

250  
82M  
(Vol. II)



**TECHNICAL DOCUMENTS**

**8**

**VOLUME II**

Community Water Supply



**PAN AMERICAN HEALTH ORGANIZATION**  
**Pan American Sanitary Bureau, Regional Office of the**  
**WORLD HEALTH ORGANIZATION**

250-82M0-2

TECHNICAL DOCUMENT SERIES 8

250  
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## INTRODUCTION

### MODULAR PLANTS FOR WATER TREATMENT

#### VOLUME II

#### Plans

The present Volume II, Plans, of Technical Document Series 8, Modular Plants for Water Treatment, contains the plans or drawings referred to in Volume I, Text. The two volumes make up a single comprehensive guide for the selection of appropriate treatment processes on the basis of raw water quality, community development and type, and institutional operation and maintenance capability at the location in question.

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#### Prepared by:

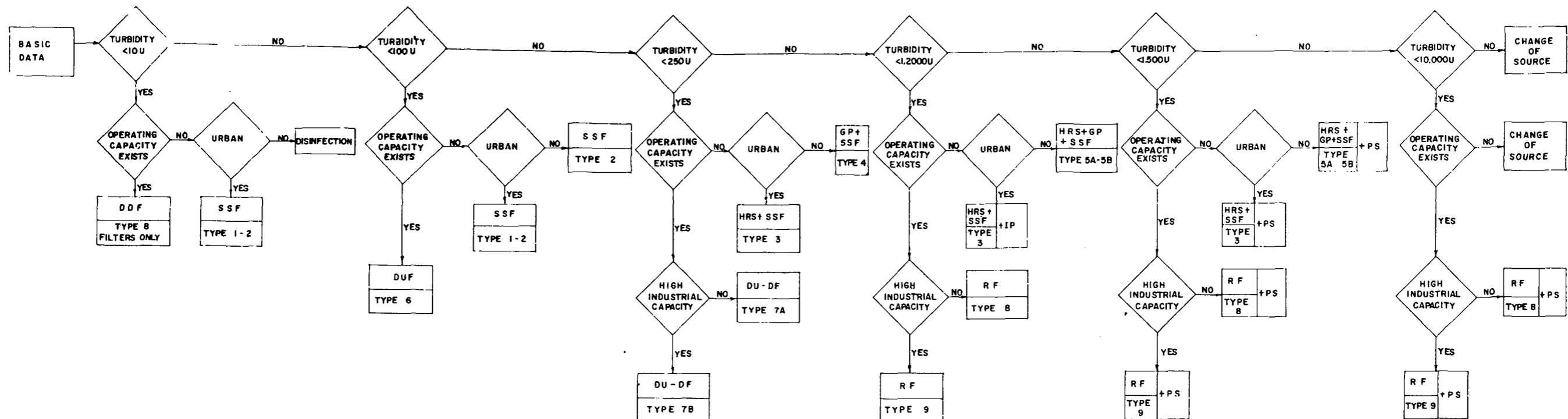
Pan American Center for Sanitary Engineering and Environmental Sciences - Division of Environmental Health -  
Pan American Sanitary Bureau, Regional Office of the  
World Health Organization  
Casilla Postal 4337  
Lima 100, Peru

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for Community Water Supply

March 1982

## LIST OF PLANS

1. Sequential process to select treatment plants as a function of water quality and degree of community development
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3. Intake - horizontal prefilter
4. Pre-sedimentation basins
5. Variable head slow sand filter - type 1A plant
6. Variable head slow sand filter - type 1A plant
7. Variable head slow sand filter - type 1B plant
8. Variable head slow sand filter - type 1B plant
9. Variable head slow sand filter - type 1C plant
10. Variable head slow sand filter - type 1C plant
11. Variable head slow sand filter - type 1C plant
12. Simple high-rate settling unit and variable head slow sand filter - type 3 plant
13. Simple high-rate settling unit and variable head slow sand filter - type 3 plant
14. Simple high-rate settling unit and variable head slow sand filter - type 3 plant
15. Unit process organization in slow sand filtration plants for rural areas
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19. Simple high rate settling unit - rough filter - slow sand filtration - type 5B plant
20. Simple high rate settling unit - rough filter - slow sand filtration - type 5B plant
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22. Details of weir, hypochlorinator and slow sand filter bed
23. Direct upflow filtration plant - type 6 plant
24. Direct upflow filtration plant - type 6 plant
25. Direct upflow filtration plant - type 6 plant
26. Direct upflow filtration plant - type 6 plant
27. Direct upflow downflow filtration plant - type 7A plant
28. Direct upflow downflow filtration plant - type 7A plant
29. Direct upflow downflow filtration plant - type 7A plant
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**NOTE**

1. THE TURBIDITIES USED FOR PROCESS SELECTION CORRESPOND TO MAXIMUM TURBIDITY VALUES IN THE ADJACENT TABLE
2. NORMAL TURBIDITY = MEAN TURBIDITY IN DRY SEASON  
AVERAGE TURBIDITY = MEAN ANNUAL TURBIDITY  
MAXIMUM TURBIDITY = MEAN ANNUAL TURBIDITY + 2 STANDARD DEVIATION
3. THE SLOW FILTRATION PLANTS WITH SEDIMENTATION AND/OR PREFILTRATION ARE ONLY CAPABLE OF TREATING WATER WITH TURBIDITIES ORIGINATED BY PARTICLES WITH A DIAMETER EQUAL TO OR GREATER THAN 1 MICRON

TURBIDITY VALUES (NU)

NORMAL TURBIDITY		30	100	250	250
AVERAGE TURBIDITY	≈ 10	50	150	750	750
MAXIMUM TURBIDITY		100	250	1,200	1,500-2,000

**LEGEND**

- SSF = SLOW SAND FILTRATION
- RF = RAPID FILTRATION
- PS = PRE SEDIMENTATION
- DUF = DIRECT UP FLOW FILTRATION
- IP = INTAKE PREFILTER
- HRS = HIGH RATE SEDIMENTATION
- DU-DF = DIRECT UP DOWN FILTRATION
- GP = GRAVEL PREFILTER
- DDF = DIRECT DOWN FLOW FILTRATION

**SEQUENTIAL PROCESS TO SELECT TREATMENT PLANTS AS A FUNCTION OF WATER QUALITY AND DEGREE OF COMMUNITY DEVELOPMENT**

PLAN N° 1

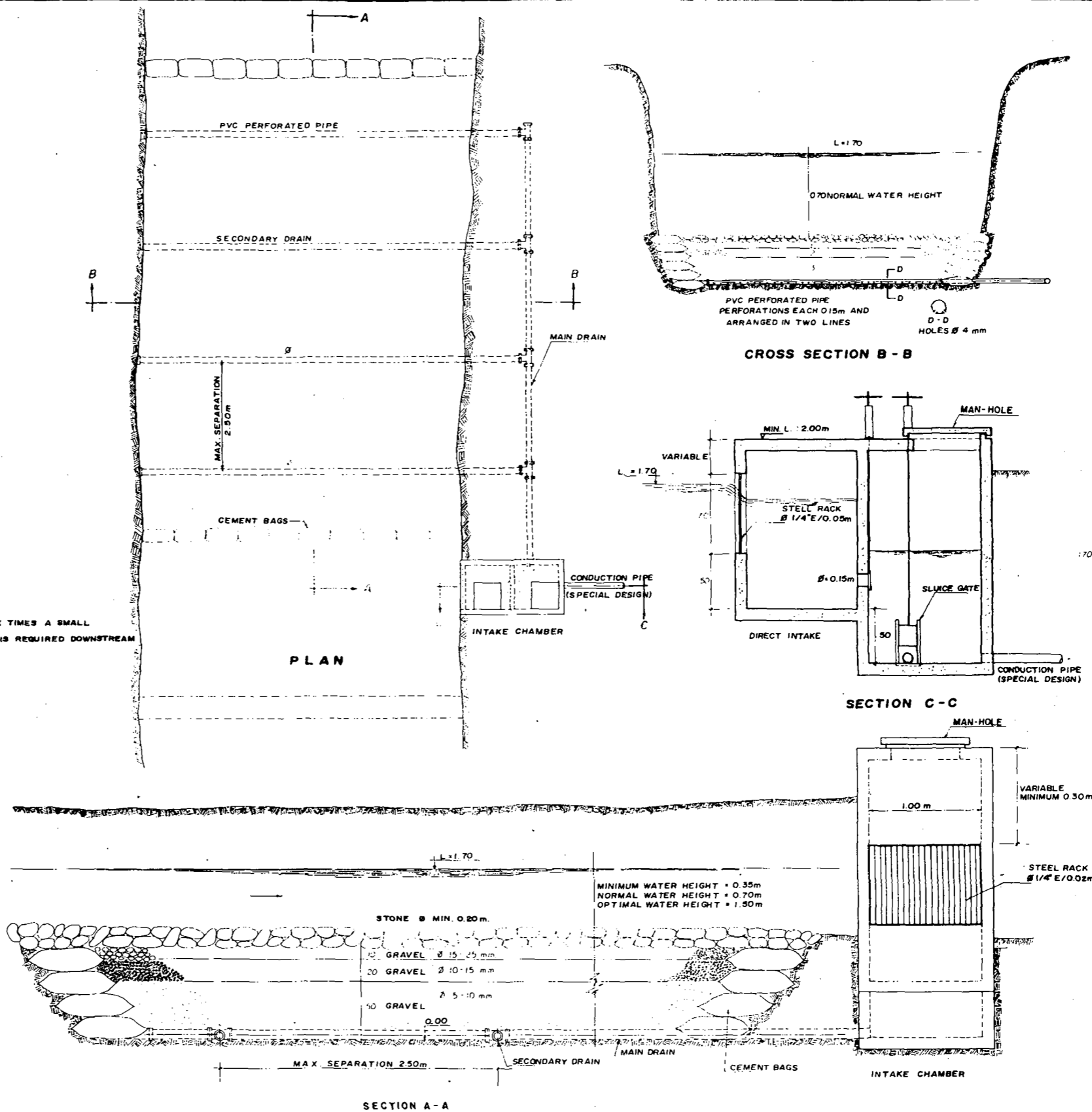
CEPIS / PAHO  
DATE: JANUARY 1981

1. MAXIMUM VELOCITY OF THE STREAM: 3.00 m/s
2. WATER QUALITY
  - MIN. TURBIDITY . . . . . 150 NTU (slow filtration)
  - MAX. TURBIDITY . . . . . 750 NTU (simple sedimentation and slow filtration)
3. MAXIMUM PREFILTER CAPACITY: 9 m<sup>3</sup>/h
4. FILTRATION VELOCITY: 0.25 m/h
5. PREFILTER DIMENSIONING:
  - (A) ONCE THE NECESSARY PREFILTER CAPACITY HAS BEEN CALCULATED ASSUME THE NEXT LARGEST FLOW IN COLUMN ①
  - (B) SELECT THE NECESSARY AREA IN COLUMN ②
  - (C) DECIDE PREFILTER DIMENSIONS BASED ON LOCAL CONDITIONS
  - (D) SELECT, FROM COLUMN ④ THE DIAMETER OF THE SECONDARY DRAIN CONSIDERING THE MAXIMUM DRAINED AREA, COLUMN ③ AND A MAXIMUM DRAIN SEPARATION OF 2.50 m
  - (E) SELECT THE DIAMETER OF THE MAIN DRAIN FROM COLUMN ④ ACCORDING TO TOTAL PREFILTER AREA IN COLUMN ③

Q	A x B AREA	CRITERIA FOR DRAIN SELECTION	
		MAX DRAINED AREA	Ø
3.6	14.4	7.4	2"
5.4	21.6	16.8	3"
7.2	28.8	30.0	4"
9.0	36.6	48.2	5"
10.8	43.2	53.0	5"
14.4	57.6	53.0	6"
18.0	72.0	94.0	6"
21.6	86.4	94.0	8"
25.2	100.8	230.0	8"
28.8	115.2	230.0	8"
32.4	130.0	230.0	8"
36.0	144.0	230.0	8"

Q = FLOW  
 Ø = DIAMETER  
 L = DEPTH OF PREFILTER

NOTE: SOME TIMES A SMALL DAM IS REQUIRED DOWNSTREAM



# INTAKE - VERTICAL PREFILTER

PLAN Nº 2

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 DATE: JANUARY 1981

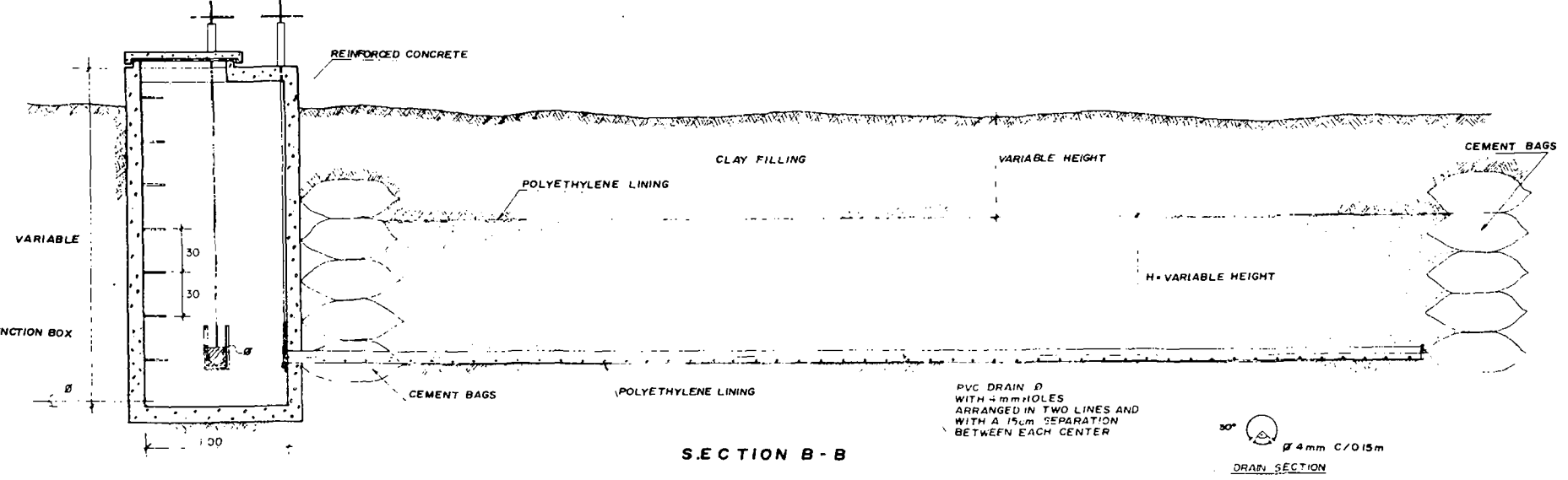
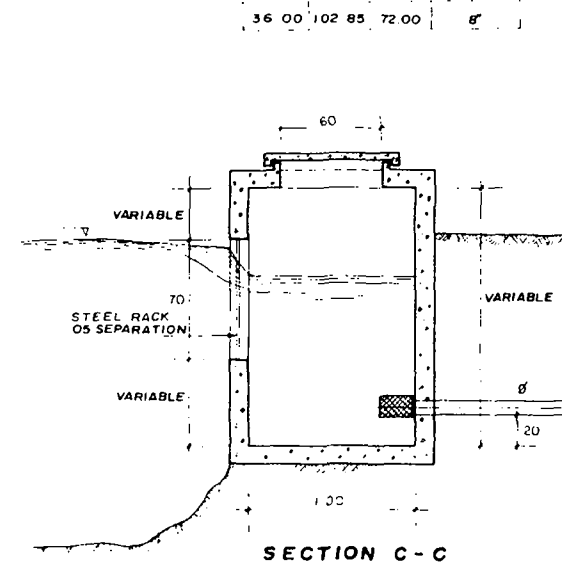
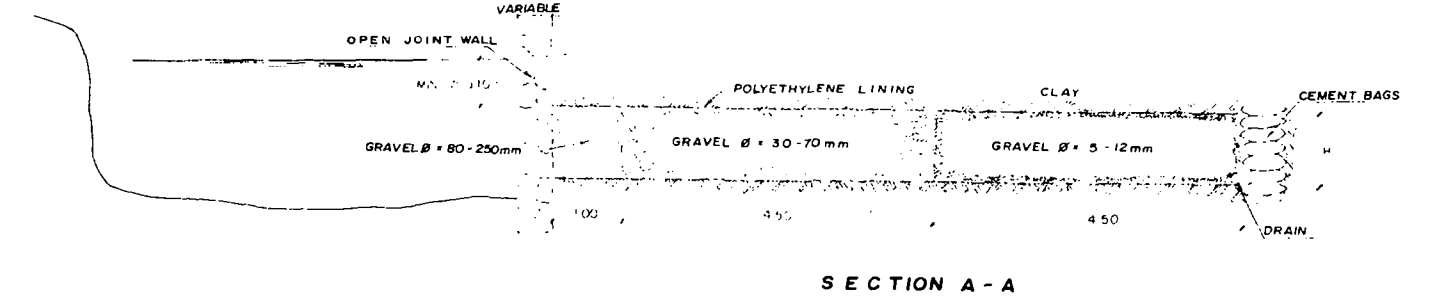
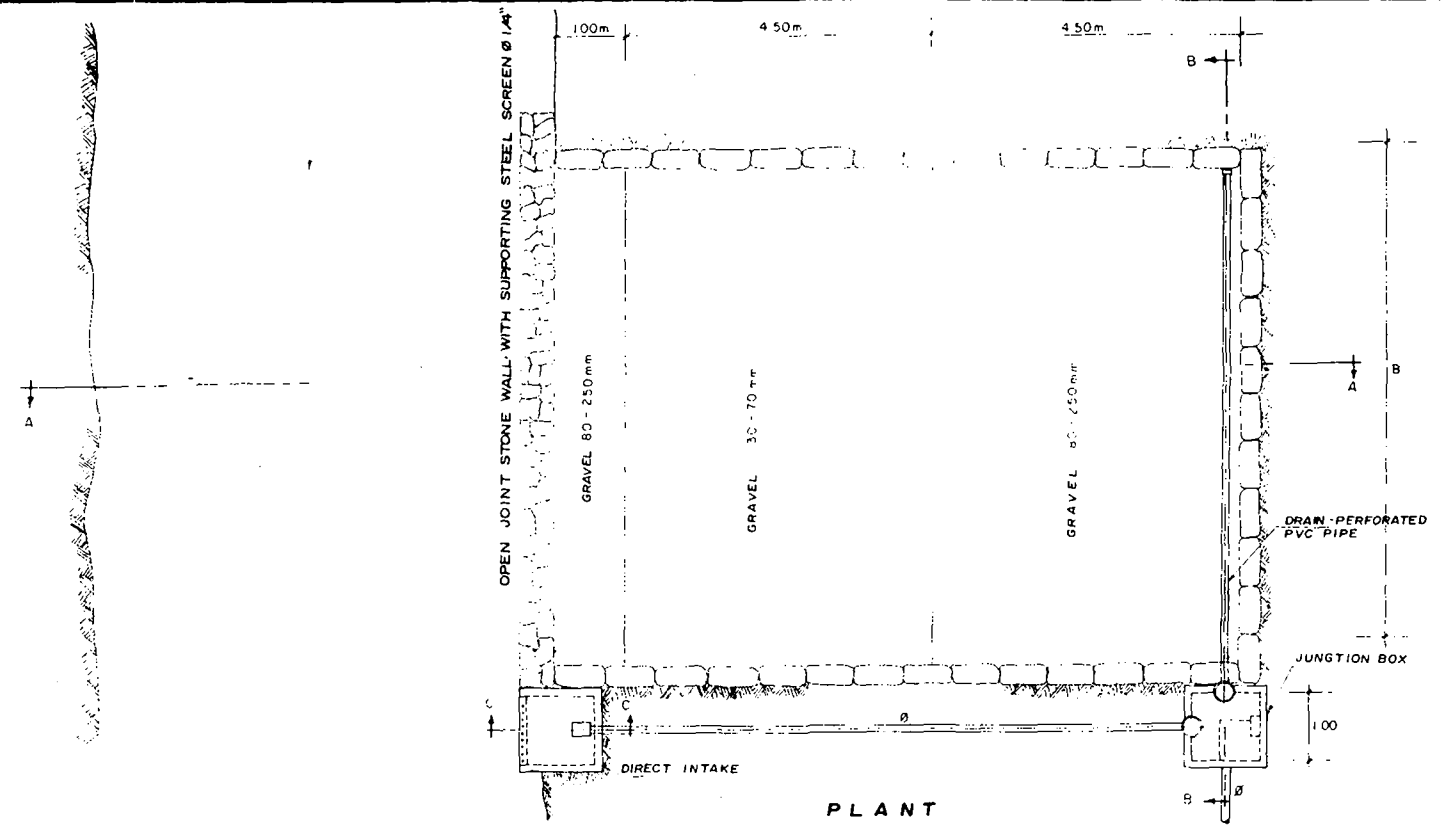
FILTERING SPECIFICATIONS AND SELECTION CRITERIA

1. WATER QUALITY
  - MAXIMUM TURBIDITY . . . . . 150 NTU (slow filtration)
  - MAXIMUM TURBIDITY . . . . . 750 NTU (simple sedimentation and slow filtration)
2. MAXIMUM CAPACITY: 10.8 m<sup>3</sup>/h
3. FILTRATION VELOCITY: 0.50 m/h
4. PREFILTER DIMENSIONS:
  - (A) ONCE THE NECESSARY CAPACITY OF THE PREFILTER HAS BEEN CALCULATED, ASSUME NEXT LARGEST FLOW IN COLUMN ①
  - (B) THE DEPTH OF THE PREFILTER IS SELECTED BETWEEN 0.70 AND 1.00 ACCORDING TO LOCAL CONDITIONS; THE CORRESPONDING WIDTH IS TAKEN FROM COLUMN ②
  - (C) OBTAIN THE CORRESPONDING DRAIN DIAMETER FROM COLUMN ③

NOTE: SOMETIMES A SMALL DAM IS REQUIRED DOWNSTREAM.

1	2		3
	Bm		
m <sup>3</sup> /h	H=70m	H=100m	Ø
3.60	10.30	7.20	3"
5.40	15.40	10.80	3"
7.20	20.50	14.40	4"
9.00	25.70	18.00	4"
10.80	30.85	21.60	4"
14.40	41.15	28.80	5"
18.00	51.43	36.00	6"
21.60	61.70	43.20	6"
25.20	72.00	50.40	8"
28.80	82.30	57.60	8"
32.40	92.60	64.80	8"
36.00	102.85	72.00	8"

H = DEPTH OF THE FILTER  
B = WIDTH OF PREFILTER



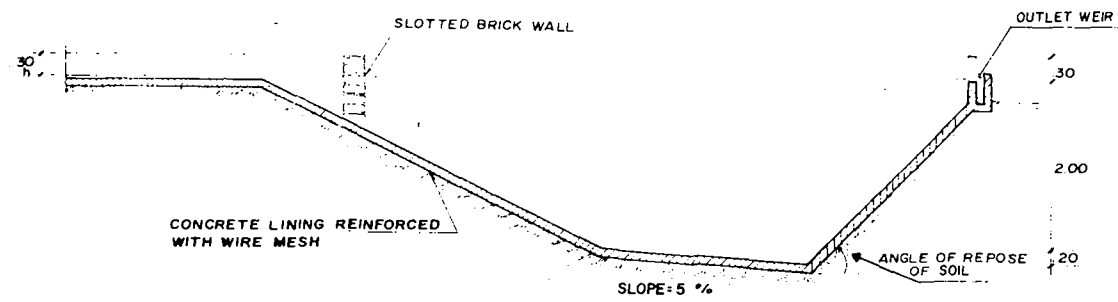
PVC DRAIN Ø WITH 4mm HOLES ARRANGED IN TWO LINES AND WITH A 15cm SEPARATION BETWEEN EACH CENTER  
 Ø 4mm C/015m  
 DRAIN SECTION

# INTAKE HORIZONTAL PREFILTER

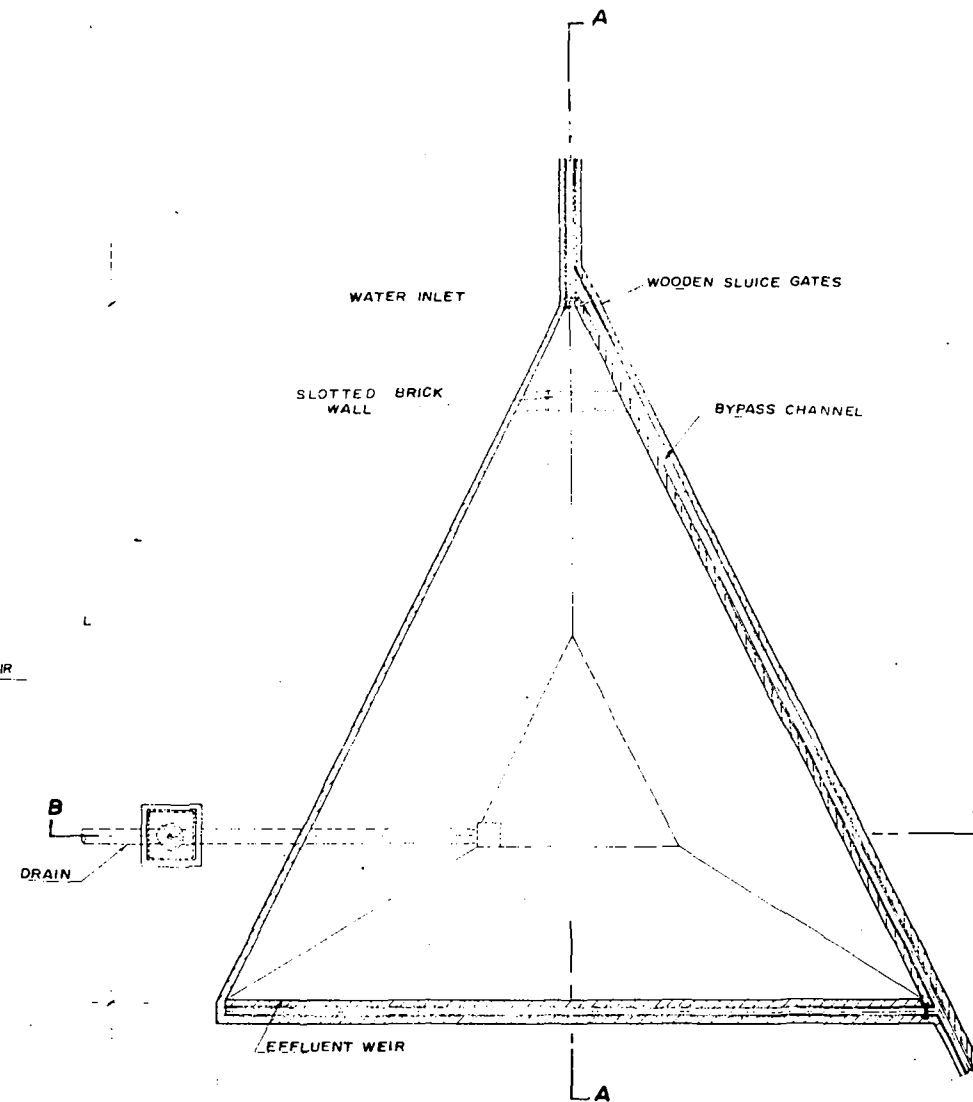
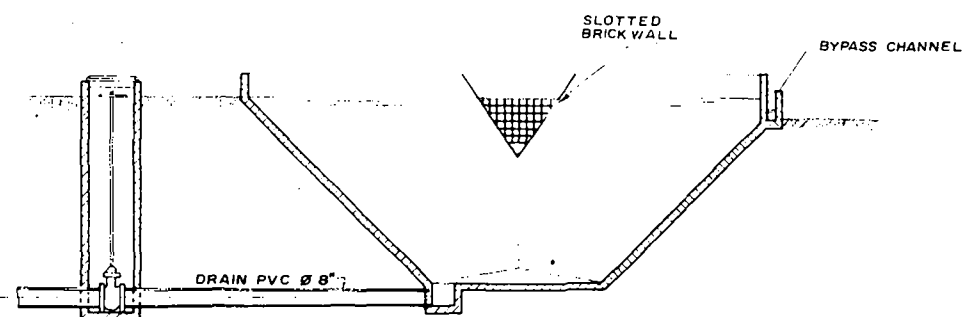
PLAN N° 3  
 CEPIS/PAHO  
 DATE: JANUARY 1981

TECHNICAL SPECIFICATIONS

1. WATER QUALITY
  - TURBIDITY > 1,000 NU
2. PRE-SEDIMENTATION
  - RETENTION PERIOD 24 HOURS
  - MAXIMUM FLOW IN EFFLUENT WEIR 1.71 m<sup>3</sup>/m / hour
3. SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE



Q <sub>m<sup>3</sup>/h</sub>	L <sub>m</sub>	h <sub>mm</sub>
3.60	9.30	106
5.40	11.20	131
7.20	13.00	150
9.00	14.50	167
10.80	16.00	183
14.40	18.00	217
18.00	20.00	244
21.60	22.00	256
25.20	24.00	283
28.80	26.00	300
32.40	27.50	319
36.00	29.00	326
52.50	35.50	411
70.00	41.00	0.475



L = LENGTH AND WIDTH OF THE PRE-SEDIMENTATION BASIN  
 h = WATER DEPTH AT THE OUTLET WEIR.

PRE - SEDIMENTATION BASINS

PLAN N° 4

CEPIS / PAHO

DATE JANUARY 1981

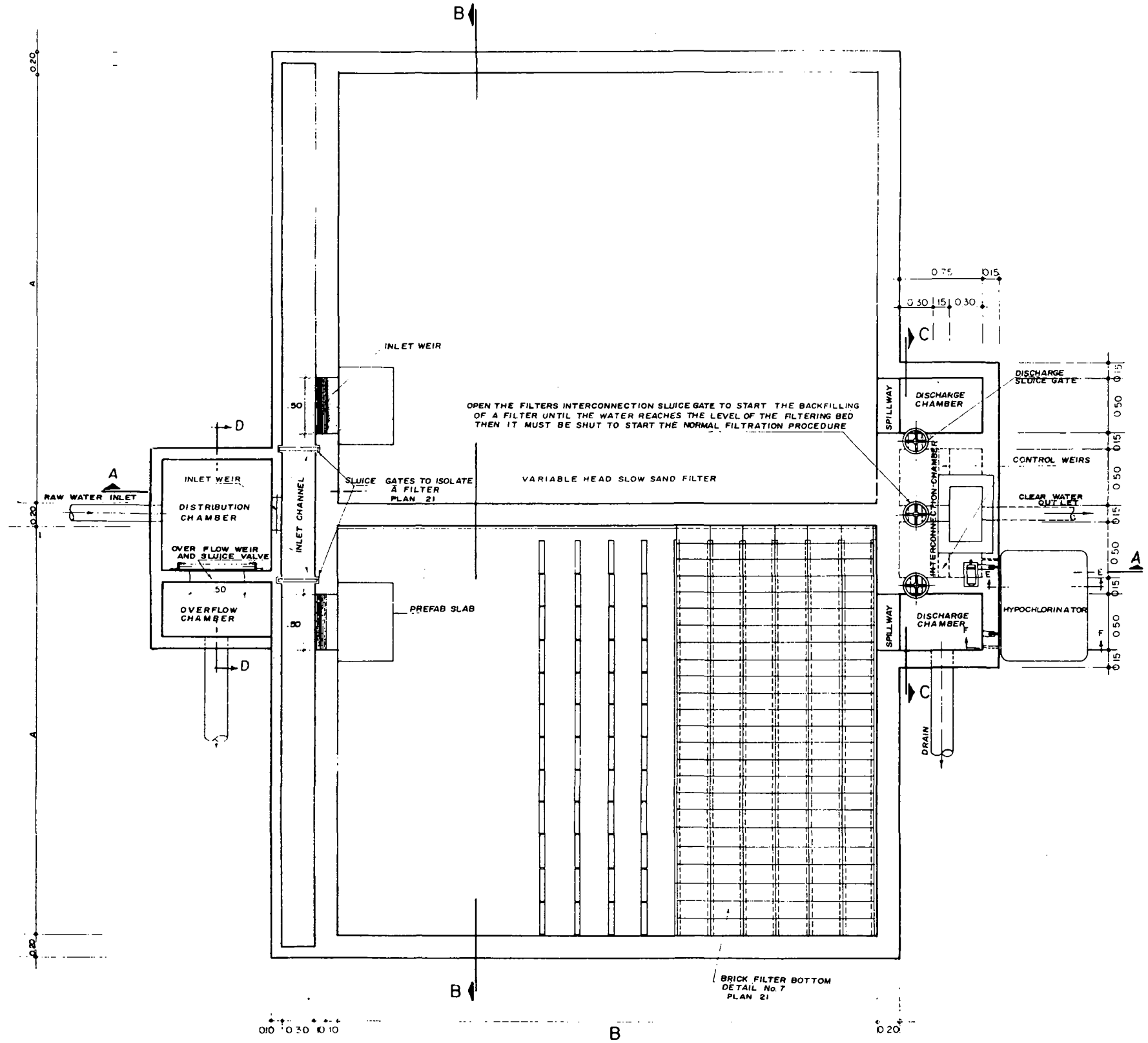
TECHNICAL SPECIFICATIONS

1. WATER QUALITY
  - NORMAL TURBIDITY . . . . . 30 NU
  - AVERAGE TURBIDITY . . . . . 50 NU
  - MAXIMUM TURBIDITY . . . . . 100 NU
  - COLOR . . . . . 50 CU
2. DESIGN CRITERIA
  - (A) FILTRATION VELOCITY . . . . . 0.10 m/h
  - (B) FIXED HEADLOSS . . . . . 5% of the initial headloss
  - (C) RE-SANDING PERIOD . . . . . 5 years
  - (D) FILTER MEDIUM CHARACTERISTICS
    - EFFECTIVE DIAMETER . . . . . 0.15 - 0.35 mm
    - COEFFICIENT OF UNIFORMITY . . . . . < 2.00
  - (E) VELOCITY IN THE MAIN DRAIN . . . . . 0.05 m/s
  - (F) MAXIMUM HEADLOSS . . . . . 1.10 m
3. SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

A = WIDTH OF FILTER BOX  
B = LENGTH OF FILTER BOX

MODULAR PLANTS DIMENSIONS

Q	A	B	h	H
m <sup>3</sup> /h	m	m	cm	cm
3.6	3.70	4.90	0.65	5.5
5.4	4.50	6.00	0.85	6.5
7.2	5.20	6.90	1.00	7.3
9.0	5.80	7.75	1.20	8.0
10.8	6.40	8.50	1.36	8.6
14.4	7.35	9.80	1.60	9.6
18.0	8.25	10.95	1.90	10.5
21.6	9.00	12.00	2.16	11.3
25.2	9.70	12.95	2.40	12.0
28.8	10.40	13.80	2.60	12.7
32.4	11.05	14.70	2.80	13.3
36.0	11.60	15.45	3.00	14.0

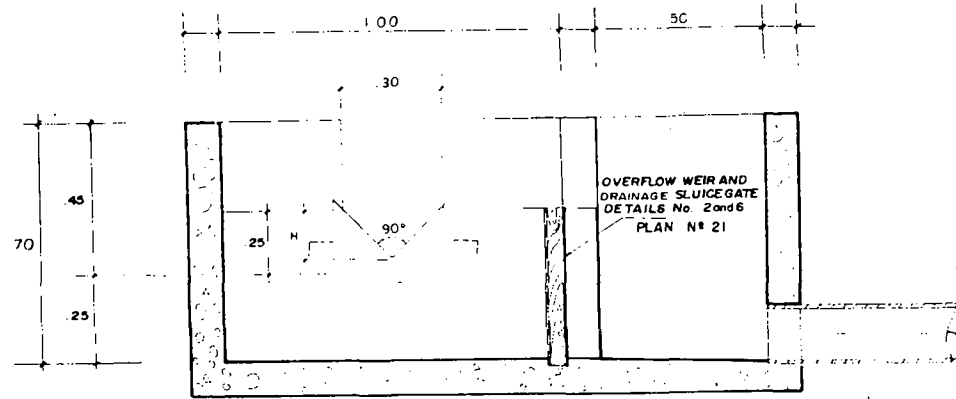


# VARIABLE HEAD SLOW SAND FILTER-TYPE IA PLANT

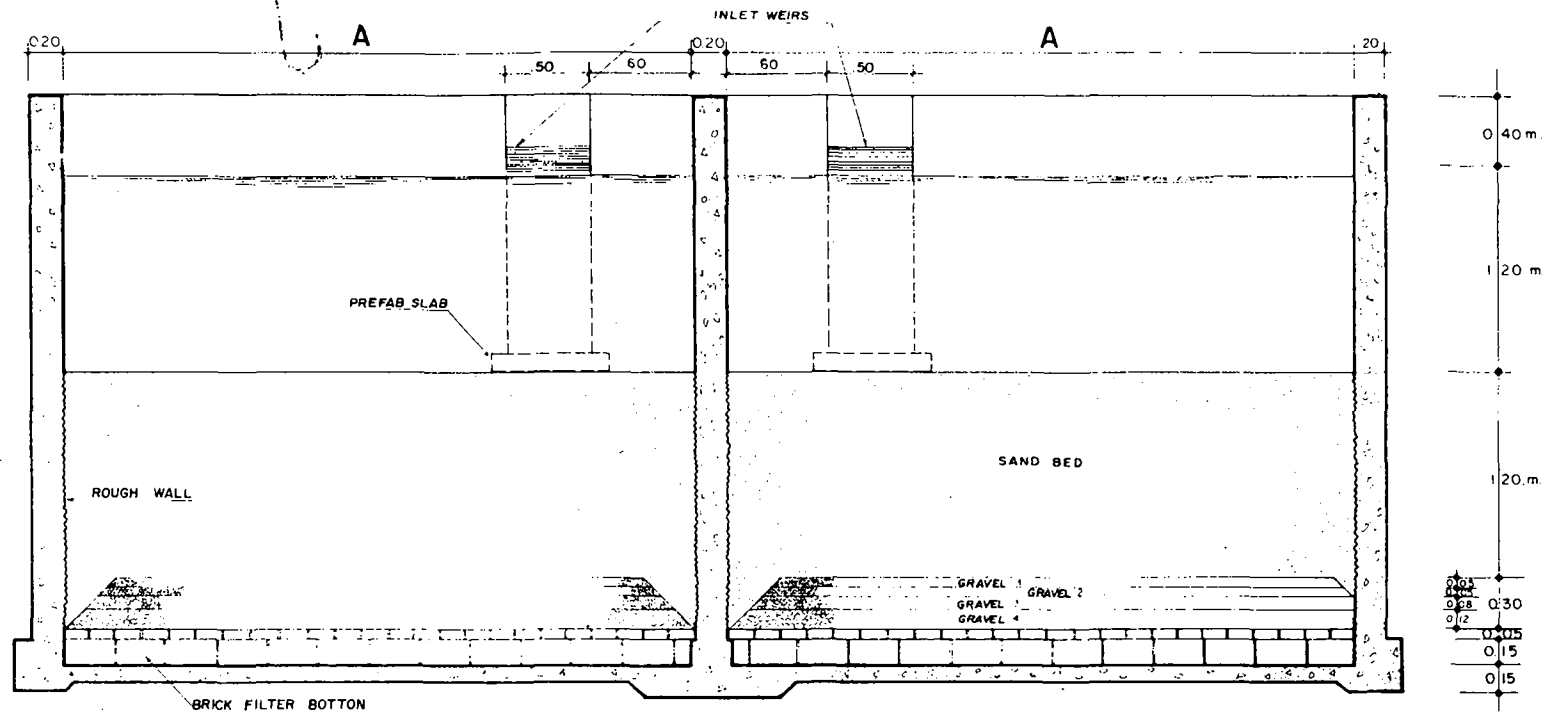
PLAN N°5

C EPIS / PAHO  
DATE: JANUARY 1981

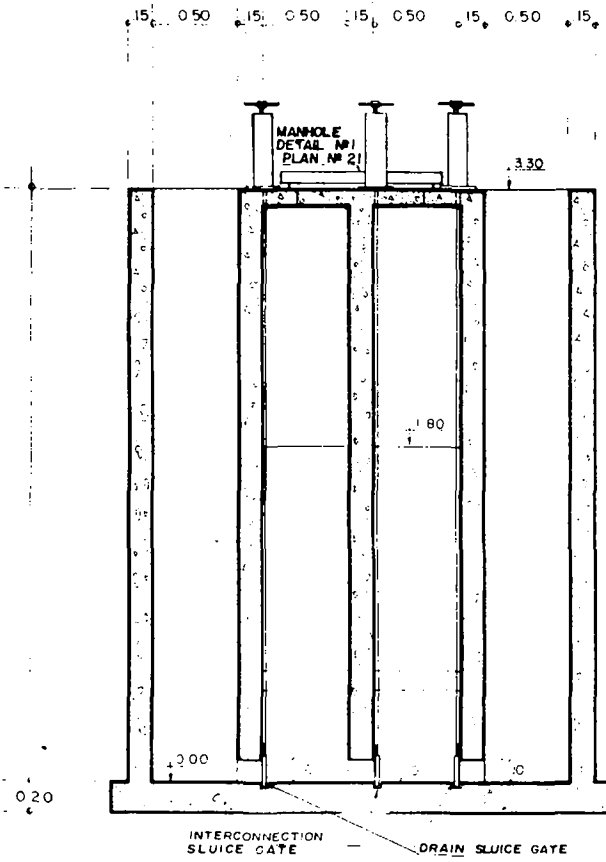




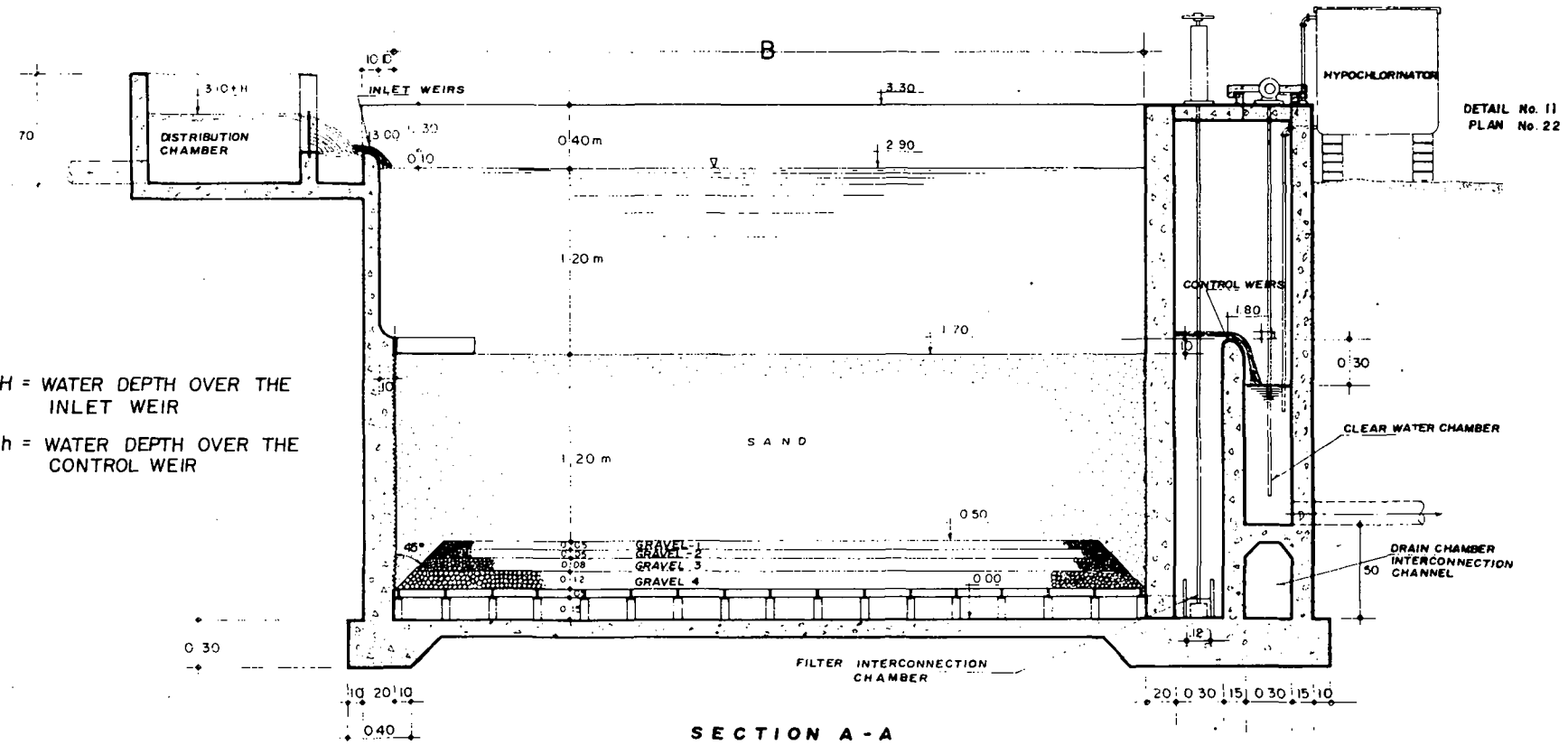
SECTION D-D



SECTION B-B



SECTION C-C



SECTION A-A

H = WATER DEPTH OVER THE INLET WEIR  
 h = WATER DEPTH OVER THE CONTROL WEIR

# VARIABLE HEAD SLOW SAND FILTER-TYPE 1A PLANT

PLAN N° 6

C EPIS / PAHO  
 DATE: JANUARY 1981

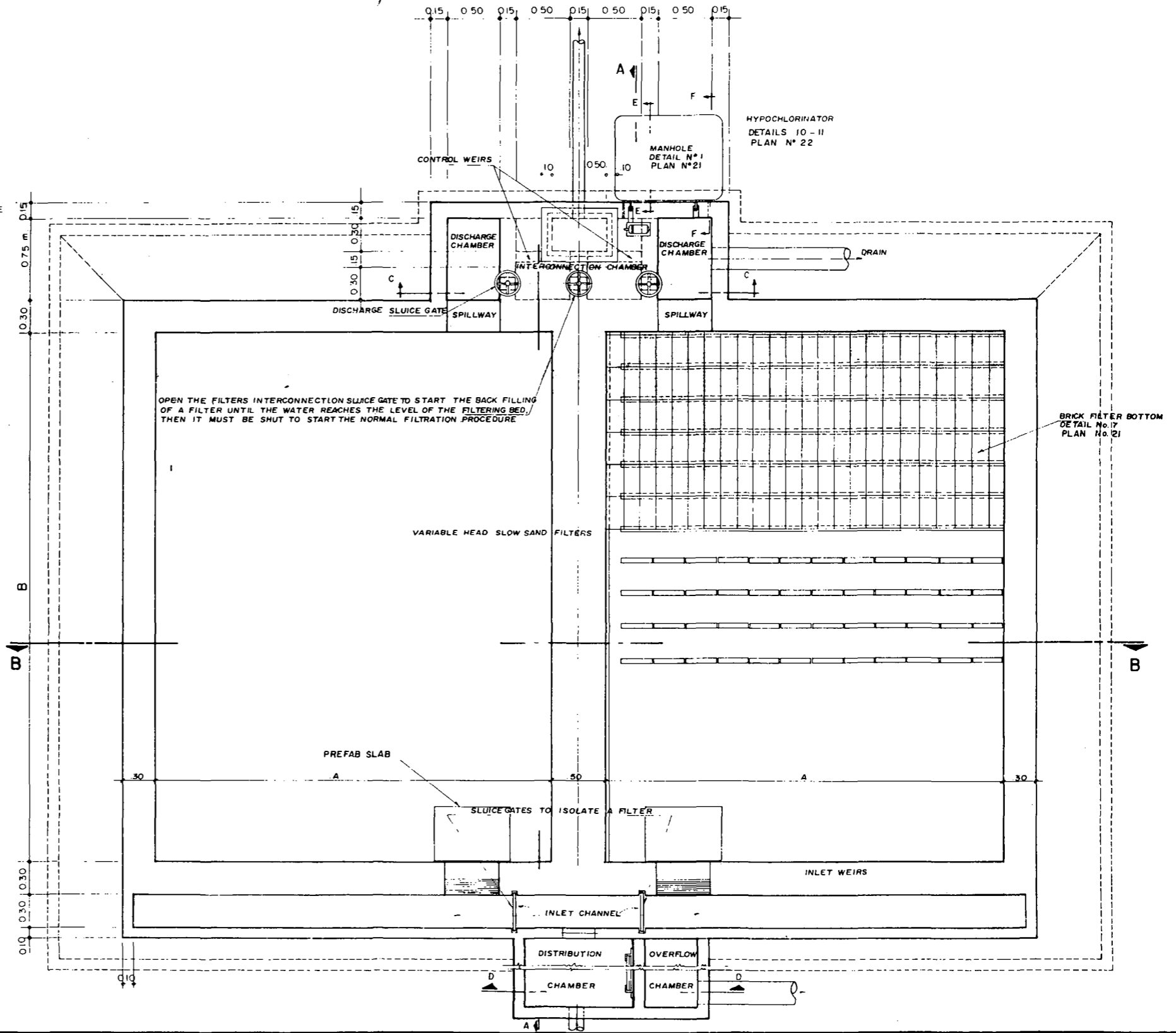
TECHNICAL SPECIFICATIONS

1. WATER QUALITY
  - NORMAL TURBIDITY . . . . . 30 NU
  - AVERAGE TURBIDITY . . . . . 50 NU
  - MAXIMUM TURBIDITY . . . . . 100 NU
  - COLOR . . . . . 50 CU
2. DESIGN CRITERIA
  - (A) FILTRATION VELOCITY . . . . . 0.10 m/h
  - (B) FIXED HEADLOSS . . . . . 5% of the initial headloss
  - (C) RE-SANDING PERIOD . . . . . 5 years
  - (D) FILTER MEDIUM CHARACTERISTICS
    - EFFECTIVE DIAMETER . . . . . 0.15 - 0.35 mm
    - COEFFICIENT OF UNIFORMITY . . . . . < 2.00
  - (E) VELOCITY IN THE MAIN DRAIN . . . . . 0.05 m/s
  - (F) MAXIMUM HEADLOSS . . . . . 1.10 m
3. SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

A = WIDTH OF FILTER BOX  
 B = LENGTH OF FILTER BOX  
 h = WATER DEPTH OVER THE CONTROL WEIRS  
 H = WATER DEPTH OVER THE TRIANGULAR WEIR

MODULAR PLANTS DIMENSIONS

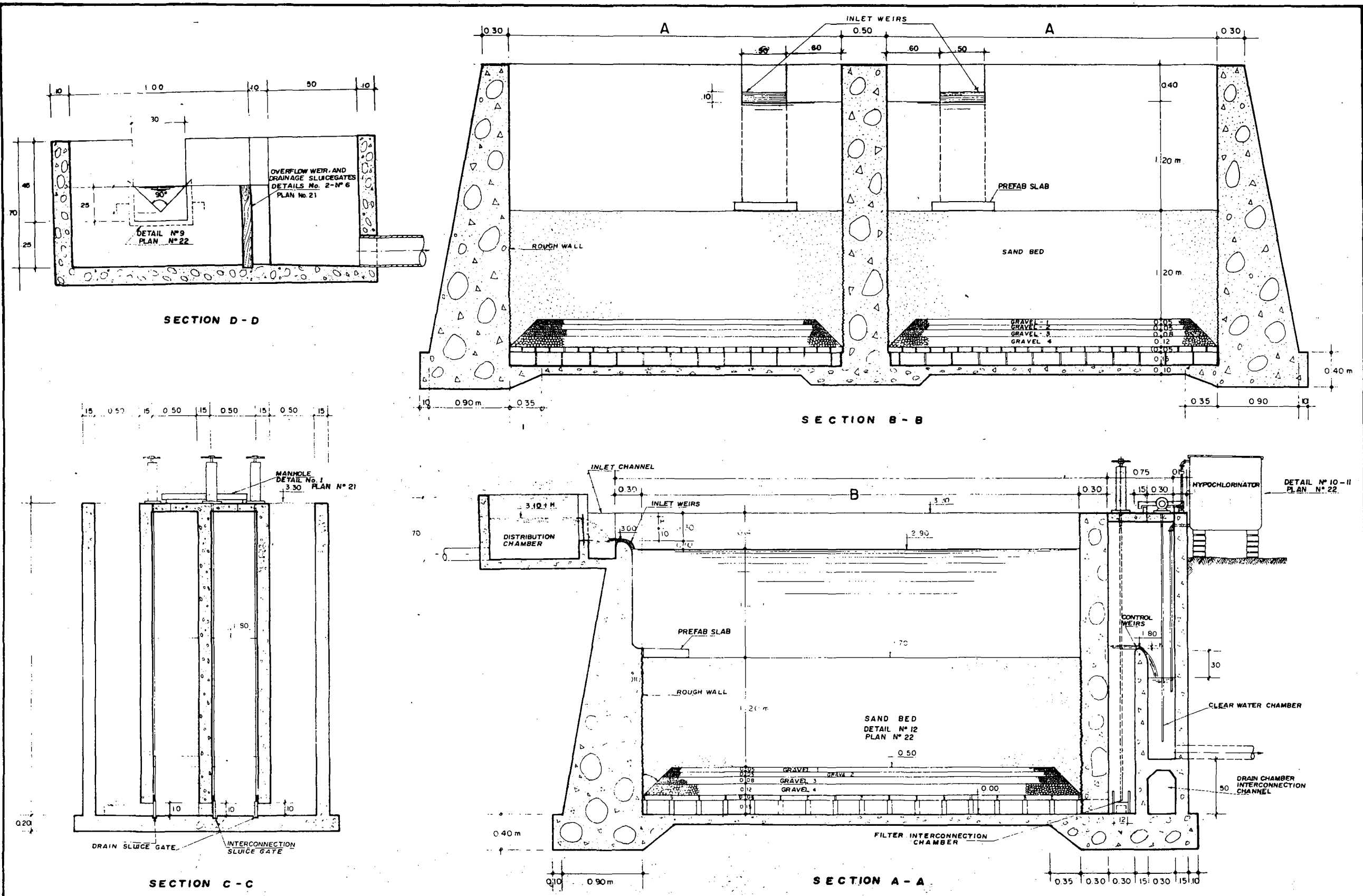
Q	A	B	h	H
m <sup>3</sup> /h	m	m	cm	cm
3.6	3.70	4.90	0.65	5.5
5.4	4.50	6.00	0.85	6.5
7.2	5.20	6.90	1.00	7.3
9.0	5.80	7.75	1.20	8.0
10.8	6.40	8.50	1.36	8.6
14.4	7.35	9.80	1.60	9.6
18.0	8.25	10.95	1.90	10.5
21.6	9.00	12.00	2.16	11.3
25.2	9.70	12.95	2.40	12.0
28.8	10.40	13.80	2.60	12.7
32.4	11.05	14.70	2.80	13.3
36.0	11.60	15.45	3.00	14.0



VARIABLE HEAD SLOW SAND FILTER-TYPE 1B PLANT

PLAN N° 7

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 DATE: JANUARY 1981



# VARIABLE HEAD SLOW SAND FILTER - TYPE IB PLANT

PLAN N° 8

CEPIS/PAHO  
DATE: JANUARY 1981

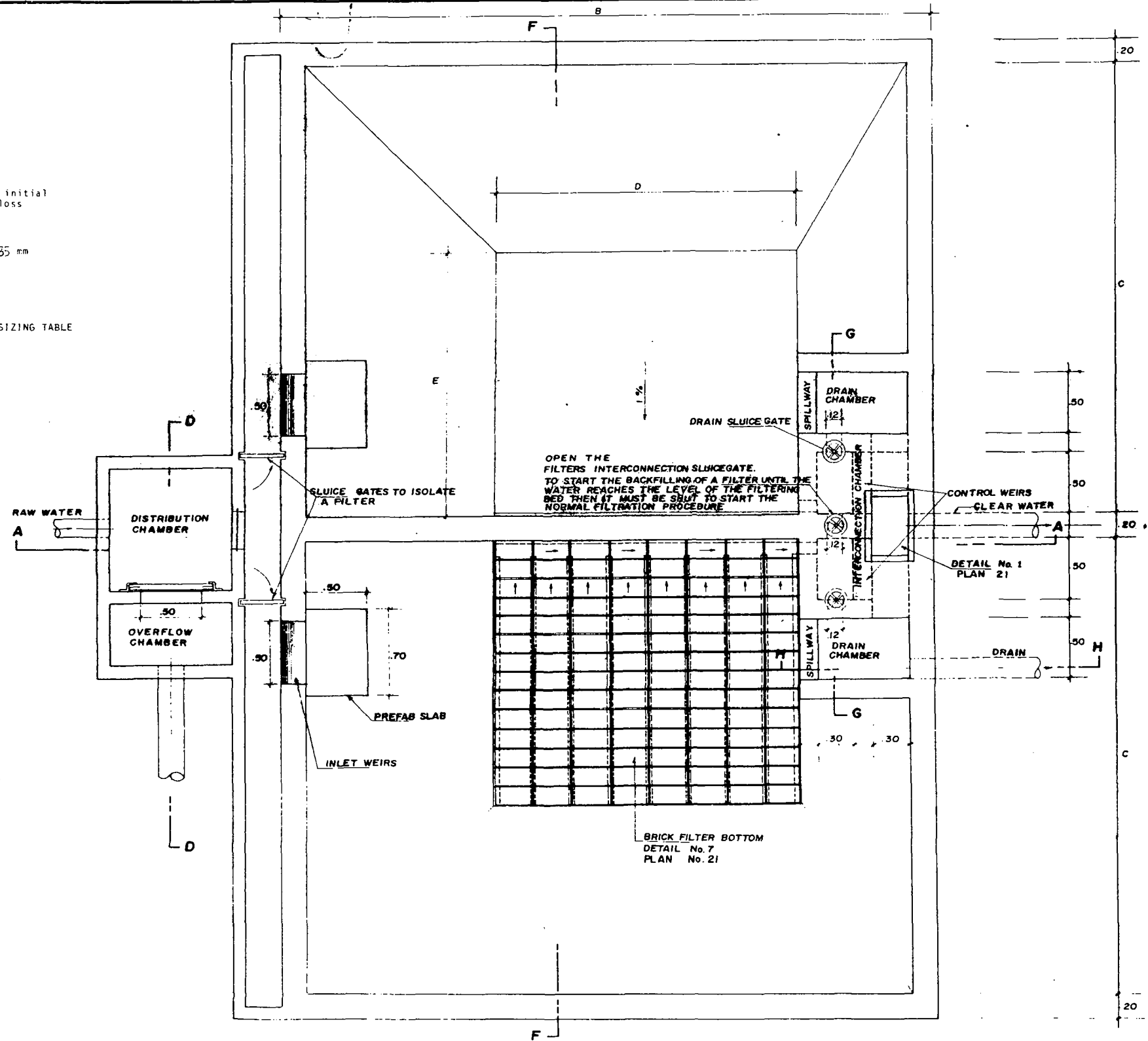
TECHNICAL SPECIFICATIONS

1. WATER QUALITY
  - NORMAL TURBIDITY . . . . . 30 NU
  - AVERAGE TURBIDITY . . . . . 50 NU
  - MAXIMUM TURBIDITY . . . . . 100 NU
  - COLOR . . . . . <50 CU
2. DESIGN CRITERIA
  - (A) FILTRATION VELOCITY . . . . . 0.10 m/h
  - (B) FIXED HEADLOSS . . . . . 5% of the initial headloss
  - (C) FILTER CHANGE PERIOD . . . . . 5 years
  - (D) FILTER MEDIUM CHARACTERISTICS
    - EFFECTIVE DIAMETER . . . . . 0.15 - 0.35 mm
    - COEFFICIENT OF UNIFORMITY . . . . . < 2.00
  - (E) VELOCITY IN THE MAIN DRAIN . . . . . 0.05 m/s
  - (F) MAXIMUM HEADLOSS . . . . . 1.10 m
3. SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

B = LENGTH OF FILTER BOX  
 C = WIDTH OF FILTER BOX  
 D = LENGTH AT THE BOTTOM OF THE FILTER BOX  
 E = WIDTH AT THE BOTTOM OF THE FILTER BOX

PLANT SIZING TABLE

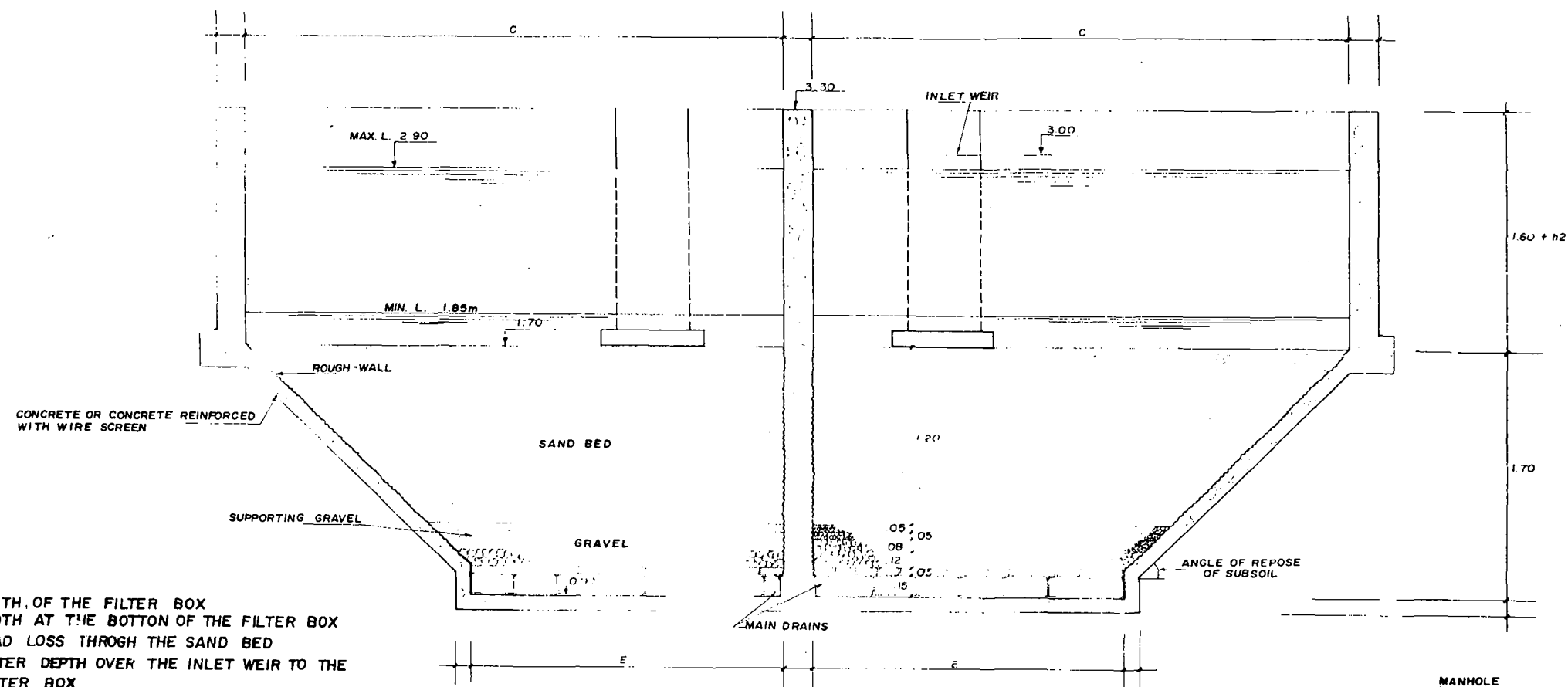
Q MLD	B m	C m	D m	E m	h2 cm.	h3 cm.	h4 cm.
1	3.6	4.90	3.70	2.50	.02	.85	6.5
2	5.4	6.00	4.50	3.60	.04	.85	6.5
3	7.2	6.90	5.20	4.50	.05	1.00	7.3
4	9.0	7.75	5.80	5.35	.06	1.20	8.0
5	10.8	8.50	6.40	6.10	.06	1.36	8.6
6	14.4	9.80	7.35	7.40	.07	1.60	9.6
7	18.0	10.95	8.25	8.55	.08	1.90	10.5
8	21.6	12.00	9.00	9.60	.08	2.16	11.3
9	25.2	12.95	9.70	10.55	.08	2.40	12.0
10	28.8	13.80	10.40	11.40	.08	2.60	12.7
11	32.4	14.70	11.05	12.30	.08	2.80	13.3
12	36.0	15.45	11.60	13.05	.08	3.00	14.0



VARIABLE HEAD SLOW SAND FILTER - TYPE IC PLANT

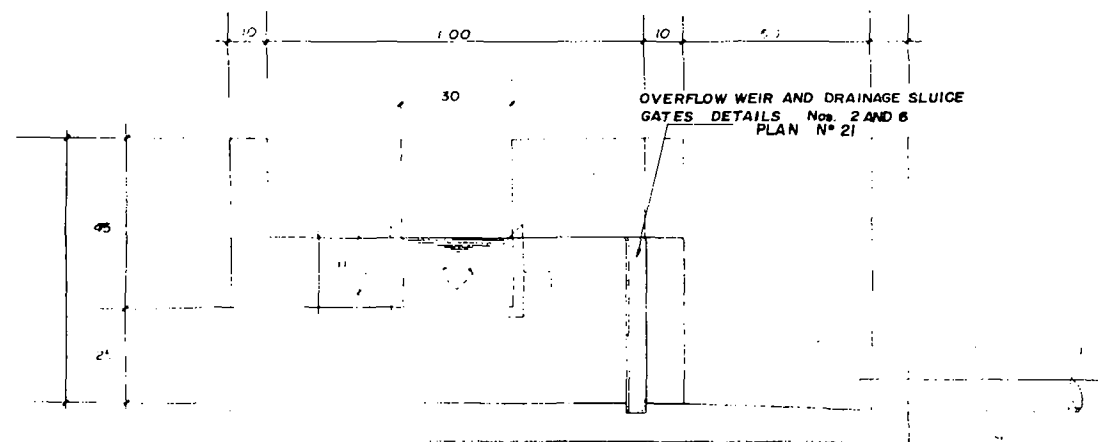
PLAN No 9

CEPIS / PAHO  
 DATE : JANUARY 1981

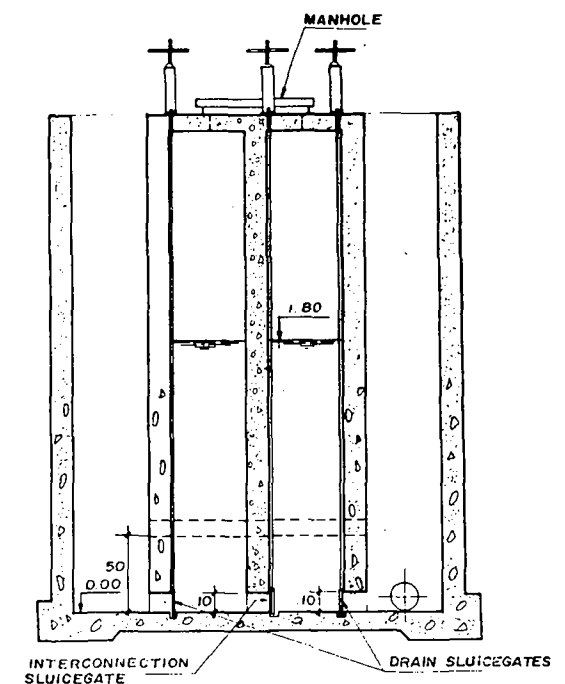


- C = WIDTH OF THE FILTER BOX
- E = WIDTH AT THE BOTTOM OF THE FILTER BOX
- h1 = HEAD LOSS THROUGH THE SAND BED
- h2 = WATER DEPTH OVER THE INLET WEIR TO THE FILTER BOX
- h3 = WATER DEPTH OVER THE CONTROL WEIR

SECTION F-F



SECTION D-D

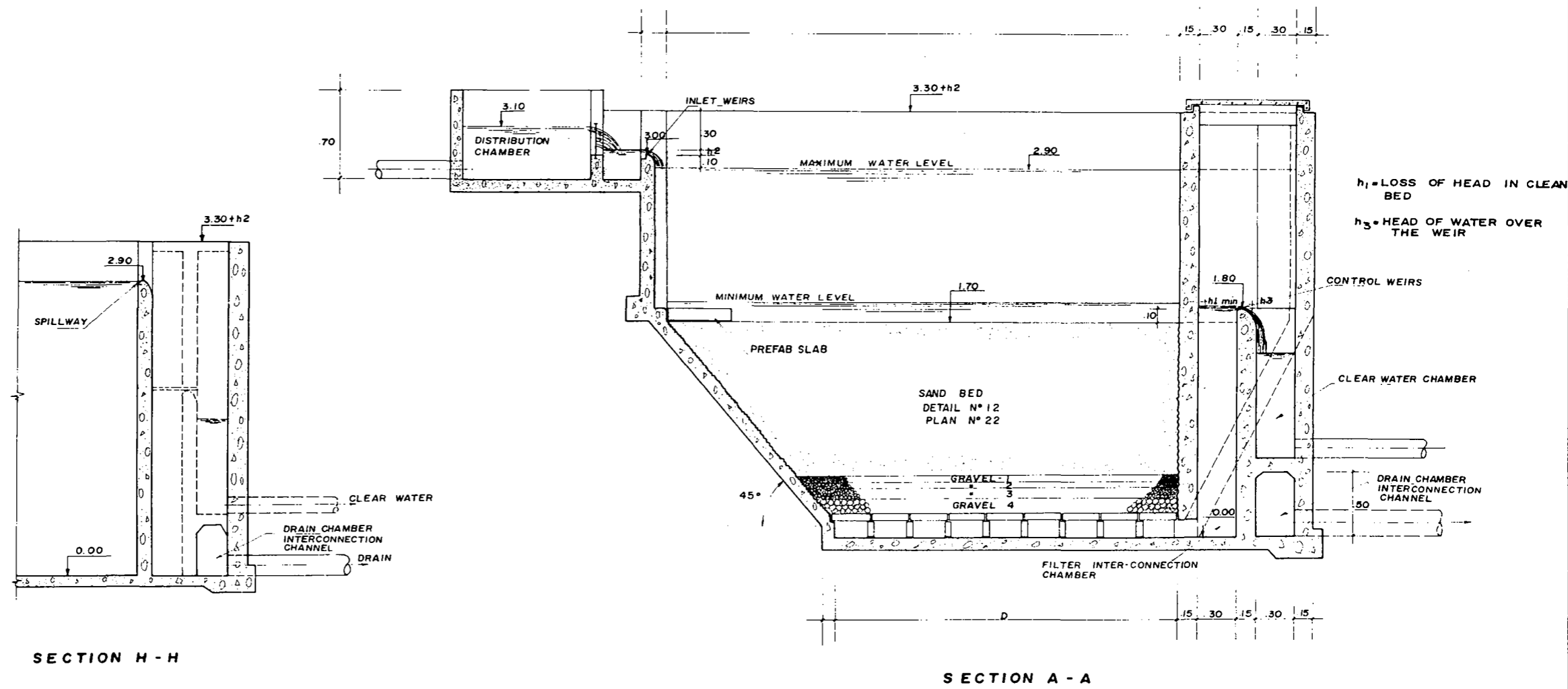


SECTION G-G

# VARIABLE HEAD SLOW SAND FILTER-TYPE 1C PLANT

PLAN N° 10

CEPIS / PAHO  
DATE : JANUARY 1981



# VARIABLE HEAD SLOW SAND FILTER-TYPE IC PLANT

PLAN N° 11

CEPIS/PAHO  
DATE: JANUARY 1981

TECHNICAL SPECIFICATIONS

(1) WATER QUALITY

- NORMAL TURBIDITY ..... 150 NU
- MEAN TURBIDITY ..... 250 NU
- MAXIMUM TURBIDITY ..... 750 NU
- COLOR ..... 50 CU

(2) DESIGN CRITERIA

SIMPLE HIGH RATE SETTLING UNIT

- (1) APPARENT OVERFLOW RATE (HAZEN PARAMETER) ..... 60 m/d
- (2) REAL OVERFLOW RATE ..... 9 m/d
- (3) REAL REYNOLDS NUMBER ..... 415
- (4) LONGITUDINAL VELOCITY ..... 0.10 m/min.
- (5) DETENTION TIME ..... 25 min.

VARIABLE HEAD SLOW FILTER

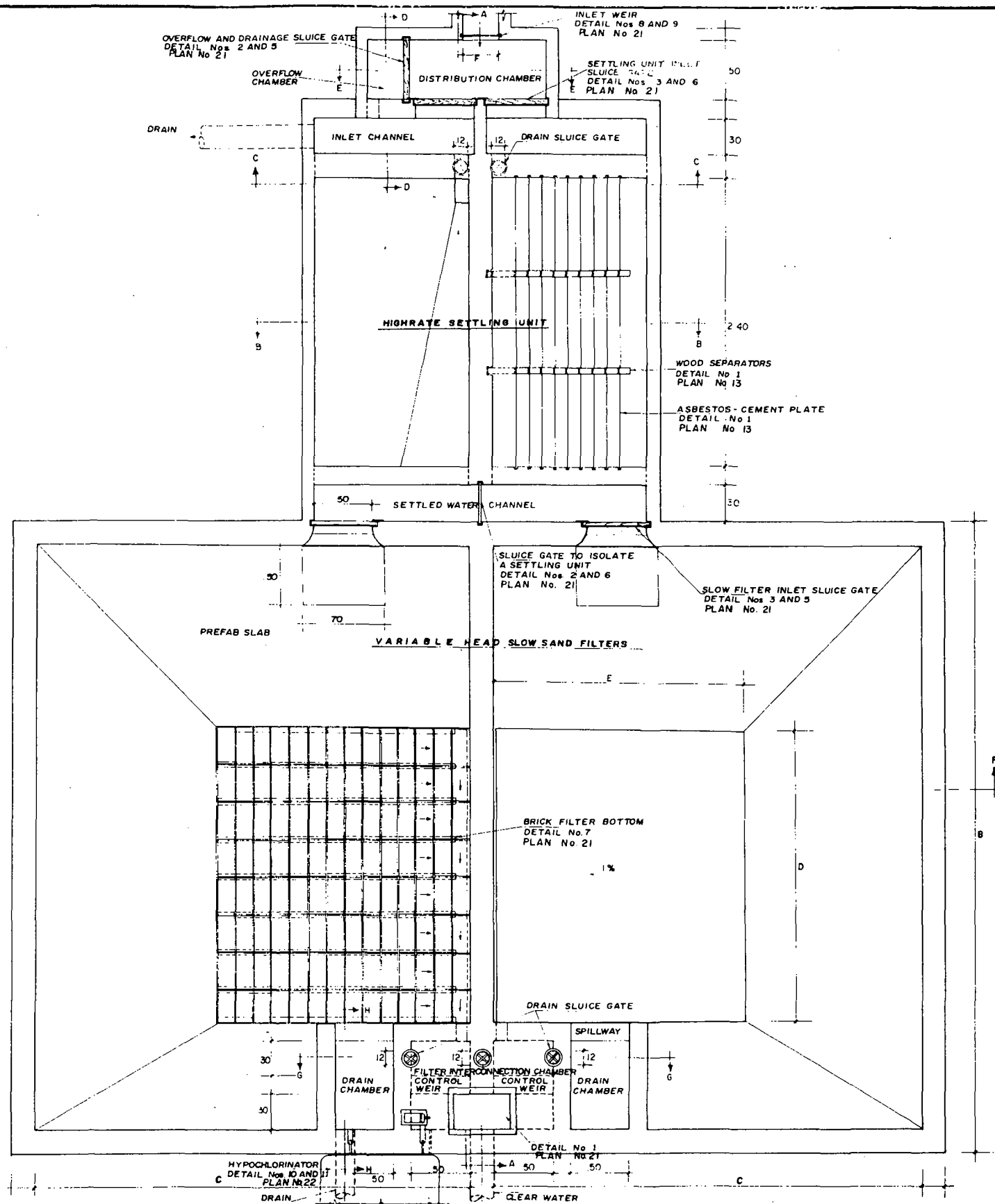
- (1) FILTRATION VELOCITY ..... 0.10 - 0.18 m/h
- (2) FIXED HEADLOSS ..... 5% of the initial headloss at the filter medium.
- (3) LIFE EXPECTATION OF THE FILTER ..... 5 years
- (4) CHARACTERISTICS OF THE FILTER MEDIUM:
  - EFFECTIVE DIAMETER ..... 0.15 - 0.35 mm.
  - UNIFORMITY COEFFICIENT ..... < 2.00
- (5) MAIN DRAIN VELOCITY ..... 0.05 m/s
- (6) MAXIMUM HEADLOSS ..... 1.10 m.

(3) SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

- A = WIDTH OF THE SETTLING UNIT.
- B = LENGTH OF FILTER BOX
- C = WIDTH OF FILTER BOX
- D = LENGTH AT THE BOTTOM OF THE FILTER BOX.
- E = WIDTH AT THE BOTTOM OF THE FILTER BOX.
- h = DEPTH OF WATER AT THE INLET CHANNEL.
- h<sub>1</sub> = WATER DEPTH AT THE INLET WEIR OF THE SETTLING UNIT.
- h<sub>2</sub> = WATER DEPTH AT THE INLET WEIR OF THE FILTER BOX.
- h<sub>3</sub> = WATER DEPTH AT THE CONTROL WEIR.
- h<sub>4</sub> = WATER DEPTH AT THE INLET WEIR.

MODULAR PLANTS DIMENSIONS

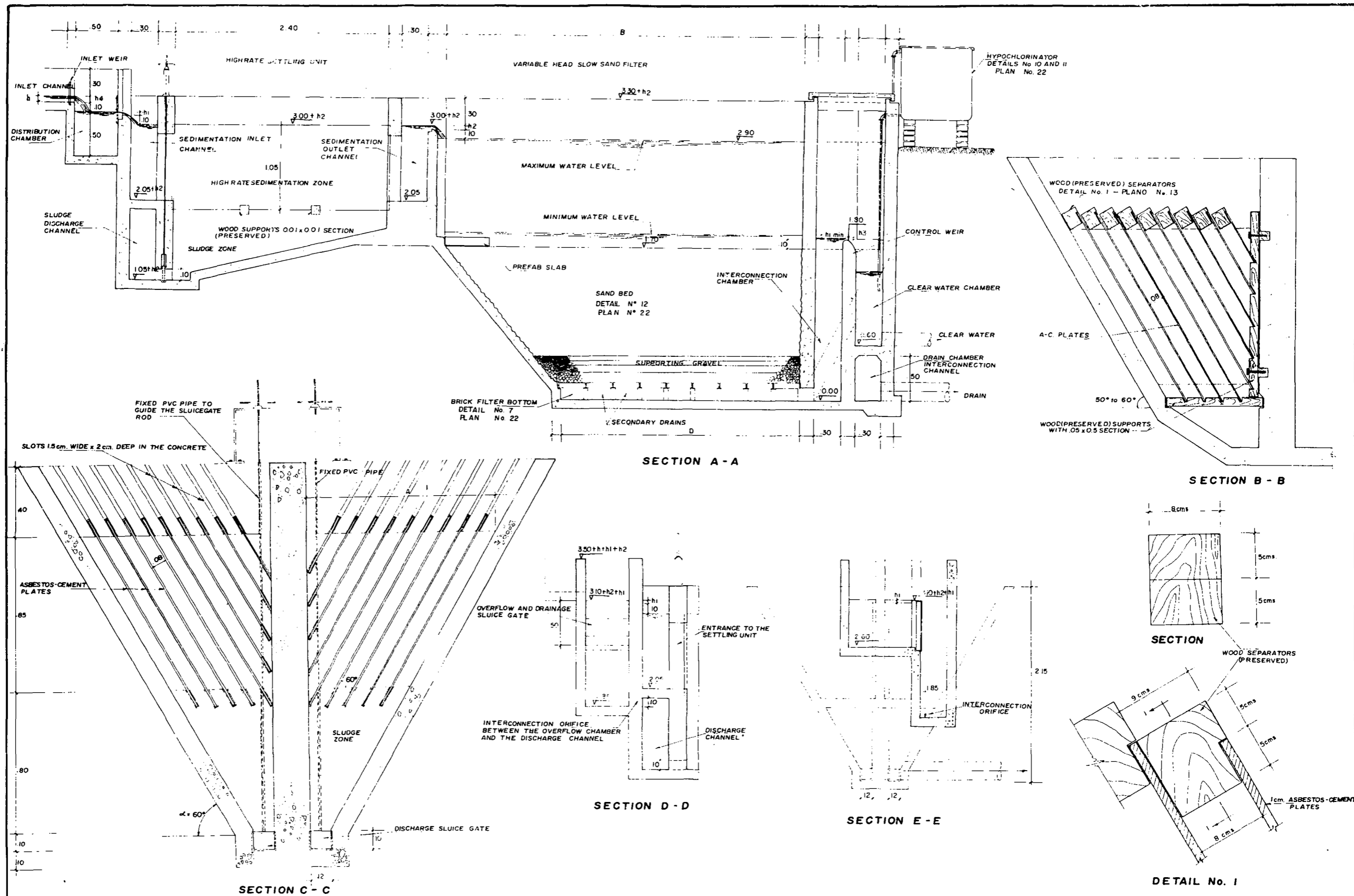
Q m <sup>3</sup> /h	A m	B m	C m	D m	E m	h cm	h <sub>1</sub> cm	h <sub>2</sub> cm	h <sub>3</sub> cm	h <sub>4</sub> cm	
1	3.6	1.11	490	3.70	2.50	215	7.1	1.0	.02	.65	65
2	5.4	1.11	600	4.50	3.60	295	8.7	1.2	.04	.85	65
3	7.2	1.11	690	5.20	4.50	3.65	10.0	1.5	.05	1.00	73
4	9.0	1.11	775	5.80	5.35	4.25	11.2	1.7	.06	1.20	80
5	10.8	1.32	850	6.40	6.10	4.85	12.2	1.9	.06	1.36	8.6
6	14.4	1.52	980	7.35	7.40	5.80	14.1	2.3	.07	1.60	9.6
7	18.0	1.72	10.95	8.25	8.55	6.70	15.8	2.7	.08	1.90	10.5
8	21.6	2.03	12.00	9.00	9.60	7.45	17.3	3.0	.08	2.16	11.3
9	25.2	2.34	12.55	9.70	10.55	8.15	18.7	3.4	.08	2.40	12.0
10	28.8	2.64	13.80	10.40	11.40	8.95	20.0	3.7	.08	2.60	12.7
11	32.4	2.95	14.70	11.05	12.30	9.50	21.2	4.0	.08	2.80	13.3
12	36.0	3.25	15.45	11.60	13.05	10.05	22.4	4.3	.08	3.00	14.0



**SIMPLE HIGH RATE SETTLING UNIT AND VARIABLE HEAD SLOW SAND FILTER - TYPE 3 PLANT**

PLAN N° 12

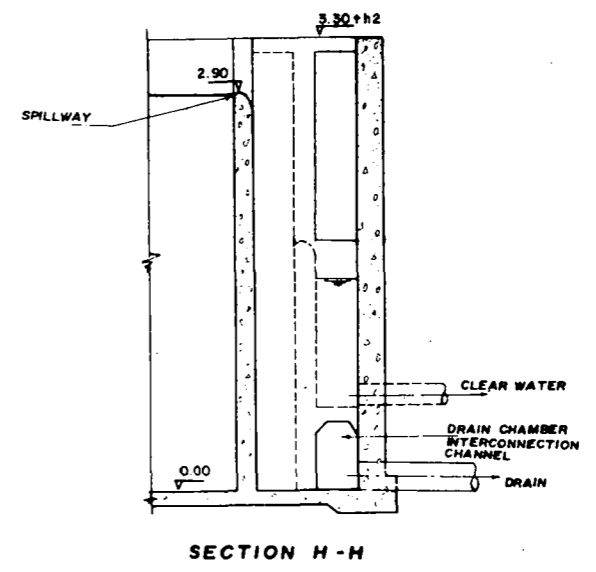
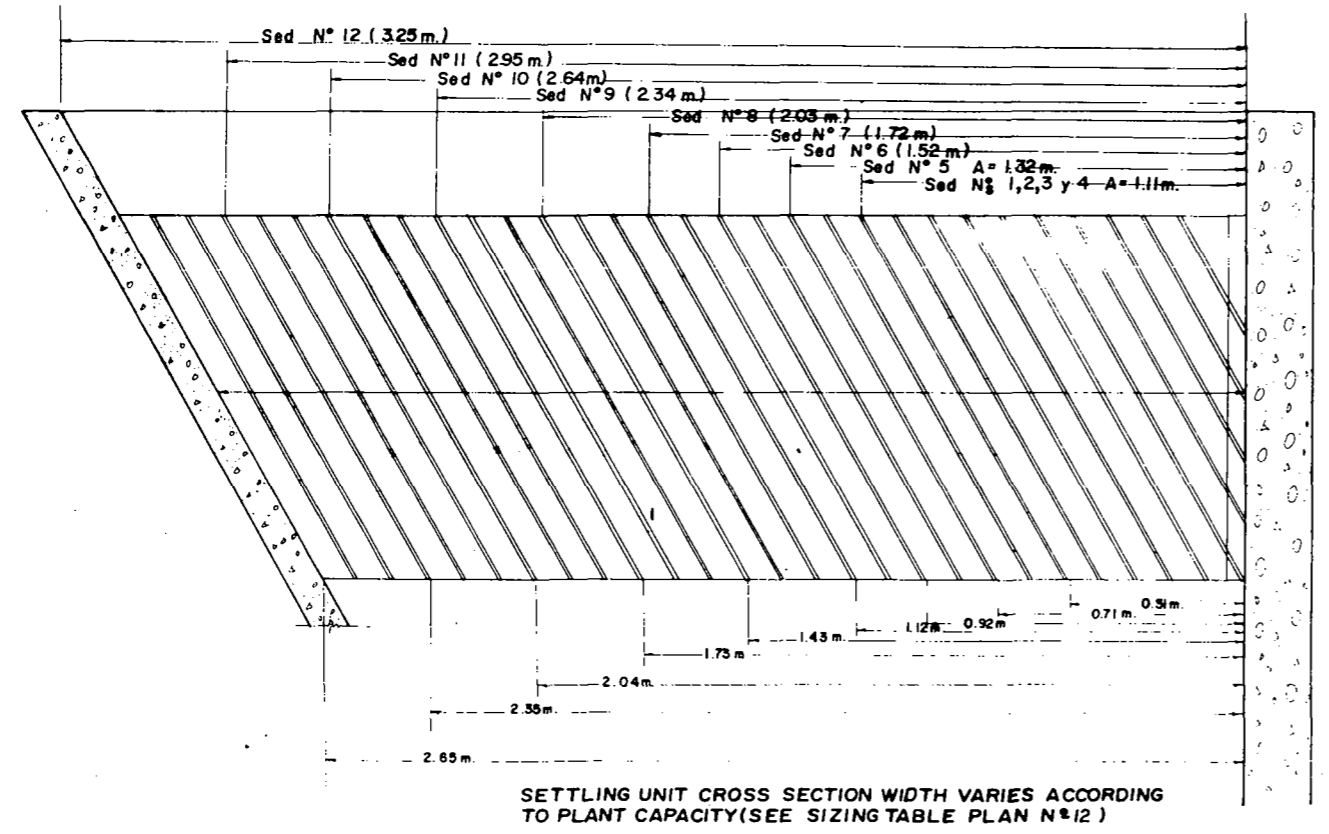
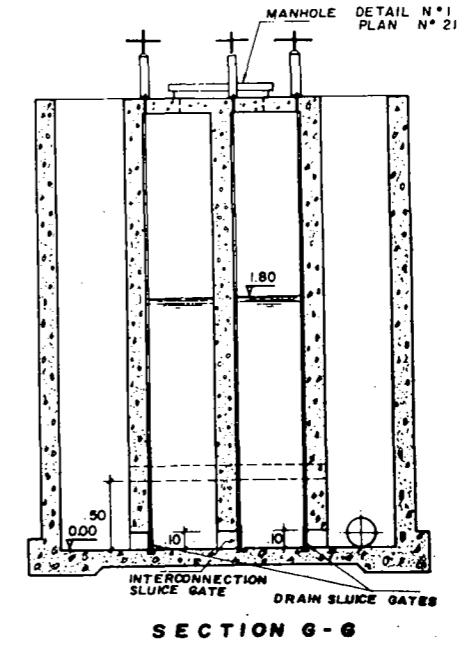
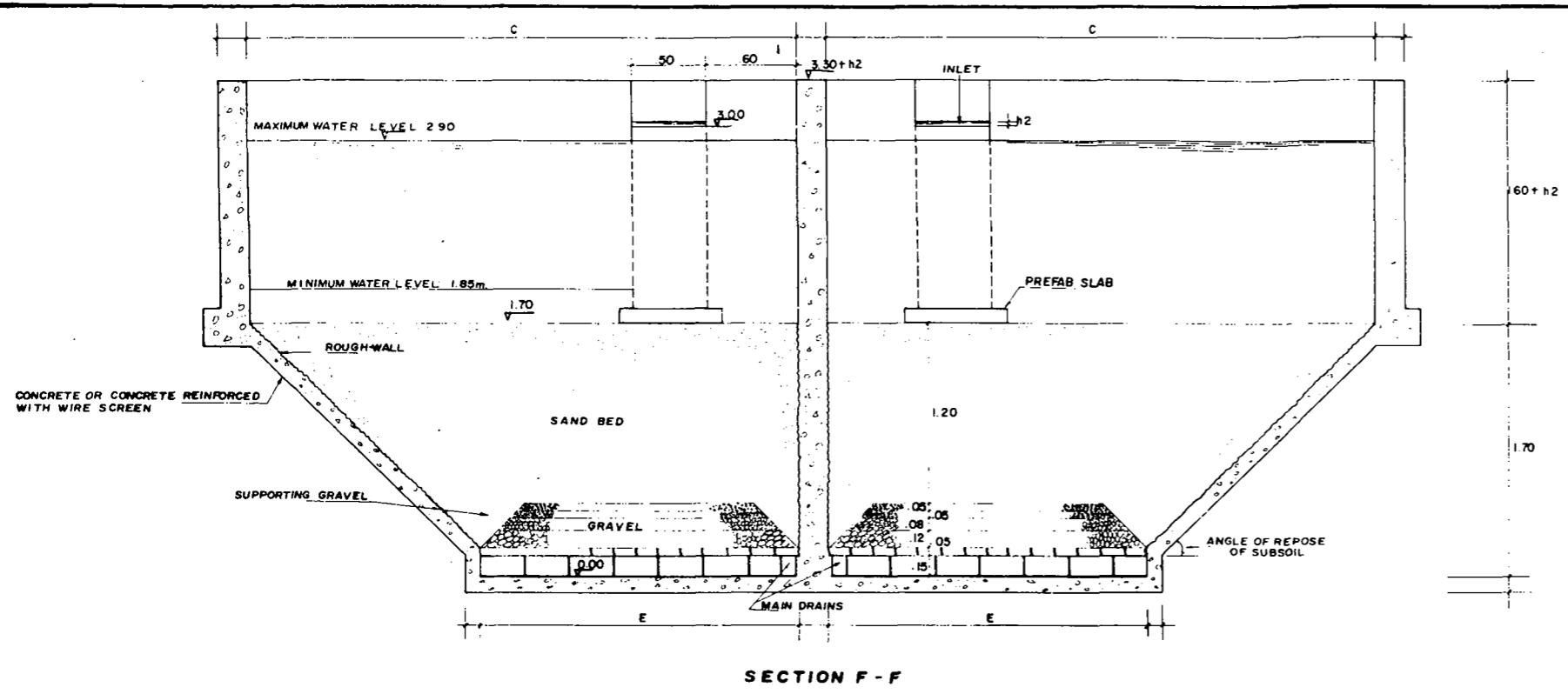
CEPIS / PAHO  
DATE: JANUARY 1981



**SIMPLE HIGH RATE SETTLING UNIT AND VARIABLE HEAD SLOW SAND FILTER - TYPE 3 PLANT**

PLAN No 13  
 CEPIS / PAHO  
 DATE: JANUARY 1981

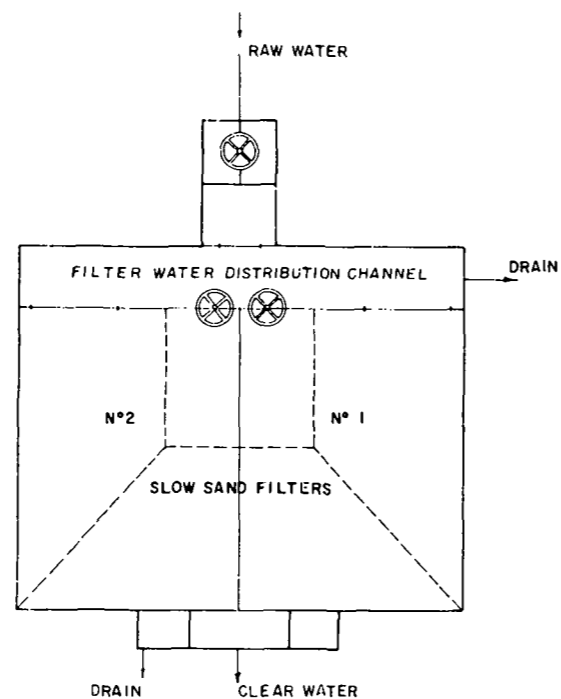




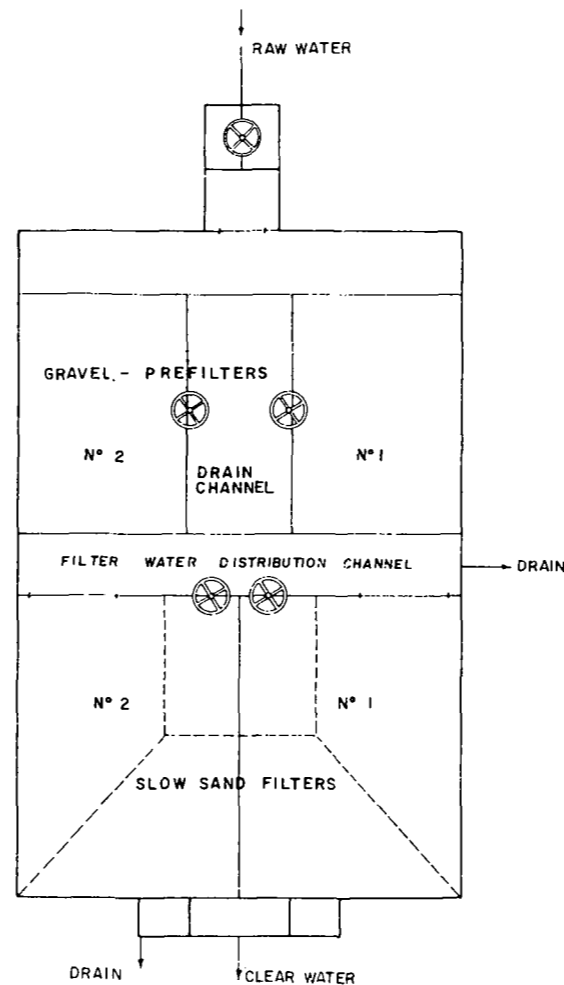
**SIMPLE HIGH RATE SETTLING UNIT AND VARIABLE HEAD SLOW SAND FILTER-TYPE 3 PLANT**

PLAN N°14

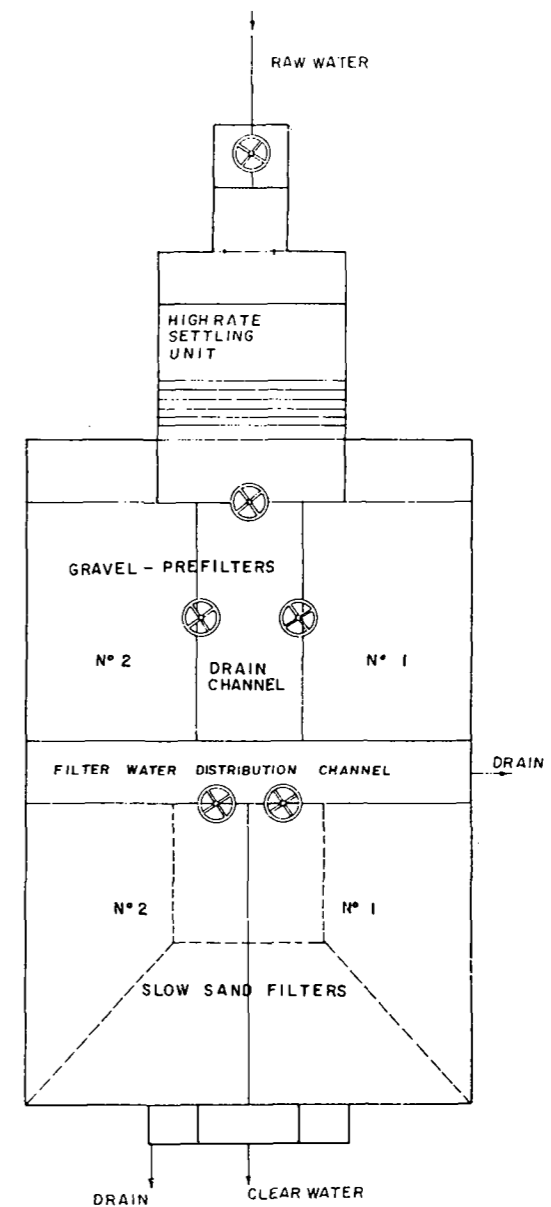
CEPIS/PAHO  
DATE: JANUARY 1981



PLANT TYPE 2



PLANT TYPE 4



PLANT TYPE 5A

UNIT PROCESS ORGANIZATION IN SLOW SAND FILTRATION  
PLANTS FOR RURAL AREA

PLAN Nº 15

CEPIS / PAHO  
DATE : JANUARY 1981

TECHNICAL SPECIFICATIONS

(1) WATER QUALITY

- NORMAL TURBIDITY ..... 150 NU
- MEAN TURBIDITY ..... 250 NU
- MAXIMUM TURBIDITY ..... 750 NU
- COLOR ..... < 50 CU

(2) DESIGN CRITERIA

SIMPLE HIGH RATE SETTLING UNIT

- (1) APPARENT OVERFLOW RATE (HAZEN PARAMETER) ..... 60 m/d
- (2) REAL OVERFLOW RATE ..... 9 m/d
- (3) REAL REYNOLDS NUMBER ..... 415
- (4) LONGITUDINAL VELOCITY ..... 0.10 m/min.
- (5) RETENTION TIME ..... 25 min.

PREFILTER

- PREFILTERING VELOCITY ..... 0.60 m/h
- CHARACTERISTICS OF THE PREFILTER MEDIUM:
- GRAVEL ..... 1/4"

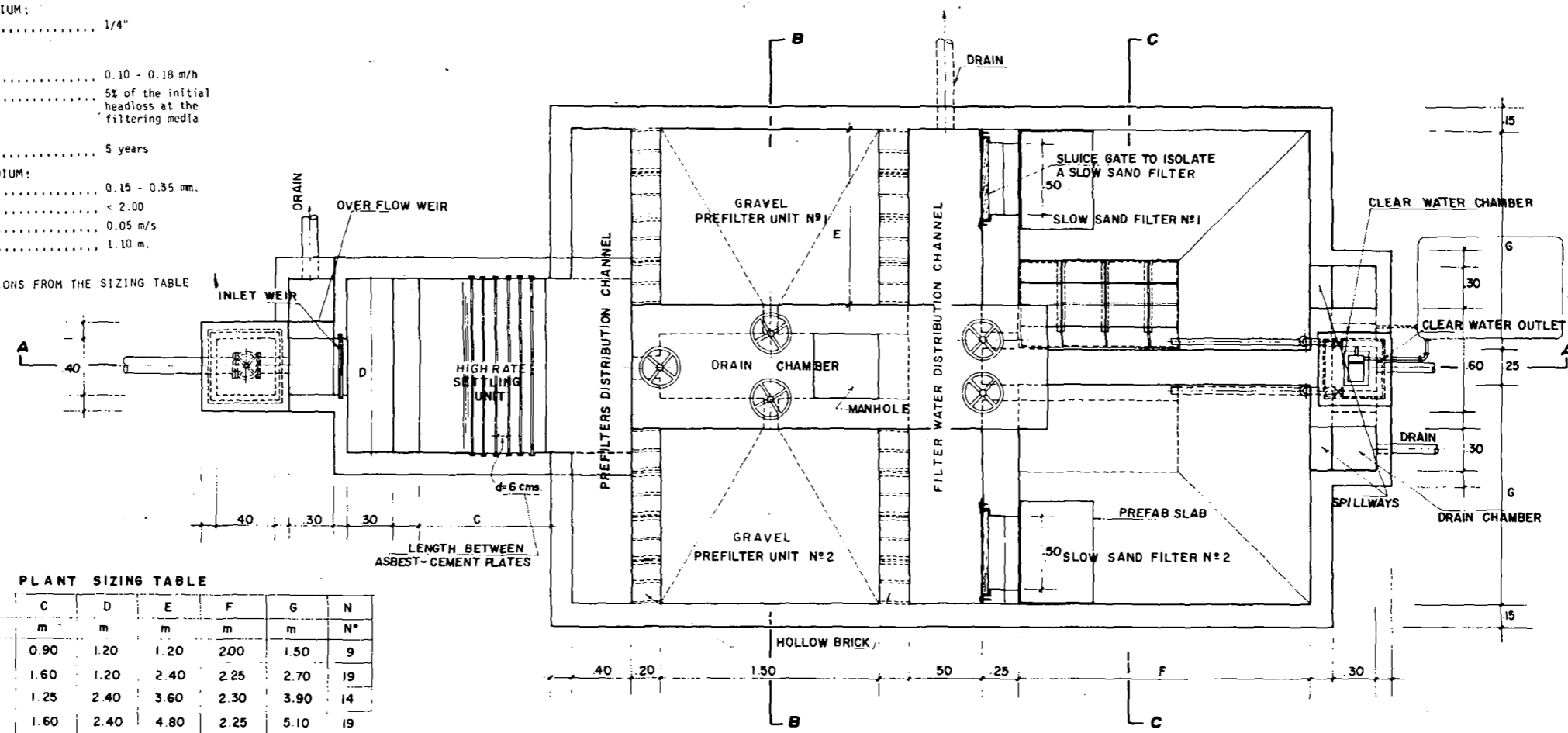
VARIABLE HEAD SLOW FILTER

- (1) FILTRATION VELOCITY ..... 0.10 - 0.18 m/h
- (2) FIXED HEADLOSS ..... 5% of the initial headloss at the filtering media
- (3) PERIOD OF RESANDING ..... 5 years
- (4) CHARACTERISTICS OF THE FILTER MEDIUM:
- EFFECTIVE DIAMETER ..... 0.15 - 0.35 mm.
- UNIFORMITY COEFFICIENT ..... < 2.00
- (5) MAIN DRAIN VELOCITY ..... 0.05 m/s
- (6) MAXIMUM HEADLOSS ..... 1.10 m.

- A = REAL LENGTH OF THE SETTLING UNIT.
- B = LENGTH OF SLUDGE ZONE
- C = PROJECTED LENGTH OF THE SETTLING UNIT.
- D = WIDTH OF THE SETTLING UNIT.
- E = WIDTH OF THE PREFILTER UNIT.
- F = LENGTH OF THE FILTER BOX.
- G = WIDTH OF THE FILTER BOX
- N = PLATES NUMBER

(3) SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

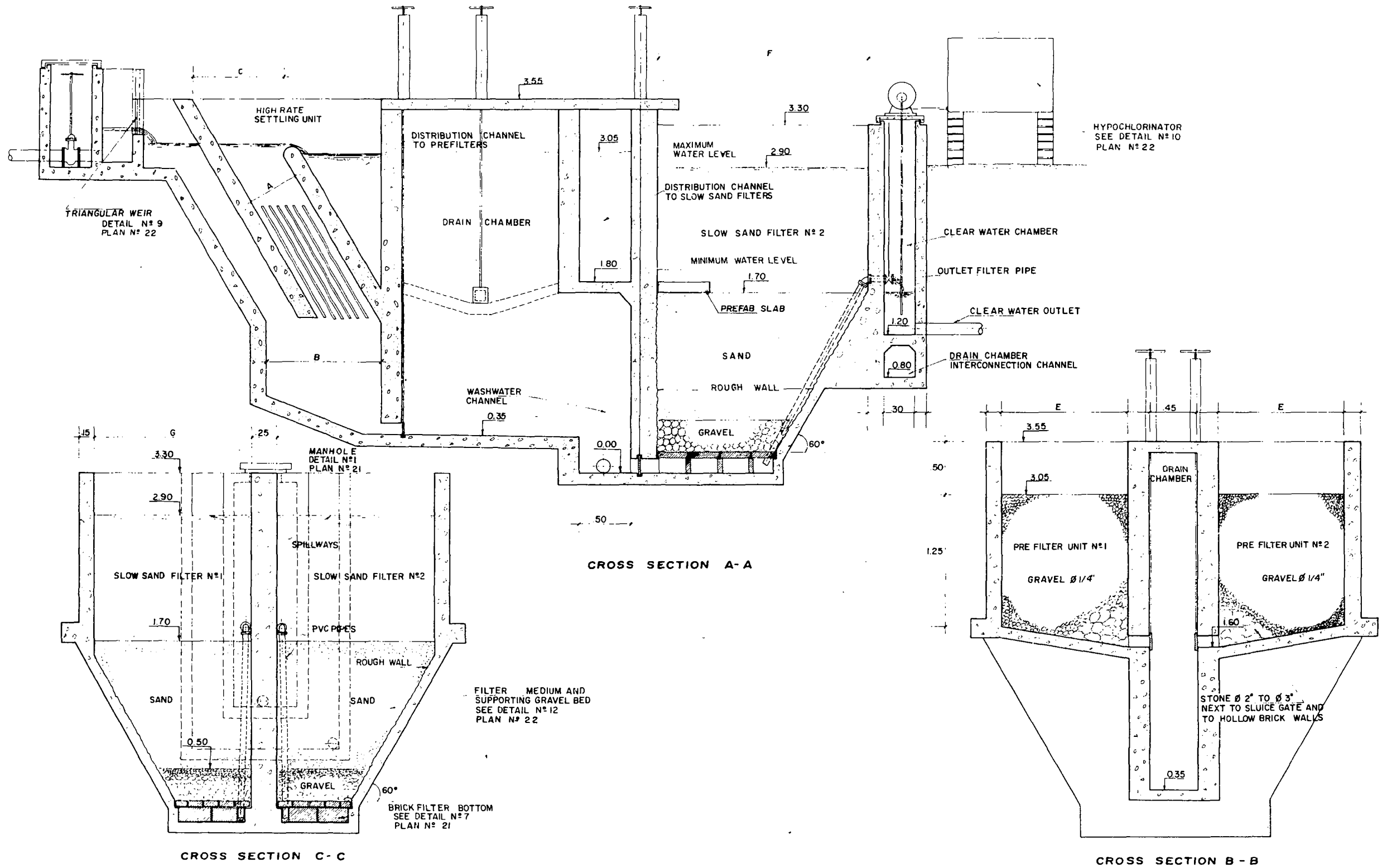
Q	A	B	C	D	E	F	G	N
m <sup>3</sup> /h	m	m	m	m	m	m	m	N°
1.8	69	0.75	0.90	1.20	1.20	2.00	1.50	9
3.6	1.39	1.45	1.60	1.20	2.40	2.25	2.70	19
5.4	1.04	1.10	1.25	2.40	3.60	2.30	3.90	14
7.2	1.39	1.45	1.60	2.40	4.80	2.25	5.10	19



SIMPLE HIGH RATE SETTLING UNIT, ROUGH FILTER UNITS AND SLOW SAND FILTERS - TYPE 5A PLANT

PLAN N° 16

CEPIS / PAHO  
DATE: JANUARY 1981



SIMPLE HIGH RATE SETTLING UNIT ROUGH FILTER-UNITS AND  
 SLOW SAND FILTERS - TYPE 5A PLANT

PLAN N° 17

CEPIS / PAHO  
 DATE JANUARY 1981

TECHNICAL SPECIFICATIONS

(1) WATER QUALITY

- NORMAL TURBIDITY	.....	150 NU
- MEAN TURBIDITY	.....	250 NU
- MAXIMUM TURBIDITY	.....	750 NU
COLOR	.....	<50 CU

(2) DESIGN CRITERIA

SIMPLE HIGH RATE SETTLING UNIT

(1) APPARENT OVERFLOW RATE (HAZEN PARAMETER)	.....	60 m/d
(2) REAL OVERFLOW RATE	.....	9 m/d
(3) REAL REYNOLDS NUMBER	.....	415
(4) LONGITUDINAL VELOCITY	.....	0.10 m/min.
(5) DETENTION TIME	.....	25 min.

PREFILTER

PREFILTERING VELOCITY	.....	0.60 m/h
CHARACTERISTICS OF THE PREFILTER MEDIA:		
GRAVEL	.....	1/4"

VARIABLE HEAD SLOW FILTER

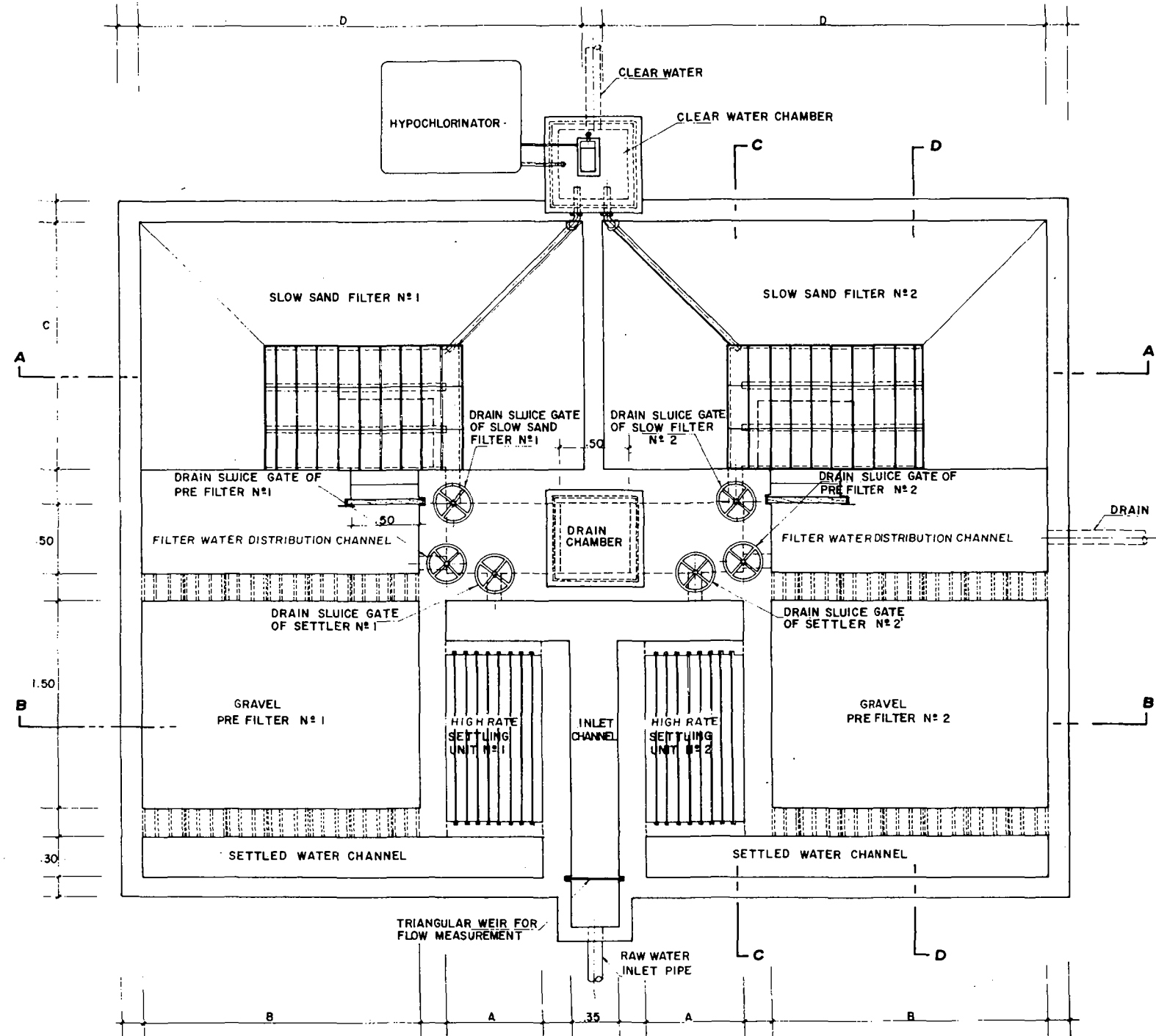
(1) FILTRATION VELOCITY	.....	0.10 - 0.18 m/h
(2) FIXED HEADLOSS	.....	5% of the initial headloss at the filtering media
(3) PERIOD OF FILTER RESANDING	.....	5 years
(4) CHARACTERISTICS OF THE FILTER MEDIUM:		
EFFECTIVE DIAMETER	.....	0.10 - 0.35 mm.
UNIFORMITY COEFFICIENT	.....	< 2.00
(5) MAIN DRAIN VELOCITY	.....	0.05 m/s
(6) MAXIMUM HEADLOSS	.....	1.3 m.

(3) SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

- A = WIDTH OF THE SETTLING UNIT.
- B = WIDTH OF THE PREFILTER UNIT.
- C = LENGTH OF THE FILTER BOX.
- D = WIDTH OF THE FILTER BOX.

PLANT SIZING TABLE

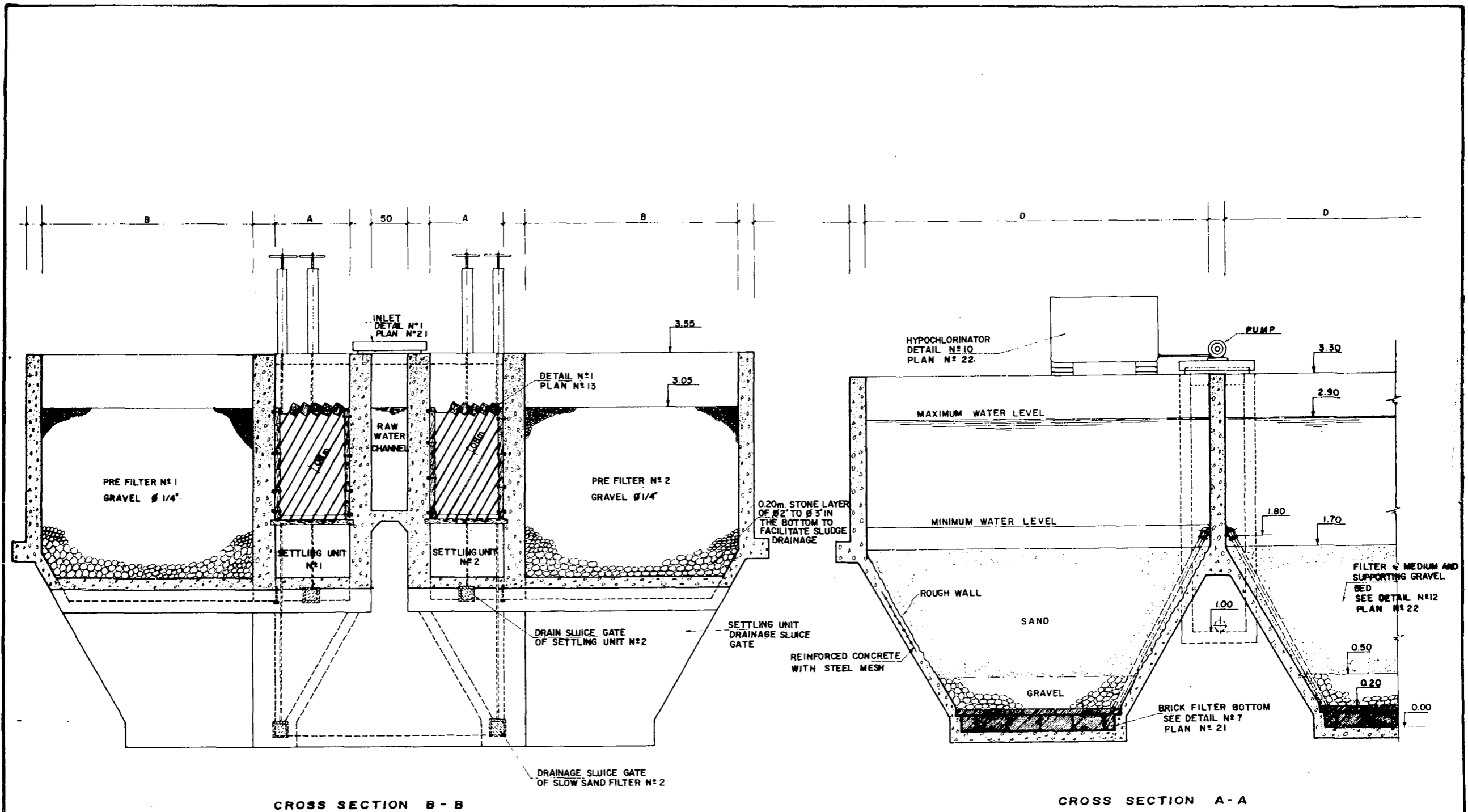
Q	A	B	C	D
m <sup>3</sup> /h	m	m	m	m
3.6	.70	2.00	1.80	3.20
5.4	1.00	3.00	2.00	4.50
7.2	1.35	4.00	2.25	5.35
9.0	1.70	5.00	2.10	7.20
10.8	2.00	6.00	2.10	8.50



SIMPLE HIGH RATE SETTLING UNIT - ROUGH FILTER - SLOW SAND FILTRATION - PLAN TYPE 5B

PLAN N° 18

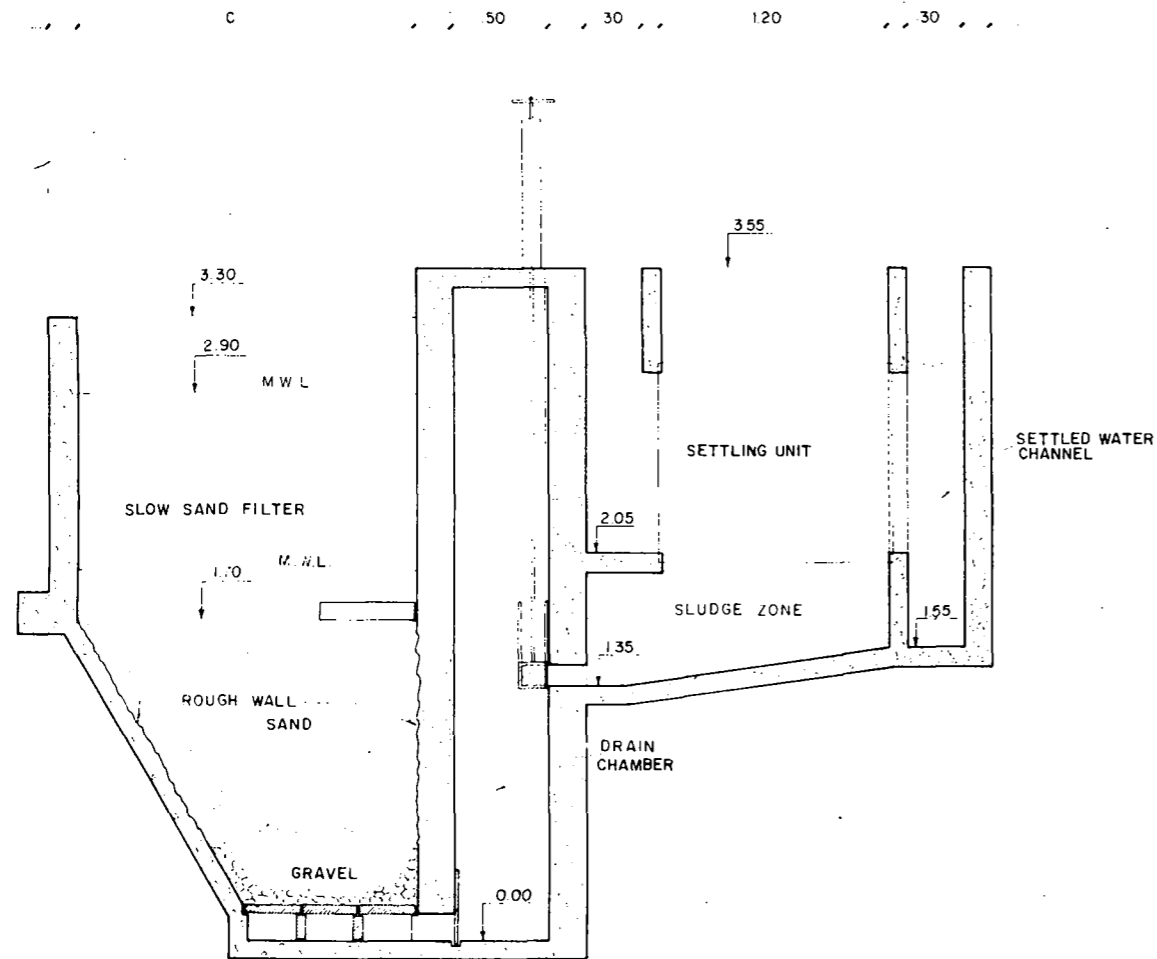
CEPIS / PAHO  
DATE JANUARY 1981



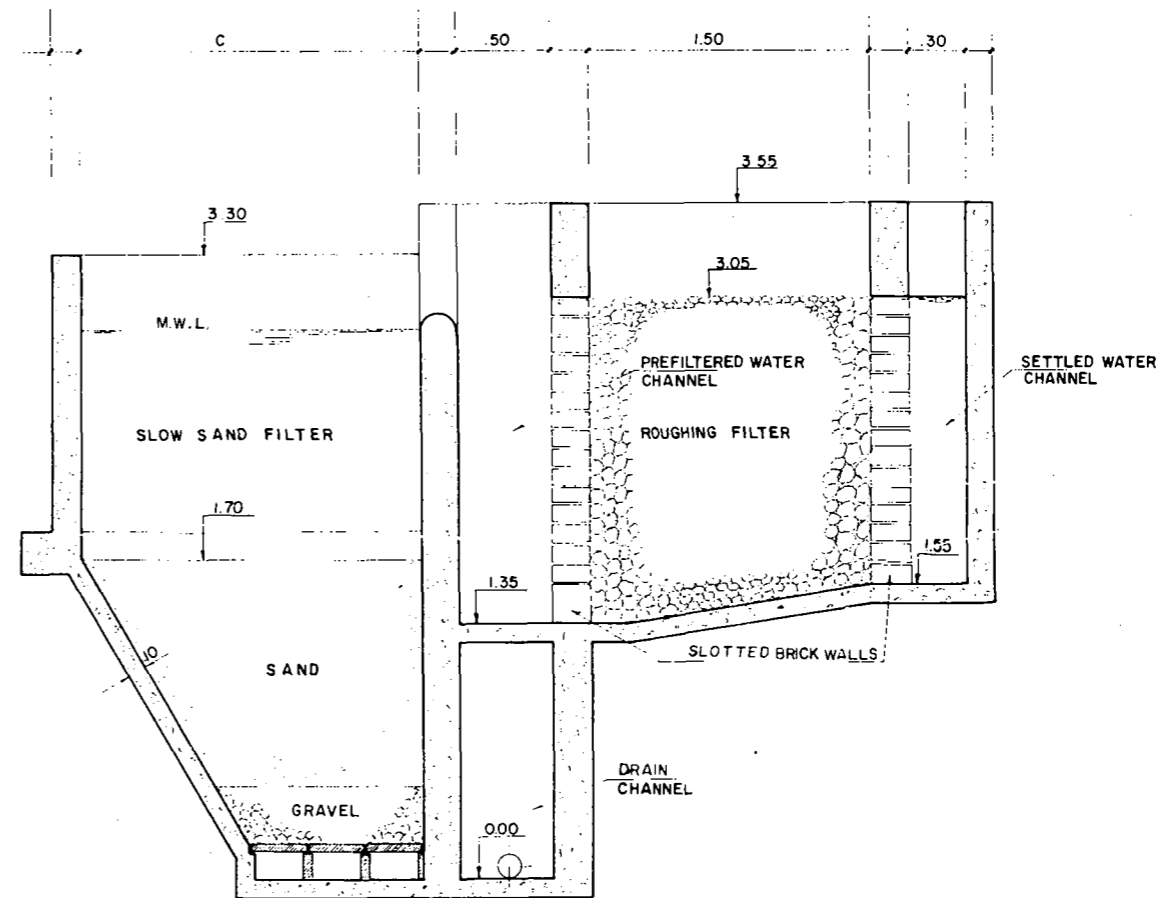
**SIMPLE HIGHRATE SETTLING UNIT-ROUGH FILTER - SLOW SAND  
FILTRATION - TYPE 5B PLANT**

PLAN N° 19

CEPIS / PAHO  
DATE : JANUARY 1981



CROSS SECTION C - C



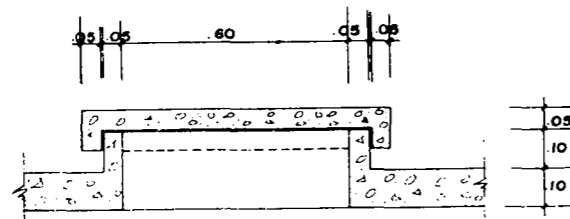
CROSS SECTION D - D

SIMPLE HIGH RATE SETTLING UNIT-ROUGH FILTER-SLOW SAND  
FILTRATION - TYPE 5B PLANT

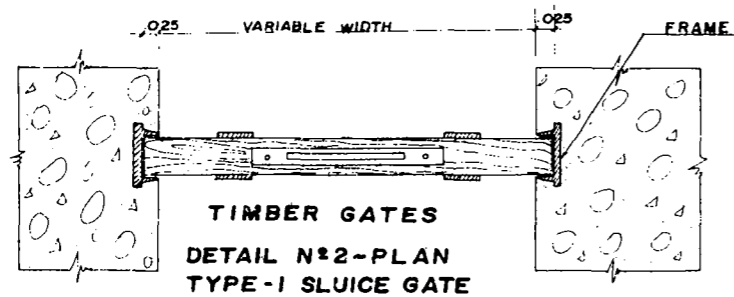
PLAN N<sup>o</sup> 20

CEPIS / PAHO

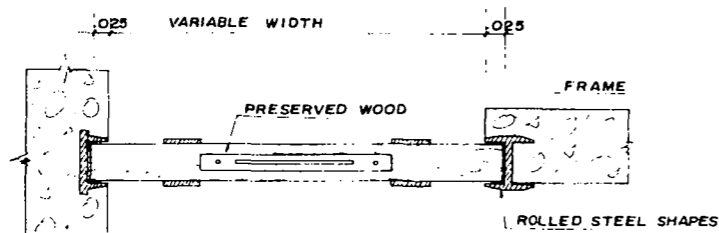
DATE : JANUARY 1981



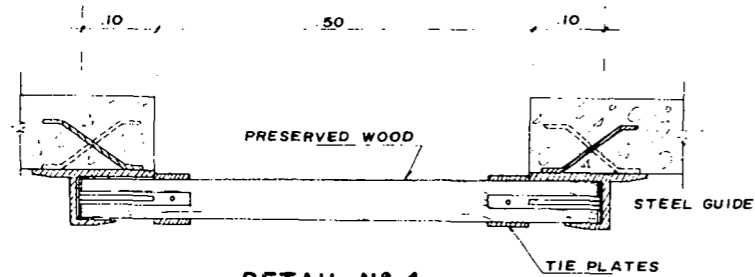
DETAIL N°1 - MANHOLE



TIMBER GATES  
DETAIL N°2 - PLAN  
TYPE-1 SLUICE GATE

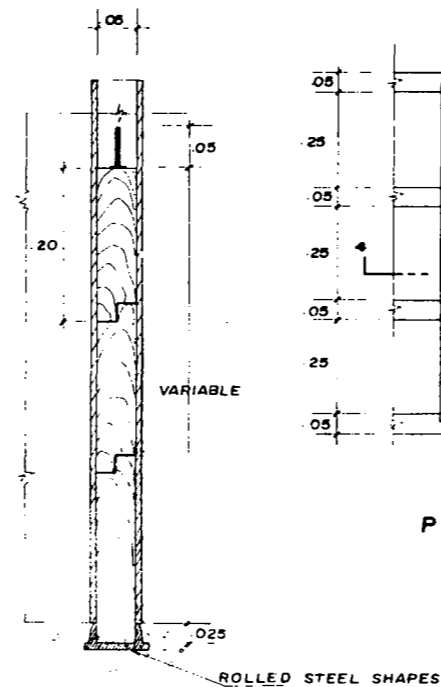


DETAIL N°3  
TYPE-2 SLUICE GATE - PLAN

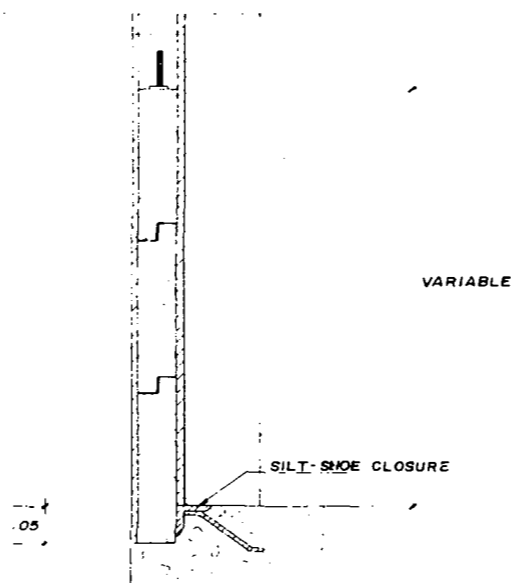


DETAIL N°4  
TYPE-3 SLUICE GATE - PLAN

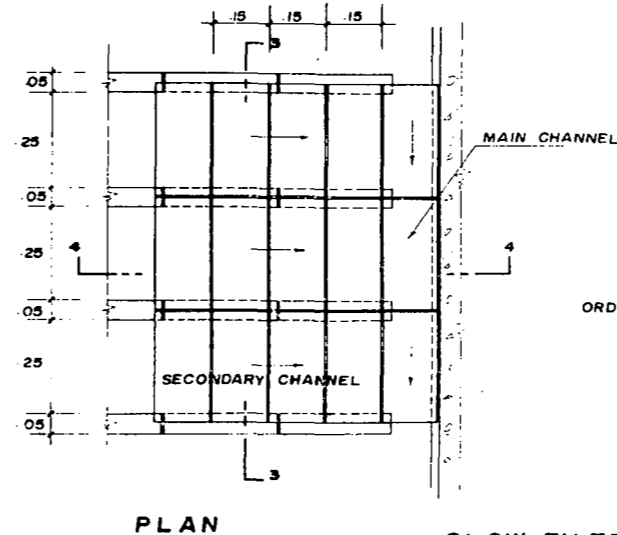
SPECIAL TREATMENT FOR WOOD: ALL WOODEN PARTS MUST BE IMPREGNATED WITH CREOSOTE



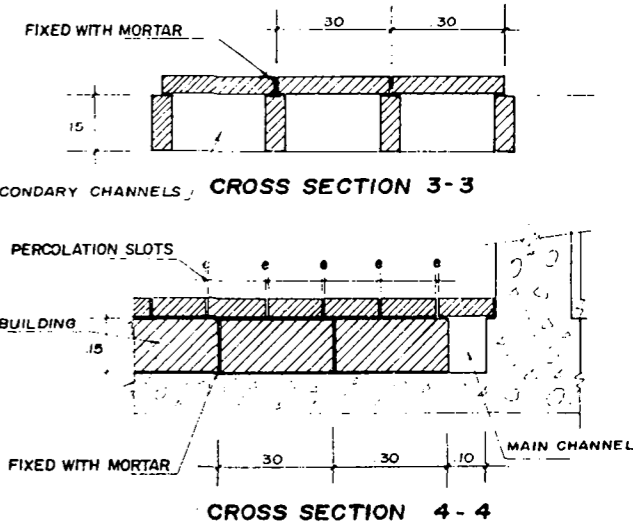
DETAIL N°6  
SLUICE GATE - CROSS SECTION



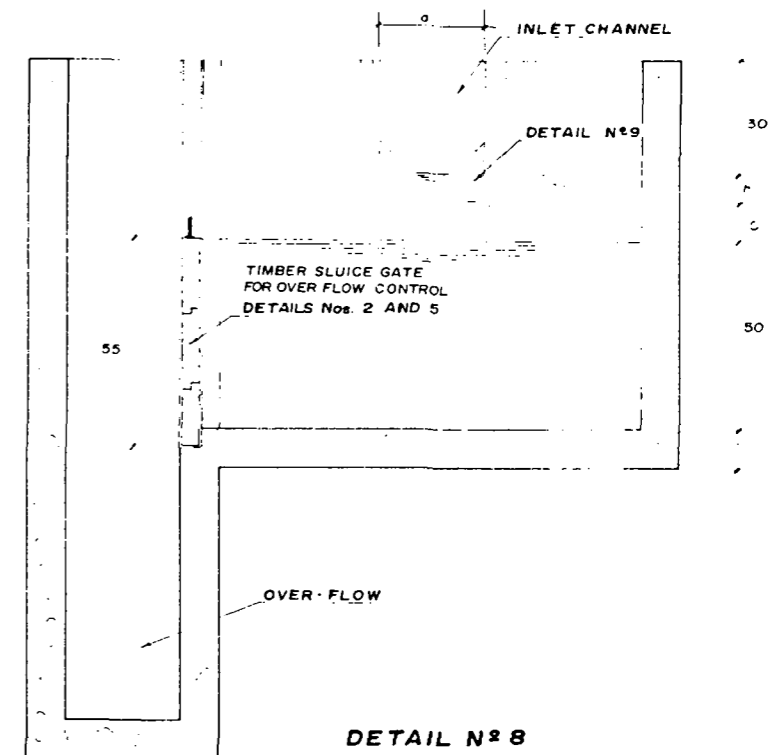
DETAIL N°5  
SLUICE GATE - CROSS SECTION



PLAN



SLOW FILTERS DRAIN  
DETAIL N°7



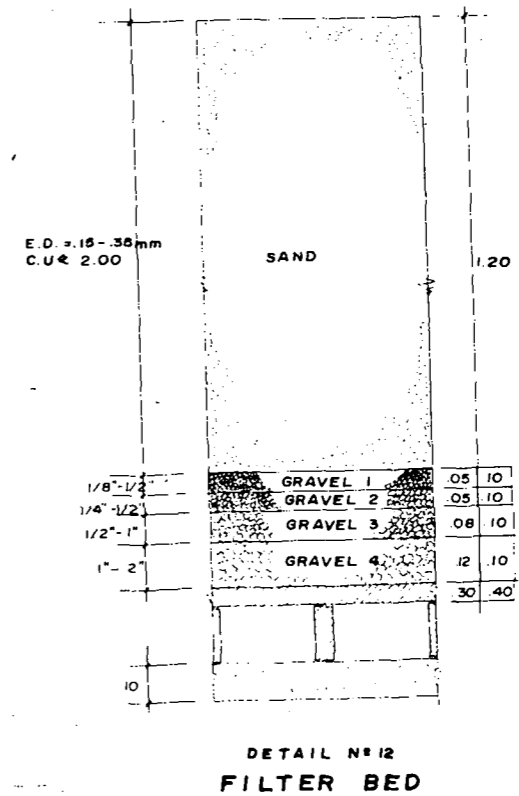
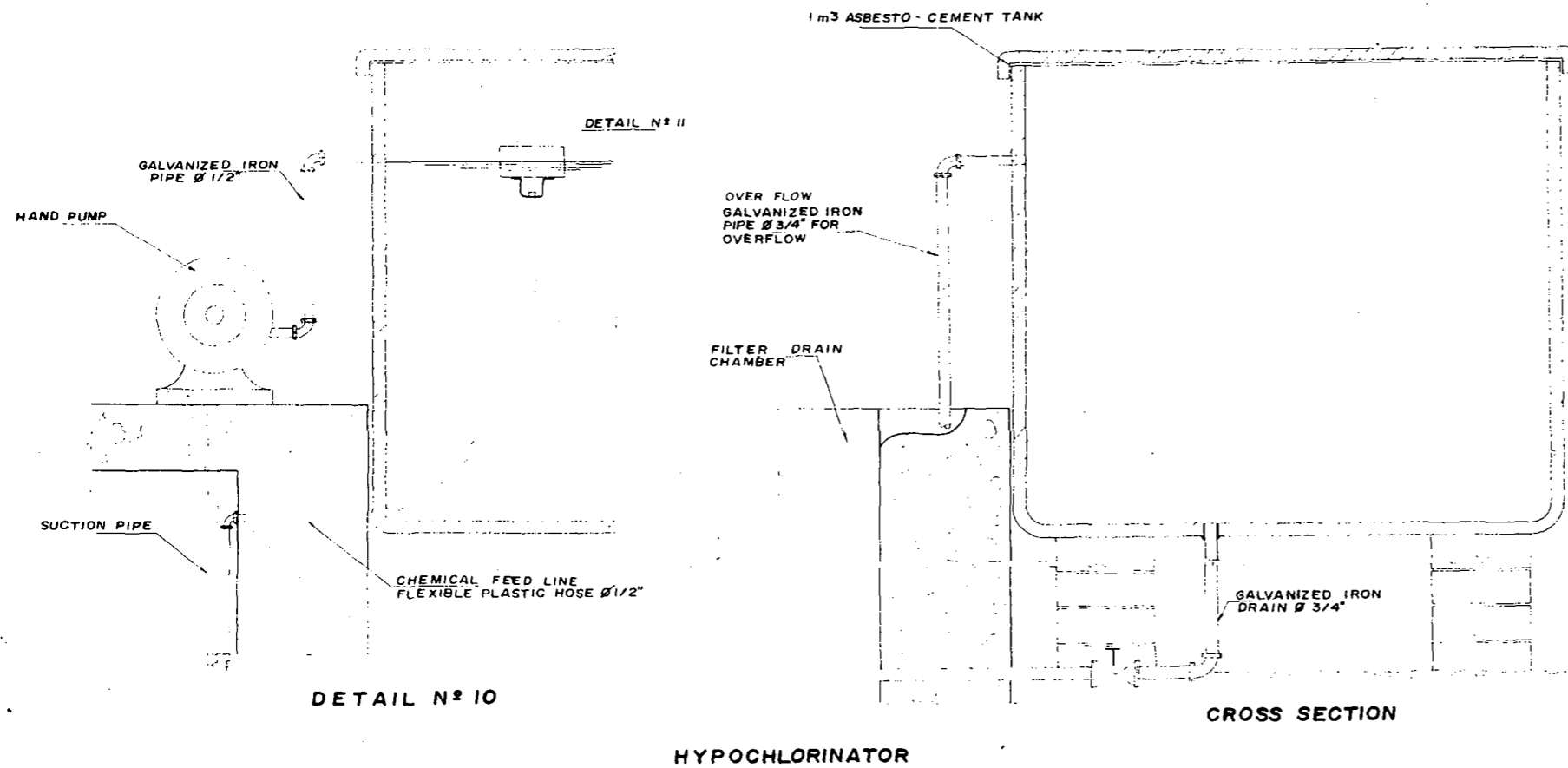
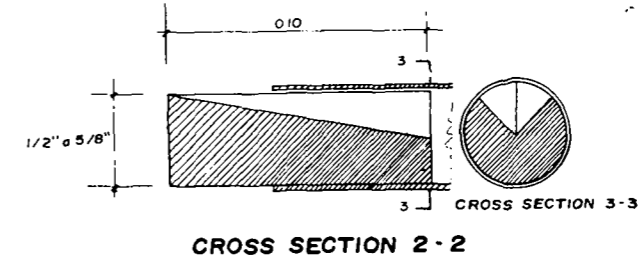
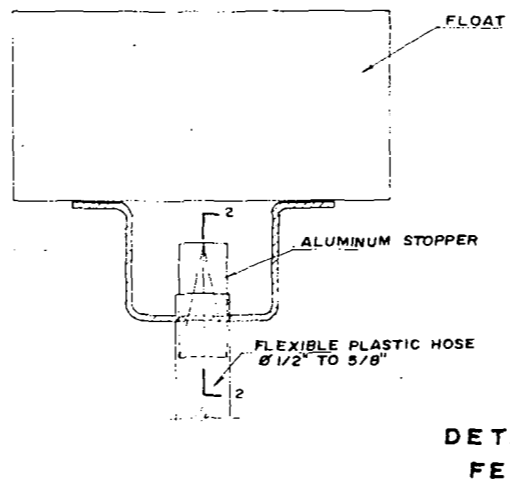
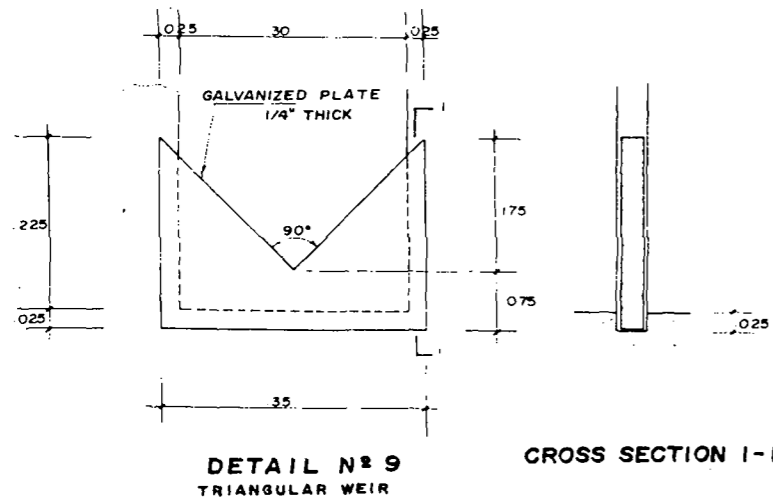
DETAIL N°8

# DETAILS OF SLOW FILTER TREATMENT PLANT

PLAN N° 21

CEPIS / PAHO  
DATE JANUARY 1981





**DETAILS OF WEIR, HYPOCHLORINATOR AND SLOW SAND FILTER BED**

**PLAN N° 22**

CEPIS / PAHO  
DATE JANUARY 1981

TECHNICAL SPECIFICATIONS

1. WATER QUALITY

NORMAL TURBIDITY	50 NU
AVERAGE TURBIDITY	100 NU
MAXIMUM TURBIDITY	150 NU
NORMAL COLOR	50 CU
AVERAGE COLOR	100 CU
MAXIMUM COLOR	120 CU

2. DESIGN CRITERIA

FILTRATION VELOCITY	120 m <sup>3</sup> /m <sup>2</sup> x day
WASHING VELOCITY	0.80 m/min

FILTER MEDIA

A. SAND

E.D.	0.7 - 0.8 mm
C.U.	< 2

B. SUPPORTING LAYER

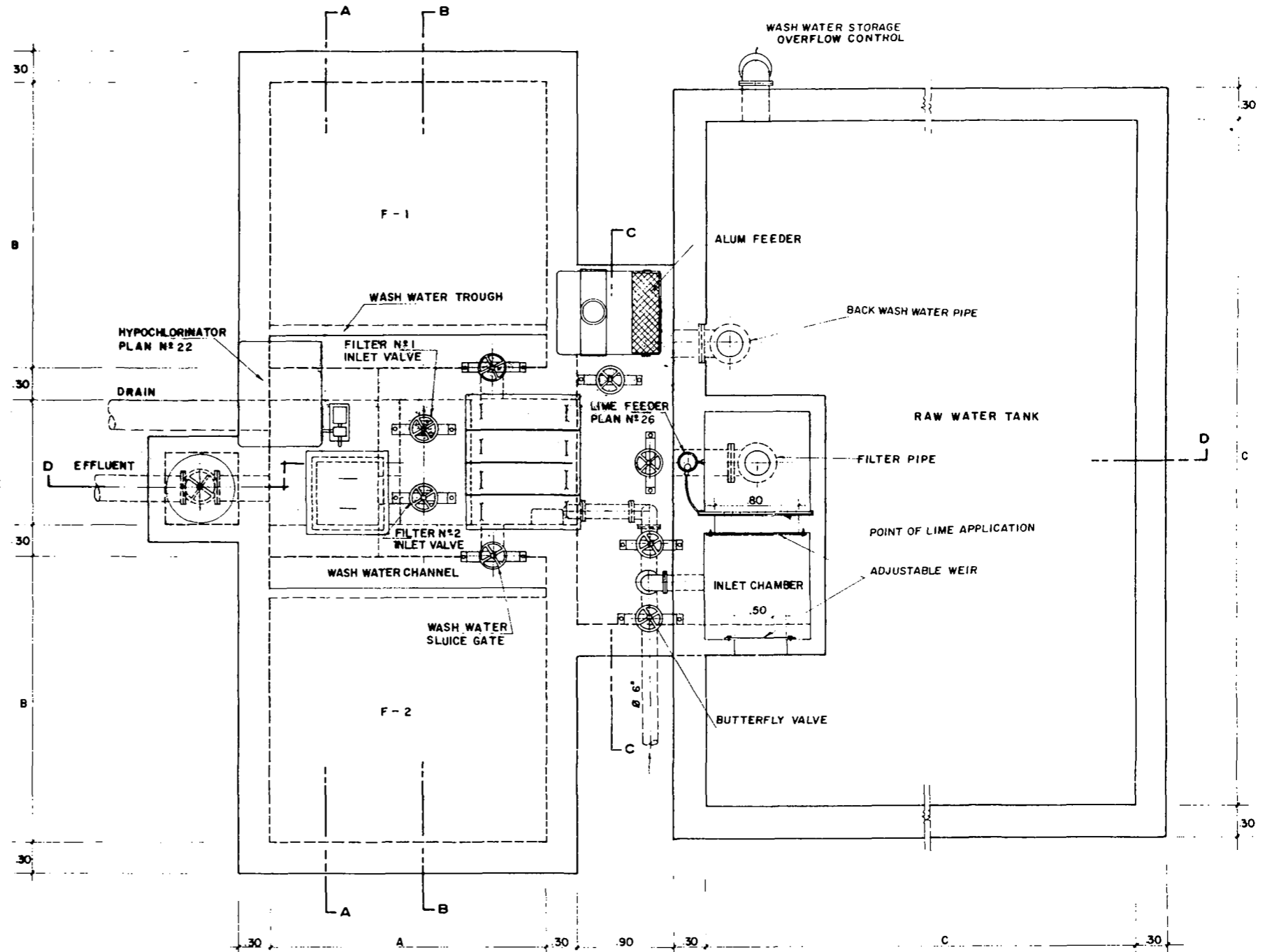
DIAMETER	HEIGHT
3/16" - 3/32"	10 cm
3/8" - 3/16"	10 cm
5/8" - 3/8"	7.5 cm
1" - 5/8"	7.5 cm
1 1/4" - 1"	5.0 cm
<b>TOTAL</b>	<b>40.0 cm</b>

3. SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

PLANT SIZING

Q	A	B	C	a	V
m <sup>3</sup> /h	m	m	m	inches	L/S
14.4	1.20	1.20	2.90	6"	20.00
18.0	1.50	1.20	3.30	6"	24.00
21.6	1.45	1.50	3.60	6"	30.00
25.2	1.60	1.50	3.90	6"	34.00
28.8	1.70	1.80	4.20	6"	39.00
32.4	1.80	1.80	4.40	8"	44.00
36.4	2.00	1.80	4.60	8"	48.00
54.6	2.20	2.40	5.60	8"	70.00
72.8	2.60	2.70	6.50	10"	90.00

A = LENGTH OF THE FILTER BOX  
 B = WIDTH OF THE FILTER BOX  
 C = LENGTH AND WIDTH OF THE RAW WATER TANK.  
 a = DIAMETER OF THE RAW WATER INLET PIPE.  
 V = WASH WATER NEED OF EACH FILTER



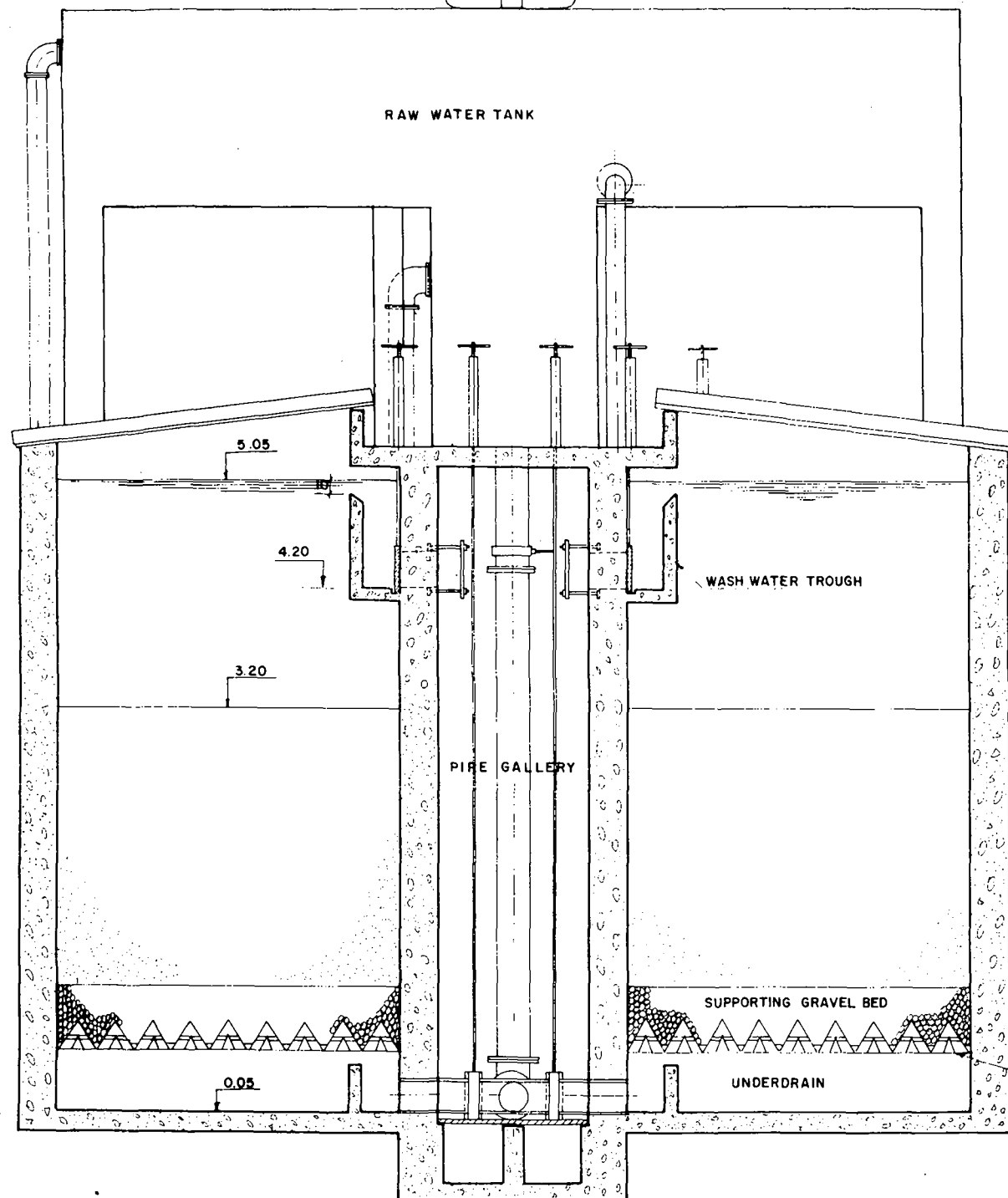
DIRECT UP FLOW FILTRATION PLANT- TYPE 6 PLANT

PLAN No 23

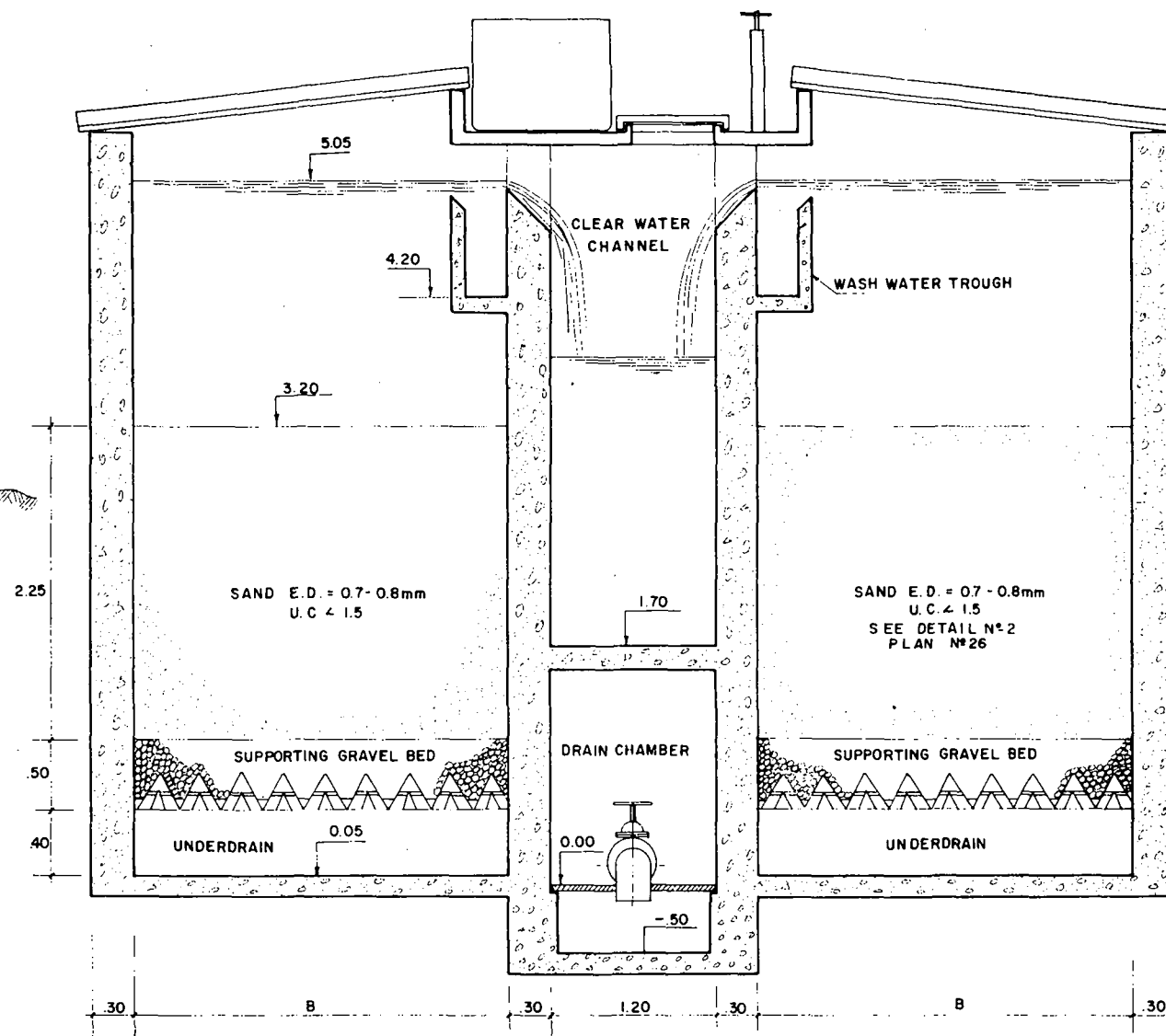
CEPIS / PAHO  
 DATE JANUARY 1981

LIME FEEDER TANK  
SEE DETAIL N°1  
PLAN N°26

LIME TANK  
SEE DETAIL N°10  
PLAN N°22



CROSS SECTION B-B



CROSS SECTION A-A

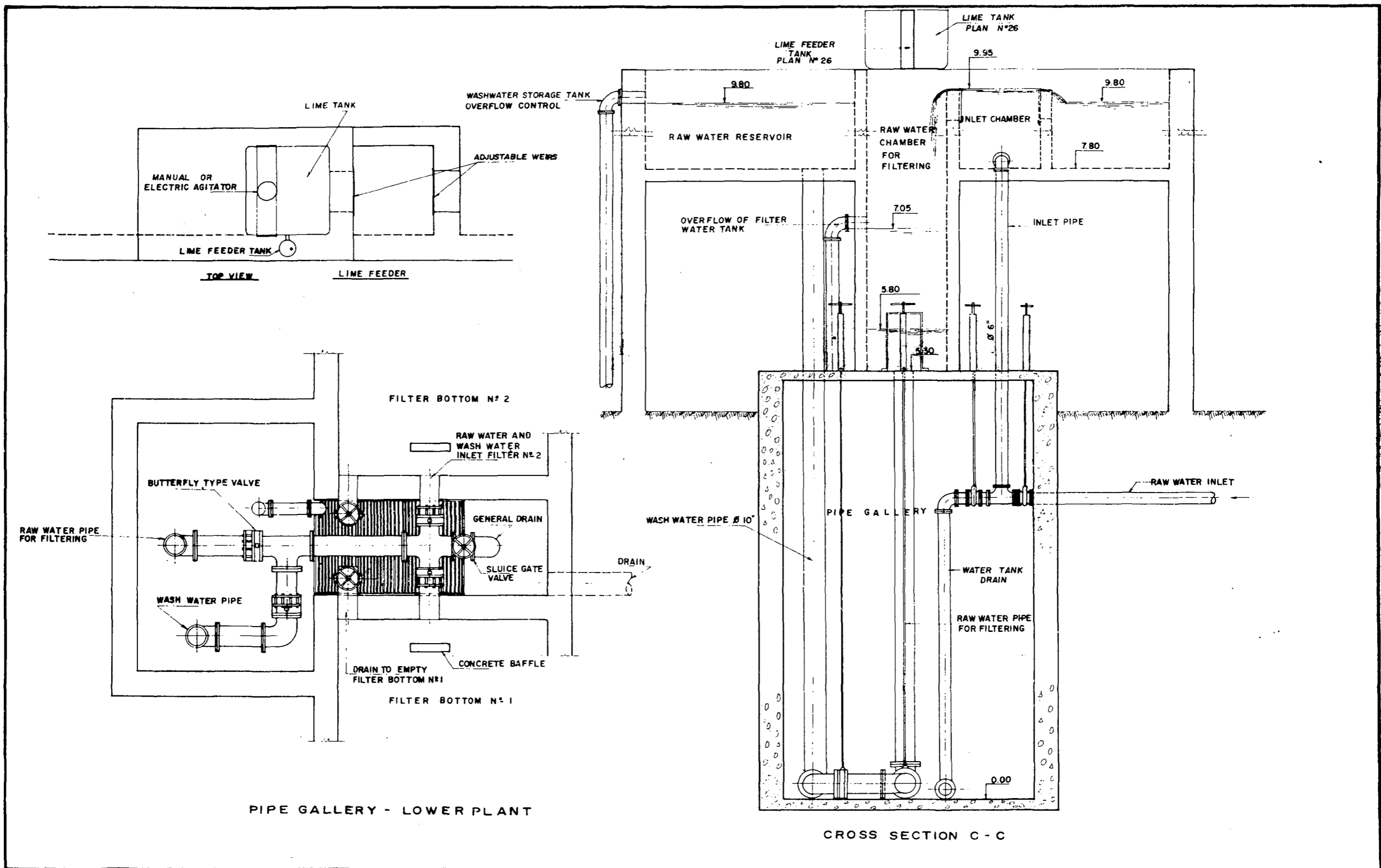
REINFORCED CONCRETE  
PRE-FAB BEAMS  
DETAIL N°2  
PLAN N°43

# DIRECT UP FLOW FILTRATION PLANT - TYPE 6 PLANT

PLAN N° 24

CEPIS / PAHO

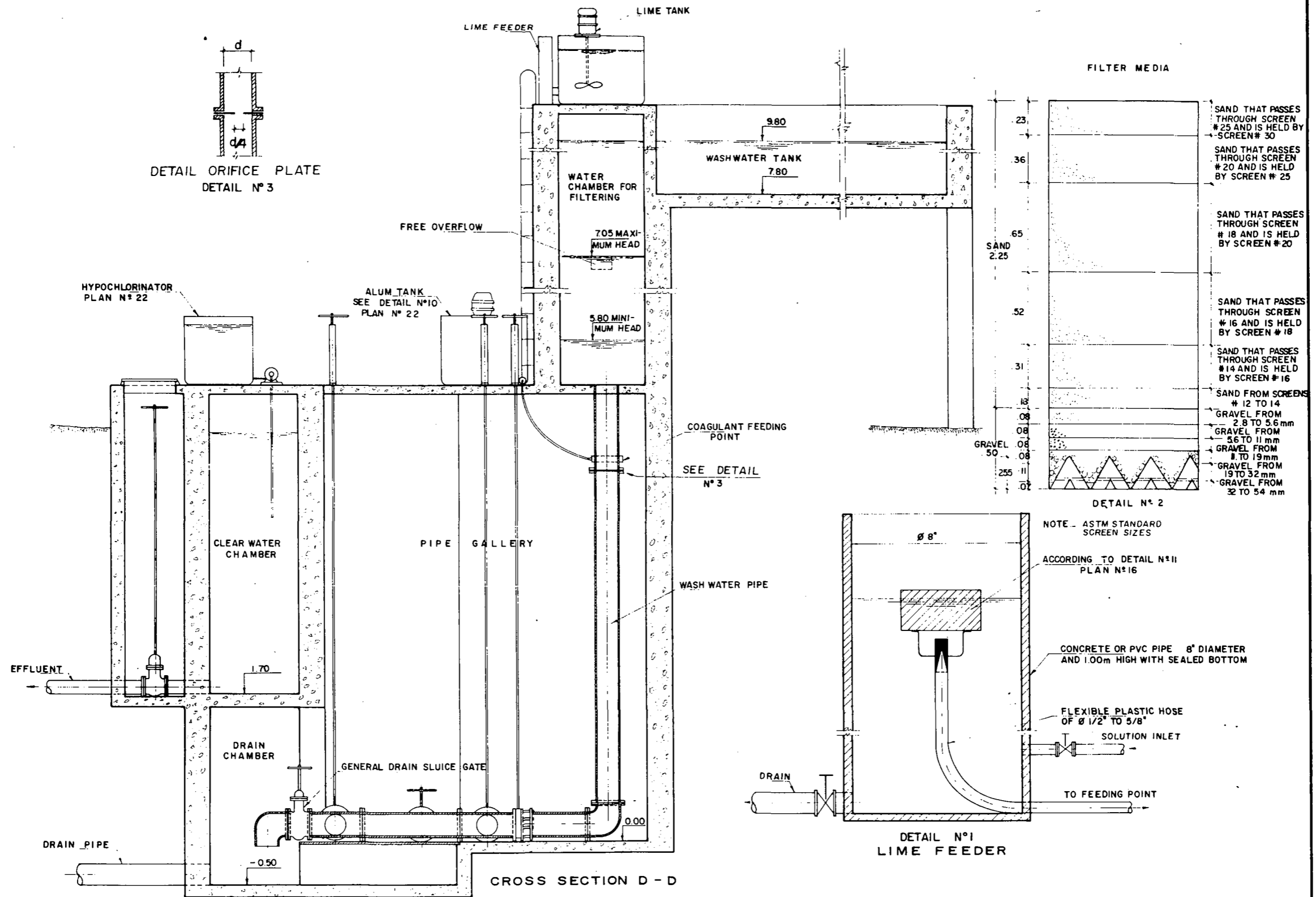
DATE : JANUARY 1981



DIRECT UP FLOW FILTER PLANT - TYPE 6 PLANT

PLAN N° 25

CEPIS PAHO  
DATE: JANUARY 1981



# DIRECT UP FLOW FILTRATION PLANT - TYPE 6 PLANT

PLAN N° 26

CEPIS / PAHO  
DATE JANUARY 1981

TECHNICAL SPECIFICATIONS

1. WATER QUALITY

NORMAL TURBIDITY	100 NU
AVERAGE TURBIDITY	150 NU
MAXIMUM TURBIDITY	250 NU
NORMAL COLOR	50 CU
AVERAGE COLOR	100 CU
MAXIMUM COLOR	150 CU

2. DESIGN CRITERIA

A. UPFLOW FILTERS

FILTRATION VELOCITY	1.70 m <sup>3</sup> /m <sup>2</sup> x day
WASHING VELOCITY	0.30 m/min

FILTER MEDIA

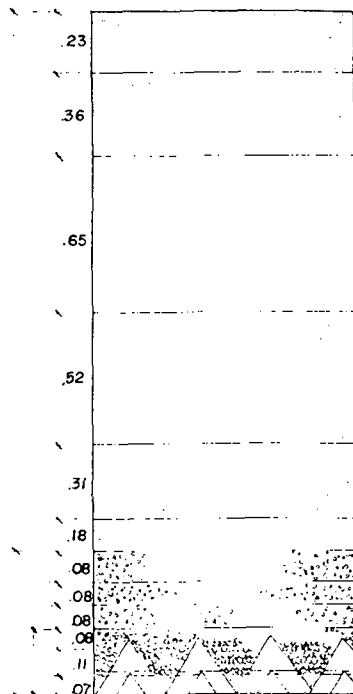
SAND

E.D.	0.7 - 0.8 mm
C.U.	< 2

SUPPORTING LAYER

DIAMETER	HEIGHT
3/16" - 3/32"	10 cm
3/8" - 3/16"	10 cm
5/8" - 3/8"	7.5 cm
1" - 5/8"	7.5 cm
1 1/4" - 1"	5.0 cm
TOTAL	49.0 cm

FILTER MEDIA



NOTE: ASTM STANDARD SCREEN SIZES

B. VARIABLE VELOCITY FILTERS

MAXIMUM FILTRATION VELOCITY IN EACH FILTER	300 m/d
AVERAGE FILTRATION VELOCITY DURING WASHING	288 m/d
AVERAGE FILTRATION VELOCITY	180 m/d
WASHING VELOCITY	0.60 m/min

FILTER MEDIA:

SAND, ANTHRACITE AND/OR ANY OTHER SIMILAR MATERIAL

MEDIA SELECTION CRITERIA

THE CHARACTERISTICS OF THE FILTER MEDIA WILL BE SELECTED BASED ON THE FOLLOWING CRITERIA:

- (A) RAW AND CLEAR WATER QUALITY
- (B) PRE-TREATMENT CONDITIONS
- (C) FILTRATION CONDITIONS
- (D) WASHING CONDITIONS
- (E) OPERATION CONDITIONS

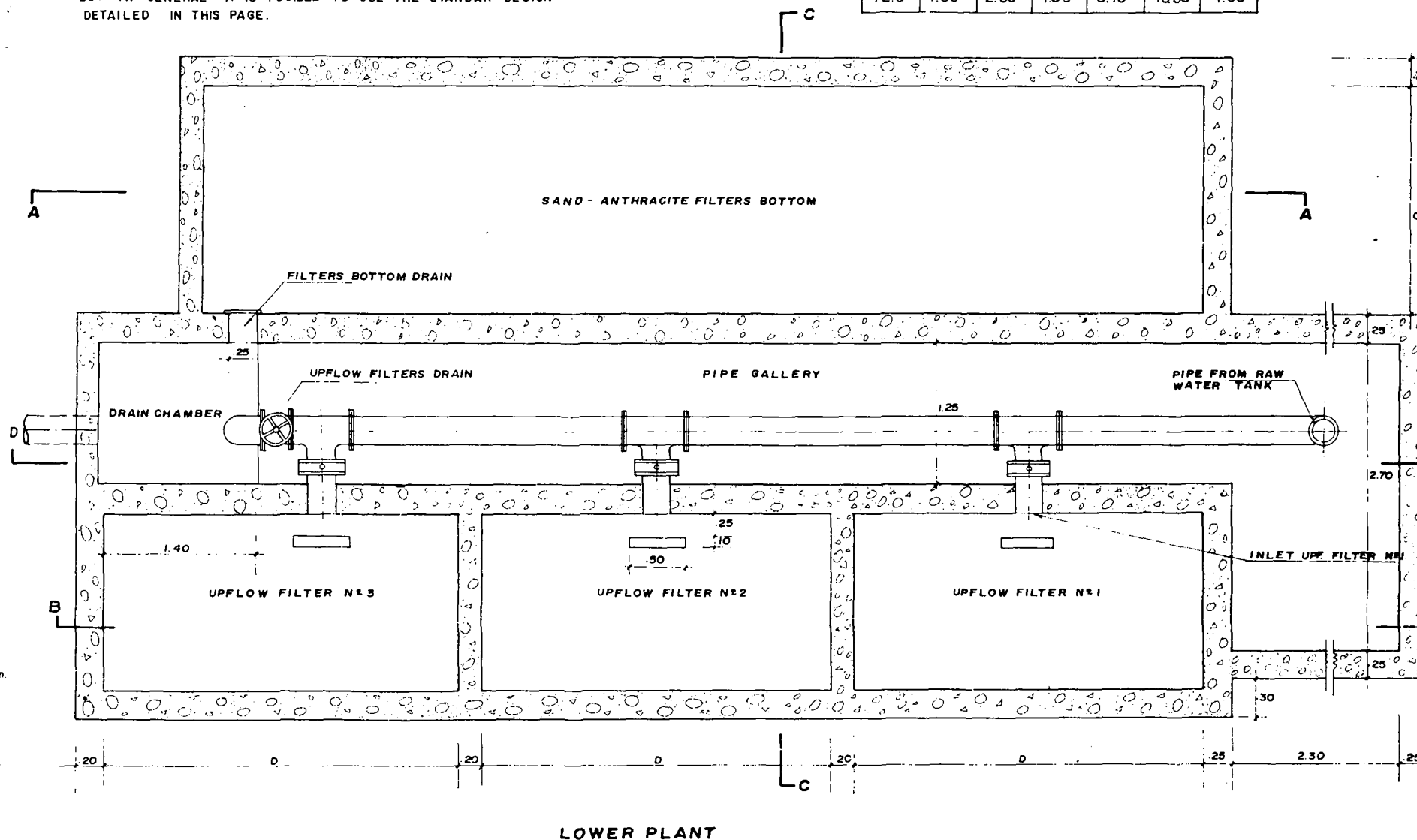
3. SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

BUT IN GENERAL IT IS POSSIBLE TO USE THE STANDAR DESIGN DETAILED IN THIS PAGE.

- A = LENGTH OF THE DOWNFLOW FILTER BOX.
- B = WIDTH OF THE DOWNFLOW FILTER BOX.
- C = WIDTH OF THE UPFLOW FILTER BOX.
- D = LENGTH OF THE UPFLOW FILTER BOX.
- E = WIDTH OF THE RAW WATER TANK.
- F = LENGTH OF THE RAW WATER TANK.
- h = DEPTH OF WATER OVER THE CONTROL WEIR.

PLANT SIZING TABLE

Q	A	B	C	D	E	F
m <sup>3</sup> /h	m	m	m	m	m	m
36.4	1.20	1.35	0.90	2.70	9.35	2.30
54.6	1.50	1.55	1.15	3.10	10.55	3.00
72.8	1.50	2.05	1.50	3.10	10.55	4.00

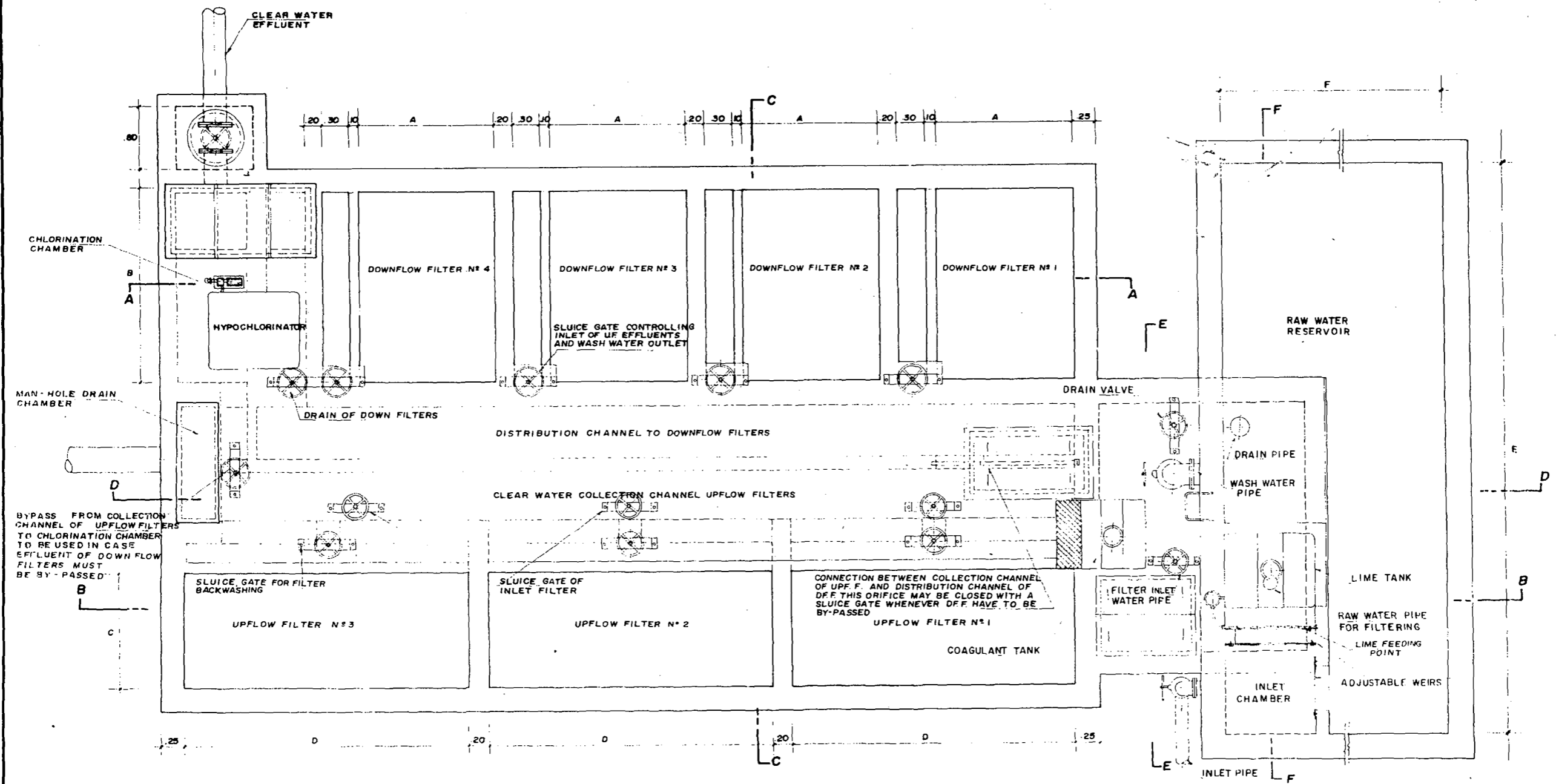


DIRECT UP FLOW DOWNFLOW FILTRATION PLANT - TYPE 7A PLANT

PLAN N° 27

CEPIS / PAHO

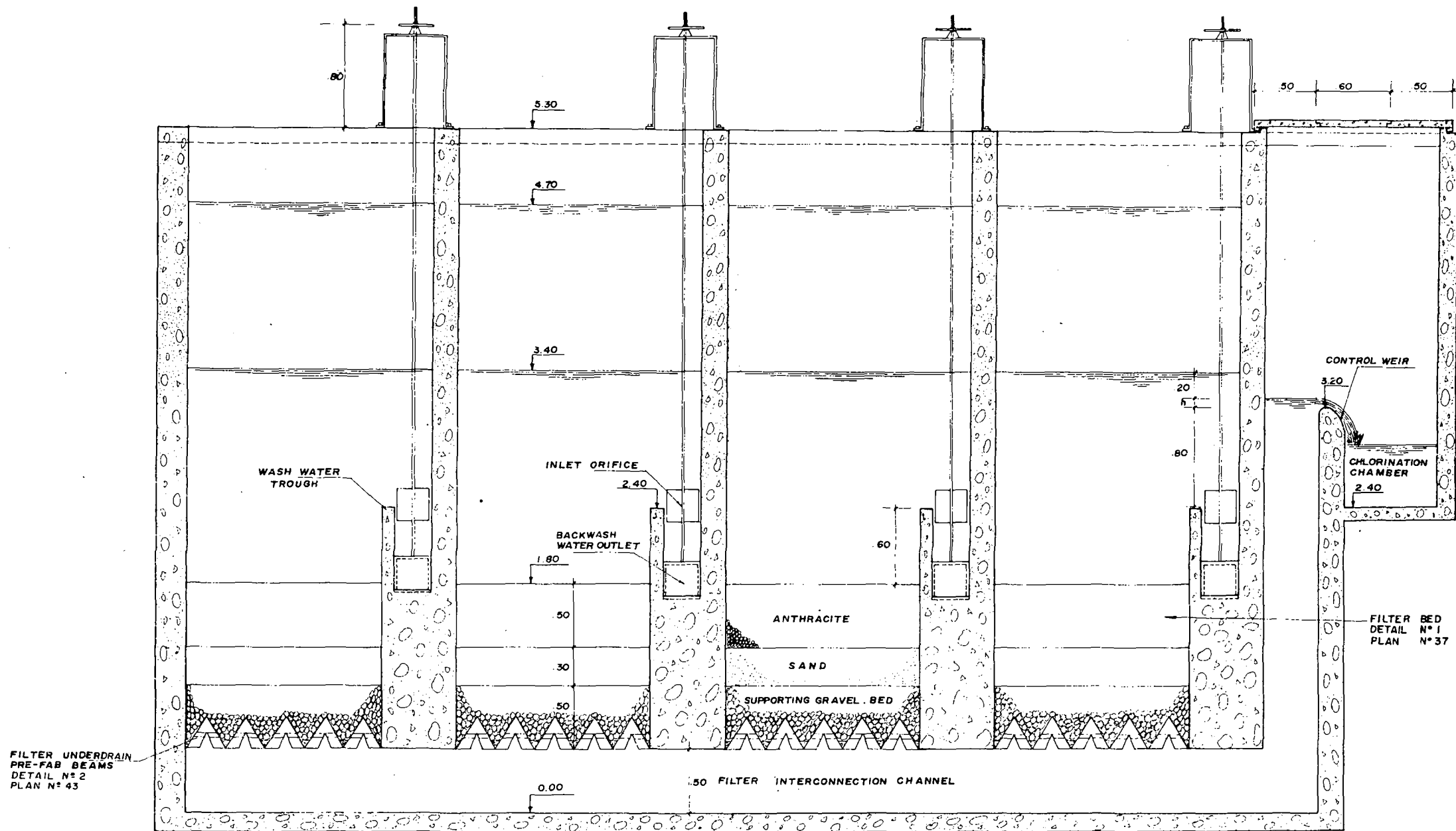
DATE JANUARY 1981



DIRECT UP FLOW DOWNFLOW FILTRATION PLANT - TYPE 7A PLANT

PLAN N° 28

CEPIS / PAHO  
DATE JANUARY 1981



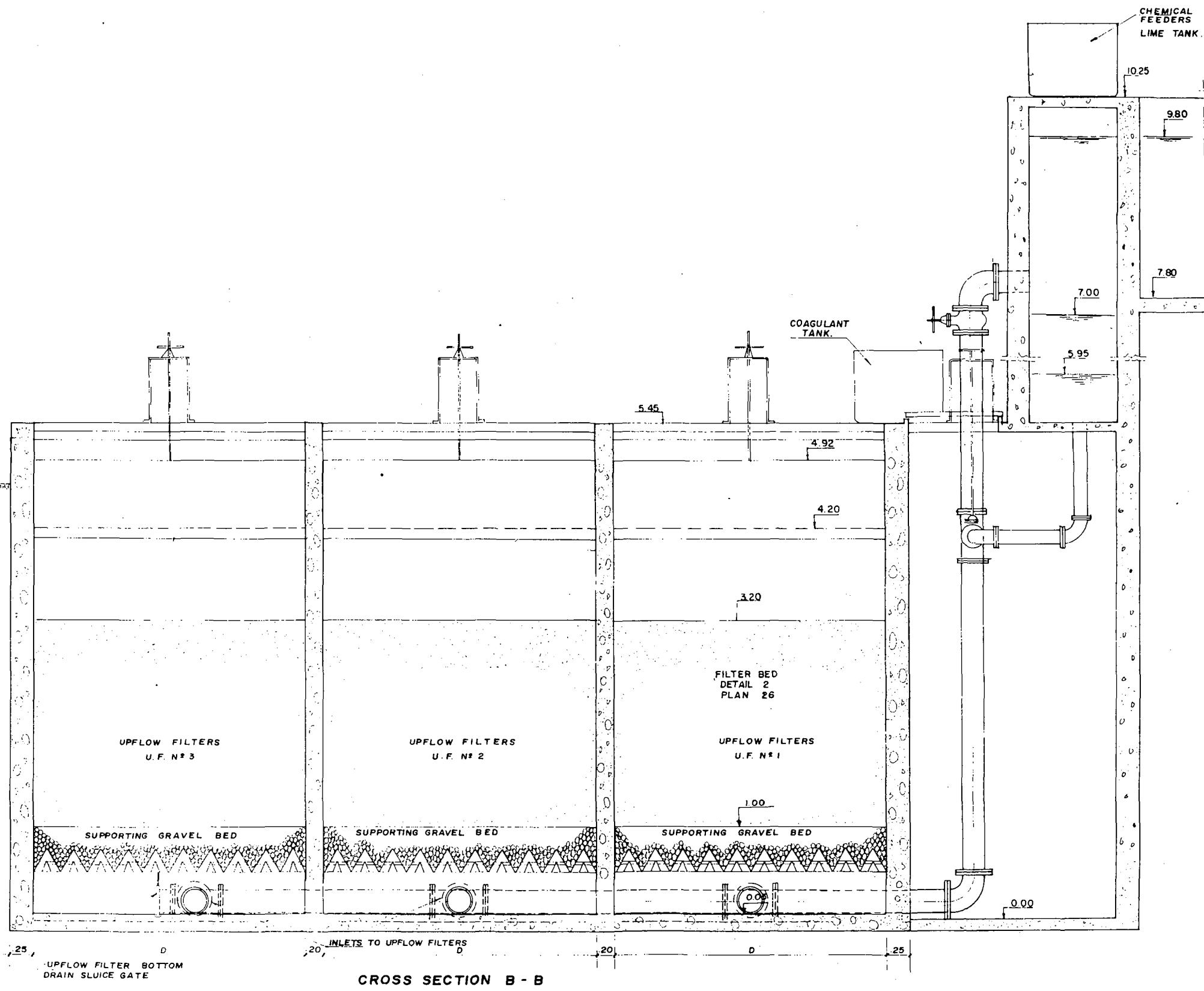
CROSS SECTION A - A

DIRECT UP FLOW DOWNFLOW FILTRATION PLANT - TYPE 7A PLANT

PLAN N° 29

CEPIS / PAHO  
DATE JANUARY 1981



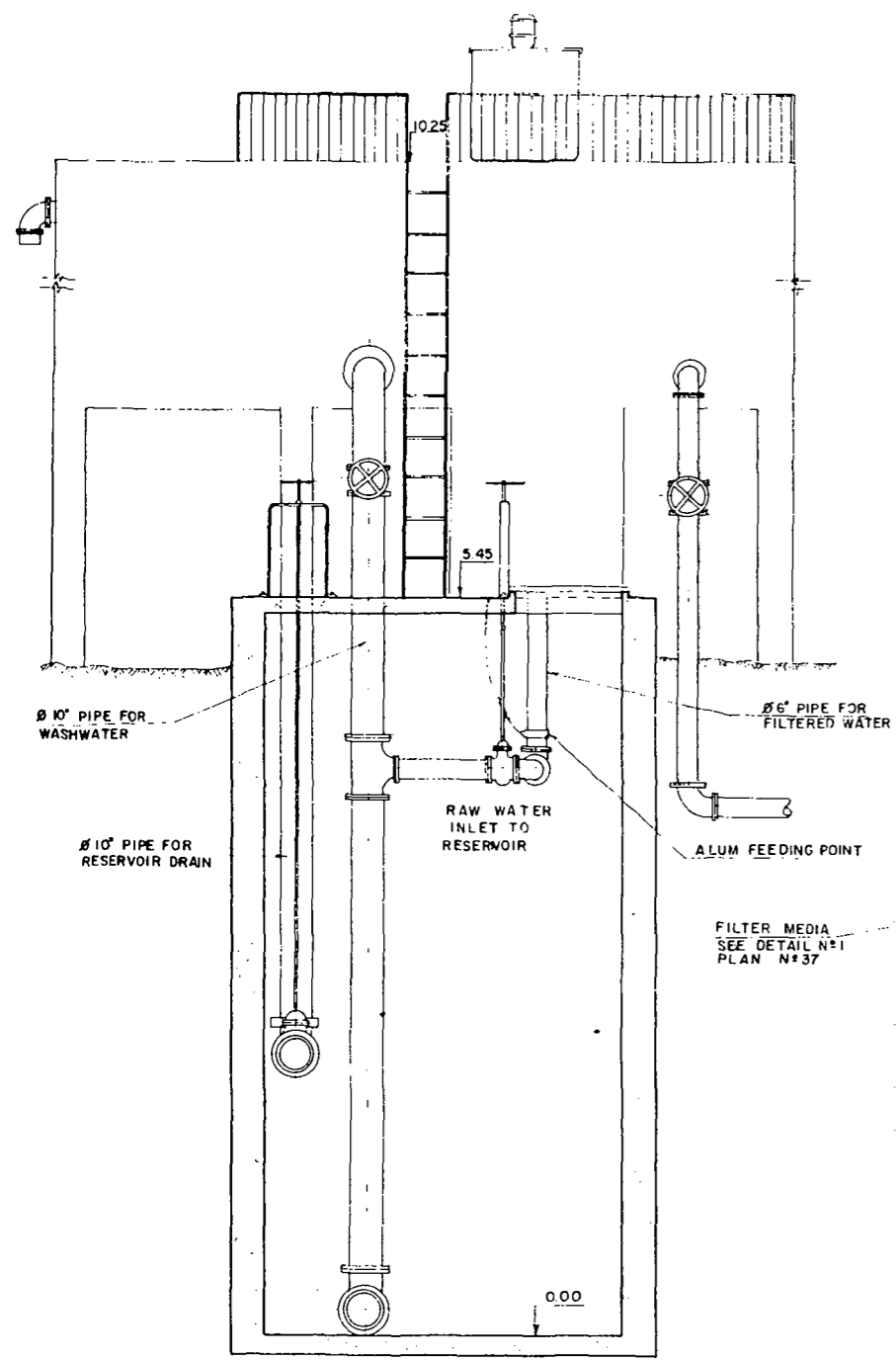


CROSS SECTION B - B

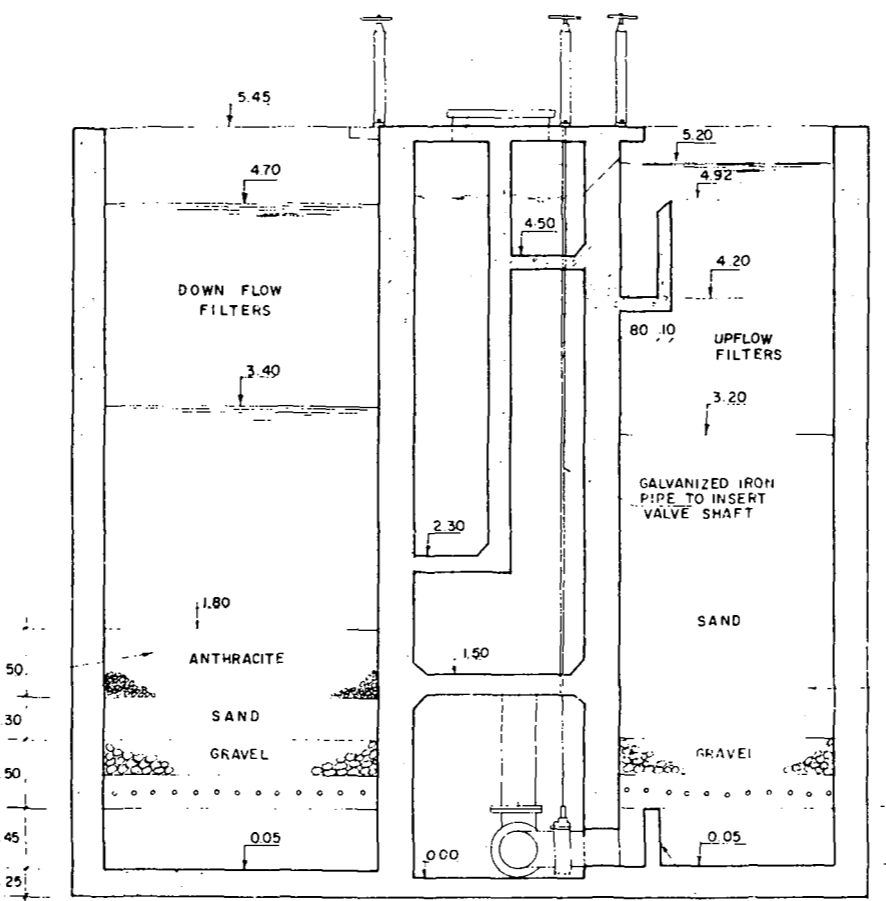
DIRECT UP FLOW DOWNFLOW FILTRATION PLANT - TYPE 7A PLANT

PLAN N° 30

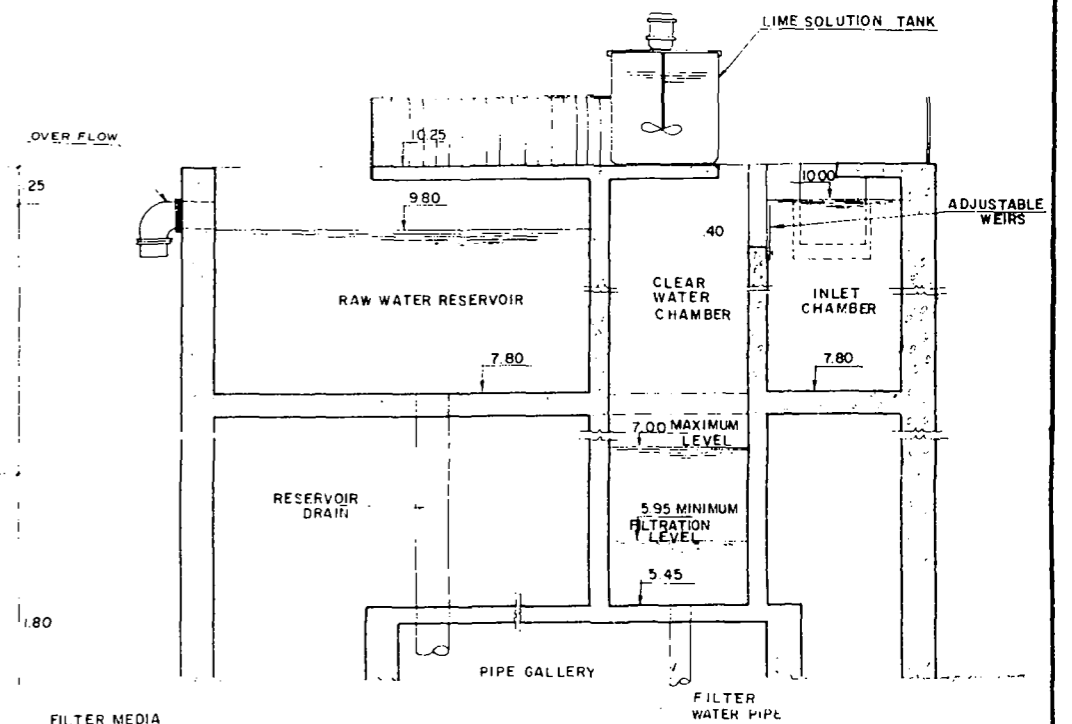
CEPIS / PAHO  
DATE JANUARY 1981



CROSS SECTION E - E



CROSS SECTION C - C

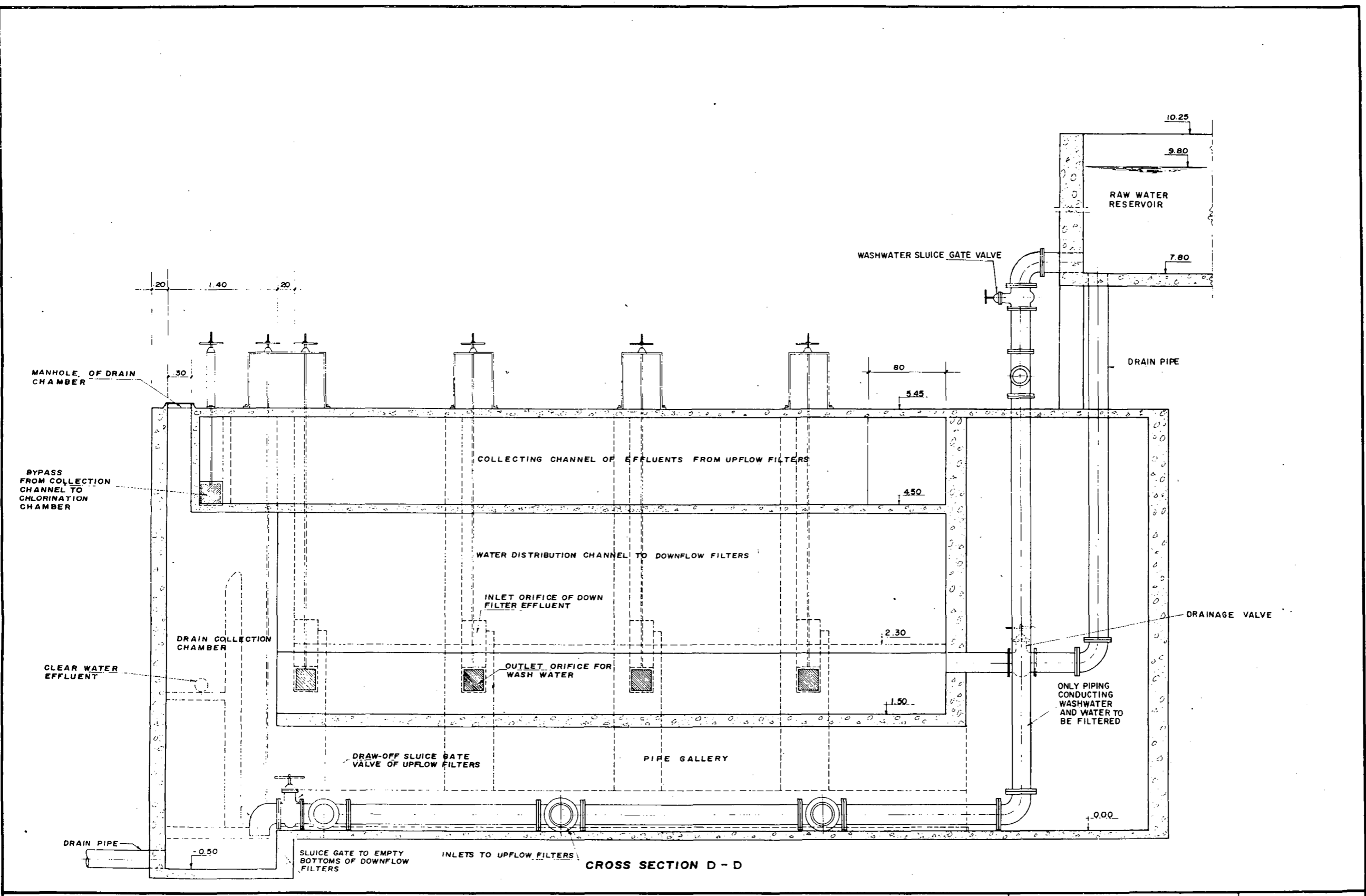


CROSS SECTION F - F

DIRECT UPFLOW DOWNFLOW FILTRATION PLANT - TYPE 7A PLANT

PLAN N° 31

CEPIS / PAHO  
 DATE: JANUARY 1981



DIRECT UP FLOW DOWNFLOW FILTRATION PLANT - TYPE 7A PLANT

PLAN N° 32

CEPIS / PAHO  
DATE JANUARY 1981

TECHNICAL SPECIFICATIONS

1. WATER QUALITY

NORMAL TURBIDITY	100 NU
AVERAGE TURBIDITY	150 NU
MAXIMUM TURBIDITY	250 NU
NORMAL COLOR	50 CU
AVERAGE COLOR	100 CU
MAXIMUM COLOR	150 CU

2. DESIGN CRITERIA

A. UPFLOW FILTERS

FILTRATION VELOCITY	120 m <sup>3</sup> /m <sup>2</sup> x day
WASHING VELOCITY	0.80 m/min

FILTER MEDIA

SAND

E.D.	0.7 - 0.8 mm
C.U.	< 2

SUPPORTING LAYER

DIAMETER	HEIGHT
3/16" - 3/32"	10 cm
3/8" - 3/16"	10 cm
5/8" - 3/8"	7.5 cm
1" - 5/8"	7.5 cm
1 1/4" - 1"	5.0 cm
TOTAL	40.0 cm

B. VARIABLE VELOCITY FILTERS

MAXIMUM FILTRATION VELOCITY IN EACH FILTER	300 m/d
AVERAGE FILTRATION VELOCITY DURING WASHING	288 m/d
AVERAGE FILTRATION VELOCITY	180 m/d
WASHING VELOCITY	0.60 m/min

FILTER MEDIA:

SAND, ANTHRACITE AND/OR ANY OTHER SIMILAR MATERIAL

MEDIA SELECTION CRITERIA

THE CHARACTERISTICS OF THE FILTER MEDIA WILL BE SELECTED

BASED ON THE FOLLOWING CRITERIA:

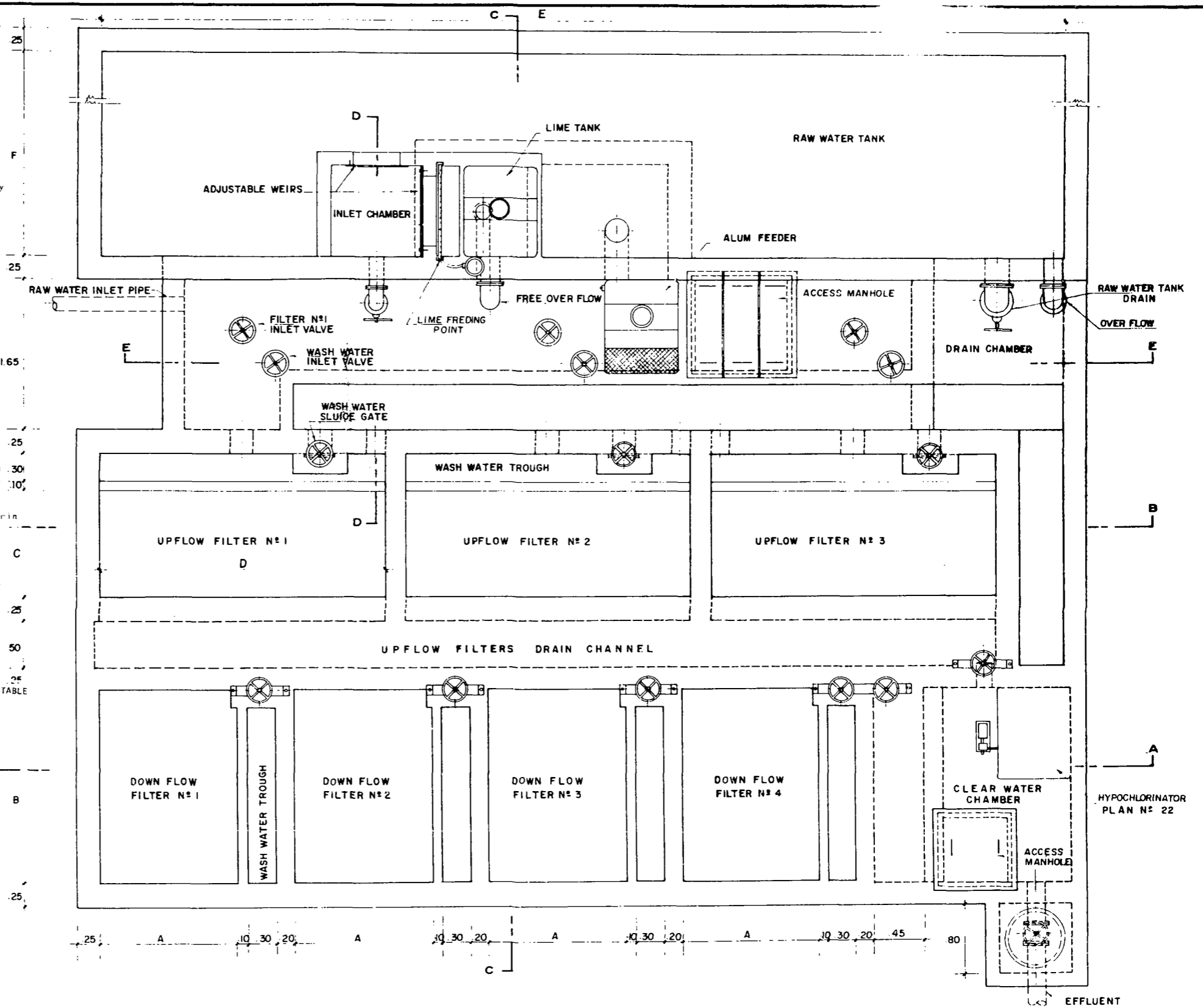
- (A) RAW AND CLEAR WATER QUALITY
- (B) PRE-TREATMENT CONDITIONS
- (C) FILTRATION CONDITIONS
- (D) WASHING CONDITIONS
- (E) OPERATION CONDITIONS

SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

A = LENGTH OF THE DOWNFLOW FILTER BOX.  
 B = WIDTH OF THE DOWNFLOW FILTER BOX.  
 C = WIDTH OF THE UPFLOW FILTER BOX.  
 D = LENGTH OF THE UPFLOW FILTER BOX.  
 E = WIDTH OF THE RAW WATER TANK.  
 F = LENGTH OF THE RAW WATER TANK.

PLANT SIZING TABLE

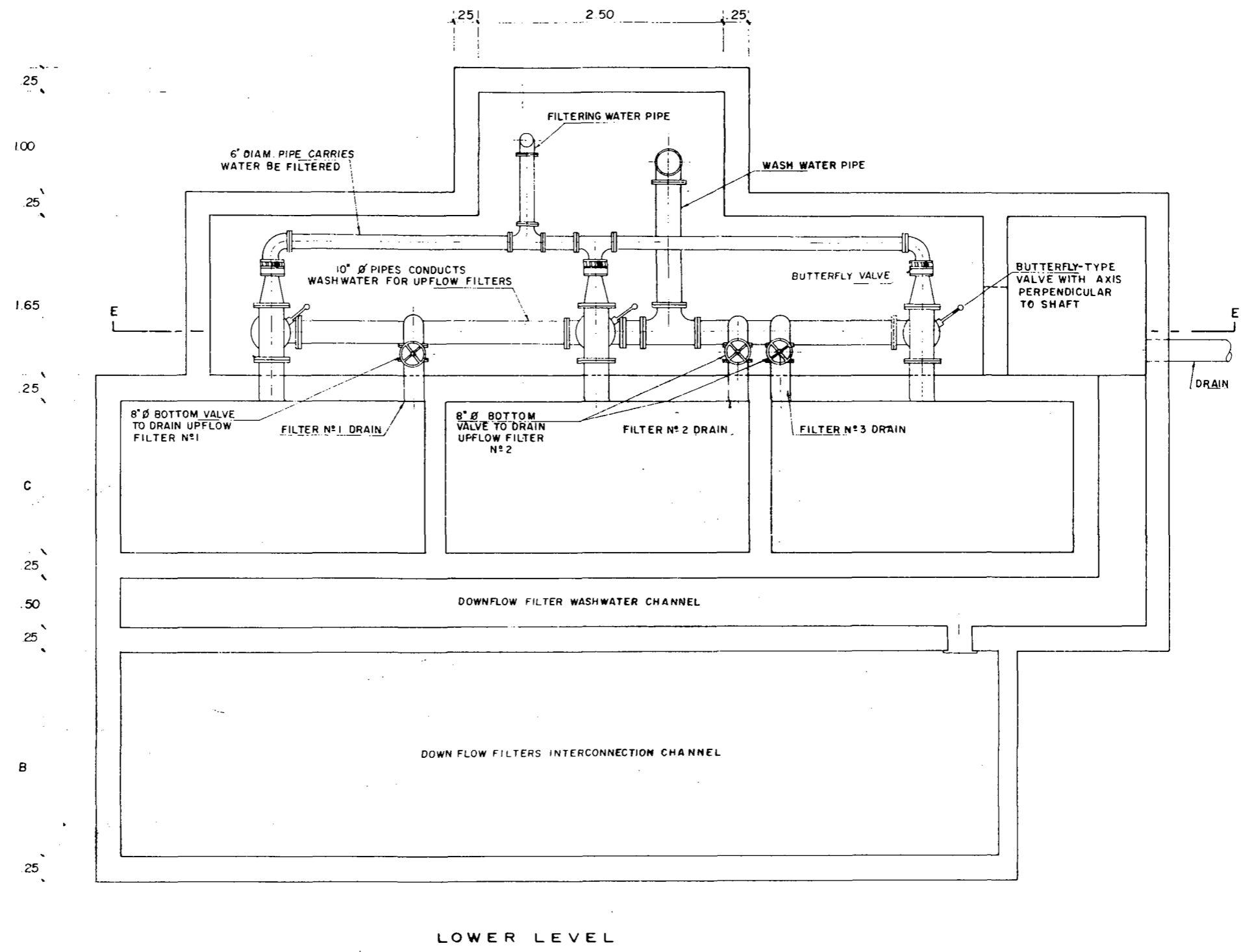
Q	A	B	C	D	E	F
m <sup>3</sup> /h	m	m	m	m	m	m
36.4	1.20	1.35	0.90	2.70	9.35	2.30
54.6	1.50	1.55	1.15	3.10	10.55	3.00
72.8	1.50	2.05	1.50	3.10	10.55	4.00



DIRECT UP FLOW DOWNFLOW FILTRATION PLANT-TYPE 7B PLANT

PLAN N° 33

CEPIS / PAHO  
 DATE: JANUARY 1981

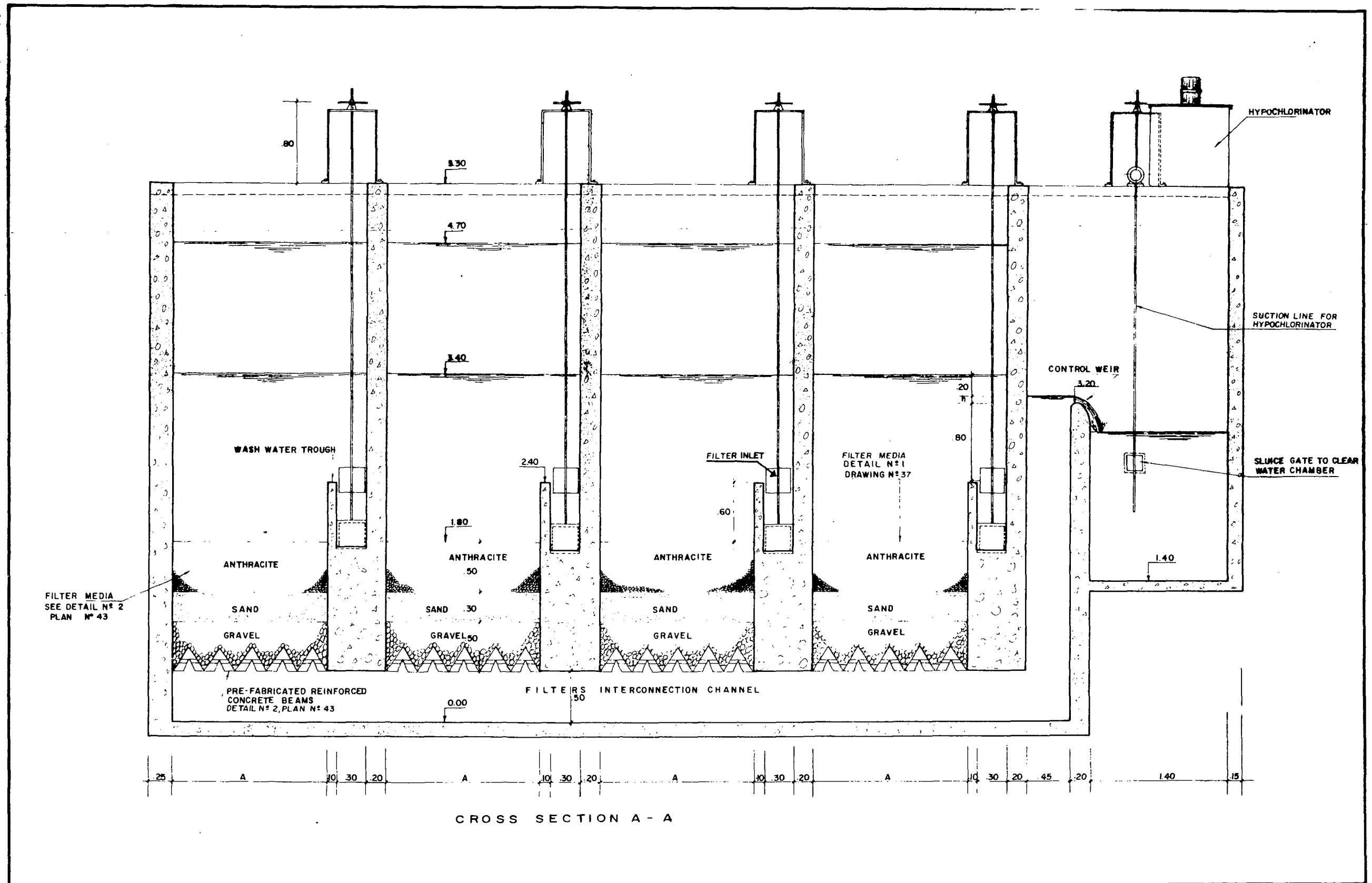


- A = LENGTH OF THE DOWNFLOW FILTER BOX.
- B = WIDTH OF THE DOWNFLOW FILTER BOX.
- C = WIDTH OF THE UPFLOW FILTER BOX.
- D = LENGTH OF THE UPFLOW FILTER BOX.
- E = WIDTH OF THE RAW WATER TANK.
- F = LENGTH OF THE RAW WATER TANK.

# DIRECT UP FLOW DOWNFLOW FILTRATION PLANT-TYPE 7B PLANT

PLAN N° 34

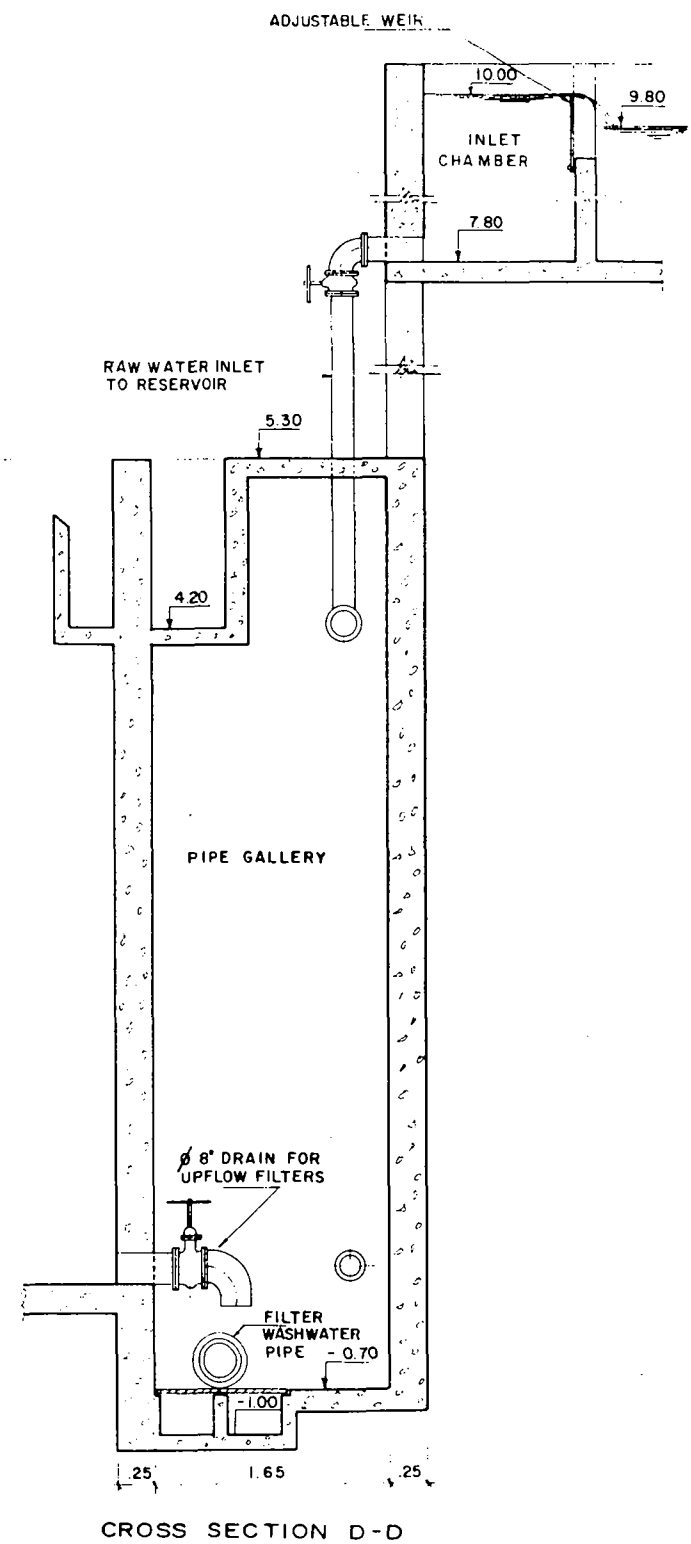
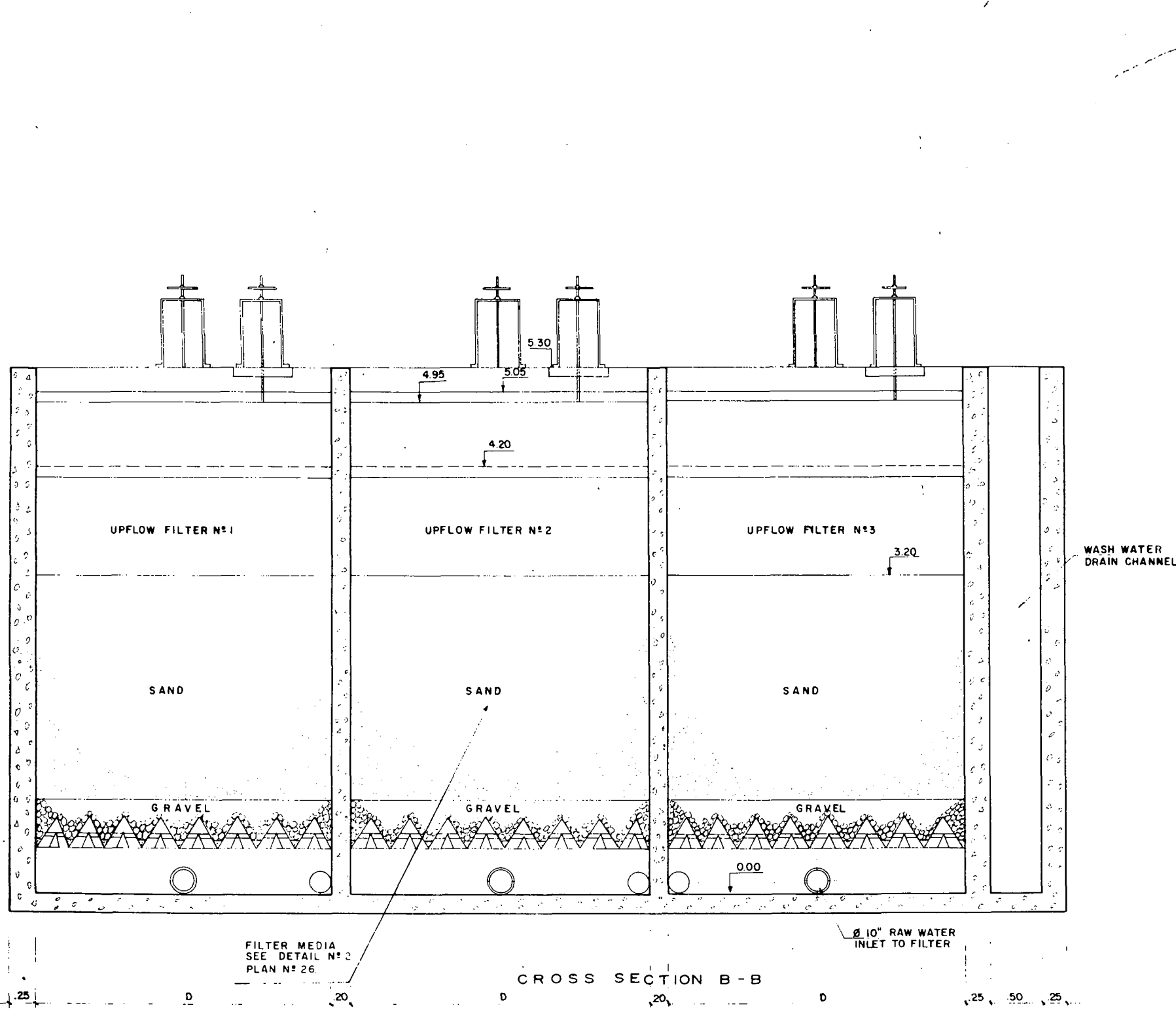
CEPIS/PAHO  
DATE: JANUARY 1981



DIRECT UPFLOW DOWNFLOW FILTRATION PLANT-TYPE 7B PLANT

PLAN N° 35

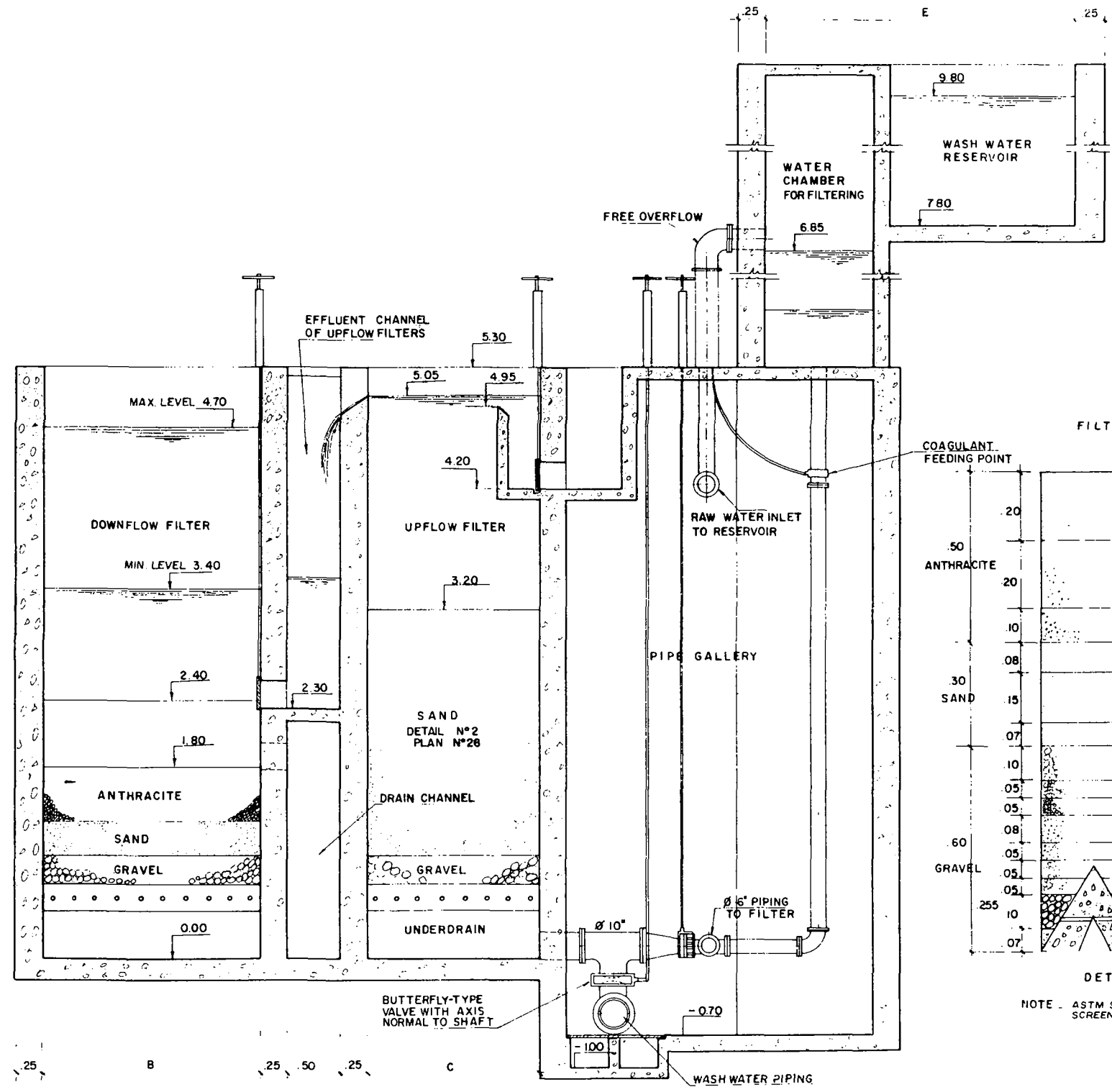
CEPIS / PAHO  
DATE: JANUARY 1981



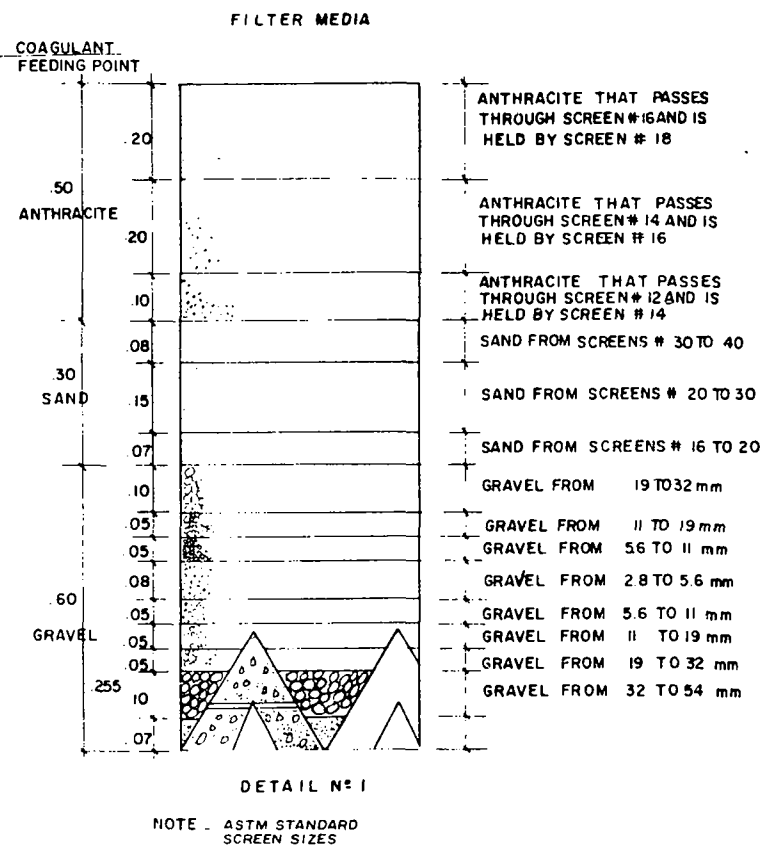
DIRECT UP FLOW DOWNFLOW FILTRATION PLANT-TYPE 7B PLANT

PLAN N° 36

CEPIS PAHO  
DATE JANUARY 1981



FILTER MEDIA  
DETAIL N°1  
PLAN N°37



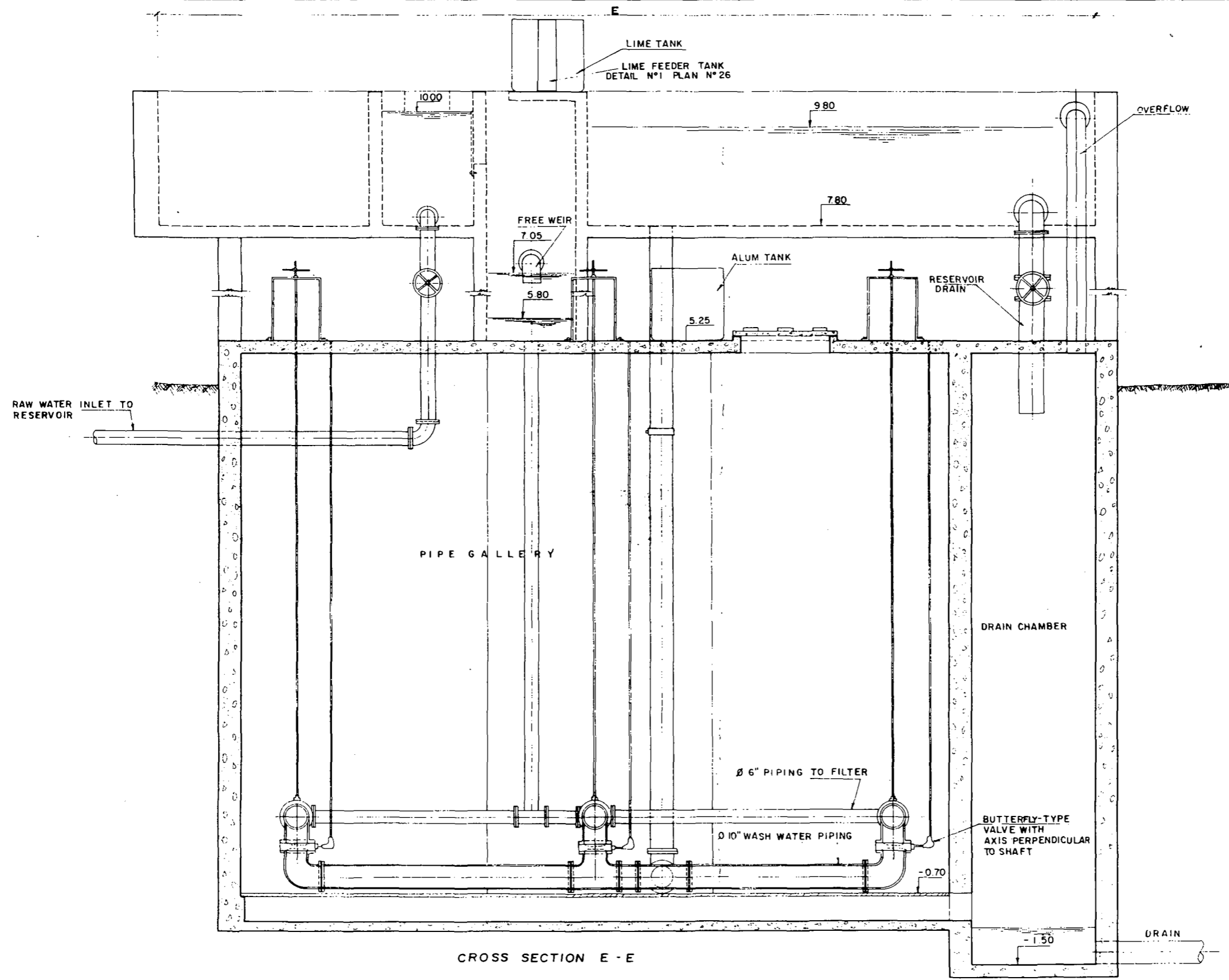
CROSS-SECTION C - C

DIRECT UP FLOW DOWNFLOW FILTRATION PLANT-TYPE 7B PLANT

PLAN N° 37

CEPIS / PAHO  
DATE: JANUARY 1981





DIRECT UP FLOW DOWNFLOW FILTRATION PLANT-TYPE 7B PLANT

PLAN N° 38

CEPIS / PAHO  
DATE JANUARY 1981

TECHNICAL SPECIFICATIONS

WATER QUALITY

- NORMAL TURBIDITY < 250 NU
- AVERAGE TURBIDITY < 750 NU
- MAXIMUM TURBIDITY < 1,500 NU
- MAXIMUM COLOR < 150 CU

DESIGN CRITERIA

A. FEEDING

- COAGULANT - MAXIMUM DOSE ≤ 50 mg/l
- pH MODIFIER ACCORDING TO RAW WATER ALKALINITY

B. RAPID MIXING

- $GTC^n = K$  (n AND K ARE VARIABLES DEPENDENT ON RAW WATER CHARACTERISTICS)
- VELOCITY GRADIENT (G) - LESS THAN 2,000 s<sup>-1</sup>
- RETENTION TIME (T) - VARIABLE

C. HYDRAULIC FLOCCULATION

- $Gn_1T = K_1$
- RETENTION TIME (T) = 25 min
- VELOCITY GRADIENT (G)
- MAXIMUM = 80 s<sup>-1</sup>
- AVERAGE = 40 s<sup>-1</sup>
- MINIMUM = 20 s<sup>-1</sup>
- n<sub>1</sub> AND K<sub>1</sub> ARE VARIABLES DEPENDENT ON RAW WATER CHARACTERISTICS

D. HIGH RATE HORIZONTAL FLOW SETTLING WITH INCLINED PLATES

- $e = \frac{2 \cdot Re \cdot v \cdot c \cdot H}{g}$
- $V_s = \frac{q_s \cdot e}{H \cdot \cos \alpha}$
- SUPERFICIAL LOAD (q<sub>s</sub>) = 120 m<sup>3</sup>/m<sup>2</sup>/d
- REYNOLDS NUMBER (Re) = < 500
- SPACE BETWEEN PLATES (e) = VARIABLE
- ANGLE OF PLATES (α) = 60°
- WIDTH OF SETTLER (c) = VARIABLE
- SETTLING VELOCITY (V<sub>s</sub>) = 0.020 - 0.025 cm/s

E. VARIABLE VELOCITY FILTERS

- MAXIMUM FILTRATION VELOCITY IN EACH FILTER . . . 300 m/d
- AVERAGE FILTRATION VELOCITY DURING WASHING . . . 288 m/d
- MEAN FILTRATION VELOCITY . . . . . 180 m/d
- WASHING VELOCITY . . . . . 0.60 m/min
- FILTER MEDIA:
- SAND, ANTHRACITE AND/OR ANY OTHER SIMILAR MATERIAL

F. MEDIA SELECTION CRITERIA

- THE CHARACTERISTICS OF THE FILTER MEDIA WILL BE SELECTED BASED ON THE FOLLOWING CRITERIA:
- (A) RAW AND CLEAR WATER QUALITY
- (B) PRETREATMENT CONDITIONS
- (C) FILTRATION CONDITIONS
- (D) WASHING CONDITIONS
- (E) OPERATION CONDITIONS

G. DISINFECTION

- CHLORINE DOSE . . . . . VARIABLE
- CONTACT TIME . . . . . < 17 min

H. SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

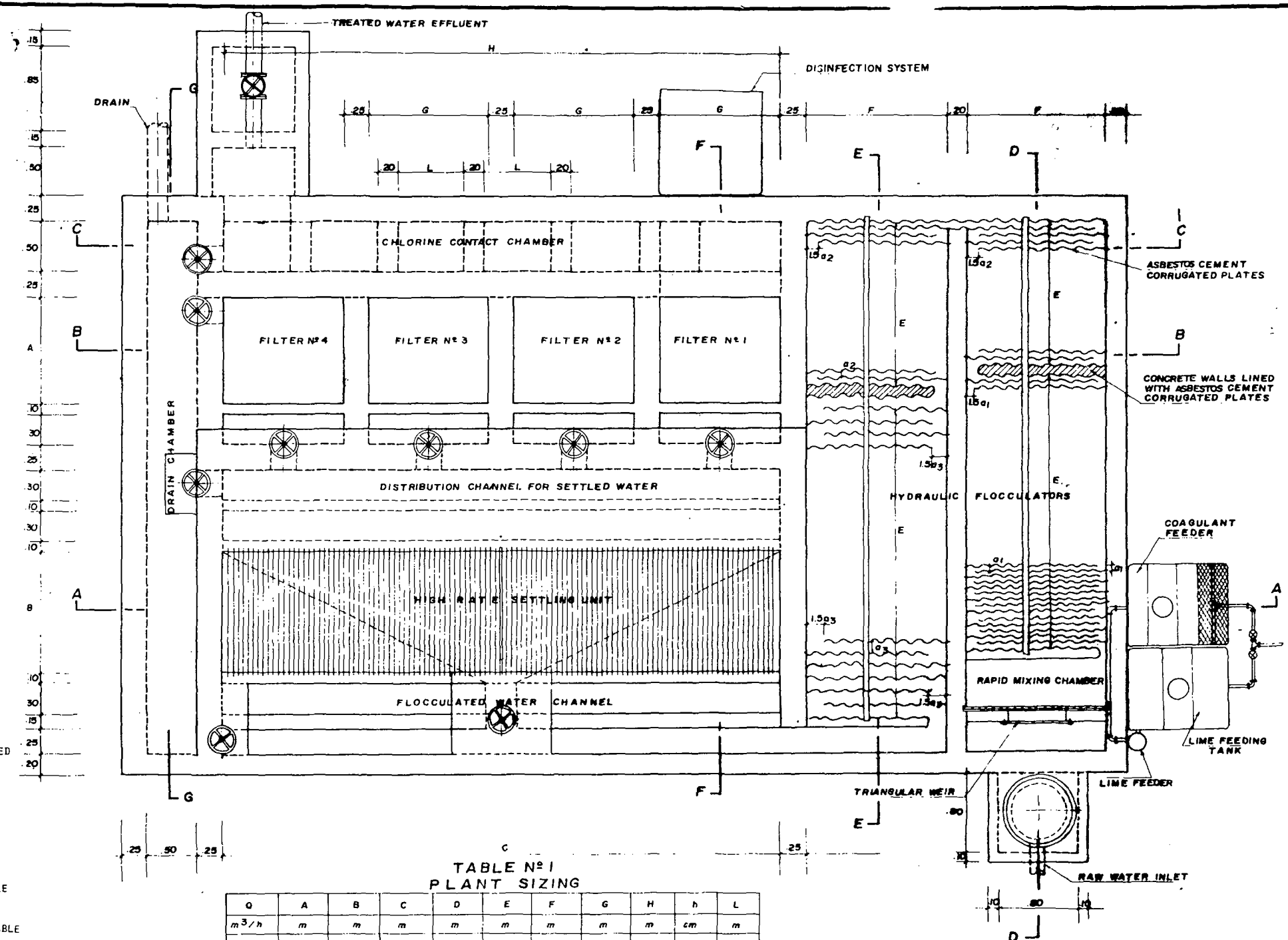


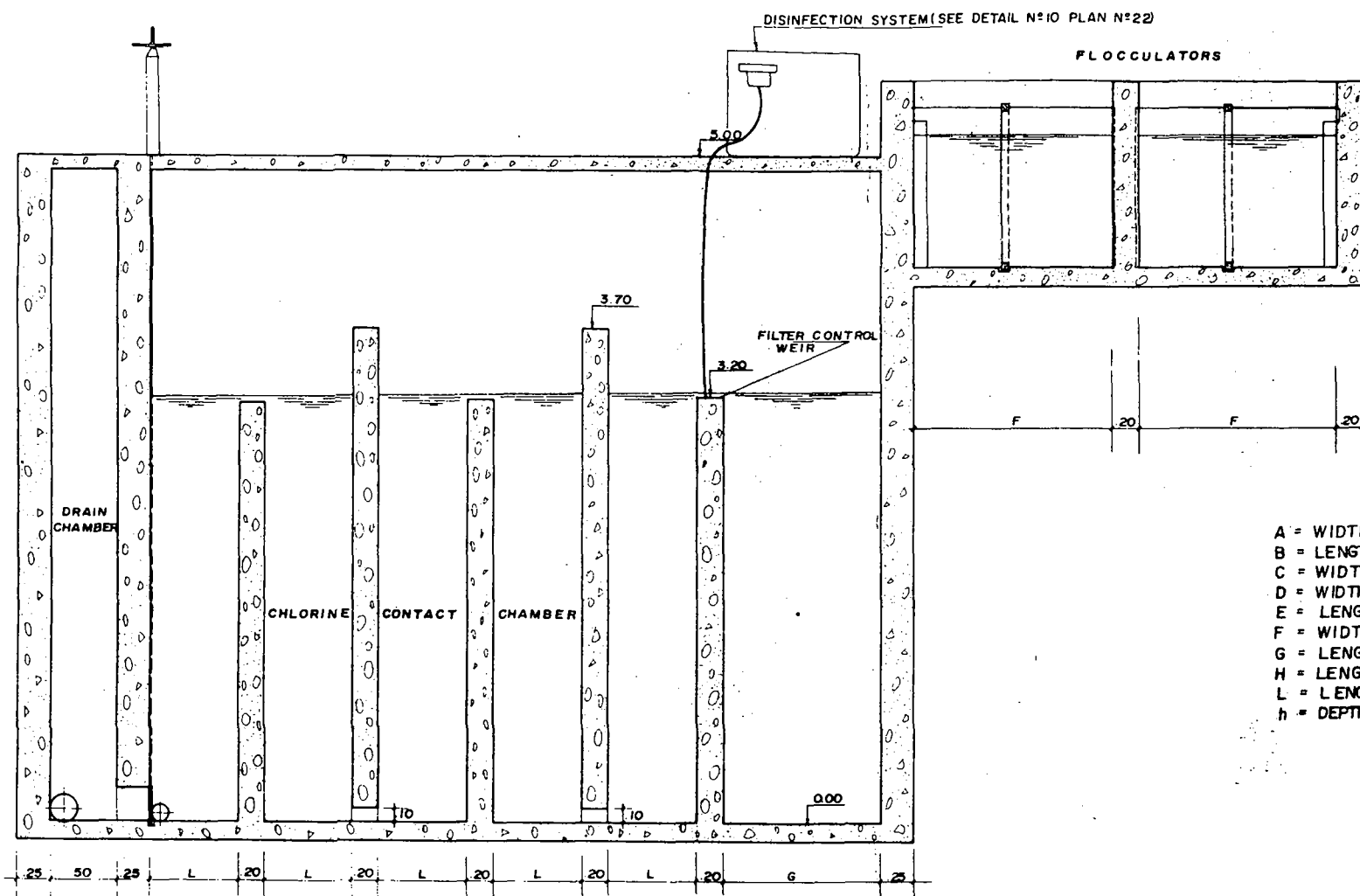
TABLE N° 1  
PLANT SIZING

Q	A	B	C	D	E	F	G	H	h	L
m <sup>3</sup> /h	m	m	m	m	m	m	m	m	cm	m
180	1.35	1.18	3.15	1.10	≈ 3.25	0.80	0.60	3.15	10.5	.27
216	1.10	1.18	4.35	1.10	≈ 3.05	1.00	0.90	4.35	11.3	.49
252	0.95	1.18	5.55	1.08	≈ 2.95	1.20	1.20	5.55	12.0	.67
288	1.05	1.18	5.55	1.18	≈ 3.00	1.32	1.20	5.55	12.7	.67
324	1.20	1.18	5.55	1.08	≈ 3.15	1.50	1.20	5.55	13.3	.67
364	1.35	2.40	5.55	1.08	≈ 4.05	1.35	1.20	5.55	14.0	.67
546	1.55	2.40	6.75	1.00	≈ 4.20	1.85	1.50	6.75	16.0	.84
728	2.05	2.40	6.75	1.02	≈ 4.55	2.30	1.50	6.75	18.0	.84

RAPID FILTRATION PLANT - TYPE 8 PLANT

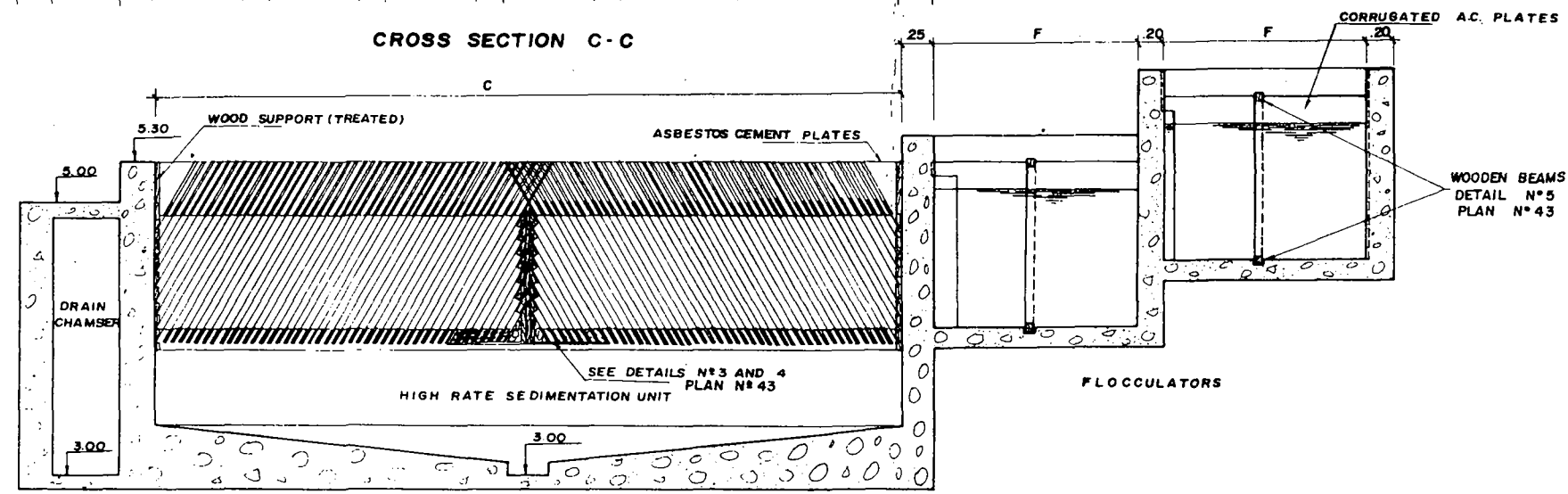
PLAN N° 39

CEPIS / PAHO  
DATE JANUARY 1981



- A = WIDTH OF THE FILTERS BOX.
- B = LENGTH OF THE SETTLING UNIT.
- C = WIDTH OF THE SETTLING UNIT.
- D = WIDTH OF THE RAPID MIXING UNIT.
- E = LENGTH OF THE FLOCCULATION UNIT.
- F = WIDTH OF THE FLOCCULATION UNIT.
- G = LENGTH OF THE FILTER BOX.
- H = LENGTH OF THE CHLORINE CONTACT CHAMBER.
- L = LENGTH OF EACH SECTION OF THE CHLORINE CHAMBER.
- h = DEPTH OF WATER OVER THE TRIANGULAR WEIR.

CROSS SECTION C-C

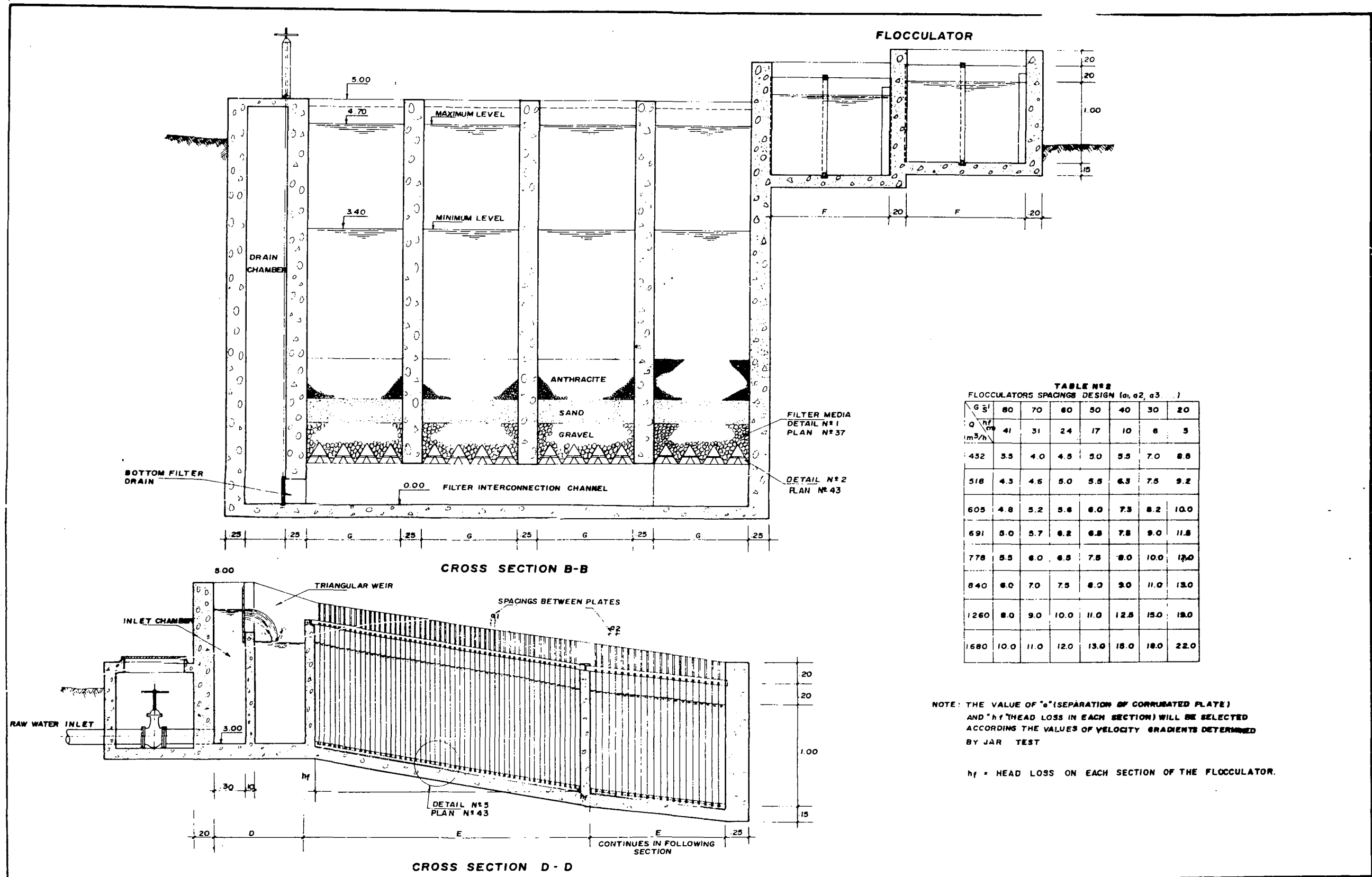


CROSS SECTION A-A

# RAPID FILTRATION PLANT - TYPE 8 PLANT

PLAN N° 40

CEPIS / PAHO  
DATE JANUARY 1981



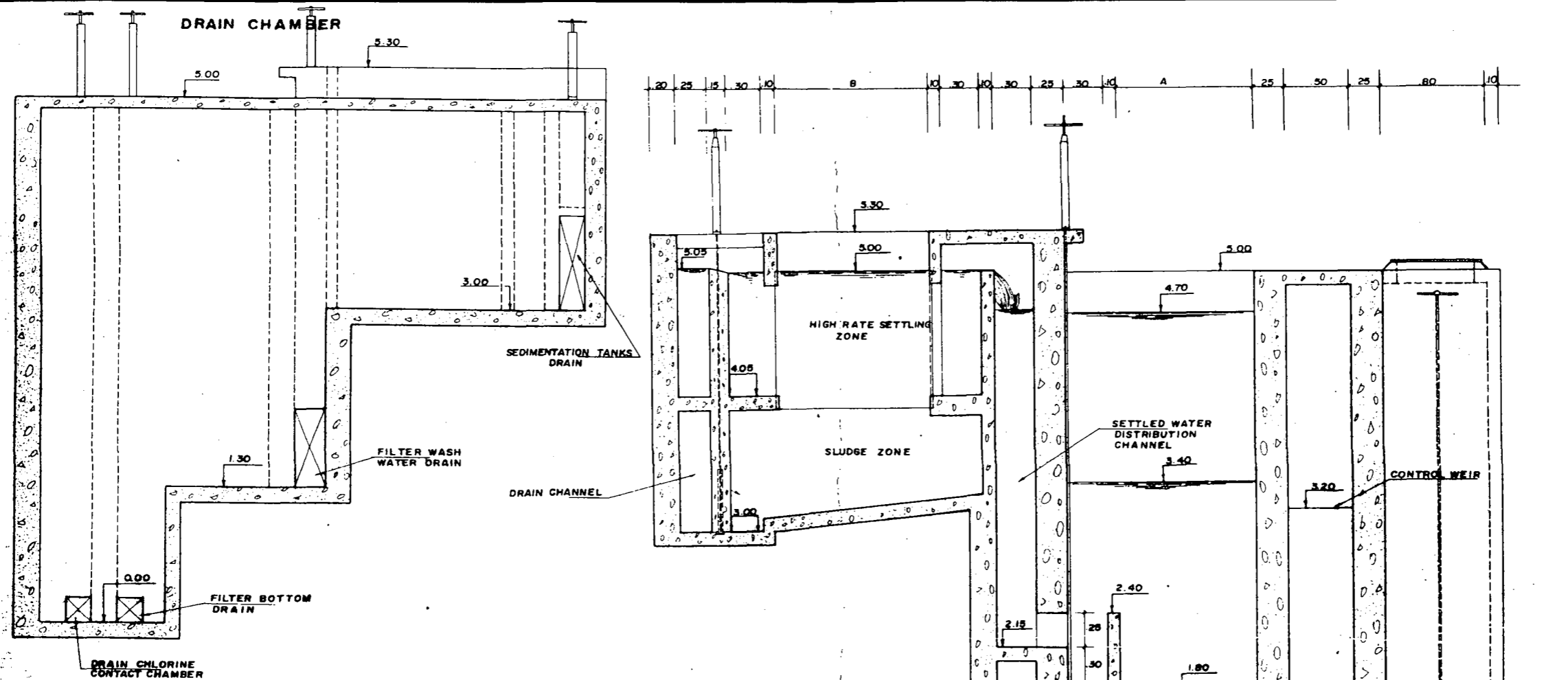
# RAPID FILTRATION PLANT - TYPE 8 PLANT

PLAN N° 41

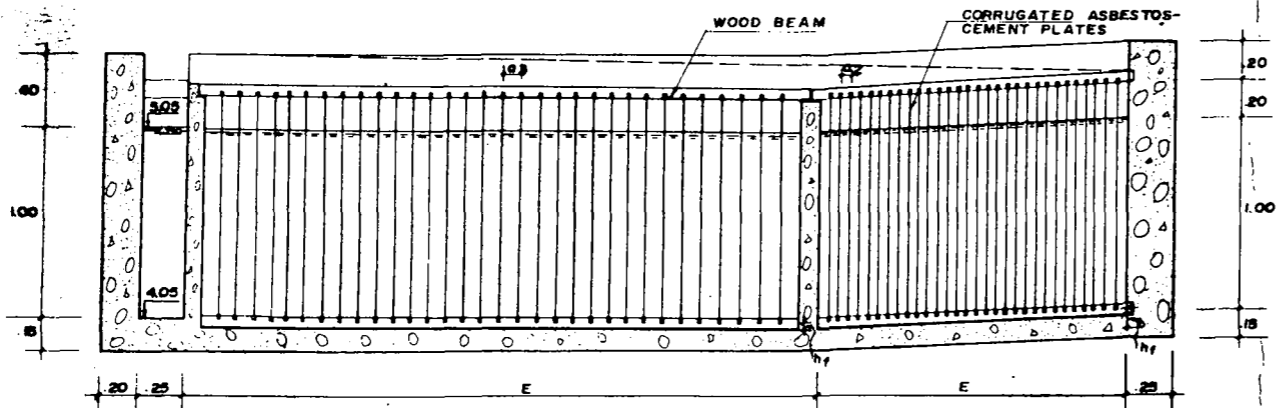
CEPIS / PAHO  
DATE JANUARY 1981

LIBRARY

International Reference Centre  
for Community Water Supply



CROSS SECTION G - G



FLOCCULATOR  
CROSS SECTION E - E

WASH WATER  
FILTER DRAIN

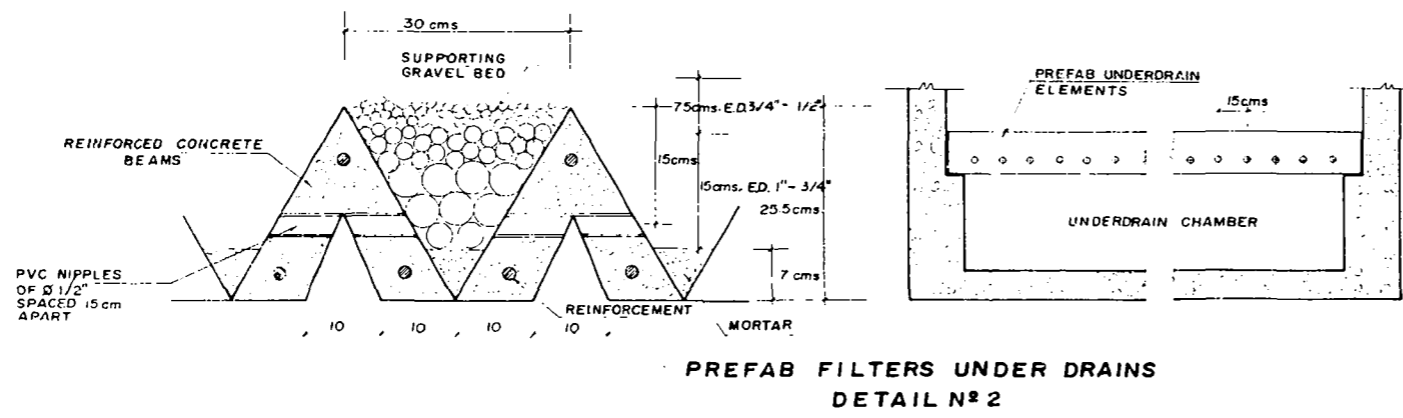
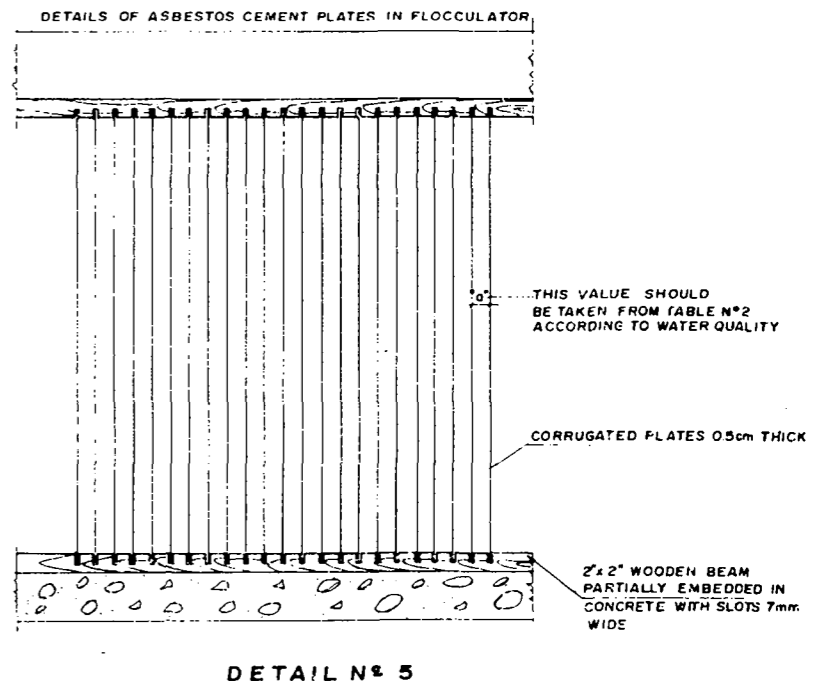
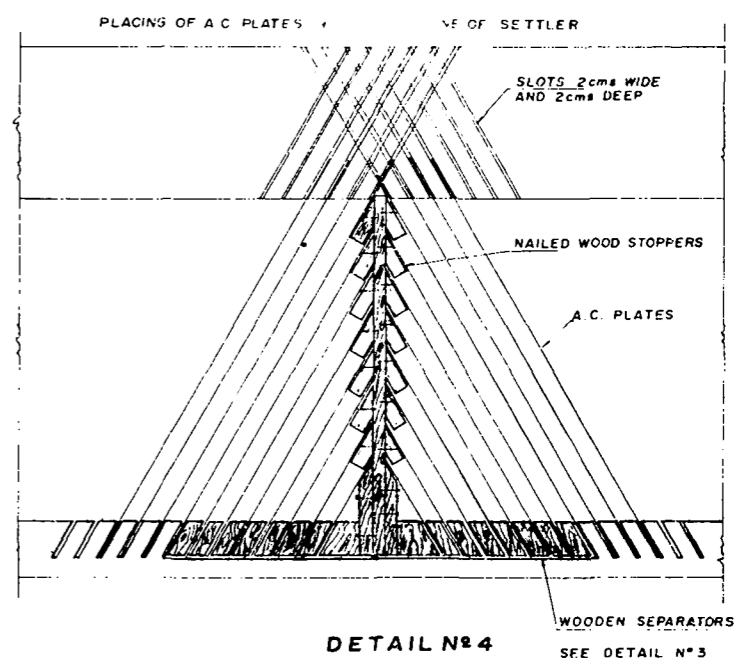
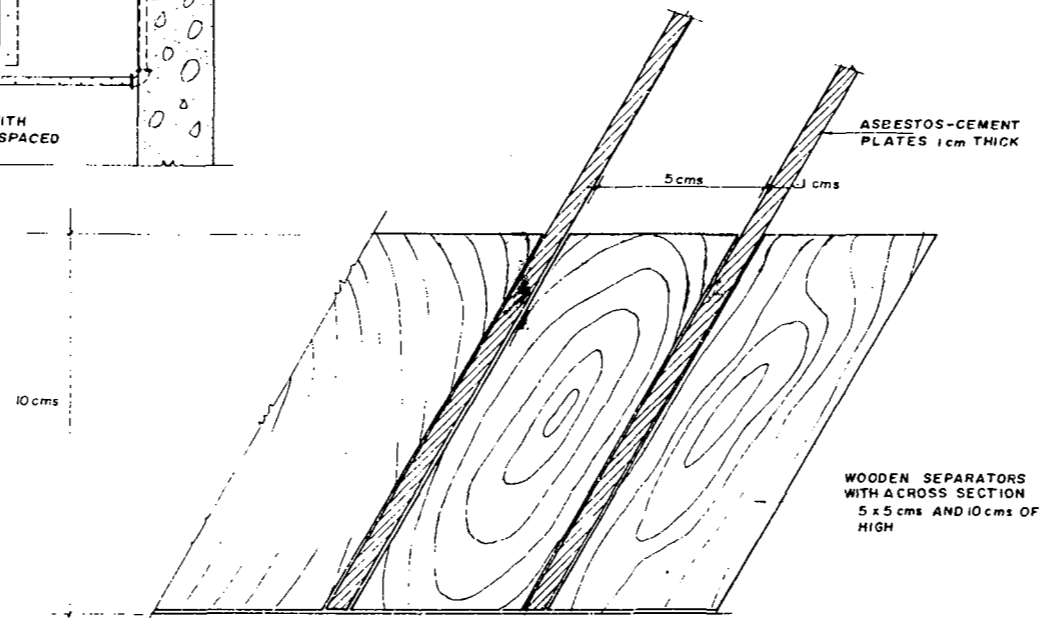
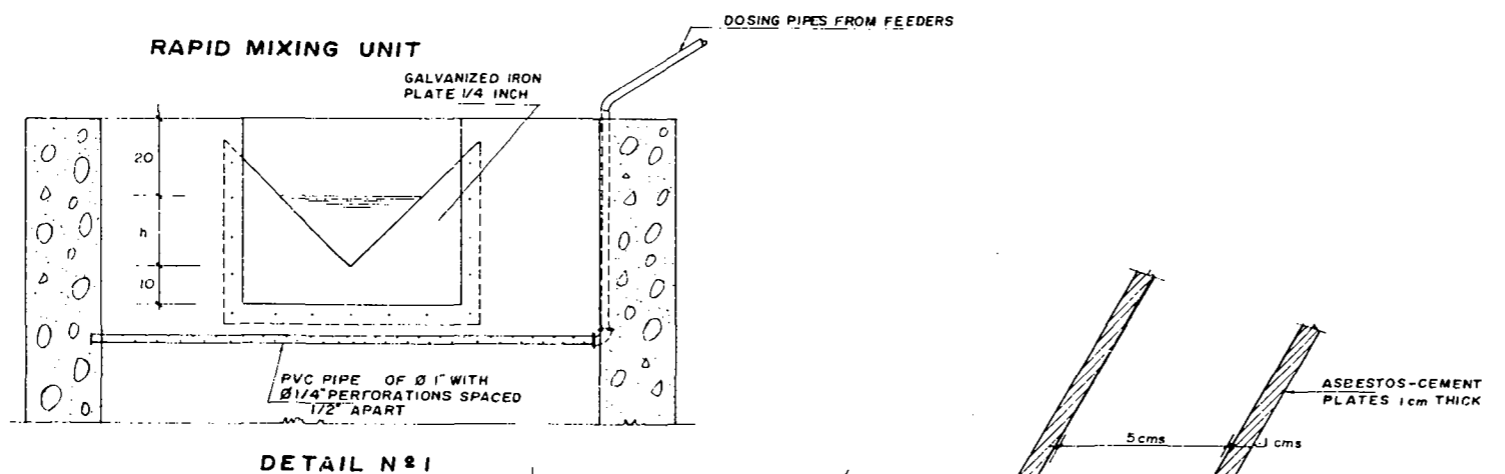
CROSS SECTION F - F

RAPID FILTRATION PLANT - TYPE 8 PLANT

PLAN N° 42

CEPIS / PAHO

DATE JANUARY 1981



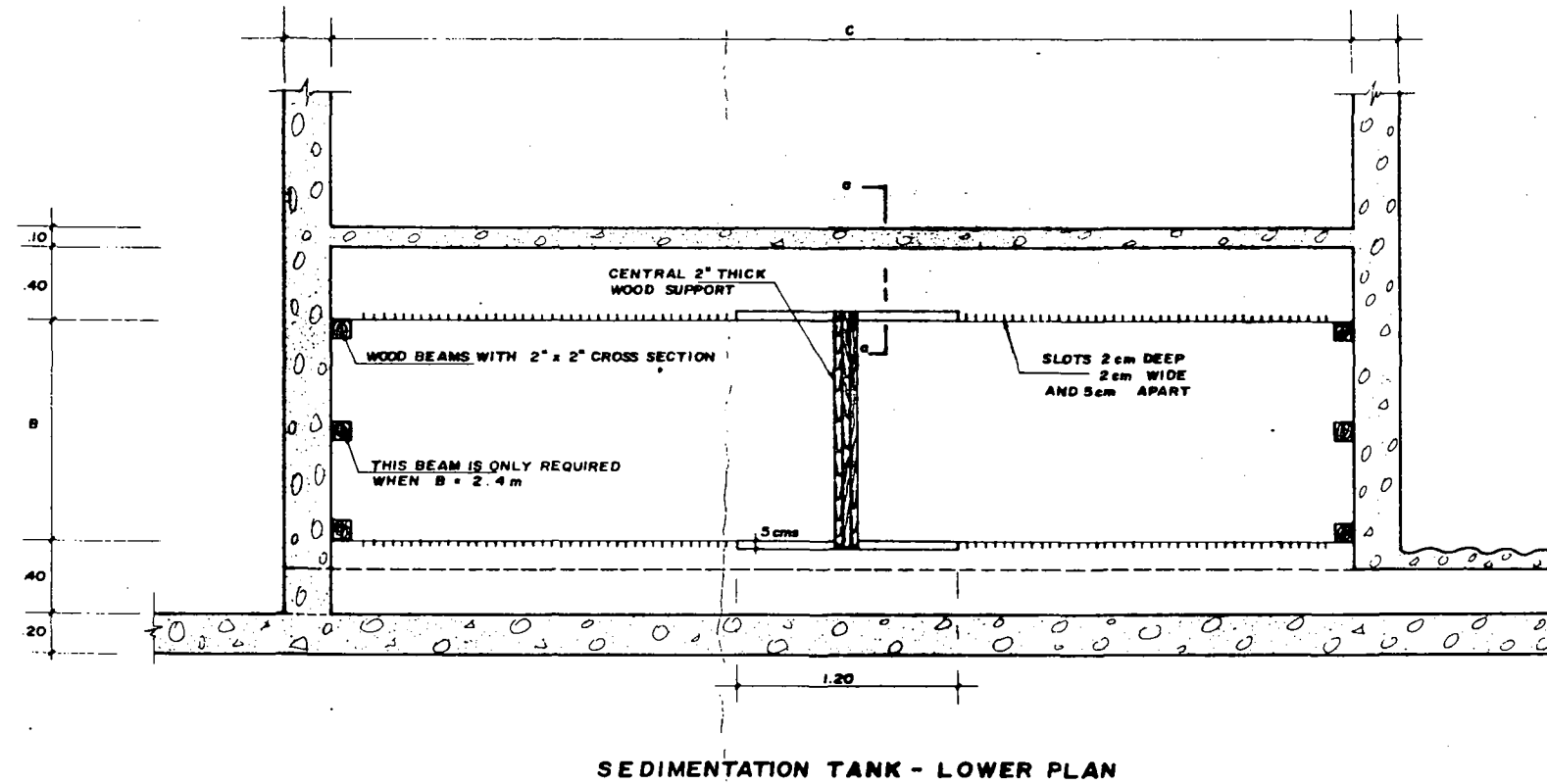
**RAPID FILTRATION PLANT - TYPE 8 PLANT**

PLAN N° 43

CEPIS / PAHO  
DATE JANUARY 1981

CENTRAL WOOD SUPPORT WHERE  
THE ENDS OF ASBESTOS-CEMENT  
PLATES WILL BE FIXED

CROSS SECTION a - a  
SEDIMENTATION TANK DETAIL OF SUPPORT



RAPID FILTRATION PLANT - TYPE 8 PLANT

PLAN N° 44

CEPIS / PAHO

DATE JANUARY 1981

DESIGN SPECIFICATIONS

- FEEDING**  
COAGULANT - MAXIMUM DOSE . . . . . 50 mg/l  
ALKALINIZER - ACCORDING TO WATER QUALITY
- RAPID MIXING**  
VELOCITY GRADIENT (G) - VARIABLE BETWEEN 777 TO 929 s<sup>-1</sup>  
RETENTION TIME (T) - VARIABLE
- MECHANICAL FLOCCULATION**  
 $G_{n1} T = K_1$   
RETENTION TIME (T) . . . . . 30 min  
NUMBER OF COMPARTMENTS . . . . . 4  
VELOCITY GRADIENTS

COMPARTMENTS	GRADIENTS s <sup>-1</sup>	
	MAXIMUM	MINIMUM
1	100	80
2	80	60
3	60	40
4	40	20

- MOTOR CHARACTERISTICS**  
POWER  
UP TO 18 m<sup>3</sup>/h . . . . . 1/4 H.P.  
UP TO 36.4 m<sup>3</sup>/h . . . . . 1/2 H.P.  
VARIABLE SPEED BETWEEN 6 AND 18 RPM

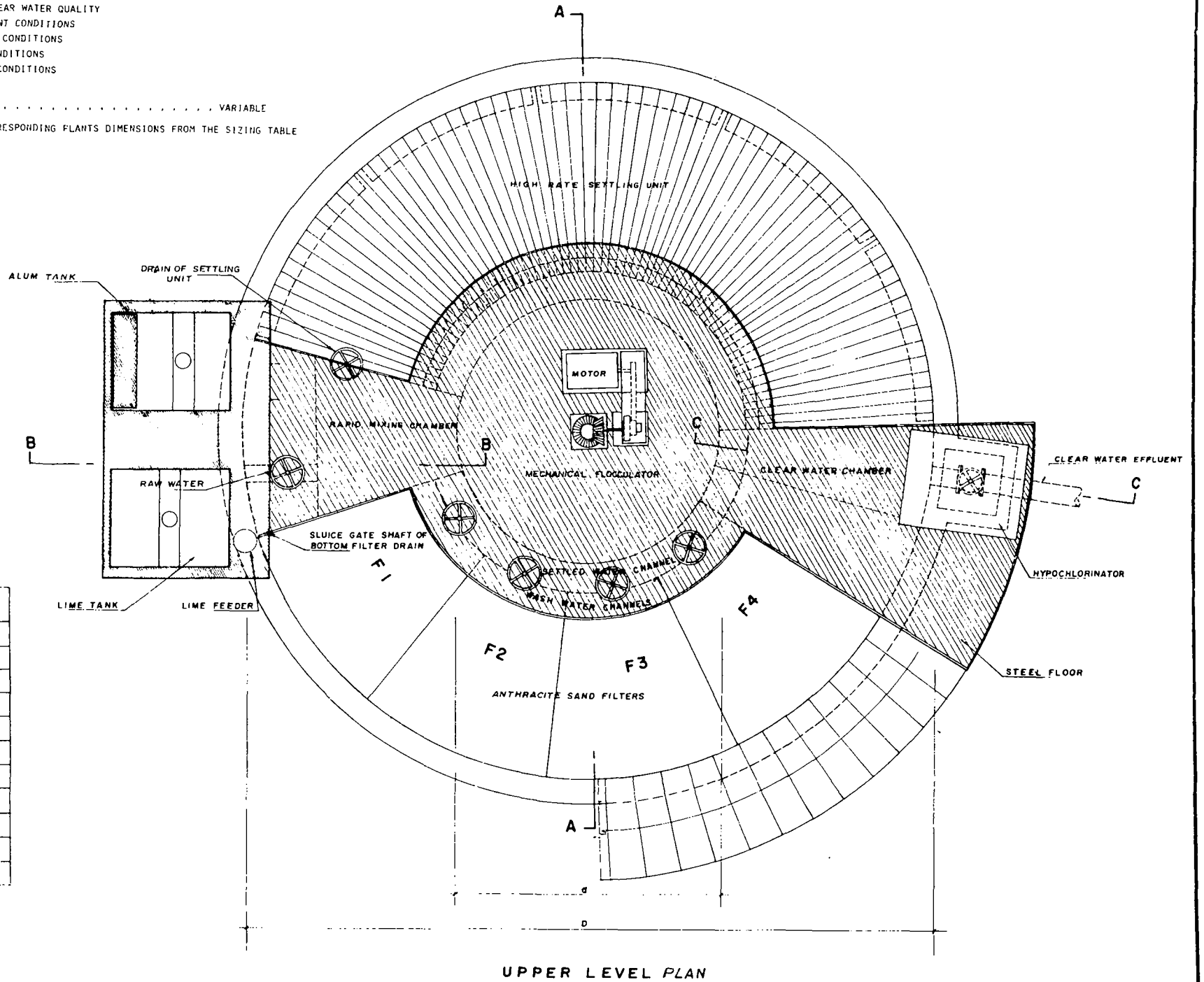
- HIGH-RATE INCLINED-FLOW SETTLING**  
$$V_0 = \frac{v_s [ \sin \theta + \frac{(L)}{d} \cos \theta ]}{5 + \frac{v_s L d}{2u} \cos \theta}$$
  
SETTLING VELOCITY (V<sub>s</sub>) . . . . . 120 m<sup>3</sup>/m<sup>2</sup>/d  
ANGLE OF PLATES (θ) . . . . . 60°  
AVERAGE SPACE BETWEEN PLATES (d) . . . . . 9 cms  
REYNOLDS NUMBER (Re) . . . . . 150

- VARIABLE VELOCITY FILTERS**  
MAXIMUM FILTRATION VELOCITY IN EACH FILTER . . . . . 300 m/d  
AVERAGE FILTRATION VELOCITY DURING WASHING . . . . . 288 m/d  
AVERAGE FILTRATION VELOCITY . . . . . 180 m/d  
WASHING VELOCITY . . . . . 0.60 m/min  
FILTER MEDIA:  
SAND, ANTHRACITE AND/OR ANY OTHER SIMILAR MATERIAL
- MEDIA SELECTION CRITERIA**  
THE CHARACTERISTICS OF THE FILTER MEDIA WILL BE SELECTED BASED ON THE FOLLOWING CRITERIA:  
(A) RAW AND CLEAR WATER QUALITY  
(B) PRETREATMENT CONDITIONS  
(C) FILTRATION CONDITIONS  
(D) WASHING CONDITIONS  
(E) OPERATION CONDITIONS
- DISINFECTION**  
CHLORINE DOSE . . . . . VARIABLE
- SELECT THE CORRESPONDING PLANTS DIMENSIONS FROM THE SIZING TABLE

- D = PLANT DIAMETER  
d = FLOCCULATOR DIAMETER
- THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°1  
t<sub>1</sub> = LENGTH OF THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°1  
b<sub>2</sub> = WIDTH OF THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°2  
t<sub>2</sub> = LENGTH OF THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°2  
b<sub>3</sub> = WIDTH OF THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°3  
t<sub>3</sub> = LENGTH OF THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°3  
b<sub>4</sub> = WIDTH OF THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°4  
t<sub>4</sub> = LENGTH OF THE WOOD PADDLE OF THE FLOCCULATOR SECTION N°4

PLANT SIZING TABLE

Q	D	d	b <sub>1</sub>	t <sub>1</sub>	b <sub>2</sub>	t <sub>2</sub>	b <sub>3</sub>	t <sub>3</sub>	b <sub>4</sub>	t <sub>4</sub>
m <sup>3</sup> /h	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.
7.2	2.80	1.00	.25	.40	.15	.40	.10	.30	.10	.30
9.0	3.00	1.10	.25	.45	.23	.40	.15	.40	.10	.35
10.8	3.30	1.20	.25	.50	.23	.45	.15	.45	.10	.40
14.4	3.70	1.40	.25	.60	.20	.55	.10	.55	.10	.50
18.0	4.10	1.55	.25	.65	.20	.60	.10	.60	.075	.55
21.6	4.40	1.70	.23	.75	.20	.70	.10	.70	.075	.60
25.2	4.80	1.84	.25	.80	.20	.75	.10	.75	.075	.75
27.0	5.10	1.98	.20	.90	.15	.85	.075	.85	.075	.75
32.4	5.70	2.10	.20	.95	.15	.90	.075	.90	.075	.85
36.0	6.00	2.20	.20	1.00	.15	.95	.075	.95	.075	.90



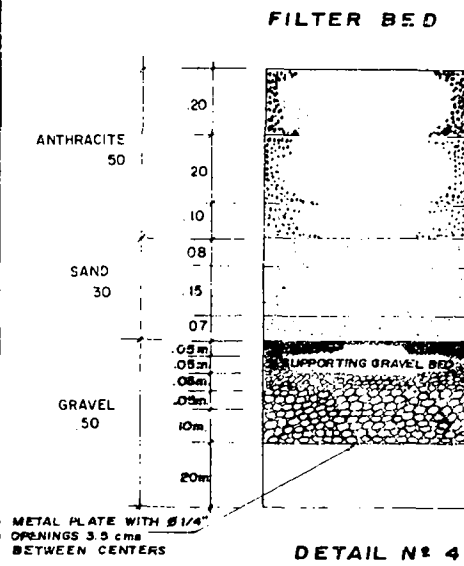
PREFAB. RAPID FILTRATION PLANT - TYPE 9 PLANT

PLAN N° 45

CEPIS / PAHO  
DATE JANUARY 1981

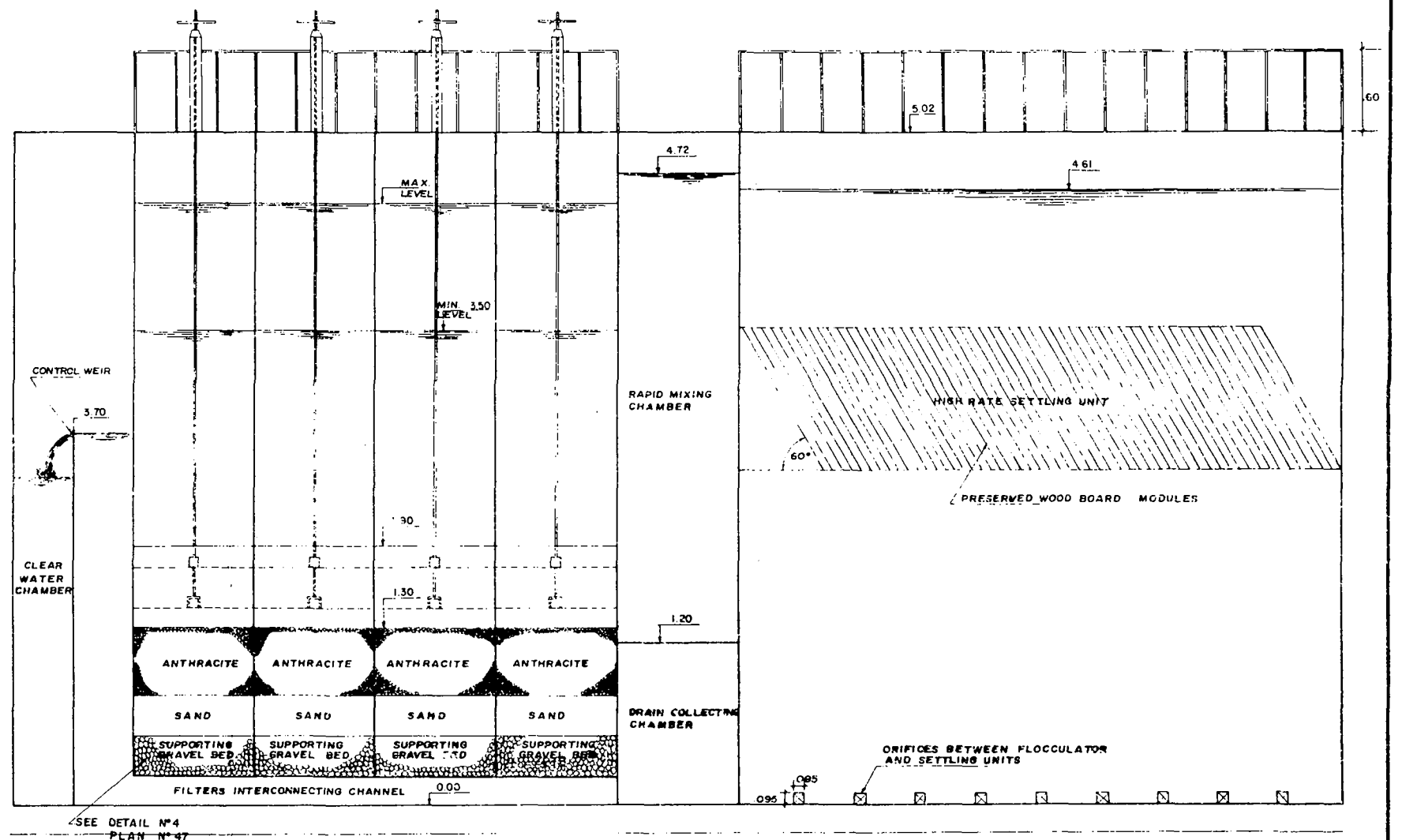






- ANTHRACITE THAT PASSES THROUGH SCREEN #16 AND REMAINS IN SCREEN #18
- ANTHRACITE THAT PASSES THROUGH SCREEN #14 AND REMAINS IN SCREEN #16
- ANTHRACITE THAT PASSES THROUGH SCREEN #12 AND REMAINS IN SCREEN #14
- SAND FROM SCREENS #30 TO 40
- SAND FROM SCREENS #20 TO 30
- SAND FROM SCREENS #16 TO 20
- 1/8" - 1/12"
- 1/4" - 1/8"
- 1/2" - 1/4"
- 3/4" - 1/2"
- 1" - 3/4"

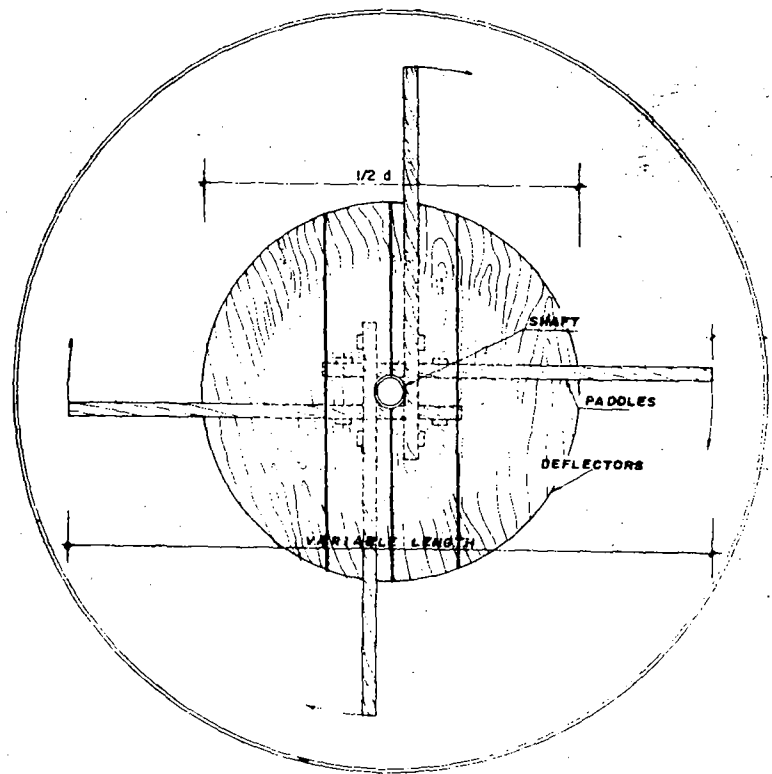
NOTE: ASTM STANDARD SCREEN SIZES



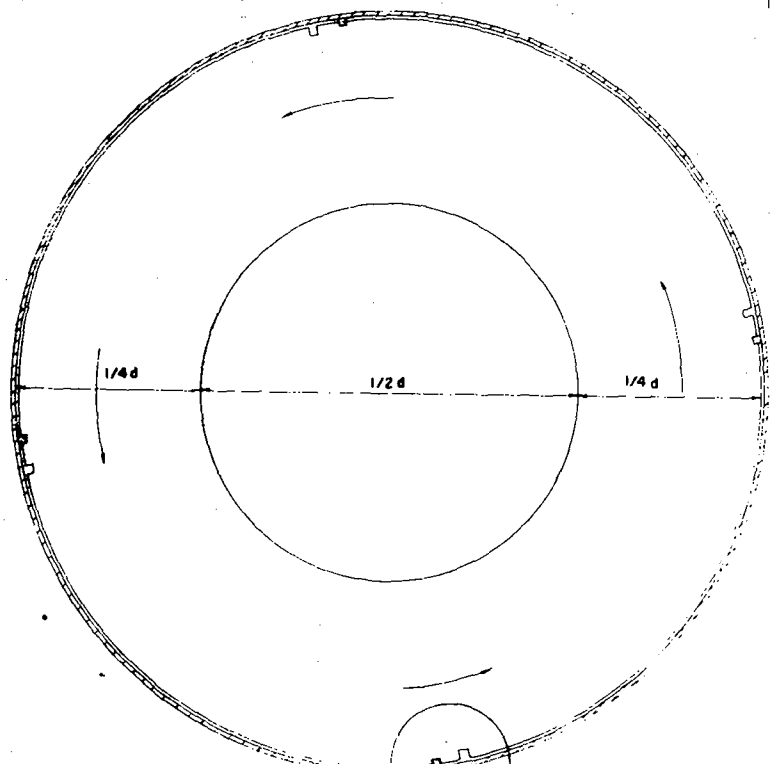
**PREFAB RAPID FILTRATION PLANT - TYPE 9 PLANT**

PLAN N° 47

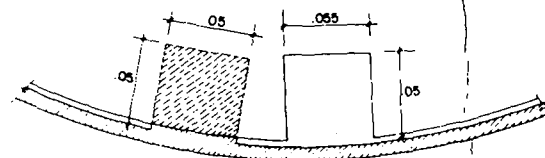
CEPIS / PAHO  
DATE JANUARY 1981



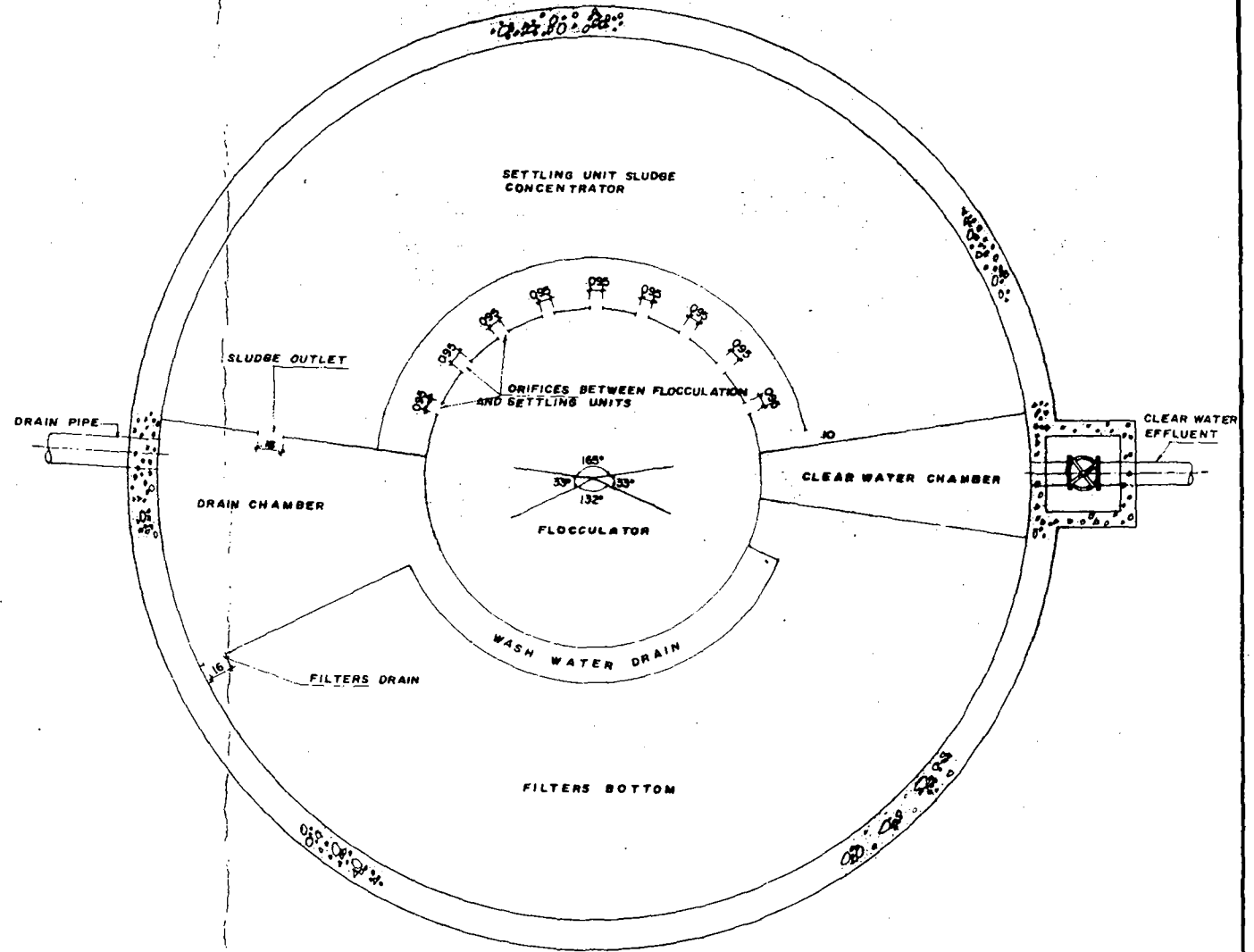
DETAIL N° 1  
FLOCCULATOR PADDLES  
VARIABLE DIAMETER



DETAIL N° 2  
FLOCCULATION UNIT SEPARATORS



DETAIL N° 3  
SEPARATOR SUPPORTS



PLAN ON D-D

RAPID FILTRATION PREFAB. PLANT - TYPE 9 PLANT

PLAN N° 48

CEPIS / PAHO  
DATE JANUARY 1981