

JAPAN INTERNATIONAL  
COOPERATION AGENCY (JICA)

MINISTRY OF PUBLIC WORKS AND  
WATER RESOURCES  
THE ARAB REPUBLIC OF EGYPT

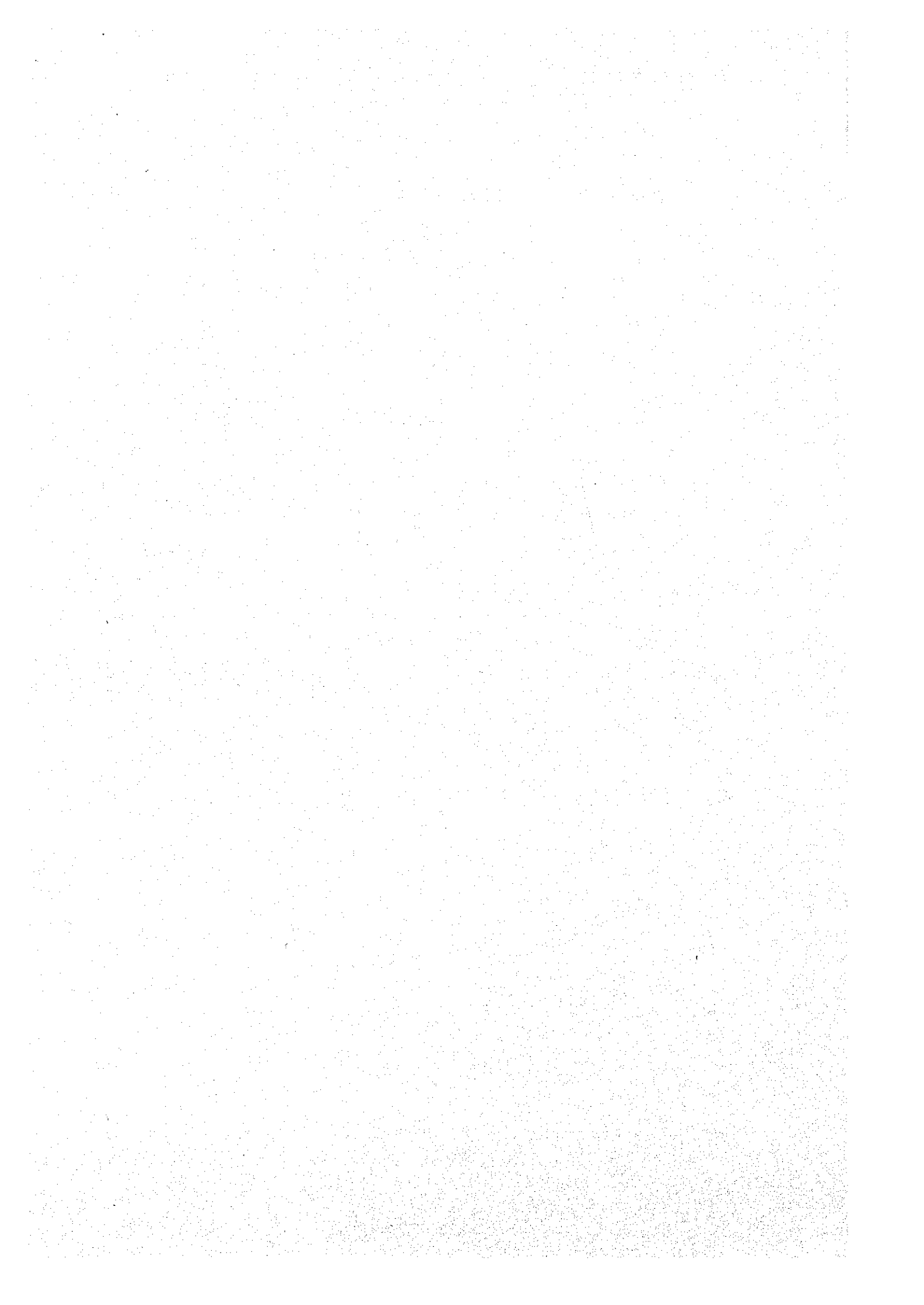
**THE FEASIBILITY STUDY  
ON  
FARMLAND ENVIRONMENTAL IMPROVEMENT  
PROJECT  
IN OMOUM AREA**

**ANNEX**

JANUARY, 1996

**SANYU CONSULTANTS INC.**

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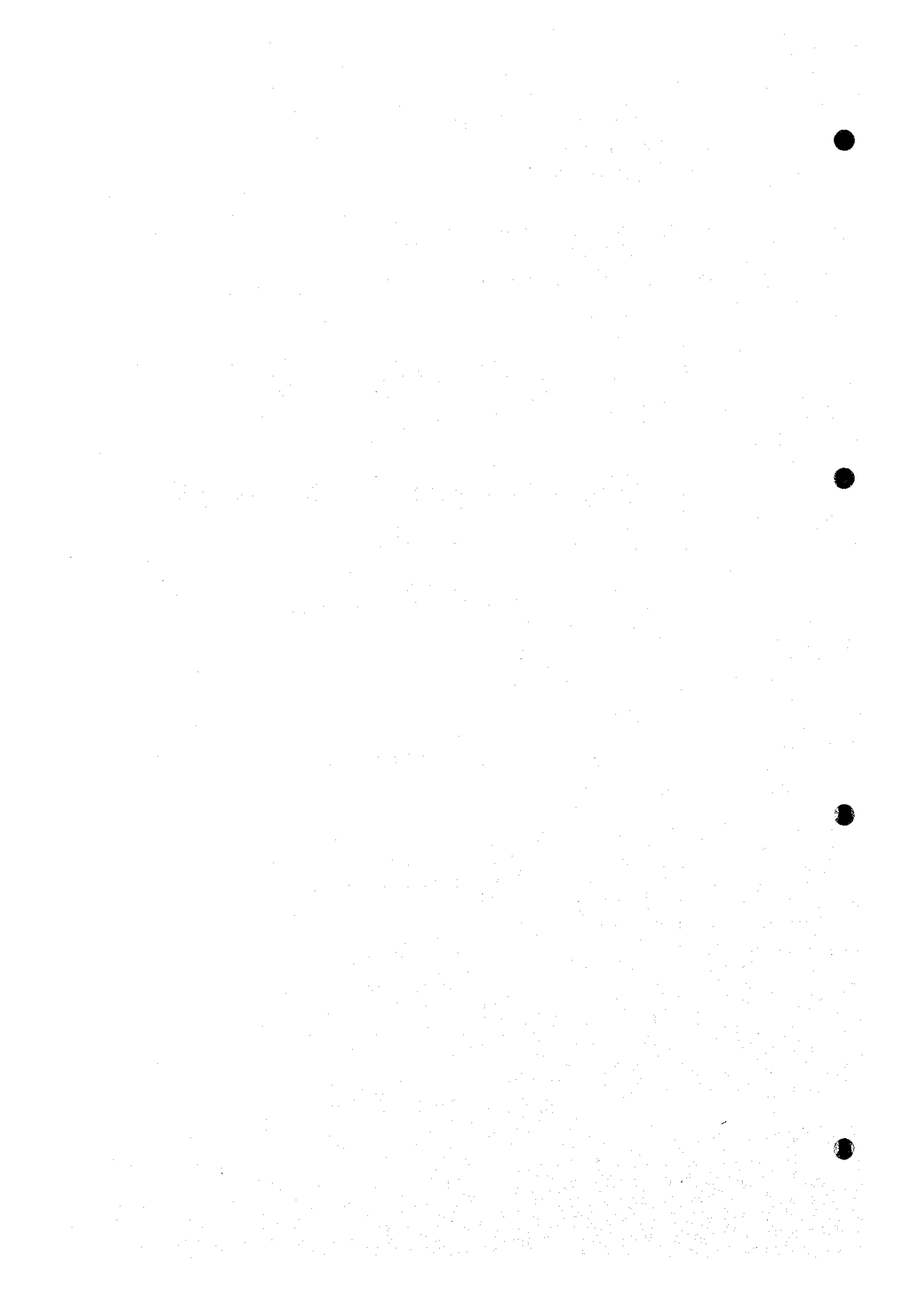
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PROJECT  
IN OMOUM AREA**

**ANNEX**

**JANUARY, 1996**



**SANYU CONSULTANTS INC.**



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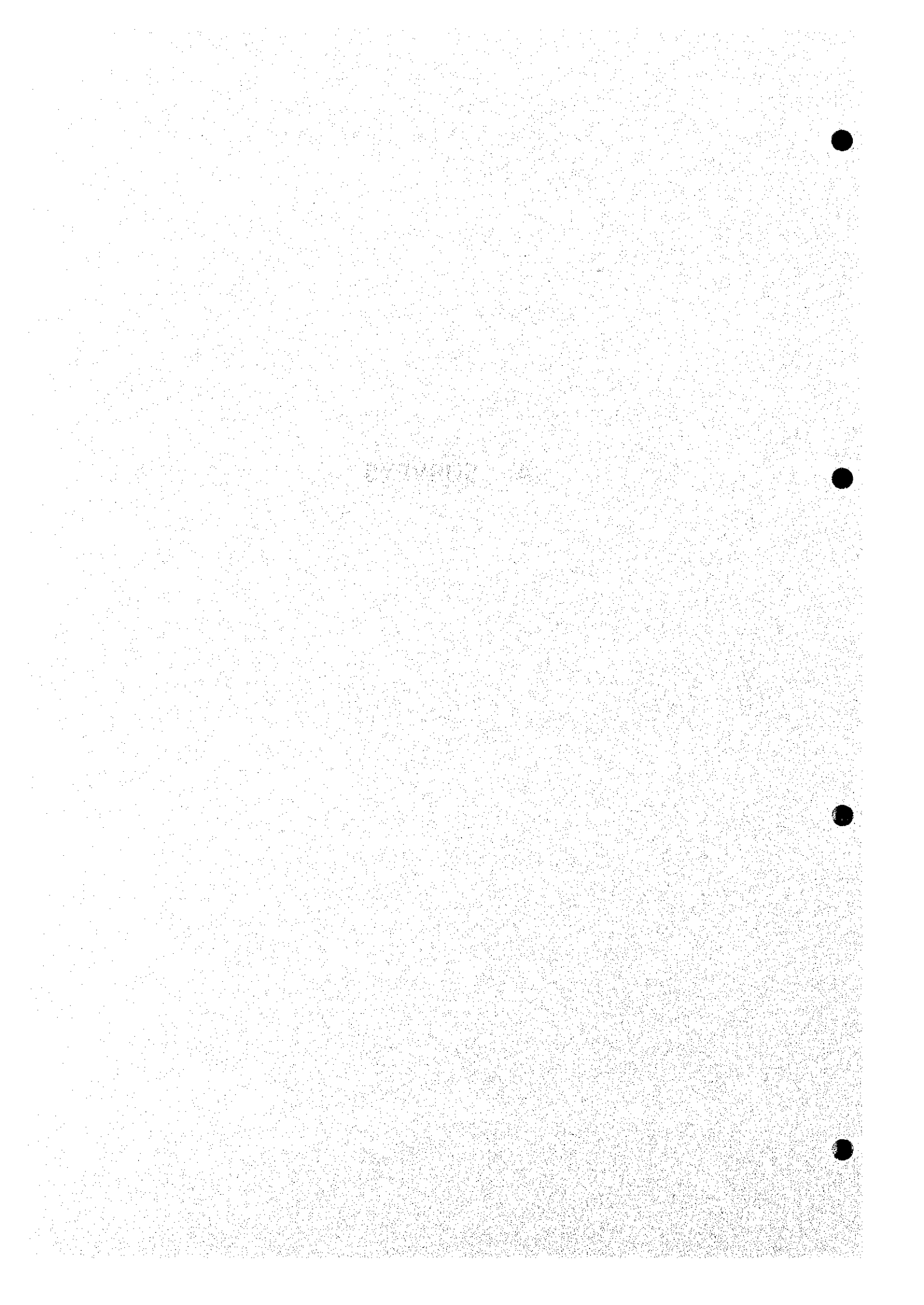
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## **A. SURVEYS**





## Annex A. Surveys

### A-1 Route Survey of Omoum Main Drain

#### 1.1 Outline of Works

##### 1) Objectives of Survey

The objectives of the survey are;

- To supply basic survey data for improvement of the Omoum Main Drain, in order to formulate farmland environmental improvement project for the area of about 171,300 ha (407,860 feddan), located in the Behera Governorate in the Lower Nile Delta, and
- To conduct leveling survey of installed water level gauges, two automatic water level gauges and ten staff gauges, which have been installed by the Study Team during the Phase-I field works.

##### 2) Contents of Survey

The contents of survey are summarized as follows;

- Route Survey : Omoum Main Drain, L = 45 km  
Preparation of route map,  
(scale S = 1/25,000)
- Longitudinal survey : Omoum Main Drain, L = 45 km
  - . Mariut Lake and marsh area : 15 km
  - . Land Survey : 30 kmPreparation of longitudinal section(Scale H=1/5,000, V=1/100)
- Cross-section survey : Survey width 200 m x 30 sections  
Preparation of cross section  
( Scale H = 1/200, V = 1/100)
- Bench Mark(BM) survey : Provision of one Bench Mark near  
EL-Max Pump Station
- Leveling survey of staff gauges : leveling survey for ten newly  
provided staff gauges and seven  
existing staff gauges

## 1.2 Undertaking of Route Survey for Omoum Main Drain

### 1) Bench Mark Survey of Omoum Main Drain

Location of the existing Bench Mark(BM) should be surveyed in the Study Area, and reliable Bench Marks, which are considered to be a basic Bench Mark for the study will be selected through the consultation with following Egyptian authorities concerned;

Public Authority : Egyptian Public Authority for Survey  
Basic BM : BM-1 --- EL-Dekhrla H = (+) 4.696 m  
BM-2 --- Kafr EL-Dawar H = (+) 0.735 m

New bench mark was established near the EL-Max Pump station in accordance with two bench marks mentioned above. The new bench mark was made by concrete steak (20 cm x20 cm x 100 cm)

Elevation of new BM : (+) 3.410 m

### 2) Route Survey of Omoum Main Drain

Route survey of Omoum main drain, (total length of about 45 km) was carried out from the mouth of Omoum main drain to Abu Hommos pump station. Coordinate system was made on the basis of public coordinate systems.

Total length : Omoum main drain L = 45 km  
Route map : Scale 1:25,000

### 3) Profile Leveling of The Drain

Profile leveling of Omoum main drain (total length of 45 km) was conducted from the mouth of Omoum main drain to Abu Hommos Pump station. Indication of survey point is length from the mouth of Omoum main drain.

Total length : Omoum main drain L = 45 km  
Interval : Two kilometers and changing points of cross section  
Profile drawing : Scale Sh = 1/5,000, Sv = 1/100

#### 4) Cross Section Survey of the Drain

Cross section of the drain was surveyed at a interval of every 2.0 Km as a rule and at a changing point of cross section of the drain. Survey width is about 200 m on an average.

Total length : Omoum main drain L = 45 km  
Interval : Two kilometers and changing points of cross section  
Width : 200 m  
Cross Section Drawing : Scale Sh = 1/200, Sv = 1/100

#### 5) Leveling of Water Level Gauges

Leveling of staff gauges was made at the newly installed gauges, two automatic water level gauges and ten staff gauges, which were installed by the Study Team, in order to use hydraulic analysis of drainage simulation.

Survey points : Automatic water level gauges 2 sites  
: New staff gauges 10 sites  
: Existing pump station gauges 7 sites

#### 6) Final Results

The following survey results are prepared;

- Route map : Scale 1/25,000  
- Profile drawing : Scale Sh = 1/5,000, Sv = 1/100  
- Cross section drawing : Scale Sh = 1/200, Sv = 1/100  
- Computation sheet : 1 set  
- Profile leveling sheet: 1 set  
- Field notes : 1 set  
- Quality control sheet : 1 set  
- Location map of BM : 1 set

QUALITY CONTROL SHEET

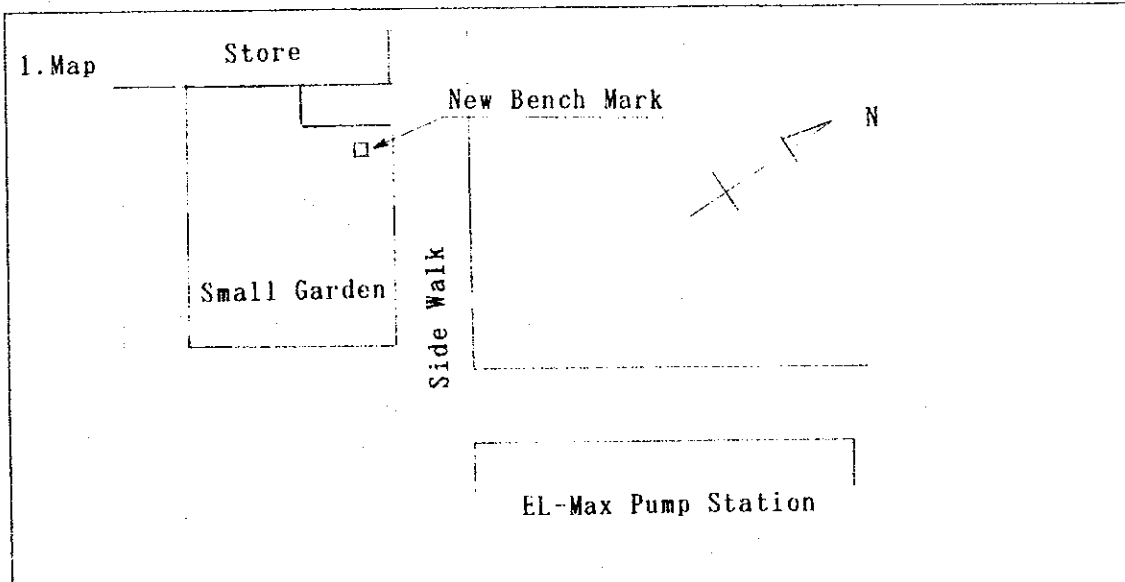
MINOR ORDER LEVELING

Project	Farmland Environmental Improvement	Employer	Sanyu Consultants Inc.
Works Area	Omoum Main Drain	Employee	Sunrise Engineering
Term	Aug.10 to Sep.8	Chief Surveyor	MAMDOUH EL-ORABY
Total Distance	Omoum Main Drain 45 km	Inspector	MOHAMED KHAMIS

Route	Distance	Error of Closure	Tolerance	Summary	
BM. 355	}	17.02 km	19 cm	< 30.7 cm	Good
T. 116					
T. 114					
T. BM. 4	}				
BM. 1940					
T. BM. 3	}				
T. 47					
BM. 552					
BM. 1949	}	16.54 km	8 cm	< 30.4 cm	Good
BM. 355					

Tolerance	6 cm + 6 cm $\sqrt{S}$ S: One way distance in km	Summary
Surveyor	ATTEM MOHAMED ALI	
Instrument Name	Transit: NIKON ND-250, NT-2A Level : NIKON AE-5C	

# RECORD OF BENCH MARK STATION



## 2. Data

Elevation	-----	(+) 3.41 m
Address	-----	EL-Max Pump Station
Day of set down	-----	Aug. 14
Fundamental bench mark	-----	EL. Dekhela H = (+) 4.696 m
		Kafr EL-Dawar H = (+) 0.735 m

## 3. Photograph



## A-2 Topographic Survey

### 2.1 Outline of Works

#### 1) Contents of Survey

The contents of survey are summarized as follows;

- Bench mark survey : Provision of Bench Marks at El-Max and Hares pumping stations and Nubariya siphon. However, in case of El-Max pumping station, the Bench Mark provided at the survey of A-1 will be utilized.
- Topographic Survey : Topographic survey of 88 ha in total at three sites mentioned in the above.
- Profile and Cross Section Survey : Profile and cross section survey of Omoum main drain at Nubariya siphon.

### 2.2 Undertaking of Topographic Survey

#### 1) Bench Mark Survey for Topographic Survey

The number of sites to be surveyed in this work is three, that is El-Max pump station, Hares pump station and Nubariya siphon. Establishment of Bench Mark, BM (Control Point) in each site was connected with the existing Bench Mark established by JICA Study Team in August 1994 at the El-Max pump station site.

#### 2) Topographic Survey of the Facility Sites

Topographic surveys at the following sites were carried;

El-Max pump station	: 30 ha (500 m x 600 m)
Hares pump station	: 18 ha (300 m x 600 m)
Nubariya siphon	: 40 ha (400 m x 1,000 m)
Total	88 ha

Principal control points to be used for topographic surveying were located at intersecting points of every 50 m mesh line.

Based on the principal control point, topographic features were measured

at intersecting point of every 10 m mesh line in principal. Topographic character and existing structures including of electric post, cable, culvert, etc. laying between intersecting points were measured.

### 3) Profile and Cross section Survey of Nubariya Siphon

The profile and cross section survey of the Omoum main drain at up and downstream of the Nubariya siphon with a length of about 190 m and width of 30 m , which is crossing the Nubariya navigation canal were surveyed.

Extent of profile survey of the Omoum main drain is 1,000 m. Intersection point(IP) at interval of 50 m and changing point(CP) of topographic features were established by wooden stakes.

Cross section survey was made at a interval of every 50 m as a rule and at a changing point of cross section of the Omoum main drain inclusive of the siphon. The survey width is 400 m on an average.

### 4) Final Results

The following survey results are prepared;

- Topographic map : scale 1 : 500 with 50 cm contour interval, spot elevation, flow direction, building, land boundary, etc.
- Profile drawing : 1 set(Scale Sh = 1 : 500, Sv = 1 : 100)
- Cross section drawing : 1 set(Scale Sh = 1 : 400. Sv = 1 : 100)
- Field notes : 1 set
- Computation sheet : 1 set

## **B. METEOROLOGY AND HYDROLOGY**



## ANNEX B. METEOROLOGY AND HYDROLOGY

### B-1. Master Plan

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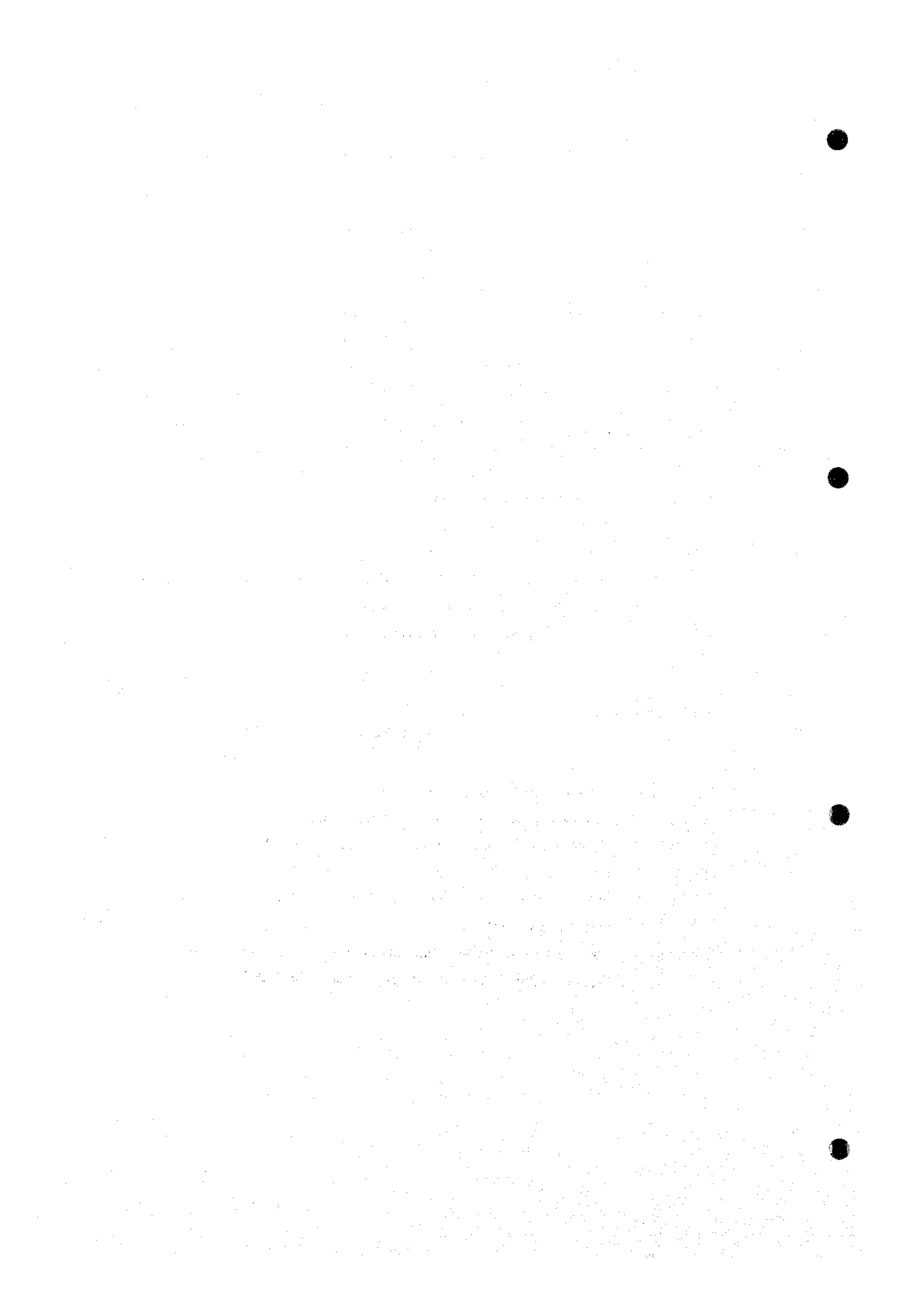


Table B-1-1 Monthly and Annual Rainfall(Alexandria)

Station: Alexandria Unit: mm

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1973	70.2	5.3	16.5	0.0	0.0	0.0	0.0	0.0	0.0	5.8	29.4	10.3	137.5
1974	133.6	4.4	28.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	46.4	191.5	404.7
1975	51.8	30.1	3.8	0.2	0.0	0.0	0.0	0.0	0.0	4.7	20.2	54.5	165.3
1976	39.8	31.1	6.9	6.0	3.2	0.0	0.0	0.0	0.0	17.0	47.1	13.5	164.6
1977	38.9	17.3	18.4	1.3	0.9	0.0	2.0	0.0	0.0	26.0	2.9	75.9	183.6
1978	59.5	5.6	20.7	0.0	0.0	0.1	0.0	0.0	0.1	7.8	16.9	60.1	170.8
1979	6.1	8.4	6.0	2.0	0.0	0.0	0.0	0.0	0.0	3.3	32.6	111.4	169.8
1980	20.2	41.5	6.9	1.8	0.0	0.0	0.0	0.0	0.0	0.1	0.2	11.5	82.2
1981	110.0	14.7	6.0	1.0	0.1	0.0	0.0	0.0	0.0	0.0	29.0	0.3	161.1
1982	32.0	66.2	36.0	2.6	0.0	0.0	0.0	0.0	0.0	0.6	14.0	41.6	193.0
1983	74.9	65.2	17.5	0.8	0.2	0.0	0.0	0.0	0.0	3.4	19.9	7.4	189.3
1984	19.2	3.0	2.0	3.1	0.0	0.0	0.0	0.0	0.0	11.6	17.0	62.2	118.1
1985	35.8	44.1	2.6	6.7	0.1	0.0	0.0	0.0	0.0	12.1	10.7	91.5	202.6
1986	18.6	18.6	7.9	4.8	7.9	0.1	0.0	0.0	0.4	0.2	98.0	62.6	219.1
1987	31.4	7.1	31.7	7.6	0.2	0.0	0.0	0.0	0.0	10.4	1.1	89.0	178.5
1988	36.7	46.8	20.1	1.3	0.0	0.0	0.0	0.0	0.0	15.2	33.1	61.0	212.2
1989	75.4	41.3	23.1	0.0	0.0	0.0	0.0	0.0	0.0	49.7	20.2	23.3	233.0
1990	49.1	28.7	13.8	0.1	0.2	0.0	0.0	0.0	0.0	0.2	5.0	0.8	97.9
1991	82.5	33.6	33.8	11.2	0.1	0.0	0.0	0.0	0.0	0.0	76.9	167.0	405.1
1992	84.8	86.0	0.8	0.9	0.8	0.0	0.0	0.0	0.0	0.0	4.0	68.4	245.7
1993	60.6	60.2	10.3	0.0	3.8	0.0	0.0	0.0	0.0	7.0	5.2	20.5	157.6
1994	51.4	3.5	33.2	0.0	0.0	0.0	0.0	0.0	0.0	5.0	112.6	67.5	273.2
AVR	53.3	30.1	15.8	2.3	0.8	0.0	0.1	0.0	0.0	8.2	29.2	58.7	198.4

Source: The Egyptian Meteorological Authority

Period: 1973 - 1994

Table B-1-2 Monthly and Annual Rainfall(Damanhur)

Station: Damanhur Unit: mm

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1973	42.5	3.5	22.9	0.0	0.0	0.0	0.0	0.0	0.0	2.3	20.8	6.7	98.7
1974	90.6	3.0	13.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	13.9	41.3	162.5
1975	22.8	31.6	4.6	2.5	0.3	0.0	0.0	0.0	0.0	2.7	2.0	34.6	101.1
1976	7.9	17.1	2.3	4.5	10.0	0.6	0.0	0.0	0.0	5.5	11.6	2.5	62.0
1977	18.8	7.8	42.4	8.4	5.7	0.0	0.0	0.0	7.5	15.8	0.3	48.0	154.7
1978	34.2	5.0	3.0	1.7	0.0	1.0	0.0	0.0	0.0	7.5	5.1	39.9	97.4
1979	4.1	1.6	1.8	0.3	0.0	0.0	0.0	0.0	0.0	0.7	12.6	53.8	74.9
1980	18.9	4.4	7.3	3.3	0.0	0.0	0.0	0.0	3.0	0.1	0.8	11.8	49.6
1981	26.3	6.9	5.7	3.2	0.2	0.0	0.0	0.0	0.0	0.0	7.5	0.0	49.8
1982	11.3	37.4	18.0	2.6	0.8	0.0	0.0	0.0	0.2	0.0	8.9	32.1	111.3
1983	51.2	28.2	20.7	0.1	0.0	0.0	0.0	0.0	0.0	0.2	7.6	9.4	117.4
1984	19.9	2.8	2.4	4.1	0.0	0.0	0.0	0.0	0.0	0.2	3.5	7.5	40.4
1985	14.8	40.3	5.4	3.0	0.0	0.0	0.0	0.0	0.0	7.3	3.1	34.0	107.9
1986	1.8	16.7	4.1	4.7	7.4	0.0	0.0	0.0	1.4	0.9	43.6	17.4	98.0
1987	11.4	12.1	20.8	0.8	0.0	0.0	0.0	0.0	0.0	18.8	0.2	17.8	81.9
1988	39.6	59.1	11.7	3.0	0.0	0.0	0.0	0.0	0.0	1.3	4.4	23.9	143.0
1989	34.8	10.4	7.5	0.0	0.0	0.0	0.0	0.0	0.0	20.0	8.2	2.8	83.7
1990	32.2	18.3	15.3	5.5	0.9	0.0	0.0	0.0	0.0	0.3	1.6	0.0	74.1
1991	36.6	16.8	28.9	0.0	2.7	0.0	0.0	0.0	0.0	0.0	68.2	99.8	253.0
1992	64.8	81.4	2.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	4.2	31.3	184.2
AVR	29.2	20.2	12.0	2.4	1.4	0.1	0.0	0.0	0.6	4.2	11.4	25.7	107.3

Source: The Egyptian Meteorological Authority

Period: 1973 - 1992

Table B-1-3 The Daily and Monthly Maximum Rainfall in Recent Years

Unit: mm

Date	Alexandria				Damanhur		
	1974 (Jan)	1974 (Dec)	1991 (Dec)	1994 (Nov)	1974 (Jan)	1991 (Dec)	1992 (Feb)
1	0.0	14.8	17.2	0.0	0.0	11.0	1.7
2	0.0	6.9	14.2	4.5	0.0	8.4	0.1
3	0.0	42.2	0.0	0.1	0.0	0.0	4.6
4	0.2	54.3	0.2	0.0	0.0	0.0	18.5
5	16.4	7.5	0.4	7.1	0.0	0.0	0.1
6	4.1	5.6	0.0	6.1	1.2	0.0	1.0
7	0.1	5.8	0.0	0.0	0.2	0.0	0.8
8	6.0	1.0	3.0	0.0	2.8	1.4	8.3
9	11.8	7.3	17.9	0.0	2.4	0.0	5.1
10	0.0	2.6	0.0	0.0	0.0	0.0	0.0
11	0.0	7.4	9.7	0.0	0.0	12.1	0.0
12	0.3	11.5	11.8	0.0	3.4	11.1	2.2
13	38.8	0.0	11.3	0.0	23.8	6.9	3.5
14	14.3	0.0	8.3	0.0	14.3	0.0	0.0
15	0.9	0.0	3.7	11.4	4.6	0.6	0.0
16	13.4	0.0	2.2	17.9	8.2	0.0	0.4
17	0.6	0.0	0.0	0.0	1.0	0.0	0.0
18	0.3	15.8	1.3	0.0	0.0	0.0	0.0
19	2.6	0.1	3.3	0.0	0.0	1.9	0.0
20	13.4	3.8	0.6	0.0	11.4	2.0	0.0
21	0.7	0.0	0.2	1.3	4.8	0.0	0.0
22	0.1	0.0	0.0	24.2	0.4	0.0	1.6
23	0.9	0.6	0.0	16.6	1.9	0.0	12.7
24	0.0	0.2	0.5	0.0	0.0	3.0	14.3
25	0.0	0.2	0.0	1.2	0.0	0.0	6.5
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	2.4	0.0	21.2	3.6	1.3	10.2	0.0
28	0.0	1.4	0.0	10.9	0.0	0.0	0.0
29	1.2	0.0	0.0	1.6	2.9	0.0	0.0
30	4.6	2.8	13.5	6.1	4.6	19.4	-
31	0.5	0.0	25.5	-	1.4	11.8	-
Total	133.6	191.5	167.0	112.6	90.6	99.8	81.4

Source: The Egyptian Meteorological Authority.

Period: 1973 - 1994

Note: Bold figures indicate the maximum daily rainfall

Table B-1-4 Pump Discharge Data(1988)

Unit: MCM

Month	El Max	Qalla	Abis	Hares	Dishudi	Truga	Shereshera	Abu Hommos
Jan	284.18	12.67	3.22	62.55	14.38	46.14	53.70	NA
Feb	208.52	16.19	2.72	12.89	16.78	26.87	31.03	NA
Mar	194.24	18.58	3.64	43.41	18.92	34.23	39.61	NA
Apr	144.74	19.75	3.49	37.41	15.75	26.82	34.70	NA
May	151.54	20.37	2.75	40.18	19.58	30.13	37.24	NA
Jun	203.69	19.66	6.01	53.46	20.38	36.17	47.83	NA
Jul	168.90	22.56	4.24	51.07	20.23	34.15	43.40	NA
Aug	188.38	21.90	4.20	49.89	21.60	42.19	53.71	NA
Sep	194.49	23.24	4.14	59.92	24.11	40.36	57.91	NA
Oct	239.41	24.53	5.53	64.34	26.71	51.65	64.04	NA
Nov	224.80	22.41	4.14	59.92	21.71	48.64	56.82	NA
Dec	257.00	20.01	3.86	55.40	18.84	45.39	19.00	NA
Total	2459.89	241.87	47.94	590.44	238.99	462.74	538.99	NA
Avr	204.99	20.16	4.00	49.20	19.92	38.56	44.92	NA

Source: Reuse monitoring report(DRI).

Note: NA= Not available

Table B-1-5 Pump Discharge Data(1989)

Unit: MCM

Month	El Max	Qalla	Abis	Hares	Dishudi	Truga	Shereshera	Abu Hommos
Jan	222.49	20.03	2.50	60.29	15.56	41.29	47.17	NA
Feb	159.22	19.13	0.00	43.03	13.24	18.68	21.41	NA
Mar	194.55	29.99	0.00	47.29	18.32	32.65	45.24	NA
Apr	160.40	30.22	3.87	47.30	16.18	25.66	23.25	NA
May	182.17	33.62	4.86	53.68	19.31	46.56	38.77	NA
Jun	196.20	30.95	0.92	59.37	18.43	50.29	42.22	NA
Jul	213.44	30.08	4.20	63.15	24.34	54.52	59.88	NA
Aug	206.55	27.73	6.61	60.52	24.59	52.55	54.95	NA
Sep	230.54	25.12	5.32	61.07	24.64	61.21	61.21	NA
Oct	267.23	25.68	7.47	57.65	25.79	57.07	63.17	NA
Nov	262.75	24.37	4.26	62.16	24.40	49.70	52.88	NA
Dec	243.46	23.36	3.98	60.30	20.48	46.52	52.82	NA
Total	2539.00	320.28	43.99	675.81	245.28	536.70	562.97	NA
Avr	211.58	26.69	3.67	56.32	20.44	44.73	46.91	NA

Source: Reuse monitoring report(DRI).

Note: NA= Not available

Table B-1-6 Pump Discharge Data(1990)

Unit: MCM

Month	El Max	Qalla	Abis	Hares	Dishudi	Truga	Shereshera	Abu Hommos
Jan	274.78	11.40	2.50	62.63	19.13	49.07	62.07	NA
Feb	189.45	22.36	0.00	47.03	12.26	26.72	24.00	NA
Mar	183.16	26.76	0.00	57.67	19.68	40.97	42.86	NA
Apr	163.45	24.48	3.87	60.40	16.16	35.05	39.98	NA
May	172.92	23.66	4.86	59.82	18.70	36.69	14.85	NA
Jun	141.22	24.20	0.92	59.71	20.43	38.30	48.96	NA
Jul	207.74	26.52	4.20	61.86	24.01	45.46	59.91	NA
Aug	206.55	20.09	6.61	62.92	19.93	40.29	47.04	NA
Sep	222.71	20.75	5.32	60.90	25.82	59.04	63.39	NA
Oct	262.40	23.74	7.47	64.26	25.94	58.89	68.63	NA
Nov	196.47	17.20	4.26	62.19	19.43	48.84	44.61	NA
Dec	222.26	18.80	3.98	64.26	24.36	56.78	54.49	NA
Total	2443.11	259.96	43.99	723.65	245.85	536.10	570.79	NA
Avr	203.59	21.66	3.67	60.30	20.49	44.68	47.57	NA

Source: Reuse monitoring report(DRI).

Note: NA= Not available

Table B-1-7 Pump Discharge Data(1991)

Unit: MCM

Month	El Max	Qalla	Abis	Hares	Dishudi	Truga	Shereshera	Abu Hommos
Jan	268.22	19.17	2.60	47.75	18.29	69.49	25.90	8.05
Feb	209.01	16.61	2.56	35.16	9.45	35.55	22.12	5.90
Mar	206.91	20.59	4.56	50.59	19.04	39.72	35.68	10.80
Apr	181.60	22.91	2.30	41.99	15.69	50.56	40.02	9.25
May	217.68	26.66	3.07	52.41	17.07	36.34	35.78	9.18
Jun	189.35	24.95	2.99	26.35	18.52	46.06	40.05	10.37
Jul	189.16	24.52	2.94	26.37	18.48	50.38	46.21	13.93
Aug	202.08	24.25	3.31	65.75	21.26	48.46	47.87	13.16
Sep	205.34	27.58	4.11	63.62	31.49	76.01	49.85	17.06
Oct	218.27	25.91	3.80	58.88	22.37	79.87	51.11	9.83
Nov	235.29	27.12	3.90	49.31	19.14	72.74	50.78	12.65
Dec	282.83	24.05	4.10	55.63	22.51	67.88	42.75	14.98
Total	2605.74	284.32	40.24	573.81	233.31	673.06	488.12	135.16
Avr	217.15	23.69	3.35	47.82	19.44	56.09	40.68	11.26

Source: Reuse monitoring report(DRI); MED, Damanhur

Table B-1-8 Pump Discharge Data(1992)

Unit: MCM

Month	El Max	Qalla	Abis	Hares	Dishudi	Truga	Shereshera	Abu Hommos
Jan	244.73	22.57	4.83	44.10	16.75	48.61	62.34	11.59
Feb	181.16	22.93	3.60	47.89	14.09	38.23	37.59	8.82
Mar	194.12	13.34	2.11	24.67	7.09	36.51	41.76	10.92
Apr	171.32	26.77	4.87	40.90	15.08	34.78	44.53	11.56
May	203.57	31.68	4.00	40.13	19.71	43.47	46.26	9.88
Jun	171.73	30.92	7.15	51.30	18.80	37.90	53.28	11.23
Jul	178.05	31.59	6.52	56.84	19.73	35.71	55.84	15.43
Aug	201.83	37.15	7.97	55.19	22.51	38.58	57.11	15.37
Sep	207.86	31.28	8.29	58.44	23.87	47.70	56.01	15.61
Oct	236.17	30.76	6.72	63.27	24.19	48.38	58.24	13.41
Nov	244.39	28.13	6.96	59.07	20.78	41.81	49.27	11.38
Dec	241.89	24.26	6.29	54.12	22.69	42.61	62.66	9.92
Total	2476.83	331.40	69.32	595.91	225.30	494.30	614.89	145.12
Avr	186.24	25.59	5.78	49.66	18.78	41.19	51.24	12.09

Source: MED, Damanhur

Table B-1-9 Pump Discharge Data(1993)

Unit: MCM

Month	El Max	Qalla	Abis	Hares	Dishudi	Truga	Shereshera	Abu Hommos
Jan	202.94	24.07	6.40	50.00	18.46	37.35	43.32	8.05
Feb	173.97	22.80	5.28	36.29	16.56	26.86	22.61	5.90
Mar	191.55	22.54	5.95	41.30	20.17	36.57	40.92	10.80
Apr	144.25	26.88	4.83	39.38	17.39	28.27	37.76	9.05
May	198.59	30.06	6.07	49.07	21.12	38.68	57.57	10.01
Jun	189.16	28.04	6.87	49.99	23.78	34.52	61.32	11.70
Jul	172.05	30.19	6.07	57.81	19.94	33.44	57.40	13.09
Aug	185.81	31.18	7.33	55.66	21.84	39.82	51.87	13.25
Sep	214.58	29.27	5.69	60.34	33.01	44.23	65.40	12.96
Oct	225.27	28.52	4.40	61.18	24.60	44.05	60.97	11.05
Nov	181.94	28.28	4.39	51.04	15.27	34.17	44.96	9.70
Dec	208.94	27.14	5.11	56.58	19.11	41.63	58.41	10.26
Total	2289.05	328.96	68.39	608.64	251.25	439.59	592.51	125.82
Avr	190.75	27.41	5.70	50.72	20.94	36.63	49.38	10.49

Source: MED, Damanhur

Table B-1-10 Pump Discharge Data(1994)

Unit: MCM

Month	El Max	Qalla	Abis	Hares	Dishudi	Truga	Shereshera	Abu Hommos
Jan	218.79	28.04	3.76	54.23	20.09	38.83	60.20	8.73
Feb	145.59	25.85	2.94	36.95	13.54	23.89	22.14	4.84
Mar	177.57	30.68	3.92	48.93	19.65	39.26	60.42	9.79
Apr	171.56	30.21	3.62	48.75	20.69	39.04	66.47	11.70
May	181.59	31.79	3.77	49.76	18.07	36.99	60.80	10.87
Jun	135.50	25.99	4.34	54.35	17.21	33.31	43.94	9.00
Jul	180.43	34.42	4.59	57.94	24.84	37.34	65.80	13.54
Aug	183.33	34.56	6.08	51.64	23.98	39.09	74.97	12.85
Sep	217.22	34.56	6.48	59.42	25.75	45.16	81.82	16.94
Oct	215.31	33.32	5.26	57.32	21.21	45.79	72.23	13.28
Nov	228.34	30.69	5.76	61.98	21.97	49.95	73.62	13.21
Dec	235.35	25.30	4.31	42.10	16.83	33.24	55.70	8.59
Total	2290.56	365.41	54.83	623.37	243.83	461.90	738.11	133.34
Avr	190.88	30.45	4.57	51.95	20.32	38.49	61.51	10.40

Source: MED, Damanhur

Table B-1-11 Monthly Average Inflow(7 pumps) and Outflow(El-Max)  
(1988-1994)

Unit: MCM

Month	El Max (A)	Qalla (1)	Abis (2)	Hares (3)	Dishudi (4)	Truga (5)	Sheresra (6)	Abu Hommos (7)	Total (7 pumps) (B)	Balance (B) - (A)
Jan	245.16	19.71	3.69	54.51	17.52	47.25	49.24	9.11	201.03	-44.14
Feb	180.99	20.84	2.44	37.03	13.70	28.11	25.84	6.37	134.34	-46.65
Mar	191.73	23.21	2.88	44.84	17.55	37.13	43.78	10.58	179.98	-11.75
Apr	162.47	25.89	3.84	45.16	16.71	34.31	40.96	10.39	177.25	14.78
May	186.87	28.26	4.20	49.29	19.08	38.41	41.61	9.99	190.84	3.97
Jun	175.26	26.39	4.17	50.65	19.65	39.51	46.80	10.58	197.74	22.48
Jul	187.11	28.55	4.68	53.58	21.65	41.57	55.49	14.00	219.52	32.41
Aug	196.36	28.12	6.02	57.37	22.24	43.00	55.36	13.66	225.77	29.40
Sep	213.25	27.40	5.62	60.53	26.96	53.39	62.23	15.64	251.76	38.52
Oct	237.72	27.49	5.81	60.99	24.40	55.10	62.63	11.89	248.31	10.59
Nov	224.85	25.46	4.81	57.95	20.39	49.41	53.28	11.74	223.03	-1.83
Dec	241.68	23.27	4.52	55.48	20.69	47.72	49.40	10.94	212.03	-29.65
Total	2443.45	304.60	52.67	627.38	240.54	514.91	586.63	134.86	2461.59	18.13
Avr	203.62	25.38	4.39	52.28	20.05	42.91	48.89	11.24	205.13	1.51

Source: Reuse Monitoring Report(DRI) and MED, Damanhur

Note: Abu Hommos data record is four years(1991-94)



Table B-1-12 Reuse Pump Discharge Data(1)

Unit: MCM

Month	Wariut No. 1						Boustain					
	(1988)	(1989)	(1990)	(1991)	(1992)	Average	(1988)	(1989)	(1990)	(1991)	(1992)	Average
Jan	4.17	9.97	0.02	12.07	0.00	5.25	2.70	0.71	3.30	3.70	2.72	2.63
Feb	0.58	3.63	0.02	1.79	9.05	3.01	1.86	1.84	2.43	2.03	2.40	2.11
Mar	12.32	12.64	8.89	16.06	12.18	12.42	2.68	2.92	3.60	3.86	3.00	3.21
Apr	7.49	9.64	12.17	15.01	5.42	9.95	2.56	3.00	3.61	3.48	3.96	3.32
May	8.15	9.27	11.92	16.09	9.63	11.01	2.88	3.20	3.54	3.67	3.69	3.40
Jun	9.07	8.14	10.26	13.06	2.38	8.58	2.82	3.44	4.15	3.96	3.80	3.63
Jul	6.41	7.20	7.18	15.88	3.98	8.13	3.34	4.30	5.46	4.72	4.65	4.49
Aug	8.45	11.14	13.10	9.65	4.75	9.42	3.73	5.04	6.00	5.20	5.16	5.03
Sep	14.01	12.50	15.45	8.63	3.67	10.85	4.04	5.39	6.02	5.47	5.35	5.25
Oct	15.09	15.39	13.72	6.29	3.87	10.87	4.15	4.82	5.26	4.88	4.63	4.75
Nov	15.20	15.33	14.65	8.15	3.82	11.43	3.31	3.85	4.04	3.94	6.64	4.36
Dec	15.70	9.15	2.84	4.14	3.13	6.99	3.05	3.60	4.14	2.64	2.98	3.28
Total	116.64	124.00	110.22	126.82	61.88	107.91	37.12	42.11	51.55	47.55	48.98	45.46

Source: Reuse Monitoring Report(DRI)

Table B-1-12 Reuse Pump Discharge Data(2)

Unit: MCM

Month	Delingat						Edko					
	(1988)	(1989)	(1990)	(1991)	(1992)	Average	(1988)	(1989)	(1990)	(1991)	(1992)	Average
Jan	11.17	13.18	15.20	13.17	17.16	13.98	10.06	9.60	11.29	12.97	9.06	10.60
Feb	10.91	7.81	10.64	10.94	12.18	10.50	9.29	0.00	1.79	0.00	2.26	2.67
Mar	16.13	11.69	13.50	14.56	16.39	14.45	11.26	10.09	14.69	20.14	6.43	12.52
Apr	14.38	12.98	15.80	13.76	16.59	14.70	9.82	12.79	15.06	17.73	10.49	13.18
May	15.90	13.11	13.80	14.31	15.95	14.61	7.67	10.39	14.14	15.04	11.76	11.80
Jun	14.37	13.53	13.60	12.77	13.87	13.63	13.76	13.87	19.10	29.02	17.90	18.73
Jul	14.55	15.29	15.80	13.88	15.63	15.03	15.99	17.94	28.16	23.97	27.02	22.62
Aug	15.46	17.98	17.37	20.37	16.62	17.56	16.32	17.64	26.72	26.85	29.26	23.36
Sep	14.16	18.28	18.26	19.59	19.66	17.99	15.52	13.73	24.01	32.10	30.34	23.14
Oct	15.08	19.66	18.04	19.85	20.63	18.65	17.01	15.75	20.22	26.32	22.65	20.39
Nov	13.67	16.40	5.05	17.07	17.12	13.86	10.32	15.58	3.99	17.20	8.20	11.06
Dec	12.99	16.05	4.99	18.36	16.99	13.88	15.21	11.29	14.65	19.01	12.27	14.49
Total	168.77	175.96	162.05	188.63	198.79	178.84	152.23	148.67	193.82	240.35	187.64	184.54

Source: Reuse Monitoring Report(DRI)

Table B-1-13 Total Reuse Pump Discharge Data(using actual)

Unit: MCM

Month	Mariut No. 1 (1988-92)	Boustain (1988-92)	Delingat (1988-92)	Edko (1988-92)	Delingat Extension (1993)	Total
Jan	5.25	2.63	13.98	10.60	3.65	36.11
Feb	3.01	2.11	10.50	2.67	2.61	20.90
Mar	12.42	3.21	14.45	12.52	3.36	45.96
Apr	9.95	3.32	14.70	13.18	4.31	45.46
May	11.01	3.40	14.61	11.80	4.94	45.76
Jun	8.58	3.63	13.63	18.73	4.13	48.70
Jul	8.13	4.49	15.03	22.62	4.97	55.24
Aug	9.42	5.03	17.56	23.36	6.54	61.91
Sep	10.85	5.25	17.99	23.14	6.36	63.59
Oct	10.87	4.75	18.65	20.39	5.62	60.28
Nov	11.43	4.36	13.86	11.06	2.75	43.46
Dec	6.99	3.28	13.88	14.49	2.24	40.88
Total	107.91	45.46	178.84	184.56	51.47	568.24

Source: Reuse Monitoring Report(DRI)

Note: For Delingat extension only one year data was available

FIGURE B-2-1 MONTHLY RAINFALL OF SELECTED YEARS

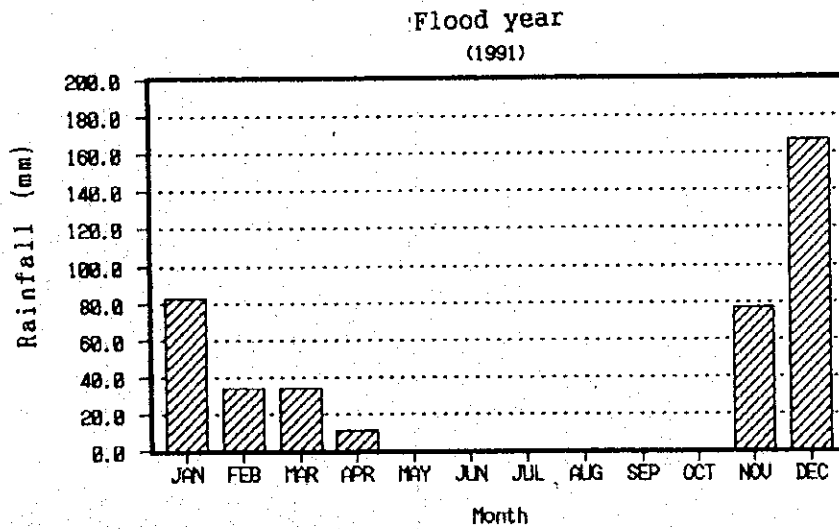
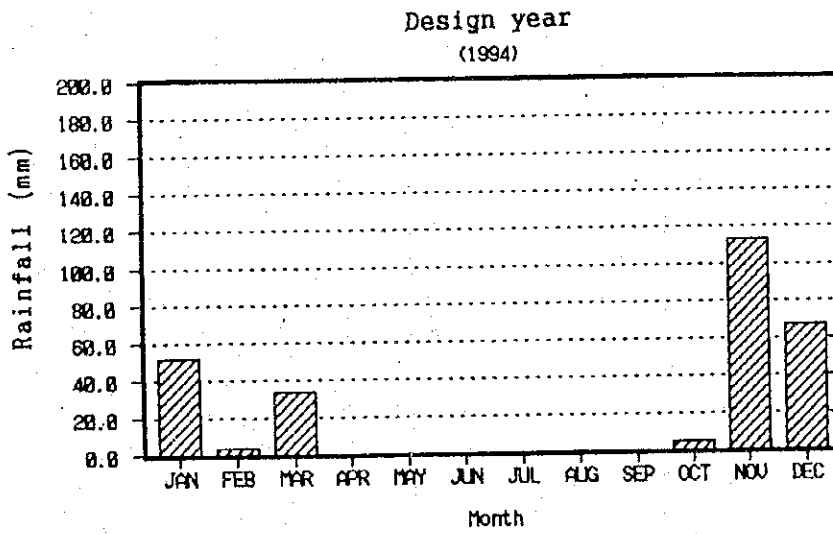
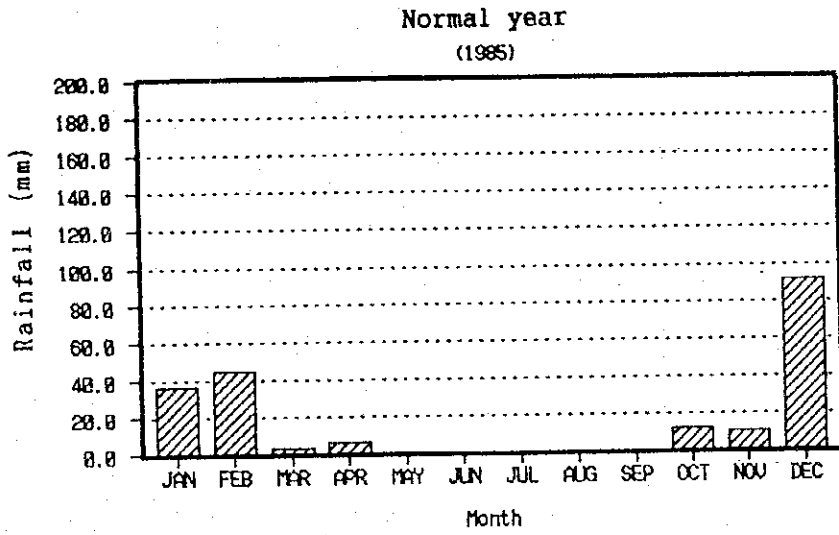


FIGURE B-2-2 CALCULATED DAILY RAINFALL RUNOFF (Normal year, 1985)

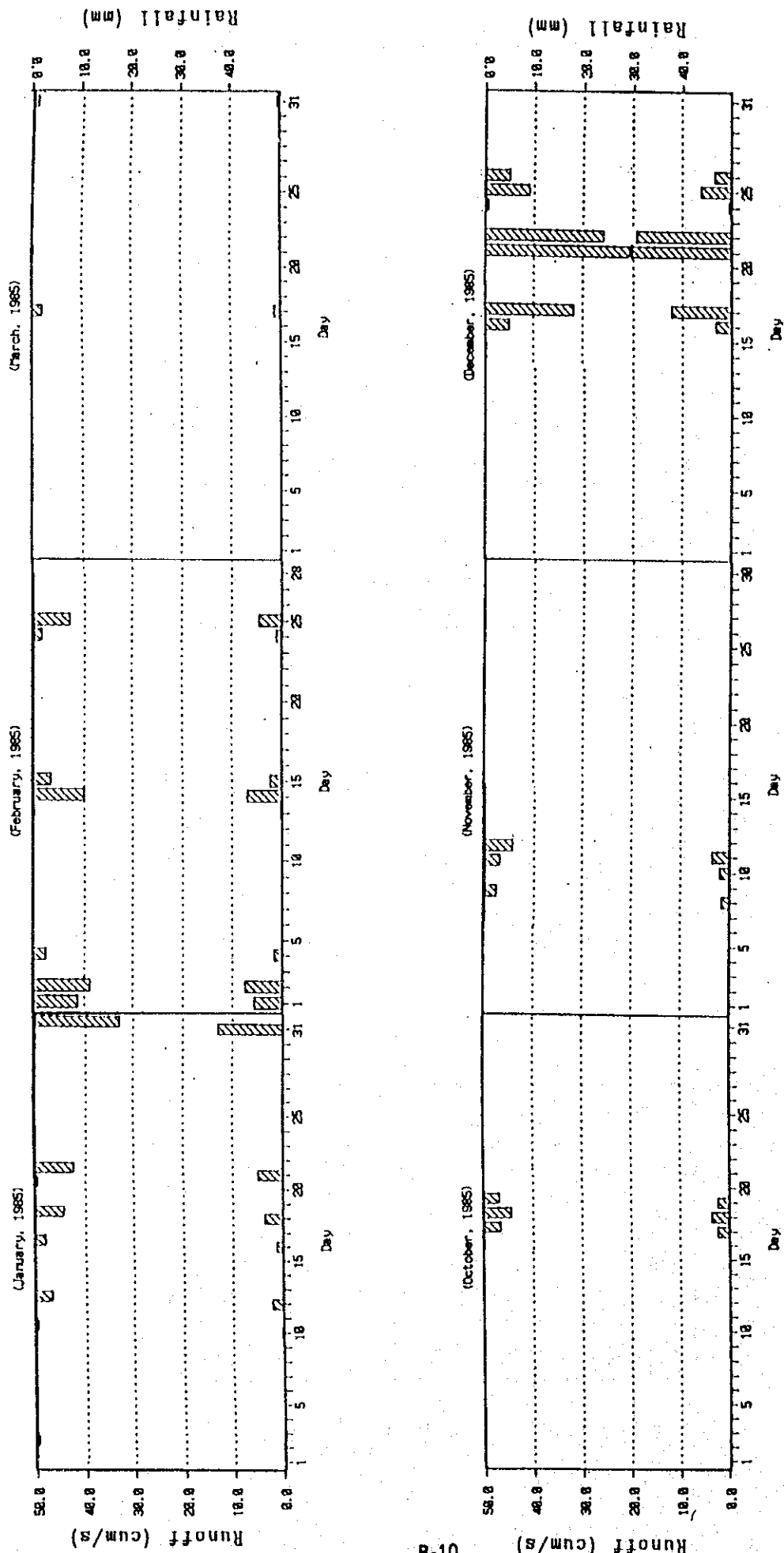


FIGURE B-2-3 CALCULATED DAILY RAINFALL RUNOFF (Design year, 1994)

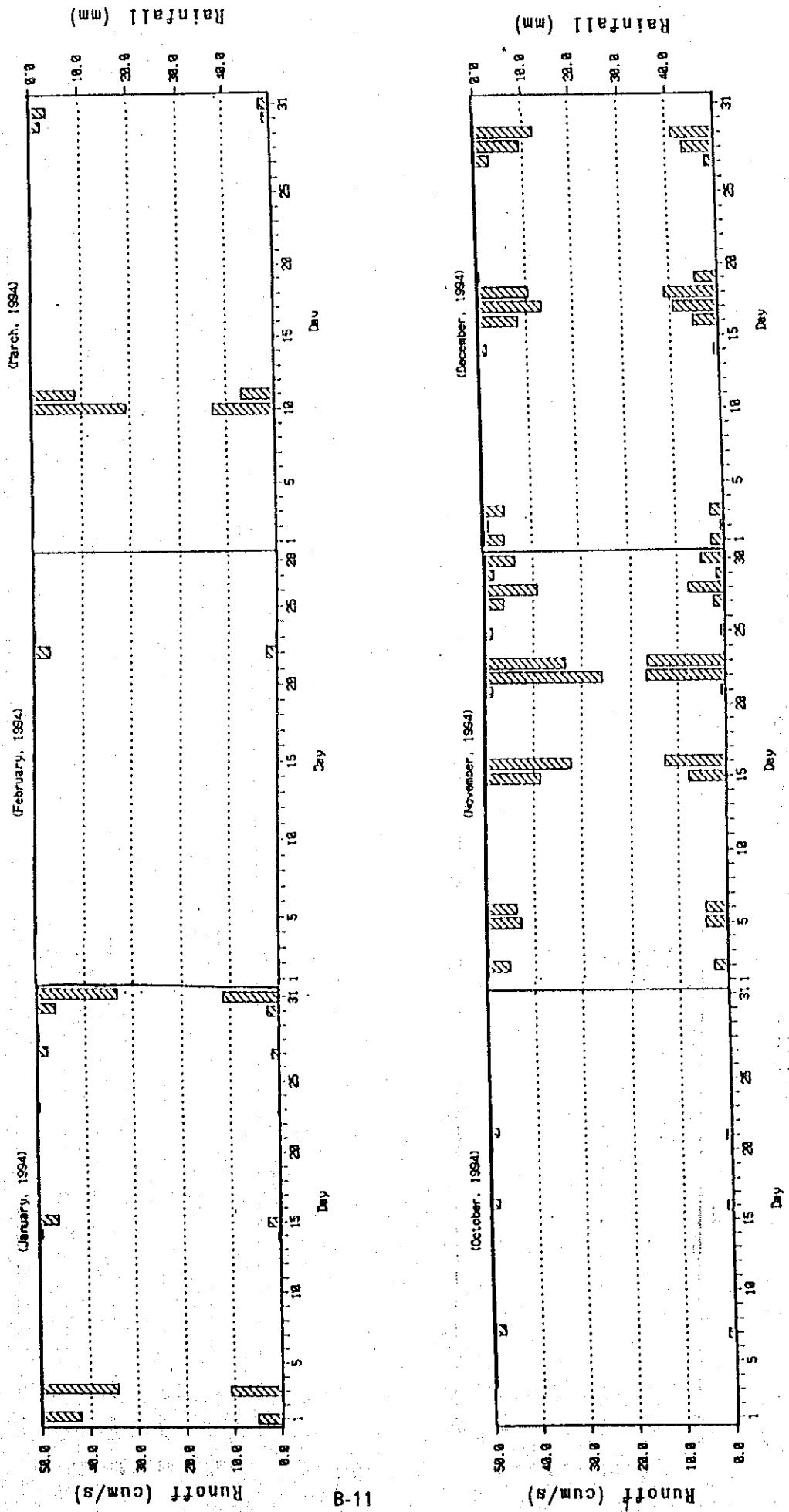
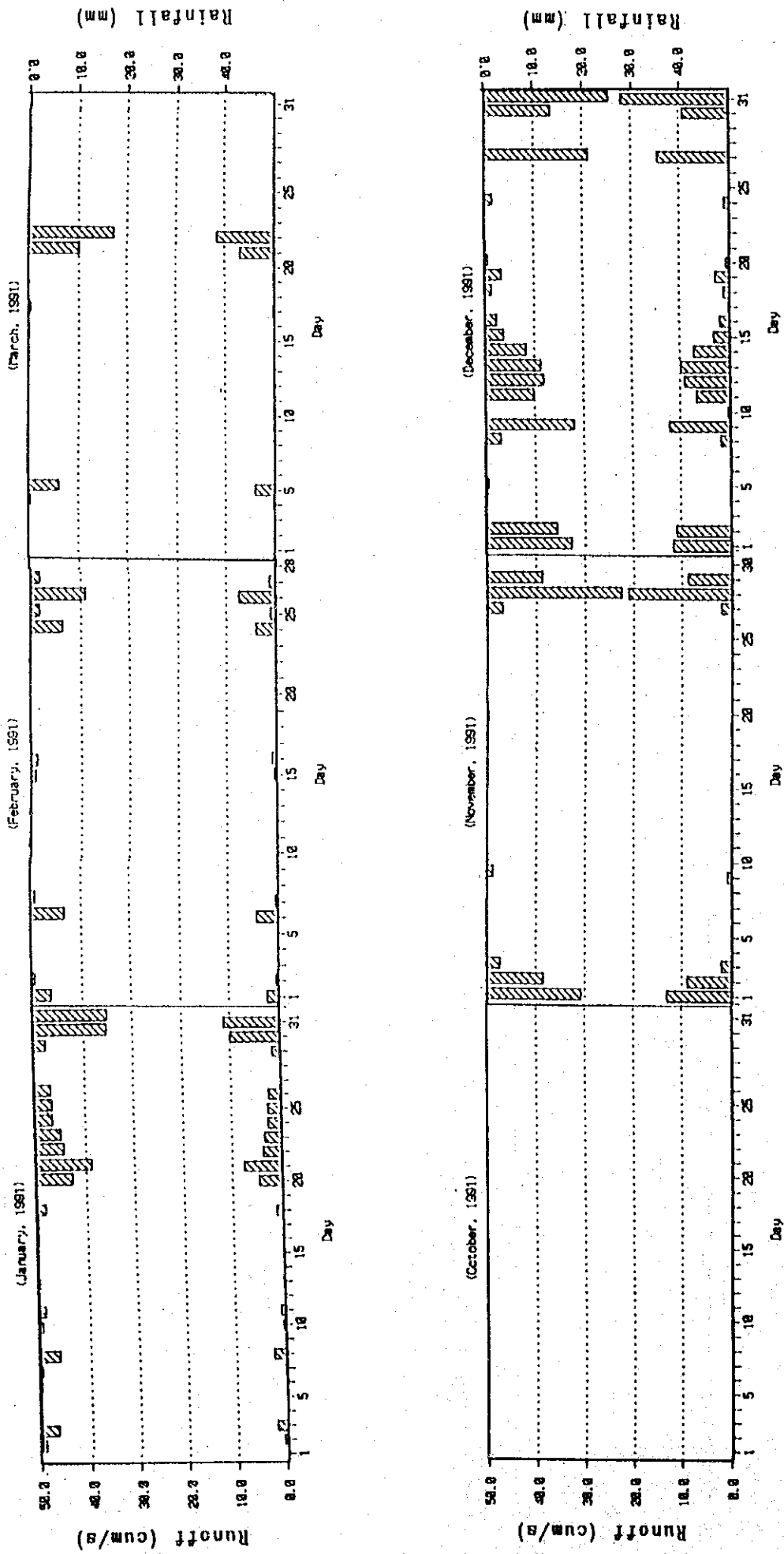


FIGURE B-2-4 CALCULATED DAILY RAINFALL RUNOFF (Flood year, 1991)



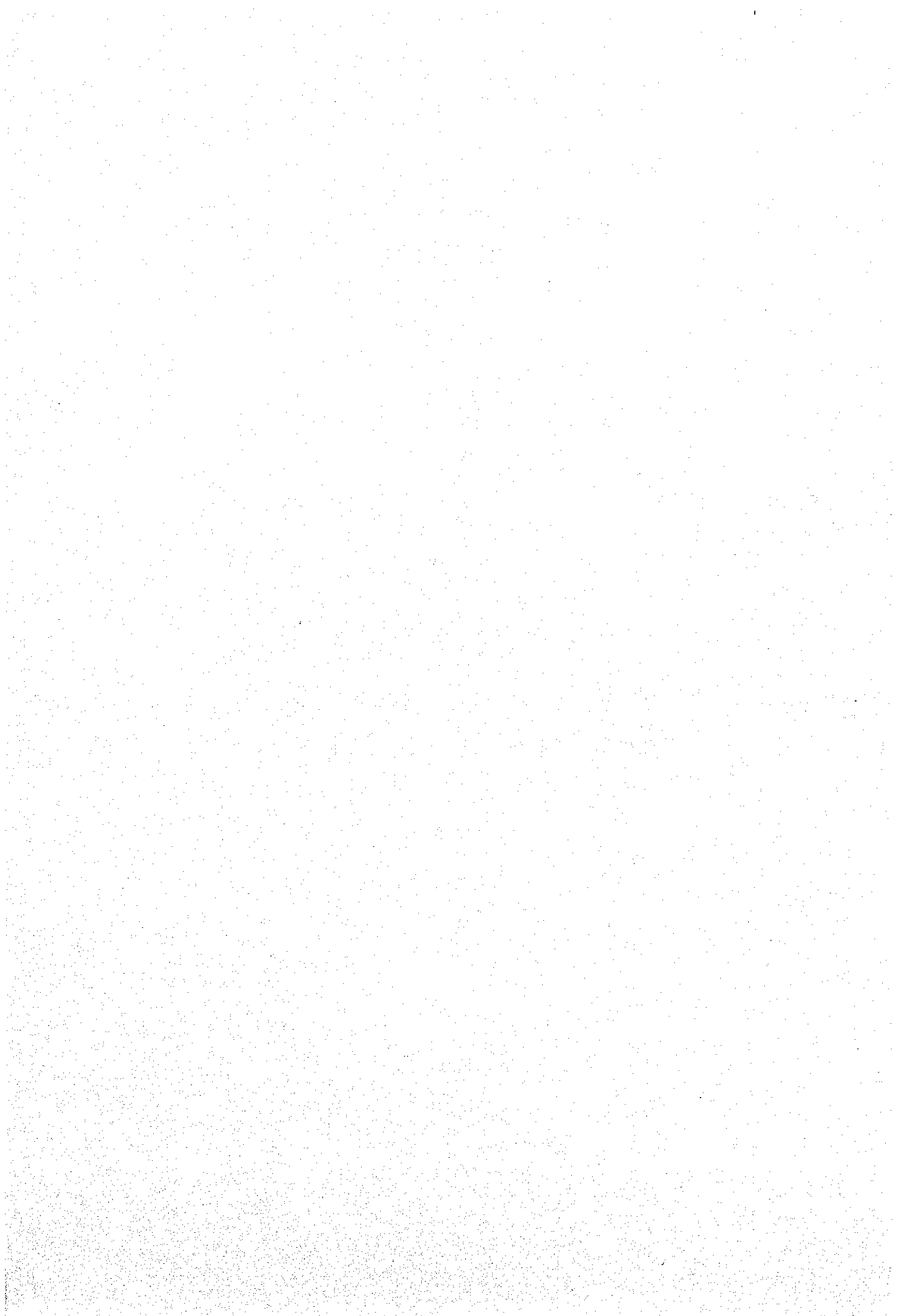


FIGURE B-2-5 RECORDED WATER LEVEL OF OMOUM MAIN DRAIN(infront of Siphon)  
 (September - December, 1994)

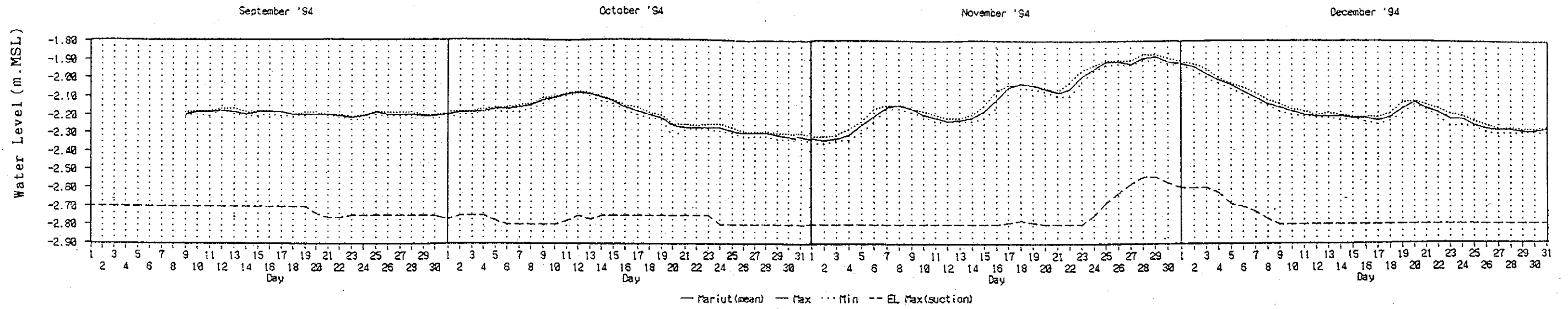
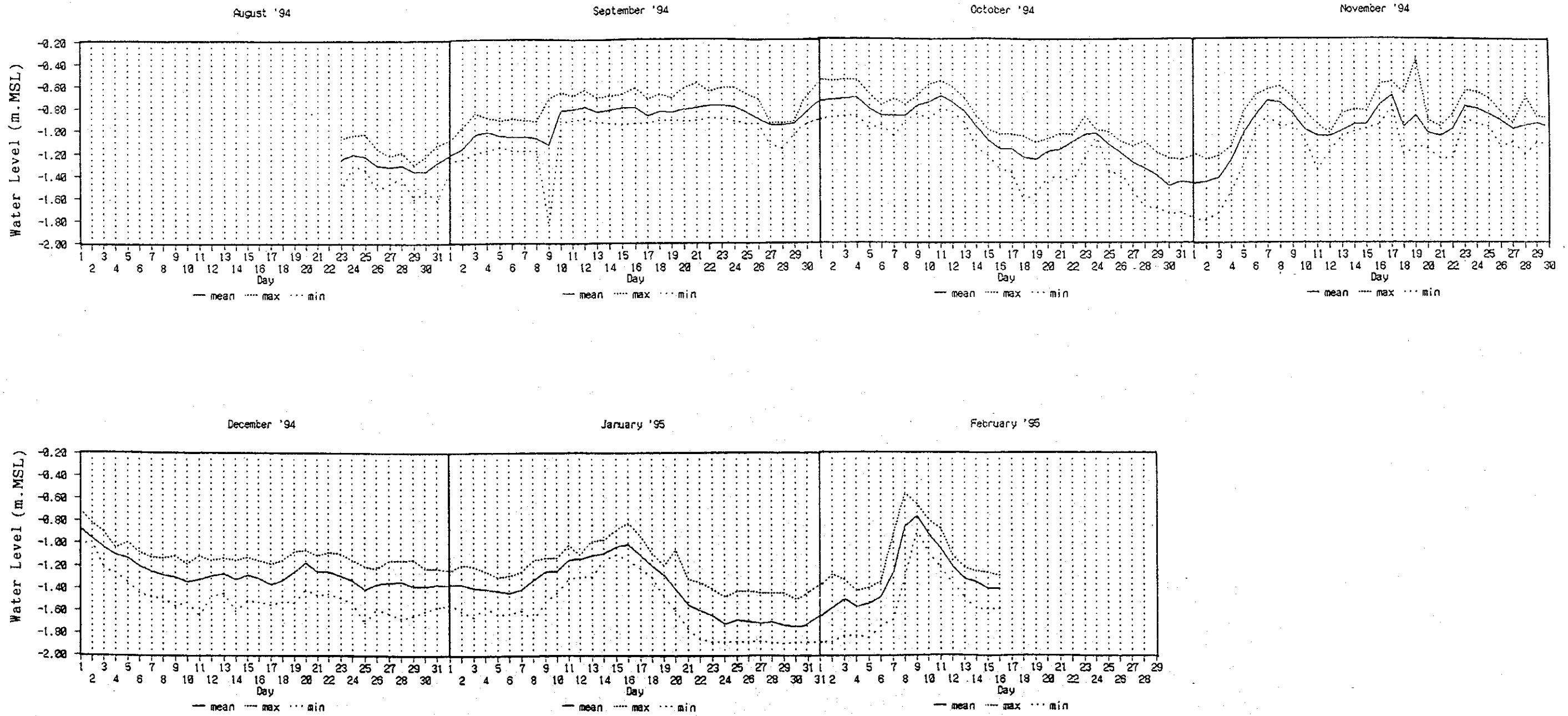




FIGURE B-2-6 RECORDED WATER LEVEL OF OMOUM MAIN DRAIN(delivery side of Abu Hommos P.S.)  
(August '94 - February, '95)



## **C. SOIL AND LAND-USE**

## ANNEX C. SOIL AND LAND-USE

### C-1. Master Plan

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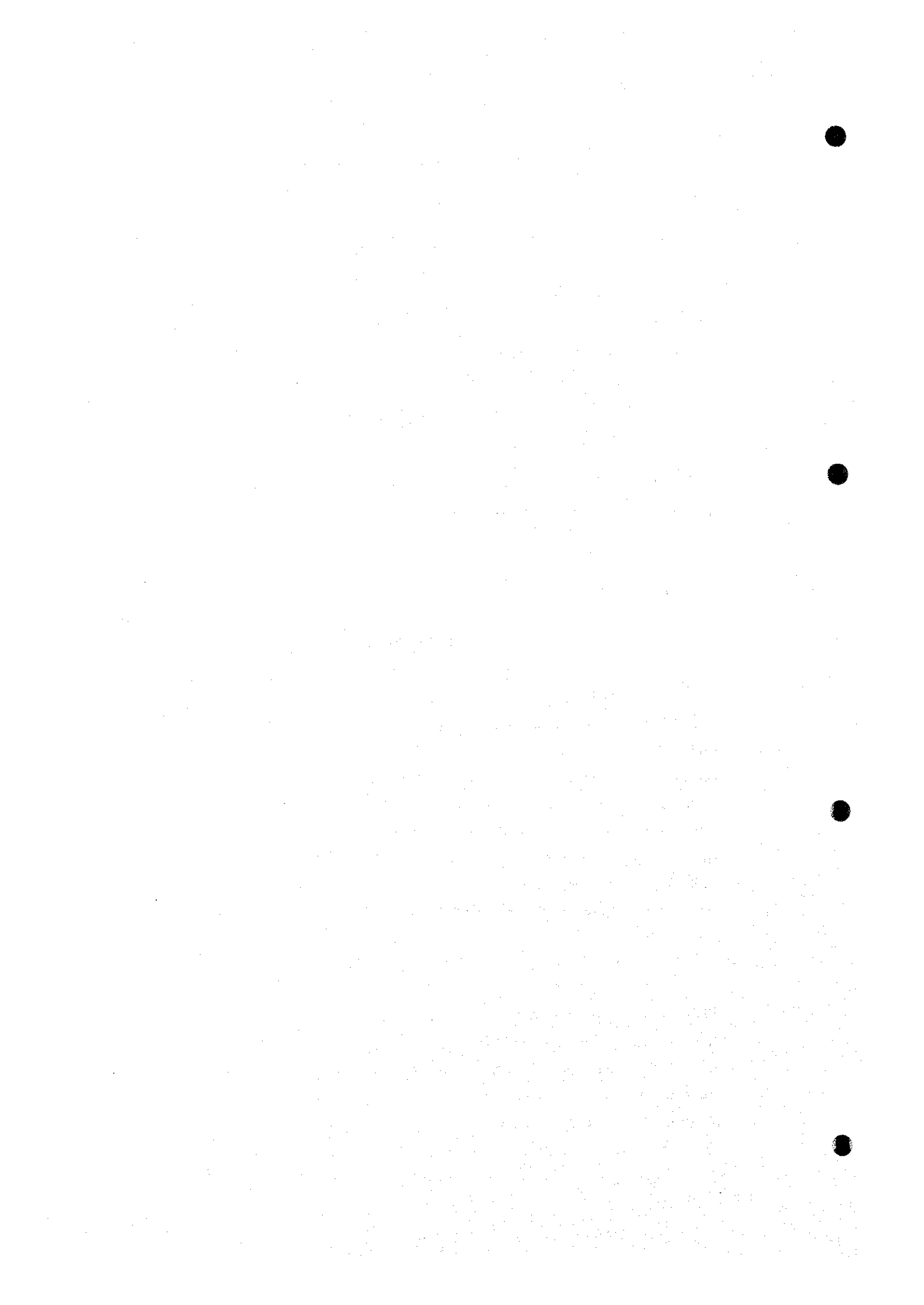


Table C-1-1 District-wise Land Area by Land Class

District	Total	Cultivated Area					Land of 5th and 6th Land													
		Subtotal		2nd Class		3rd Class		4th Class		5th Class		6th Land								
		(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)							
Dalangat	38,921	(100.0)	25,443	(65.4)	0	(0.0)	3,145	(8.1)	16,044	(41.2)	6,254	(16.1)	11,303	(29.0)	128	(0.3)	1,885	(4.8)	162	(0.4)
Damanhur	39,127	(100.0)	32,406	(82.7)	0	(0.0)	4,436	(11.3)	26,088	(66.5)	1,932	(4.9)	2,997	(7.7)	314	(0.8)	3,394	(8.7)	16	(0.0)
Hosh Esa	27,545	(100.0)	14,787	(53.7)	0	(0.0)	1,187	(4.3)	7,706	(28.0)	5,894	(21.4)	10,309	(37.4)	565	(2.1)	1,882	(6.8)	2	(0.0)
Abu Hommos	52,742	(100.0)	40,132	(76.1)	0	(0.0)	11,070	(21.0)	23,347	(44.3)	5,715	(10.8)	5,969	(11.3)	3,979	(7.5)	2,448	(4.6)	214	(0.4)
Abu El Matameer	70,716	(100.0)	22,116	(31.3)	0	(0.0)	3,119	(4.4)	15,129	(21.4)	3,868	(5.5)	44,820	(63.4)	3,780	(5.3)	0	(0.0)	0	(0.0)
Kafr El Dawar	59,476	(100.0)	42,980	(72.4)	2,231	(3.8)	7,831	(13.2)	23,785	(40.0)	9,133	(15.4)	3,208	(5.4)	9,814	(16.5)	3,404	(5.7)	70	(0.1)
Total	288,527	(686,969)	177,864	(423,486)	2,231	(5,312)	30,788	(73,305)	112,049	(266,783)	32,796	(78,086)	78,606	(187,157)	18,580	(44,238)	13,013	(30,983)	464	(1,105)
(%)	(100.0)	(61.7)	(0.8)	(10.7)	(38.8)	(11.4)	(27.3)	(6.4)	(4.5)	(0.2)										

Source: Soil Survey of Egypt, 1957

Table C-1-2 Land Use by District in the Study Area ( 1993 )

District	Total		Subtotal (ha)	Cultivated Ar- ea More than Twice a Year (ha)	Once a Year (ha)	Culturable Wasted, Housing and Others (ha)
	(ha)	(%)				
Diangat (%)	38,883 ( 100.0 )		32,451 ( 83.5 )	25,028 ( 64.4 )	7,423 ( 19.1 )	6,432 ( 16.5 )
Damanhur (%)	40,215 ( 100.0 )		32,685 ( 81.4 )	32,605 ( 81.2 )	80 ( 0.2 )	7,530 ( 18.6 )
Hosh Esa (%)	27,600 ( 100.0 )		22,076 ( 80.0 )	19,240 ( 69.7 )	2,836 ( 10.3 )	5,524 ( 20.0 )
Abo Hommos (%)	49,574 ( 100.0 )		38,748 ( 78.1 )	35,962 ( 72.5 )	2,786 ( 5.6 )	10,826 ( 21.9 )
Abo El Matamee (%)	43,563 ( 100.0 )		34,799 ( 79.8 )	22,586 ( 51.8 )	12,213 ( 28.0 )	8,764 ( 20.2 )
Kafr El Dawar (%)	59,457 ( 100.0 )		41,555 ( 69.8 )	38,139 ( 64.1 )	3,416 ( 5.7 )	17,902 ( 30.2 )
Total ( feddan )	259,292 ( 617,362 )		202,314 ( 481,700 )	173,560 ( 413,238 )	28,754 ( 68,462 )	56,978 ( 135,662 )
(%)	( 100.0 )		( 78.0 )	( 66.9 )	( 11.1 )	( 22.0 )

Source : Computer Center, Behera Governorate

Table C-1-3 Land Use and Cropping Intensity ( 1993 )

Sub Drain	Total	Cultivated Area				Culturable Wasted Area	Others	% of Cultivated Area	Total Annual Cropped Area
		Subtotal	With Annual Crops	Orchard	Current Fallow				
	a=b+f+g (fed)	b=c+d+e (fed)	c (fed)	d (fed)	e (fed)	f (fed)	g (fed)	$h=(c+d)/(b+f) \times 100$ (%)	i (fed)
1. Abu Hommos	29,940	29,717	27,674	798	1,245	223	0	95.1	59,876
2. Shreshra	99,540	92,411	69,541	17,349	5,521	7,129	0	87.3	178,240
3. Truga	80,268	77,526	53,483	17,082	6,961	2,742	0	87.9	141,181
4. Dishudi	32,020	29,623	25,218	2,484	1,971	2,397	0	86.4	58,405
5. El Hares	63,330	47,190	47,190	0	0	6,730	9,410	87.5	90,137
6. Abis	8,822	6,963	6,297	0	666	0	1,859	90.4	13,926
7. Qalla	3,331	2,291	2,291	0	0	1,040	0	68.8	4,582
Total	317,251	285,721	231,694	37,663	16,364	20,261	11,269	88.0	546,347
(ha)	(133,245)	(120,002)	(97,311)	(15,818)	(6,872)	(8,510)	(4,733)		(229,466)

Note: The area in the above table are not equal to the physical net cultivated area in this study.

because the figures mean the registered area.

Source: Agricultural Statistics Zone Office, Behera, MALRF

Table C-1-4 Properties of Soil Profile

Kind of Soils	Distribution of Soil Particles by Size			Hydraulic Conductivity (cm/hr)	Water Saturation Capac.	Content of Calcium Carbonate (%)
	Clay (%)	Silt (%)	Sand & Others (%)			
1. Permeable Clay Soils	50~65	10~16	15~20	<0.1	75~95	>10
2. Calcareous Permeable Clay Soils with Rough Sand	40~60	10~23	(1) 5~16	<0.1	7~9	>10
3. Pemeable Clay Soils	40~55	17~30	15~25	<0.1	N.A	2~3
4. Loamy and Clayey Soils	±40	19~22	30~35	0.1~1.0	30~50	±3
5. Clay and Calcareous Clay Laom Soils	5~35	20~35	(2) 13~40	N.A	40~55	15~30
6. Sandy Loam and Loamy Sand Soils	10~25	±6	30~60	>1.0	30~35	1~3
7. Sandy Loam and Calcareous Loamy Sand Soils	5~20	1~11	(3) 30~55	0.1~1.0	30~35	7~17

Note : (1)....including coarse sand at 1~2%  
 (2)....including coarse sand at 1~20%  
 (3)....including coarse sand at 12~30%

Source : Soil Suevey, 1957~1973, Ministry of Agriculture



Table C-2-1 Present Land Use

( Unit: feddan )

Land Use	Area			Total
	Hager Ext.	Nahda	Mosharak	
Culturable Land				
- Cultivated Land	11,260	21,350	14,580	47,190 ( 74.5%)
- Culturable Waisted	3,570	790	2,370	6,730 ( 10.6%)
Subtotal	<u>14,830</u>	<u>22,140</u>	<u>16,950</u>	<u>53,920 ( 85.1%)</u>
Resident and Others	2,510	3,910	2,990	9,410 ( 14.9%)
Total	<u>17,340</u>	<u>26,050</u>	<u>19,940</u>	<u>63,330 ( 100.0%)</u>

Note: (1) The culturable area is referred to that figures which are collected from Nahda Irrigation Directorate, ID.  
 (2) The total areas are measured by planimeter.

Table C-2-2 Land Slope and Geomorphology

Class	Slope ( % )	Area (feddan) ( % )	Major Geomorphology
1	<0.05	28,240 ( 44.6% )	Recent lacustrine deposits
2	0.05 - 0.1	14,630 ( 23.1% )	Recent lacustrine deposits and Transitional area
3	0.10 - 0.20	10,580 ( 16.7% )	Transitional area
4	0.2 - 0.3	5,570 ( 8.8% )	Transitional area/ Pleistocene marine deposits
5	>0.30	4,310 ( 6.8% )	Pleistocene marine deposits
Total		63,330 (100.0% )	

Source: Study Team

Table C-2-3 Soil Taxonomic Unit

Symbol	Soil Association	Order	Suborder	Great Group	Area (feddan)	Area (%)
A1	Lacustrine	Entisol	Aquents	Fluvaquents	9,100	( 14.4 )
A2	Lacustrine	Entisol	Aquents	Fluvaquents	11,080	( 17.4 )
B	Lacustrine	Entisol	Aquents	Torrifluvents	4,900	( 7.7 )
C	Lacustrine	Aridisols	Orthids	Gypsiorthids	8,450	( 13.3 )
D	Lacustrine	Aridisols	Orthids	Salorthid	7,000	( 11.1 )
F1	Lacustrine/Marine	Entisol	Orthids	Torriorthids	5,260	( 8.3 )
F2	Lacustrine/Marine	Entisol	Orthids	Torriorthids	12,850	( 20.3 )
E	Marine	Aridisols	Orthids	Calciorthid	4,740	( 7.5 )
Total					63,380	( 100.0 )

Note: (1) The A1 soils are subdivided mainly by the groundwater level of A1 soils which is lower than that of A2.  
(2) The F1 soils are subdivided mainly by the value of ESP for F1 soils which is higher than that of F2.

Table C-2-4 Criteria of Land Capability Classification

Limiting Factors	Unit	Land Class				
		1 (100-80)	2 (80-60)	3 (60-40)	4 (40-20)	5 (<20)
1. Soil Salinity ( Ece )	dS/m	0-4	4-8	8-16	16-30	>30
2. ESP	%	0-8	8-15	15-30	>30	>30
3. EMP	%	0-8	8-15	15-30	>30	>30
4. Infiltration Rate	cm/hr	2.5-3.5	3.5-7.0	7.0-11.0	11.0-12.5	12.5-20.0
5. Texture		C.L.	S.C.	C.	L.S.	S.
		S.C.L.	S.L.			
		L.				
6. Groundwater Table	cm	>100	80-100	50-80	25-50	<25
7. Nutrient Availability	%	>3	1.5-3	0.8-1.5	0.5-0.8	<0.5
	- Available phosphate p.p.m	>20	15-20	10-15	5-10	<5
	- Exchangeable Potassium meq/100g	>1.2	0.6-1.2	0.3-0.6	0.1-0.3	<0.1

Table C-2-5 Land Capability Classification by Soil Taxonomic Unit

Item	A1	A2	B	C	D	E	F1	F2
1. Soil Salinity								
Class	2	2	2	2	5	2	2	1
Rating	80	80	80	80	20	80	100	100
2. ESP								
Class	3	4	4	4	5	3	3	2
Rating	60	40	40	40	20	60	60	80
3. EMP								
Class	2	3	2	3	2	2	1	2
Rating	80	60	80	60	80	80	100	80
4. Infiltration Rate								
Class	4	4	4	4	5	4	4	4
Rating	40	40	40	40	20	40	40	40
5. Texture								
Class	1	2	3	3	2	1	1	1
Rating	100	80	60	60	80	100	100	100
6. Groundwater Table								
Class	2	4	2	4	3	2	2	2
Rating	40	40	80	40	60	80	80	80
7. Nutrient Availability								
- O. M.								
Class	3	4	3	4	4	6	3	3
Rating	60	40	60	40	40	80	60	60
- Available phosphate								
Class	1	2	1	2	2	1	1	1
Rating	100	80	100	80	80	100	100	100
- Exchangeable Potassium								
Class	1	2	1	2	2	1	1	1
Rating	100	80	100	80	80	100	100	100
Final Rating	73	55	68	56	46	80	71	82
Class	2	3	2	3	4	1	2	1

Source: Study Team

Table C-2-6 Area by Land Class for Upland Crops

Land Class	Mapping Unit	Area	
		(feddan)	(%)
First Class: Soils very well suited for upland crops having no significant limitations that restrict their use	F2	12,850	( 20.3)
	E	4,740	( 7.5)
	Total	17,590	( 27.8)
Second Class: Soils well suited for upland crops, having slight limitations that restrict their use	A1	9,100	( 14.4)
	B	4,910	( 7.8)
	F1	5,260	( 8.3)
	Total	19,270	( 30.5)
Third Class: Soils moderately suited for upland crop having moderate limitations that reduce the choice of crops/or require special management	A2	11,030	( 17.4)
	C	8,440	( 13.3)
	Total	19,470	( 30.7)
Fourth Class: Soils poorly suited for upland crops, having severe limitations that restrict the choice of crops/or require very carefull management	D	7,000	( 11.0)
Total		63,330	( 100.0)

Source: Study Team

Table C-2-7 Land Capability Classification of Different Crops

Crops	Soil Txonomic Unit							
	A1	A2	B	C	D	E	F1	F2
1. Maize	2	3	2	4	1	1	2	1
2. Cotton	2	3	2	2	4	1	2	1
3. Beans	1	2	2	2	4	2	3	1
4. Wheat	1	2	2	2	3	1	2	1

Source: Study Team

Table C-2-8(1) Soil Salinity and Reaction( Auger Boring Samples, 1:2.5Water)

Auger No.	Ec dS/m	pH	Auger No.	Ec dS/m	pH	Auger No.	Ec dS/m	pH	Auger No.	Ec dS/m	pH
A 1 a	0.34	8.94	A 13 a	0.57	8.61	A 25 a	2.23	8.33	A 37 a	1.86	8.58
b	1.97	8.22	b	0.89	8.62	b	2.1	8.16	b	1.96	8.7
c	1.82	8.70	c	0.93	8.53	c	2.77	8.24	c	0.53	8.65
A 2 a	0.34	8.69	A 14 a	0.46	8.71	A 26 a	0.31	8.86	A 38 a	0.88	8.46
b	1.04	9.01	b	0.42	8.70	b	0.46	8.78	b	0.6	8.66
c	0.89	8.67	c	0.33	8.75	c	0.4	8.78	c	0.98	8.39
A 3 a	1.83	8.35	A 15 a	1.48	8.56	A 27 a	1.89	8.64	A 39 a	0.33	8.58
b	0.60	8.43	b	2.38	8.49	b	2.02	8.67	b	0.34	8.64
c	0.55	8.56	c	0.90	8.60	c	1.86	8.88	c	0.35	8.89
A 4 a	0.44	8.64	A 16 a	0.51	8.56	A 28 a	0.42	8.82	A 40 a	0.6	8.41
b	0.56	8.43	b	0.43	8.72	b	0.57	9.11	b	0.61	8.47
c	0.53	8.57	c	0.39	8.67	c	0.47	8.93	c	0.75	8.35
A 5 a	3.10	8.20	A 17 a	0.41	8.80	A 29 a	0.35	8.89	A 41 a	2.49	8.19
b	2.05	8.23	b	0.51	8.77	b	0.33	8.75	b	1.14	8.54
c	2.08	8.14	c	0.48	8.77	c	0.28	8.93	c	0.96	8.46
A 6 a	1.91	8.83	A 18 a	0.48	8.94	A 30 a	1.94	8.22	A 42 a	2.16	8.28
b	2.80	8.25	b	0.68	8.59	b	0.47	8.3	b	7.8	6.7
c	1.59	8.14	c	1.21	8.31	c	2.17	8.18	c	9.51	8.78
A 7 a	0.26	8.77	A 19 a	0.42	8.78	A 31 a	1.94	8.12	A 43 a	2.57	8.49
b	0.36	8.88	b	0.67	8.40	b	2.08	8.18	b	2.75	8.35
c	0.40	8.85	c	0.54	8.81	c	1.96	8.06	c	3.22	8.2
A 8 a	0.25	8.74	A 20 a	1.77	8.28	A 32 a	2.15	8.22	A 44 a	3.14	8.33
b	0.35	8.84	b	2.30	8.19	b	2.21	8.25	b	3	8.36
c	0.41	8.81	c	2.41	8.32	c	1.34	8.21	c	2.99	8.42
A 9 a	0.44	8.90	A 21 a	2.32	8.03	A 33 a	0.42	8.82	A 45 a	3	8.36
b	0.40	8.86	b	0.46	8.20	b	0.67	8.76	b	2.99	8.33
c	0.71	8.81	c	1.82	8.35	c	0.48	8.82	c	3.14	8.36
A 10 a	0.72	8.79	A 22 a	1.31	8.63	A 34 a	0.45	8.3	A 46 a	3.86	8.61
b	0.71	9.06	b	1.56	8.40	b	0.48	8.76	b	4.98	8.55
c	0.62	8.93	c	2.44	8.22	c	0.5	8.62	c	2.91	8.54
A 11 a	2.49	9.05	A 23 a	0.56	8.79	A 35 a	0.56	8.75	A 47 a	2.96	8.56
b	5.86	9.11	b	0.78	8.70	b	0.5	8.59	b	3.86	8.61
c	1.10	9.06	c	1.08	8.79	c	0.46	8.78	c	4.98	8.55
A 12 a	0.69	8.54	A 24 a	0.36	8.93	A 36 a	0.42	8.88	A 48 a	0.34	8.6
b	0.41	8.85	b	0.41	8.66	b	0.56	8.78	b	0.52	8.73
c	0.55	8.68	c	0.48	8.86	c	0.48	8.71	c	0.55	8.72

Table C-2-8(2) Soil Salinity and Reaction( Auger Boring Samples, 1:2.5Water)

Augar No.	Ec dS/m	pH	Augar No.	Ec dS/m	pH	Augar No.	Ec dS/m	pH	Augar No.	Ec dS/m	pH
A 49 a	1.31	8.71	A 61 a	0.71	8.7	A 73 a	3.07	8.42	A 85 a	1.02	8.54
b	1.21	8.81	b	0.68	9.06	b	2.95	8.49	b	1.06	8.62
c	1.32	8.78	c	0.45	9.23	c	2.86	8.65	c	1.1	8.6
A 50 a	1.06	8.54	A 62 a	0.99	8.38	A 74 a	1.08	8.86	A 86 a	6.14	8.61
b	0.86	8.55	b	1.13	8.67	b	1.51	9.04	b	8.35	8.64
c	0.94	8.62	c	1.22	8.78	c	1.62	8.69	c	9.24	8.59
A 51 a	3.46	8.66	A 63 a	0.5	8.69	A 75 a	1.62	8.69	A 87 a	1.67	8.33
b	4.08	8.64	b	0.77	8.63	b	1.51	9.04	b	1.09	8.21
c	0.46	8.7	c	0.48	9.35	c	1.08	8.86	c	1.23	8.41
A 52 a	0.73	8.34	A 64 a	2.77	8.51	A 76 a	1.37	8.28	A 88 a	1.23	8.76
b	0.96	8.35	b	2.4	8.96	b	1.24	8.3	b	1.49	8.89
c	2.12	8.32	c	2.83	8.5	c	1.31	8.29	c	1.5	8.97
A 53 a	0.73	8.24	A 65 a	0.44	8.57	A 77 a	0.82	8.95	A 89 a	2.07	8.28
b	0.96	8.25	b	0.45	8.53	b	3.04	8.24	b	2.54	8.65
c	2.12	8.32	c	0.4	8.97	c	1.59	8.22	c	2.6	8.51
A 54 a	0.58	8.25	A 66 a	3.01	8.4	A 78 a	4.45	8.64	A 90 a	2.17	8.54
b	0.97	8.18	b	3.25	8.54	b	4.53	8.54	b	2.43	8.65
c	1.11	8.78	c	3.57	8.54	c	4.64	8.32	c	2.6	8.45
A 55 a	3.02	8.38	A 67 a	0.42	9.15	A 79 a	9.56	8.49	A 91 a	7.79	8.61
b	2.32	9.01	b	0.71	8.37	b	19.89	8.38	b	5.37	8.4
c	1.04	8.58	c	0.68	8.99	c	13.65	8.64	c	8.18	8.53
A 56 a	3.12	8.28	A 68 a	1.78	8.4	A 80 a	3.06	8.92	A 92 a	2.23	8.49
b	2.41	9.11	b	1.66	8.49	b	3.54	8.67	b	0.93	8.84
c	1.14	8.48	c	1.29	8.58	c	4.68	8.59	c	3.35	8.42
A 57 a	3.81	8.92	A 69 a	2.06	8.45	A 81 a	3.3	8.31	A 93 a	0.42	9.01
b	4.96	8.28	b	2.68	8.31	b	1.32	8.38	b	2.3	8.62
c	4.18	8.36	c	2.91	8.41	c	2.9	8.48	c	0.72	8.63
A 58 a	2.23	8.74	A 70 a	2.64	8.27	A 82 a	3.98	8.25	A 94 a	1.93	8.45
b	0.66	8.65	b	3.07	8.2	b	1.08	8.67	b	1.86	8.83
c	2.77	8.88	c	2.38	8.31	c	4.55	8.09	c	2.95	8.56
A 59 a	0.52	8.66	A 71 a	0.55	8.71	A 83 a	0.98	8.67	A 95 a	2.15	8.51
b	0.53	8.81	b	0.68	8.86	b	1.11	8.68	b	1.49	8.8
c	0.49	8.79	c	1.03	9.03	c	1.02	8.8	c	1.65	8.68
A 60 a	0.51	8.77	A 72 a	0.57	8.71	A 84 a	1.97	8.64	A 96 a	1.79	8.37
b	0.89	9.08	b	0.67	8.66	b	1.85	8.89	b	1.15	8.44
c	0.86	9.11	c	1.13	8.96	c	1.92	8.82	c	1.45	8.41



Table C-2-8(3) Soil Salinity and Reaction( Auger Boring Samples, 1:2.5Water)

Auger No.	Ec dS/m	pH	Auger No.	Ec dS/m	pH	Auger No.	Ec dS/m	pH	Auger No.	Ec dS/m	pH
A 97 a	1.51	7.9	A 109 a	1.65	8.53	A 121 a	0.32	8.88	A 133 a	6.25	8.73
b	0.84	8.57	b	4.31	8.25	b	1.86	8.43	b	5.27	8.54
c	1.12	8.47	c	1.05	8.71	c	2.34	8.43	c	4.75	8.63
A 98 a	2.39	8.54	A 110 a	1.6	8.31	A 122 a	9.75	8.03	A 134 a	21.2	8.73
b	2.94	8.4	b	1.52	8.6	b	7.32	8.33	b	23	8.6
c	0.78	8.41	c	1.01	8.38	c	6.35	8.07	c	27	8.58
A 99 a	0.81	8.46	A 111 a	2.07	8.28	A 123 a	2.01	8.48	A 135 a	0.35	8.87
b	2.16	8.31	b	2.71	8.08	b	3.23	8.41	b	0.85	8.51
c	1.74	8.17	c	2.91	8.19	c	2.96	8.45	c	0.96	8.48
A 100 a	0.64	8.61	A 112 a	3.17	8.44	A 124 a	2.06	8.71	A 136 a	3.18	8.11
b	0.59	8.52	b	3.17	8.4	b	2.08	8.56	b	2.84	8.1
c	0.58	8.74	c	1.59	8.6	c	4.59	8.17	c	3.21	8.23
A 101 a	3.48	8.21	A 113 a	2.97	8.3	A 125 a	9.29	8.56	A 137 a	15.43	8.69
b	2.02	8.88	b	3.24	8.24	b	12.42	8.71	b	14.42	8.85
c	2.82	8.56	c	8.35	8.22	c	12.38	8.69	c	14.89	8.54
A 102 a	3.18	8.32	A 114 a	6.24	8.26	A 126 a	2.12	8.24	A 138 a	1.25	8.53
b	3.62	8.29	b	1.96	8.48	b	2.36	8.36	b	1.23	8.69
c	3.17	8.54	c	2.21	8.19	c	2.21	8.32	c	1.26	8.54
A 103 a	2.19	8.43	A 115 a	2.08	8.38	A 127 a	1.95	8.35	A 139 a	0.58	8.87
b	3.22	8.23	b	2.13	8.3	b	2	8.38	b	2.93	8.09
c	3.25	8.31	c	2.52	8.41	c	2.95	8.39	c	1.99	8.53
A 104 a	2.56	8.41	A 116 a	5.01	8.45	A 128 a	1.22	8.43	A 140 a	2.68	8.54
b	3.73	8.46	b	15.59	8.12	b	2.4	8.28	b	1.31	8.51
c	3.27	8.2	c	12.94	8.57	c	1.71	8.39	c	0.91	8.74
A 105 a	2.29	8.1	A 117 a	2.66	8.51	A 129 a	2.93	8.45	A 141 a	4.64	8.43
b	2.42	8.06	b	3.42	8.48	b	5.71	8.48	b	6.37	8.41
c	2.43	7.9	c	2.57	8.52	c	1.93	8.46	c	3.59	8.29
A 106 a	0.43	8.64	A 118 a	2.98	8.82	A 130 a	22.56	7.94	A 142 a	21.54	8.39
b	0.59	8.33	b	3.14	8.76	b	10.12	8.52	b	2.92	8.41
c	1.11	8.23	c	3.16	8.86	c	9.65	8.32	c	2.86	8.49
A 107 a	3.5	8.47	A 119 a	10.79	8.75	A 131 a	1.66	8.43	A 143 a	5.36	8.56
b	6.26	8.57	b	5.65	8.41	b	1.85	8.59	b	8.12	8.44
c	4.16	8.64	c	2.33	8.88	c	1.06	8.44	c	6.69	8.44
A 108 a	10.79	8.75	A 120 a	3.91	8	A 132 a	4.13	8.53	A 144 a	2.71	8.32
b	20.1	8.41	b	4.23	8.6	b	4.27	8.56	b	1.34	8.37
c	2.33	8.88	c	3.32	8.6	c	3.58	8.54	c	0.63	8.28

Table C-2-8(4) Soil Salinity and Reaction( Auger Boring Samples. 1:2.5Water)

Augur No.	Ec dS/m	pH	Augur No.	Ec dS/m	pH	Augur No.	Ec dS/m	pH	Augur No.	Ec dS/m	pH
A 145 a	2.55	8.43	A 159 a	0.51	8.67	A 173 a	4.52	8.3	A 187 a	0.41	8.52
b	2.27	8.24	b	0.57	8.12	b	0.48	9.1	b	2.47	8.79
c	1.83	8.42	c	0.93	8.78	c	0.53	8.7	c	2.4	8.83
A 148 a	4.42	8.49	A 160 a	1.28	8.6	A 174 a	2.55	8.4	A 188 a	2.95	8.37
b	4.63	8.45	b	0.86	8.53	b	0.63	8.62	b	3.75	8.36
c	4.08	8.02	c	1.11	8.42	c	1.72	8.94	c	3.17	8.28
A 147 a	2.98	8.7	A 161 a	1.31	8.73	A 175 a	2.69	8.29	A 189 a	0.7	8.45
b	4.08	8.37	b	1.24	8.76	b	2.7	8.41	b	4.87	8.29
c	6.72	8.54	c	1.83	8.47	c	2.76	8.25	c	0.51	8.68
A 148 a	0.78	8.75	A 162 a	1.08	8.55	A 176 a	3.12	8.58	A 190 a	0.53	8.55
b	0.94	8.51	b	2.38	8.41	b	4.48	8.58	b	0.86	8.52
c	0.56	8.85	c	2.73	8.41	c	6.82	8.63	c	2.74	8.61
A 148 a	13.1	8.6	A 163 a	1.74	8.48	A 177 a	3.17	8.78	A 191 a	1.93	8.62
b	25.76	8.79	b	0.41	9.27	b	4.45	8.45	b	2.45	8.2
c	25.32	8.85	c	0.36	9.12	c	4.68	8.54	c	0.49	8.49
A 150 a	1.31	8.6	A 164 a	0.81	8.91	A 178 a	7.1	8.79	A 192 a	2.29	8.47
b	3.23	8.56	b	0.73	8.88	b	7.99	8.64	b	2.71	8.51
c	3.33	8.5	c	1.88	8.58	c	9.05	8.33	c	0.55	8.56
A 151 a	0.79	9.08	A 165 a	2.22	8.73	A 179 a	2.08	8.3	A 193 a	2.14	8.45
b	0.78	8.71	b	4.62	8.84	b	1.43	8.28	b	1.05	8.87
c	1.51	9.14	c	5.62	8.87	c	2.02	8.43	c	1.19	8.33
A 152 a	0.64	9.12	A 166 a	0.77	8.8	A 180 a	0.96	8.42	A 194 a	1.18	8.54
b	0.81	8.22	b	0.86	8.82	b	1.23	8.52	b	0.78	9.01
c	2.68	8.73	c	0.88	8.38	c	0.51	8.51	c	1.18	8.82
A 153 a	5.3	8.4	A 167 a	4.35	8.49	A 181 a	0.32	8.7	A 195 a	0.48	8.56
b	7.49	8.4	b	5.43	8.51	b	0.41	8.63	b	0.35	8.62
c	6.07	8.66	c	5.33	8.58	c	1.52	8.19	c	3.35	8.8
A 154 a	1.37	8.46	A 168 a	0.53	8.51	A 182 a	0.27	8.69	A 198 a	0.48	8.74
b	0.98	8.73	b	0.43	8.35	b	0.37	8.78	b	1.44	8.77
c	1.59	8.59	c	0.48	8.48	c	0.25	8.8	c	0.44	8.79
A 155 a	2.58	8.14	A 168 a	0.45	8.6	A 183 a	1.98	8.51	A 197 a	0.88	8.39
b	2.85	8.27	b	0.51	8.73	b	4.51	8.45	b	1.9	8.25
c	2.25	8.34	c	1.2	7.89	c	0.37	8.59	c	0.62	8.57
A 156 a	1.47	8.25	A 170 a	3.45	8.45	A 184 a	0.82	8.51	A 198 a	0.86	8.45
b	2.13	8.46	b	4.38	8.47	b	3.49	8.45	b	0.55	8.44
c	1.17	8.63	c	0.76	8.42	c	1.41	8.58	c	2.72	8.38
A 157 a	14.32	8.81	A 171 a	2.71	8.3	A 185 a	1.86	8.48	A 199 a	0.8	8.51
b	15.48	8.6	b	2.76	8.33	b	2.15	8.43	b	0.51	8.57
c	13.59	8.73	c	2.85	8.42	c	1.13	8.64	c	0.39	8.68
A 158 a	1.33	8.18	A 172 a	1.01	8.45	A 186 a	23.4	8.53	A 200 a	0.37	8.47
b	0.83	8.67	b	2.61	8.35	b	26.3	8.48	b	0.28	8.62
c	0.87	8.42	c	1.97	8.38	c	20.2	8.38	c	0.32	8.71

Table C-2-9(1) Result of Physical and Chemical Analysis

Code No.	Description	ADw %	Sand %	Silt %	Clay %	Soil Texture
1	P1 (0-25)	1.10	68.40	7.60	24.00	Sandy clay loam
2	(25-60)	1.90	55.40	10.20	34.40	sandy clay loam
3	(60-90)	0.80	55.90	17.60	26.40	sandy clay loam
4	P2 (0-25)	2.70	65.30	5.10	29.50	sandy clay loam
5	(25-50)	1.50	68.30	5.10	26.60	sandy clay loam
6	(50-80)	2.10	52.80	7.70	39.60	sandy clay
7	(80-105)	0.90	48.30	7.60	44.10	sandy clay
8	P3 (0-25)	5.90	66.90	2.60	30.40	sandy clay loam
9	(25-60)	1.90	75.80	5.10	19.10	sandy loam
10	(60-100)	4.00	46.70	7.80	45.50	sandy clay
11	P4 (0-20)	9.20	52.20	16.40	31.40	sandy clay loam
12	(20-30)	13.10	70.30	19.80	9.90	sandy loam
13	(30-60)	8.20	77.00	16.20	6.80	loamy sand
14	(60-100)	SH.	SH.	SH.	SH.	SH.
15	P5 (0-30)	1.40	59.20	22.80	19.00	sandy loam
16	(30-55)	3.90	46.80	23.40	299.00	sandy clay loam
17	P6 (0-30)	2.60	80.80	5.10	14.10	sandy loam
18	(30-40)	SH.	SH.	SH.	SH.	SH.
19	(40-50)	0.70	66.00	7.60	26.40	sandy clay loam
20	(50-60)	SH.	SH.	SH.	SH.	SH.
21	(60-90)	4.00	80.50	2.60	16.90	sandy loam
22	(90-110)	0.70	53.40	10.10	36.50	sandy clay
23	P7 (0-30)	7.40	63.70	16.10	20.10	sandy clay loam
24	(30-40)	SH.	SH.	SH.	SH.	SH.
25	(40-70)	SH.	SH.	SH.	SH.	SH.
26	P8 (0-25)	4.10	70.70	8.40	21.00	clay loam
27	(25-60)	11.80	50.50	20.10	28.90	sandy clay loam
28	(60-100)	0.70	45.80	17.70	36.60	sandy clay
29	P9 (0-30)	0.90	54.40	23.50	22.20	sandy clay loam
30	(30-50)	4.30	93.10	0.00	6.90	sand
31	(50-60)	SH.	SH.	SH.	SH.	SH.
32	(60-100)	10.80	42.90	33.00	24.10	loam
33	(100-110)	SH.	SH.	SH.	SH.	SH.
34	P10 (0-30)	1.50	47.20	42.80	10.00	loam
35	(30-60)	14.10	43.50	14.50	42.00	clay
36	(60-90)	15.90	29.40	16.60	54.00	clay
37	(90-110)	SH.	SH.	SH.	SH.	SH.
38	P11 (0-30)	10.80	59.10	2.60	38.30	sandy clay
39	(30-60)	5.70	62.80	8.30	28.90	sandy clay loam
40	(60-90)	10.20	50.40	16.10	33.50	sandy clay loam
41	P12 (0-30)	7.20	17.50	24.40	58.20	clay
42	(30-50)	8.20	49.30	17.40	33.30	sandy clay loam
43	(50-70)	SH.	SH.	SH.	SH.	SH.
44	P13 (0-30)	16.00	48.2	13.3	38.5	sandy clay
45	(30-60)	6.30	62.70	8.30	29.00	sandy clay loam
46	(60-80)	SH.	SH.	SH.	SH.	SH.

SH. = Shells Layer

Table C-2-9(2) Result of Physical and Chemical Analysis

Code No.	Description	ADw %	Sand %	Silt %	Clay %	Soil Texture
47	P14 (0-20)	10.50	78.80	8.50	12.70	sandy loam
48	(20-60)	13.00	40.00	20.50	39.50	clay loam
49	(60-80)	SH.	SH.	SH.	SH.	SH.
50	P15 (0-30)	17.10	62.60	15.50	21.90	sandy clay loam
51	(30-60)	3.00	51.00	18.60	30.50	sandy clay loam
52	(60-90)	6.00	47.70	10.70	41.60	sandy clay
53	P16 (0-30)	7.20	40.80	22.00	37.10	clay loam
54	(30-60)	10.10	53.90	16.70	29.30	sandy clay loam
55	(60-90)	11.70	56.70	14.00	29.30	sandy clay
56	P17 (0-30)	11.70	59.80	15.60	24.60	sandy clay loam
57	(30-60)	3.80	55.00	18.00	27.00	sandy clay loam
58	(60-80)	2.90	59.50	18.30	22.20	sandy clay loam
59	P18 (0-15)	4.60	55.60	25.40	19.00	sandy loam
60	(15-30)	1.60	46.30	15.70	38.00	sandy clay
61	(30-70)	4.80	65.80	13.70	20.50	sandy clay loam
62	P19 (0-35)	9.60	53.40	14.10	32.40	sandy clay loam
63	(35-80)	12.90	34.00	16.80	49.10	clay
64	(80-100)	12.30	35.40	24.70	39.90	clay loam
65	P20 (0-30)	10.00	40.20	13.90	45.90	clay
66	(30-60)	11.30	56.10	15.00	28.80	sandy clay loam
67	(60-90)	SH.	SH.	SH.	SH.	SH.
68	P21 (0-25)	0.20	56.50	10.60	33.00	sandy clay loam
69	(25-60)	5.50	56.30	13.30	30.50	sandy clay loam
70	(60-100)	6.00	57.60	7.80	32.60	sandy clay loam
71	P22 (0-35)	4.30	53.10	8.00	38.80	sandy clay
72	(35-75)	7.10	55.90	8.00	36.10	sandy clay
73	(75-110)	6.80	56.00	8.50	35.50	sandy clay loam
74	P23 (0-30)	13.50	35.50	11.50	53.00	clay
75	(30-50)	14.70	55.80	15.20	29.10	sandy clay loam
76	(50-60)	1.00	75.80	7.60	16.50	sandy loam
77	(60-110)	1.50	55.60	5.10	39.30	sandy clay
78	P24 (0-15)	2.50	75.7	5.10	19.20	sandy loam
79	(15-35)	2.30	70.6	7.70	21.70	sandy clay loam
80	(35-60)	0.80	76.1	7.70	16.40	sandy loam
81	(60-85)	0.90	76	10.10	13.90	sandy loam
82	(85-120)	1.80	75.8	5.10	19.10	sandy loam
83	P25 (0-20)	6.70	53.30	18.70	28.00	sandy clay loam
84	(20-40)	0.90	53.30	15.10	31.50	sandy clay loam
85	(40-70)	3.70	70.20	7.80	22.00	sandy clay loam
86	(70-110)	3.70	70.20	5.20	24.60	sandy clay loam
87	P26 (0-30)	7.80	74.40	5.40	20.20	sandy clay loam
88	(30-60)	14.40	67.10	8.60	24.30	sandy clay loam
89	(60-90)	10.60	73.70	8.30	18.00	sandy loam

Table C-2-9(3) Result of Physical and Chemical Analysis

Code No.	Profile No.	Depth cm	pH	EC dS/m	Cations Meq/L				Anions Meq/L				CaCO3 %	Gypsum Req. Tons/Fed.	
					Ca	Mg	Na	K	Cl	HCO3	CO3	SO4			
1	P1	(0-25)	8.35	1.83	4.21	2.00	3.98	0.82	3.50	6.00	-	-	8.80	20.00	
2		(25-60)	8.43	0.60	3.00	1.00	3.19	0.62	2.00	5.00	-	-	0.10	12.40	
3		(60-90)	8.56	0.55	3.00	1.00	3.10	0.20	1.20	3.00	-	-	1.30	7.60	
4	P2	(0-25)	8.56	0.51	4.00	4.00	2.56	0.13	4.00	3.00	-	-	0.10	10.70	
5		(25-50)	8.72	0.43	4.00	1.00	2.17	0.05	4.30	7.00	0.10	-	0.10	17.80	
6		(50-80)	8.67	0.39	4.00	3.80	1.93	0.16	2.50	12.00	0.08	-	0.10	24.40	
7		(80-105)	8.63	0.45	2.00	5.00	1.80	1.14	6.00	6.00	0.07	-	0.10	34.20	
8	P3	(0-60)	8.94	0.48	4.00	1.00	2.17	0.40	6.10	5.00	1.20	-	3.70	9.80	
9		(25-60)	8.59	0.68	5.00	2.00	3.60	0.86	2.00	4.00	0.05	-	0.80	4.40	
10		(60-100)	8.31	1.21	4.00	1.00	3.85	0.22	2.50	2.00	-	-	7.60	6.70	
11	P4	(0-20)	8.03	2.32	12.00	16.00	3.60	0.09	3.00	4.00	-	-	16.20	6.20	
12		(20-30)	8.20	0.45	19.00	31.80	12.42	0.08	3.10	5.00	-	-	0.10	5.30	
13		(30-60)	8.35	1.82	4.00	2.00	17.39	0.24	5.20	5.00	-	-	8.00	9.80	
14		(60-100)	8.30	2.34	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	35.80
15	P5	(0-30)	8.52	0.37	3.00	5.00	2.87	0.19	5.50	2.00	-	-	0.10	12.90	
16		(30-55)	8.46	0.51	7.00	3.00	2.17	0.15	4.20	2.00	-	-	0.10	11.10	
17	P6	(0-30)	8.46	0.88	3.00	5.00	3.79	0.18	6.10	4.00	-	-	0.10	8.40	
18		(30-40)	8.66	0.60	6.50	3.00	2.37	0.15	12.10	10.00	0.02	-	0.10	12.40	
19		(40-50)	8.39	0.98	4.00	2.00	5.07	0.16	4.00	5.00	-	-	0.80	11.10	
20		(50-60)	8.77	0.88	4.00	1.00	4.14	0.15	3.20	6.00	0.03	-	0.10	10.20	
21		(60-90)	8.49	0.8	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	36.70
22		(90-110)	8.61	0.82	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	38.70
23	P7	(0-30)	8.19	2.49	3.00	2.00	3.48	0.09	17.00	5.00	-	-	2.90	8.90	
24		(30-40)	8.54	1.14	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	33.30
25		(40-70)	8.46	0.96	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	26.70
26	P8	(0-60)	8.77	0.51	1.20	0.80	2.46	0.13	5.10	6.00	0.08	-	0.10	8.90	
27		(25-60)	9.08	0.89	3.60	17.40	88.51	0.42	12.00	5.00	0.90	-	0.10	15.60	
28		(60-100)	9.11	0.86	2.20	34.80	1.86	0.69	4.20	5.00	1.10	-	0.10	5.30	
29	P9	(0-30)	8.69	0.50	3.00	38.00	3.60	0.35	7.50	6.00	0.08	-	0.10	8.40	
30		(30-50)	8.63	0.77	4.00	2.00	2.07	0.12	3.50	4.00	0.06	-	0.20	6.70	
31		(50-60)	9.35	0.48	SH.	SH.	SH.	SH.	16.25	5.00	1.20	-	0.10	4.40	
32		(60-100)	8.85	0.81	2.00	1.40	3.73	0.11	5.20	3.00	0.12	-	0.10	7.10	
33		(100-110)	8.66	0.97	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	32.30
34	P10	(0-30)	8.49	9.56	22.00	12.00	76.09	2.70	4.50	5.00	-	-	3.20	7.60	2.80
35		(30-60)	8.38	19.98	1.80	2.20	128.02	2.70	10.50	10.00	-	-	2.10	7.10	
36		(60-90)	8.46	13.65	6.40	18.60	123.19	2.70	6.50	4.00	-	-	2.10	13.30	
37		(90-110)	8.39	9.42	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	38.40
38	P11	(0-30)	8.61	6.14	16.00	11.00	31.16	0.07	35.00	6.00	0.08	-	0.10	6.70	
39		(30-60)	8.64	8.35	10.00	27.00	1.80	0.06	22.00	4.00	0.09	-	0.10	7.60	
40		(60-90)	8.59	9.24	1.00	2.30	0.22	0.05	11.00	5.00	0.06	-	0.10	8.00	
41	P12	(0-30)	8.61	7.79	14.00	33.00	61.59	0.34	12.50	5.00	0.06	-	3.50	13.30	4.80
42		(30-50)	8.64	5.37	22.00	17.00	1.00	0.18	5.50	3.00	0.07	-	2.40	11.60	
43		(50-70)	8.59	6.18	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	31.60
44	P13	(0-30)	8.61	2.15	3.20	1.80	10.35	0.67	28.00	4.00	0.08	-	0.10	8.90	
45		(30-60)	8.40	1.49	5.00	1.00	8.80	0.67	27.50	5.00	-	-	0.10	8.90	
46		(60-80)	8.53	1.65	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	38.00

Table C-2-9(4) Result of Physical and Chemical Analysis

Code No.	Profile No.	Depth cm	pH	EC dS/m	Cations Meq/L				Anions Meq/L				CaCO <sub>3</sub> %	Gypsum Req. Tons/Fed.
					Ca	Mg	Na	K	Cl	HCO <sub>3</sub>	CO <sub>3</sub>	SO <sub>4</sub>		
47	P14	(0-20)	8.30	2.97	11.20	11.80	4.14	1.18	10.10	5.00	-	0.50	10.20	
48		(20-60)	8.24	3.24	5.00	1.00	10.35	0.84	2.50	5.00	-	0.60	8.90	
49		(60-80)	8.22	8.35	SH.	SH.	SH.	SH.	SH.	SH.	SH.	SH.	35.80	
50	P15	(0-30)	8.45	5.01	17.00	11.00	36.96	3.04	4.00	10.00	-	3.50	8.70	
51		(30-60)	8.12	15.59	22.20	10.80	115.94	3.78	19.00	4.00	-	2.40	5.30	
52		(60-90)	8.57	12.94	6.20	9.80	96.27	2.77	13.50	4.00	0.09	0.10	7.60	
53	P16	(0-30)	8.51	5.65	12.00	3.00	18.63	1.42	2.50	5.00	0.08	3.50	8.40	
54		(30-60)	8.63	8.47	14.00	11.00	54.35	2.29	2.00	4.00	0.07	2.80	8.70	
55		(60-90)	8.55	5.88	10.00	2.00	52.80	2.58	33.50	4.00	0.09	2.10	28.70	
56	P17	(0-30)	8.75	10.79	6.00	20.00	76.09	2.70	12.10	2.00	0.10	3.90	11.10	4.40
57		(30-60)	8.41	20.10	27.00	28.00	173.91	5.40	11.20	4.00	-	1.80	9.30	
58		(60-80)	8.88	2.33	7.00	6.00	15.70	1.35	3.50	5.00	0.15	1.40	5.80	
59	P18	(0-15)	8.56	5.36	17.00	11.00	27.17	2.38	5.80	9.00	0.09	3.80	8.40	
60		(15-30)	8.44	8.12	14.00	2.00	42.39	2.02	5.50	3.00	-	1.20	12.40	
61		(30-70)	8.44	6.69	6.20	0.40	25.00	2.02	31.50	5.00	-	3.00	8.90	
62	P19	(0-35)	8.4	2.98	4.20	2.80	4.14	1.35	2.50	5.00	-	2.20	6.70	
63		(35-80)	8.37	4.06	7.00	22.00	13.89	2.38	2.00	10.00	-	2.80	2.20	
64		(80-100)	8.34	6.72	6.00	31.00	32.61	2.70	4.10	5.00	-	5.80	4.40	
65	P20	(0-30)	8.70	12.14	21.00	14.00	77.90	2.02	46.50	2.00	0.09	7.20	6.70	5.60
66		(30-60)	8.75	6.69	9.00	1.00	73.91	1.35	32.00	0.50	0.08	3.40	8.90	
67		(60-90)	8.45	5.91	SH.	SH.	SH.	SH.	SH.	SH.	SH.	5.90	36.40	
68	P21	(0-25)	8.70	0.32	3.00	1.00	0.77	0.23	7.00	10.00	0.10	0.10	26.20	
69		(25-60)	8.83	0.41	6.00	23.00	3.83	0.18	3.50	6.00	0.09	0.10	24.90	
70		(60-100)	8.19	1.52	9.00	1.00	1.74	0.13	3.00	7.00	-	0.50	13.80	
71	P22	(0-35)	8.67	0.51	6.00	2.00	2.70	1.99	3.50	5.00	0.09	0.10	4.40	
72		(35-75)	9.12	0.57	3.10	1.10	20.59	0.07	2.50	4.50	1.10	0.10	2.70	
73		(75-110)	8.78	0.93	1.00	1.40	4.14	0.11	2.00	4.00	0.09	0.30	19.60	
74	P23	(0-30)	8.52	6.14	3.00	21.00	30.43	2.02	13.00	5.00	0.10	0.10	6.20	
75		(30-50)	8.79	2.47	5.00	2.00	21.14	1.69	9.50	5.00	0.10	0.10	30.20	
76		(50-60)	8.83	2.40	3.00	1.00	7.25	1.01	4.00	2.00	0.09	1.80	13.30	
77		(60-110)	9.03	1.57	3.50	1.50	10.00	0.82	4.00	3.00	1.10	0.80	16.00	
78	P24	(0-15)	8.47	2.29	1.00	1.00	10.35	1.01	5.00	5.00	0.01	1.21	4.00	
79		(15-35)	8.51	2.71	3.00	1.00	3.52	1.01	12.50	3.00	0.03	1.10	4.40	
80		(35-60)	8.56	0.55	3.00	1.00	1.74	0.19	11.35	8.00	0.02	0.10	9.30	
81		(60-85)	8.80	0.55	1.00	2.30	24.64	0.13	6.00	5.00	0.08	0.10	8.40	
82		(85-120)	9.32	0.39	4.00	2.00	1.52	0.15	5.50	4.00	1.12	0.10	10.20	
83	P25	(0-20)	8.39	0.89	1.00	1.50	5.18	0.19	2.00	25.00	-	0.10	13.80	
84		(20-40)	8.25	1.90	11.00	19.00	3.31	0.19	5.00	4.00	-	1.00	19.10	
85		(40-70)	8.57	0.62	8.00	3.00	3.41	0.08	4.50	5.00	0.07	0.10	15.60	
86		(70-110)	8.69	0.66	1.20	3.20	4.10	0.16	1.00	2.00	0.08	0.30	10.20	
87	P26	(0-30)	8.32	2.77	4.50	2.50	60.39	2.36	2.50	6.00	-	1.30	17.80	0.80
88		(30-60)	8.20	4.19	13.00	22.00	12.68	1.01	8.00	6.00	-	2.70	16.90	
89		(60-90)	8.27	2.53	8.00	22.00	8.45	0.49	10.00	5.00	-	1.00	12.40	

FIGURE C-1-1 SOIL PROFILE CHARACTERISTICS

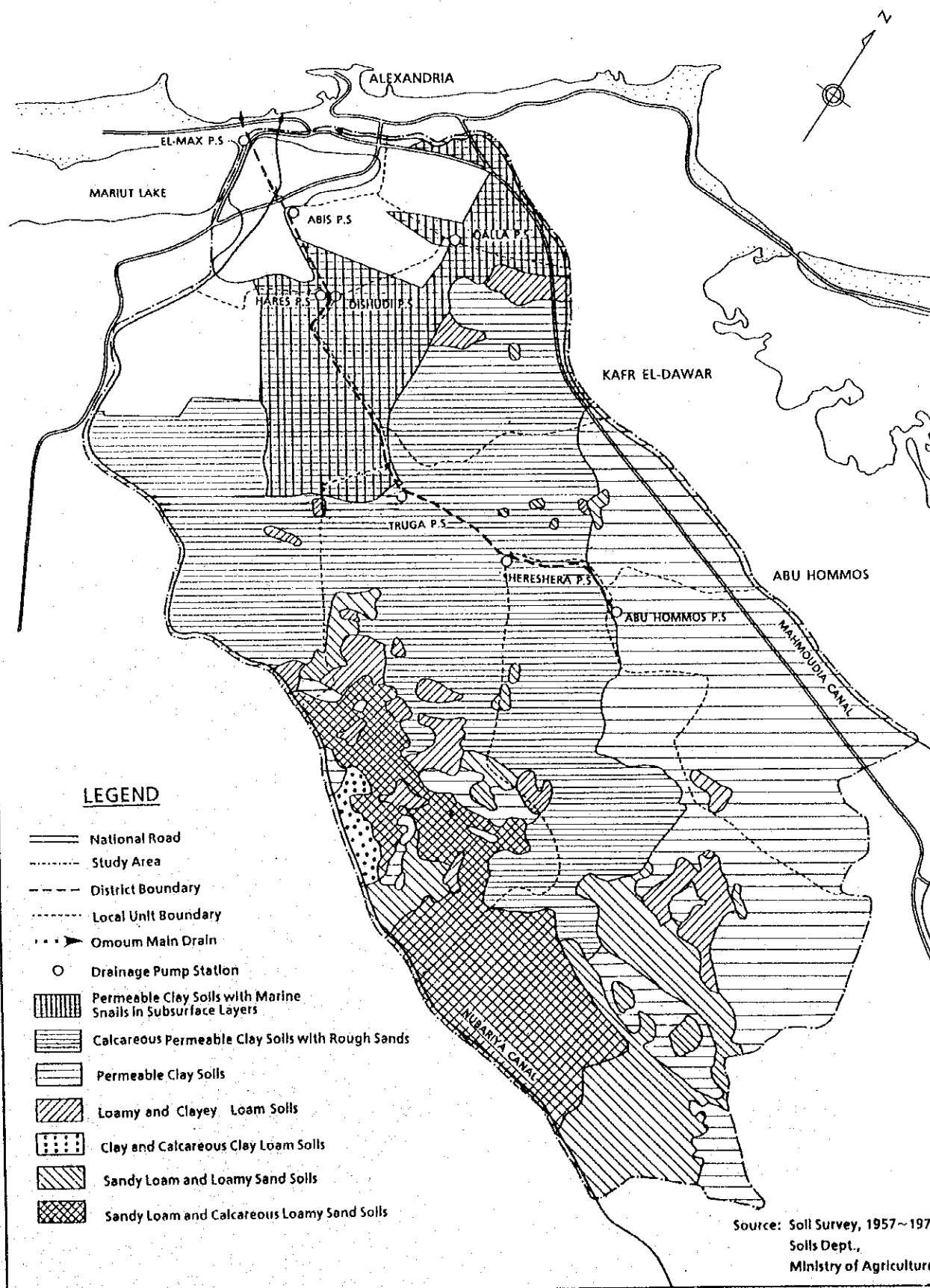


FIGURE C-1-2 DEPTH OF GROUNDWATER TABLE

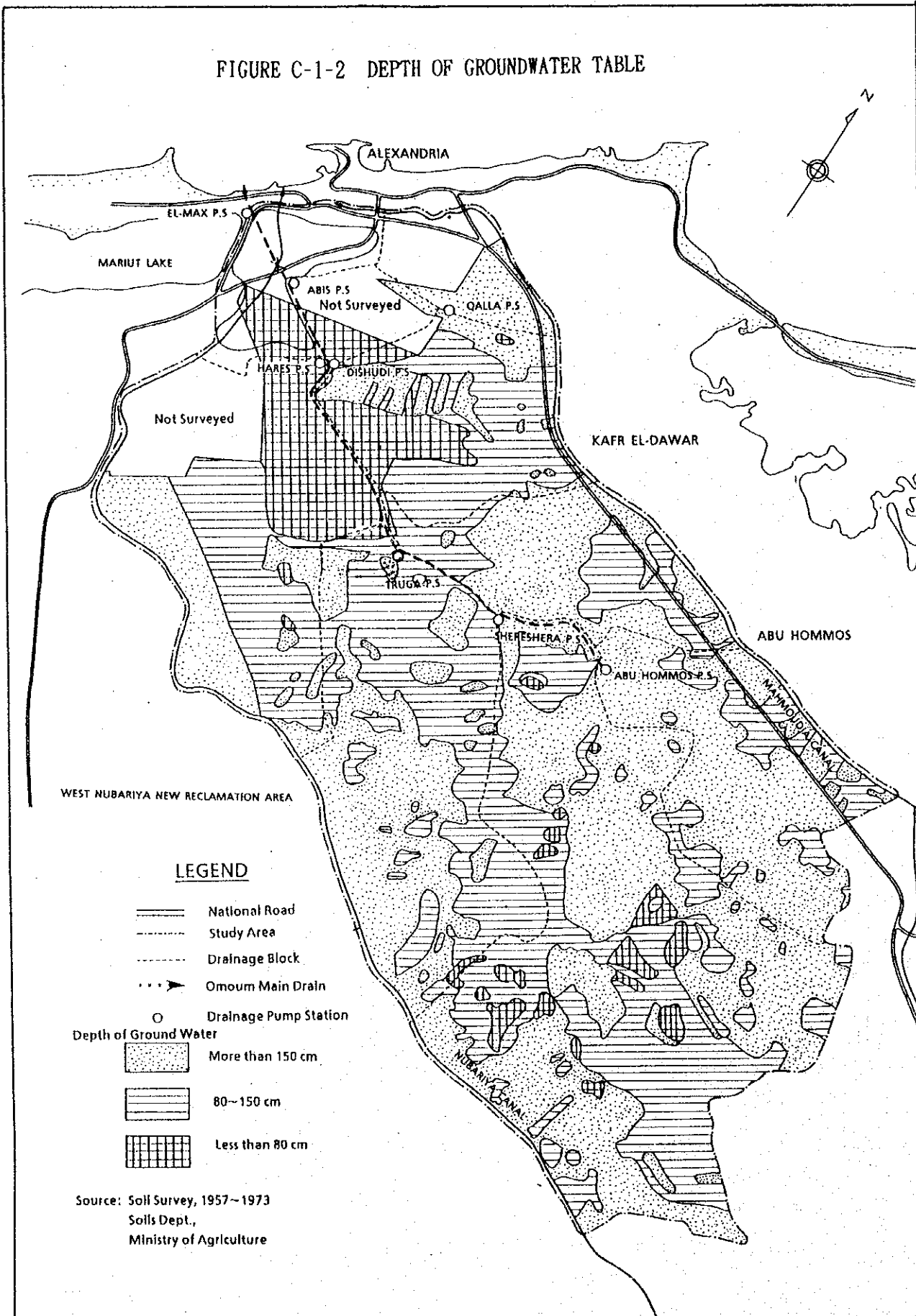




FIGURE C-1-3 SOIL SALINITY

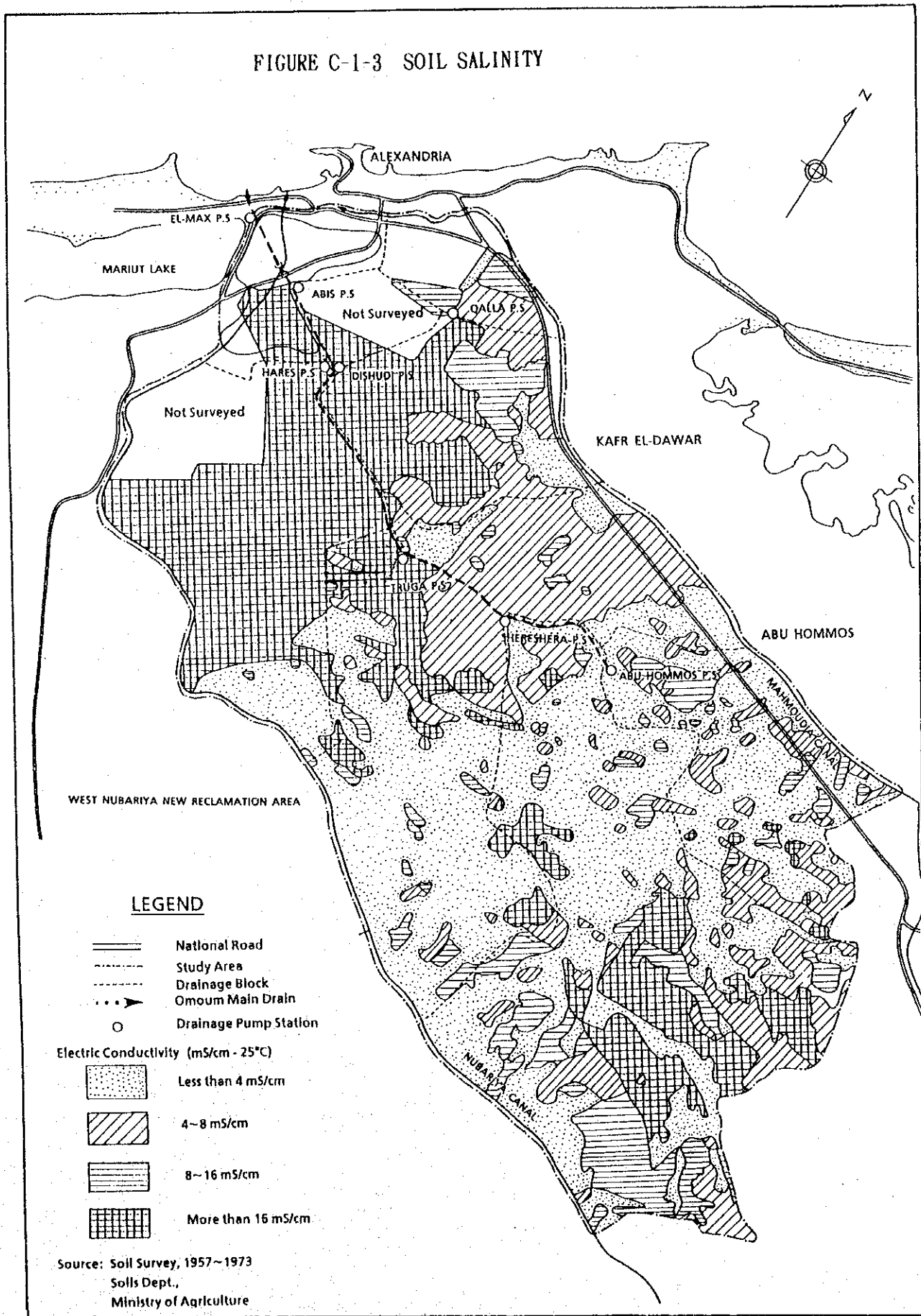
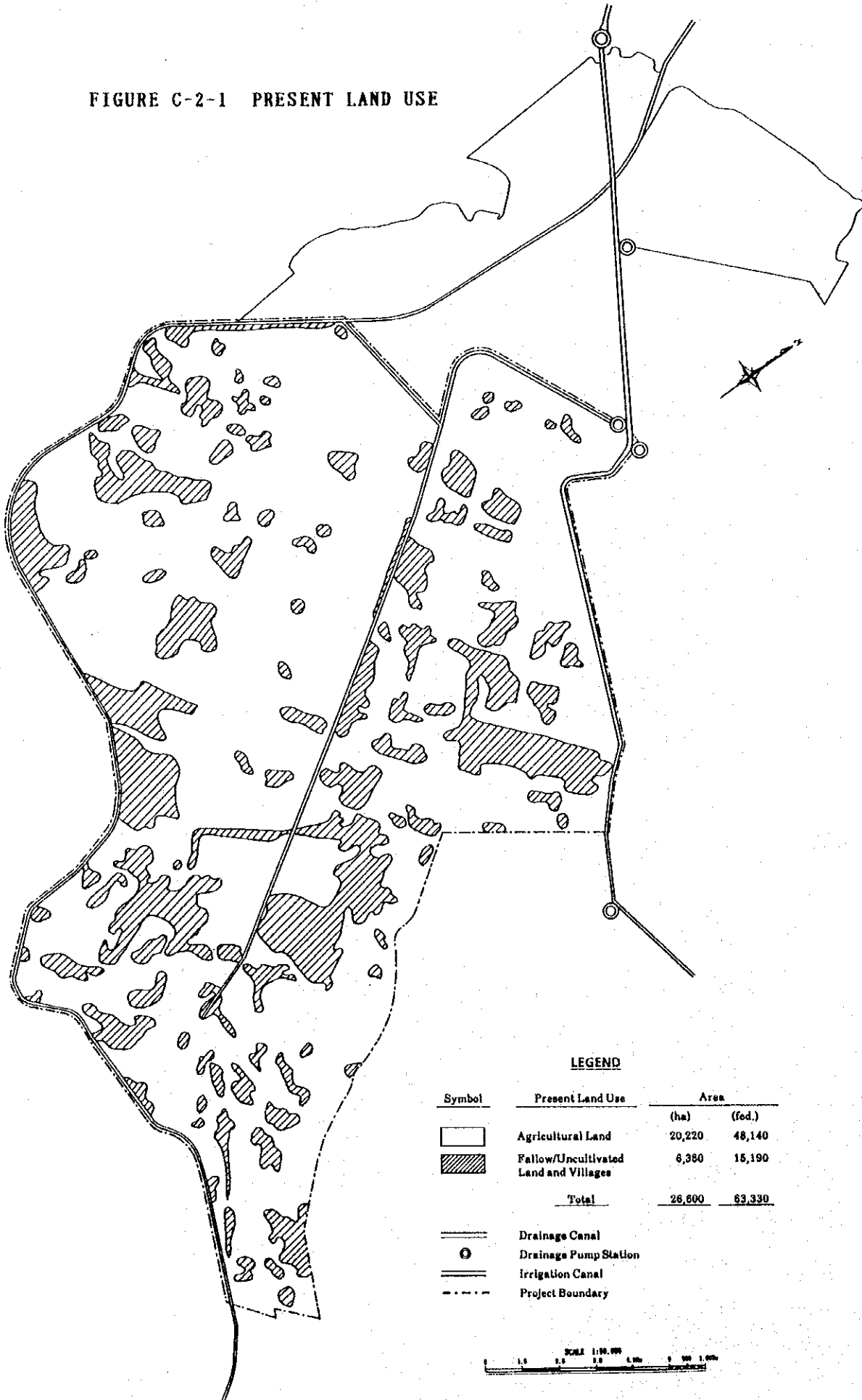


FIGURE C-2-1 PRESENT LAND USE



**LEGEND**

Symbol	Present Land Use	Area	
		(ha)	(fed.)
	Agricultural Land	20,220	48,140
	Fallow/Uncultivated Land and Villages	6,380	15,190
	<b>Total</b>	<b>26,600</b>	<b>63,330</b>
	Drainage Canal		
	Drainage Pump Station		
	Irrigation Canal		
	Project Boundary		

SCALE 1:50,000  
 0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0  
 Kilometers

FIGURE C-2-2 LOCATION OF SOIL SURVEY SITES

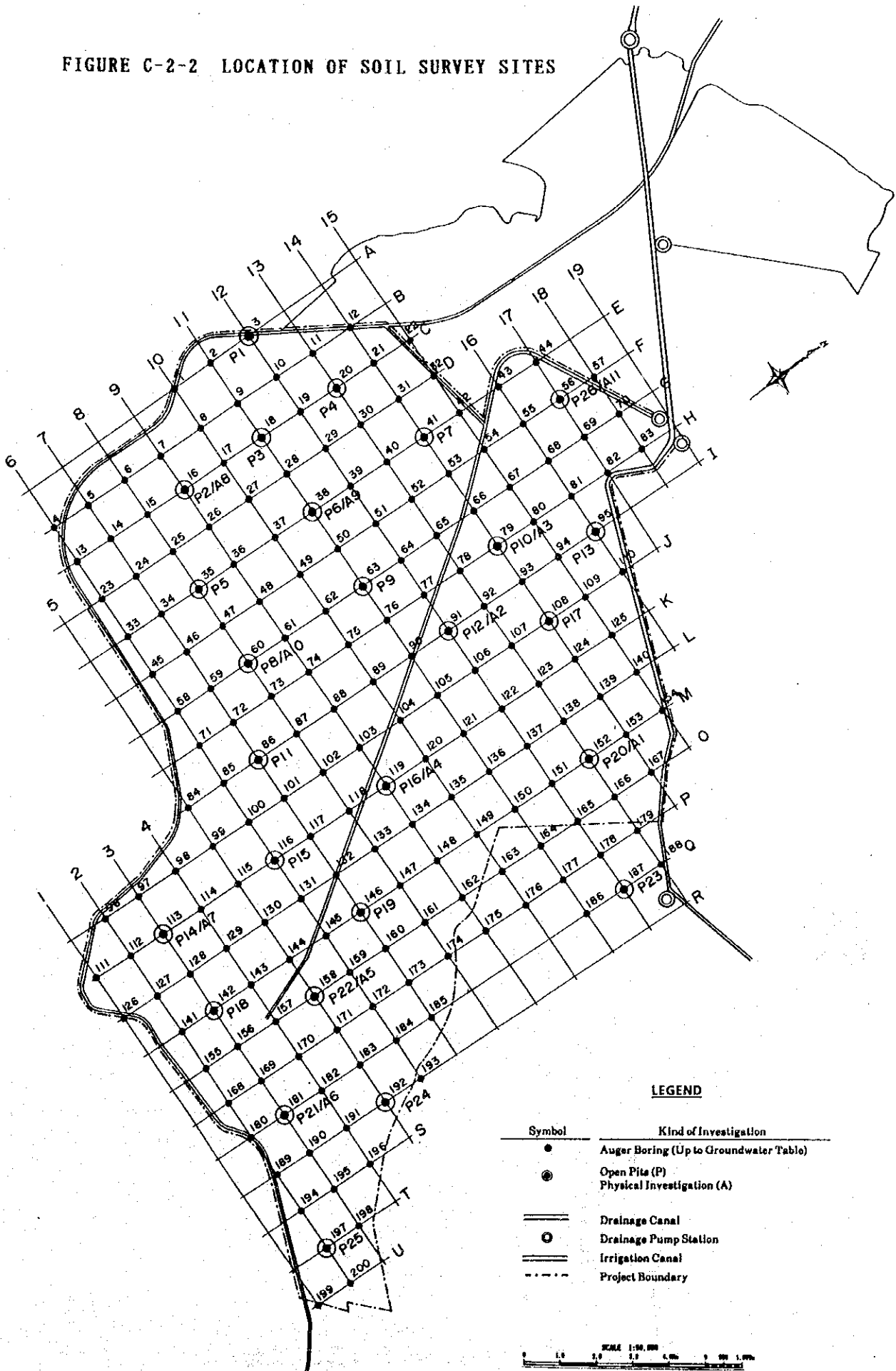
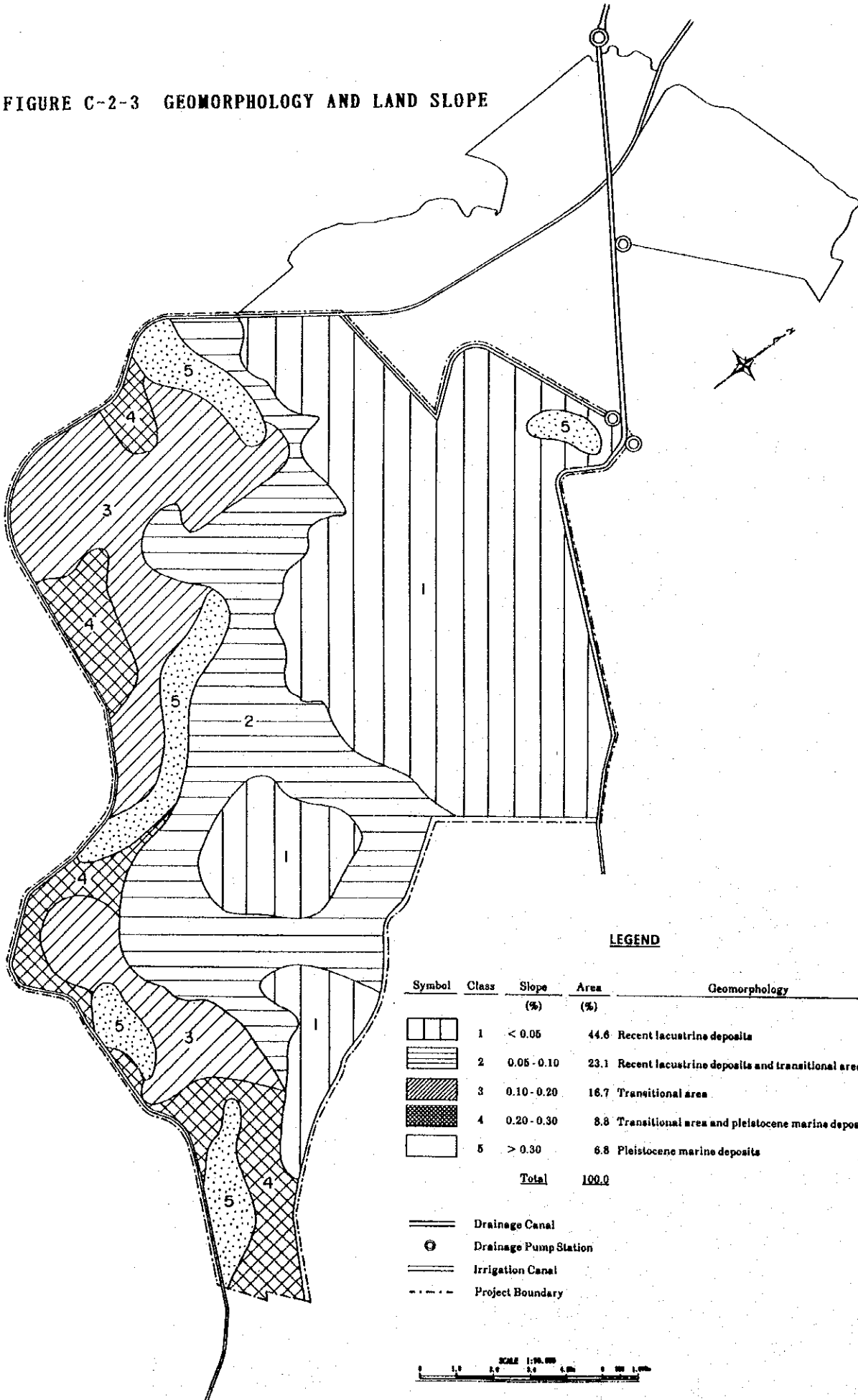


FIGURE C-2-3 GEOMORPHOLOGY AND LAND SLOPE

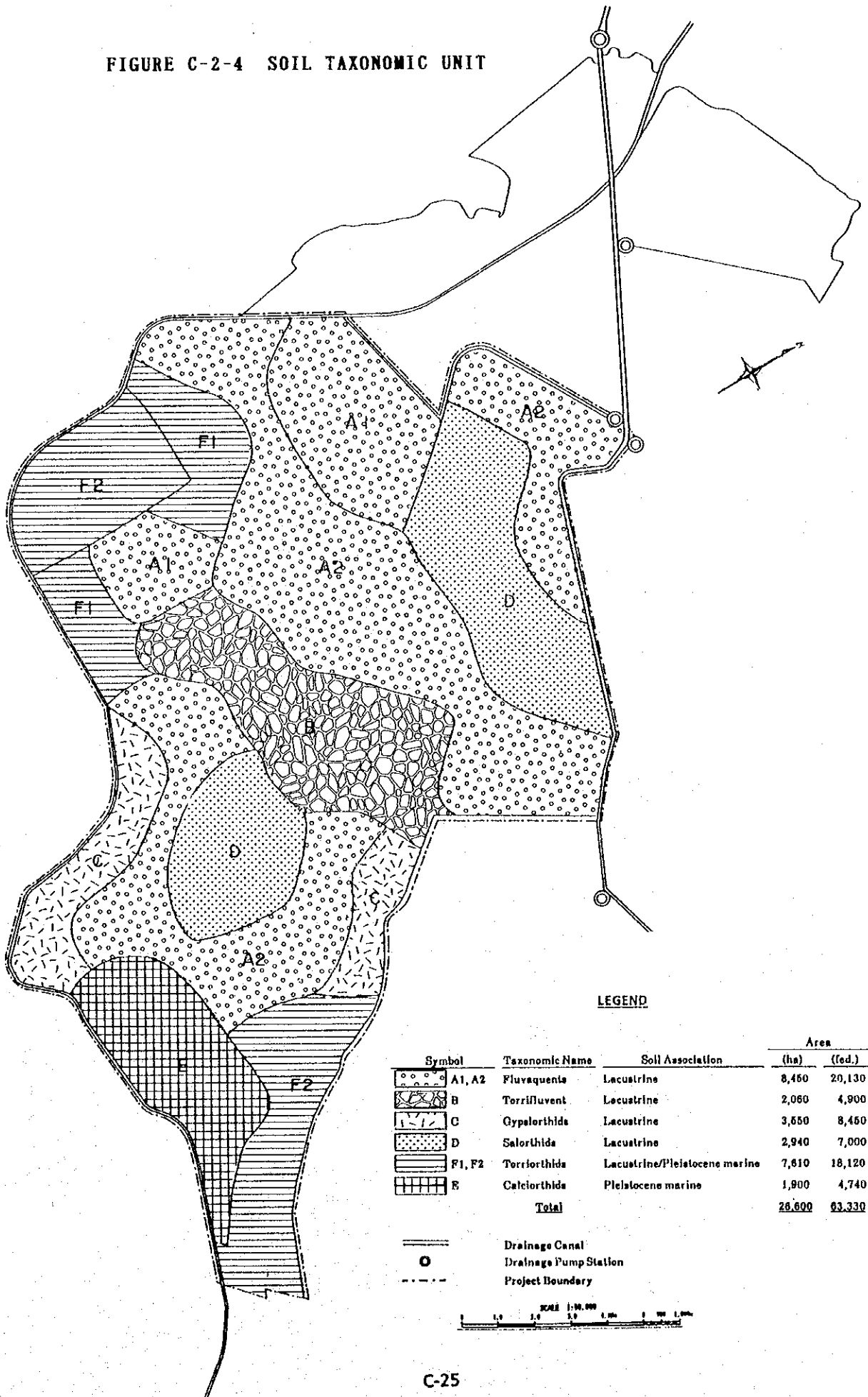


**LEGEND**

Symbol	Class	Slope (%)	Area (%)	Geomorphology
	1	< 0.05	44.6	Recent lacustrine deposits
	2	0.05 - 0.10	23.1	Recent lacustrine deposits and transitional area
	3	0.10 - 0.20	16.7	Transitional area
	4	0.20 - 0.30	8.8	Transitional area and pleistocene marine deposits
	5	> 0.30	6.8	Pleistocene marine deposits
	<b>Total</b>		<b>100.0</b>	
	Drainage Canal			
	Drainage Pump Station			
	Irrigation Canal			
	Project Boundary			

SCALE 1:50,000  
0 1.0 2.0 3.0 4.0 5.0 1.00

FIGURE C-2-4 SOIL TAXONOMIC UNIT



LEGEND

Symbol	Taxonomic Name	Soil Association	Area		
			(ha)	(fed.)	
	A1, A2	Fluvaquents	Lacustrine	8,460	20,130
	B	Torrifluvent	Lacustrine	2,060	4,900
	C	Gypsalorthids	Lacustrine	3,550	8,450
	D	Salorthids	Lacustrine	2,940	7,000
	F1, F2	Torriorthids	Lacustrine/Pleistocene marine	7,610	18,120
	E	Calciorthids	Pleistocene marine	1,900	4,740
<b>Total</b>				<b>28,600</b>	<b>68,330</b>

Drainage Canal  
 Drainage Pump Station  
 Project Boundary

FIGURE C-2-5 LAND SUITABILITY RATING

