9. 外国からの援助資金

NET RECEIPTS OF FOREIGN ASSISTANCE

(Rs Millions)

TYPE OF SOURCE	1977	1978	1979	1980	1981	1982
LOANS :	880.7	3,215.3	2,379.4	3,516.0	4,880.1	5,027.7
(a) A.D.B.	88.6	412.1	128.2	50.9	147.7	266.3
(b) I.B.R.D.	-5.8	-7.9	2.9	-21.9	-27.1	-19.2
(c) I.D.A.	120.2	166.4	180.6	359.6	515.9	1,096.1
(d) Canada	4.32	143.7	113.0	365.3	605.6	257.5
(e) People's Republic of China	-135.3	-40.0	-75.7	-142.6	252.6	61.5
(f) U.K.	276.2	-35.4	-2.5	-2.8	-2.6	-
(g) U.S.A.	219.9	524.8	553.1	625.0	486.1	850.3
(h) U.S.S.R.	-11.1	2.2	-14.0	-22.0	-24.5	-23.5
(i) Federal Republic of Germany	28.9	318.6	240.7	117.0	-29.6	-41.7
(j) Yugoslavia	-	-	-	-	-	0.6
(k) Poland	-	-	44.1	67.8	-	41.8
(l) France	-	-22.2	36.6	37.1	307.5	180.0
(m) Japan	83.2	433.2	352.5	258.1	316.5	938.9
(n) India	50.3	130.4	83.5	82.7	-45.5	-10.5
(o) German Democratic Republic	-25.6	-31.3	-33.2	-5.9	-5.3	-4.8
(p) Denmark	-0.1	9.0	1.5	51.5	41.8	0.4
(q) Italy	2.4	-3.4	-	-	-	-2.8
(r) Hungary	0.7	0.1	-1.3	-1.3	-1.3	-1.2
(s) Netherlands	34.7	348.4	188.3	139.1	551.8	161.4
(t) Kuwait	43.6	61.3	25.9	46.4	13.6	-13.9
(u) U.A.E.	-	-	-	0.6	-4.8	-10.2
(v) O.P.E.C.	64.8	16.3	-	22.1	183.6	110.8
(w) I.M.F.	-	789.2	599.3	520.6	8.2	-
(x) Euro Currency	-	-	-	897.5	1,517.7	836.4
(y) Iraq	-	-	-	94.9	-	6.5
(z) Switzerland	-	-	-	-	4.3	-

NET RECEIPTS OF FOREIGN ASSISTANCE (Cont'd)

(Rs Millions)

TYPE OF SOURCE	1977	1978	1979	1980	1981	1982
Grants :	500.5	660.7	1,390.4	2,619.5	2,721.3	3,376.1
(a) Colombo Plan	75.3	128.4	40.2	52.1	-	-
(i) Australia	-	-	-	-	-	-
(ii) Canada	75.3	128.4	40.2	52.1	-	-
(iii) New Zealand	-	-	-	-	-	-
(b) Other	425.2	532.3	1,350.2	2,567.4	2,721.3	3,376.1
(i) United Nations	99.0	19.9	33.8	86.3	27/7	214.6
(ii) People's Republic of China	-	-	1.7	-	-	-
(iii) U.S.A.	0.1	0.1	0.3	4.9	-	3.6
(iv) Federal Republic of Germany	33.0	29.0	8.2	85.8	137.3	13.1
(v) Yugoslavia	20.0	7.2	3.8	-	-	-
(vi) United Kingdom	50.9	66.0	498.1	1,108.3	836.4	1,319.8
(vii) German Democratic Republic	-	-	-	-	-	-
(vii) France	19.5	15.5	-	-	39.7	-
(ix) U.S.S.R.	-	-	40.0	-	-	-
(x) Sweden	109.2	203.1	101.0	599.8	497.2	865.7
(xi) Switzerland	-	-	-	-	-	-
(xii) Italy	-	-	-	-	-	2.1
(xiii) European Economic Community	19.7	32.7	51.4	95.4	294.4	135.3
(xiv) Netherlands	41.0	68.9	42.6	15.9	359.3	157.6

NET RECEIPTS OF FOREIGN ASSISTANCE (Cont'd)

(Rs. Millions)

TYPE OF SOURCE	1977	1978	1979	1980	1981	1982 (1)
(xv) Iraq	-	-	-	-	-	-
(xxi) Algeria	-	-	-	-	-	-
(xvii) Saudi Arabia	-	-	-	-	-	-
(xviii) Kuwait	-	-	-	-	-	
(xix) Republic of Korea	-	0.6	-	-	-	-
(xix) Libya	-	-	-	-	-	-
(xx) Quartar	-	-	-	-	-	-
(xxii) Australia	12.0	25.9	30.6	38.2	79.3	173.4
(xxiii) I.M.F.	-	37.0	74.4	102.8	-	-
(xxiv) Norway	-	5.1	139.3	46.4	174.6	128.2
(xxv) Hong Kong	-	-	-	-	-	-
(xxvi) Japan	-	3.3	230.8	198.2	222.2	206.3
(xxvii) India	-	0.5	-	-	-	-
(xxviii) New Zealand	-	0.2	-	-	0.1	0.1
(xxix) Canada	-	0.6	75.1	22.8	-	143.2
(xxx) Others	20.8	16.7	19.2	163.2	37.6	1.0
(xxxi) Finland	-	-	-	-	15.5	5.2
Total of loans and grants	1,381.2	3,876.0	3,769.8	6,135.5	7,601.5	8,403.8

(1) Provisional

Note : The figures in the above table indicate the actual amount of the loans/grants utilised by Sri Lanka and not the total amount pledged by the donor countries at the time of signing the agreement. Further in the case of commodity Loans/Grants, the total amount utilized is indicated only after the completion of the Programme. Technical assistance in the form of services of experts, scholarships and training facilities are also not included.

10. Kalatuwawa浄水処理施設の概要

Kalatuwawa Treatment Plant

1. Analysis of water before & after treatment

Description	Before treatment	After treatment
Color	clear	clear
Turbidity	6.8	3.2
pH	6.0	7.6
Odour	Fishy	Nil

(additional reports are annexed.)

2. Organization for Maintenance and Operation

Plant is designed to supply 20 m.g.d. and is operated throughout 24 hours of the day in three shifts of 8 hour duration each.

Shift staff

Shift officer (Technical Asst.)	01
Generator Plant Operator	01
Generator Plant Assistant	01
Chemical Plant Operator	01
Chemical Plant Assistant	01
Filter Plant Operator	01
Filter Plant Assistant	01

3. (i) Organization Chart

The organization chart is as follows.

Officer-in-Charge

Shift Officer — Non shift officer — Store Keeper

Operators, Fitter, Electrician, Drivers, Labourers — Stores Labourers

3. (ii) Number of Personnel and their Academic career

(a) Administrative Staff : In addition to the overall supervision, the administration of the schemes are executed by the O.I.CC. assisted by 3 Technical Assistants and 2 Supervisors who are mainly attached to Water Works staff as stated below.

(b) Water works staff :

Designation		Academic Standard
Officer-in-charge		Departmental Inspector's (Civil) Examination
Technical Assistants	03	G.C.E. (A.L.)
Supervisors	02	G.C.E. (O.L.)
Store Keeper	01	G.C.E. (O.L.)
Plant Operators	04	7th Standard
Filter	01	7th Standard
Labourers Gr. III	30	7th Standard

(c) Electrical Staff :

Electrician	01	Upto G.C.E. & Tech. College Trade Certificate

(d) Mechanical Staff :
Attended to by General Mechanical staff of the Board as and when necessary.

(e) Financial Staff :
There is no separate staff. O.I.C. attends to payment and other accounting matters.

(f) Other staff :

Driver	02	
Security Guards	07	
Casual labourers	07	
Ad Hoc casual labourers	46	(to attend to various repair & maintenance work)

4. Training Programmes for the staff :

Short-duration training programmes are organized by the Training Centre of the Board to improve the ability of the staff.

However, it is felt that the training given to technical staff is inadequate. Hence, further extensive training is desirable.

11. Labugama浄水処理施設の概要

Labugama Treatment Plant

1. Analysis of Water

Please refer to the reports attached.

2. Organization for Maintenance and Operation

Plant is designed to supply 16 MGD and is operated throughout 24 hours of the day in three shifts of 8 hours duration each.

3. (i) Organization Chart

The organization chart is as follows:

Officer-in-Charge

Shift Officer	Supervisor	Minor Supervisor	Store-keeper
Operators	Fitter Labourer	Mechanic	Stores Labourer

(ii) Number of Personnel and their Academic Career

(a) Administative Staff: In addition to the overall supervision the administration of the scheme is executed by the O.I.C. assisted by one Engineering Assistant, 2 Technical Assistants and 2 Supervisors who are mainly attached to Water Works Staff.

(b) Water Works Staff

Designation		Academic Standard
Officer-in-Charge		Departmental Sub-Inspectors (Civil) Examination
Engineering Assistant	- 01	G.C.E. (O.L) Technical Training Course
Technical Assistants	- 02	G.C.E. (A.L)
Supervisors	- 01	G.C.E. (O.L)
Fitters	- 03	7th Standard
Labourers	- 33	7th Standard

G.C.E. = General Certificate of Education
O.L = Ordinary Level
A.L = Advanced Level

(c) Electrical Staff

Electrician	- 01	7th Standard

(d) Mechanical Staff

Supervisor	- 01	7th Standard

(e) Financial Staff

There is no separate staff O.I.C. attends to payment and other accounting matters.

(f) Other Staff

Mason	- 01	7th Standard
Painter	- 01	8th Standard
Carpenter	- 01	8th Standard
Watcher	- 11	7th Standard
Driver	- 01	G.C.E. (O.L)
Lorry Cleaner	- 01	Upto G.C.E. (O.L)

4. Training Programme for the Staff

Short-duration training programmes are organized by the Training Centre of the Board to improve the ability of the staff.

However, it is felt that the training given to technical staff is inadequate. Hence, further extensive training is desirable.

12. 水質分析結果

TABLE OF WATER QUALITY TESTS

Source : Kalatuwawa Treatment Plant

Sampling Date : 29, May, 1984 Cloudy, occasionally heavy rain

ITEM	SAMPLING POINT				
	Tank (reser-voir	Outfall of cascade	End of settling	Top of filter	Tap of the plant
Water Temp. °C	29.	28.7	28.8	28.5	28.
pH	6.1	5.9	6.0	-	5.9
Turbidity, degree unit	6.6	6.6	4.5	-	4.6
Alkalinity, ppm as CaCo3	10	9	8	8	14
Chloride ion, ppm	7.8	-	7.6	-	8.0
Iron, ppm	ND	-	ND	-	ND
Manganese, ppm	0.25	-	0.03	0	0.05
Dissolved O_2 ppm	9.55	8.64	8.20	9.25	8.82
Residual chlorine		after pre Cl_2			less than
Free, ppm	-	0.2	0.2	0.2	0.1
Combined, ppm	-	0.3	0.3	0.3	0.1
Coliform Group/ml	6	7	neg	1	neg
General Bacteria/ml	150	205	8	7	neg
Colour, degree unit	25	-	-	-	20

Remarks ; ND - none detective; neg - negative.

TABLE OF WATER QUALITY TESTS

Source : Labugama Treatment Plant

Sampling Date : 30 May, 1984 Cloudy, occasionally heavy rain

Item	SAMPLING POINT		
	Tank (reservoir)	Settling	Tap water at meter station
Water Temp. °C	27.0	26.5	26.5
pH	5.8	5.8	5.7
Turbidity, degree unit	10	9	9
Alkalinity, ppm as CaCo3	12	13	11
Chloride ion, ppm	13.3	12.3	12.4
Iron, ppm	0.25	-	0.25
Manganese, ppm	0.03	-	0.03
Dissolved O_2, ppm	8.46	9.46	-
Residual chlorine, ppm			
Free	-	-	trace
Combined	-	-	0.25
Coliform Group/ml	15	-	neg
General Bacteria/ml	numerous	-	31
Colour, degree unit	45		45

13. 水質データ（理化学試験）

WATER QUALITY RECORD

ITEM	KALATUWAWA			
Sampling Date	18 July '83	18 July '83	24 Nov. '83	24 Nov '83
Source of sample	Reservoir	Final water	Reservoir	Final water
Appearance	Turbid	Clear	Clear	Clear
Turbidity (J.T.U.)	12.5	2	2.8	3.0
pH	6.5	6.1	6.6	6.0
Electrical Conductivity	25	70	24	47
Chloride, mg/l	10	16	10	10
Total Alkalinity, mg/l	6	8	8	6
Total Hardness	12	20	8	16
Total Dissolved Solids, mg/l	21	45	20	31
Nitrates, mg/l	minute trace	minute trace	minute trace	minute trace
Nitrates, mg/l	do.	do.	do.	do.
Free Ammonia	-	-	-	-
Albuminoid Ammonia	-	-	-	-
Iron (total), mg/l	2.2	0.4	0.4	0.08
Colour (Hazen Scale), mg/l		20	15	10 10
Aluminum, mg/l	-	-	trace	0.45
Fluoride. mg/l	0.4	0.4	-	-
Water Level of Tank *	38	-	19	-

Data source; Laboratory, National Water Supply & Drainage Board, Ratmalana.

Remark: * Data from daily record of the treatment plant

WATER QUALITY RECORD

ITEM	KALATUWAWA		LABUGAMA	
Sampling Date	19 Aug.'83	19 Aug,'83	19 Aug,'83	19 Aug.'83
Source of sample	Raw water Reservoir	Final water	Raw water	Final water
Appearance	Turbid	Clear	Coloured	More coloured
Turbidity (J.T.U.)	18	7.0	8	14
pH	6.8	6.4	6.6	6.4
Electrical Conductivity	30	80	20	20.5
Chloride, mg/l	8	12	8	14
Total Alkalinity, mh/l	16	8	36	6
Total Hardness, mg/l	6	32	12	24
Total Dissolved Solids	-	-	-	-
Nitrates	minute trace	minute trace	minute trace	minute trace
Nitrites	do.	do.	do.	do.
Free Ammonia	-	-	-	-
Albuminoid Ammonia	-	-	-	-
Iron (total), mg/l	1.4	0.32	0.5	1.4
Colour (Hazen Scale)	80	5	25	30
Alminum	-	-	-	-
Fluoride	-	-	-	-

Water Level of Tank* 36.5

Data source; Laboratory, National Water Supply & Drainage Board, Ratmalana.

Remarks: * Data from daily record of the treatment plant

14. 細菌試験データ

BACTERIOLOGICAL EXAMINATION OF WATER

(Outside of the Plant)

Data, Time Collected	Sampling Point	No. of Colonies /ml, 24 hrs 37 °C	Coli-form MPN/ 100 ml	E.Coli (Fecal) MPN/ 100 ml	Residual Cl_2, ppm	Remarks
8.50 am 15,08, '83	Waga Post Office	Nil	Nil	Nil	0.3	Satis-factory
9.05 am 15,08, '83	Hanwella Rest House	Nil	Nil	Nil	0.1	do.
15,08, '83	Panagoda Camp	Nil	Nil	Nil	-	do.
10.00 am 15,08, '83	Rukmalagama Housing scheme	Nil	Nil	Nil	0.4	do.
10.30 am 15,08, '83	Cancer Hospital Maharagama	Nil	Nil	Nil	Nil	do.
10.35 am 15,08, '83	Bellanwila Temple	Nil	Nil	Nil	0.6	do.
11.25 am 15,08, '83	Dehiwela Reservoir	Nil	Nil	Nil	more than 1ppm	do.
10.00 am 27,08 '83	Waga Post Office	Nil	Nil	Nil	0.4	do.
10.20 am 27,08, '83	Hanwella Rest House	Nil	Nil	Nil	0.2	do.
10.50 am 29,08, '83	Panagoda Army Camp	Nil	Nil	Nil	0.4	do.
12.40 am 29,08, '83	Cancer Hospital, Maharagama	Nil	Nil	Nil	0.1	do.
12.10 pm 29,08, '83	Rukmalgama Scheme	Nil	Nil	Nil	0.6	do.
1.00 pm 29,08, '83	Bellanwila Temple	Nil	Nil	Nil	0.2	do.
1.15 pm 29,08, '83	Dehiwela Reservoir	Nil	Nil	Nil	1.0	do.

BACTERIOLOGICAL EXAMINATION OF WATER

(Outside of the Plant)

Data, Time Collected	Sampling Point	No. of Colonies /ml, 24 hrs 37 °C	Coli-form MPN/ 100 ml	E.Coli (Fecal) MPN/ 100 ml	Residual Cl_2, ppm	Remarks
12.15 pm 25,09, '83	Panagoda Army Camp	Nil	Nil	Nil	0.2	Satis-factory
12.35 pm 25,09, '83	Rukmalagama	Nil	Nil	Nil	0.1	do.
1.15 pm 25,09,'83	General Hospital Maharagama	Nil	nil	nil	0.1	do.
1.25 pm 25,09, '83	Bellanwila Temple	Nil	Nil	Nil	Nil	do.
1.35 pm 25,09, '83	Dehiwela Reservoir	Nil	Nil	Nil	more than 1ppm	do.

Data Source; Records from Bacteriological Laboratory,
National Water Supply & Drainage Board, Ratmalana

BACTERIOLOGICAL EXAMINATION OF WATER

(Outside of the Plant)

Data, Time Collected	Sampling Point	No. of Colonies /ml, 24 hrs 37 °C	Coli-form MPN/ 100 ml	E.Coli (Fecal) MPN/ 100 ml	Residual Cl_2, ppm	Remarks
8.20 10,08, '83	Kalatuwawa (before post Cl2)	Nil	Nil	Nil	0.1	Satis-factory
7.55 am 17,08, '83	Kalatuwawa	Nil	Nil	Nil	0.6	do.
22,08, '83	Kalatuwawa	Nil	nil	nil	1.8	do.
24,08, '83	Kalatuwawa (Inlet water)	Nil	nil	nil	0.8	do.
8.45 am 26,08, '83	Kalatuwawa	Nil	Nil	Nil	1.0	do.
8.40 am 27,08, '83	Kalatuwawa	Nil	Nil	Nil	0.4	do.
8.20 am 31,08, '83	Kalatuwawa	Nil	Nil	Nil	0.6	do.
8.10 am 05,09, '83	Kalatuwawa	Nil	Nil	Nil	0.5	do.
14,09, '83	Kalatuwawa	Nil	Nil	Nil	0.6	do.
8.40am 07,09, '83	Kalatuwawa	Nil	Nil	Nil	0.8	do.
8.00 am 16,09, '83	Kalatuwawa	Nil	Nil	Nil	0.3	do.
7.35 am 16,09, '83	Kalatuwawa	Nil	Nil	Nil	0.4	do.
7.35 am 05,10, '83	Kalatuwawa	Nil	Nil	Nil	2.0	do.
8.30 am 05,10, '83	Kalatuwawa	Nil	Nil	Nil	2.0	do.
8.15 am 17,10, '83	Kalatuwawa	Nil	Nil	Nil	2.0	do.
9.20 am 26,10,'83	Kalatuwawa	Nil	Nil	Nil	2.4	do.

BACTERIOLOGICAL EXAMINATION OF WATER

(Outside of the Plant)

Data, Time Collected	Sampling Point	No. of Colonies /ml, 24 hrs 37 °C	Coli-form MPN/ 100 ml	E.Coli (Fecal) MPN/ 100 ml	Residual Cl_2, ppm	Remarks
8.05 am 24,10, '83	Kalatuwawa	Nil	Nil	Nil	2.0	Satis-factory
8.30 am 02,11, '83	Kalatuwawa	Nil	Nil	Nil	2.0	do.
8.15 am 14,11, '83	Kalatuwawa	Nil	Nil	Nil	2.5	do.
8.00 am 01,11, '83	Kalatuwawa	Too Numerous	8	Nil	2.2	Shows Coliform but F-c not detected
7,11, '83	Kalatuwawa	Nil	Nil	Nil	-	Satis-factory
7.20 am 16,11, '83	Kalatuwawa	Nil	Nil	Nil	2.4	do.
6.20 am 21,11, '83	Kalatuwawa	Nil	Nil	Nil	1.4	do.

Data Source ; Records from Bacteriological Laboratory,
National Water Supply & Drainage Board, Ratmalana

BACTERIOLOGICAL EXAMINATION OF WATER

(Outside of the Plant)

Data, Time Collected	Sampling Point	No. of Colonies /ml, 24 hrs 37 °C	Coli-form MPN/ 100 ml	E.Coli (Fecal) MPN/ 100 ml	Residual Cl_2, ppm	Remarks
8.40 am 10,08, '83	Labugama	Nil	Nil	Nil	0.5	Satis-factory
8.25 am 15,08, '83	Labugama	Nil	Nil	Nil	0.5	do.
9.00 am 17,08, '83	Labugama	Nil	Nil	Nil	0.7	do.
22,08, '83	Labugama	Nil	Nil	Nil	0.5	do.
24,08, '83	Labugama	Nil	Nil	Nil	1.2	do.
9.20 am 26,08, '83	Labugama	Nil	Nil	Nil	2.0	do.
9.25 am 27,08, '83	Labugama	Nil	Nil	Nil	0.5	do.
9.25 am 31,08, '83	Labugama	Nil	Nil	Nil	1.2	do.
9.45 am 05,09, '83	Labugama	Nil	Nil	Nil	0.4	do.
8.40 am 07,09, '83	Labugama	Nil	Nil	Nil	0.6	do.
14,09, '83	Labugama	Nil	Nil	Nil	0.5	do
8.25 am 26,09, '83	Labugama	Nil	Nil	Nil	1.2	do.
8.10 am 03,10, '83	Labugama	Nil	Nil	Nil	1.2	do.
8.20 am 05,10, '83	Labugama	Nil	Nil	Nil	1.2	do.
8.35 am 12,10, '83	Labugama	71	5	Nil	0.1	Shows coliform but F-c not detected

BACTERIOLOGICAL EXAMINATION OF WATER

(Outside of the Plant)

Data, Time Collected	Sampling Point	No. of Colonies /ml, 24 hrs 37 °C	Coli-form MPN/ 100 ml	E.Coli (Fecal) MPN/ 100 ml	Residual Cl_2, ppm	Remarks
8.35 am 17,10 '83	Labugama	Nil	Nil	Nil	0.5	Satis-factory
10,30 am 26,10, '83	Labugama	Nil	Nil	Nil	1.0	do.
9.30 am 24,10, '83	Labugama	Nil	Nil	Nil	0.7	Satis-factory
9.10 am 02,11, '83	Labugama	Nil	Nil	Nil	1.0	do.
9.10 am 14,11, '83	Labugama	Nil	Nil	Nil	0.8	do.
8.35 am 01,11, '83	Labugama	Nil	Nil	Nil	1.2	do.
7,11, '83	Labugama	Nil	Nil	Nil	-	do.
9.15 am 16,11, '83	Labugama	Nil	Nil	Nil	0.3	do.
5.45 am 21,11 '83	Labugama	Nil	Nil	Nil	1.0	do.

Data Source ; Records from Bactoriological Laboratory,
National Water Supply & Drainage Board, Ratmalana

15. 生物試験結果　　1984.6.18

1. 優占種

No.1、No.3、No.4：Rhizosalenia（ウロコ ケイソウ＝硅藻）

No.2：Ankistrodesmus（イトクズモ＝緑藻）

これらの他Tetraedron（テトラエドロン＝緑藻）、Elakatothrix（エラ・カトスリックス＝緑藻）が比較的多く見られた。

以上の主要種についてはその形態をスケッチで図－1に示した。

2. 総個体数

No.1、No.3：1,500～2,000個／mlで近いレベルにある。これらの数値は一般的なもので湖沼として特に多いものではない。

No.2、No.4：620～920個／mlでこれも近いレベルにある。ろ過されていないことを勘案しても、浄水処理された水としてはかなり多量の藻類が含まれている。

3. 特記事項

(1) No.2ではNo.1に比べ、ウロコケイソウを中心とした硅藻類が顕著に除去されている。

(2) (1)で示した傾向はNo.3→No.4でもほぼ同様であるが、その除去率はかなり低いものとなっている。

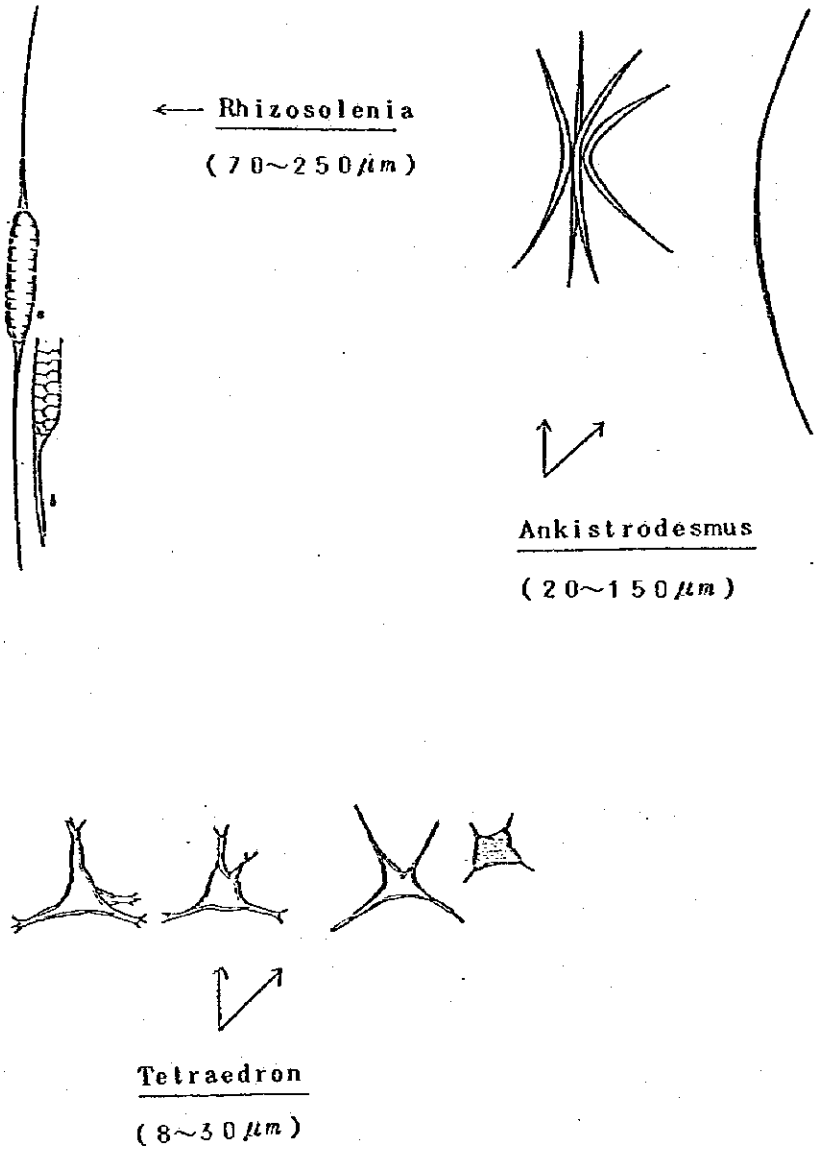
(3) 国内の一般的な湖沼と比べた場合、緑藻の出現種数が多いようである。

(4) No.2のろ過池表面のサンプル中には藻類は見られなかった。

表－1　スリランカ生物結果

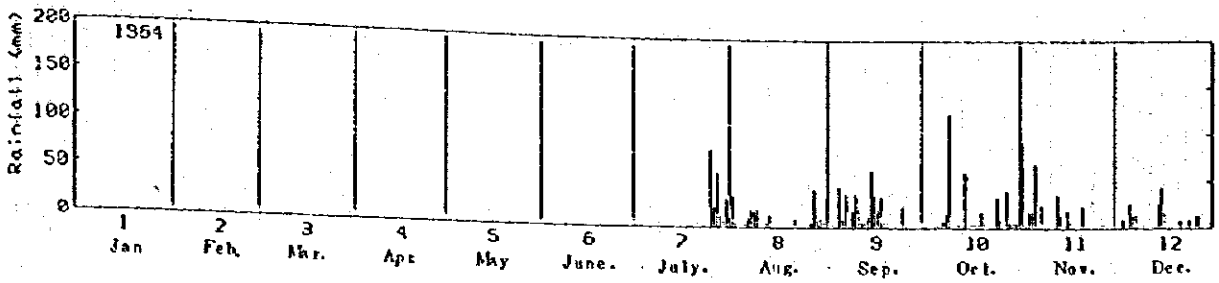
（数値：個／mℓ）　'84・6・15

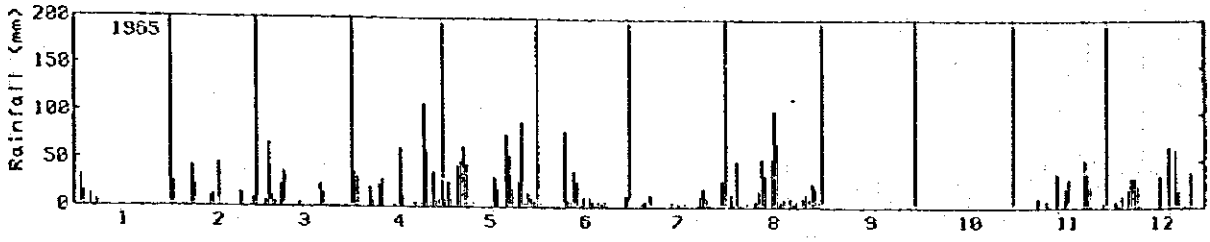
分類（綱）	種類（属）	No.1 貯水池	No.2 ろ過池表層	No.3 貯水池	No.4 沈でん池表層	備考
硅藻						
	Rhizosolenia sp.	1,300		1,100	530	
	Navicula sp.	10		10		
	Gomphonema sp.	10				
	Achnanthes sp.			20	20	
	Nitzschia sp.			10	20	
	Cyclotella sp.			10		
	Cymbella sp.			10	10	
緑藻						
	Elakatothrix sp.	120	100	80	40	
	Ankistrodesmus spp.	260	250	250	250	
	Staurastrum sp.	80	60	10	10	
	Actinastrum sp.	10		10		
	Tetraedron spp.	90	120	20	20	
	Oocystis sp.	10				
	Scenedesmus sp.		10			
	Cosmarium sp.			10		
	Closterium sp.			10		
鞭毛藻						
	Dinobryan sp.	70	50	10	30	
	Peridinium sp.	40	30	20		
（合計）		2,000個／mℓ	620個／mℓ	1,580個／mℓ	920個／mℓ	

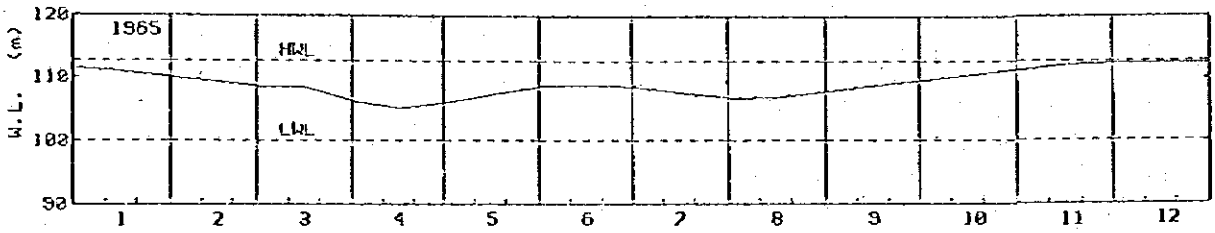

← Rhizosolenia
(70～250μm)
Ankistrodesmus
(20～150μm)
Tetraedron
(8～30μm)

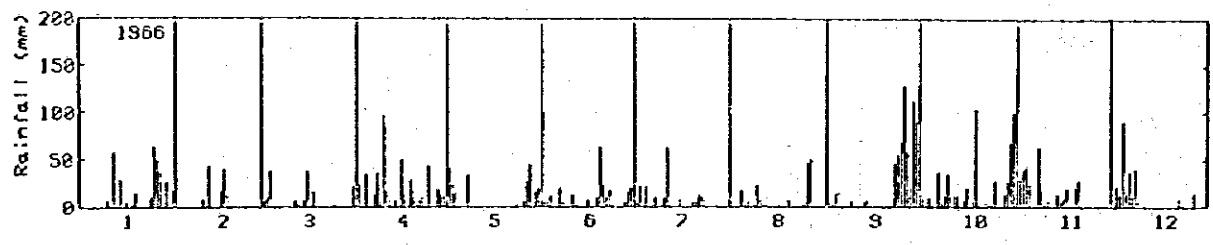
図－1　主要出現種の形態

16. Kalatuwawa , Labugama ダムの水位変化と降雨量









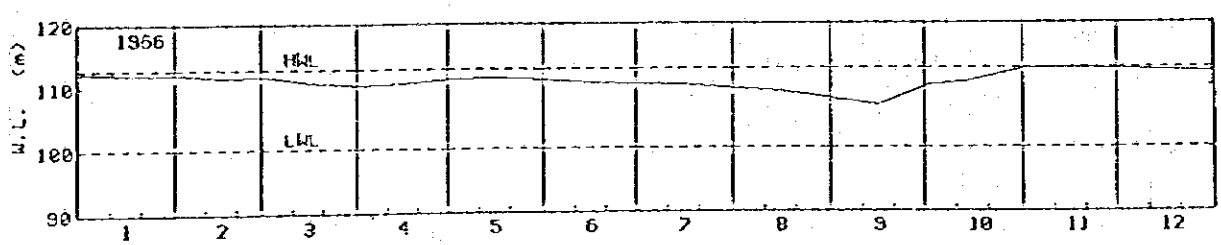


図　　KALATUWAWA ダムの水位変化と降雨量

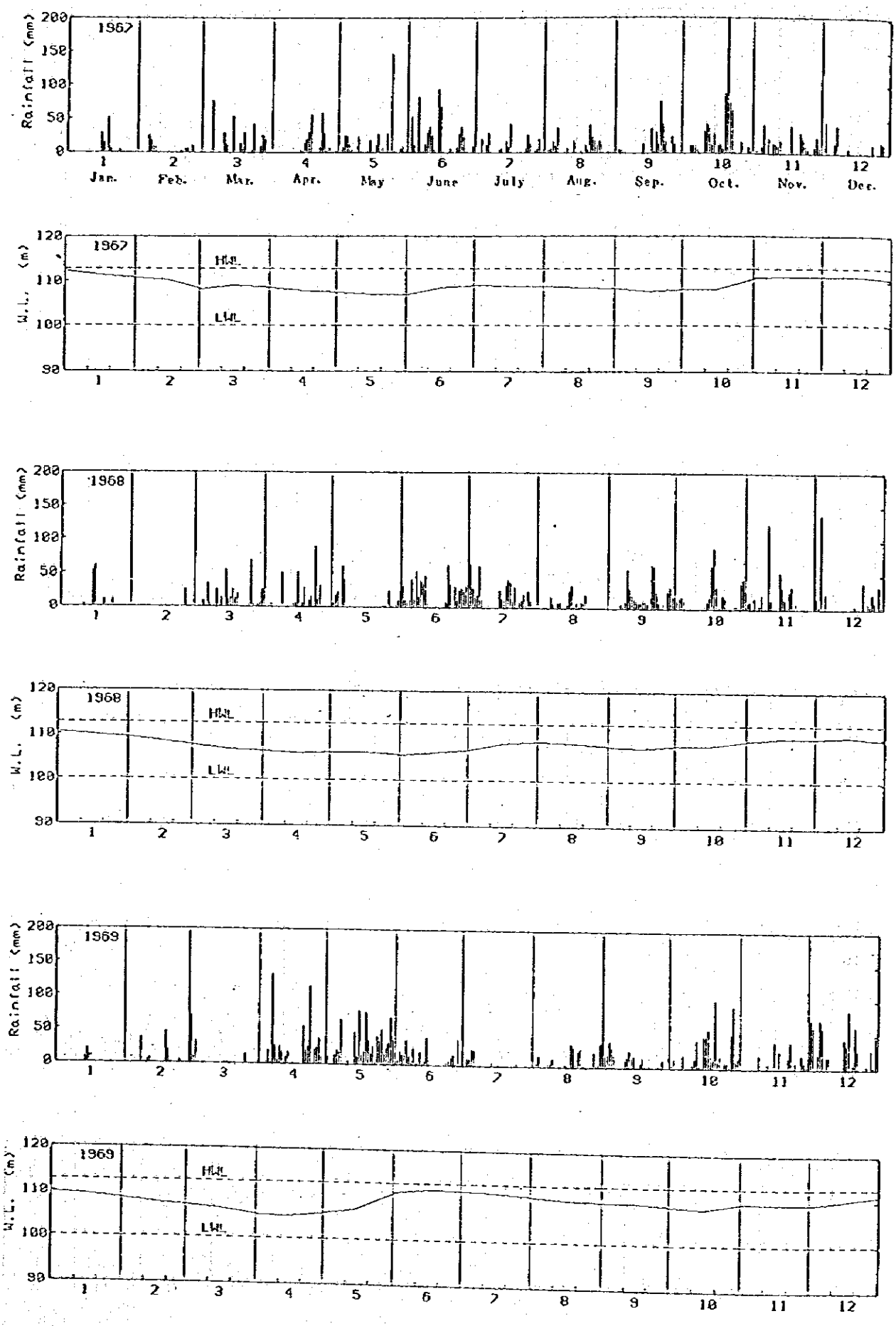
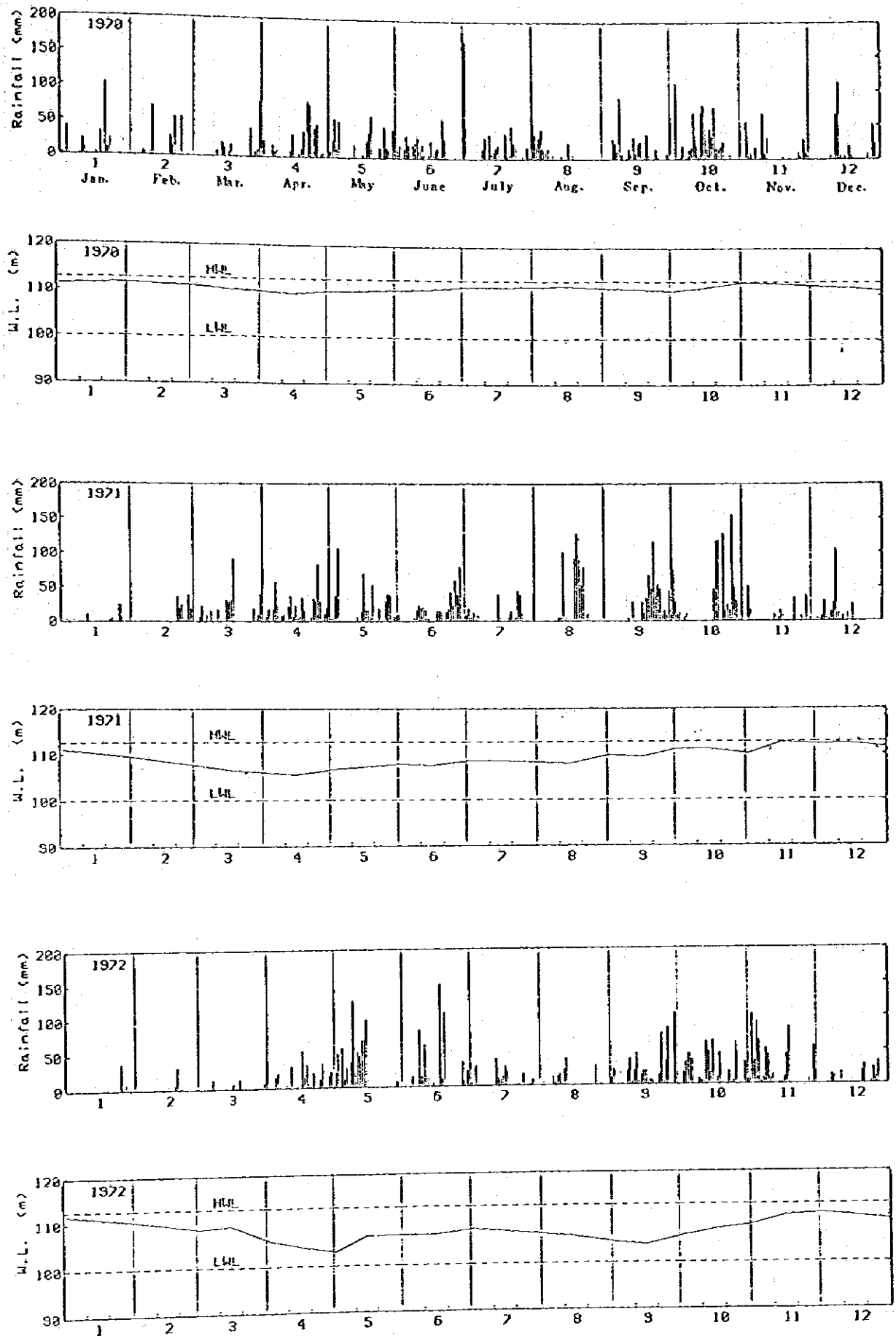


図　　KALATUWAWA ダムの水位変化と降雨量



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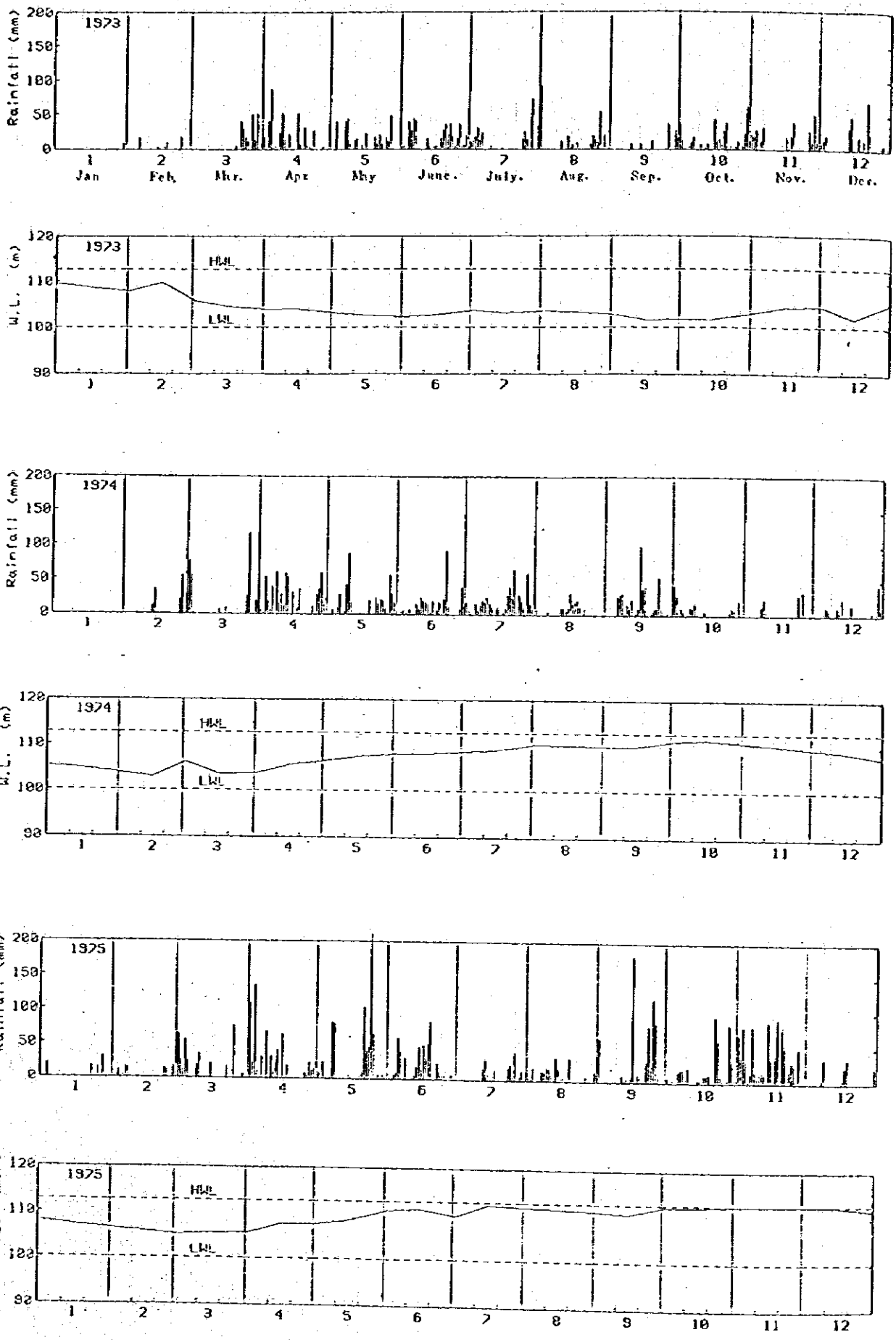

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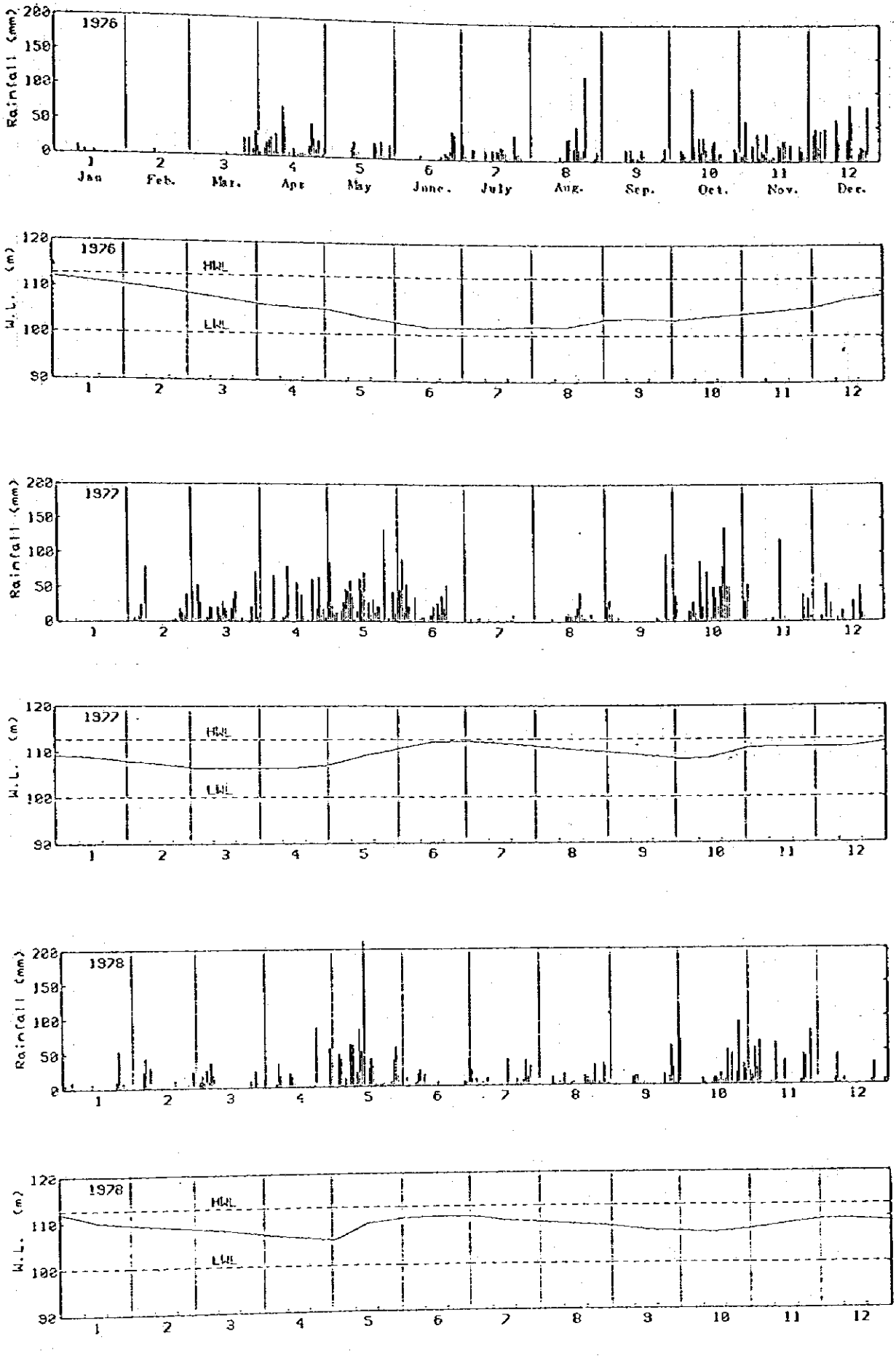

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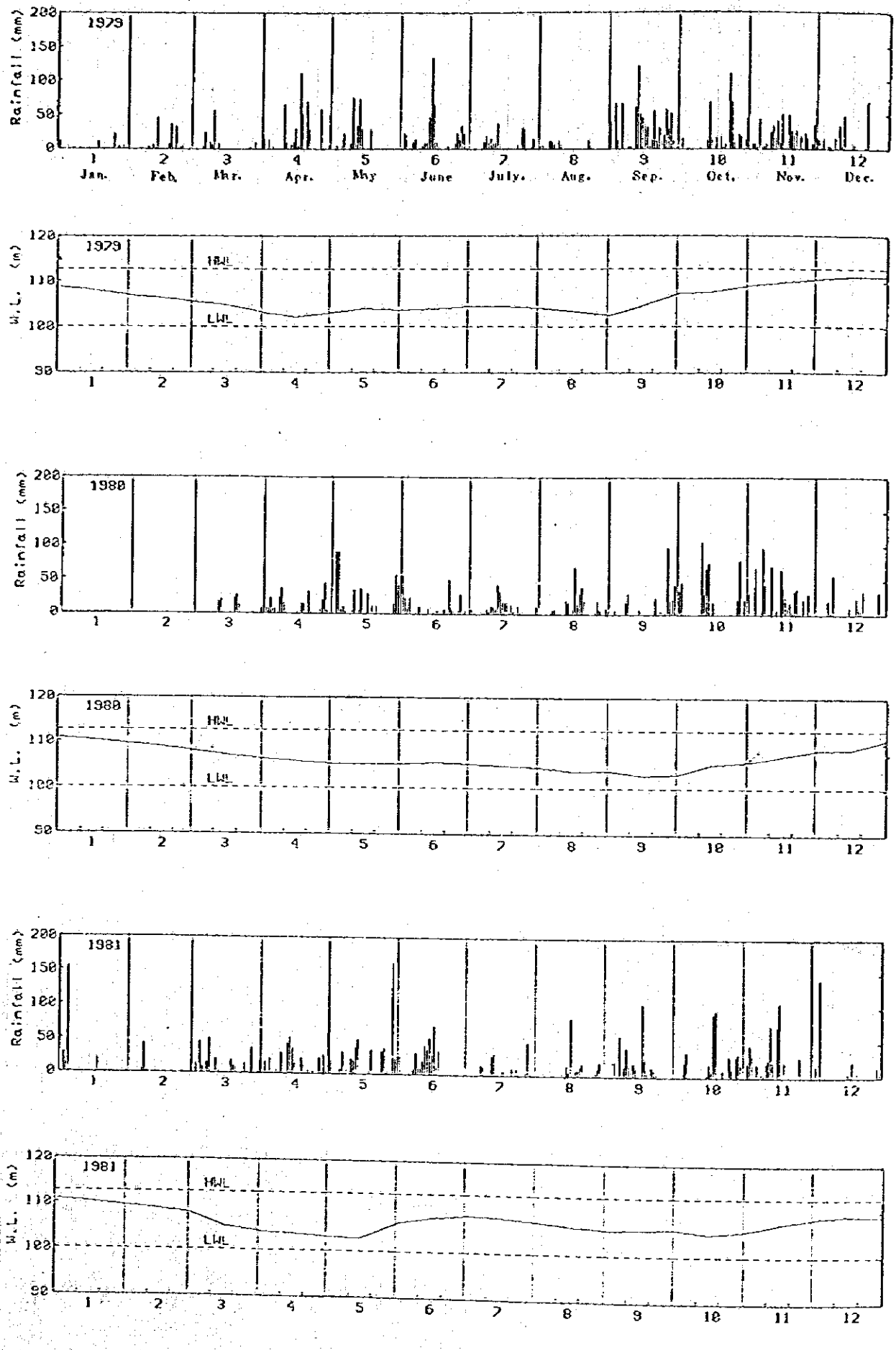

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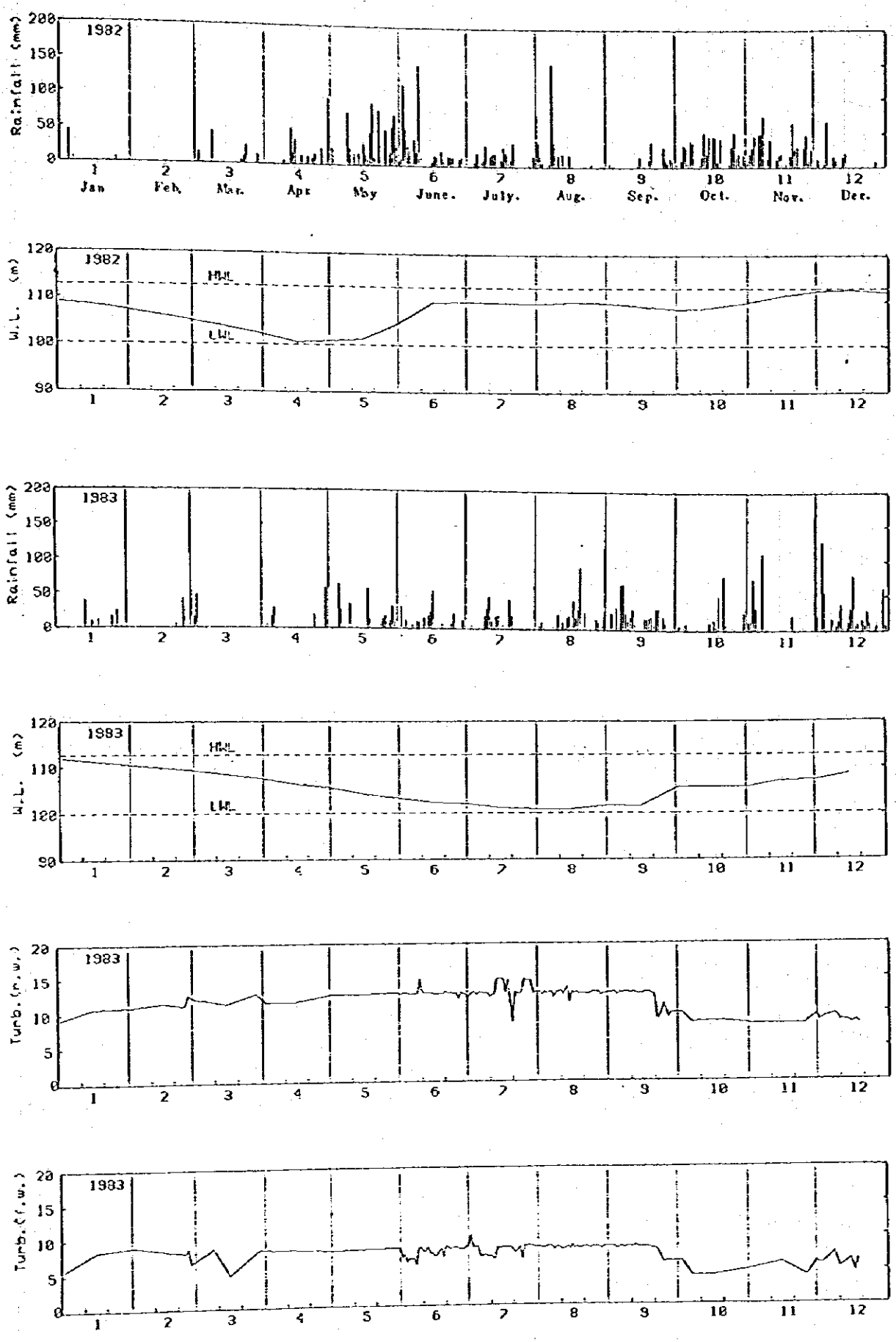
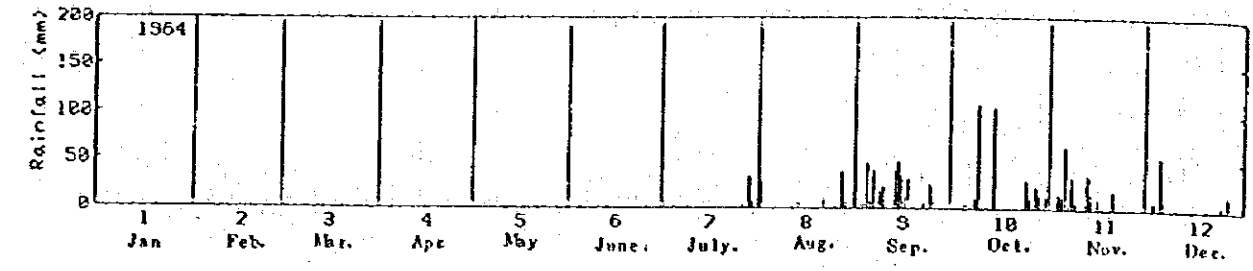
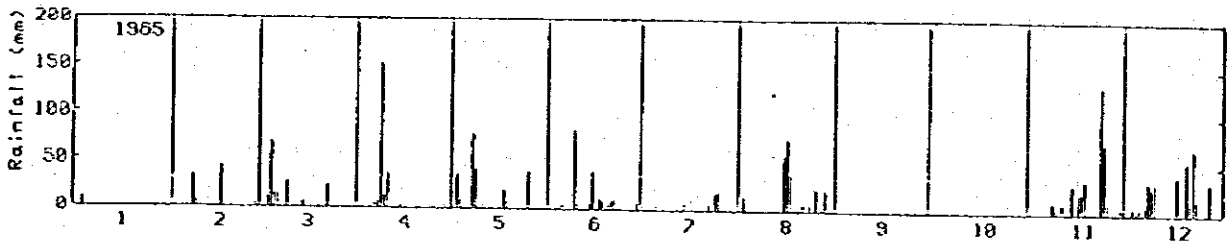
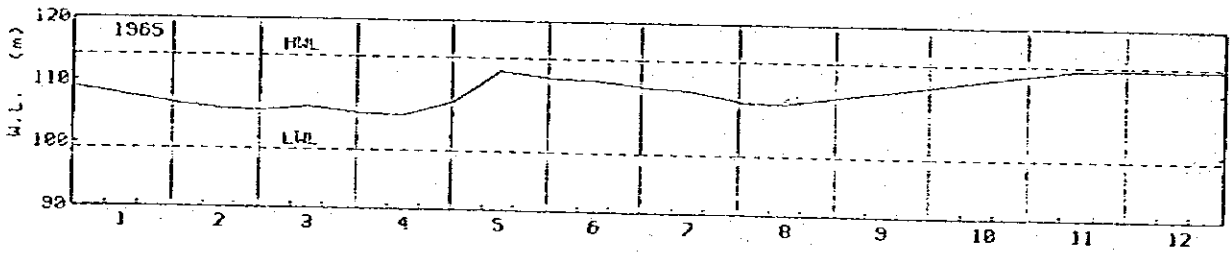
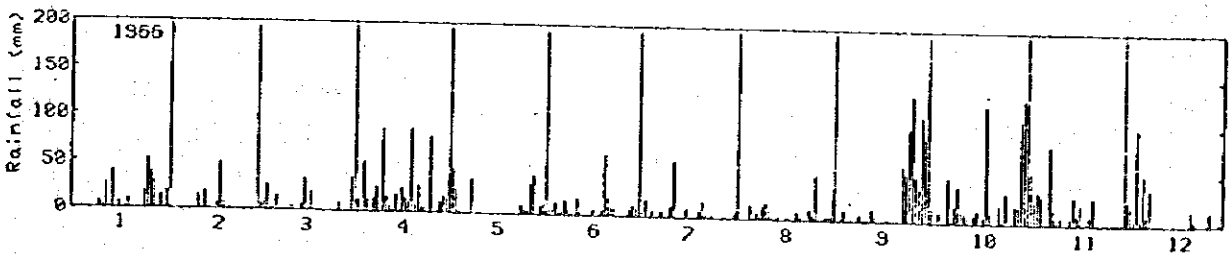


図　　KALATUWAWAダムの水位、濁度変化と降雨量









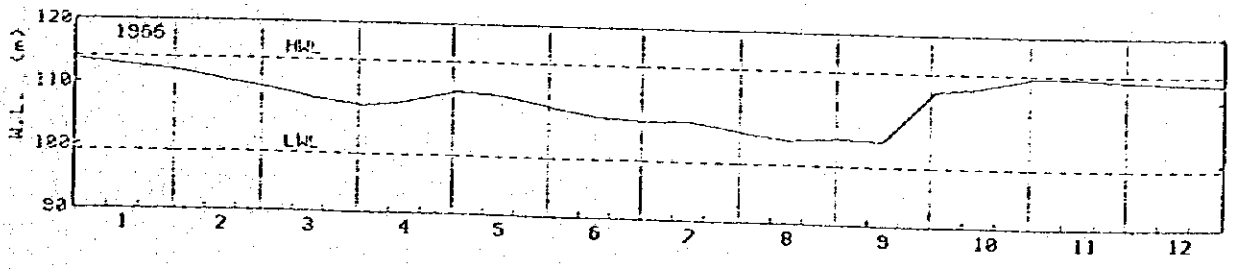


図　　LABUGAMAダムの水位変化と降雨量

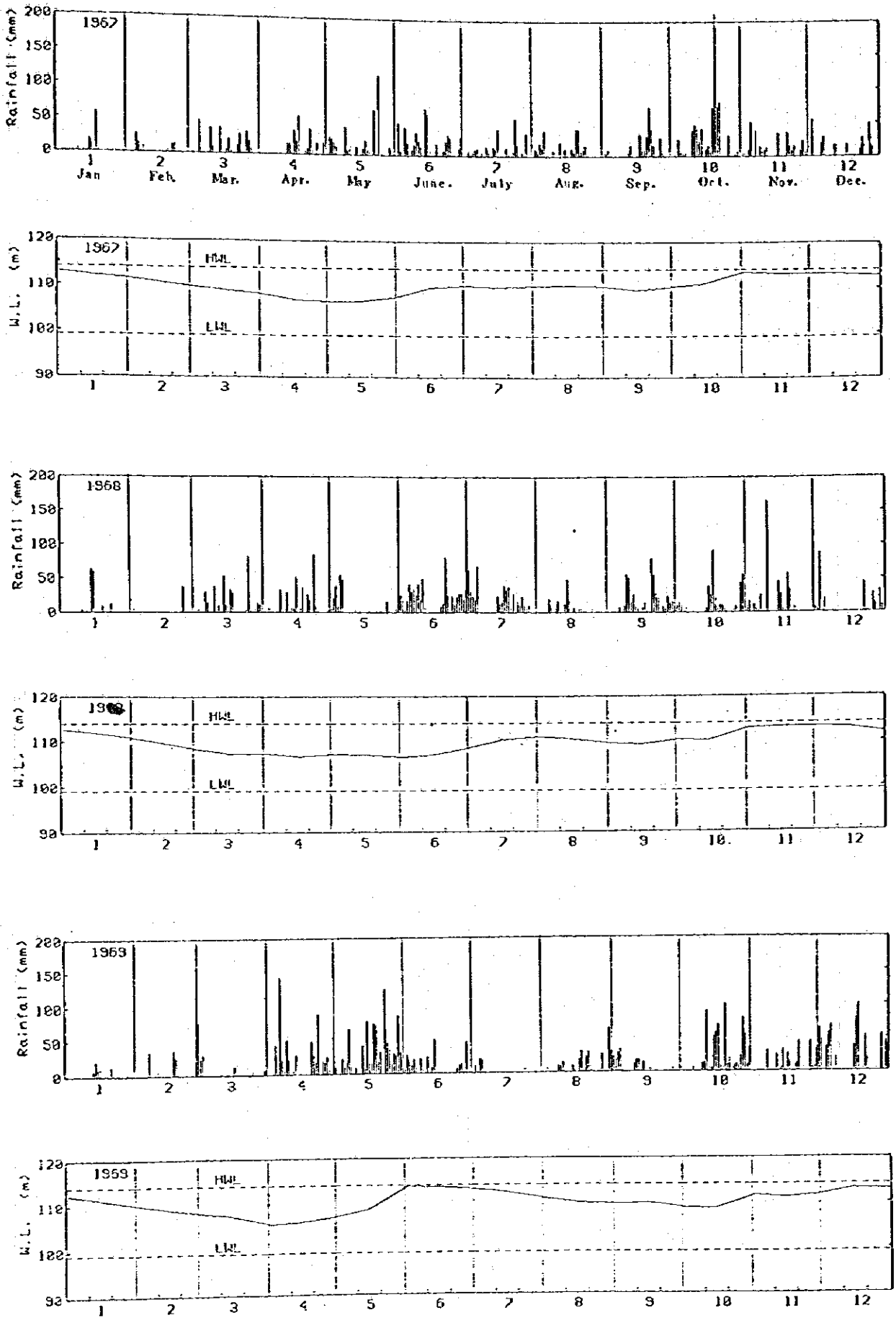
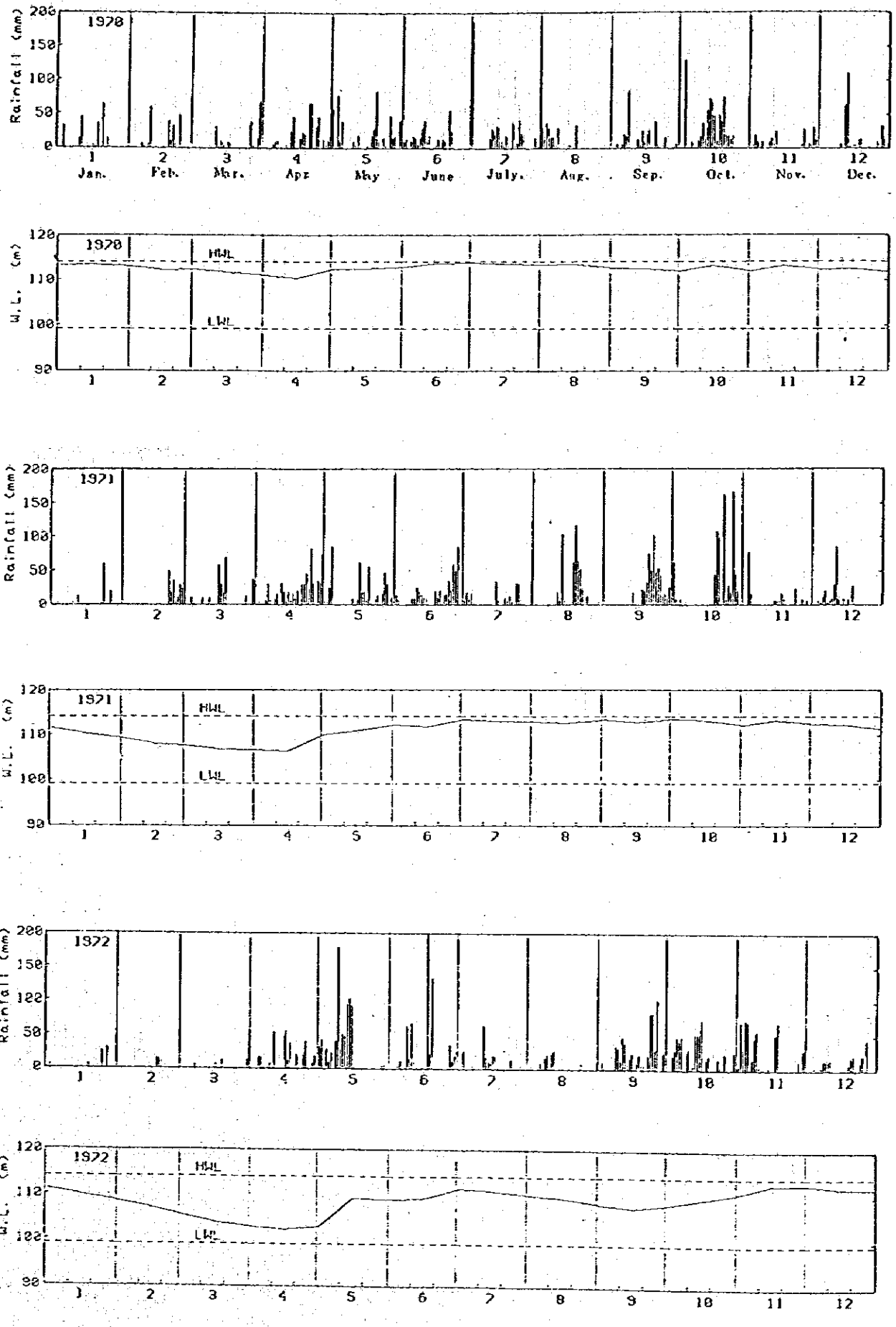


図　　LABUGAMA ダムの水位変化と降雨量



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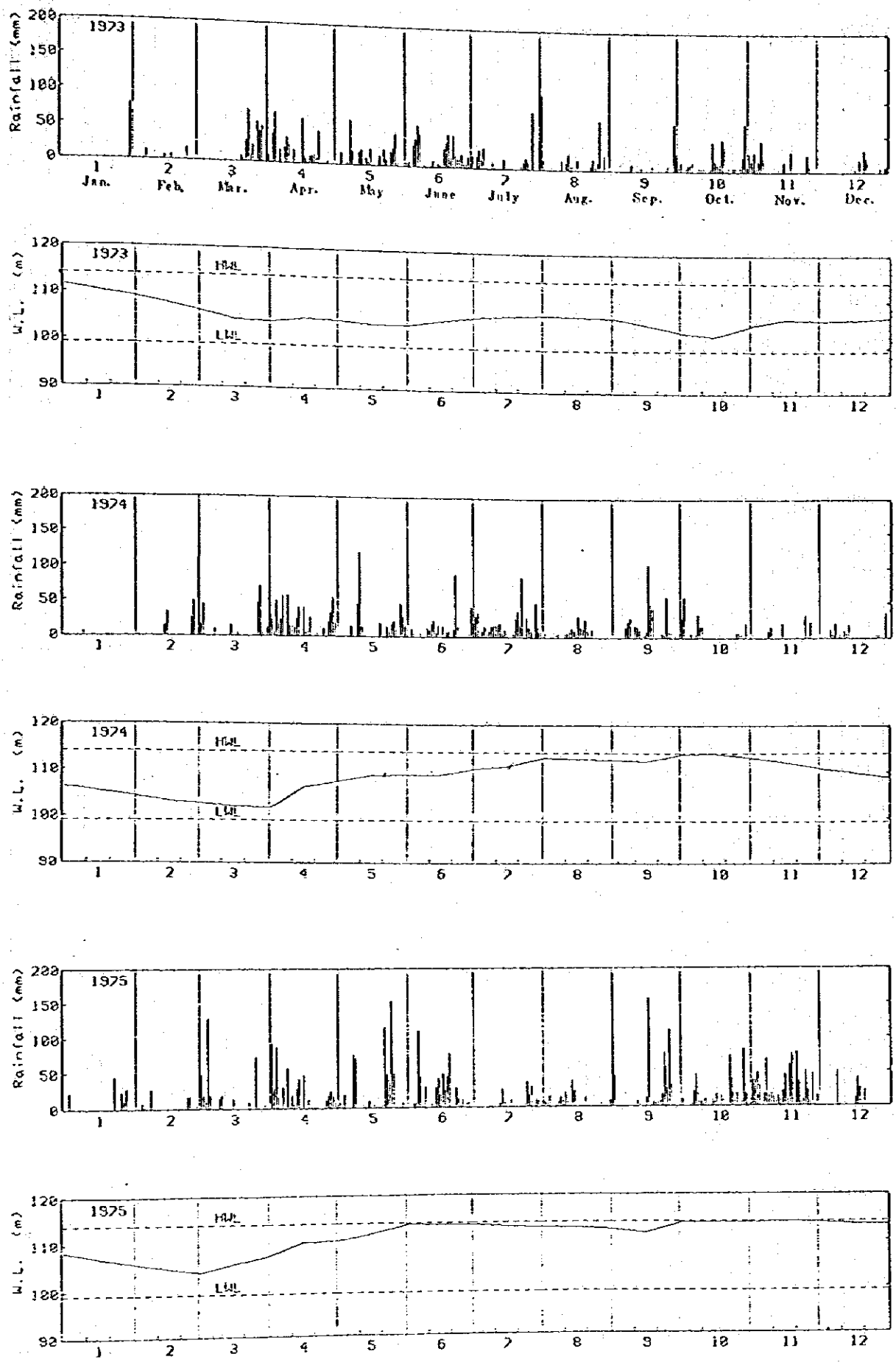

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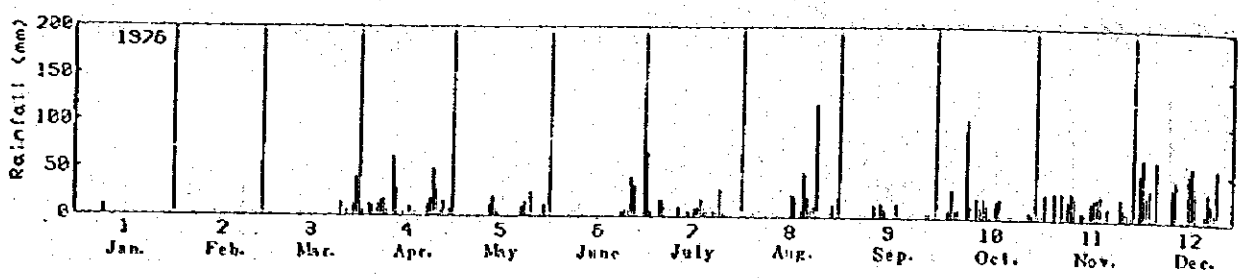
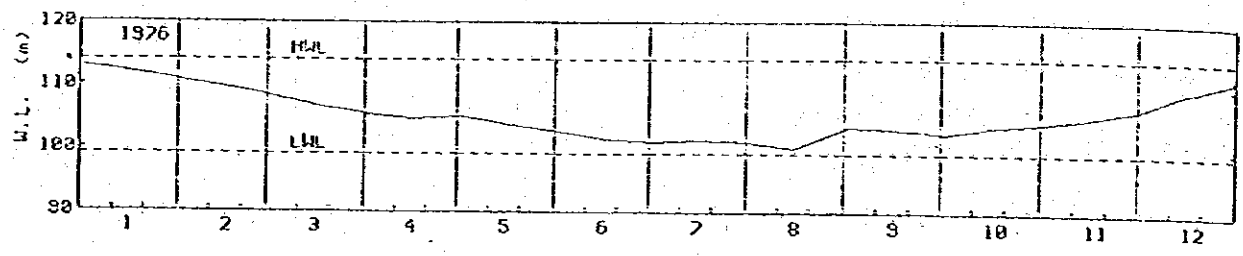
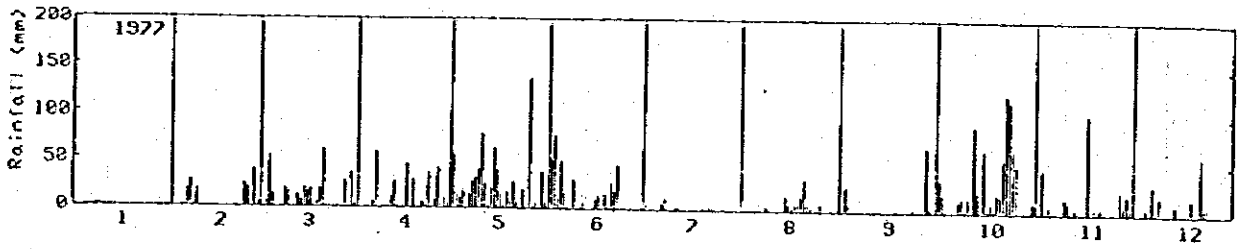
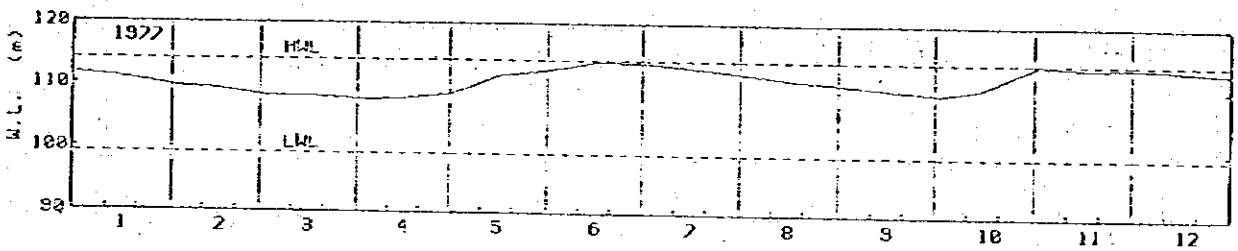
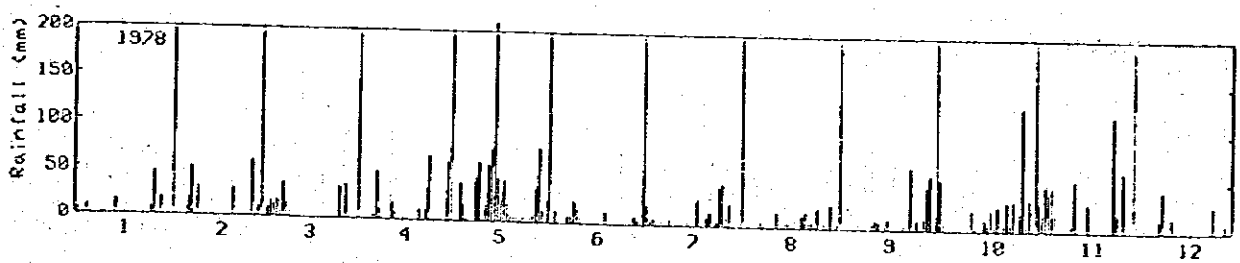










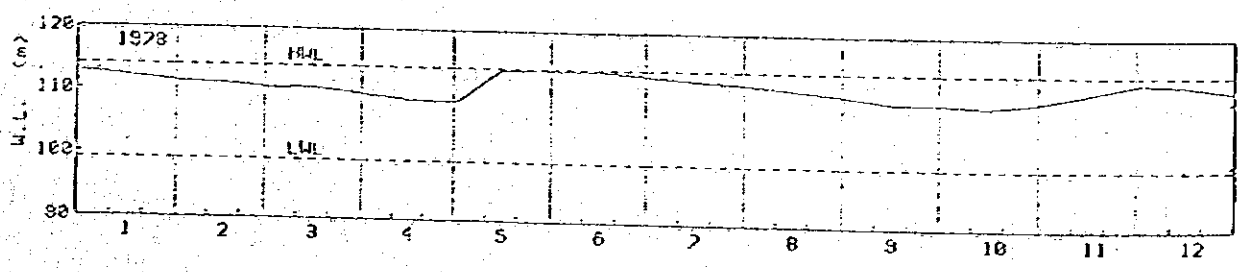
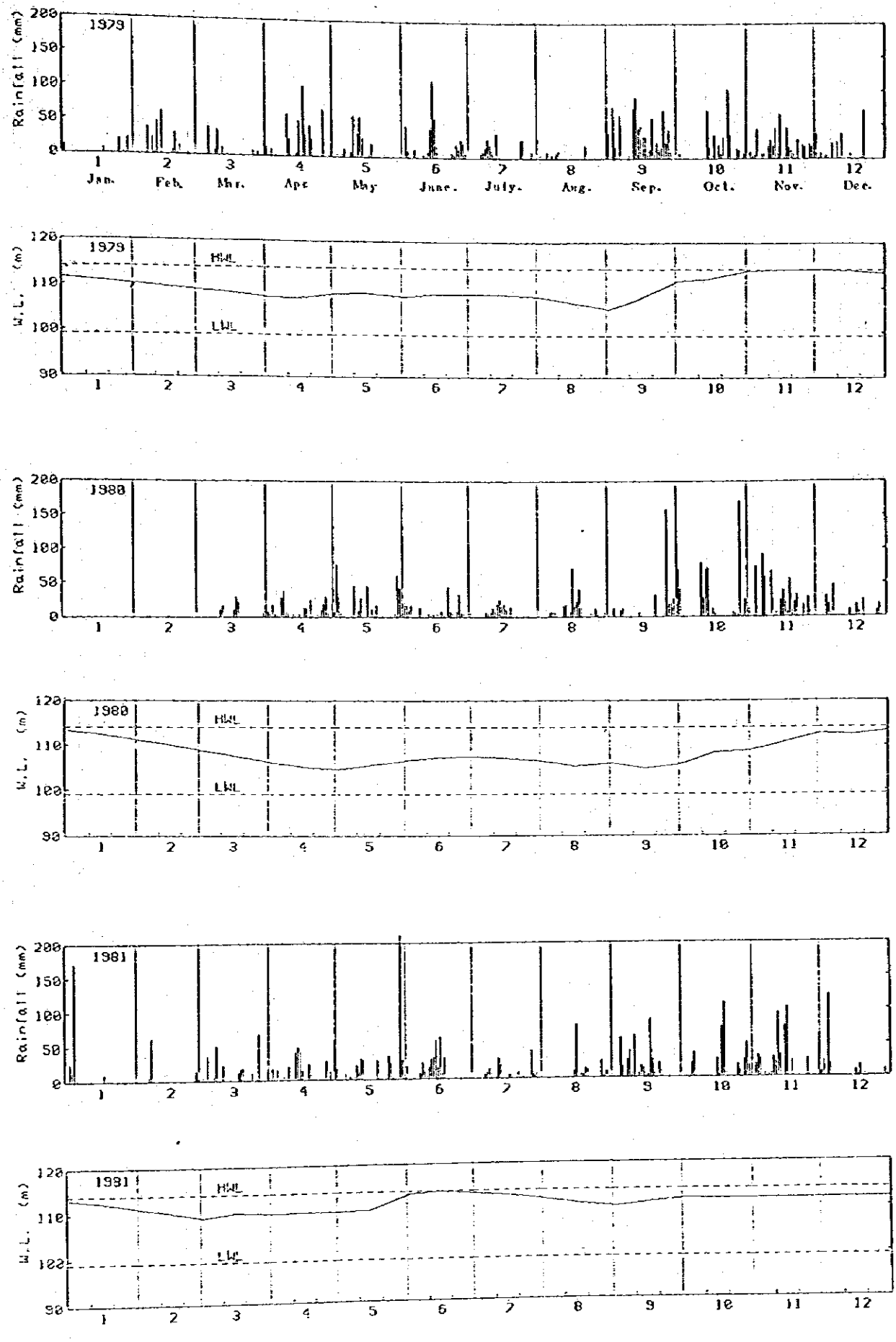


図　　LABUGAMAダムの水位変化と降雨量



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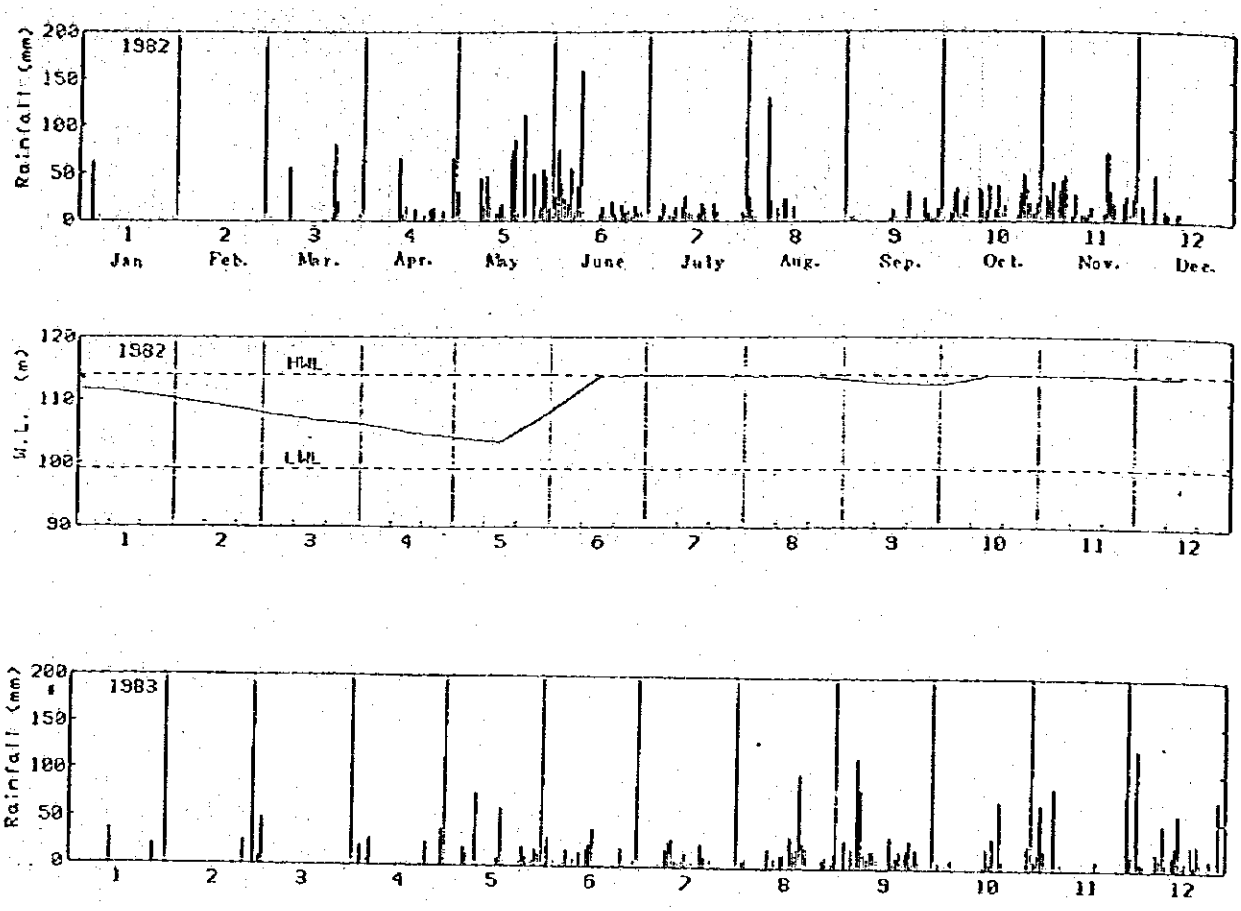


図　　LABUGAMAダムの水位変化と降雨量

17. スリランカ飲料水基準

SRI LANKA WATER QUALITY STANDARD

Sri Lanka Standard

SPECIFICATION FOR POTABLE WATER

PART 2 - BACTERIOGICAL REQUIRMENTS

PROCEDURE

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Bureau of Ceylon Standards on 83-12-20 after the draft, finalized by the Drafting Committee on Potable Water had been approved by the Agricultural and Food Products Divisional Committee.

This specification covers the quality of water used for drinking purposes. The specification consists of two parts, Part 1 Dealing with the physical and chemical requirements and Part 2 Dealing with the bacteriological requirements of drinking water. Bacteriological examination of water is necessary in determining its fitness for use for human consumption, and for use in food processing industries.

For the purpose of deciding whether a particular requirment of this specification is complied with, the final value, observed or calculated expressing the result of a test or analysis shall be rounded off in accordance with CS 102. The number of significant places retained in the rounded off value should be the same as that of the specified value in this specification.

In the preparation of this specification the valuable assistance obtained from the relevant publications of the Worl Health Organization and the Department of Health and Social Security of the Ministry of Housing and Local Government of the United Kingdom, is gratefully acknolwedge.

1 SCOPE

This part of the specification prescribes the bacteriological requirements and the methods of sampling and testing drinking water.

2 REFERENCES

CS 102 Presentation of numerical values.

3 REQUIREMENTS

The bacteriological requrements for potable water are based on the examination of several samples taken from the supply source under different conditions. The samples obtained as prescribed in 4, when examined by the methods given in Appendix A, shall comply with the following requirements:

3.1 Pipe borne public water supplies

3.1.1 Throughout any year, 95 per cent of the samples shall not contain any coliform organisms in 100 ml.

3.1.2 None of the samples examined shall contain more than 10 coliform organisms per 100 ml.

3.1.3 Coliform organisms shall not be detectable in 100 ml of any two consecutive samples.

3.1.4 None of the samples examined shall contain E. coli in 100 ml.

3.2 Indivisual or small community supplies

3.2.1 None of the samples examined shall contain more than 20 coliform organisms per 100 ml on repeated examination.

3.2.2 No sample shall contain E. coli in 100 ml.

NOTE - Individual or small community supplies include wells, bores and springs.

4. SAMPLING

4.1 General requirements of smapling

4.1.1 Sample containers

When a number of samples for various purposes are being collected from the same sampling point, the sample for bacteriological examination shall be collected first.

4.1.2 Sample containers

These shall be sterilized glass bottles (see 4.1.3). They shall be fitted with ground glass stoppers or metal screw caps and the stopper and neck of the bottle shall be protected from contamination by a suitable cover either of Aruminium foil or other suitable material, alternatively screw-capped bottles may be protected by fixing to the cap an aluminium test tube cover slightly larger than the cap. Silicone rubber linors, which will withstand repeated sterilization at 170°C shall be used inside the screw-cap.

4.1.3 Sterilization of containers

All bottles shall be wrapped in Aluminium foil or other suitable material and sterilized before use, wither by exposure to hot air in an oven (see A.2.2.2) or by exposure to saturated steam in an autoclave (see A.2.2.). The bottle shall be maintained in a sterile condition until used.

4.1.4 Opening and filling the bottles

The bottle shall be kept unopened until the moment it is required for filling. During sampling, the bottle shall be held by the base in one hand, while with the other hand the stopper and cover are removed together. The bottles shall be filled, without rinsing, and the stopper shall be replaced immediately. The stopper shall finally be secured by capping with a piece of clean linen or parchment paper.

4.1.5 Sampling instruments

Suitable sampling instruments shall be used for taking samples from different locations and sources. Sampling instruments shall be sterilized (See 4.1.3 before taking the samle.

4.1.6 Nutralization of chlorine and chloramine

If the water to be sampled contains, or is likely to contair, traces of chlorine, chloramine, or ozone it is necessary to add to the sampling bottles, before sterilization a sufficient quantity of sodium thiosulphate ($Na_2S_2O_3 \cdot 5H_2O$) to neutralize these substances. It has been shwon that 0.1 ml of a 3 per cent solution of crystalline sodium thiosulphate in a 170-ml bottle has no signficant effect on the coliform of E. coli content of unchlorinated water during 6 hours store. This amount of sodium thiosulphate is sufficient to neutralize up to at least 5 mg 1 of residual chlorine, and it is therefore recommended that it should be added to all bottles used for the collection of samples for bacteriological examination. If samples of chlorine water are taken, it is desirable to determine the content of chlorine at the sampling point.

4.1.7 Preservation of sample

4.1.7.1 Examination for bacteriological quality shall preferably be started within one hour of collection of the sample. In any case the interval between collection of the sample and beginning of the examination shall not exceed 24 hours.

4.1.7.2 If the time interval between collection and examination is to exceed one hour the sample shall be transported to the loboratory in iced collers (ideally samples should be held at 4 + 2°C). Samples shall not be drozen.

4.1.8 Labelling

An identification number shall be marked on each container and the following information shall be provided with the sample.

4.1.8.1 Name and address of person requesting the examination;

4.1.8.2 Reason for examination, whether routine sample or otherwise.

4.1.8.3 Source, for example, wells, bores or piped supply;

4.1.8.4 Exact place from which the sample was taken. If from a house-tap whether drawn through a storage tank or directly from the main line;

4.1.8.5 Whether water has been filtered, chlorinated or otherwise treated;

4.1.8.6 If from a well, approximate depth of well and of water surface from ground level, whether covered or uncovered and whether recently constructed or altered:

4.1.8.7 Observation on any possible sources of pollution in the vicinity and their appropriate distance from the sampling point

4.1.8.8 Data and time when sample was taken and despatched; and

4.1.8.9 Name, address and signature of person drawing samples

4.1.9 Frequency of sampling for maintenance water

The recommended maximum intervals between successive samples and minimum numbers of samples to be examined each month are given in Table-1.

Table-1 Frequency of Sampling for pipe borne water

Population served	Maximum interval between successive samples	Minimum number of smaples to be taken from whole distribution system each month
Less than 20,000	1 month	1 sample per 5,000 population
20,001 to 50,000	2 weeks	
50,001 to 100,000	4 days	
More than 100,000	1 day	1 sample per 10,000 population

TABLE 1 - Physical requirements

Characteristir (1)	Maximum desirable level (2)	Maximum permissible level (3)	Method of test(ref. to publication in Caluse 5) (4)	Technique of the method (5)
Colour	5 units	30 units	1	Colorimetry - Tristimulus filter method (Reference method) Colorimetry - Visual comparision method Colorimetry - Soectrophotometric method
Odour	Unobject-ionable	Unobject-ionable		Sensory evaluation
Taste	Unobject-ionbale	Unobject-ionable		Sensory evaluation
Turbidity	2 Jackson turbidity units	8 Jackson turbidity units	1	Visual methods - Candle turbidimeter (Reference method)

NOTE - Sevelral methods of test have been given for each parameter in colum 5 of Tables 1,2,3 & 4. One method has been indicated as the reference method which is to be used in case of dispute.

3.2 Chemical requirements

3.2.1 Water shall conform to the chemical requirements specified in Table 2.3 and 4. Ths characteristics speficied in Table 3 and 4 shall be tested only if considered appropriate for a particular location or on request.

TABLE 2 - Chemical requirements (Basic)

Substance or Characteristic	Maximum desirable level	Maximum permissible level	Method of test (Ref. to publications in Clause 5 and relevant Appendices	Technique of the method
(1)	(2)	(3)	(4)	(5)
PH range	7.0-8.5	6.5-9.0	1	Electrometry - By means of pH meter with glass electrodes (Reference method)
			2	Colorimetry
Electrical conductivity	750 s/l	3,500 s/l	1	Conductometry (Reference method)
Chloride (as Cl)	200 mg/l	1,200 mg/l	1	Titrimetry - Silver nitrate method (Reference method)
			1	Titrimetry - Mercuric nitrate method
Free residual chlorine (as Cl_2)		0.2 mg/l	1	Colorimetry - DPD colorimetric method (Reference method)
Alkalinity (total as $CaCO_3$)	200 mg/l	400 mg/l	1	Titrimetry - Visual titration (Reference)
			2	Titrimetry - Electrometric titration
Free Ammonia		0.06 mg/l	Appendix B	Colorimetry - Nesslerization (Reference method)
			1	
			2	Colorimetry - Phenate method
Albuminoid ammonia		0.15 mg/l	Appendix B	Colorimetry - Nesslerization (Reference method)
Nitrate (as N)		10 mg/l	1	Ultraviolet spectrophotometric method (Reference method)
			1	
			2	Colorimetry - Brucine method
			Appendix C	Colorimetry - Phenoldisulphonic cid method

Cont'd ..... Table 2.

Substance or Characteristic	Maximum desirable level	Maximum permissible level	Method of test (Ref. to publications in Clause 5 and relevant Appendices	Technique of the method
(1)	(2)	(3)	(4)	(5)
Nitrite (as N)		0.01 mg/l	1 2	Colorimetry - Diazotization method (Reference method)
Fluoride	0.6 mg/l	1.5 mg/l	1	Selective ion electrode method (Reference method)
			1	Colorimetry - Alizarin visual metthod.
Total phosphates (as PO_4)		2.0 mg/l	1	Colorimetry - Vanadomolybdophosphoric acid colorimetric method (Reference method)
Total residue	500 mg/l	2,000 mg/l	2	Gravimetric method (Reference method)
Total hardness (as Fe)	250 mg/l	600 mg/l	1	Titrimetry - EFTA titrimetric method (Reference method)
Total iron (as $CaCO_3$)	0.3 mg/l	1.0 mg/l	1	Colorimetry - Phenanthroline mtehod (Reference method)
Sulphate (as SO_4)	200 mg/l	400 mg/l	1	Gravimetric method, ignition of residue (Reference method)
			1	Gravimetric method, drying of residue
			1	Turbidimetry - Turbidimetric method

TABLE 3 - Chemical Requirement (Optional)

Substance or Characteristic	Maximum desirable level	Maximum permissible level	Method of test (Ref. to publications in Clause 5 and relevant Appendices	Technique of the method
(1)	(2)	(3)	(4)	(5)
Anionic detergents	0.2 mg/l	1 mg/l	1	Colorimetry - Methylene blue method for methylene blue active substances (Reference method)
Phenolic compounds (as phenolic OH)	0.001 mg/l	0.002 mg/l	1	Colorimetry - Chloroform extration method (Reference method)
Grease and oil		1.0 mg/l	1	Gravimetric method (Reference method)
Calcium (as Ca)	100 mg/l	240 mg/l	1	A.A* spectrophotometric method (Reference method)
			1	Titrimetry - EDTA titrimetric method
Magnesium (as Mg)	Not more than 30 mg/l if there are 250 mg/l of sulphate. If there is less sulphate, magnesium upto 150 mg/l may be allowed	140 mg/l	1	A.A spectrophotometric method (Reference method)
			1	Titrimetry - Magnesium by clculation (EDTA calcium and hardness titration)
Copper (as Cu)	0.05 mg/l	1.5 mg/l	1	A.A Spectrophotometric method (Reference method)
			1	Colorimetry - Bathocuproine method (Reference method)

Cont'd ..... Table 3.

Substance or Characteristic	Maximum desirable level	Maximum permissible level	Method of test (Ref. to publications in Clause 5 and relevant Appendices	Technique of the method
(1)	(2)	(3)	(4)	(5)
Manganese (as Mn)	0.05 mg/l	0.5 mg/l	1	A.A Spectrophotometric method (Reference method)
			1	Colorimetry - Periodiate method for potable water
Zinc (as Zn)	5.0 mg/l	15 mg/l	1	A.A Spectrophotometric method (Reference method)
			1	Colorimetry - Dithizone method II
Aluminium (as Al)		0.2 mg/l	1	A.A Spectrophotometric method (Reference method)
Pesticide residue		As per WHO FAO requirements	2	Gaschromatography (Reference method)
COD (Chemical oxygen demand)		10 mg/l	1	Titrimetry (Reference method)

18. 浄水場施設の改良検討

1. Kalatuwawa 浄水場

当浄水場は、貯水池の水位低下時の色度、臭気の問題およびフロック形成、沈殿の問題がある。したがって下記の施設について改良検討を行う。

(1) 曝気装置

(2) フロック形成池

(3) 沈殿池

(4) 沈殿水集水トラフ

(5) 沈殿池排泥装置

ここでは、水処理的な検討のみを行う。

◎設計条件

流　　量……20MGD＝91,000m^3/d＝3,792m^3/h＝63.2m^3/min

設計基準……設計基準は、水道施設設計指針・解説に準ずる。

(1) 曝気装置

既設の曝気装置の容量および効果が不充分であるため増設を行う。原水曝気は次の目的の為に行う。

(a) 鉄、マンガンの除去（特に鉄分の酸化が大きいと思われる）。

(b) 貯水池の低水位時に発生する硫化水素の除去による悪臭の防止

(c) 前塩素注入量の減少

(d) ろ過池内の溶存酸素の増加による嫌気性化の防止等。

曝気の方法には種々あるが、(1)立地条件、(2)消エネルギー、(3)維持管理の容易性等の条件を考慮し既設の方法を用い、既存施設の横に増設する。

次図に示すよう　型鋼とステンレス材を用い、現地で簡単に組立て既設コンクリート壁に接続できる構造が最適と思われる。容量としては、約1.5倍となりより効率的な曝気が可能である。

(2) フロック形成池

フロック形成の方法は大きくわけて、機械的に攪拌する方式と自然流を利用したう流式とがある。当浄水場では電力を利用せず、維持管理が簡単な水流自体のエネルギーによる上・下う流式によるフロック形成池構造が最適と思われる。

フロック形成池の概略容量

設計条件……流量６３.２ m^3/min、滞留時間２０ min

滞留容量……$V = 63.2\ m^3/min \times 20\ min = 1,264\ m^3$

（既設沈殿池容量　長５９ m ×平均深3.5 m ×巾１４.８ m ×２池＝6,112 m^3→有効6,000 m^3）

既設沈殿池にフロック形成池を新たに追加して設けるとすれば、池巾と深さは既設沈殿池とほぼ同じとし長さを計算すると次のようになる。

$$L = 1,264\ m^3 / \overset{V}{14.8}\ m \times 2\text{池} \times \overset{H}{4.8}\ m = 8.9\ m$$

この形状のフロック形成池を既設沈殿池始端に追加建設することは場内搬入道路との関係で用地的に適切でない。したがって既設沈殿池を改造し、フロック形成池を設けることとする。

既設沈殿池内のフロック形成池の有効平均深さを4.5 m とすると、$\overset{V}{9.5}\ m \times \overset{B}{14.8}\ m \times 2\text{池} \times \overset{H}{4.5}\ m = 1,265\ m^2 > 1,264\ m^3$、池内壁を４板、約２０ cm とすると長さは L＝10.3 m、またフロック形成池後の整流壁との間を1.5 m とすると、長さ１１.８ m ×深さ4.5 m ×巾１４.８ m ×２池となる。う流段数は、池巾が大きいので４段が適切である。

(3)　沈　殿　池

既設沈殿池の有効容量は約6,000 m^3（長さ５９ m ×平均深さ3.5 m ×巾１４.８ m ×２池＝6,112 m^3 → 6,000 m^3）である。したがって滞留時間は、$T = 6,000\ m^3 / 63.2\ m^3/min = 95\ min \fallingdotseq$ １時間半と推定され十分でなかった。また、今回フロック形成池を既設沈殿池内に設けるので滞留時間はなお短かくなる。十分な沈殿効果を得るために、傾斜板による沈殿方式を検討する。

傾斜板池設計条件……板効率７５％、粒子沈降速度0.55 m ／ h、板ピッチ１００ mm、１池分水量 $\frac{3.792\ m^3/h}{2} = 1,896\ m^3/h$

(イ)　沈降必要面積……$A = 1,896 / 0.55 = 3,447\ m^2$

(ロ)　傾斜板１枚当りの沈降面積……$a = 1\ m \times 0.92\ m = 0.92\ m^2$（標準）

(ハ)　傾斜角60°の場合の有効沈降面積　$a' = 0.92\ m^2 \times \cos 60° = 0.46\ m^2$

(ニ)　(イ)に対する傾斜板の必要枚数　$N = 3,447\ m^2 / 0.46\ m^2 \times 0.75 = 9,991$（枚）

(ホ)　傾斜板の配列　池巾１４.８ m、ピッチ(P)１００ mm、段数　３段と仮定

(ヘ)　傾斜板１列の枚数　巾14,800 mm ／１００ mm － 2（取付代）＝１４６枚

(ト)　列　数　9,991枚／１４６枚×３段＝２２.８列→２４列とすると、

（傾斜板総板数は、１４６枚×３段×２４列×２池＝２１,０２４枚となる。）

傾斜板沈殿池の流速および滞留時間は次のようになる。

(イ) 傾斜板内

面　　積　　巾１４.８ｍ×実質長さ約２.５１ｍ＝３７.１５ｍ²

流　　速　　V＝１,８９６ｍ³/ｈ／３７.１５ｍ²＝５１ｍ/ｈ＝０.８５ｍ/min

滞留時間　　$T=\frac{14.8\,m\times 2.51\,m\times(24\times 1.05)\text{実質縦長さ}}{1,896\,m^3/h}=0.494^{hr}=29.6^{min}>20min$

(ロ) 沈殿池の滞留時間

池の長さは、傾斜板の縦長さ（２５.２ｍ）と整流壁と板との間隔（１.５ｍ×２ケ所）および板と板との間隔（１ｍ×３ケ所）を考慮し３１.２ｍとした。また、フロック形成池を除いた沈殿池の深さを２.８ｍとした。

沈殿池の容量　V＝巾１４.８ｍ×長３１.２ｍ×深２.８ｍ＝１,２９３ｍ³

滞留時間　　T＝１,２９３ｍ³／１,８９６ｍ³/ｈ＝０.６８ｈｒ≒４０.９min

(4) 沈殿水集水トラフ

既存の沈殿水集水には越流堰が使われているが、越流負荷が大きくあまり効果的でない。したがって集水トラフを用いて集水を検討する。

(イ) トラフ長さ　　９１,０００ｍ³/ｄ／３８０ｍ³/ｄ/ｍ×２池＝１２０ｍ　（最適越流負荷（３５０～４００ｍ³/ｄ/ｍ））

(ロ) トラフの本数　１本当りの長さを６０ｍとして両側面から集水すると１２０m/６ｍ×２面＝１０本／池となる。

(5) 沈殿池排泥装置

既設の沈殿池排泥装置は、維持管理を怠るとあまり効率的でない。既設沈殿池の底を捨てコンクリート等で埋め排泥しやすくなるように形成するか、もしくは既存の排泥施設を用い維持管理を十分行うことによって沈殿汚泥が底に堆積しないように沈殿池の効果を向上させる。

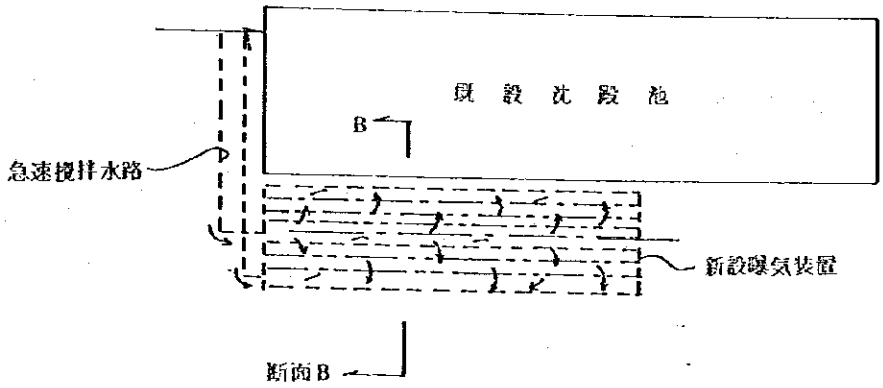
2. Labugama 浄水場

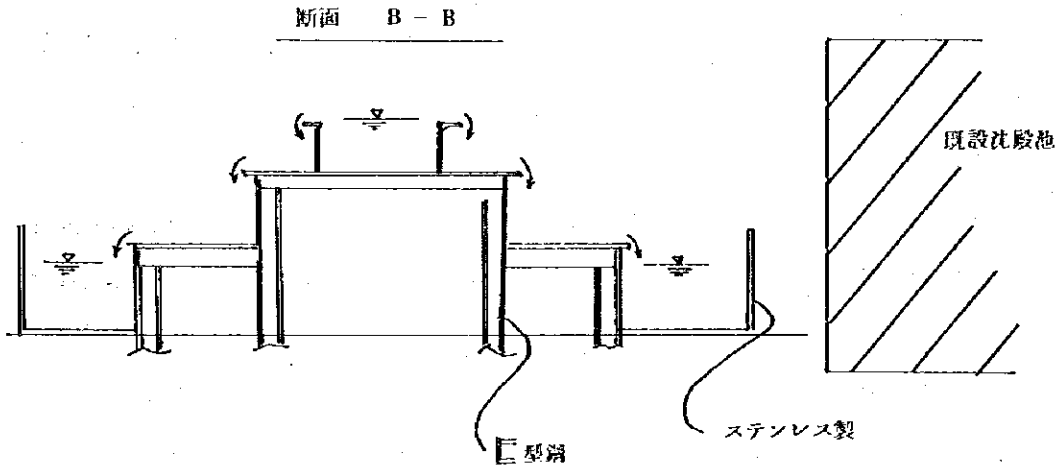
当浄水場は施設の老朽化のため、浄水機能が低下している。したがって下記について新設・改良を検討する。

(1) 曝気装置の新設

(2) 急速撹拌装置

(3) フロック形成池


既設沈殿池
B
急速攪拌水路
新設曝気装置
断面B


断面　B－B
既設沈殿池
ステンレス製
型鋼

(4) 沈 殿 池

(5) 沈殿水集水トラフ

(6) 沈殿池排泥装置

ここでは水処理的な検討のみを行う。

◎設計条件

流　　量……１３ＭＧＤ＝５９，１５０ m^3/d ＝２，４６５ m^3/h ＝４１．１ m^3/min

設計基準……Ｋａｌａｔｕｗａｗａと同じ

(1) 曝気装置

現在、曝気装置はない。Ｋａｌａｔｕｗａｗａ と同様の効果および立地条件等を考慮してカスケード方式による曝気装置を新設する。

用地が限られているのでコンパクトで簡単な構造とし、次図に示すように　型鋼とステンレス材を用い現場で簡単に組立てられ、あまり用地を必要としない装置とする。

(2) 急速攪拌装置

現在、急速攪拌装置はない。電気動力を使わず、効率的に攪拌するため、Ｋａｌａｔｕｗａｗａと同様な方式が最適である。したがって新設曝気装置に流入する前の水路内にバッフルプレートを設け、攪拌を行う。急攪水路前にＡｌｕｍとＬｉｍｅ を注入、混合し、前塩素は曝気装置後注入する。

(3) フロック形成池

現在はフロック形成池がなく、沈殿効果が悪いためフロック形成池を新設し沈殿効果の向上を計る。構造はＫａｌａｔｕｗａｗａと同様の考え方で、上下う流式によるフロック形成池構造とする。

フロック形成池の概略容量

設計条件……流量　４１．１ m^3/min、滞留時間　２０ min

滞留容量……Ｖ＝４１．１ m^3/min × ２０ min ＝８２２ m^3

（既設沈殿池容量　長４０ｍ×深４ｍ×巾１２ｍ×１池＝１９２０ m^3 →有効１，８００ m^3）

フロック形成池は既設沈殿池の前に設けなくてはならないが用地が無いので、既設沈殿池内に後述の傾斜板沈殿池と共に設ける。既設沈殿池を池内洗浄等の維持管理面を考慮し、池内を２系統に分割して新設する。したがって仕切壁を４０ cm と考えると１池分の巾は５．８ｍとなる。効果的なフロキュレーションを計るため、う流段数を６段とすると長さは約１２ｍとなる。沈殿池および集水トラフ用の池分を考慮すると、妥当なフロック形成池の長さだと

思われる。次に池深さは　$H = 8\,2\,2\ m^3/1\,2\ m \times 5.8\ m \times 2$池$= 5.9\ m$となる。既設の深さが4mであり、また水面からの余裕を30cm以上見込むとかさ上げ高さが2.2m～2.5m必要となる。

フロック形成池寸法　$5.8\ m \times 6.5\ m \times 1.3\ m$（整流壁との間隔1mを含む）

(4) 沈殿池

既設沈殿池の有効容量は約1,800m^3（長さ40m×深さ4m×巾12m×1池＝1,920m^3→1,800m^3）である。したがって滞留時間は　T＝1,800m^3／411m^3/min＝4.3min　と短かく、沈殿効果はほとんどない。その上フロック形成池を設置するので、沈殿池の滞留時間はもっと短かくなる。短かい滞留時間で十分な沈殿効果を得るために、傾斜板による沈殿方式を検討する。

傾斜板池設計条件……板効率75%、粒子沈降速度0.55m／h、板ピッチ80mm、

$$1\text{池分水量}\quad \frac{2,465\ m^3/hr}{2} = 1,232.5\ m^3/hr$$

(イ) 沈降必要面積　　$A = 1,232.5 / 0.55 = 2,241\ m^2$

(ロ) 傾斜板1枚当りの沈降面積　$a = 1\ m \times 0.92\ m = 0.92\ m^2$（標準）

(ハ) 傾斜角60°の場合の有効沈降面積　$a' = 0.92\ m^2 \times \cos 60 = 0.46\ m^2$

(ニ) (イ)に対する傾斜板の必要枚数　$N = 2,241\ m^2 / 0.46\ m^2 \times 0.75 = 6,496$枚

(ホ) 傾斜板の配列　池巾5.8m／池、ピッチ(P)80mm、段数5段（深く長さがない為）と仮定

(ヘ) 傾斜板1列の枚数　巾5,800mm／80mm－2（取付代）≒70枚

(ト) 列数　6,496枚／70枚×5段＝18.56列→18列とする。

（傾斜板枚数は70枚×5段×18列×2池＝12,600枚となる）

以上の傾斜板沈殿池の流速および滞留時間は次のようになる。

(イ) 傾斜板内

面　　積　　巾5.8m×実質長さ4.19m＝24.3m^2

流　　速　　$V = 1,232.5\ m^3/hr / 24.3\ m^2 = 50.7\ m/hr = 0.845\ m/min$

滞留時間　　$T = \dfrac{\text{巾}5.8\ m \times \text{深}4.19\ m \times \text{実質縦長さ}(18 \times 1.05)}{1,232.5\ m^3/h} = 0.373hr = 22.4min > 20min$

(ロ) 沈殿池の滞留時間

池の長さは、傾斜板長さ（18.9m）と整流壁と板の間隔（1.5m×2ケ所）および板と板の間隔（0.6m）とし22.5mとした。

池の深さは、傾斜板の長さ(深さ)（約4.2m）と板から底（1.5m）、板から天端(0.6m)

とした。そのうち傾斜板沈殿の有効水深は板の上・下10cmとして4.4mとなる。

沈殿池の容量　V＝巾5.8m×長22.5m×深4.4m＝574.2m³

滞留時間　T＝574.2m³／1,232.5m³/h＝0.466hr ≒28min

(5) 沈殿水集水トラフ

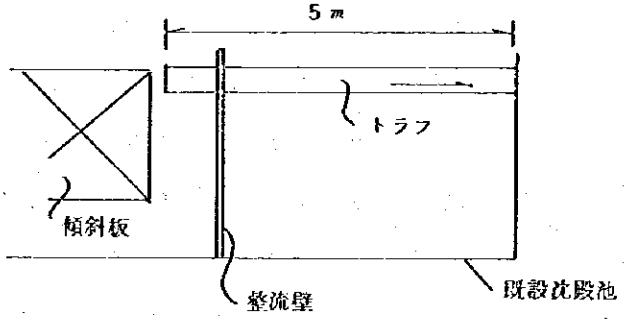
既存の沈殿水は越流堰により集水されているが、越流負荷が大きくあまり効果的でない。したがって集水トラフによる集水を検討する。

(イ) トラフの長さ……最大越流負荷を500m³/d／mとして、必要トラフ長さを算出する。

29,575m³/d／500m³/d／m＝59.15m→60m

(ロ) トラフの本数、単本長さ……トラフの隔が短かすぎると、集水効果が悪い。間隔を約60cmとすると、トラフは6本となる。単本の長さは、次のようになる。

60m／2両側×6本＝5m／本



(6) 沈殿池排泥装置

既設の沈殿池排泥装置の構造、効率は不明である。したがって、汚泥収集用ピットおよび排泥管等を設け、効率的な排泥が出来るようにする。

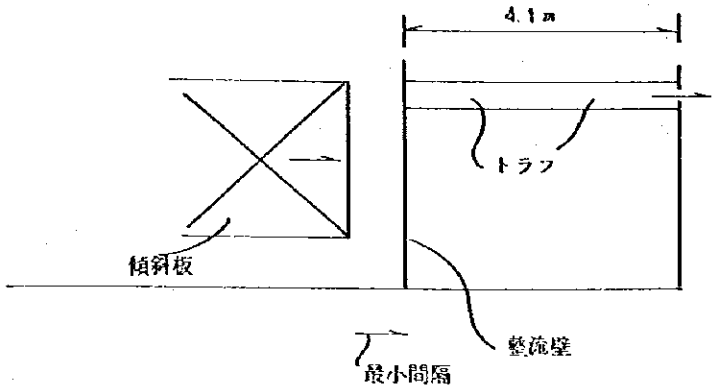
（参　考）

Labugama 浄水場

トラフの長さを短かくした場合の越流負荷

現計画では、トラフ6本、各5mとなっているが、全体池長が短かく、トラフが整流壁を越えなくてはならない。

トラフを整流壁内におさめた場合は、次のような越流負荷となる。



トラフ総長＝６本×４.１ｍ＝２４.６ｍ＝Ｌ

越流負荷＝Ｑ／Ｌ＝２９５７５ｍ³／ｄ／２４.６ｍ≒１２０２ｍ³／ｄ／ｍ

水道設計指針では、最大越流負荷を５００ｍ³／ｄ／ｍ前後としており、約２.４倍の負荷となる。

19. Ambatale浄水場の概要と拡張計画

Ambatale浄水場はコロンボ市東方9km、海抜14mに位置している。取水地点は浄水場の北方640mのKelani 河南岸で河口から14.5kmの位置である。

1966年には9.1万m^3、1977年には18.2万m^3の公称能力で稼動している。

1980年には増量計画がつぎの内容で作成された。

新規取水施設　　30.4万m^3/日

沈殿池　　6.1万m^3/日　　1池

（将来分としてさらに1池同量で増設）

沪過池に関しては1966年に運転開始した12池について沪材を交換することで9.1万m^3/日であった能力を20.4万m^3/日に増強し、総量30.7万m^3とする計画である。

Ambatale 浄水場の現況

	当初施設	1980計画	完成合計
	万m^3/日	万m^3/日	万m^3/日
取水施設	18.2	新規30.4	48.6
沈殿池	18.42	12.2	30.6
セントリフロッククラリファイヤー	6.1 ×2池		
パルセーター	6.14×1池	6.1×2池 （1池将来）	
沪過池	18池		
	12池（1966年）	沪材変更により	
	9.1 →	20.4 →	30.7
	6池（1977年）	↑	
	10.32 →		

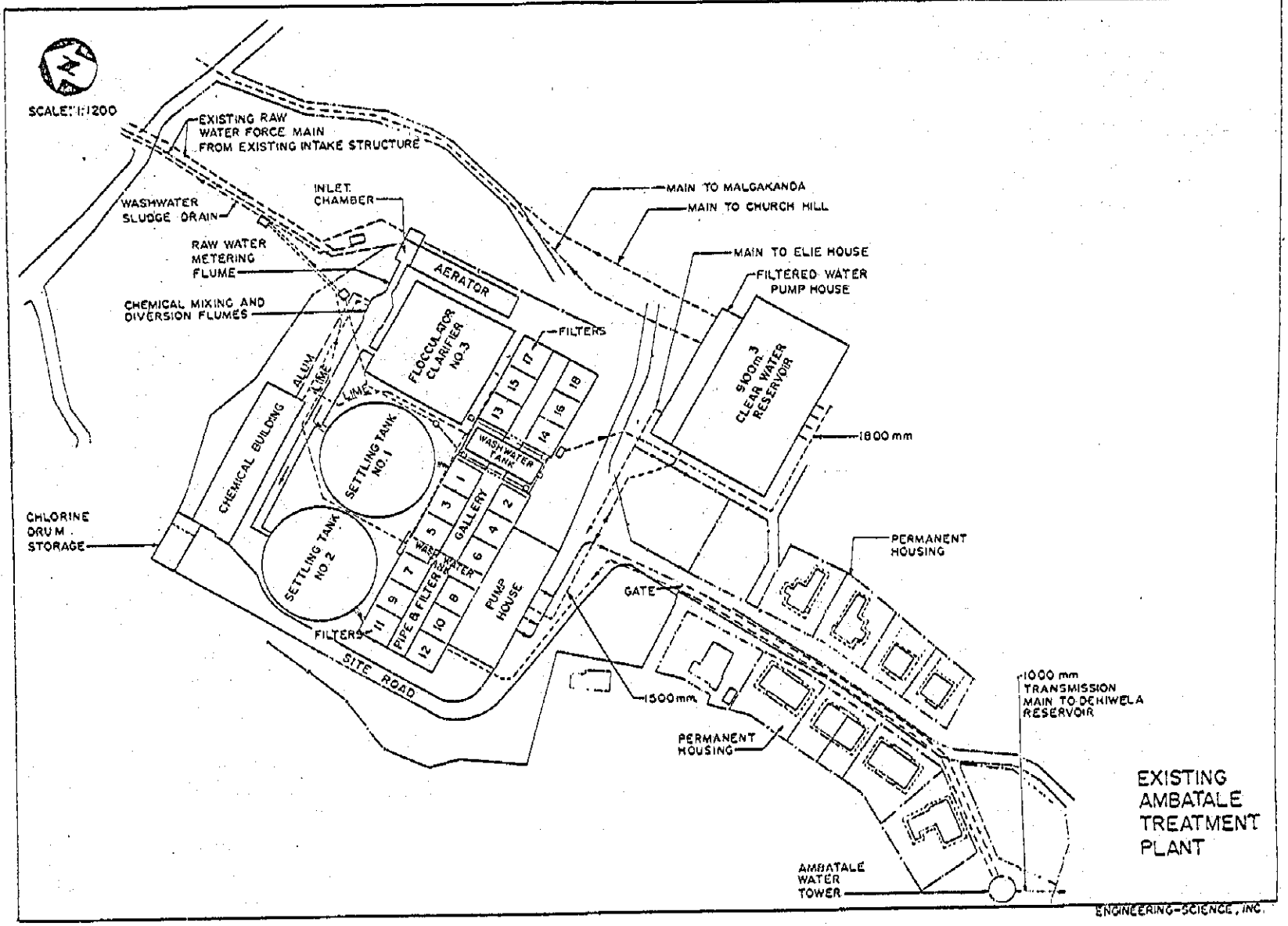
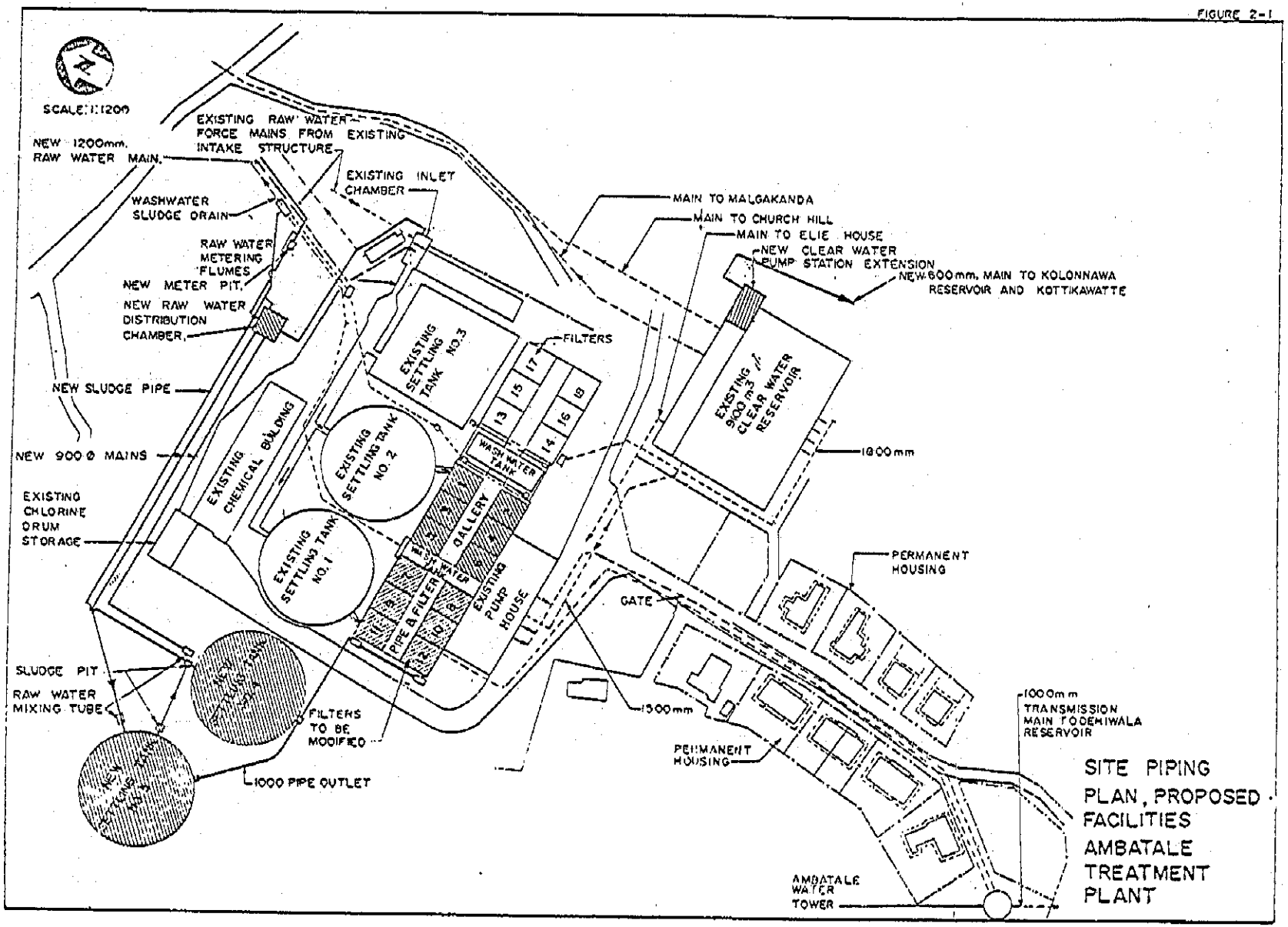

SCALE: 1:1200
EXISTING RAW WATER FORCE MAIN FROM EXISTING INTAKE STRUCTURE
WASHWATER SLUDGE DRAIN
INLET CHAMBER
RAW WATER METERING FLUME
CHEMICAL MIXING AND DIVERSION FLUMES
AERATOR
FLOCCULATOR CLARIFIER NO.3
FILTERS
ALUM
LIME
CHEMICAL BUILDING
SETTLING TANK NO.1
SETTLING TANK NO.2
WASH WATER TANK
GALLERY
PIPE GALLERY
PUMP HOUSE
CHLORINE DRUM STORAGE
SITE ROAD
MAIN TO MALGAKANDA
MAIN TO CHURCH HILL
MAIN TO ELIE HOUSE
FILTERED WATER PUMP HOUSE
900m³ CLEAR WATER RESERVOIR
1800 mm
PERMANENT HOUSING
GATE
1500mm
1000 mm TRANSMISSION MAIN TO DEHIWELA RESERVOIR
AMBATALE WATER TOWER
EXISTING AMBATALE TREATMENT PLANT
ENGINEERING-SCIENCE, INC.

FIGURE 2-1


SCALE: 1:1200
EXISTING RAW WATER FORCE MAINS FROM EXISTING INTAKE STRUCTURE
NEW 1200mm. RAW WATER MAIN.
EXISTING INLET CHAMBER
WASHWATER SLUDGE DRAIN
RAW WATER METERING FLUMES
NEW METER PIT.
NEW RAW WATER DISTRIBUTION CHAMBER.
NEW SLUDGE PIPE
NEW 900 Ø MAINS
EXISTING CHLORINE DRUM STORAGE
EXISTING CHEMICAL BUILDING
EXISTING SETTLING TANK NO.3
EXISTING SETTLING TANK NO. 2
EXISTING SETTLING TANK NO. 1
FILTERS
WASH WATER TANK
GALLERY
PIPE & FILTER
EXISTING PUMP HOUSE
SLUDGE PIT
RAW WATER MIXING TUBE
NEW SETTLING TANK NO. 4
NEW SETTLING TANK NO. 5
FILTERS TO BE MODIFIED
1000 PIPE OUTLET
MAIN TO MALGAKANDA
MAIN TO CHURCH HILL
MAIN TO ELIE HOUSE
NEW CLEAR WATER PUMP STATION EXTENSION
NEW 600mm. MAIN TO KOLONNAWA RESERVOIR AND KOTTIKAWATTE
EXISTING 9000 m3 CLEAR WATER RESERVOIR
1800 mm
PERMANENT HOUSING
GATE
1500 mm
PERMANENT HOUSING
1000 m m TRANSMISSION MAIN TO DEHIWALA RESERVOIR
AMBATALE WATER TOWER
SITE PIPING PLAN, PROPOSED FACILITIES AMBATALE TREATMENT PLANT