ≈ 18

D.2. Animal Products

D.2.1. Milk Processing

a. Introduction

Production of milk for processing in the Project Area is forecast to be 59,200 tons starting from 10,200 tons in Year 2 and increasing to 59,200 tons in Year 9. Therefore, it is proposed to establish a multi-product dairy processing plant with the following particulars.

b. Factory Capacity

The factory is designed to process 81 tons per eight hours shift per day or 29,600 tons per annum (assuming 365 days processing). In Year 5 factory the total would be 39,170 tons when it should be necessary to start operating a second shift which would process for eight hours per day by Year 9 and thence onward.

c. Products to be Manufactured

(1) U.H.T. Milk (Ultra High Temperature Treated Milk)
Starting with 4,080 tons, ultimately producing 23,680 tons.

(2) Butter
Starting with 79 tons, ultimately producing 457 tons.

(3) White Cheese
Starting with 1,020 tons, ultimately producing 5,920 tons.

The factory is designed to process about 40 percent of its daily intake into U.H.T. milk, 40 percent into white cheese, and 20 percent into butter. And yielding recovery rate are estimated at 100 percent for U.H.T. milk, 3.75 percent for butter, 25 percent for white cheese respectively.

Table D-15 Availability of Raw Milk

Year	Factory Year	Annual Production for Processing (tons)	Daily Arrivals at the Factory (tons)
1990	2	10,200	28
1991	3	17,670	48
1992	4	30,190	83
1993	5	39,170	107
1994	6	42,900	118
1995	7	49,910	137
1996	8	55,530	152
1997	9	59,200	162

Nine tons milk tankers will be used for the collection of raw milk. Although an exact assessment of the number of tankers required could be made only once the locations of the village milk collecting centers were known, 9 milk tankers of the said capacity would be required at full development.

All milk should be strained at the village milk collecting centers equipped with colling facilities. It is recommended that the milk should be chilled to at least 10°C within 2-3 hours after milking and to -4°C within 5-6 hours. Any milk containing anti-biotics used for mastitis control should be rejected, and 99 percent the spore forming bacteria needs to be removed from the raw milk prior to pasteurization.

e. Plant Layout and Processing Procedures

Figure D-4 shows a layout for U.H.T. milk to which necessary facilities for butter and white cheese would have to be added. In the proposed milk plant, the indirect method will be adopted for U.H.T. treatment, that is; the final heating of the milk is done by heat exchange without the milk coming into direct contact with the heating medium.

The plant would need to have a well-equipped laboratory staffed with qualified and experienced personnel capable of carrying out check and control of the incoming raw milk quality, control of processing operations and monitoring of the quality of products leaving the factory.

f. Capital Costs

Tables D-16 and D-17 give details of the individual components of the proposed 59,200 ton per annum milk processing plant along with an estimate of capital costs.

Table D-16 59,200 ton Milk Processing Plant - Phasing of Staff Housing and Furniture Capital Costs (LE)

Type of House	Number Required	Factory Year 1	2	6	Total
A_1	2	44,130	44,130		88,260
A_2	3	33,830	67,660		101,490
A_3	1		24,700		24,700
B_1	12		77,670	77,670	155,340
B_2	38		139,750	139,750	279,500
C_1	44		26,860	26,860	53,720
Total		77,960	380,770	244,280	703,010

Table D-17 59,200 Ton Milk Processing Plant - Capital Costs at Full Development

ITEM	LE '000
1. Specifications of Processing Equipment	
Milk reception and recombing	340.340
Pasteurization	196.470
U.H.T. Treatment	283.300
Aseptic Packing	200.300
Butter	126.330
Cheese	94.400
Cold Store Incubation	32.880
Boiler	62.520
Refrigeration	297.030
Water and Air Supply	10.680
Electrical Installation	194.640
Stainless Steel, Pipes and Fittings	38.580
Steel Pipes, Fittings and Installation	45.300
Internal Transport	6.080
Laboratory Equipment	18.000
Miscellaneous Dairy Equipment	8.030
Workshop	12.300
Spare Parts	42.370
Total Price f.o.b. European Port (1)	2,009.550
Freight and insurance European Port of Port Alexandria @18.0%	361.720
Total Price c.i.f. Port of Alexandria	2,371.270
Plus: 5.0% internal costs	118.560
TOTAL COSTS	2,489.830

Note (1) Processing equipment of the proposed plant have been estimated of their prices as of European make.

(Continued)

2.	Factory Transport and Staff Vehicles	
	2 Distribution Vans for milk & milk products & LE 14,000	28,000
	7 Milk Collection Tankers	261,130
	4 Staff Vehicles	22.170
		311,300
3.	Water Treatment Plant	66,180
4.	Effluent Plant	125.750
5.	Distribution Refrigeration Equipment	275.750
6.	Mechanical Engineering Design and Planning	47,650
7.	Erection and Running-in	317.000
8.	Supervision of Building and External Work	64.860
9.	Capital Cost of Building	
	Foundation and external works	551.600
	Building Approximately 4,000 m^2	1,045.900
	Staff Housing	703.000
		2,300.500
10.	Working Capital Costs(2)	3,265.840
	TOTAL CAPITAL COSTS	9,264.66

Note (2) Excluding contingencies

g. Factory Managerial and Labor Requirement

Table D-18 shows the factory's permanent labor and management force. Total labor costs for one shift (Year 2 to Year 5) and two shifts (Year 6 onward), both 8 hour, are shown therein.

h. Operating Costs

Operating costs comprise: (i) material costs, and (ii) overhead costs. Cost calculations have been done on the following assumptions:

(1) Material Costs

1) Raw Milk Purchases

@ LE 0.30/litre (X)
@ LE 0.25/litre (Y)
@ LE 0.20/litre (Z)

It has been found that the proposed milk processing plant can be a profitable business enterprise only when it pays LE 0.20/litre for raw milk. For details, see Table D-20.

2) Packing Materials

U.H.T. Milk	@ LE 0.04/kg
Butter	@ LE 0.08/kg
White Cheese	@ LE 0.07/kg

3) Chemicals, Salt and Rennet for White Cheese

@ LE 0.007/kg

(2) Overhead Costs

1) Permanent labor and Managerial Costs

See Table D-18: Permanent Management and Labor Costs.

Table D-18 59,200 Ton Milk Processing Plant - Permanent Management & Labour Costs

Operation	Position/Title	Gross Monthly Salary LE	Factory Year 1 No.	1 LE	2+ No.	2+ LE	6+ No.	6+ LE
1. General	Factory Manager International Staff	4,300	1	51,600	1	51,600	-	-
	Factory Manager	1,180			1	14,160	1	14,160
	Asst. Factory Manager	740			1	8,880	1	8,880
	Factory Engineer International Staff	3,680	1	44,160	1	44,160	-	-
	Factory Engineer	440			1	5,280	1	5,280
	Secretary	150			1	1,800	1	1,800
2. Milk Reception	Supervisor	180			1	2,160	2	4,320
	Skilled Labourers	135			2	3,240	4	6,480
	Unskilled Labourers	60			2	1,440	4	2,880
3. Pasteurisation	Skilled Labourers	135			1	1,620	2	3,240
	Unskilled "	60			1	720	2	1,440
4. Palarizator	Skilled Operator	180			1	2,160	2	4,320
5. Aseptic Packing	Supervisor	180			1	2,160	2	4,320
	Skilled Labourers	135			2	3,240	4	6,480
	Unskilled "	60			2	1,440	4	2,880
6. Butter Production	Supervisor	180			1	2,160	2	4,320
	Skilled Labourers	135			2	3,240	4	6,480
	Unskilled "	60			2	1,440	4	2,880
7. Cheese Production	Supervisor	180			1	2,160	2	4,320
	Skilled Labours	135			2	3,240	4	6,480
	Unskilled "	60			2	1,440	4	2,880
8. Laboratory	Supervisor International Staff	3,680			1	44,160	-	-
	Supervisor	180			1	2,160	1	2,160
	Skilled Labourers	135			2	3,240	4	6,480
	Unskilled "	60			2	1,440	4	2,880
9. Store	Store Keeper	135			1	1,620	2	3,240
	Asst. Store Keeper	90			1	1,080	2	2,160
	Unskilled Labourers	60			4	2,880	8	5,760
10. Auxiliary & Maintenance Operations	Boiler Operator	135			1	1,620	2	3,240
	Electricians	135			1	1,620	2	3,240
	Fitters	135			2	3,240	4	6,480
	Unskilled Labourers	60			2	1,440	4	2,880
Total			2	95,760	47	222,240	83	132,360

i. Average Annual Working Capital

See Table D-19: Calculation of Average Annual Working Capital.

j. Gross Cash Flow

See Table D-20: Gross Cash Flow at Financial Prices.

k. Financial Internal Rate of Return

See Table D-21: Internal Rate of Return at Financial Prices.

Table D-19 59,200 ton Milk Processing Plant - Calculation of Average Annual Working Capital

Factory Year	Total Operating Costs and Milk Purchases (LE)	Average Working Capital Per Annum (LE)	Average Additional Working Capital Requirement in Year (LE)
1	95,800	7,960	7,960
2	2,873,700	218,170	210,210
3	4,784,400	524,500	314,290
4	7,631,000	573,900	259,610
5	9,812,900	790,350	530,740
6	10,559,700	782,850	252,110
7	12,198,400	866,670	614,560
8	13,569,400	1,006,980	392,420
9	14,448,000	1,076,360	683,940
Average Working Capital at Full Development			3,265,840

Table D-20 59,200 Ton Milk Processing Plant - Gross Cash Flow at Financial Prices

Project Year / Factory Year		1	2	3	4	5	6	7	8	9
PHYSICAL OUTPUT										
UHT Milk - 40% (tons)			4,080.0	7,068.0	12,076.0	15,668.0	17,160.0	19,964.0	22,212.0	23,680.0
Butter - 20% (tons)			76.5	132.5	226.4	293.8	321.8	374.3	416.5	440.0
White Cheese - 40% (tons)			1,020.0	1,767.0	3,019.0	3,917.0	4,290.0	4,991.0	5,553.0	5,920.0
INCOME (Ex. Factory) (LE '000)										
UHT Milk @LE 0.40/kg			1,632.0	2,827.2	4,830.4	6,267.2	6,864.0	7,985.6	8,884.8	9,472.0
Butter @ LE 3,000/ton			229.5	397.5	679.2	881.4	965.4	1,122.9	1,249.5	1,320.0
White Cheese @ LE 1,500/ton			1,530.0	2,650.5	4,528.5	5,875.5	6,435.0	7,486.5	8,329.5	8,880.0
TOTL INCOME			3,391.6	5,875.2	10,038.1	13,024.1	14,264.4	16,595.0	18,463.8	19,672.0
MILK PURCHASES										
Tons			10,200.0	17,670.0	30,190.0	39,170.0	42,900.0	49,910.0	55,530.0	59,200.0
PURCHASES OF FRESH MILK (LE '000) (A)										
@ LE 0.30/kg (x)			3,060.0	5,301.0	9,057.0	11,751.0	12,870.0	14,973.0	16,659.0	17,760.0
@ LE 0.25/kg (y)			2,550.0	4,417.5	7,547.5	9,792.5	10,725.0	12,477.5	13,882.5	14,800.0
@ LE 0.20/kg (z)			2,040.0	3,534.6	6,038.0	7,834.0	8,580.0	9,982.0	11,106.0	11,840.0
OPERATING COSTS (LE '000) (B)										
Packaging Materials										
- UHT Milk @ LE 0.04/kg			163.2	282.7	483.0	626.7	686.4	798.6	888.5	947.2
- Butter @ LE 0.08/kg			6.1	10.6	18.1	23.5	25.7	29.9	33.3	35.2
- White Cheese @ LE 0.07/kg			71.4	123.7	211.3	274.2	300.3	349.4	388.7	414.4
Chemicals, Salt and Rennet for White Cheese @ LE 0.007/kg			7.1	12 4	21.1	27.4	30.3	34.9	38.9	41.4
Sub-Total B			247.8	429.4	733.5	951.8	1,042.4	1,212.8	1,349.4	1,438.2
OVERHEAD COST (LE '000) (C)										
Perm. Labour & Managerial Costs			82.3	82.3	82.3	82.3	132.4	132.4	132.4	132.4
International Staff Costs		95.8	139.9	139.9	139.9	139.9	-	-	-	-
Machinery & Equipment Repairs @ 5.0% capital value			160.2	160.2	160.2	160.2	160.2	160.2	160.2	160.2
Building Repairs @ 2.0% capital value			46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
Vehicle Fuel & Oil			2.8	4.1	5.4	8.1	8.1	10.7	14.7	17.4
General Insurance @ LE 4.5/LE 1000 capital value			16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
Miscellaneous Costs @ LE 0.015/litre purchases			138.2	372.0	409.2	574.1	574.1	637.8	744.2	797.3
Sub-Total (C)		95.8	585.9	821.0	859.5	1,027.1	937.3	1,003.6	1,114.0	1,169.8
TOTAL COSTS (LE '000) (A + B + C)	(x)		3,893.7	6,551.4	10,650.0	13,729.9	14,849.7	17,189.4	19,122.4	20,368.0
	(y)		3,383.7	5,667.9	9,140.5	11,771.4	12,704.7	14,693.9	16,345.9	17,408.0
	(z)	95.8	2,873.7	4,784.4	7,631.0	9,812.9	10,559.7	12,198.4	13,569.4	14,448.0
GROSS CASH FLOW (LE '000)	(x)		(502.2)	(676.2)	(611.9)	(705.8)	(585.3)	(594.4)	(658.6)	(696.0)
	(y)		7.8	207.3	897.6	1,252.7	1,559.7	1,901.1	2,117.9	2,264.0
	(z)	(95.8)	517.8	1,090.8	2,407.1	3,211.2	3,704.7	4,396.6	4,894.4	5,224.0

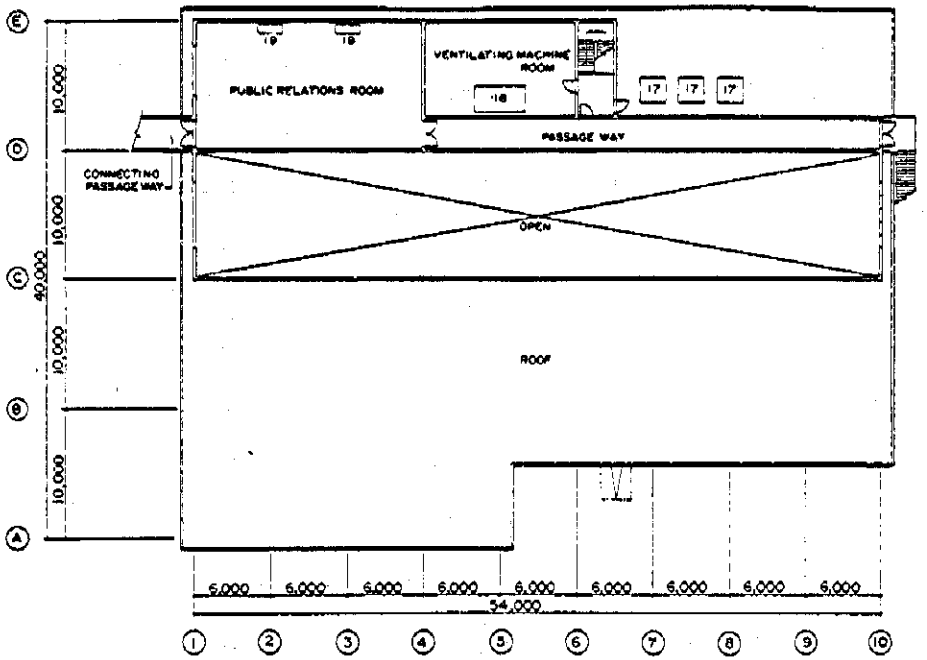
Table D-21 Project Financial Cost and Return

SOUTH HUSSINIA -MILK PROCESSING PLANT-

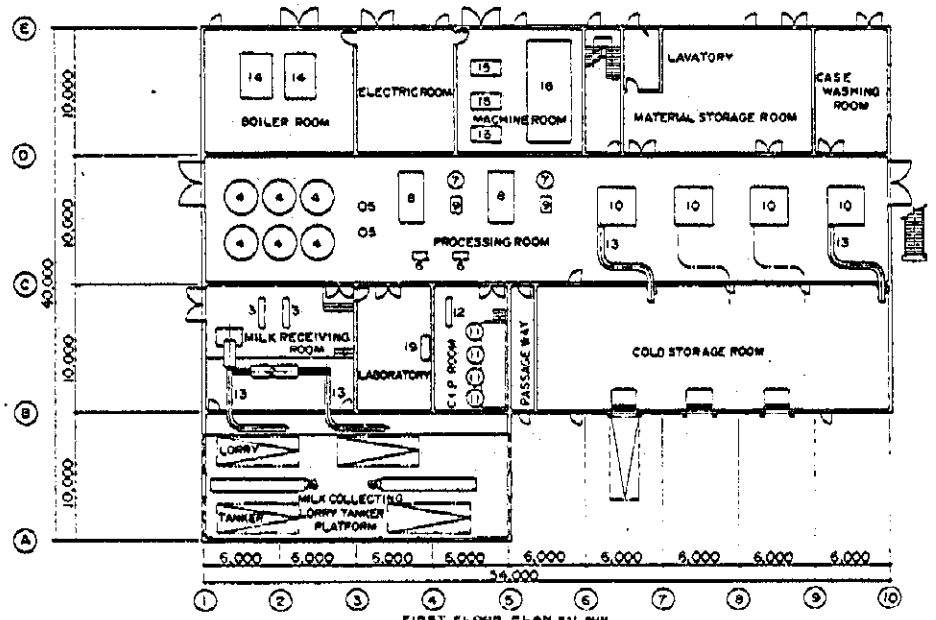
(UNIT : MILLION LE)

YEAR	PROJECT COST			INCREMENTAL BENEFITS	PROJECT RETURN	PRESENT WORTH VALUE	
	CAPITAL	O & M	TOTAL (1)	(2)	(3) =(2)-(1)	(3)*DISCOUNT RATE (33 %)	(34 %)
1	5.15	0.10	5.25	0.0	-5.25	-3.95	-3.92
2	0.71	2.87	3.58	3.39	-0.19	-0.11	-0.11
3	0.35	4.78	5.13	5.88	0.75	0.32	0.31
4	0.29	7.63	7.92	10.04	2.12	0.68	0.66
5	0.58	9.81	10.39	13.02	2.63	0.63	0.61
6	0.55	10.56	11.11	14.26	3.15	0.57	0.54
7	3.99	12.20	16.19	16.60	0.41	0.06	0.05
8	0.43	13.57	14.00	18.46	4.46	0.46	0.43
9	0.75	14.45	15.20	19.67	4.47	0.34	0.32
10	0.0	14.45	14.45	19.67	5.22	0.30	0.28
11	0.0	14.45	14.45	19.67	5.22	0.23	0.21
12	0.06	14.45	14.51	19.67	5.16	0.17	0.15
13	3.25	14.45	17.70	19.67	1.97	0.05	0.04
14	0.0	14.45	14.45	19.67	5.22	0.10	0.09
15	0.0	14.45	14.45	19.67	5.22	0.07	0.06
16	0.0	14.45	14.45	19.67	5.22	0.05	0.05
17	0.06	14.45	14.51	19.67	5.16	0.04	0.04
18	3.25	14.45	17.70	19.67	1.97	0.01	0.01
19	0.0	14.45	14.45	19.67	5.22	0.02	0.02
20	0.0	14.45	14.45	19.67	5.22	0.02	0.01
21	0.06	14.45	14.51	19.67	5.16	0.01	0.01
22	0.0	14.45	14.45	19.67	5.22	0.01	0.01
23	0.0	14.45	14.45	19.67	5.22	0.01	0.01
24	0.0	14.45	14.45	19.67	5.22	0.01	0.00
25	3.25	14.45	17.70	19.67	1.97	0.00	0.00
TOTAL	22.73	307.17	329.90	416.04	86.14	0.10	-0.10

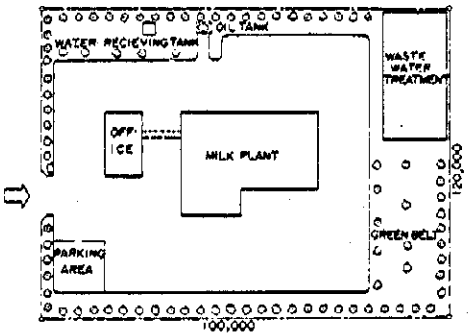
FIRR = 33 ..... 33 + 0.10 / (0.10 + 0.10) = 33.49



SECOND FLOOR PLAN 1:400



FIRST FLOOR PLAN 1:400



PLOT PLAN 1:2000

19	AIR CONDITIONER
18	VENTILATOR
17	REMOTE CONDENSER
16	ICE BANK
15	REFRIGERATOR
14	BOILER
13	CONVEYOR
12	C.I.P HEATER
11	T.I.P TANK
10	FILLER
9	HOMOGENIZER
8	STERILIZER
7	BALANCE TANK
6	SEPARATOR
5	FLOAT BALANCE TANK
4	RAW MILK STORAGE TANK
3	RAW MILK COOLER
2	CHURN WASHER
1	WEIGHING UNIT
NO	EQUIPMENT LIST

Figure D-4

MILK PLANT

REFERENCE NO.
DRAWING NO.
DATE
SCALE

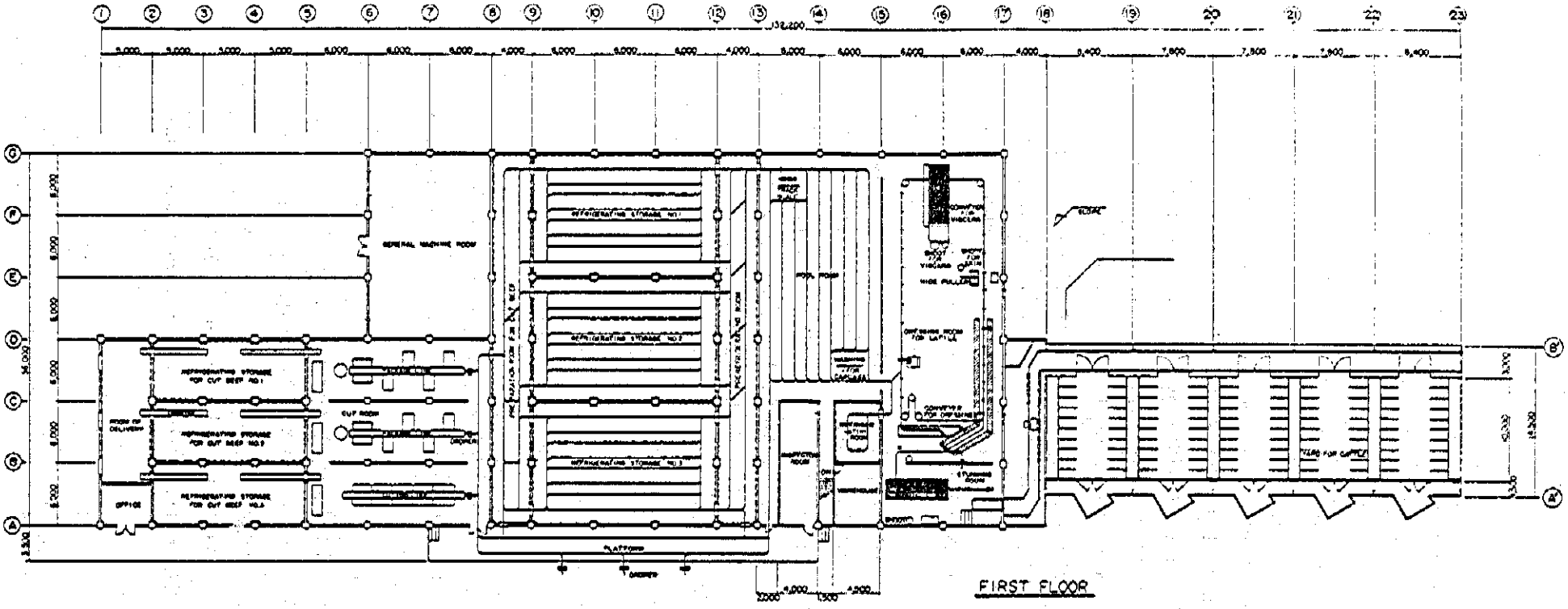
D.2.2. Slaughterhouse

Annual beef production is estimated at 6,900 ton in North Hussinia and 4,130 ton in South Hussinia. Assuming that a slaughterhouse operates 300 days a year, the total production in South Hussinia can be processed by slaughtering 64 head per day. This number is readily accommodated at the existing slaughterhouse in Ismailia which has a capacity of 500 head per day.

The total production in North Hussinia would be processed at the proposed slaughterhouse which has a capacity of 160 head a year. This slaughterhouse would be capable not only of slaughtering and dressing, but also of packing and storing in cold storages. It would be a one story and one basement structure, and the raw hiding and offal treatment would be carried out on the basement. Plane map of plan is shown in Figure D-5.

The prerequisites for the proposed slaughterhouse are: 1) availability of sufficient water, 2) good transportation facilities, 3) limited impact on the neighboring people. As in the case of the milk processing plant, it is desirable that the slaughterhouse facilities be expanded as the number of slaughtered head increases. The following are the basic dimensions of the proposed slaughterhouse.

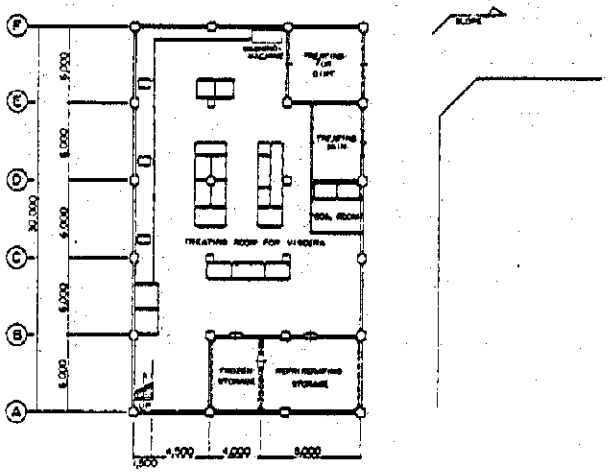
Item			
1. Capacity	160 head/day		
2. Functions	Slaughter, dressing, cutting, packing, storing		
3. Staff	Dressing	30 persons	
	Cutting	15 persons	
	Packing	10 persons	
	Veterinarian	3 persons	
	Others	10 persons	
	Administration	20 persons	
4. Building	1.0 feddan		
5. Lot	6.7 feddan		
			x 10^3
6. Cost	Building	LE	403
	Machineries	LE	1,070
	Electricity	LE	160
	Cold Storage	LE	893
	Water Supply	LE	143
	Samitary facilities		0
	Purification facilities	LE	786
	Incinerate facilities	LE	179
	Enclosure	LE	286
	Total	LE	3,920



FIRST FLOOR

Room	Area(m^2)
Stunning Room	72.0
Dressing Room	360.0
Yard for Cattle	582.9
Inspection Room	72.0
Pool Room	330.0
Refrigerating Storage	27.0
Ware House	27.0
Inspector Room	48.0
Prerefrigerating Room	144.0
Refrigerating Storage No.1 - No.3	648.0
Preparation Room for Cut Beef	144.0
General Machine Room	216.0
Treating Room for Cut Beef	324.0
Refrigerating Room for Cut Beef No.1 - No.3	270.0
Preparation Room for Delivery	70.0
Office	20.0
Plat Form	133.0
Sub-total	3,487.9

Room	Area (m^2)
Treating Room of Viscera	392.0
Treating Room for Dirt	36.0
Treating Room for Skin	24.0
Boil Room	16.0
Refrigerating Room	48.0
Frozen Room	24.0
Sub-total	540.0
Total	4,027.9
	(0.96feddan)



BASEMENT ROOM

Figure D-5
SLAUGHTER HOUSE

REFERENCE NO.
DRAWING NO.
DATE
SCALE

D.3. Tomato Paste and Ketchap Factory

D.3.1. Introduction

The proposed factory is meant for production of the tomato paste for export. As such the product should have excellent quality as regards its colour, fungal spore count, bacterial count, amount of insect fragments and other impurities, sugar/acid ratio and flavour. A high quality tomato paste acceptable by the international market can only be produced from quality tomatoes; suitable high quality tomato varieties with a high slids content need to be selected for growing in the Project Area. It is most desirable, therefore, that the tomato producers will be put under a careful control of the factory through their co-operatives.

The factory would have to be supplied with good quantities of potable water which is indispensable for the washing of the fresh tomatoes as well as for the operation of the evaporator-condenser and the can cooling operation. Supply of fuel and power should also be dependable since power failure and/or shortage of fuel would cause plant shut-downs and deterioration or loss of fresh tomatoes. High quality tin cans and corrugated paper boxes are essential for export of the product.

D.3.2. Factory Capacity

Material tomatoes would be harvested twice a year in the Project Area: during the months of June to November in summer, and during the months of December to February in winter. Material tomatoes of processing factory in the South Hussinia Valley Project would be supplied during the third ten days of June to the first ten days of November (174 days). According to the projection of tomato production, material tomatoes supplied in the year 2005 at full development stage would be amounted at 141,000 tons. This correspond to 810 tons per day (141,000 tons ÷ 174 days = 810 tons per day).

The proposed processing line has been designed to process an average of 6-7 tons of tomatoes per hour or 150 tons per day. With a processing campaign of around 170 days, two shift with three lines per shift would be required to handle the production expected at full development (150 tons x 3 line x 170 day = 76,500 tons, 76,500 tons x 2 shift = 153,000 tons).

As mentioned earlier, the factory is primarily meant for export product, it is planned to produce triple strength (38-40 percent solids) tomato paste for reprocessing abroad. At full development about 17,910 tons of triple strength tomato paste would be produced.

D.3.3. Factory Location

The factory should have a good access road to the port of Alexandria, adequate supplies of water and be close to housing and amenities for the labour and management required to operate the factory. Eventually, it is proposed to establish the factory at a site decided by the land use plan.

D.3.4. Factory Buildings

A single storey building with a floor space of 1600sq. metres (approx. 50 x x 32 m) should provide enough space for each processing line. A single storey warehouse with 6,000 m^2 of floor space (or two single storey warehouses @ 3,000-2,000 m^2 of floor space each) would be needed for finished products and raw materials.

Office and laboratory space with a floor space of approx. 230 m^2 have been included for these facilities. A site of six feddans would provide sufficient space for the buildings and their approaches.

D.3.5. Factory Processing Equipment

The factory would accommodate the modern, medium to large scale automated processing equipment; a flow sheet for a single line is shown in Fig. D-6. The following three sections may describe the proposed operations and plant:

(a) Preparation of Juice for Concentration
(b) Tomato Juice Concentration and Tomato Paste Sterilization
(c) Filling, Seaming and Cooling Filled Cans

D.3.6. Capital Costs

In estimating the processing equipment costs, the standard equipment have been taken into consideration and priced at c.i.f. Alexandria mainly in view of saving ocean freight. This does not preclude purchase of non-European equipment if they are competitive. Capital cost of plant items for 150 ton/day line is given in Tables D-22 and D-23.

While supply of the material tomatoes is not large, that is during Factory Years 2 and 3, only one line will be put into operation; then, as material tomato supply becomes more, 2 lines will start working during Factory Years 4 and 5. Since Factory Year 6 onward, 3 lines would be working. With three lines required to handle the anticipated production at full development, the total capital cost of plant would be as follows:

Table D-22 Capital Cost of Plant Items for 150 TPD Line

(Unit: LE)

Plant Items	
Juice Preparation Line	
Washing machine with grading table	
1 Centrifugal rotary pump for tomato washing	
1 Rotary air blower	
1 Automatic controlling and recording set	
1 Single stage air compressor	
1 Metal cabinet for controls	
1 Collection tank for refined tomato juice	
1 Metal frame with SS steel collector	
Sub-total	78,200
Juice Concentration and Paste Sterilization	
1 Continuous plant for concentration of tomato juice	
1 Tomato paste sterilizing unit	
Sub-total	273,710
Can Filling, Seaming and Cooling	
1 Automatic valumetric can filler	
1 Connecting disc to seaming and packing machine	
1 Automatic seaming and packing machine	
1 Metal control cabinet	
1 Filled can cooler	
1 Electric control cabinet	
1 Filled can conveyor	
1 Elevator can conveyor	
Sub-total	117,300
Other Equipment	
1 500 Hp steam generator	
1 Water treatment plant	
1 Gasoline fork truck (1 ton)	
1 Electric fork truck (1 ton)	
3000 Pallets, each	
1 Sem-automatic case loader and sealer	
Sub-total	170,480
Total price c.i.f. Port of Alexandria	639,690
Plus: 5.0% internal costs	31,985
Grand Total	671,675

Table D-23 Total Capital Costs for 450 TPD Tomato Factory

(Unit : 1,000LE)

Main Plant (LE 671,680 x 3 lines)	2,015.0
Office equipment and furniture	15.0
Laboratory equipment and furniture	26.0
Installation costs and spare parts	213.3
Processing buildings, 4,800 m^2 @ LE 120	576.0
Warehouse, 6,000 m^2 @ LE 100	600.0
Laboratory and office, 230 m^2 @ LE 150	34.5
Architect fees and supervision @ 8% building costs	96.9
Staff housing (see Table D-24)	937.8
Staff vehicles (see Table D-25)	34.4
Total	4,548.9

Capital costs would also include the staff housing costs and vehicle costs; their annual costs are given in Tables D-24 and D-25 respectively.

D.3.7. Material Supplies

The proposed plant would process only the high quality fresh tomatoes and the production of tomato paste for export would take place by stage as the experience of the tomato growers groups in sorting and delivery would be advancing year after year. Thus, the plant would start processing 31,000 tons a year, gradually increasing the quantity till it handles a constant amount of 141,000 tons in Factory Year 9 onward.

Nevertheless, the tomato growers and the plant would be put in an awkward position as regards determination of the purchase price of the material tomatoes. While high purchasing price would apparently be beneficial for the growers, low purchasing price should be more favourable to the plant. Thereupon, three cases of (x), (y) and (z) have been compared by fixing the unit purchase price of fresh tomato at LE 60, LE 80 and LE 100, respectively, each per ton.

Table D-24 Phasing of Housing Costs for Tomato Processing Plant

(Unit: LE)

Designation	Type of House	Cost per House	1	2	3	4	5
General Manager	A1 (1)	14,000	44,000				
General Manager	A1 (1)	44,000		44,000			
Assistant Manager	A2 (3)	33,800	33,800		33,800		33,800
Quality Control Supervisor	A2 (1)	33,800	33,800				
Quality Control Assistants	A3 (3)	24,700	24,700		24,700		24,700
Accountant	A3 (1)	24,700	24,700				
Clerks	B1 (3)	12,900	12,900		12,900		12,900
Drivers	C1 (3)	1,220	2,440		1,220		
Plant Supervisor	A3 (2)	24,700	49,400				
Shift Foremen	B1 (9)	12,900	12,900	12,900	51,600		38,700
Chief Mechanic	A3 (1)	24,700	24,700				
Asst. Mechanic	B1 (6)	12,900	12,900	12,900	25,800		25,800
Canfilling Operators	C1 (18)	1,220	7,320		7,320		7,320
Can Packers	C1 (18)	1,220	7,320		7,320		7,320
Forklift Drivers	B3 (21)	4,700	32,900		32,900		32,900
Weighers	C1 (6)	1,220	2,440		2,440		2,440
General Labourers	C1 (12)	1,220	4,880		4,880		4,880
Hostel	(1)	141,200	141,200				
		Total	472,300	69,800	204,880	-	190,760

Table D-25 Staff Vehicle Costs

Number	Type of Vehicle	Cost of Vehicle	Factory Year (1)
2	C1	@LE 4,960	9,920
2	C2	@LE 4,300	8,600
2	Pool Cars	@LE 4,300	8,600
2	Pick-ups	@LE 3,640	7,280
		Total	34,400

As a result, the percentage of material tomato cost in the total operating cost of the plant has been identified at 61% in case of (x), 67% in case of (y), and 72% in case of (z), at full development. By taking into consideration the high quality which is the basic requirement, plus the labour in sorting and delivery by the tomato growers' co-operative, case (y) has been ultimately adopted, since (x) would be too harsh to the growers but (z) might give severe pressure on the plant management (for details, see Table D-29: Gross Cash Flow in Financial Prices).

Among other materials, the containers and packaging materials are available in Egypt and the utilities such as fuel oil and electricity are also enjoyable in the project area. Their unit costs have been computed as follows:

Table D-26 Costs of Raw Materials and Other Supplies

Tomatoes	@ LE 80/ton
Cans 5 kg gross (4.5 kg net)	@ LE 0.70/ton paste
Cartons	@ LE 22.5/ton paste
Fuel Oil	@ LE 9.7/ton tomato
Electricity	@ LE 0.5/ton tomato

D.3.8. Operating Costs

The operating costs have been estimated in three sectors of (A): Purchase of Tomatoes; (B): Other Materials and Supplies, and (C): Overhead Costs. Permanent and temporary staff costs which are included in the Overhead Costs are estimated as per Table D-27.

At full development, the total operating costs are estimated as follows:

Table D-27 Staff Costs for Tomato Processing Plant

(Unit: LE)

Project Year / Factory Year	Annual Salary	Number Required on Full Development	1	2	3	4	5	6	7	8	9
Administration											
General Manager	Fee	1	38,500	38,500	38,500	38,500					
General Manager	12,500	1	-	-	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Asst. Managers	7,800	3	-	7,800	7,800	15,600	15,600	23,400	23,400	23,400	23,400
Quality Control Supervisor	7,800	1	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800
" " Assistants	1,700	3	-	1,700	1,700	3,400	3,400	5,100	5,100	5,100	5,100
Accountant	1,700	1	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Clerks	1,560	3	-	1,560	1,560	3,120	3,120	4,680	4,680	4,680	4,680
Secretary	1,560	1	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560	1,560
Typists	1,250	1	-	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
Office Juniors	625	3	-	625	625	1,250	1,250	1,875	1,875	1,875	1,875
Drivers	1,000	3	2,000	2,000	2,000	3,000	3,000	3,000	3,000	3,000	3,000
Watchmen	625	3	625	625	625	1,250	1,250	1,875	1,875	1,875	1,875
Sub-Total		24	52,185	65,120	77,620	90,930	52,430	64,740	64,740	64,740	64,740
Operation											
Plant Supervisors	1,700	2	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400	3,400
Shift Foremen	1,870	9	1,870	3,740	3,740	11,220	11,220	16,830	16,830	16,830	16,830
Chief Mechanist	7,800	1	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800	7,800
Assist. Mechanist	1,700	6	1,700	3,400	3,400	6,800	6,800	10,200	10,200	10,200	10,200
Canfilling Operators	1,560	18	-	9,360	9,360	18,720	18,720	28,080	28,080	28,080	28,080
Can Packers	1,560	18	-	9,360	9,360	18,720	18,720	28,080	28,080	28,080	28,080
Forklift Drivers	1,560	21	-	10,920	10,920	21,840	21,840	32,760	32,760	32,760	32,760
Weishters	1,560	6	-	3,120	3,120	6,240	6,240	9,360	9,360	9,360	9,360
General Labourers	625	12	-	2,500	2,500	5,000	5,000	7,500	7,500	7,500	7,500
Sub-Total		93	14,770	53,600	53,600	99,740	99,740	144,010	144,010	144,010	144,010
Total Permanent Staff Costs:	One Shift		66,955	118,720	131,220	190,670	152,170	208,750	208,750	208,750	208,750
	Two Shift		66,955	118,720	131,220	190,670	304,340	417,500	417,500	417,500	417,500
Temporary Labour											
Tomato Graters:	One Shift	90		16,800	16,800	33,600	33,600	50,400	50,400	50,400	50,400
	Two Shift			16,800	16,800	33,600	67,200	100,800	100,800	100,800	100,800

Table D-28 Annual Factory Operating Cost at Full Development

(Unit : 1,000 LE)

Raw Materials and Other Supplies	8,460.3
Permanent Staff Costs	208.8
Temporary Staff Costs	50.4
Insurance	9.8
Machinery and Equipment Repairs	82.2
Building Repairs	42.9
Administration	13.0
Total	8,867.4

(For details, see Table D-29: Gross Cash Flow at Financial Prices)

D.3.9. Gross Cash Flow

The gross cash flow of the proposed tomato processing plant is given in Table D-29: Gross Cash Flow at Financial Prices.

D.3.10. Financial Internal Rate of Return

This has been computed as per Table D-30: Financial Internal Rate of Return.

Initial capital cost of 5.0 million LE consists of 4.55 million LE of basic cost and o.45 million LE of physical contingency. This cost does not include the price escalation. If the price escalation is counted, it is about 16.6 million LE due to the starting of Project in 1997 (Table D-31). In this evaluation of FIRR, the financial project cost does not include the price escalation. Terminal value (residual cost) is excluded in benefit flow because of the conservative estimation of IRR.

Note: FIRR ... 32.5%.

Table D-29 Tomato Paste Processing Plant - Gross Cash Flow at Financial Prices

(Unit: 1,000 LE)

Project Year / Factory Year	1997 / 1	1998 / 2	1999 / 3	2000 / 4	2001 / 5	2002 / 6	2003 / 7	2004 / 8	2005 / 9
Physical Output (000's Tons)									
Tomato Paste @12.7% of fresh tonnage		3.94	6.22	10.03	12.95	16.00	17.02	17.65	17.91
Income (LE '000)									
Tomato Paste @LE 1,200		4,728	7,464	12,036	15,540	19,200	20,424	21,180	21,492
Purchase of Tomatoes (000's Tons)		31.0	49.0	79.0	102.0	126.0	134.0	139.0	141.0
Tomato Purchase (A)									
@LE 60/Ton (X)		1,860	2,940	4,740	6,120	7,560	8,040	8,340	8,460
" 80/Ton (Y)		2,480	3,920	6,320	8,160	10,080	10,720	11,120	11,280
" 100/Ton (Z)		3,100	4,900	7,900	10,200	12,600	13,400	13,900	14,100
Other Material and Supplies (B)									
- 5kg (Gross) Cans (4.5 kg net) @LE0.70		612.9	967.6	1,560.2	2,014.4	2,488.9	2,647.6	2,745.6	2,786.0
- Fuel Oil @LE 9.7/Ton of tomato processed		300.7	475.3	766.3	989.4	1,222.2	1,299.8	1,348.3	1,367.7
- Cartons @LE 22.5/Ton paste		88.7	140.0	225.7	291.4	360.0	383.0	397.1	403.0
- Electricity @LE 0.5/Ton of tomato processed		15.5	24.5	39.5	51.0	63.0	67.0	69.5	70.5
Sub-total		1,017.8	1,607.4	2,591.7	3,346.2	4,134.1	4,397.4	4,560.5	4,627.2
Overhead Costs (C)		2 lines (1 shift)	2 lines (1 shift)	3 lines (1 shift)	3 lines (2 shift)	3 lines (2 shift)	3 lines (2 shift)	3 lines (2 shift)	3 lines (2 shift)
- Perm.Management, Labour & Clerical Salaries	67.0	118.7	131.2	190.7	152.2	308.8	308.8	208.8	208.8
- Temporary Labour	-	16.8	16.8	33.6	33.6	50.4	50.4	50.4	50.4
- Administration	6.5	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
- Maintenace of Equipment @ 4% of Capital Cost		28.5	28.5	55.4	55.4	82.2	82.2	82.2	82.2
- Insurance @ 0.3% of Value (Buildings & Equipment)		5.8	5.8	7.8	7.8	9.8	9.8	9.8	9.8
- Building Repairs @ 2% of Capital Cost		35.1	35.1	39.2	39.2	42.9	42.9	42.9	42.9
Sub-total : One Shift	73.5	217.9	230.4	339.7	301.2	407.1	407.1	407.1	407.1
Two Shift	73.5	217.9	230.4	339.7	602.4	814.2	814.2	814.2	814.2
Total Costs (A + B + C) (X)	73.5	3,095.7	4,777.8	7,671.5	10,068.6	12,508.3	13,251.6	13,714.7	13,901.4
(Y)	73.5	3,715.7	5,757.8	9,251.4	12,108.6	15,028.5	15,931.6	16,494.7	16,721.4
(Z)	73.5	4,335.7	6,737.8	10,831.4	14,148.6	17,548.5	18,611.6	19,274.7	19,541.4
Gross Cash Flow (X)	(73.5)	1,632.3	2,686.2	4,364.6	5,471.4	6,691.3	7,172.4	7,465.3	7,590.6
(Y)	(73.5)	1,012.3	1,706.2	2,784.6	3,431.4	4,171.3	4,492.4	4,685.3	4,770.6
(Z)	(73.5)	392.3	726.2	1,204.6	1,391.4	1,651.7	1,812.4	1,905.3	1,950.6

Table D-30 Tomato Paste Processing Plant - Financial Internal Rate of Return (Raw Tomatoes: 80 LE/tons)

(Unit: LE 1,000)

Factory Year	Gross Cash Flow	Buildings	Plant & Equipment	Installation Costs & Spare Parts	Architect Fee & Supervision	Staff Housing	Staff Vehicles	Average Additional Annual Working Capital (1)	Total Investment Incl. 10% Contingency	Net Cash Flow
1	(73.5)	1,210.5	712.7	71.1	32.3	472.3	34.4	-	2,786.6	(2,860.1)
2	1,012.3	-	-	-	-	69.8	-	1,114.7	1,303.0	(290.7)
3	1,706.2	-	671.7	71.1	32.3	204.9	-	1,727.3	2,978.0	(1,271.8)
4	2,784.6	-	-	-	-	-	-	2,775.4	3,052.9	(268.3)
5	3,431.4	-	671.7	71.1	32.3	190.8	34.4	3,632.6	5,096.2	(1,664.8)
6	4,171.3	-	-	-	-	-	-	-	-	4,171.3
7	4,492.4	-	-	-	-	-	-	-	-	4,492.4
8	4,685.3	-	-	-	-	-	-	-	-	4,685.3
9	4,770.6	-	-	-	-	-	-	-	-	4,770.6
10	"	-	-	-	-	-	-	-	-	4,770.6
11	"	-	712.7 (4)	-	-	-	34.4 (5)	-	821.8	3,948.8
12	"	-	-	-	-	-	-	-	-	4,770.6
13	"	-	671.7	-	-	-	-	-	738.9	4,031.7
14	"	-	-	-	-	-	-	-	-	4,770.6
15	"	-	671.7	-	-	-	-	-	738.9	4,031.7
16	"	-	-	-	-	-	34.4	-	37.8	4,732.8
17	"	-	-	-	-	-	-	-	-	4,770.6
18	"	-	-	-	-	-	-	-	-	4,770.6
19	"	-	-	-	-	-	-	-	-	4,770.6
20	"	-	-	-	-	-	-	-	-	4,770.6
21	"	-	712.7	-	-	-	34.4	-	821.8	3,948.8
22	"	-	-	-	-	-	-	-	-	4,770.6
23	"	-	671.7	-	-	-	-	-	738.9	4,031.7
24	"	-	-	-	-	-	-	-	-	4,770.6
25	"	-	671.7	-	-	-	-	-	-	4,770.6
26	"	-	-	-	-	-	34.4	-	37.8	4,732.8
27	"	-	-	-	-	-	-	-	-	4,770.6
28	"	-	-	-	-	-	-	-	-	4,770.6
29	"	-	-	-	-	-	-	-	-	4,770.6
30	4,770.6	-	-	-	-	-	-	-	-	4,770.6
Terminal Value		302.6 (3)	-	-	-	234.5	-	9,250.0	-	14,557.7 (2)

Note: (1) Average annual working capital is estimated as 30% of total operating costs.

(2) Include terminal value.

(3), (4), (5) Life periods are 40, 10, 5 years respectively.

Table D-31 Initial Investment Cost - Tomato Processing Factory

(Unit: Million LE)

	Total	F.C.	L.C.
Construction Cost (Base Cost)	4.55	2.92	2.63
Contingency	0.45	0.19	0.26
Total	5.00	2.11	2.89

	1997	1998	1999	2000	2001	Total
Total Cost	2.79	0.07	1.08	-	1.06	5.00
F.C.	0.70	-	0.70	-	0.71	2.11
L.C.	2.09	0.07	0.38	-	0.35	2.89
Price Escalation Ratio						
F.C.	2.197	2.329	2.468	2.617	2.774	
L.C.	3.625	3.987	4.386	4.825	5.308	
Price Escalation						
F.C.	1.54	-	1.73	-	1.97	5.24
L.C.	7.57	0.28	1.67	-	1.86	11.38
Total	9.11	0.28	3.40	-	3.83	16.62
Grand Total	11.90	0.35	4.48	-	4.89	21.62

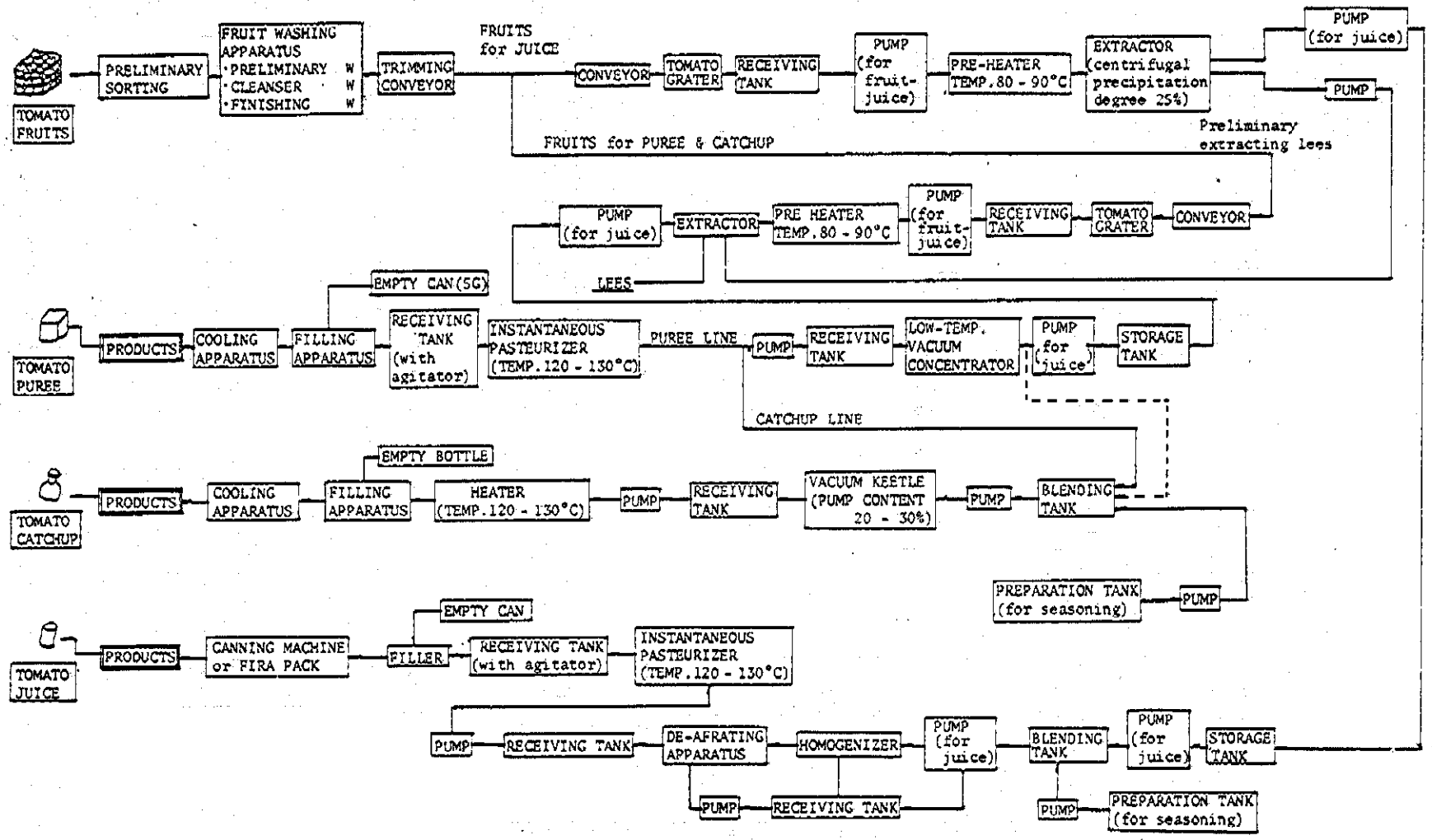
Table D-32 Project Financial Cost and Return
South Hussinia - Tomato Paste Processing Plant

(Unit: Million LE)

Year	Project Cost			Incremental Benefits	Project Return	Present Worth Value (3) x Discount Rate	
	Capital	O & M	Total (1)	(2)	(3)=(2)-(1)	(32%)	(33%)
1	2.79	0.07	2.86	0.0	-2.86	-2.17	-2.15
2	1.30	3.72	5.02	4.73	-0.29	-0.17	-0.16
3	2.98	5.76	8.74	7.46	-1.28	-0.56	-0.54
4	3.05	9.25	12.30	12.04	-0.26	-0.09	-0.08
5	5.10	12.11	17.21	15.54	-1.67	-0.42	-0.40
6	0.0	15.03	15.03	19.20	4.17	0.79	0.75
7	0.0	15.93	15.93	20.42	4.49	0.64	0.61
8	0.0	16.49	16.49	21.18	4.69	0.51	0.48
9	0.0	16.72	16.72	21.49	4.77	0.39	0.37
10	0.0	16.72	16.72	21.49	4.77	0.30	0.28
11	0.82	16.72	17.54	21.49	3.95	0.19	0.17
12	0.0	16.72	16.72	21.49	4.77	0.17	0.16
13	0.74	16.72	17.46	21.49	4.03	0.11	0.10
14	0.0	16.72	16.72	21.49	4.77	0.10	0.09
15	0.74	16.72	17.46	21.49	4.03	0.06	0.06
16	0.04	16.72	16.76	21.49	4.73	0.06	0.05
17	0.0	16.72	16.72	21.49	4.77	0.04	0.04
18	0.0	16.72	16.72	21.49	4.77	0.03	0.03
19	0.0	16.72	16.72	21.49	4.77	0.02	0.02
20	0.0	16.72	16.72	21.49	4.77	0.02	0.02
21	0.82	16.72	17.54	21.49	3.95	0.01	0.01
22	0.0	16.72	16.72	21.49	4.77	0.01	0.01
23	0.74	16.72	17.46	21.49	4.03	0.01	0.01
24	0.0	16.72	16.72	21.49	4.77	0.01	0.01
25	0.0	16.72	16.72	21.49	4.77	0.00	0.00
26	0.04	16.72	16.76	21.49	4.73	0.00	0.00
27	0.0	16.72	16.72	21.49	4.77	0.00	0.00
28	0.0	16.72	16.72	21.49	4.77	0.00	0.00
29	0.0	16.72	16.72	21.49	4.77	0.00	0.00
30	0.0	16.72	16.72	21.49	4.77	0.00	0.00
Total	19.16	446.20	465.36	573.35	107.99	0.09	-0.09

Note: IRR = 32 ... 32 + 0.09/(0.09 + 0.09) = 32.48

Figure D-6 Tomato Paste & Ketchup Factory



ANNEX E RURAL DEVELOPMENT

Appendix E Rural Development

LIST OF TABLES

LIST OF FIGURES

E. Rural Development Plan

A development plan for farm villages inclusive of a settlement plan has been formulated based on the field survey to cope with the land reclamation plan, irrigation and drainage plan, agricultural facilities plan, and farm management plan proposed for the Project. In formulating the development plan of farm villages, studies were focussed on the following;

- ° Alignment of Villages
- ° Housing
- ° Infrastructures
  - a) Village facilities
  - b) Trunk and village roads
  - c) Potable water
  - d) Sewage and refuse treatment
  - e) Electric power
  - f) Telecommunication

Village facilities and so on to be materialized under this Project have been determined through various discussions made between CARPAD and the Team.

E.1. Settlement

E.1.1 Outline of Settlement

The settlement plan in the Project is included as part of the comprehensive development plan covering about 240,000 feddan of wide land areas composed of the North Hussinia and the South Port Said, and about 230,000 people will settle in this wide area in future. Such being the case, social and technical services shall be provided as appropriate to improve the life of the new settlers.

Various facilities should be provided to give the appropriate social and technical services to the inhabitants within the proposed activity sphere so as to meet their leveling standard.

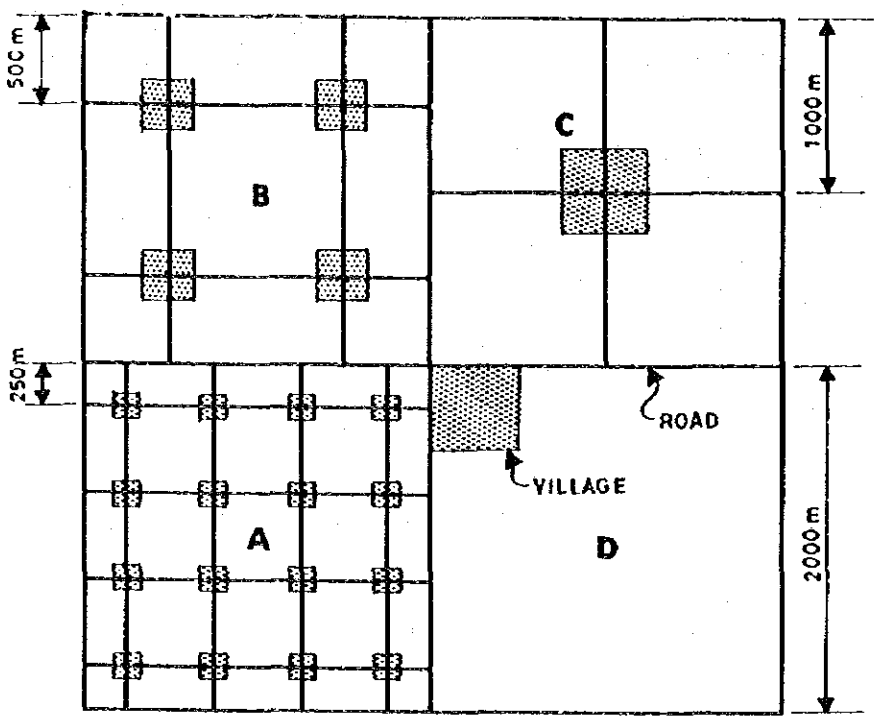
Successful realization of such plan will require the establishment of an elementary settlement, a primary activity sphere and a secondary activity sphere with the local activity zone to be set up as a wide area local administration entity within the aforesaid comprehensive development areas. The secondary activity sphere means the individual project areas. Towns will be developed functioning as cores of the wide-area local administration entity, being located in the center of the North Hussinia (the site at the crossing of El Salam canal and Bahr El Baqar).

The respective activity spheres should provide their own settlements to form such local rural communities. The settlements shall be established in groups of inhabitants by their farming level and social activities so that the social and technical services can be rendered more effectively and efficiently. Under these conditions, the Project will provide satellite villages as elementary settlements so that they can function as cores of the primary activity sphere, and the service village will be established in the center of the secondary sphere to function as the central villages.

On the other hand, the social function of the communities should be maintained by limiting the size of the communities to 300 households with a population of 2,000. Consequently, the size of the satellite settlements shall meet the requirements mentioned above.

Scattered villages would be advantageous for farming management, although they would have some demerits in rendering efficient public services. The Project, therefore, will employ clustered villages in the community planning.

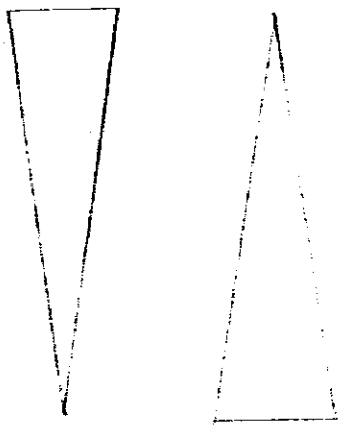
Figure E-1. Comparative Chart for Village Pattern



Case	Farmers/Village	Villages	Village Road
A	5 farmers	64	64 km
B	20 farmers	16	32 km
C	80 farmers	4	16 km
D	300 farmers	1	8 km

Table E-1. Hierarchy of Activity Sphere

Activity Sphere	Village	Activity	
		Agriculture	Social & Economic
		max	min
elementary settlement	satellite village		
primary activity sphere	service vilalge		
secondary activity sphere	central village		
local activity sphere	town (agro-town)	min	max



E.1.2 Alignment of Villages

The settlements will be located along irrigation canals as far as possible so that the roads to be constructed along the canals will be utilized both as village roads and as the operation and maintenance roads for the canals. It has been also taken into consideration that water management will be easy if villages are located along irrigation canals.

A settlement pattern has been established so as to let all farmers have their houses within walking distance, about two kilometers, of their farm fields. The settlements will be arranged in a hierarchy consisting of three types of settlements, that is, satellite villages, service villages, and central villages. Satellite villages are the smallest of them, and occupy the majority. For every three to four satellite villages one service village will be provided, and for every three service village one central village will be founded. Figure E-5 illustrates the hierarchy of settlements. The estimated number of villages by types is as follows:

- Satellite villages: 21
- Service villages: 6
- Central villages: 2

The approximate household composition by types would be as follows:

- Satellite village: 280 farm households, 35 owner households and 46 non-farm households
- Service village: 250 farm households, 37 owner households and 95 non-farm households
- Central village: 228 farm households, 18 owner households and 426 non-farm households

Assuming that a household consists of five members on an average, the population by village types is computed as follows:

- ° Satellite village: 1,800 persons
- ° Service village: 1,900 persons
- ° Central village: 3,400 persons

The number of households and population after settlement are roughly computed as follows:

	Households	Population
Farm households	7,900	39,000
Owner households	1,000	5,000
Non-farm households	2,400	12,000
Total	11,300	56,000

E.2. Housing

About 60,000 persons are estimated to reside permanently in the Project Area in the full development stage. Therefore, it would be necessary to provide 29 villages with 12,000 houses assuming that one household consists of five members. In villages different housing types will be intermixed to promote social integration. Six house types will be build to accommodate project residents, accordingly, namely, farmers' house, owners' house, apartment, technical laborers' house, assistant directors' house and director's house. Land holding farmers will be provided with starter households that can be expanded and developed as the need arises. The basic features of six housing types are outlined in Table E-2, and the features of farmer's houses are illustrated in Figure E-9.

The number of houses on an average required in the Project will be as follows:

Table E-2. Characteristics of Housing Program

	Farmers Houses	Owners Houses	Anart-ment	Tech. Laborers Houses	Ass't Directors Houses	Director's Houses
Plot Size (sq.m)	200	500				
Room Number	2	2	2	2	6	8
Building Area (sq.m)	54	60	300	58	153	200
Materials	Brick	Brick	Reinforced Concrete	Reinforced Concrete	Reinforced Concrete	Reinforced Concrete
Enclosure	Mud Wall	Mud Wall				
Water Supply	Communal tap	Single tap	3 Multi Point	3 Multi Point	6 Multi Point	8 Multi Point
Sewage Disposal	Pit Latrine	Sewage Line to Treatment System				
Electricity	220 V Connection					

Table E-3 Houses Required by Village Types

Houses	Satellite Village	Service Village	Central Village	Project Area
Director's	-	1	8	22
Assist Director's	-	1	8	22
Technical Laborer's	8	20	60	408
Apartment	2	3	9	78
Owner's	35	37	18	993
Farmer's	280	250	228	7,836
Total	325	312	331	9,359

E.3 Infrastructures

E.3.1 Village Facilities Plan

The rural community of the Project Area will consist of satellite villages, service villages and two central villages. The outline of village facilities are as follows:

A satellite village is a basic unit in the Project Area to support a range of social services. Therefore, the satellite village will be settled by about 300 farm households, and be provided with daily necessities for living such as potable water, electric power, sewage treatment and market, etc. Moreover, in order to give techinical guidance to settlers in farm management, an agricultural administration office will be established, requiring accommodations for the office staff and techinical officials.

Service villages shall be responsible for the administrative aspect of the surrounding satellite villages, three to four in number. Therefore, a village development office will be necessary for the service villages in addition to the above-mentioned agricultural administration office. Furthermore, education facilities such as combined ones of primary and preparatory schools will be necessary in service villages. A medical service unit to look after the health of the villagers and to give first aid, a market and stores for daily necessities and miscellaneous goods, workshop to repair simple farm machines and vehicles, etc., and a rice mill to process paddy for self-consumption of farmers will be installed in service villages in addition to the above-mentioned facilities.

The central villages will be provided with similar facilities to those of service villages. However, the scale of them shall be larger than those of service villages. For instance, a hospital will be necessary in place of medical units. For education, a secondary school shall be maintained in the central villages for higher education. The main post office shall be installed in each central village for controlling post offices in service villages. Furthermore, facilities for veterinary services and breeding of domestic animals will be installed there. A village area will be divided into three zones; that is, service zone, farmers house zone and owners house zone. This zoning is commonly made by GARPAD. Figure E-7 illustrates the layout of typical zoning of villages.

The general infrastructures would be as follows:

° Education:

A combined school will be built in each service village and central village. In a central village, a secondary high school and a nursery school will be built.

° Health:

Medical treatment unit to keep settlers healthy will be built in each service and central village. A central village will be provided with a hospital with about 20 beds.

° Commercial:

In satellite villages small stores will be built for daily lives of villagers such as bakery, grocers, and general stores, etc. More space will be necessary for those of the central and service villages to reflect the high level of commercial activities there.

° Mosque:

A mosque is usually provided by the Government. A site for it has been allocated in each village, a small site for a mosque without tower in satellite villages and a large site for a mosque with tower in the service and central villages. Lands for cemeteries have also been alloted near villages.

° Access:

Villages will be linked to each other by paved roads. Street in villages will have an effective width of ten meters. The street will be provided with a footpath of three meters wide at both sides. The main streets in villages will be paved.

° Utilities:

Potable water and electric power will be supplied to all houses in villages. In addition, some communal standpipes with washing facilities will be installed so that no villagers have to use irrigation water for drinking or other domestic purposes. Telephone services will be made available by connecting to town exchange.

Table E-4. Facilities and Population of Satellite Village

Buildings	Building Area	Number of Buildings	Number of Families	Population
Agri. Administrative Office	500 sq.m	1	15	75
Group of Shops	300	1	20	100
Mosque	100	1	3	15
Technical Laborers House	58	8	8	40
Apartment	300	2	(40)	-
Owners House	60	35	35	175
Farmers House	54	280	280	1,400
Total			361	1,805

Table E-5. Facilities and Population of Service Village

Buildings	Building Area	Number of Buildings	Number of Families	Population
Village Development Office	75 sq.m	1	20	100
Combined School	1,600	1	18	90
Medical Treatment Unit	212	1	5	25
Mosque	181	1	3	15
Auto Service	180	1	10	50
Market with Bakery	717	1	15	75
Directors House	200	1	2	10
Ass't Directors House	153	1	2	10
Technical Laborers House	58	20	20	100
Apartment	300	3	-	-
Owners House	60	37	37	185
Farmers House	54	250	250	1,250
Total			382	1,910

Table E-6. Facilities and Population of Central Village

Buildings	Building Area	Number of Buildings	Number of Families	Population
Village Develop-Office	800 sq.m	1	20	100
Administration Office	1,600	1	40	200
Artificial Insemination Center	1,025	1	12	60
Nursery School	500	2	20	100
Combined School	3,200	1	30	150
High School (General, Agriculture and Commerce)	3,200	1	30	150
Hospital (20 beds)	500	1	30	150
Medical Treatment Unit	212	1	5	25
Mosque	181	2	6	30
Police Station	568	1	8	40
Post Office	170	1	15	75
Fire Station	230	1	6	30
Store	1,000	1	8	40
Village Bank (Incl. Insurance)	250	1	10	50
Workshop	1,000	1	20	100
Auto Service Station	180	1	10	50
Market with Bakery	717	2	30	150
Group of Shops	258	8	24	120
Separeted Bakery	180	1	6	30
Rest House for Employees	1,200	1	6	30
Club	500	1	4	20
Cinema/Theater House	710	1	10	50
Directors House House	200	8	8	40
Ass't Directors House	153	8	8	40
Technical Laborers House	58	60	60	300
Apartment	300	9	-	-
Owners House	60 sq.m	18	18	90
Farmers House	54	228	228	1,140
Total			672	3,360

° Others:

The principal social service facilities such as police station, fire station, post office, bank, telephone office, etc. will be established in a central village.

Figures E-17 - 19 illustrates the location of buildings at village.

E.3.2 Trunk and Village Roads

The road networks shall conform to the irrigation and drainage layout because as mentioned above village roads will function as operation and maintenance roads as well. For the settlement scheme three categories of roads have been planned as follows:

Roads	Structures
Trunk roads:	Pavement - 6 meters wide
	Shoulders - 2 and 4 meters wide
Village and Farm roads:	Pavement - 4 meters wide
	Shoulders - 2 and 4 meters wide
On-farm roads:	Unpaved - 6 meters wide

a. Trunk Roads

Trunk roads will mainly function to connect the major villages in the Project Area and the surrounding major cities and towns. The roads, will be used for transporting daily goods, farm input and output to and from areas outside the Project Area. The construction of two trunk roads has been planned to connect the existing road running through the heart of the Project Area from north to southeast and the national road passing through the eastern-most of the Project Area. The truck roads will have an effective width of six meters to allow two units of heavy farm machines or heavy trucks to pass each other. Furthermore, an additional width of two meters and four meters will be secured for their shoulders. Trees (Eucalyptus and/or Nilotica) will be planted on the two meters wide shoulder. The other wide shoulder will be used for the operation and maintenance of canals.

Table E-7. Construction Schedule of Villages

	1989	1990	1991	1992	1993	Total
1. Satellite Village	4	5	5	3	4	21
2. Service Village	2	1	2	-	1	6
3. Central Village	-	1	-	-	1	2
Total	6	7	7	3	6	29

Table E-8. Building Schedule of Housing

	1989	1990	1991	1992	1993	Total
1. Director's House	2	9	2	-	9	22
2. Ass't Director	2	9	2	-	9	22
3. Technical Laborer's	72	120	80	24	112	408
4. Apartment	14	22	16	6	20	78
5. Owner's House	214	230	249	105	195	993
6. Farmer's House	1,620	1,878	1,900	840	1,598	7,836
Total	1,924	2,268	2,249	975	1,943	9,359

b. Village Roads

Village roads will connect satellite villages, service villages and central villages. The effective width of this road type will be four meters so that farm machines such as tractors and trucks will be able to pass. As trunk roads, village roads will be provided with a shoulder of two meters wide at one side where trees can be planted and the other shoulder at the other side, four meters wide, and will be utilized for the operation and maintenance of canals. The road surface will be paved with asphalt.

c. Farm Roads

Farm road are classified into two types, namely, the main farm roads and on-farm roads. The main farm roads in the Project fall into a category of the above-mentioned village roads. On-farm roads with a total surface width of six meters will be utilized for the operation and maintenance of canals. The length and structure of roads are as follows:

Table E-9 Dimensions of Roads

Roads	Length (km)	Width		Pavement
		Total (m)	Passing (m)	
Trunk Roads	51	12	6	Asphalt
Village Roads	82	10	4	- do -
Farm Roads	504	10	4	Gravel
Total	637			

Road Density: 32 m/ha (13 m/feddan)

Table E-10. List of Trunk Roads

No.	Length (km)	Bridge		
TR - 1	29.5	L = 8m	W = 6m	N = 8
		L = 16m	W = 6m	N = 11
		L = 22m	W = 6m	N = 4
		L = 32m	W = 6m	N = 1
TR - 2	5.5	L = 8m	W = 6m	N = 1
		L = 16m	W = 6m	N = 1
		L = 32m	W = 6m	N = 1
TR - 3	16.0	L = 8m	W = 6m	N = 5
		L = 16m	W = 6m	N = 6
Total	51.0	L = 8m	W = 6m	N = 14
		L = 16m	W = 6m	N = 18
		L = 22m	W = 6m	N = 4
		L = 32m	W = 6m	N = 2

Table E-11. List of Village Roads

No.	Length(km)	Bridge		
VR - 1	2.5	L = 8m	W = 4m	n = 1
		L = 12m	W = 4m	n = 1
VR - 2	3.0	L = 8m	W = 4m	n = 1
		L = 12m	W = 4m	n = 1
VR - 3	6.5	L = 12m	W= 4m	n = 1
		L = 16m	W = 4m	n = 2
VR - 4	2.5	L = 8m	W = 4m	n = 1
		L = 16m	W = 4m	n = 1
VR - 5	5.0	L = 8m	W = 4m	n = 1
		L = 12m	W = 4m	n = 1
		L = 16m	W = 4m	n = 1
VR - 6	4.0	L = 12m	W = 4m	n = 1
		L = 18m	W = 4m	n = 1
VR - 7	4.5	L = 12m	W = 4m	n = 1
VR - 8	4.0	L = 8m	W = 4m	n = 1
		L = 16m	W = 4m	n = 1
VR - 9	5.0	L = 8m	W = 4m	n = 1
		L = 16m	W = 4m	n = 1
VR - 10	5.0	L = 8m	W = 4m	n = 4
		L = 12m	W = 4m	n = 1
		L = 18m	W = 4m	n = 1
VR - 11	7.0	L = 8m	W = 4m	n = 1
		L = 12m	W = 4m	n = 2
VR - 12	4.0	L = 8m	W = 4m	n = 1
		L = 16m	W = 4m	n = 1
VR - 13	2.5	L = 8m	W = 4m	n = 1
		L = 12m	W = 4m	n = 1
VR - 14	1.0	L = 12m	W = 4m	n = 1
VR - 15	10.5	L = 8m	W = 4m	n = 3
		L = 12m	W = 4m	n = 1
VR - 16	3.5	L = 8m	W = 4m	n = 2
VR - 17	9.0	L = 8m	W = 4m	n = 3
		L = 12m	W = 4m	n = 2
VR - 18	3.5	L = 8m	W = 4m	n = 1
Total	82.0	L = 8m	W = 4m	n = 22
		L = 12m	W = 4m	n = 14
		L = 16m	W = 4m	n = 7
		L = 18m	W = 4m	n = 2

Planning Map of Roads is illustrated in Figure E-11.
Typical Section of Road is shown in Figure E-12.

E.3.3 Potable Water

Taking into consideration the difficulty in using groundwater and the El Salam canal water as a drinking water supply, fresh water of the Nile will be utilized as the water source for drinking water supply to villages in the Wide Area (South Hussinia, North Hussinia and South Port Said). One unit of water filtration facilities will be installed near the Town (North Hussinia Project Area) to meet the daily maximum water requirement of 50,000 cu.m/day. The clarification facilities will be connected with pipelines, to all villages. It is generally accepted that the designed potable water requirement for rural development projects ranges from 100 to 200 liters per day per person. In this plan the volume has been determined at 150 liters per day per person. In addition, the water requirement for cattle breeding has been determined at 70 liters per day per head.

About 12,000 households are estimated to reside permanently in the Project Area in future. Assuming five members per household, population in the Project Area is computed at 60,000 persons. In general, a drinking water supply plan shall be formulated in consideration of a future increase in population. In this plan, the benefited population has been computed at 68,000 persons using the following formula:

$$Pw = (1 + a)^n Po$$

Where; Pw = population in the year 2000
Po = Population in the year 1995
a = Increasing rate of population, 2.5%
n = Passage of time, 5 years

The averaged daily water requirement for the population and cattle are computed as follows:

150 liters x 68,000 persons = 10,200 cu.m/day
70 liters x 35,000 head = 2,450
Total 12,650 cu.m/day
(12,650 cu.m/day/86,400 = 0.15 cu.m/sec)

Water Supply Facilities

Intake and Water Conveyance Facilities: The intake point for water supply will be installed at the intake of El Salam Canal. And the water conveyance pipeline will be constructed along the El Salam Canal from the intake point to the water clarification planned at the crossing point of the El Salam Canal and the Bahr El Baqar Drain. The water conveyance pipeline will be about 70 kilometers long and the diameter of pipe used will be 800 millimeters. Ductile pipe will be used for the pipeline. (See Figure E-13)

Water Clarification Facilities: One unit of water clarification facilities will be installed near the Town (North Hussinia Project Area) to meet the daily maximum water requirement of 50,000 cubic meters per day. Pumping facilities for water distribution will be also be provided at the site.

Water Conveyance Facilities: The clarification facilities will be connected by pipelines to 21 satellite villages, six service villages, and two central villages in the Project Area. Water supply pipes will be laid along the trunk roads. Booster pumps will be installed where necessary to keep the water pressure in pipelines at an appropriate value. The trunk pipeline will be about 28 kilometers long in total whereas branch pipelines will be about 100 kilometers long. Ductile pipes will be used for pipelines. The diameter of pipes for trunk lines will be 450 millimeters and that of branch lines will range from 100 to 200 millimeters. Water supply facilities are as follows;

Intake facilities		1 set
Clarification and pump station		1 set
Water conveyance pipeline (800 m/m)		70 km
Distribution of pipeline		
- Main pipeline (450 m/m)		28 km
- Branch pipeline	200	20 km
	100	80 km
Distribution network for villages		
- Satellite Village		21 unit
- Service Village		6 unit
- Central Village		2 unit

E.3.4 Sewage and Refuse Treatment

Since 29 villages are scattered over the Project Area, house wastewater and night soil treatment facilities have been planned for each of these villages. In this farm village development plan all houses exclusive of farmers houses will be provided with flush toilets. Waste will be flushed through pipelines to a public waste treatment tank. House wastewater will be treated in the same way as waste. Waste from farmers' houses will be hauled from their pit latrines to treatment tank by vaccum-car, and wastewater from communal taps and farmers' houses will be gathered for treatment tank through drains. Facilities to treat refuse will be installed separately from waste treatment facilities. Trucks will be used to collect refuse. Refuse will be gathered at specified pits, and buried and resolved in soils.

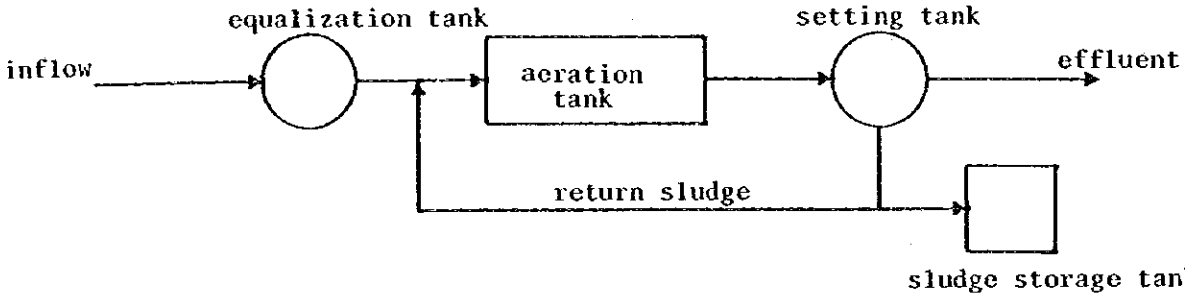
a. Wastewater Treatment Facilities

Today, in the world, there are many different treatment methods Figure E-2 illustrats methods of wastewater treatment. But in these various treatment methods, four systems as shown in below have been generally used.

(1) Activated Sludge Process
(2) Rotary Disk Process
(3) Contact Aeration
(4) Oxidation Ditch

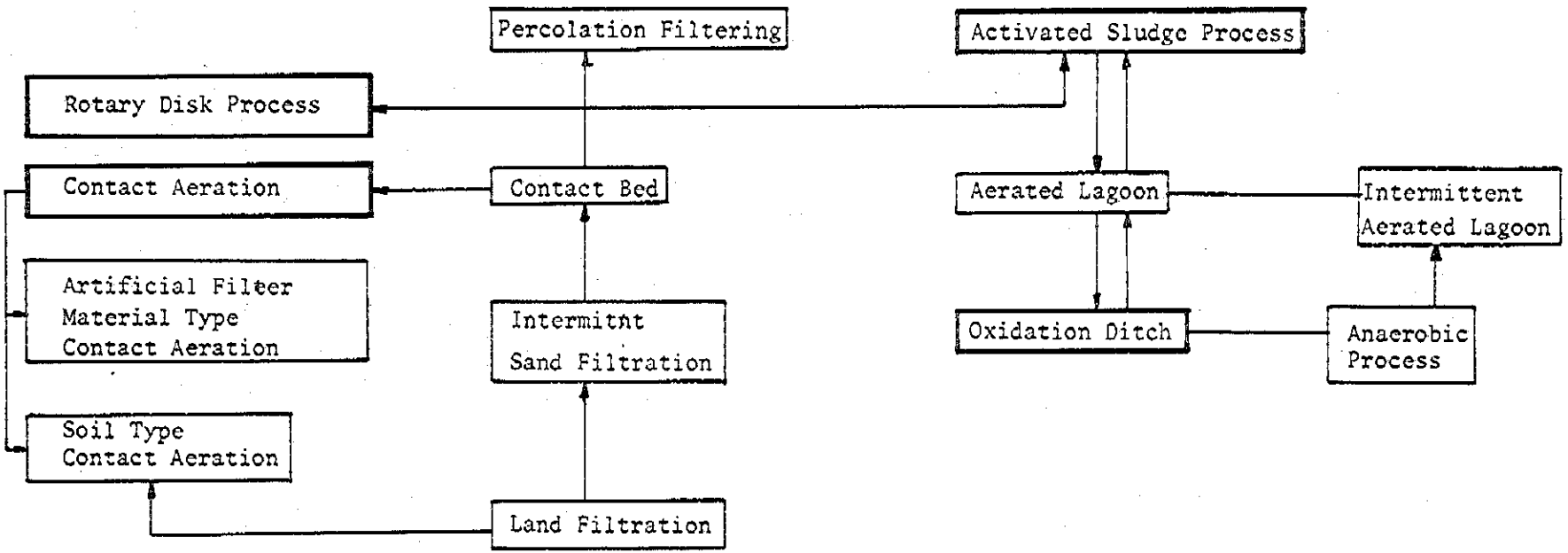
The outline of four treatment systems are as follows;

Activated Sludge Process: The activity of aerobic bacteria is accelerated by blowing air into waste water and the supernatant separated through sedimentation in the settling tank is disinfected and released.



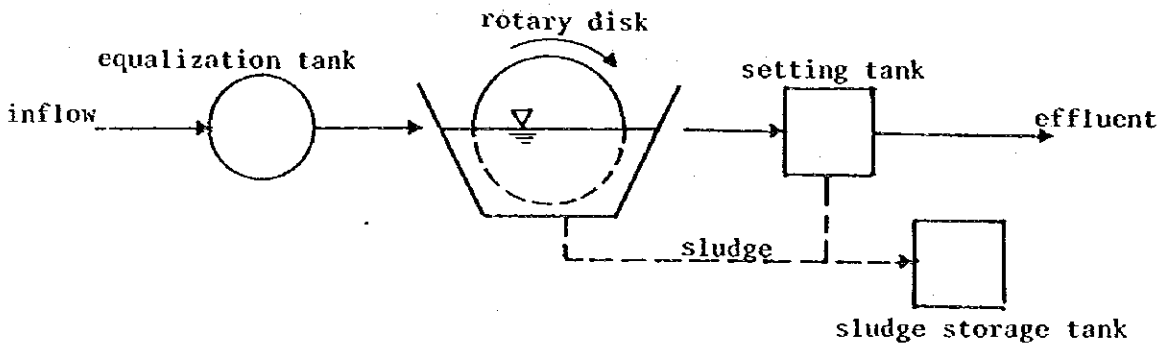
Removal ratio: 90% or more
Amount of sludge produced: 40% of B.O.D removed
Maintenance and operation: Must be attended by personnel
Power consumption: Large
Sludge return: Requires regulation
Recovery from accident: More than a month
Load regulating capacity: Ordinary
Plot of treatment works: Small
Foul odor: Occurs. Deodorizing apparatus is necessary.

Figure E-2 Method of Biological Sewage Treatment



Rotary Disk Process: A disk is dipped half into waste water having been separated through initial sedimentation.

The water is subjected to both aerobic and anerobic treatment by turning the disk and, after being sedimentarily separated through final sedimentation, it is disinifected and released.

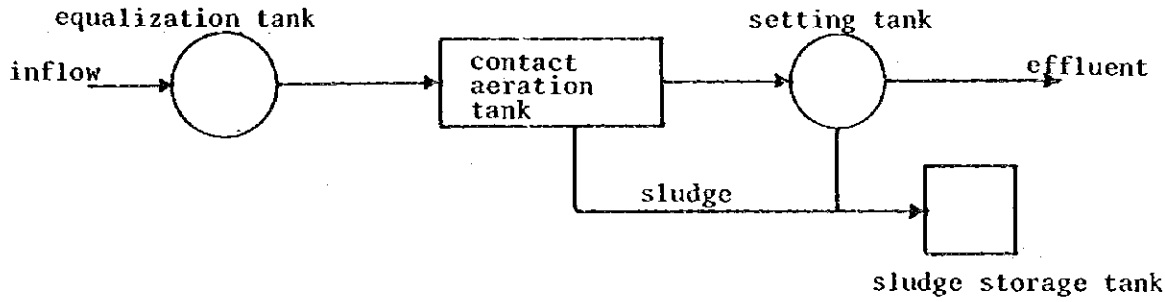


Removal ratio	:	90% or more
Amount of sludge produced	:	40% of B.O.D removed
Maintenance and operation	:	Inspection once a week or so
Power consumption	:	Small
Sludge return	:	None
Recover from accident	:	More than a week
Load regulating capacity	:	Large
Foul odor	:	Occurs
Noise	:	none
Plot for treatment works	:	Small
Nitrogen treating capacity	:	Can be treated to an extent

Contract Aeration System: Diverse microorganisms are supplied into waste water and the contact filter bed by covering the entire treatment tank with soil or artificial filter material. High treatment can be easily performed and deodorization and the decrease of sludge are possible.

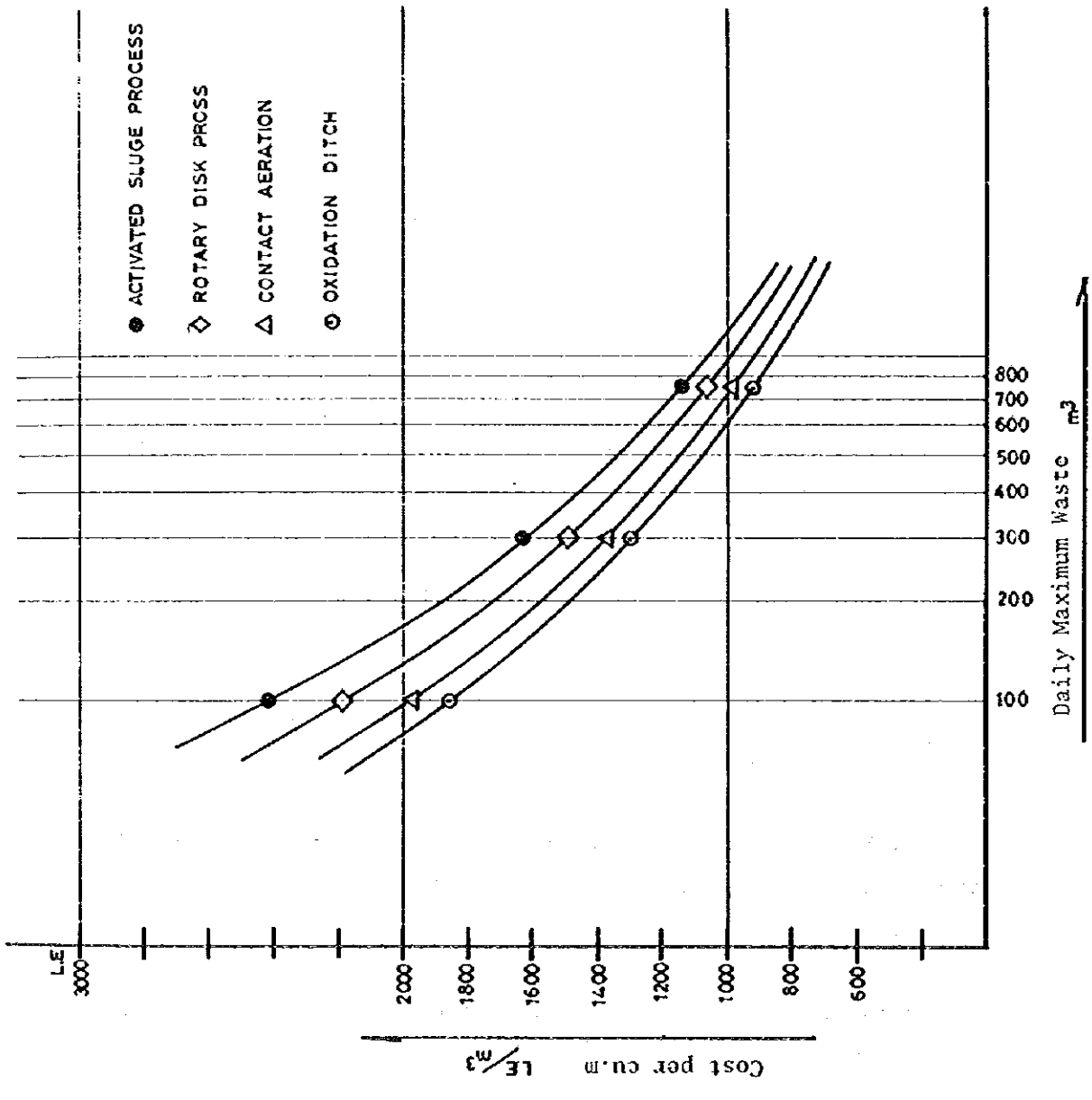
Artificial filter material type is named JARUS - I.
JARUS is "The Japanese Association of Rural Sewerage".
JARUS - I was developed for rural villages.

This system is compact one and can be easily gotten higher treatment.

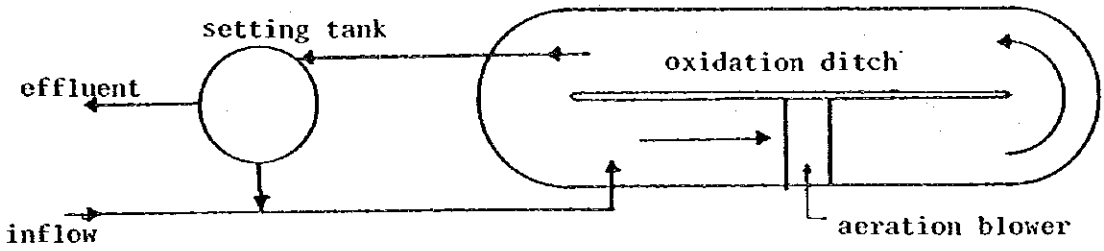


Removal ratio	:	95% or more
Amount of sludge produced	:	30% or more
Maintenance and operation	:	Inspection once a month
Power consumption	:	Small
Sludge return	:	None
Recovery from accident	:	2 or 3 days
Load regulating capacity	:	Large
Foul odor	:	None
Occurrence of mosquits and flies	:	None
Scattering of bubbles and waste water	:	None
Noise	:	None
Nitrogen treating capacity Plot for treatment works	:	Ordinary

Figure E-3. Comparative Chart for Construction Cost



Oxidation Ditch System: Waste water is circulated in the linked ditch with aeration. The water is subjected to both aerobic and anerobic treatment by circulating the ditch. This system is simple one, and maintenance and operation can be easily performed, but large lot is necessary.



Removal ratio	:	90% or more
Amount of sludge produced	:	40% of B.O.D
Maintenance and operation	:	Inspection once a month or so
Power consumption	:	Small
Sludge return	:	None
Recovery from accident	:	2 or 3 days
Load regulating capacity	:	Large
Nitrogen treating capacity	:	Large
Plot for treatment work	:	Large

As shown in the above study, these four treatment methods have both side of a merit and a demerit, therefor it is difficult to decide of their superiority or inferiority.

But by comparative for construction cost, Oxidation Ditch is the most low cost system, and Activated Sludge Process is the most high cost one.

Figure E-3 indicates the comparative chart for construction cost.

Oxidation Ditch system is necessary large plot for treatment works, but this system will be profitable if there, as the Project Area, is well off for land use.

As a result, the sewage treatment system give Oxidation Ditch a position.

Each village will have one unit of this system.

This system is so that air and sewage are mixed the open ditch. Oxygen-using bacteria grow, digest sewage and liquid most solids. Liquid discharges to canals after disinfection.

Satellite Village	:	2,000 persons' system
Service Village	:	2,000 persons' system
Central Village	:	5,000 persons' system

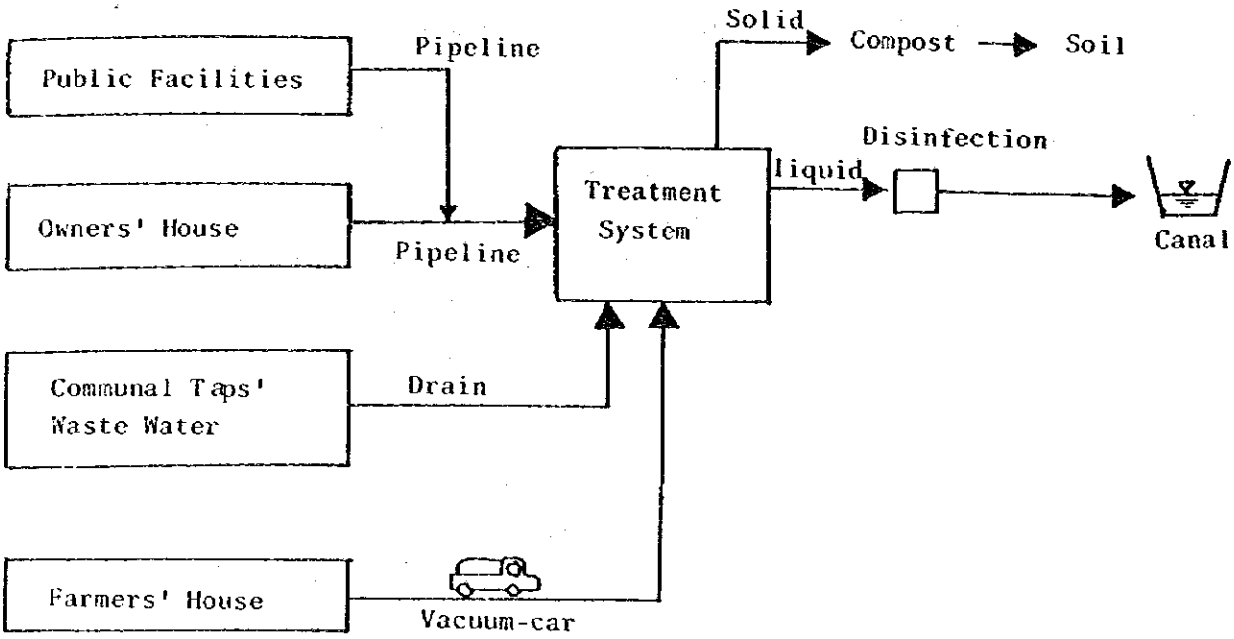
Design criteria for Oxidation Ditch as shown below;

Daily maximum waste water	:	150 lit/man.day
Estimated influent quality	:	B.O.D 200 ppm (200 mg/lit)
		S.S. 200 ppm (200 mg/lit)
Estimated effluent quality	:	B.O.D 60 ppm (60 mg/lit)
		S.S. 30 ppm (30 mg/lit)
Estimated population	:	p^1 = 2,000 persons
		p^2 = 5,000 persons

Table E-12. Design Criteria for Oxidation Ditch

Item	Dimension		Unit	Population (3,000)	Population (5,000)
Daily maximum waste water	QDM	BP x 150 lit/man	m^3	300	750
Estimated influent quality					
B.O.D	BODi	QDM x 200 mg/lit	m^3	60	150
S.S	SSi	QDM x 200 mg/lit	m^3	60	150
Estimated effluent quality					
B.O.D	BODef	QDM x 60 mg/lit	m^3	18	45
S.S	SSef	QDM x 30 mg/lit	m^3	9	23
Equalization tank	Veq	QDM x 8 hr/24 hr	m^3	100	250
Oxidation ditch	Vod	BODi/0.2kg/m^3 day	m^3	300	750
Settling tank	Vst	QDM x 4 hr/24 hr	m^3	50	125
Estimated slude	ES	(BODi-BODef)x3/20kg/m^3	m^3/day	0.8	1.9
Sludge strage tank	Vct	ES x 15 day	m^3	12	29

Figure E-4. Sewage Treatment Flow



Facilities of Sewage Works are as follows:

Treatment system for 2,000 persons (Satellite and Service Villages)	27 set
Treatment system for 5,000 persons (Central Villages)	2 set
Connecting pipe network	
- Satellite Village	21 unit
- Service Village	6 unit
- Central Village	2 unit

b. Treatment of Refuse

Trucks will be used to collect refuse. Refuse will be gathered at a specified pit, and buried and resolved in soils. Combustible materials will be destroyed by fire in an incinerator.

E.3.5 Electric Power

The existing high voltage line of 220 KV running along the Suez Canal will be the power source for the Wide Area. A high voltage transmission line will be constructed along the El Salam Canal from the existing line to the sub-station planned at the crossing point of the El Salam Canal and the Bahr El Baqar Drain. The voltage will be drawn down from 220 KV to 11 KV at the sub-station. From the sub-station, 11 KV lines will be extended to villages, pumping stations, clarification plant, etc. Village and various facilities requiring power will be provided with transformer to obtain appropriate voltages. Electric demand at farm houses has been determined at 1,000 W per household in the full development stage. To reflect higher living standards of non-farm households on an average, the power demand has been decided at 2,000 W per household. This is a value commonly used by the Egyptian Rural Electrification Authority. The other electric demand for service and commercial use and for street lighting, etc., has been taken at 50 KW per satellite village, 100 KW per service village, and 200 KW per central village. The water supply pumping station will have a loan requirement of about 300 KW. (See Figure E-15 and E-16)

The facilities for electric power supply will be as follows:

Village electric equipment:	18,000 KW
Irrigation and drainage pumps:	3,000 KW
Agro-industrial electric equipment:	5,000 KW
220 KV/66KV sub-station:	1 Unit
66 KV/11KV sub-station:	1 unit
66 KV distribution line:	10 km
11 KV distribution line:	130 km

Table E-13. Electric Demands

	Connected Load (KW)	Demand Factor	Maximum Demand (KW)	Av. Annual Load Factor	Annual Power Consumption (KWH)
Farm Houses	8,500	0.7	5,950	0.5	26,000
Other Houses	7,000	0.7	4,900	0.5	22,000
Satellite Village Service and Commercial	1,100	0.6	660	0.6	3,500
Service Village Service and Commercial	600	0.6	360	0.6	2,000
Central Village Service and Commercial	400	0.6	240	0.6	1,300
Water Supply	300	0.8	240	0.8	1,800
Total	17,900	0.7 (av.)	12,350	0.5 (av.)	56,600

Note. Demand for irrigation and drainage pumps is not included.
Pumping equipment for irrigation and drainage : 3,000 KW

Low voltage distribution works:	36 Units
Village distribution network	29 Units

E.3.6 Telecommunication

Telephone networks are essential for keeping communities in newly developed areas under good conditions. At present it is not necessary to provide all houses with telephone, but it will be necessary in the near future. In the Project it will be essential to have smooth communication links for social services or among operation and maintenance units, pump station and headquarters to ensure satisfactory operation of the irrigation systems.

Links between villages and outside towns or cities are also necessary to ensure optimum use of social services to be provided.

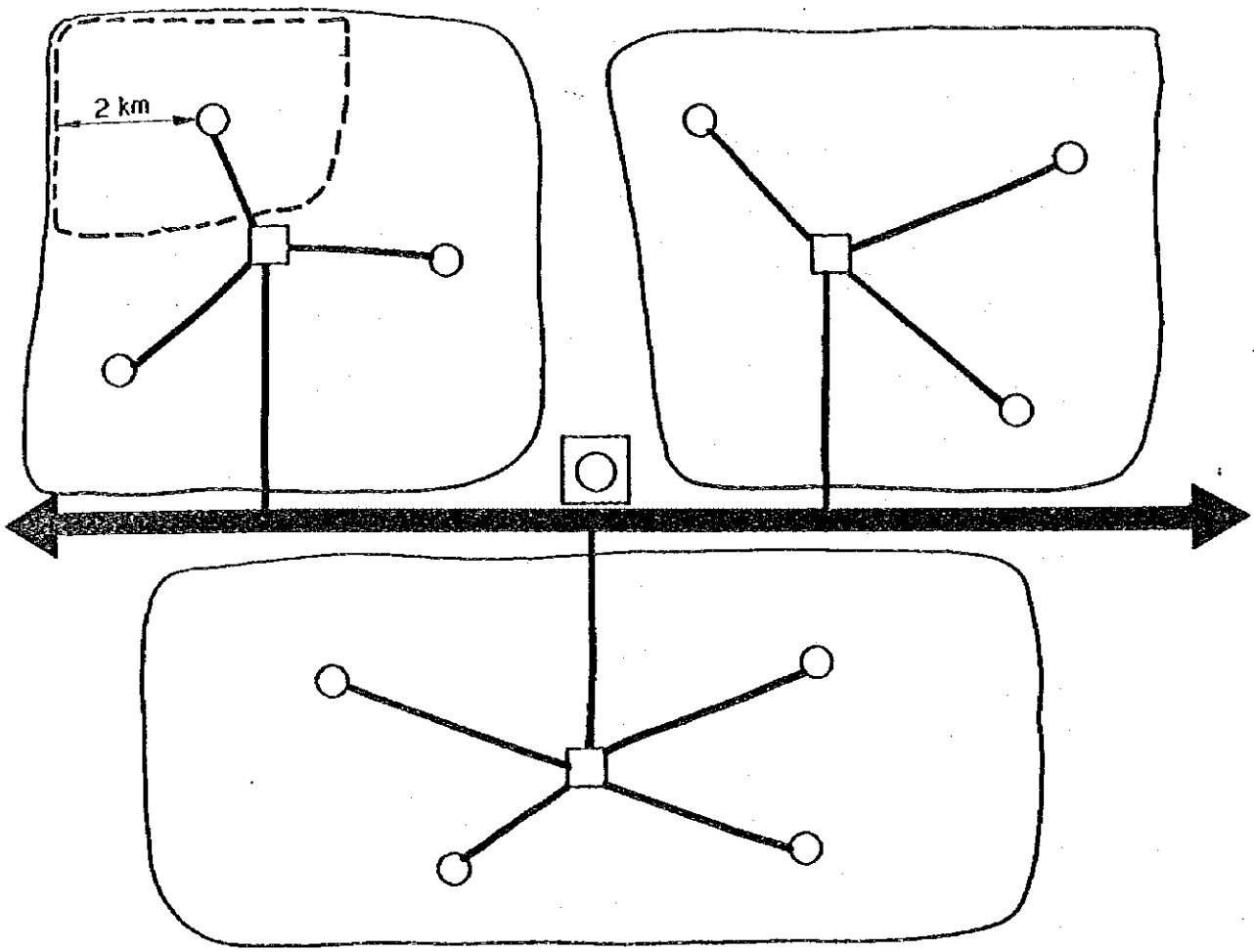
Table E-14. Telecommunication Facilities

Trunk cable to connect with the national networks:	20 km
Lines within the Project Area:	180 km
Central exchange:	1 set
Total capacity of telephone lines:	400 lines 1/
Telex facilities	2 sets 2/

Note: 1/; Five lines per satellite village
16 lines per service village
100 lines per central village

2/; Telex system will be made available at the central villages.

Figure E-5. Hierarchy of Settlement for Rural Development



Central Village
Service Village
Satellite Village
Trunk Road
Village Road
Service Village Hinterland
Satellite Village Hinterland

Figure E-6. Village Alignment Planning Map

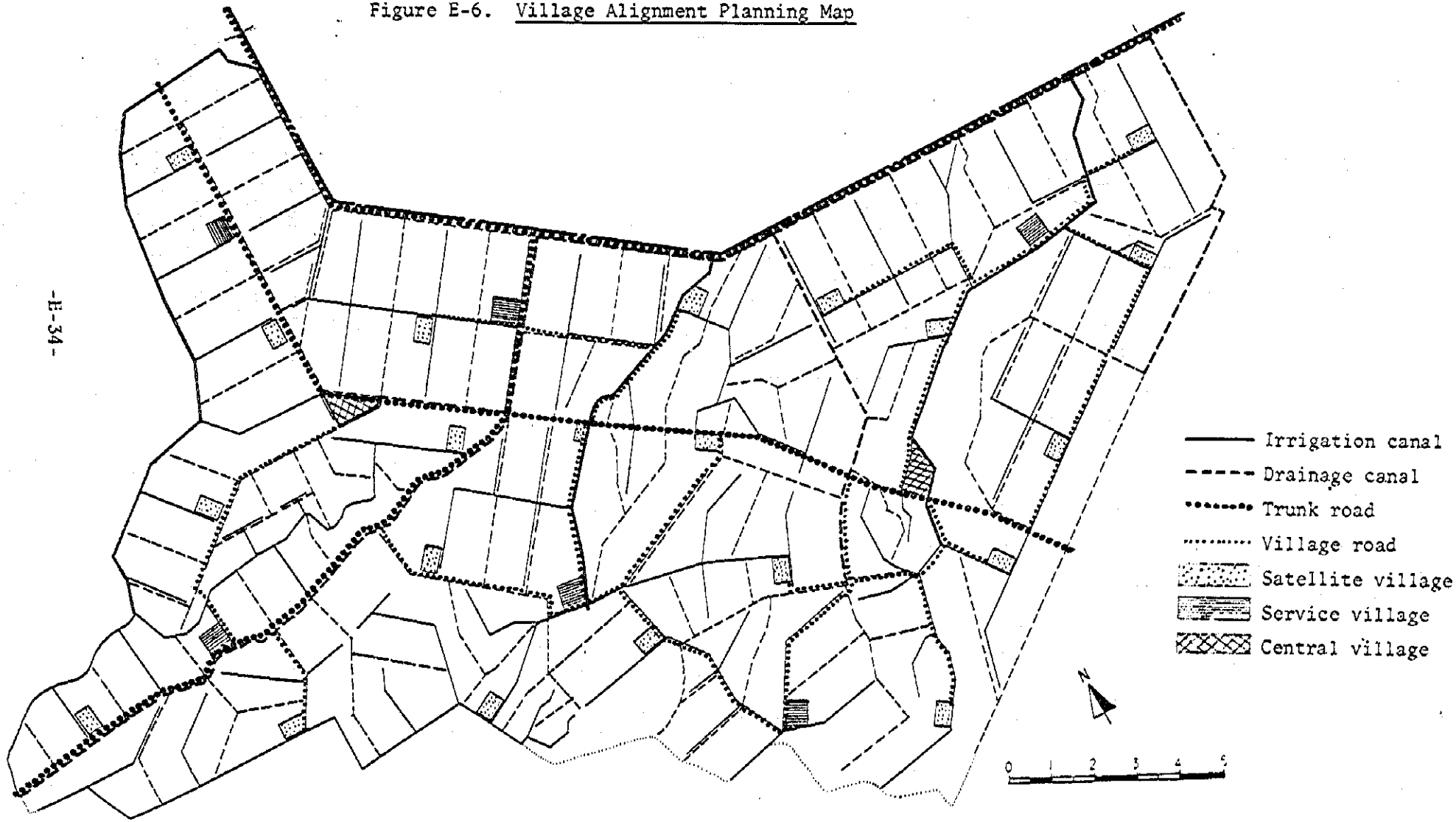


Figure E-7. Planning Map of Village

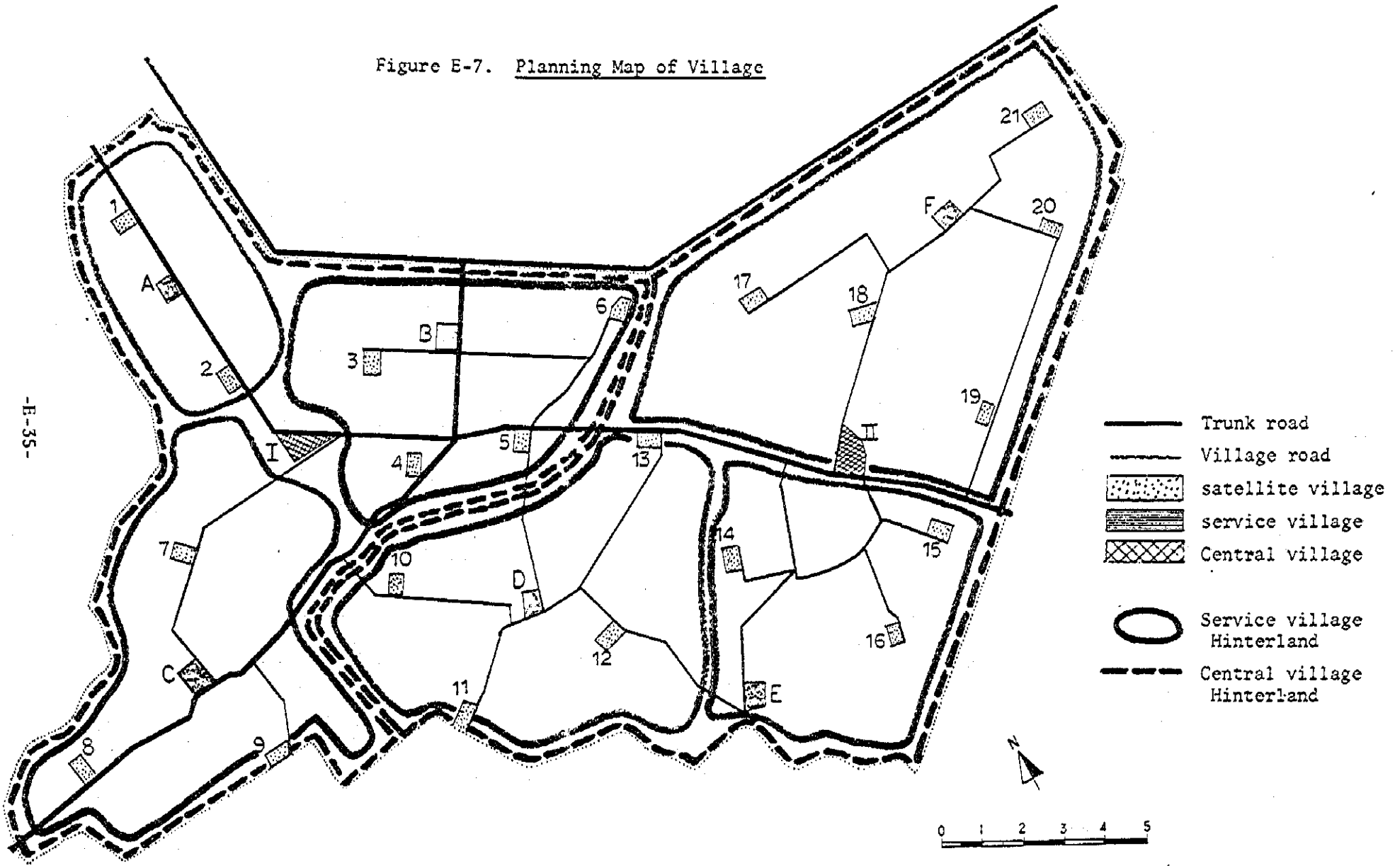


Figure E-8. Hierarchy of Settlement

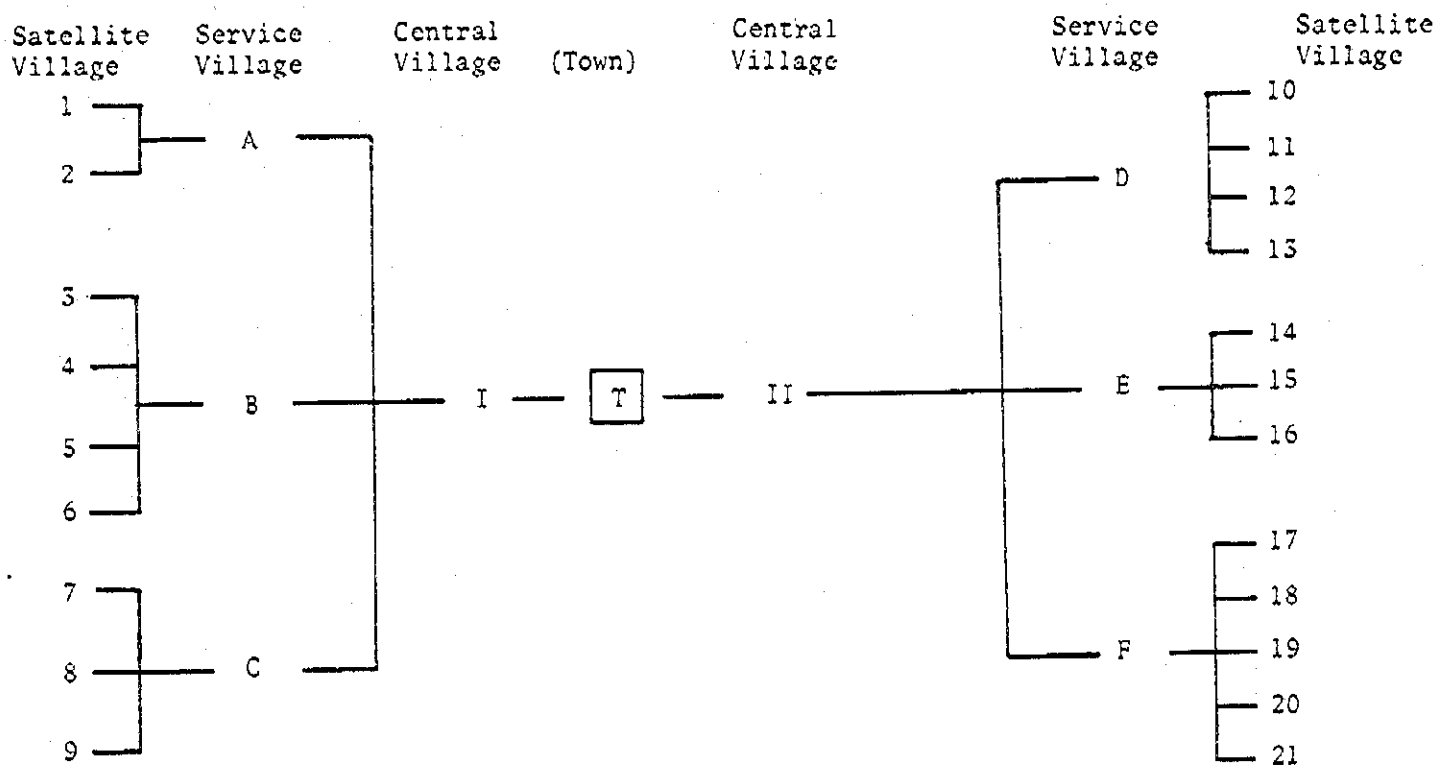


Figure E-9. Typical Plan of Farmers' House

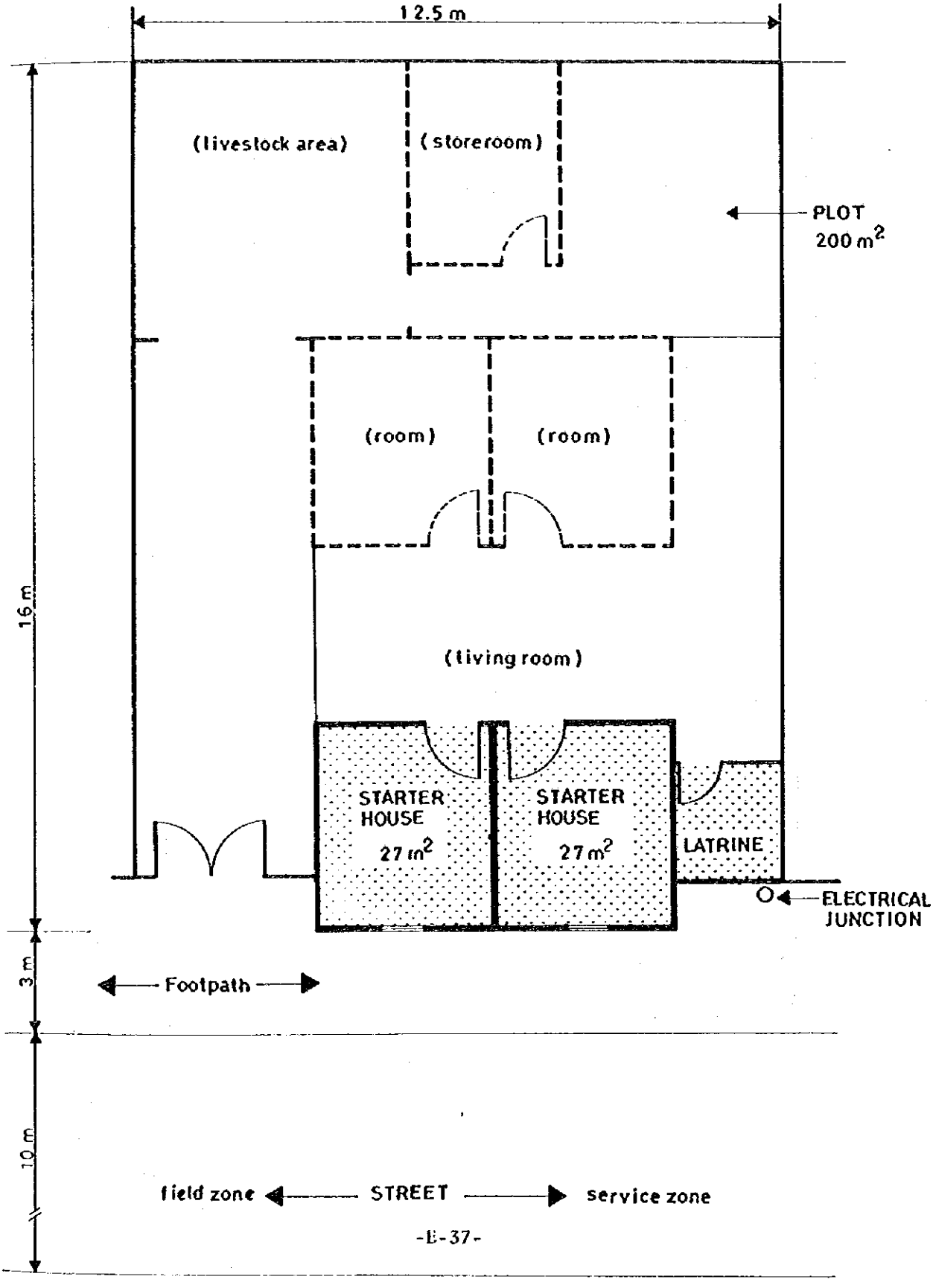


Figure E-10. Typical Zoning of Village

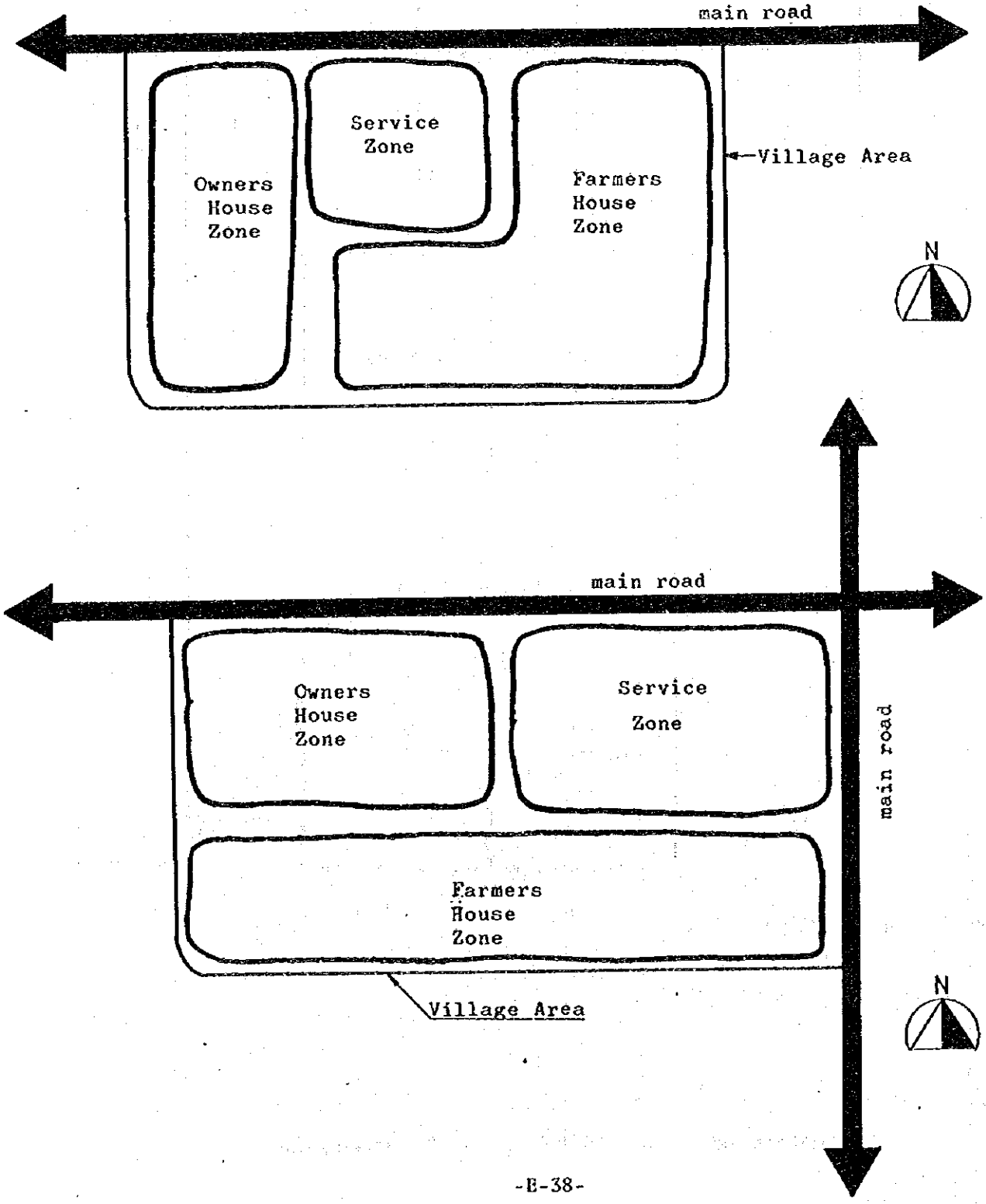


Figure E-11. Planning Map of Road

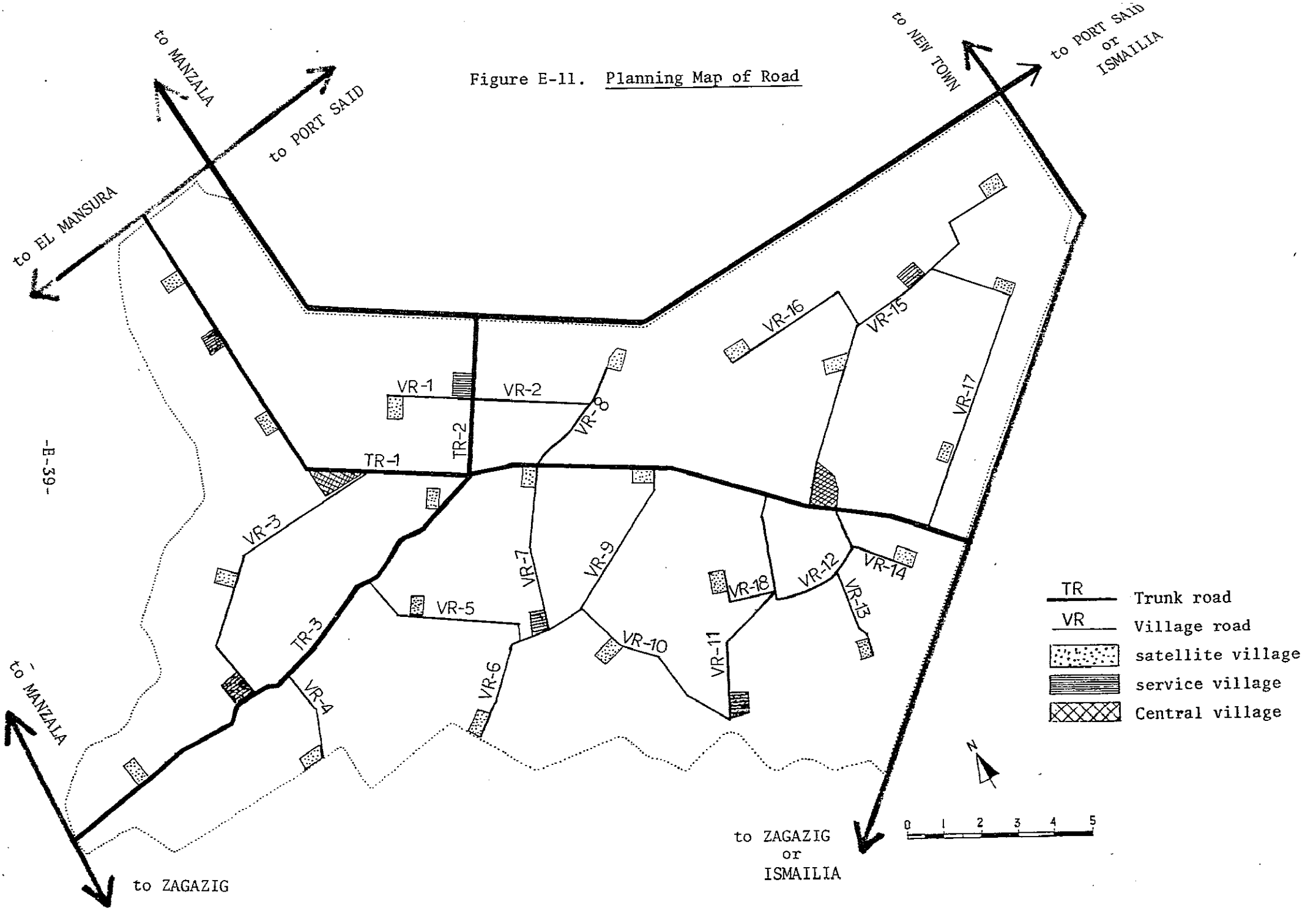


Figure E-12. Typical Section of Road

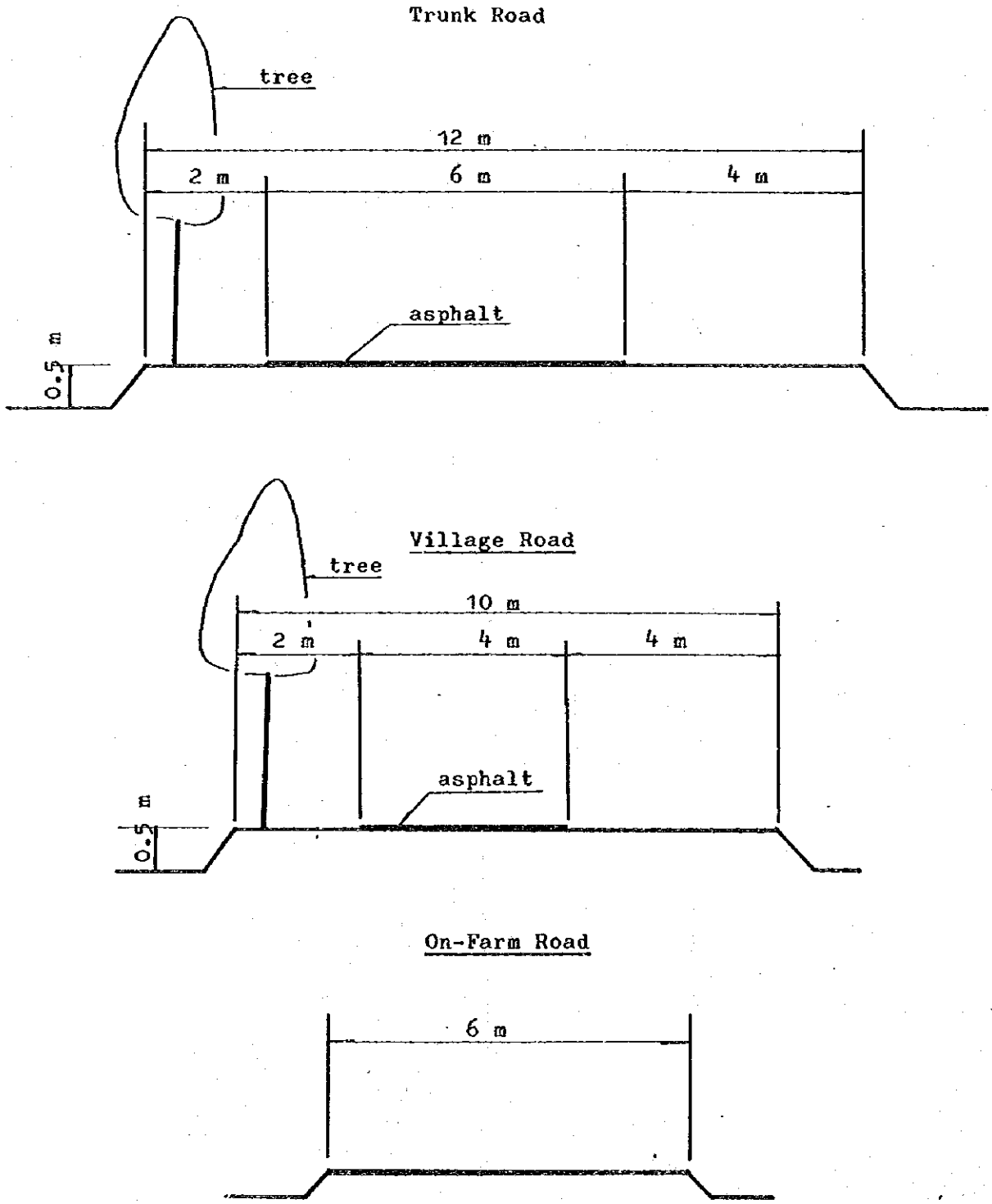


Figure E-13. Location of Water Supply Facilities

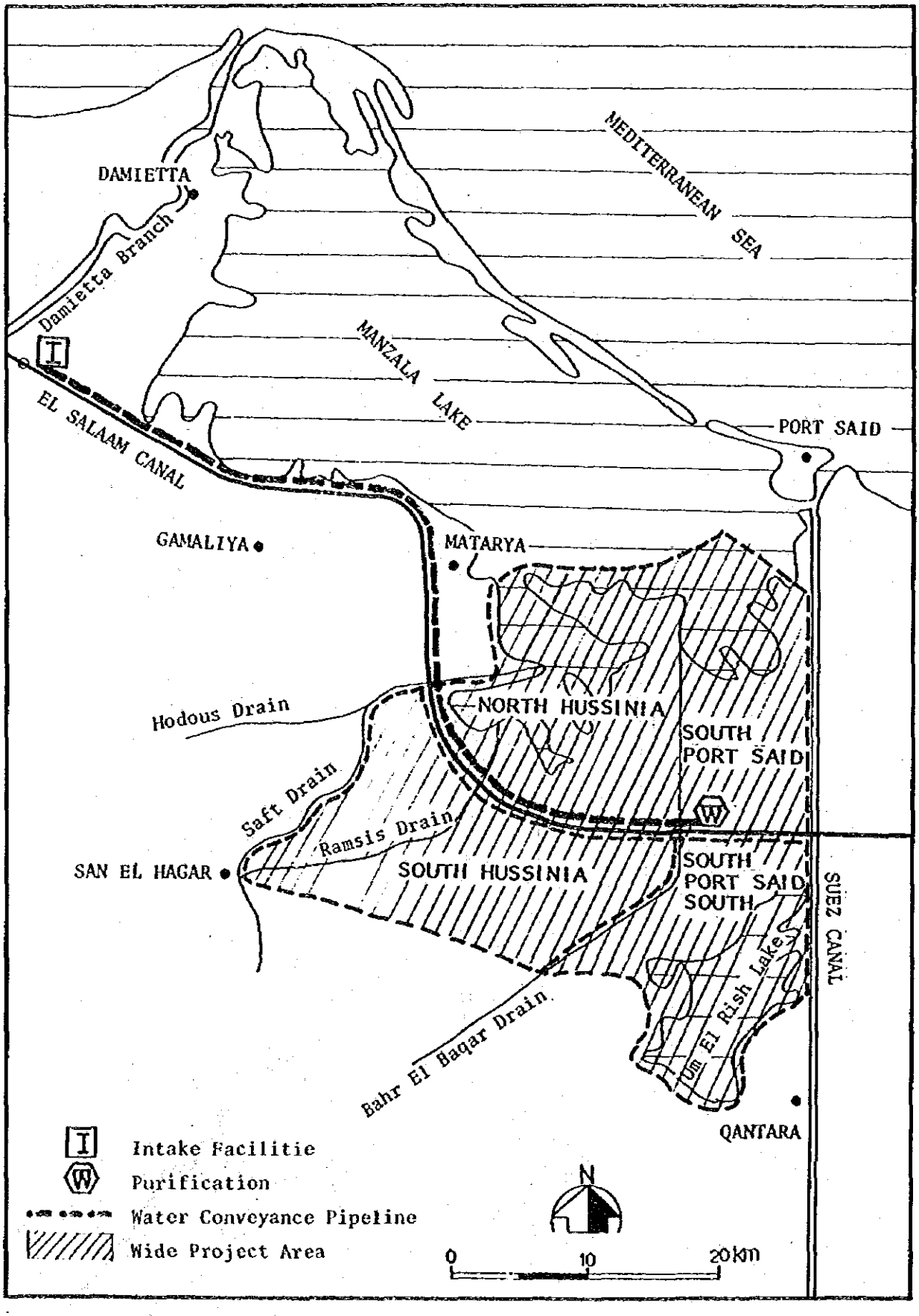


Figure E-14. Planning Map of Water Supply

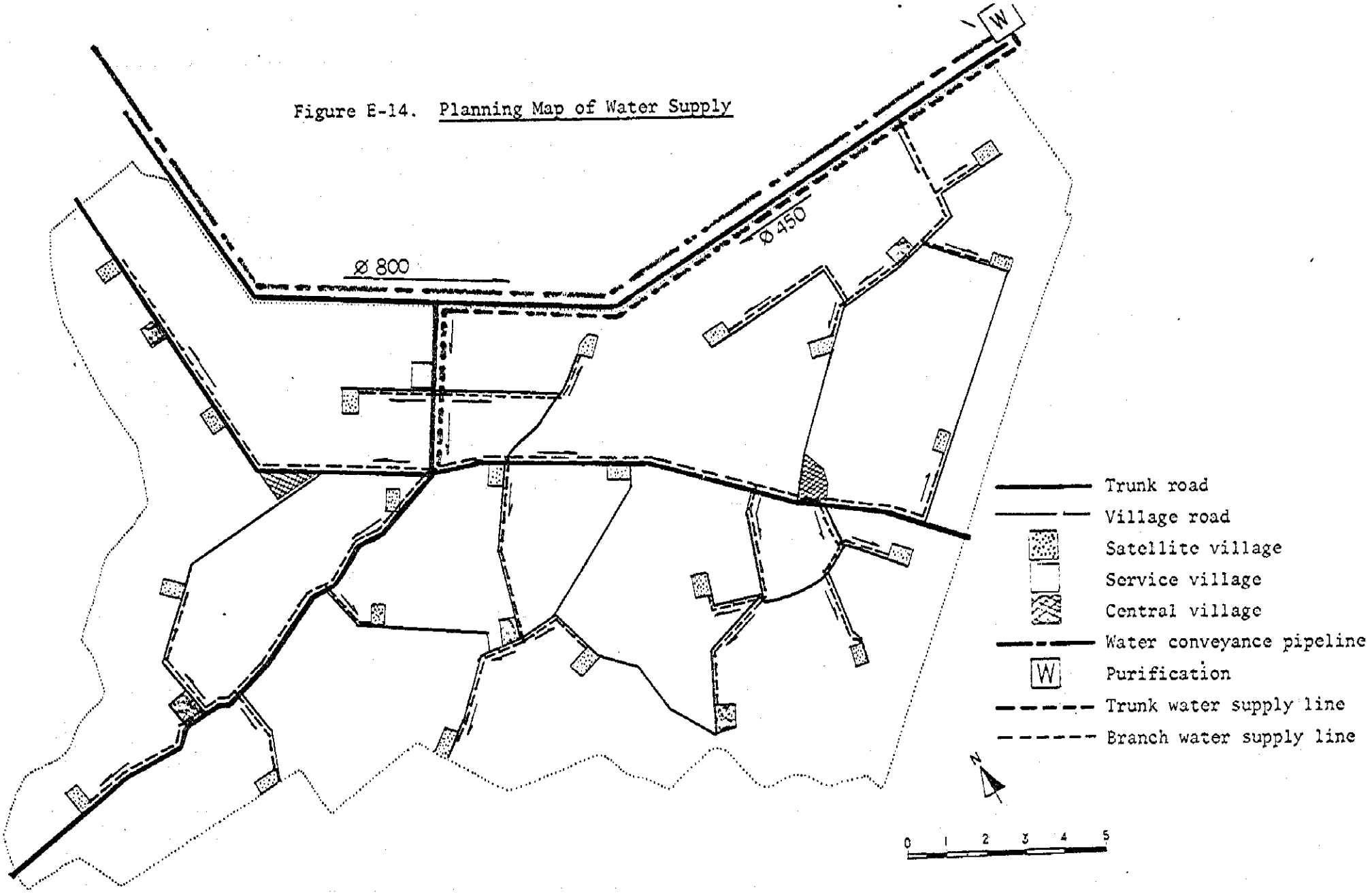


Figure E-15. Illustration of Electric Lines

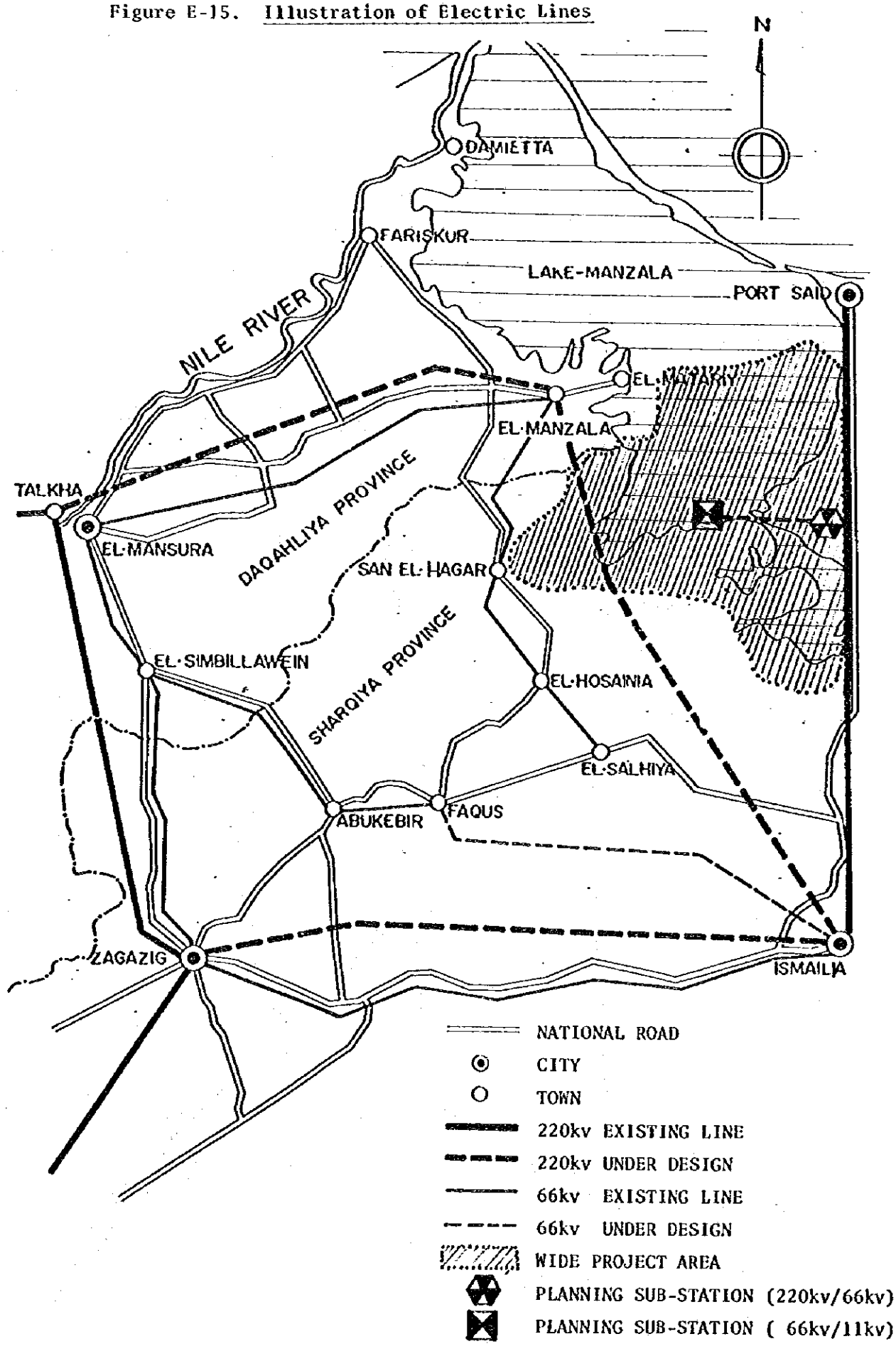
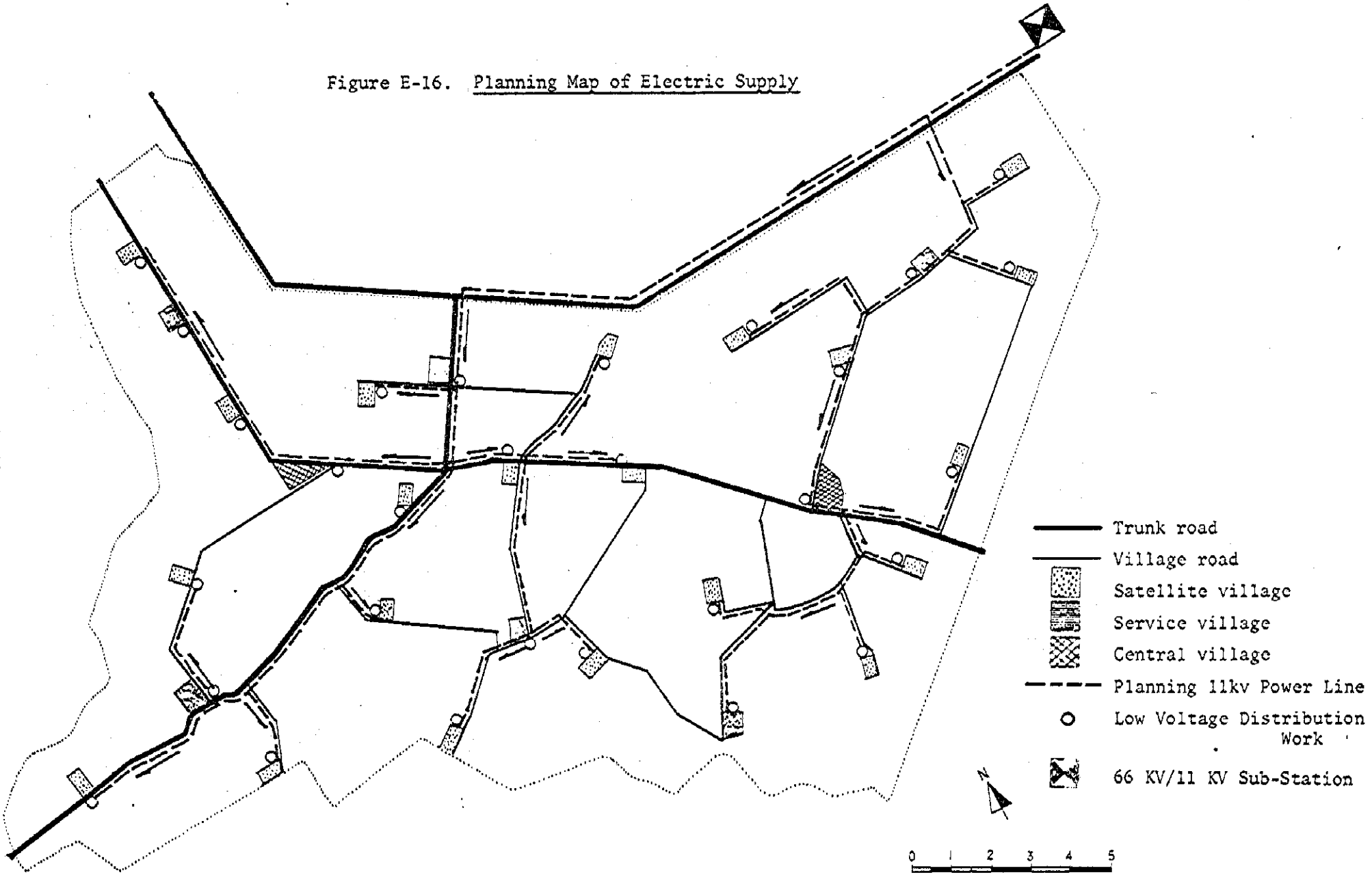
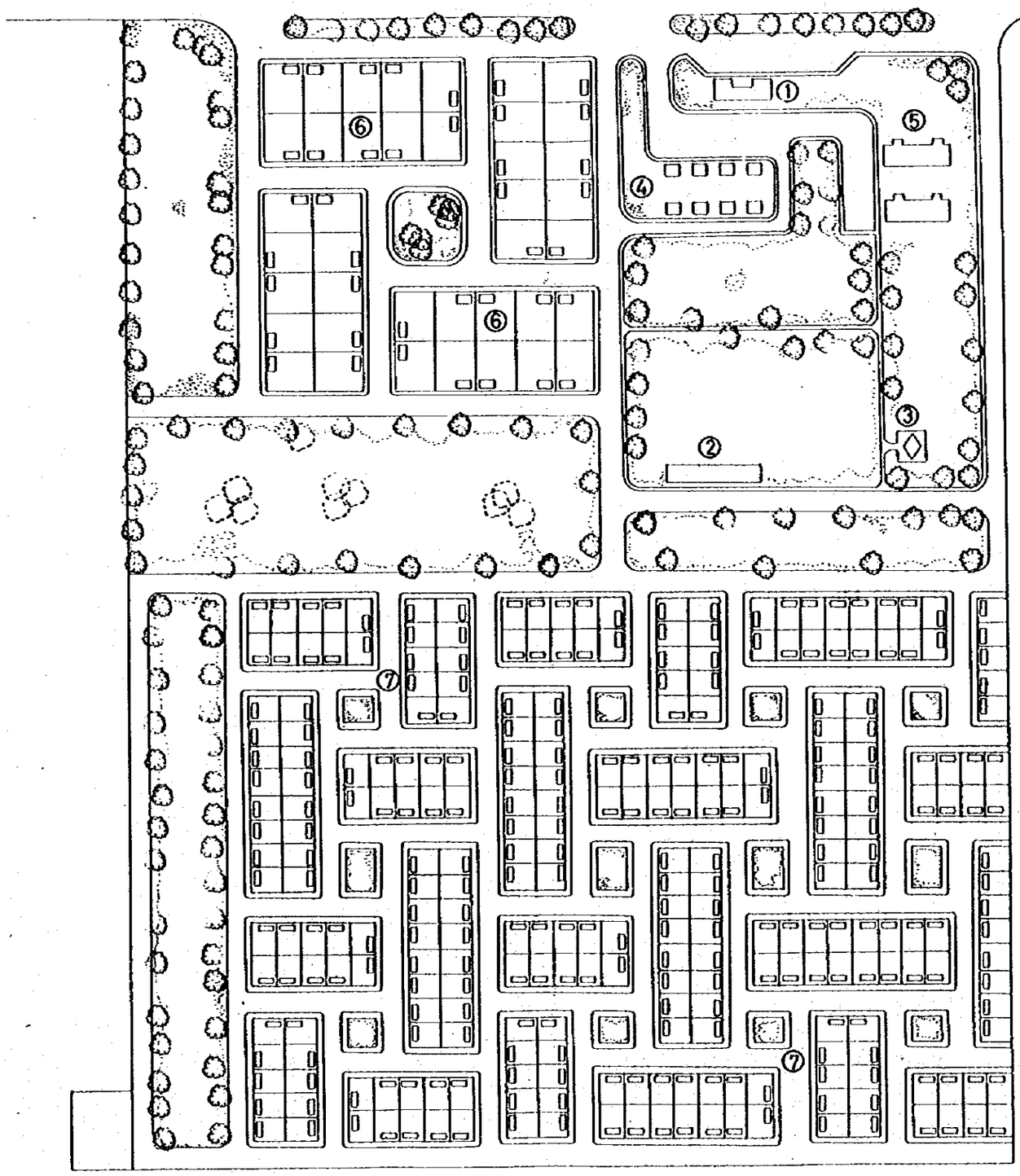
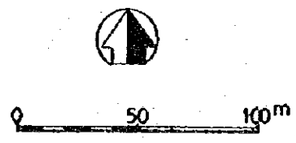


Figure E-16. Planning Map of Electric Supply

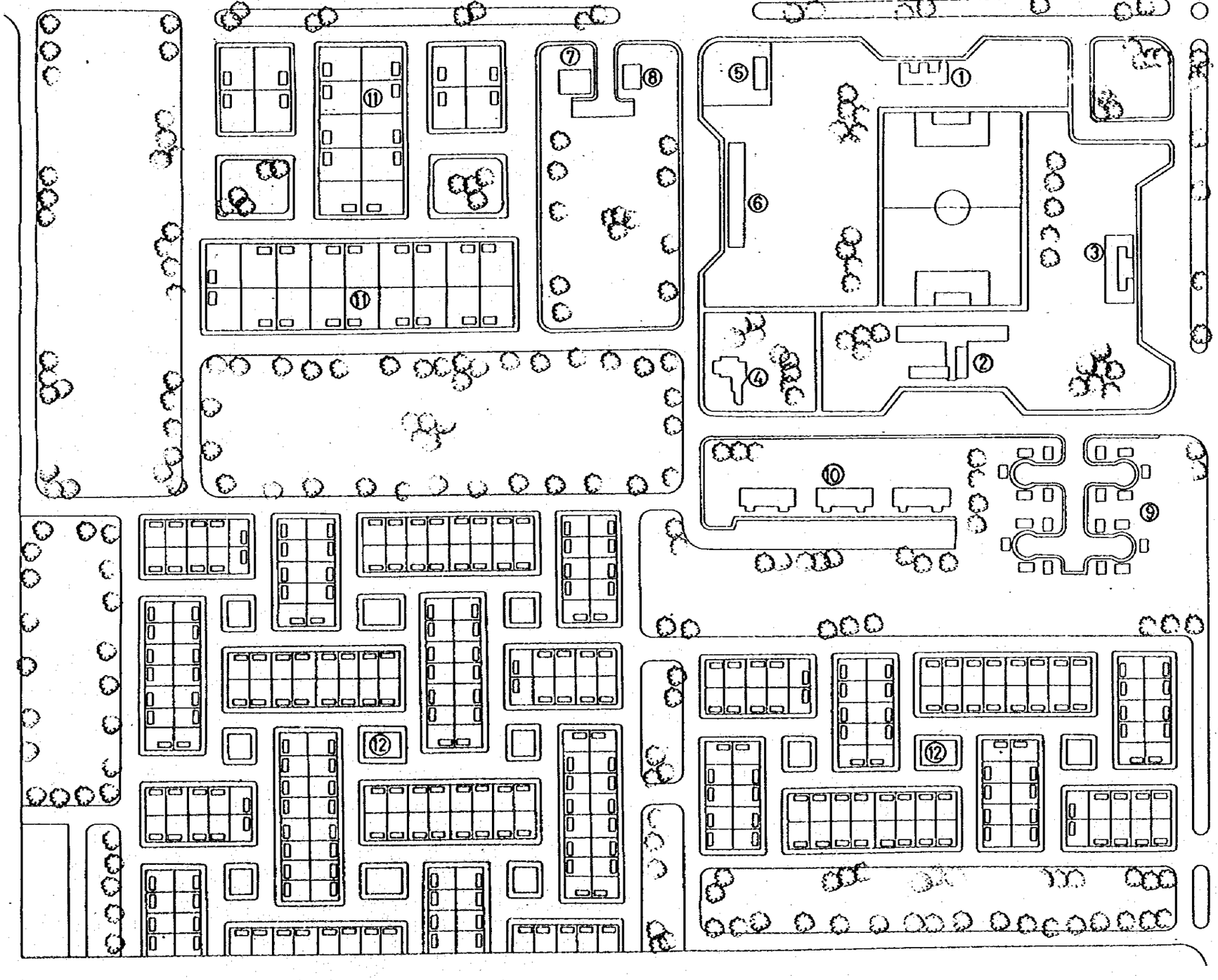




① AGRI. ADMINISTRATIVE OFFICE
② GROUP OF SHOPS
③ MOSQUE
④ TECHNICAL LABORERS HOUSE
⑤ APARTMENT
⑥ OWNERS' HOUSE
⑦ FARMERS' HOUSE



ARAB REPUBLIC OF EGYPT MINISTRY OF LAND RECLAMATION			
SOUTH NUSSINIA VALLEY AGRICULTURAL DEVELOPMENT PROJECT			
LOCATION of BUILDINGS (SATELLITE VILLAGE)			
DATE		Drawing	E-17
JAPAN INTERNATIONAL COOPERATION AGENCY			



① VILLAGE DEVELOPMENT OFFICE
② COMBINED SCHOOL
③ MEDICAL TREATMENT UNIT
④ MOSQUE
⑤ AUTO SERVICE
⑥ MARKET WITH BAKERY
⑦ DIRETORS' HOUSE
⑧ ASS'T DIRECTORS' HOUSE
⑨ TECHNICAL LABORERS' HOUSE
⑩ APARTMENT
⑪ OWNERS' HOUSE
⑫ FARMERS' HOUSE

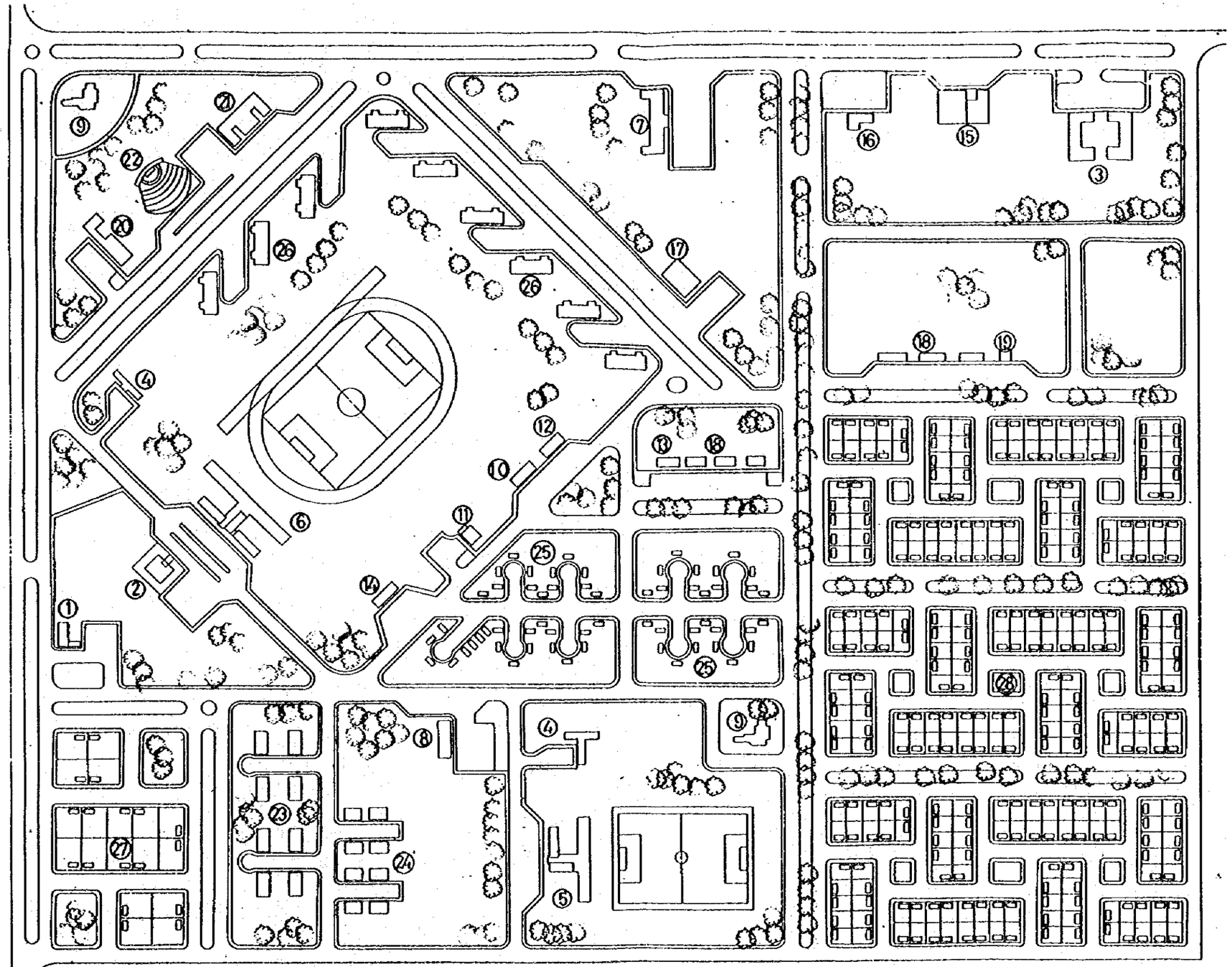
0 50 100m

ARAB REPUBLIC OF EGYPT
MINISTRY OF LAND RECLAMATION
SOUTH HUSSINIA VALLEY
AGRICULTURAL DEVELOPMENT PROJECT

LOCATION of BUILDINGS
(SERVICE VILLAGE)

DATE		Figure	E-18

JAPAN INTERNATIONAL COOPERATION AGENCY



① VILLAGE DEVELOPMENT OFFICE
② ADMINISTRATION OFFICE
③ ARTIFICIAL INSEMINATION CENTER
④ NURSERY SCHOOL
⑤ COMBINED SCHOOL
⑥ HIGH SCHOOL
⑦ HOSPITAL
⑧ MEDICAL TREATMENT UNIT
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⑪ POST OFFICE
⑫ FIRE STATION
⑬ STORE
⑭ VILLAGE BANK
⑮ WORKSHOP
⑯ AUTO SERVICE
⑰ MARKET WITH BAKERY
⑱ GROUP OF SHOPS
⑲ SEPARATED BAKERY
⑳ REST HOUSE FOR EMPLOYEES
㉑ CLUB
㉒ CINEMA/THEATRE HOUSE
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㉖ APARTMENT
㉗ OWNERS' HOUSE
㉘ FARMERS' HOUSE

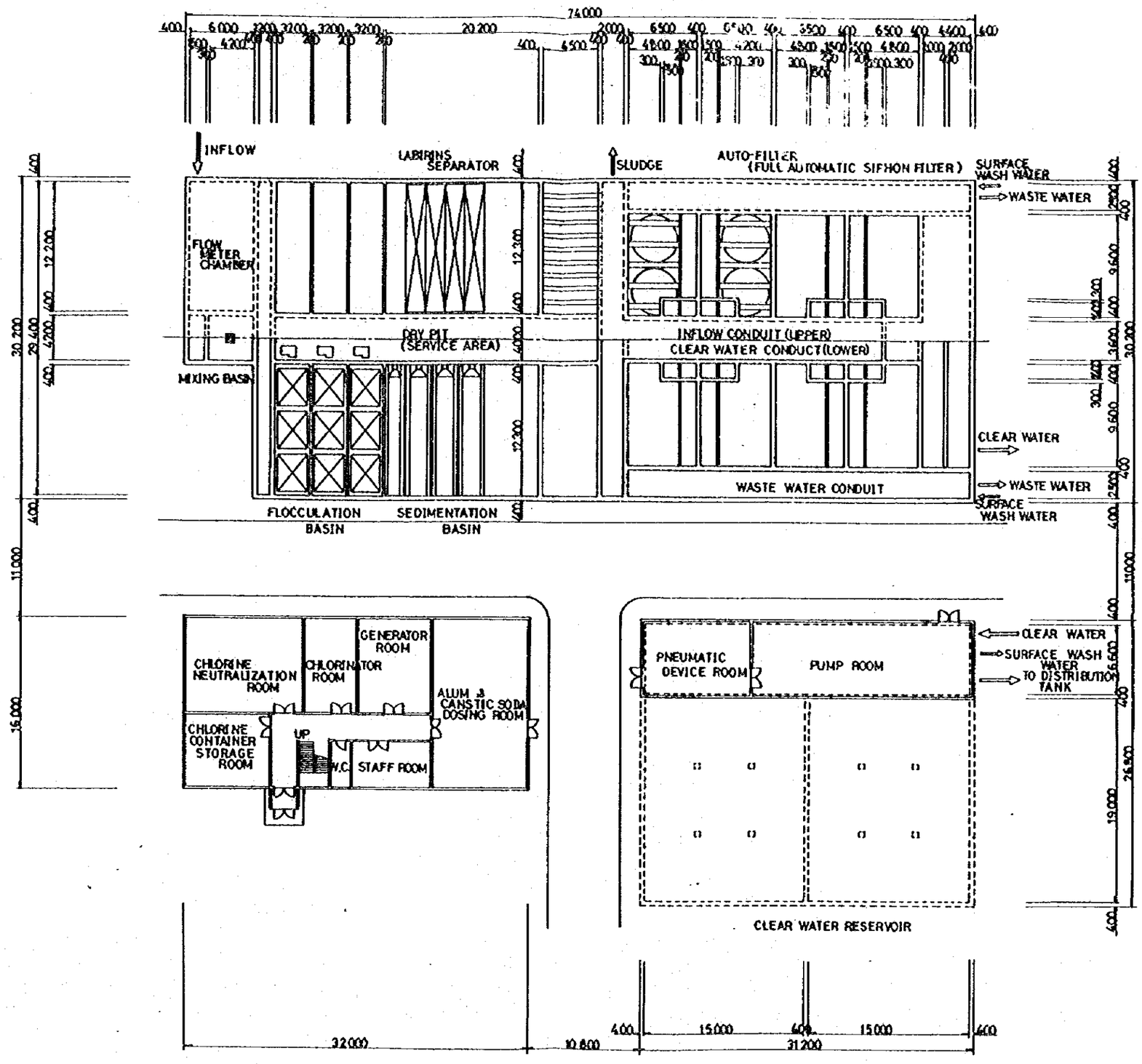
0 50 100m

ARAB REPUBLIC OF EGYPT
MINISTRY OF LAND RECLAMATION
SOUTH HUSSINIA VALLEY
AGRICULTURAL DEVELOPMENT PROJECT

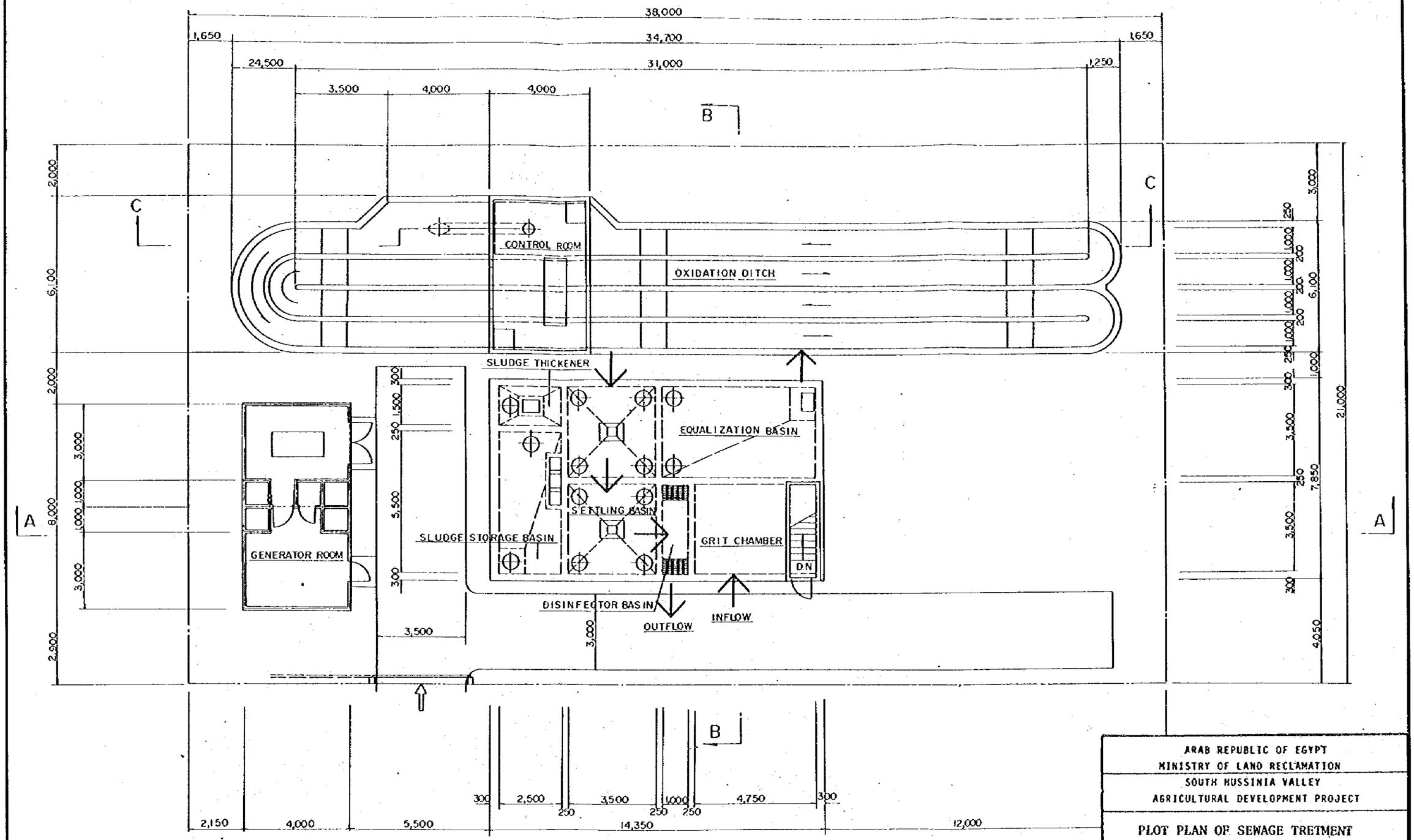
LOCATION of BUILDINGS
(CENTRAL VILLAGE)

DATE		Figure	E-19

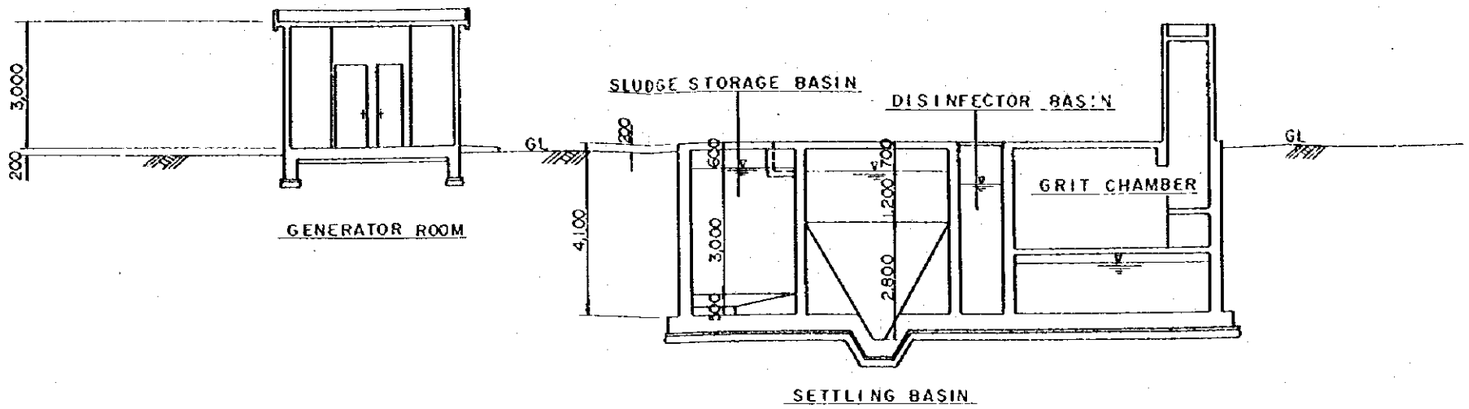
JAPAN INTERNATIONAL COOPERATION AGENCY



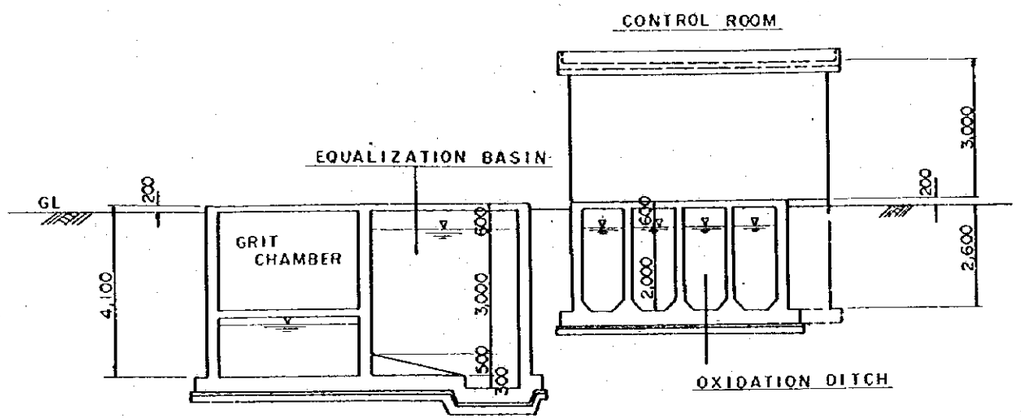
ARAB REPUBLIC OF EGYPT MINISTRY OF LAND RECLAMATION	
SOUTH HUSSINIA VALLEY AGRICULTURAL DEVELOPMENT PROJECT	
PLOT PLAN OF WATER TRETMENT (WATER CAPACITY 50,000 cu.m/d)	
DATE	Figure E-20
JAPAN INTERNATIONAL COOPERATION AGENCY	



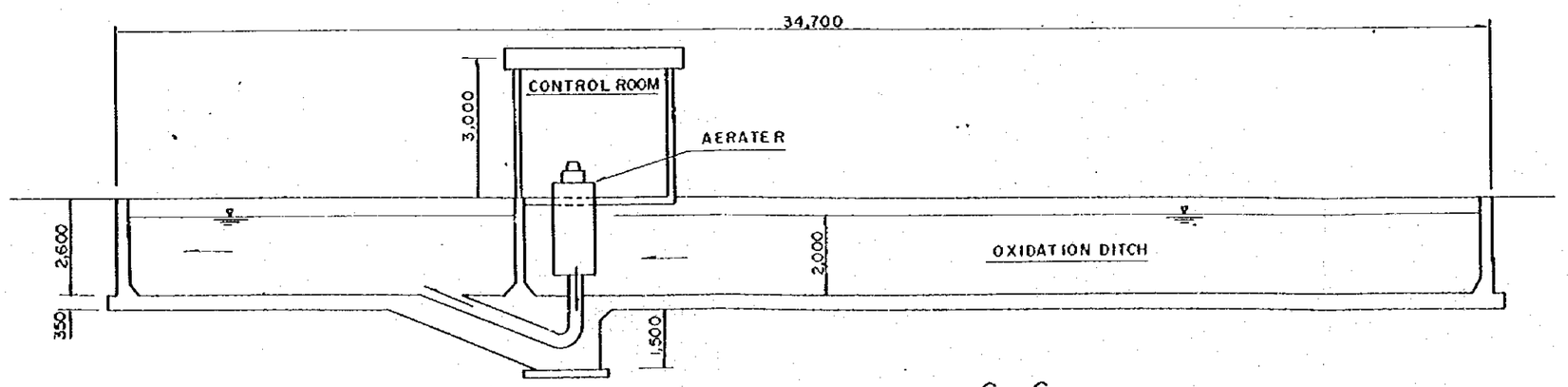
ARAB REPUBLIC OF EGYPT MINISTRY OF LAND RECLAMATION	
SOUTH HUSSINIA VALLEY AGRICULTURAL DEVELOPMENT PROJECT	
PLOT PLAN OF SEWAGE TRETMENT 2,000 PERSONS	
DATE	Figure E-21
JAPAN INTERNATIONAL COOPERATION AGENCY	



A — A

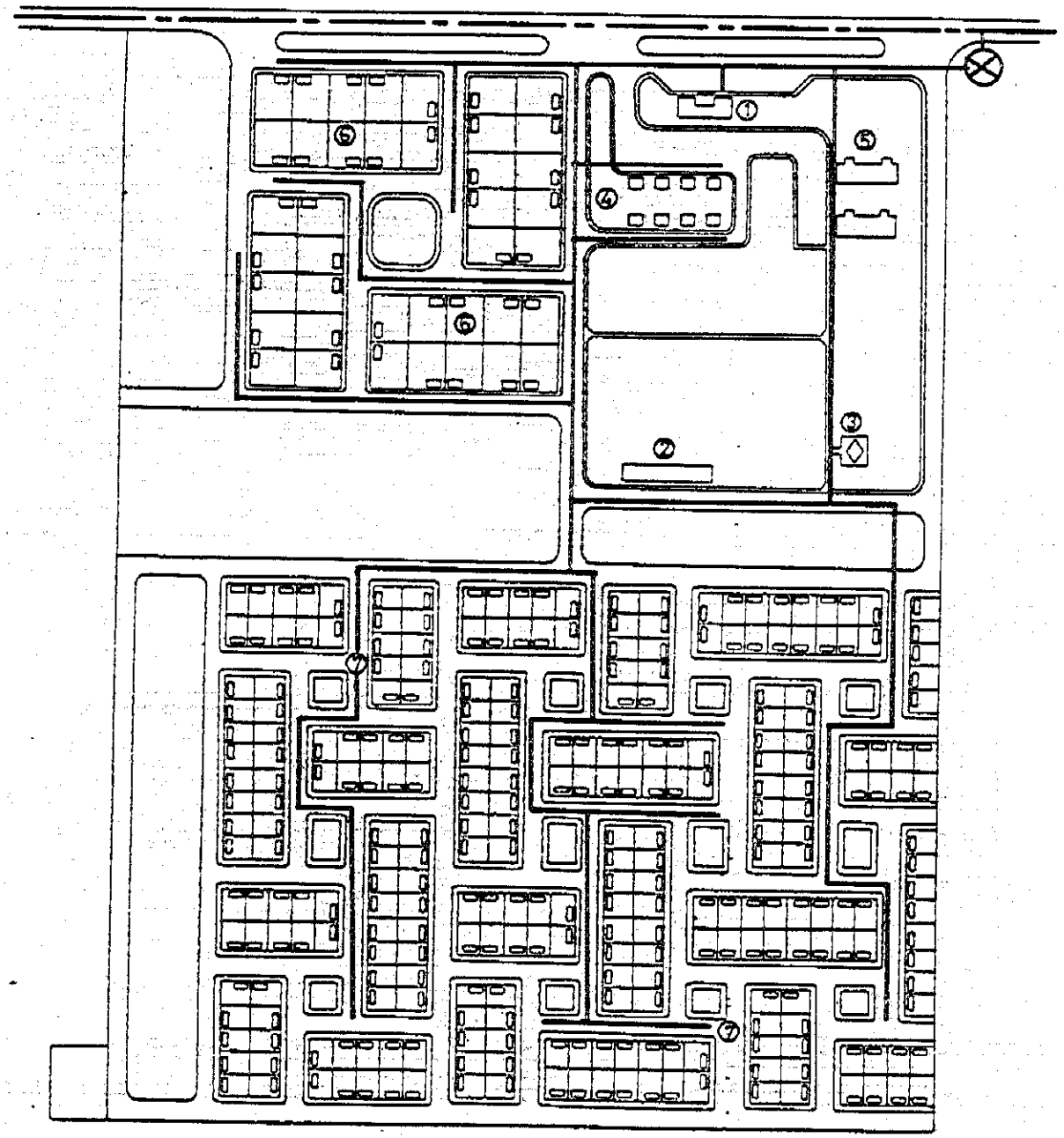


B — B



C — C

ARAB REPUBLIC OF EGYPT MINISTRY OF LAND RECLAMATION SOUTH HUSSINIA VALLEY AGRICULTURAL DEVELOPMENT PROJECT			
SECTIONAL VIEW (2,000 PERSONS)			
DATE		Figure	E-22
JAPAN INTERNATIONAL COOPERATION AGENCY			



① AGRI. ADMINISTRATIVE OFFICE
② GROUP OF SHOPS
③ MOSQUE
④ TECHNICAL LABORERS HOUSE
⑤ APARTMENT
⑥ OWNERS' HOUSE
⑦ FARMERS' HOUSE

WATER TOWER

PIPELINE

0 50 100m

Figure E-23

PIPELINE of POTABLE WATER
at SATELLITE VILLAGE

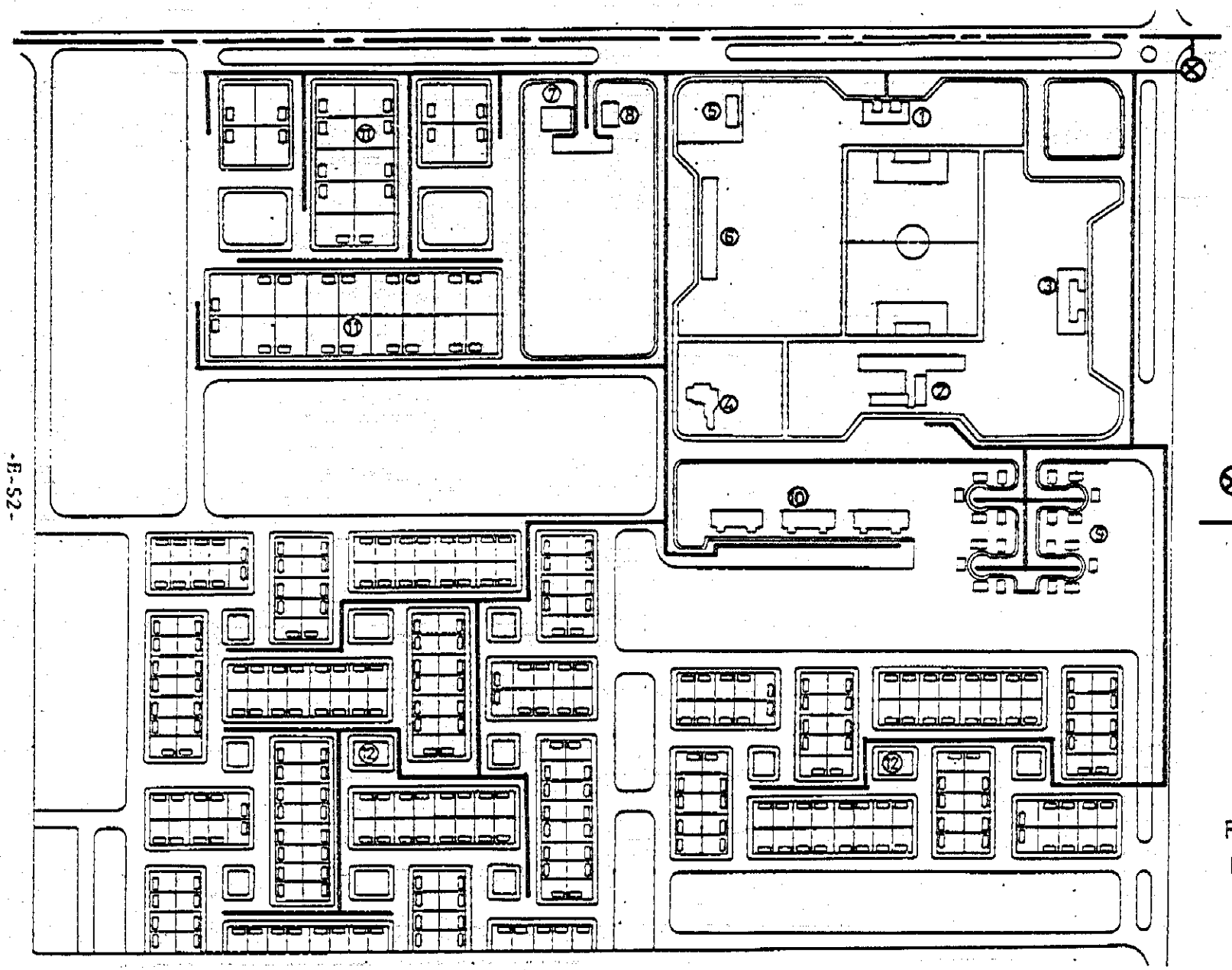
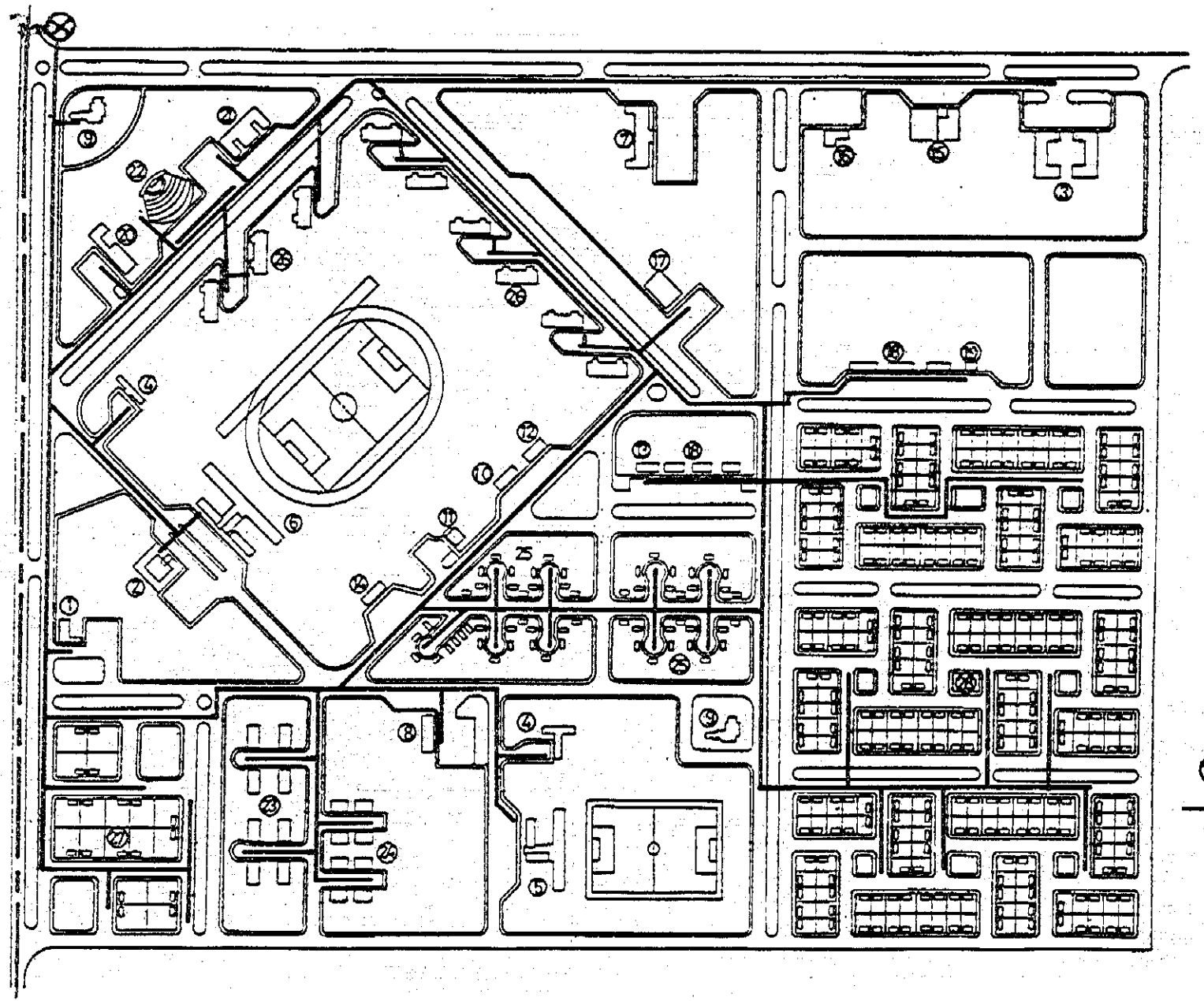


Figure E-24
PIPELINE of POTABLE WATER
at SERVICE VILLAGE



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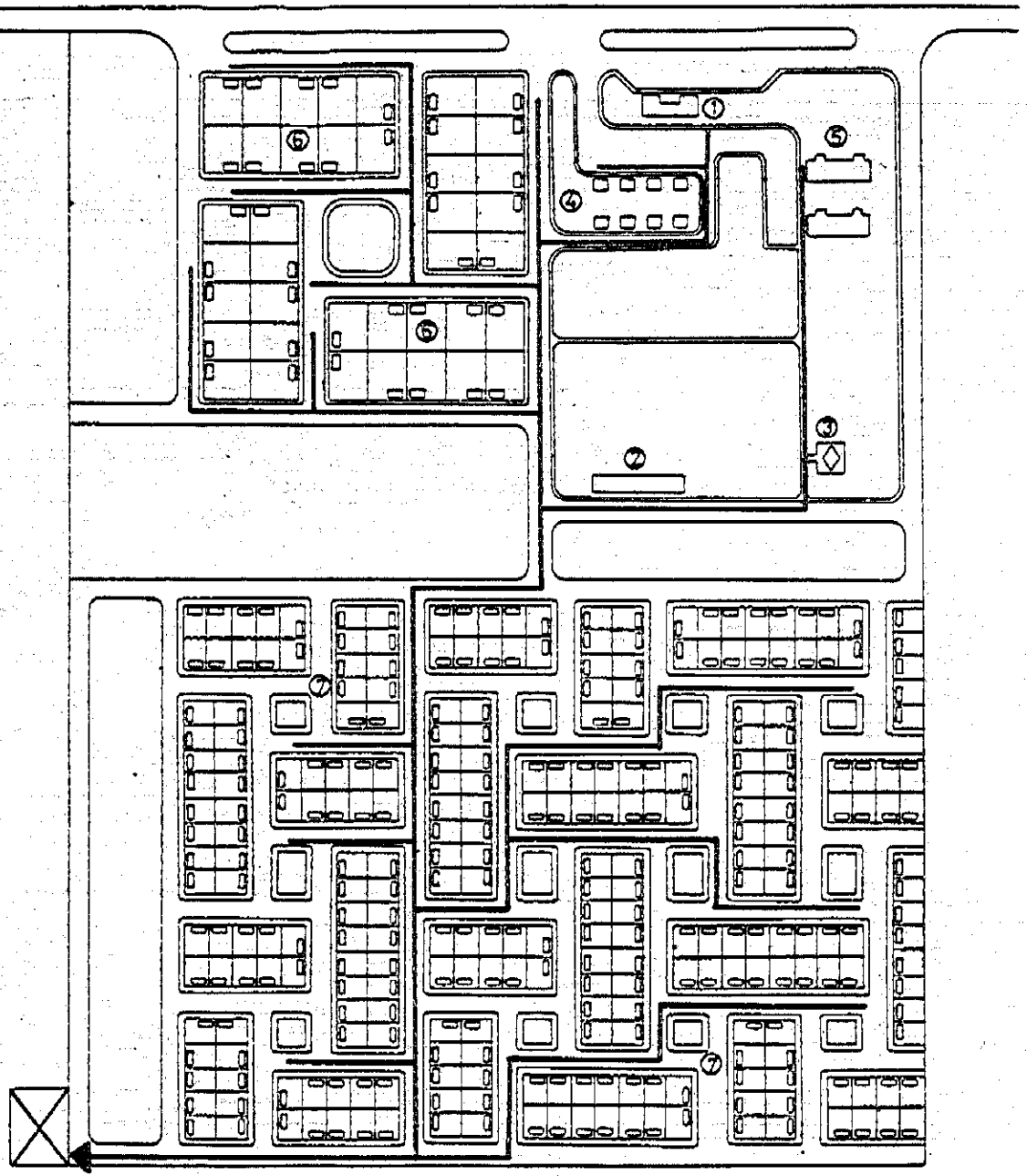
㉖ APARTMENT
㉗ OWNERS" HOUSE
㉘ FARMERS' HOUSE

⊗ WATER TOWER

PIPELINE of POTABLE WATER

0 50 100m

Figure E-25
PIPELINE OF POTABLE WATER
at CENTRAL VILLAGE



① AGRI. ADMINISTRATIVE OFFICE
② GROUP OF SHOPS
③ MOSQUE
④ TECHNICAL LABORERS HOUSE
⑤ APARTMENT
⑥ OWNERS' HOUSE
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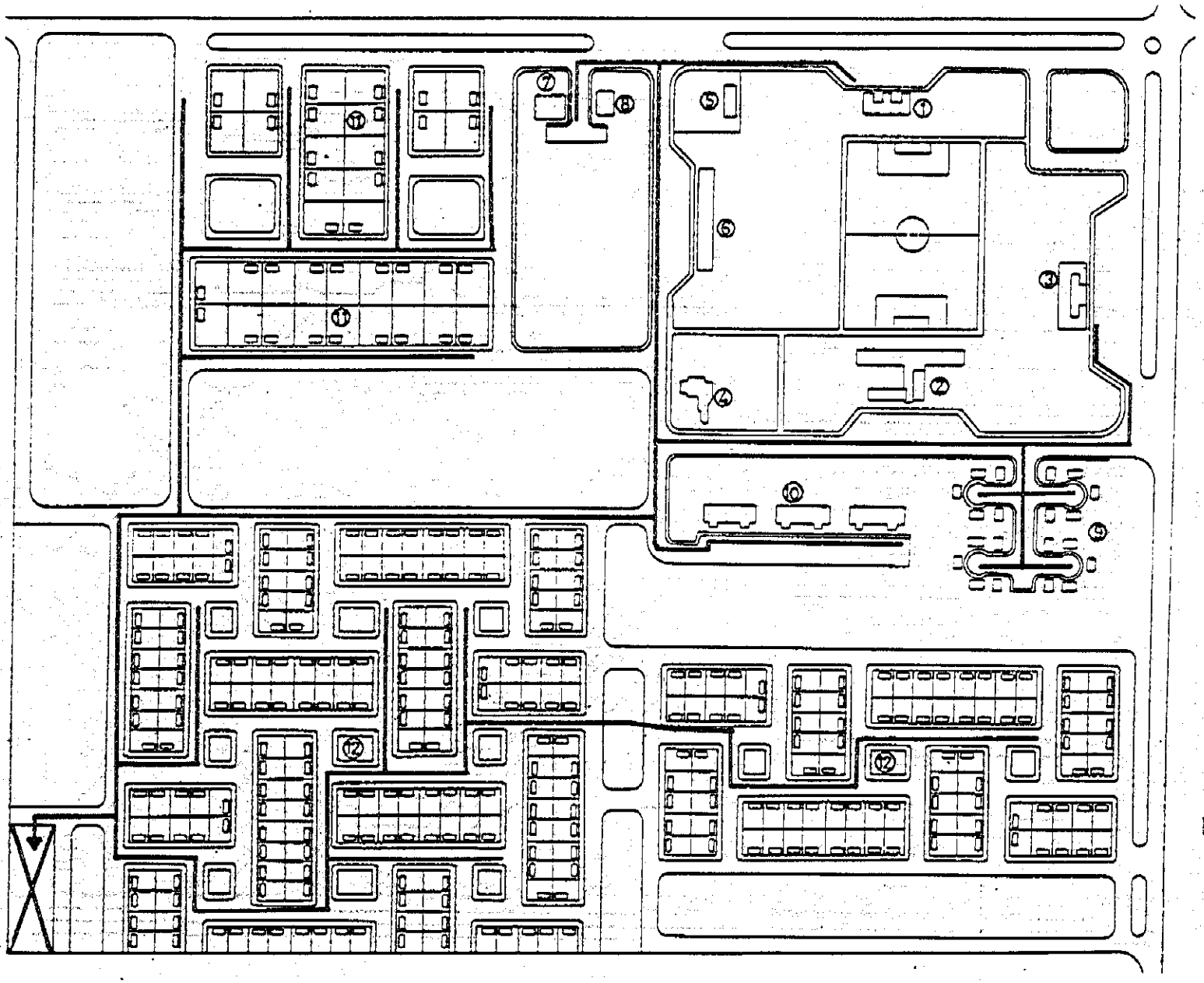
SEWAGE TREATMENT WORK

PIPELINE

0 50 100m

Figure E-26
PIPELINE of SEWAGE
at SATELLITE VILLAGE



① VILLAGE DEVELOPMENT OFFICE
② COMBINED SCHOOL
③ MEDICAL TREATMENT UNIT
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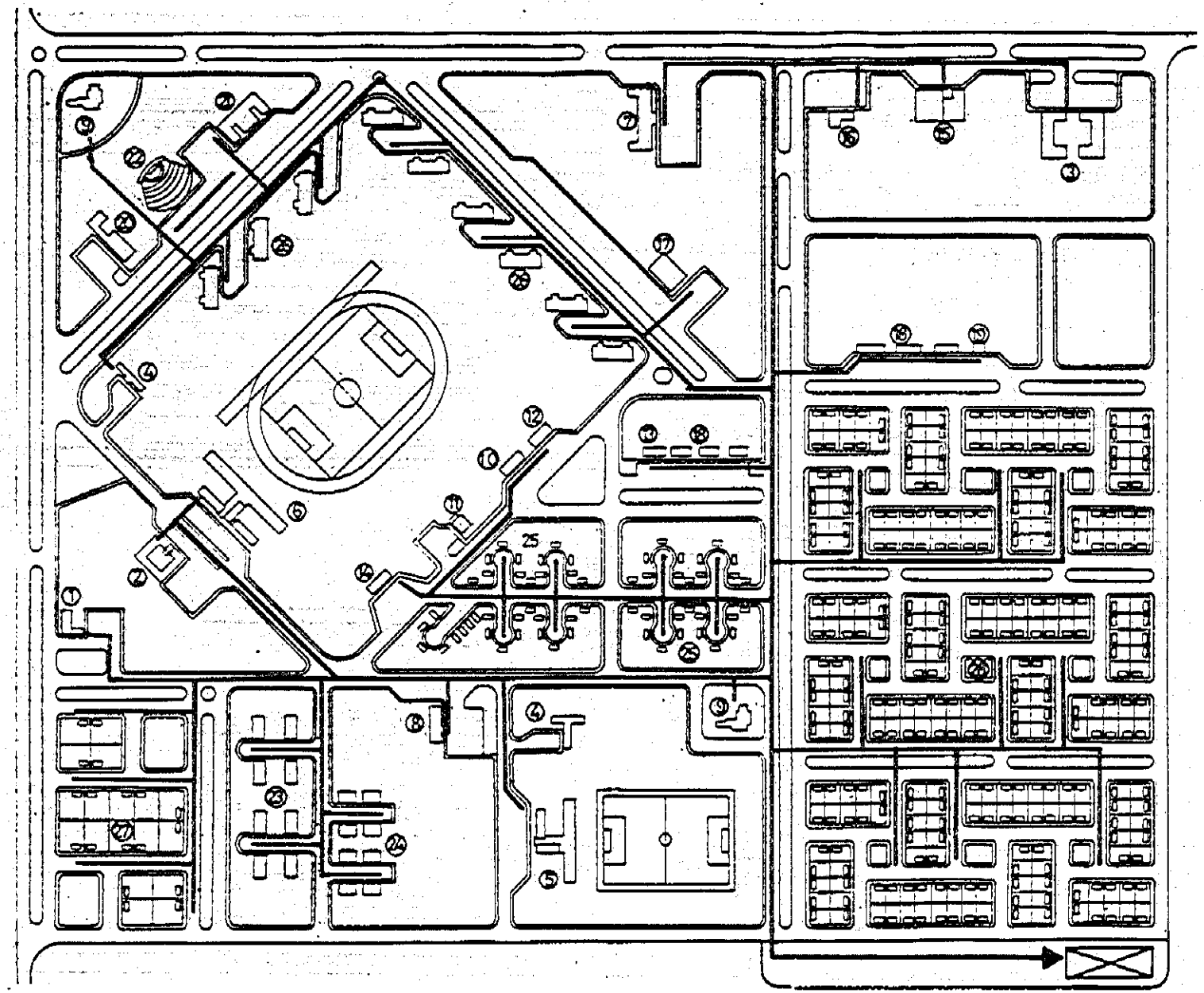
⑩ APARTMENT
⑪ OWNERS' HOUSE
⑫ FARMERS' HOUSE

SEWAGE TREATMENT WORK
PIPELINE

0 50 100m

Figure E-27
PIPELINE of SEWAGE
at SERVICE VILLAGE



1. VILLAGE DEVELOPMENT OFFICE
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13. STORE
14. VILLAGE BANK
15. WORKSHOP
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26. APARTMENT
27. OWNERS' HOUSE
28. FARMERS' HOUSE

SEWAGE TREATMENT WORK

PIPELINE

0 50 100 m

Figure E-28

PIPELINE of SEWAGE
at CENTRAL VILLAGE

Figure E-29 SEWAGE TREATMENT PLAN (2000 PERSINS)

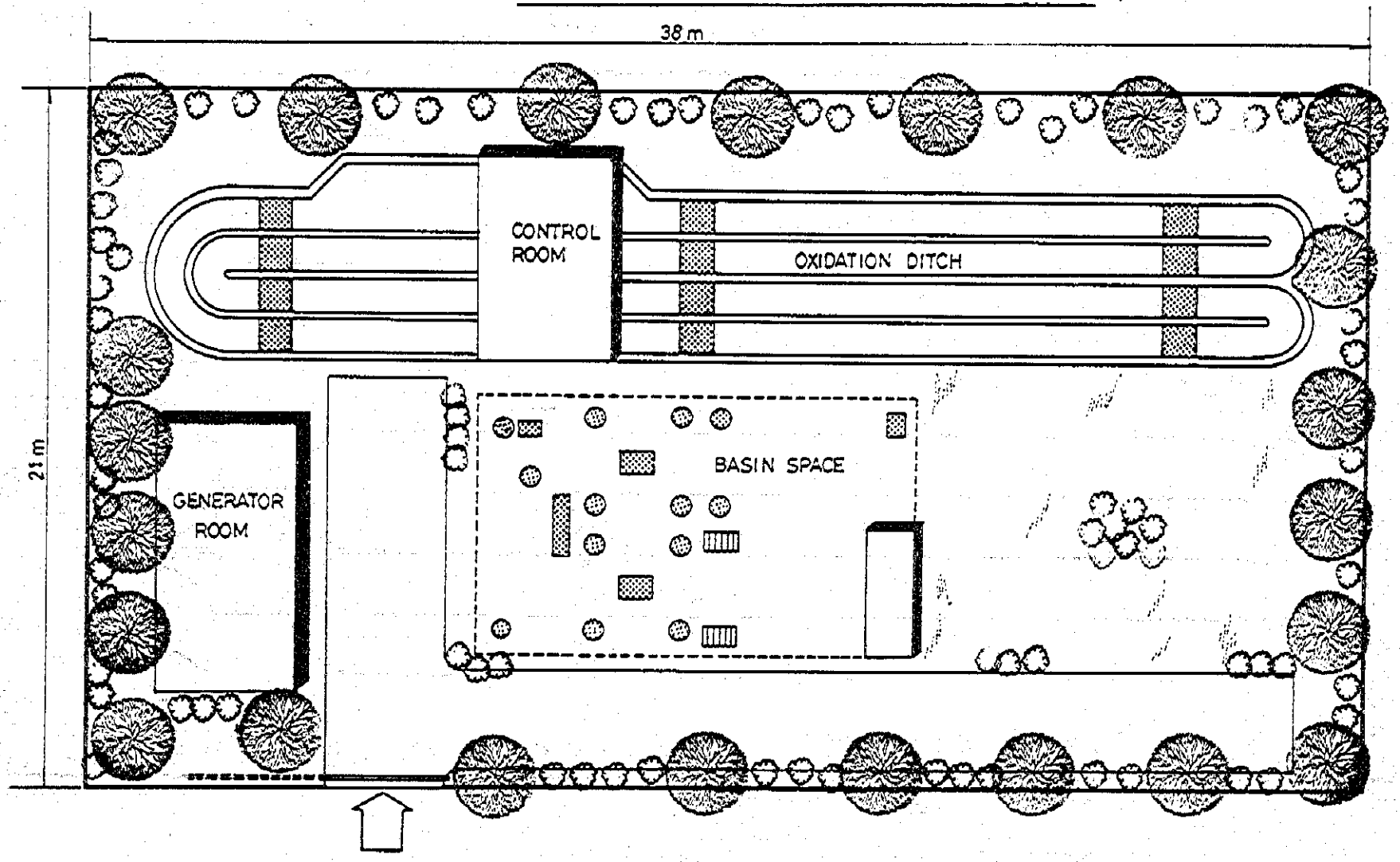

Figure E-30 SEWAGE TREATMENT PLAN (5000 PERSONS)