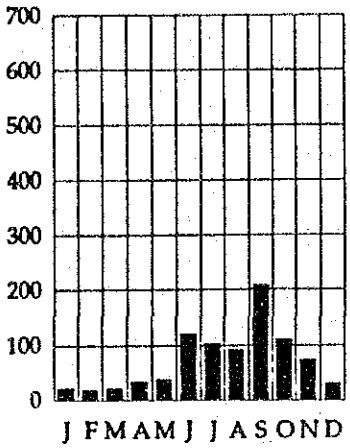
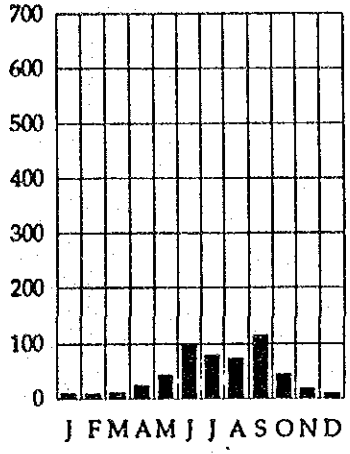
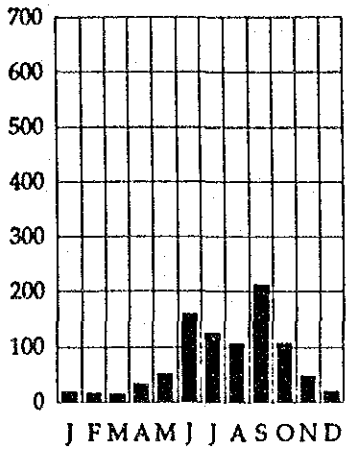


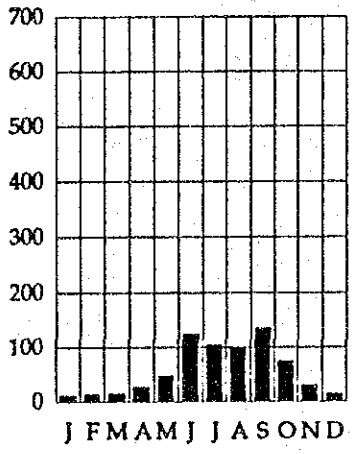
8. GOMEZ PONIENTE



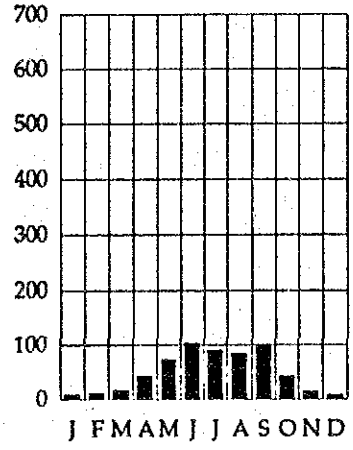
9. ZAUTLA



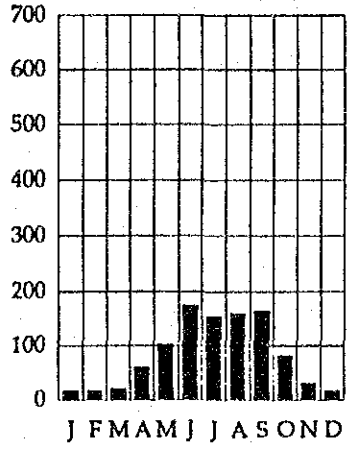
10. CAPULUAQUE



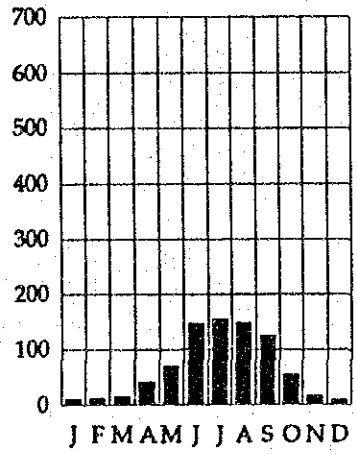
11. AQUIXTLA



12. IXTACAMAXTITILAN



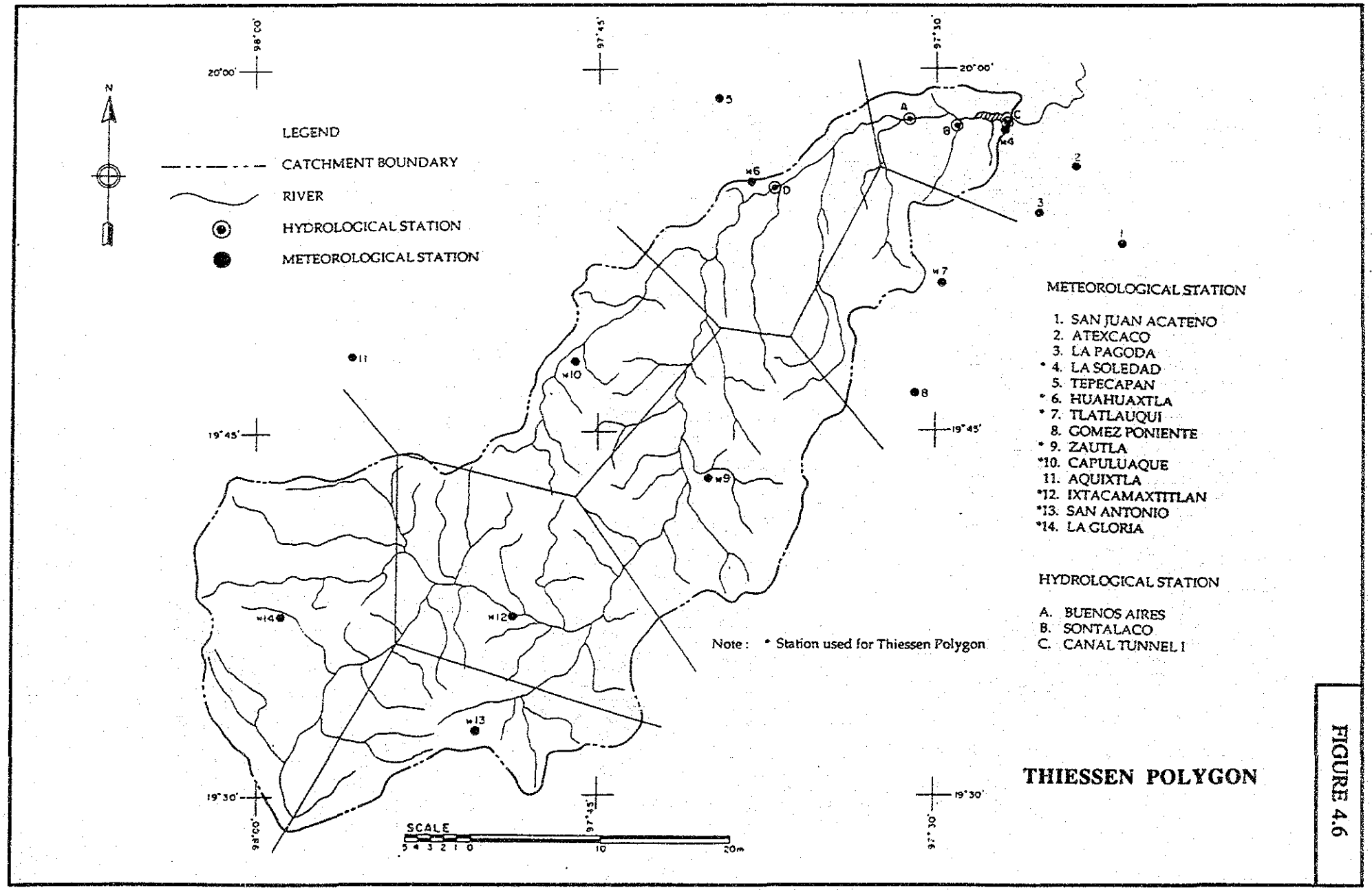
13. SAN ANTONIO



14. LA GLORIA

Unit : mm

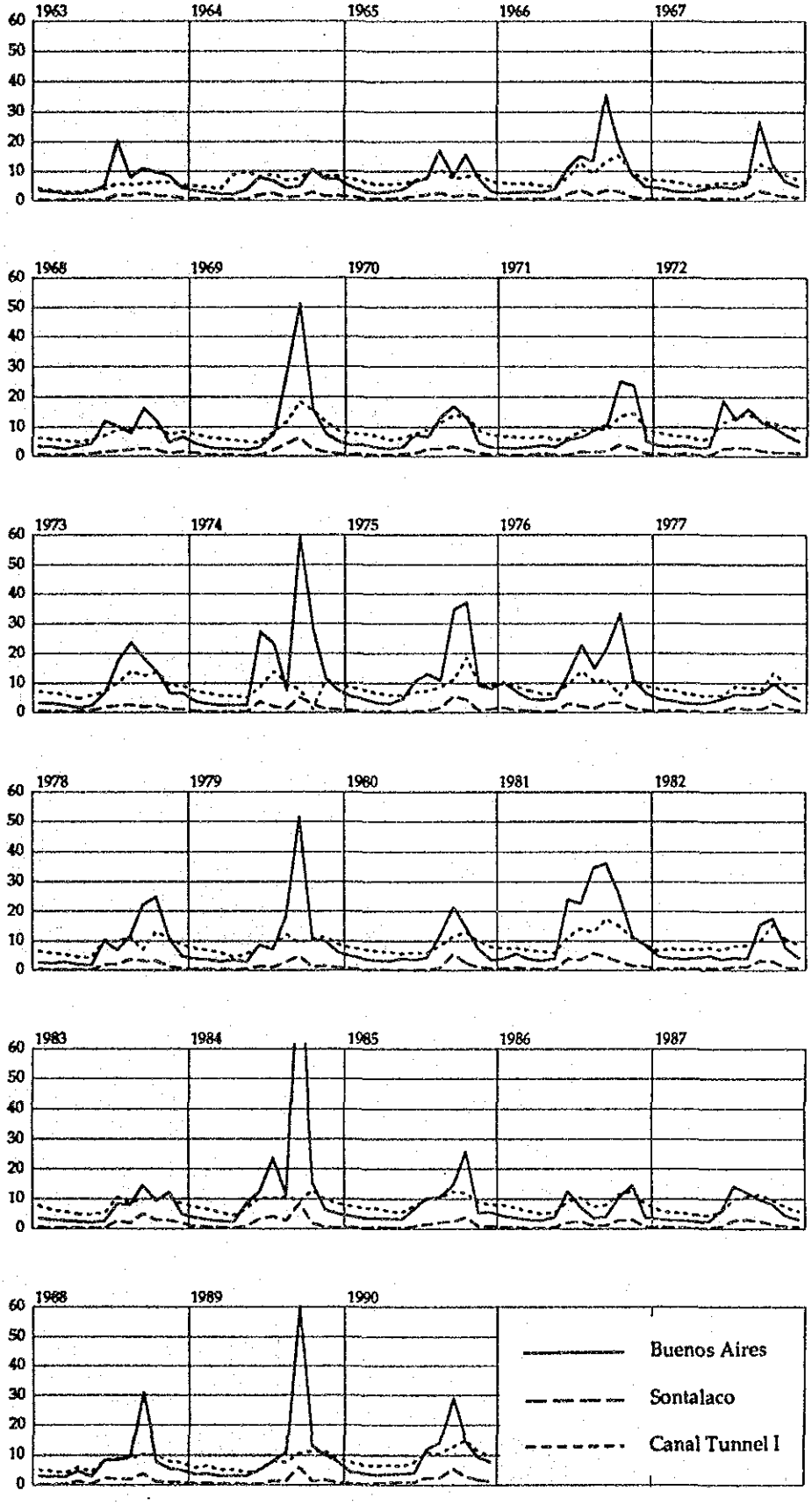
MEAN MONTHLY RAINFALL (2/2)



THIESSEN POLYGON

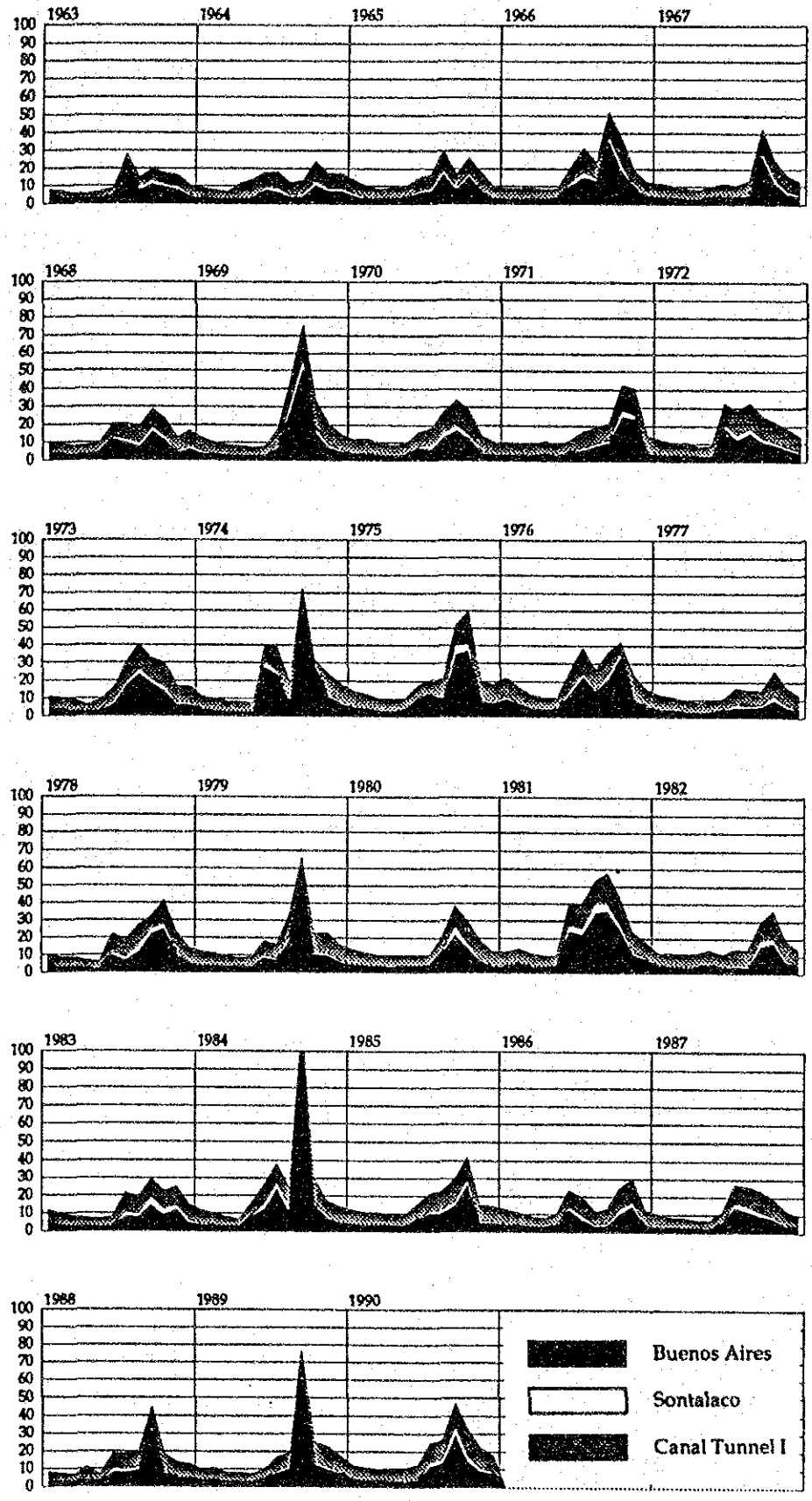
FIGURE 4.6

FIGURE 4.7



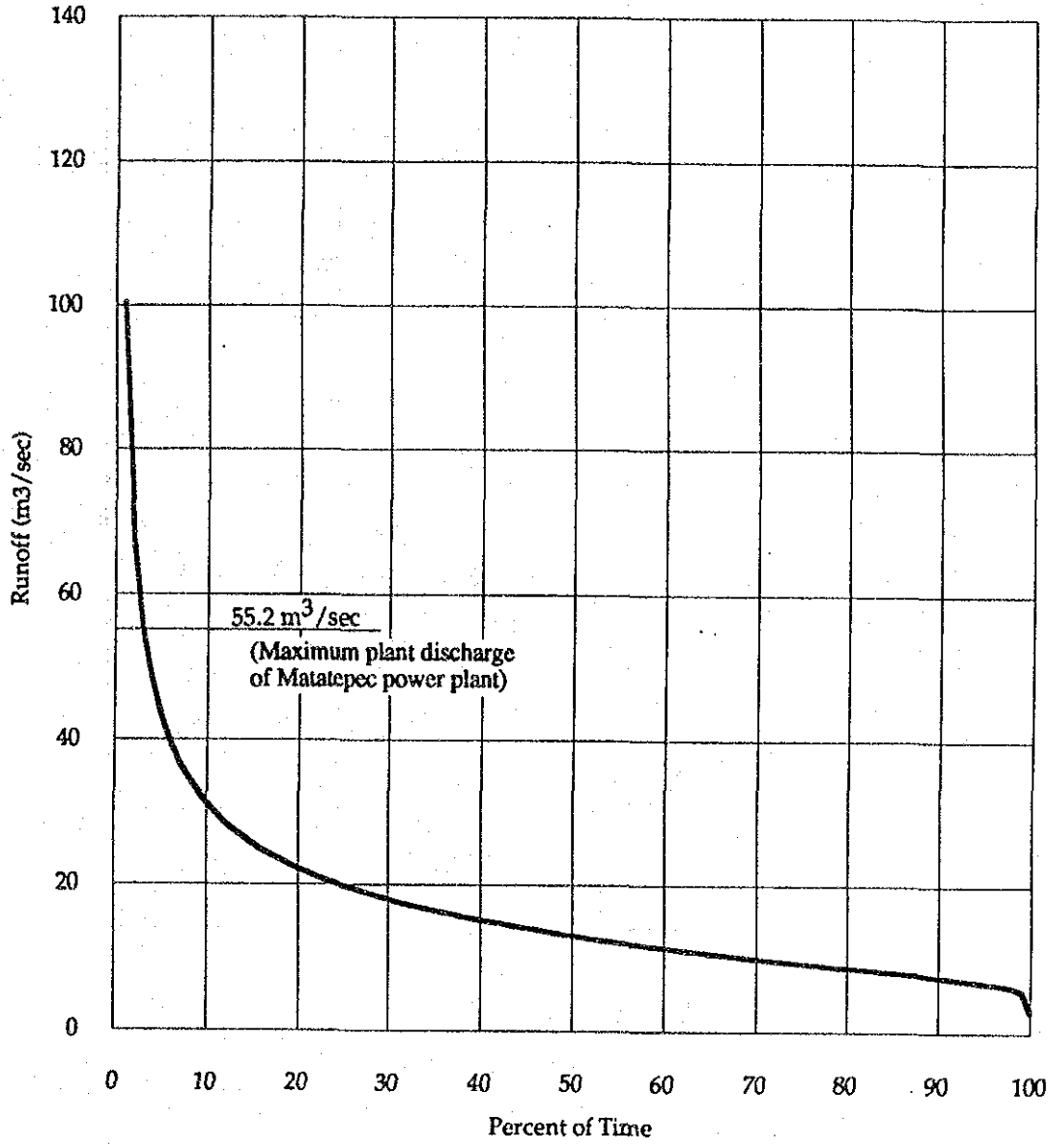
RUNOFF HYDROGRAPHS OF THREE STATIONS

FIGURE 4.8



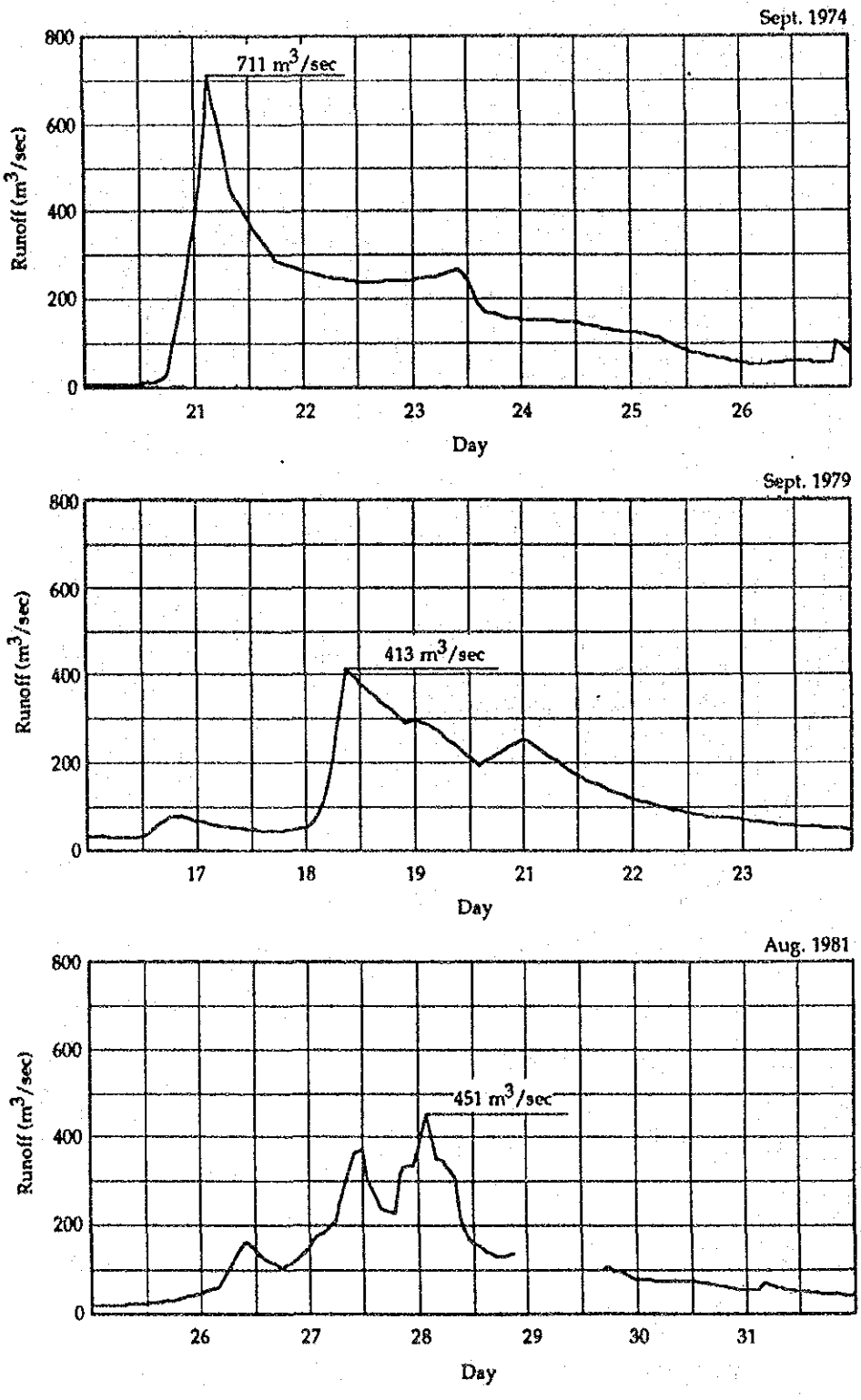
INFLOW HYDROGRAPH INTO RESERVOIR

FIGURE 4.9



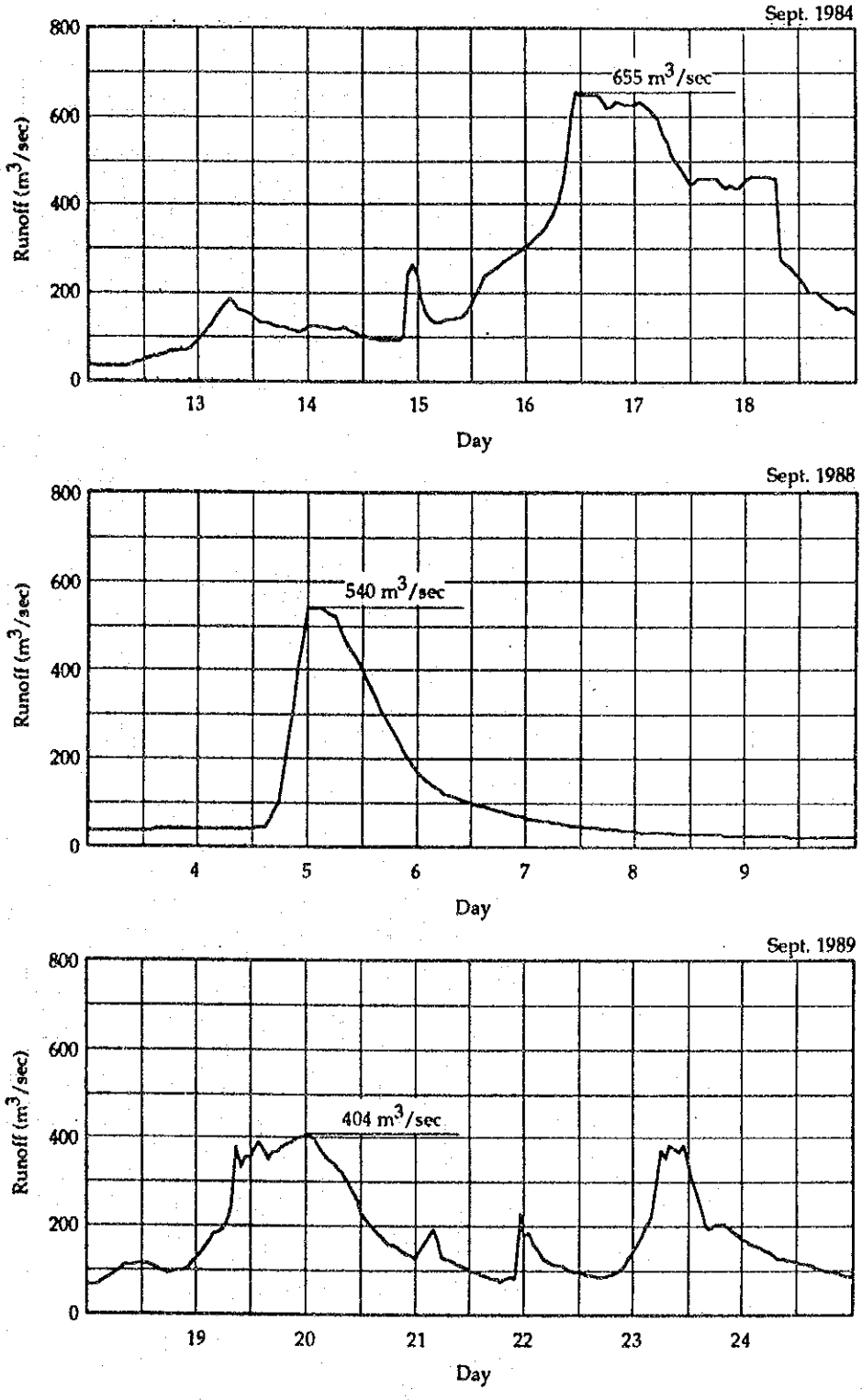
FLOW DURATION CURVE OF RESERVOIR INFLOW

FIGURE 4.10(1/2)



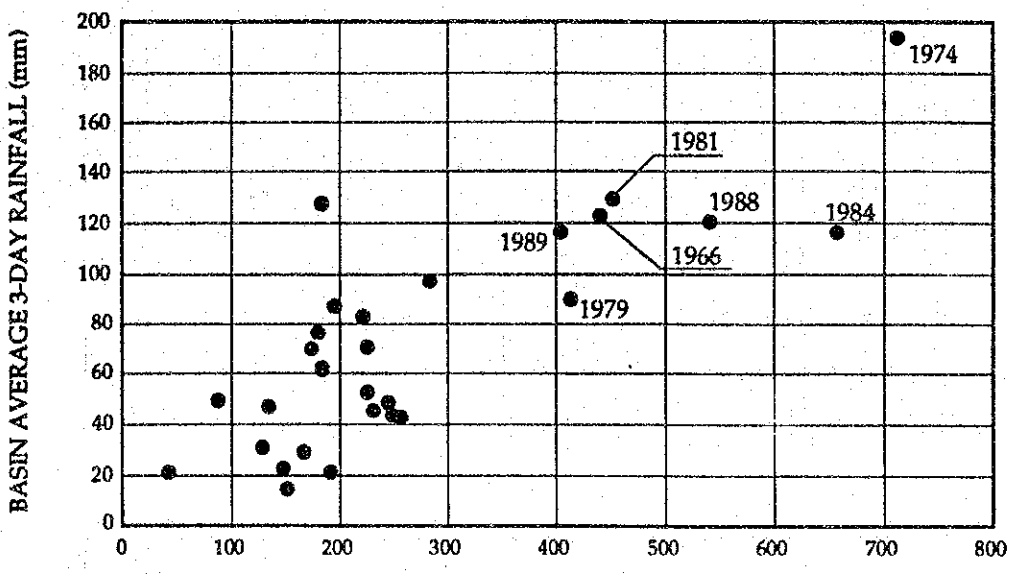
FLOOD HYDROGRAPHS AT BUENOS AIRES (1/2)

FIGURE 4.10(2/2)

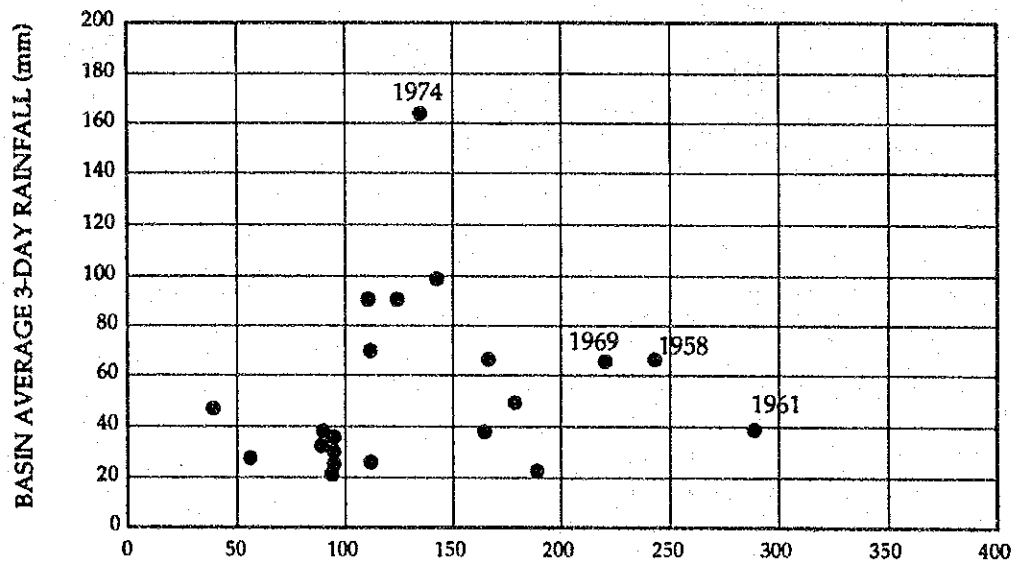


FLOOD HYDROGRAPHS AT BUENOS AIRES (2/2)

FIGURE 4.11



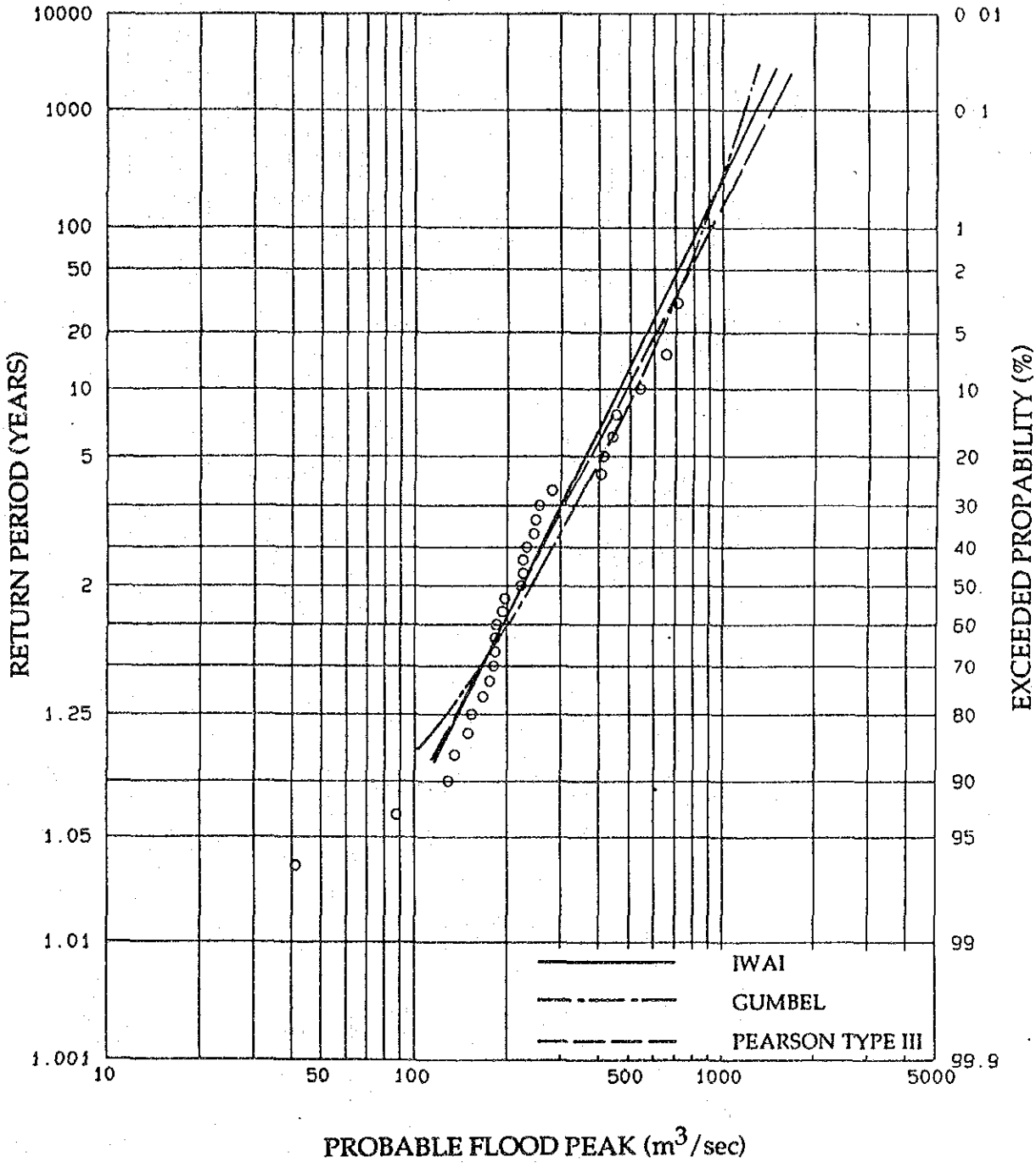
FLOOD PEAK AT BUENOS AIRES (m^3/sec)



FLOOD PEAK AT RANCHO APULCO (m^3/sec)

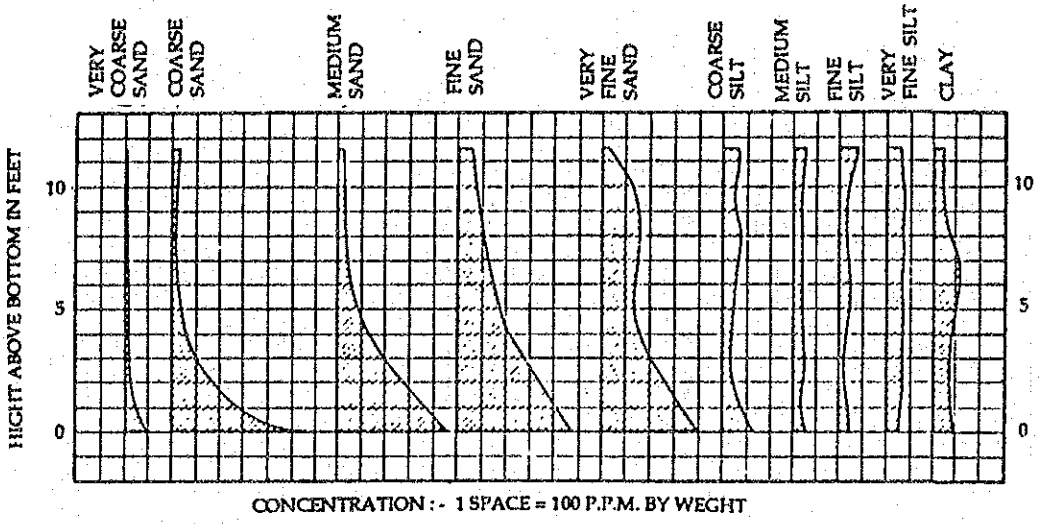
RELATIONSHIP BETWEEN FLOOD PEAK AND BASIN AVERAGE RAINFALL

FIGURE 4.12

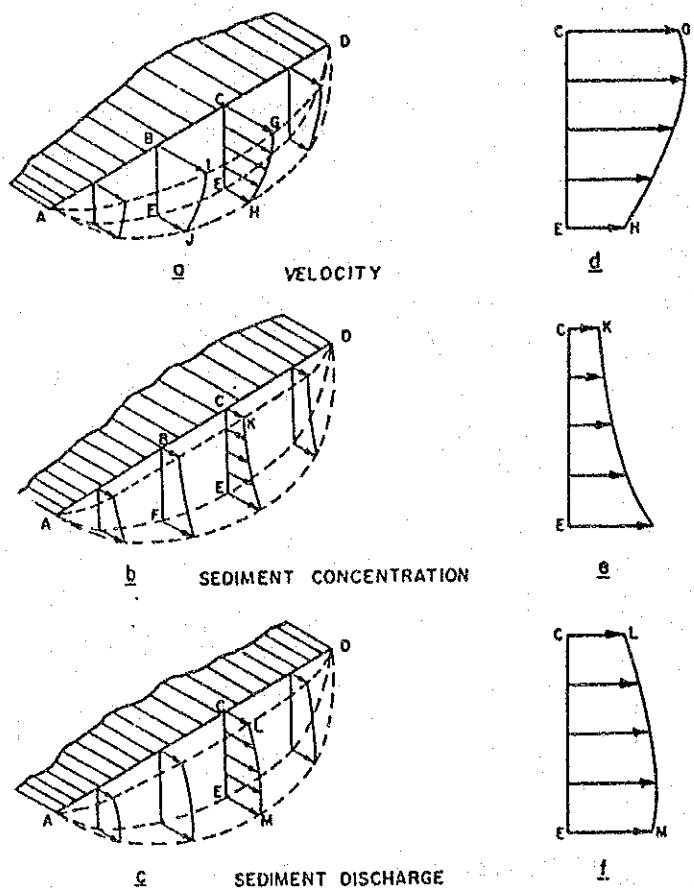


PROBABLE DISTRIBUTION OF ANNUAL MAXIMUM FLOOD PEAK AT BUENOS AIRES

FIGURE 4.13



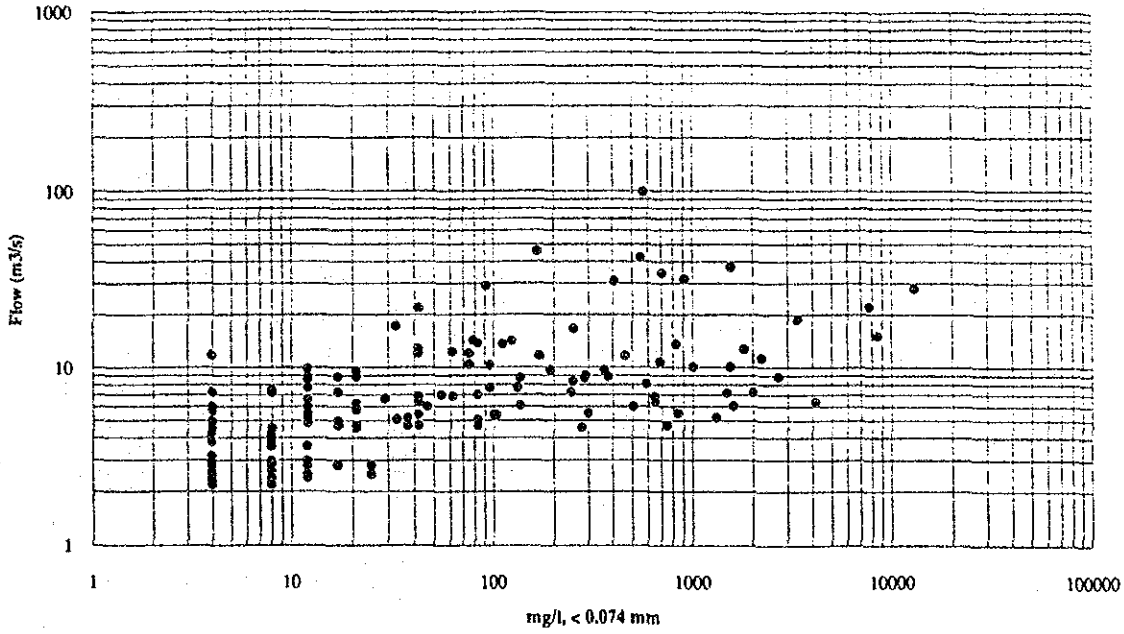
VERTICAL DISTRIBUTION OF SEDIMENT IN THE MISSOURI RIVER AT KANSAS CITY, MO.



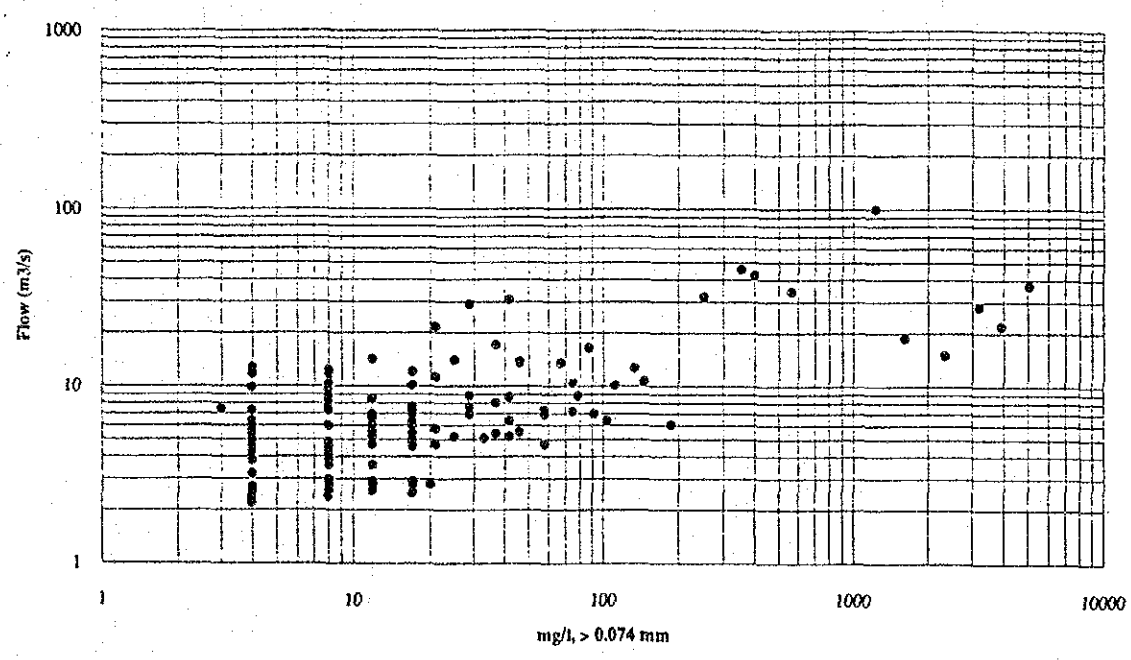
VELOCITY, SEDIMENT CONCENTRATION, AND SEDIMENT DISCHARGES IN STREAMS

VARIATION OF SEDIMENT CONCENTRATION WITH DEPTH

FIGURE 4.14



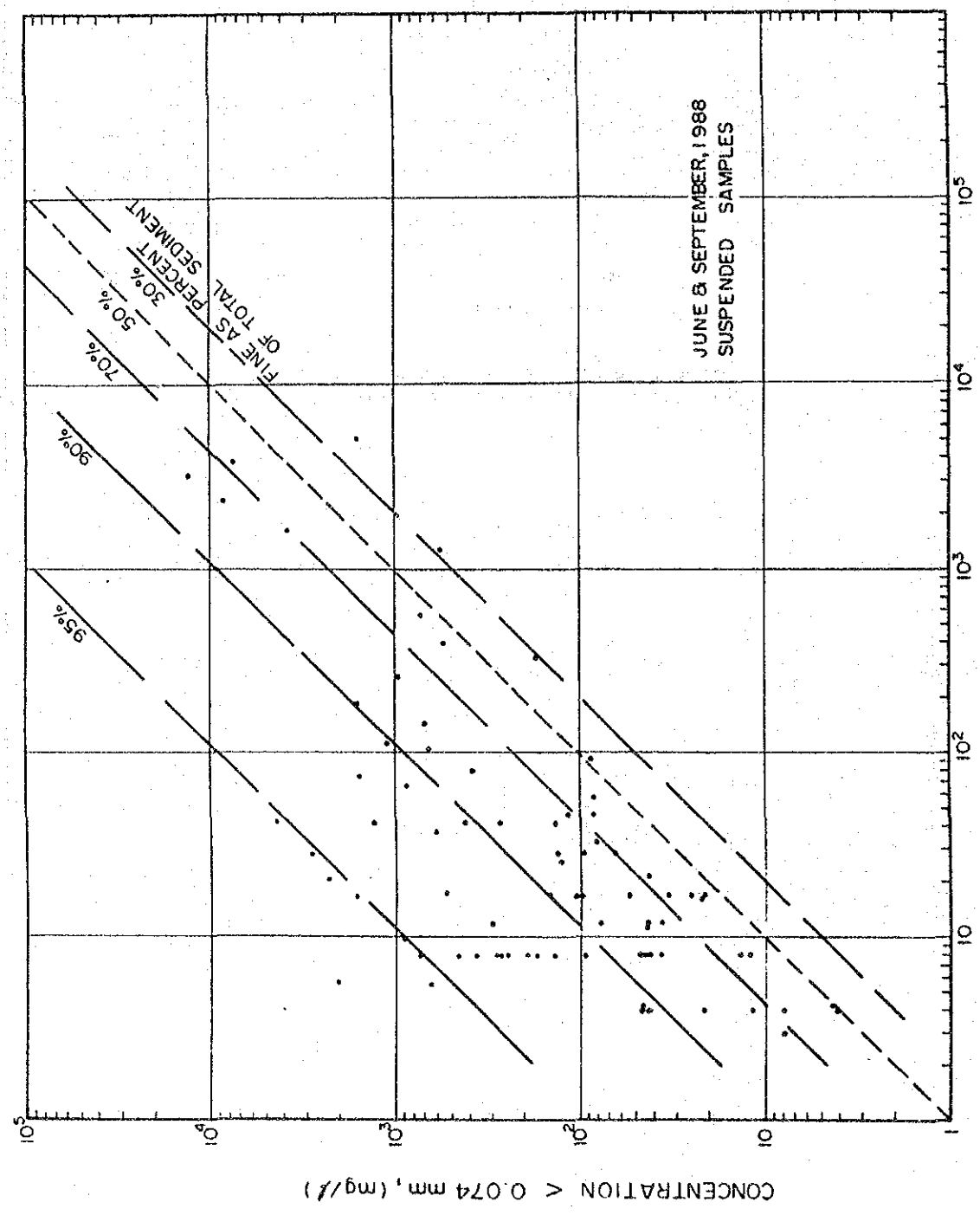
APULCO RIVER AT BUENOS AIRES
SUSPENDED CONCENTRATION < 0.074 mm



APULCO RIVER AT BUENOS AIRES
SUSPENDED CONCENTRATION > 0.074 mm

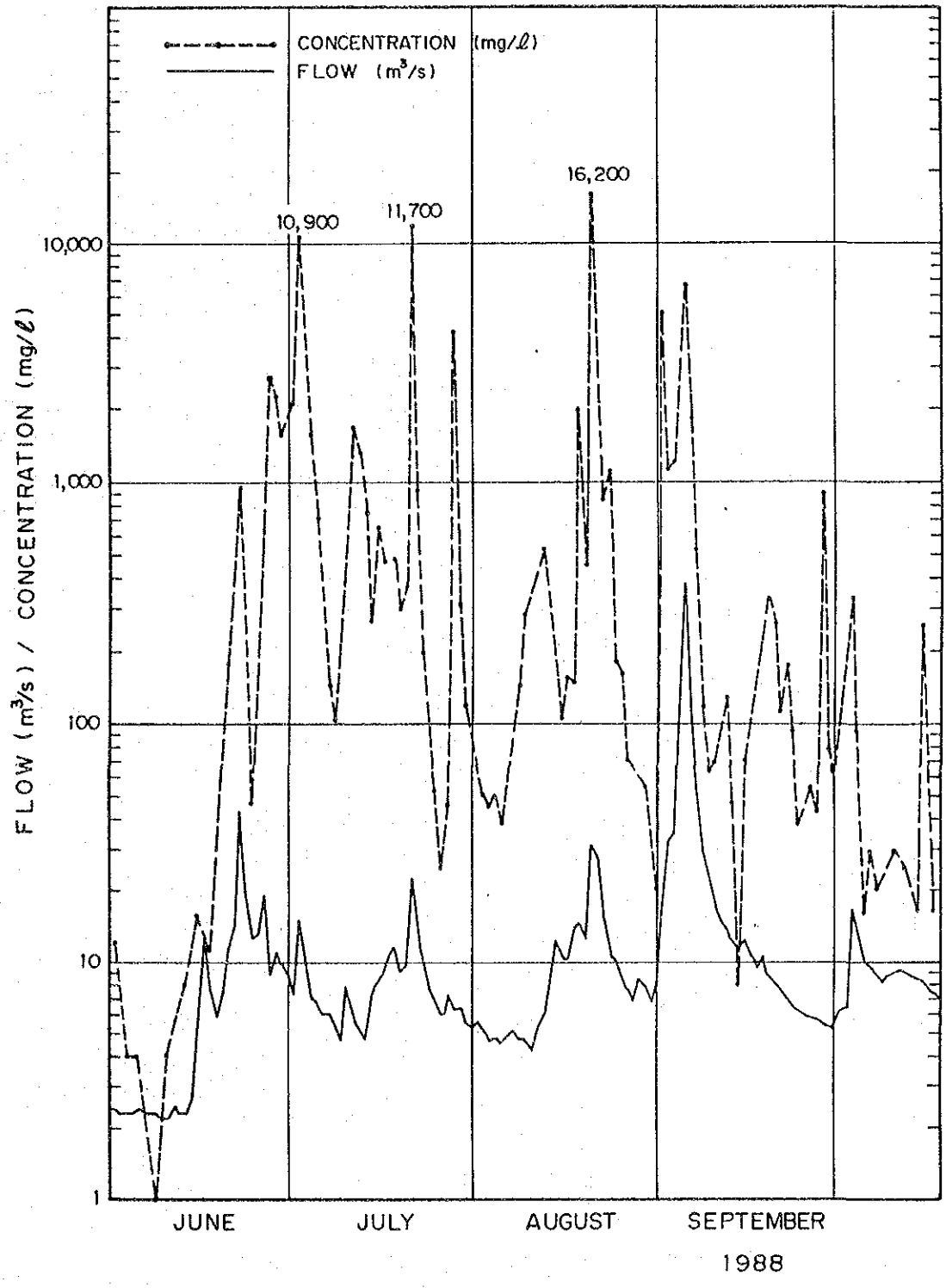
SEDIMENT CONCENTRATION RATE

FIGURE 4.15



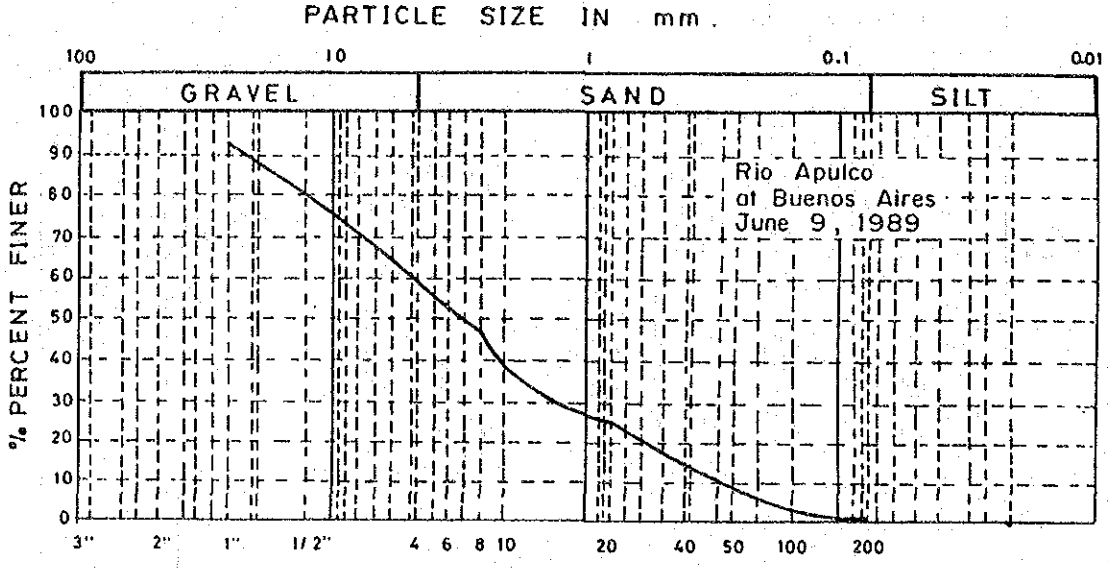
PROPORTION OF FINE AND COARSE MATERIALS OF SUSPENDED LOAD

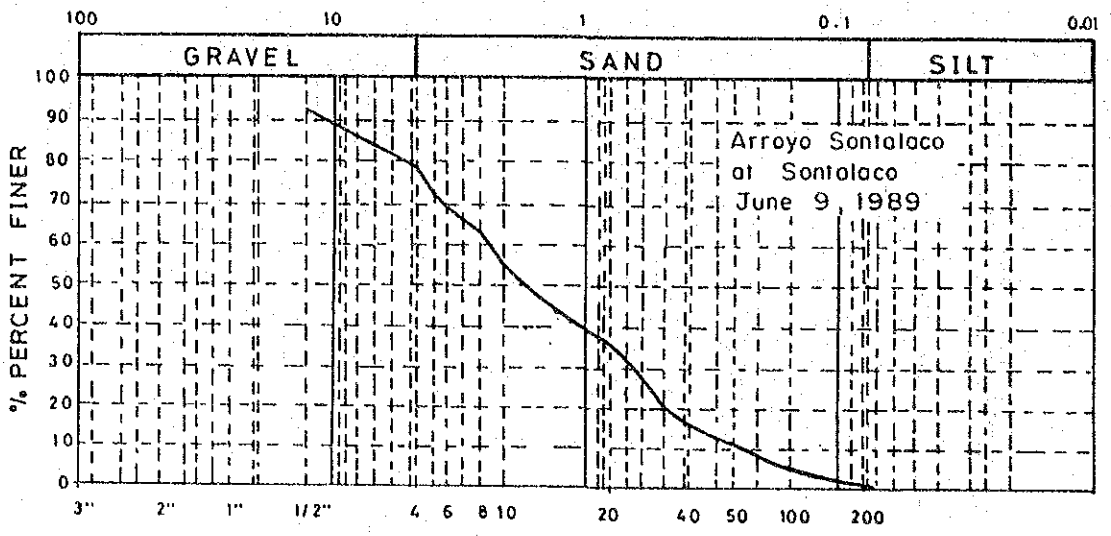
FIGURE 4.16



FLOWS AND SUSPENDED SEDIMENT CONCENTRATIONS
OF APULCO RIVER AT BUENOS AIRES

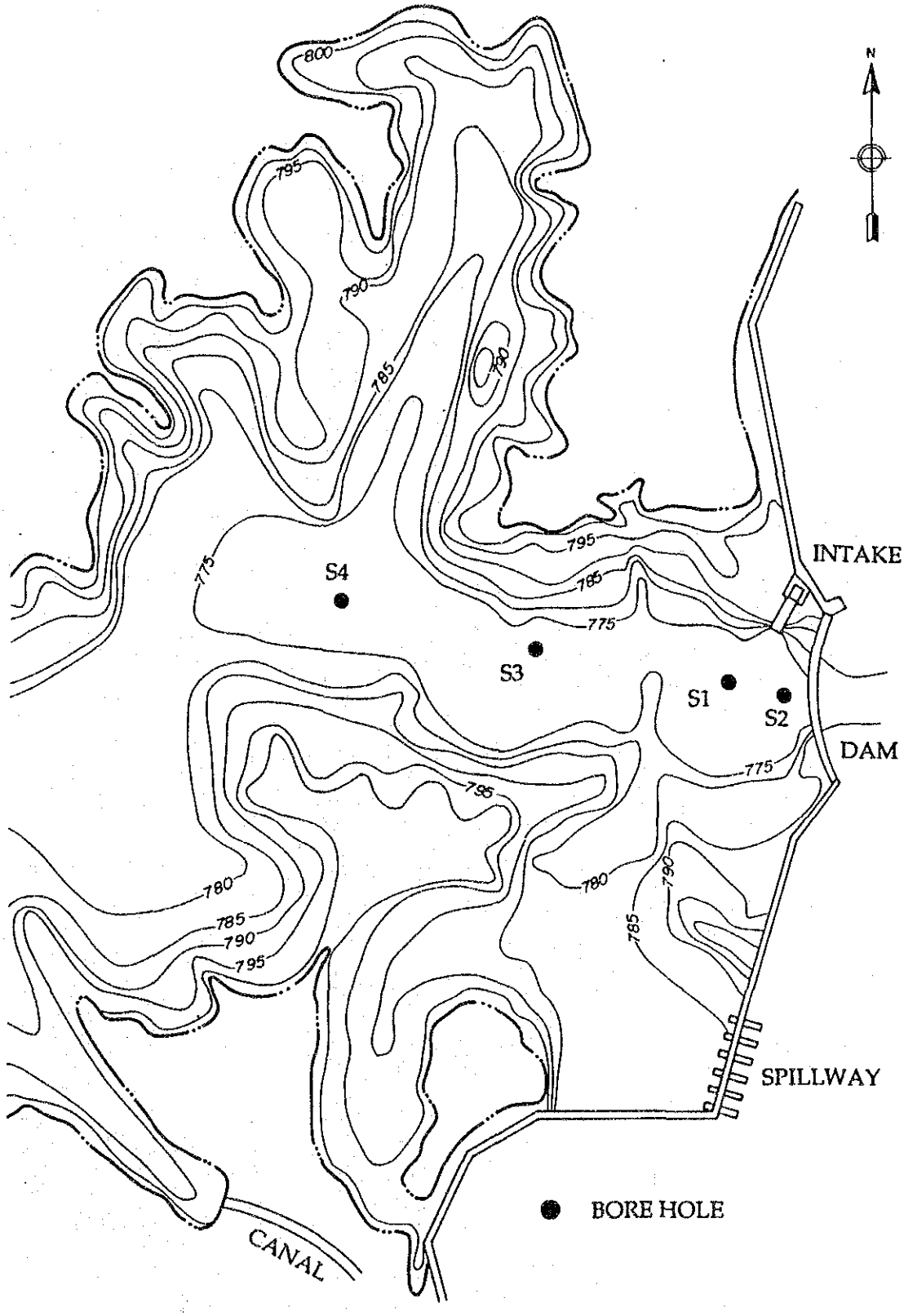
FIGURE 4.17





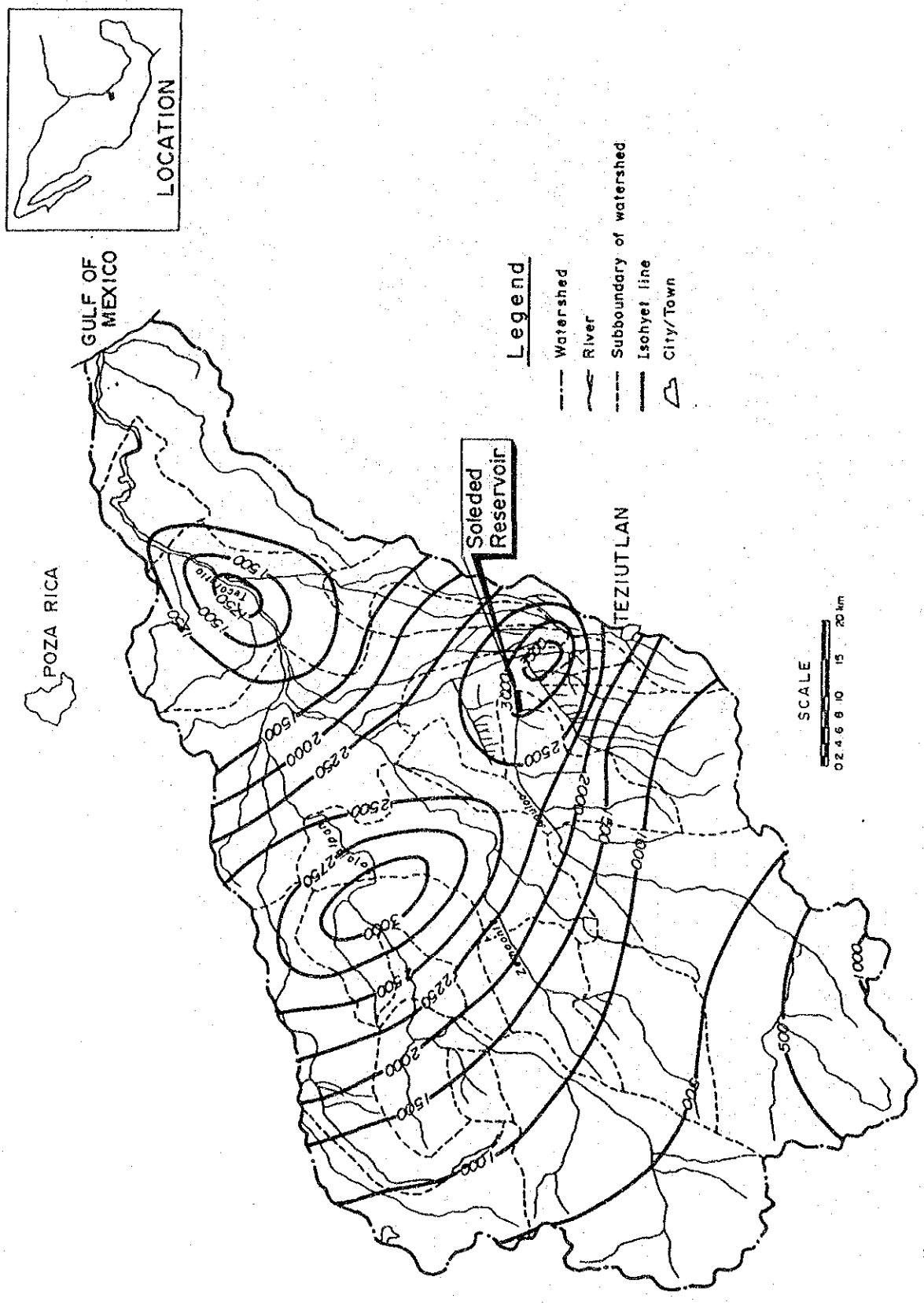
BED MATERIAL SIZE DISTRIBUTION
OF RIO APULCO AND ARROYO SONTALACO

FIGURE 4.18



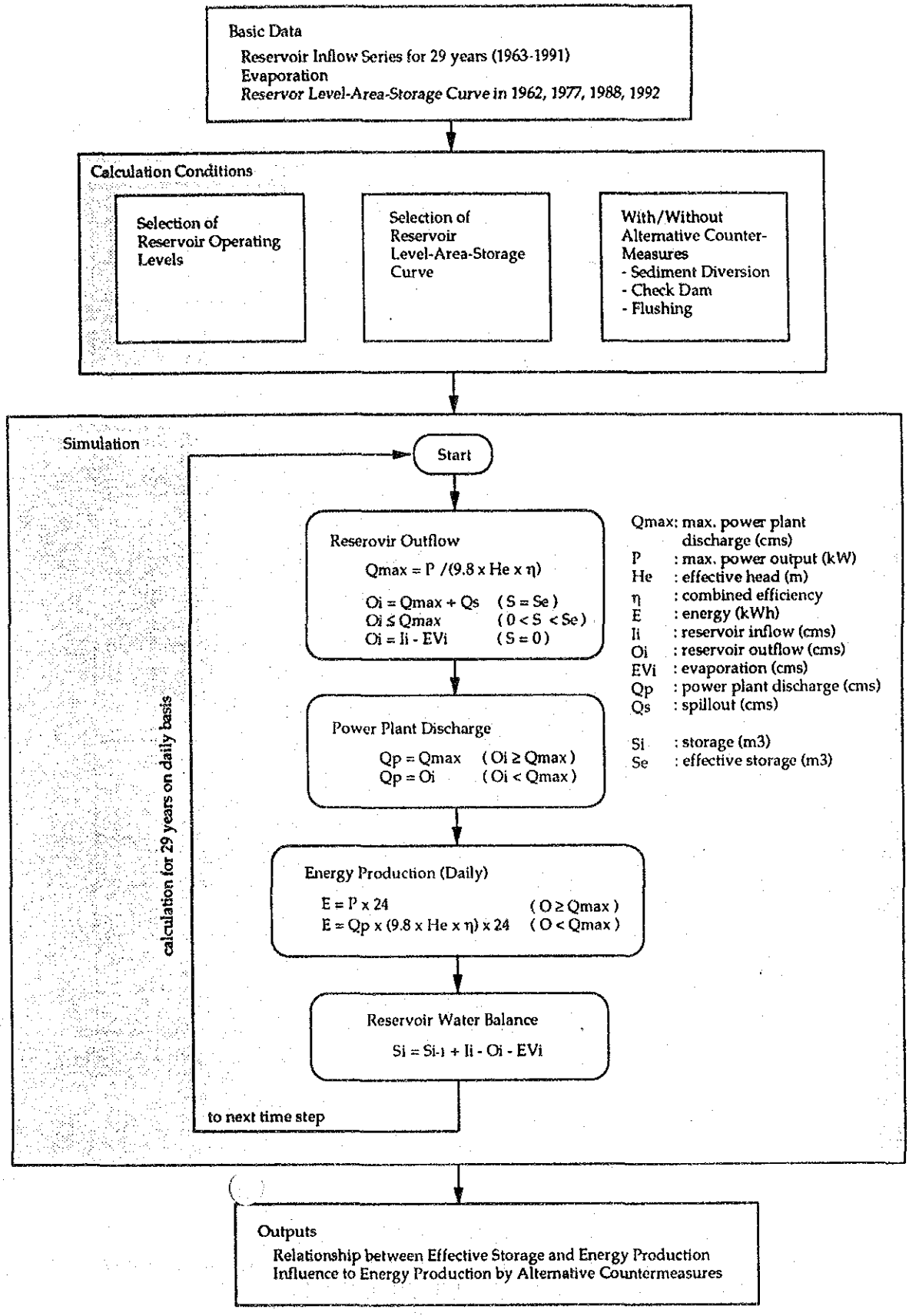
LOCATION OF BORE HOLES IN 1987

FIGURE 4.19



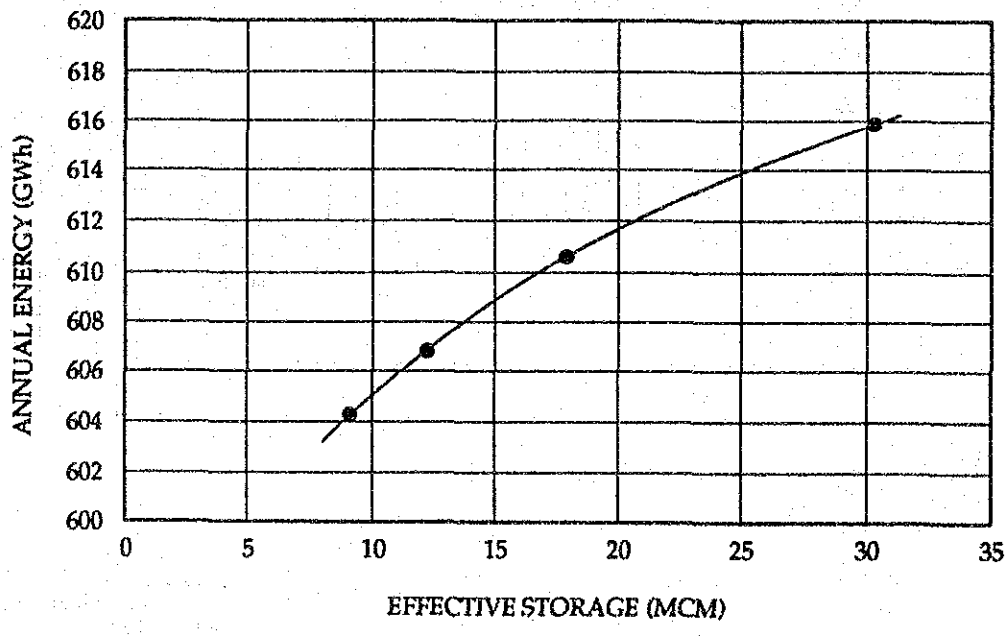
ISOHYETAL MAP OF ANNUAL RAINFALL

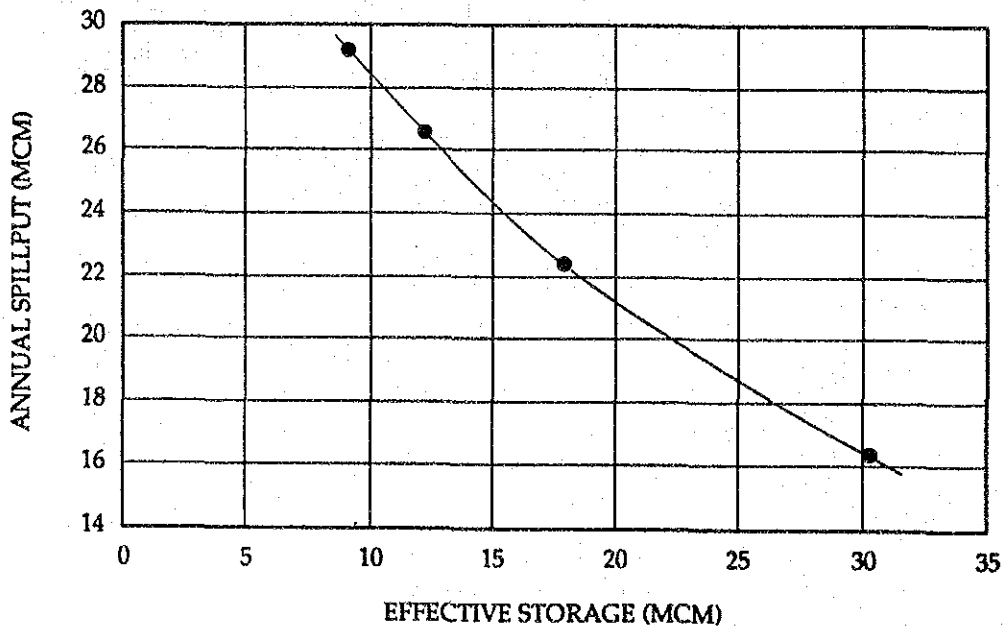
FIGURE 5.1



GENERAL FLOW CHART OF SIMULATION STUDY

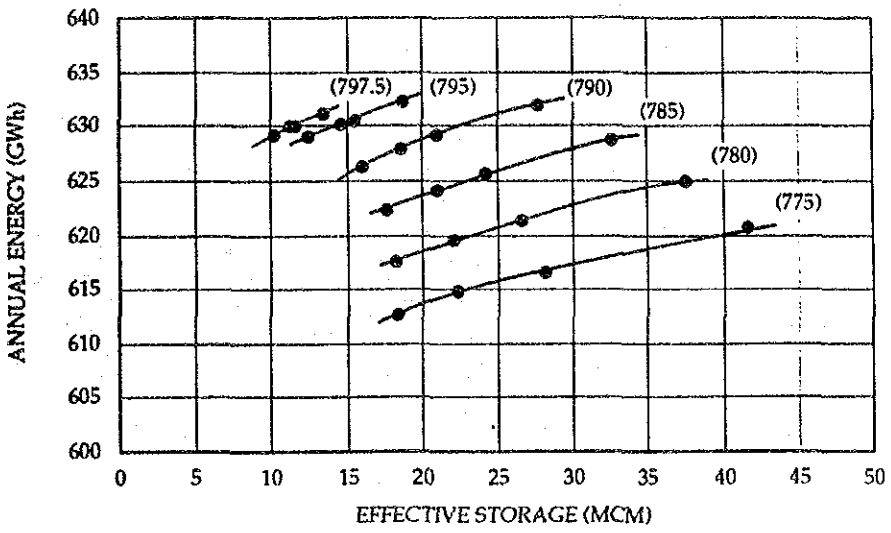
FIGURE 5.2





RELATIONSHIPS BETWEEN EFFECTIVE STORAGE AND ENERGY OUTPUT/SPILLOUT DISCHARGE

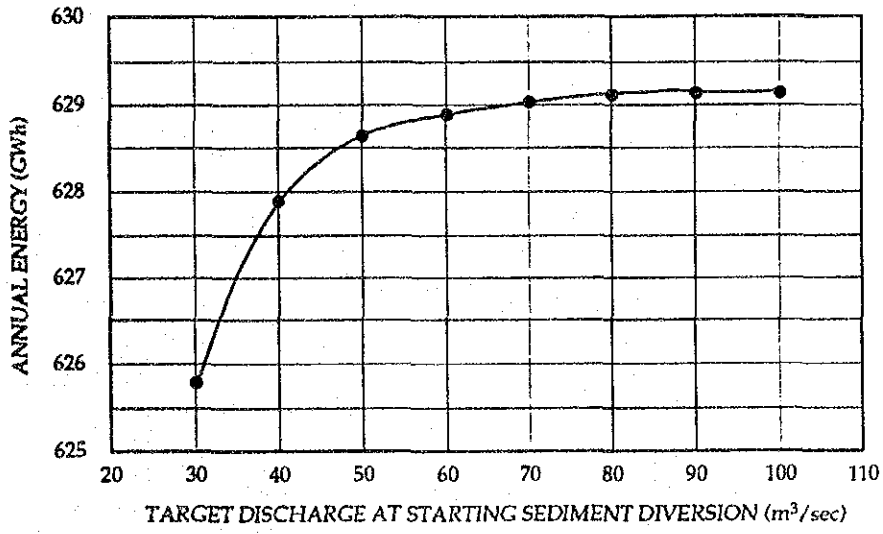
FIGURE 5.3



Note : Normal high water level is set at El. 804.5 m.
Figures in ( ) mean minimum operating level.

RELATIONSHIPS BETWEEN EFFECTIVE STORAGE AND ENERGY OUTPUT BY CHANGE OF RESERVOIR OPERATING LEVELS

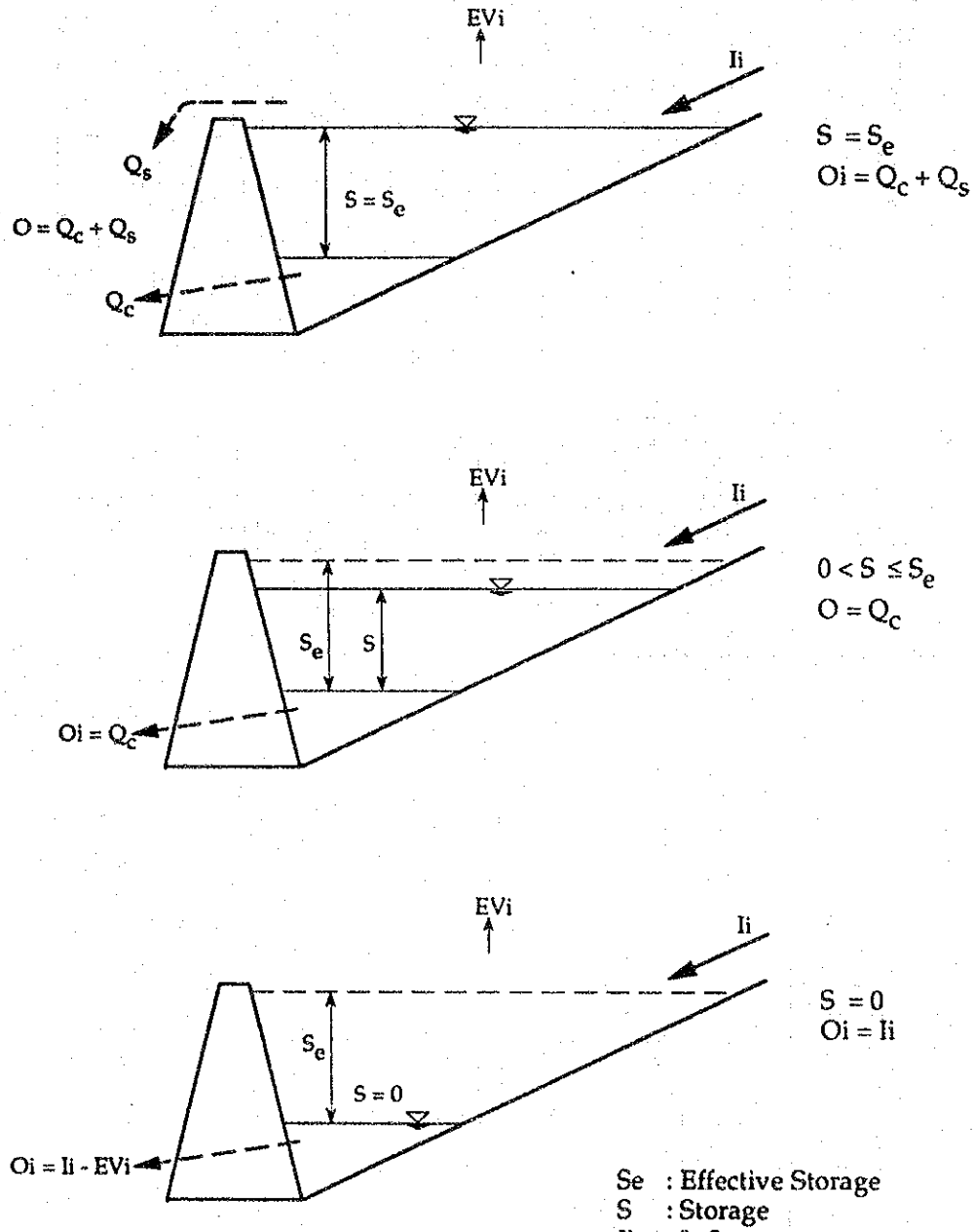
FIGURE 5.4



Note : Excess river flow above target discharge is used for sediment diversion.

RELATIONSHIP BETWEEN DISCHARGE FOR SEDIMENT DIVERSION AND ENERGY OUTPUT

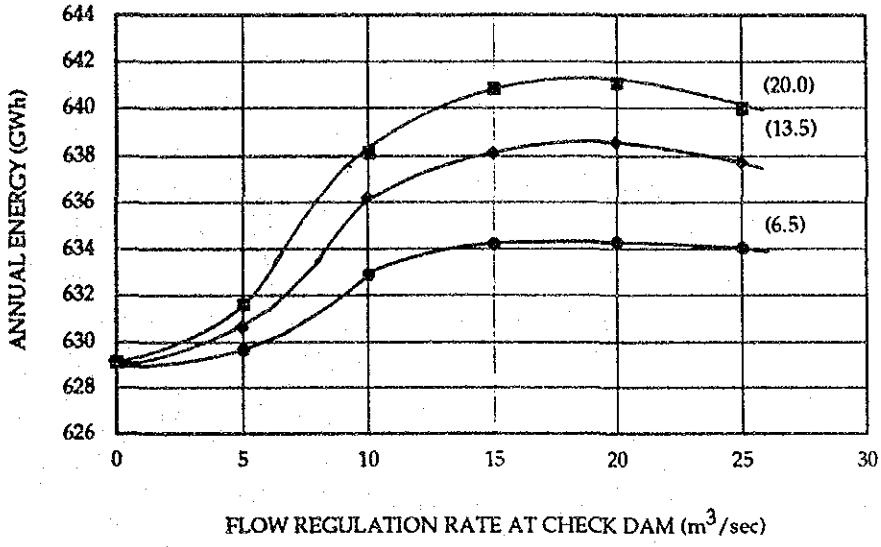
FIGURE 5.5



Se : Effective Storage
S : Storage
Ii : Inflow
Oi : Outflow
EVi : Evaporation
Qc : Regulated Outflow
Qs : Spillout

ASSUMPTION OF FLOW REGULATION BY CHECK DAM

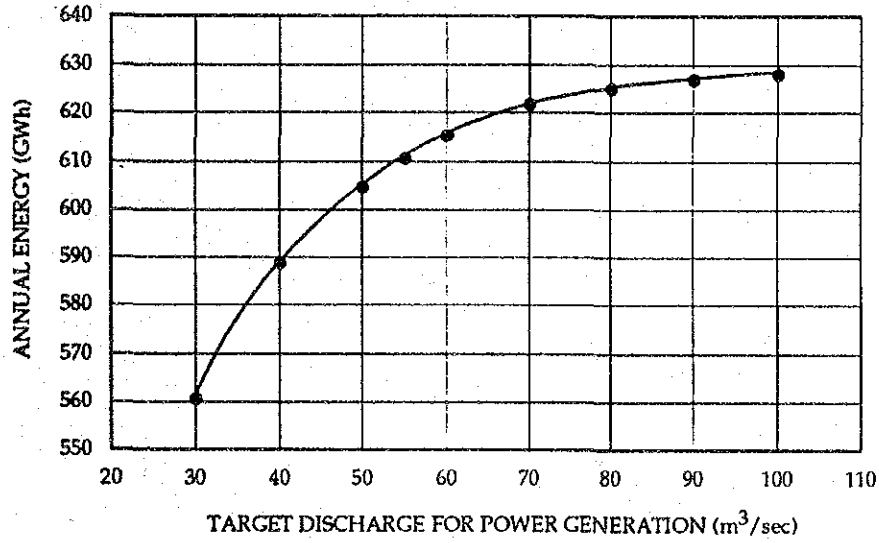
FIGURE 5.6



Note : Figure in ( ) means effective storage of check dam (mcm).

ENERGY INCREMENT BY FLOW REGULATION EFFECT OF CHECK DAM

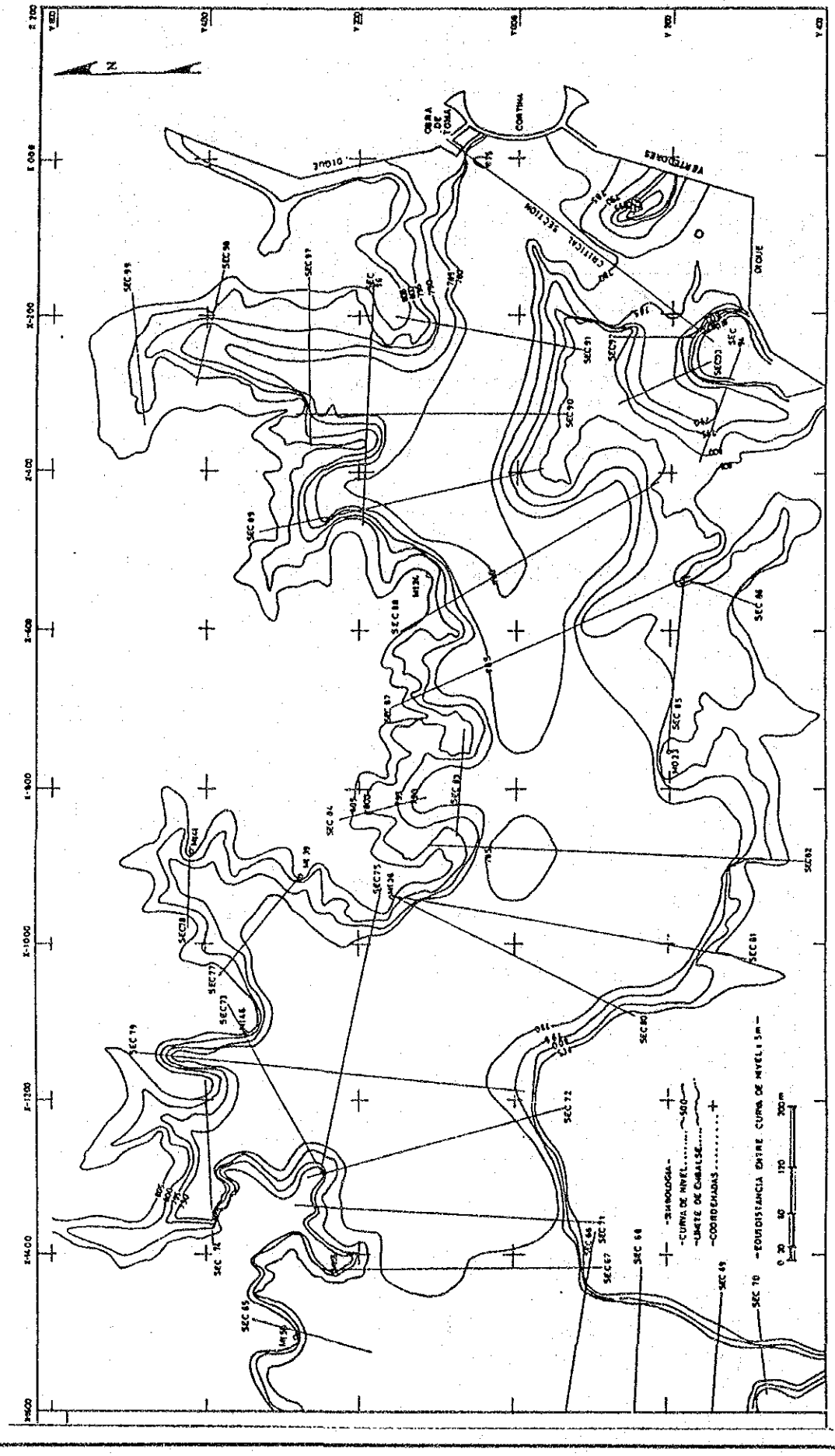
FIGURE 5.7



Note : Maximum power plant discharge is limited to 55.2 m3/sec in any case.
Excess inflow above target discharge is used for sediment flushing.

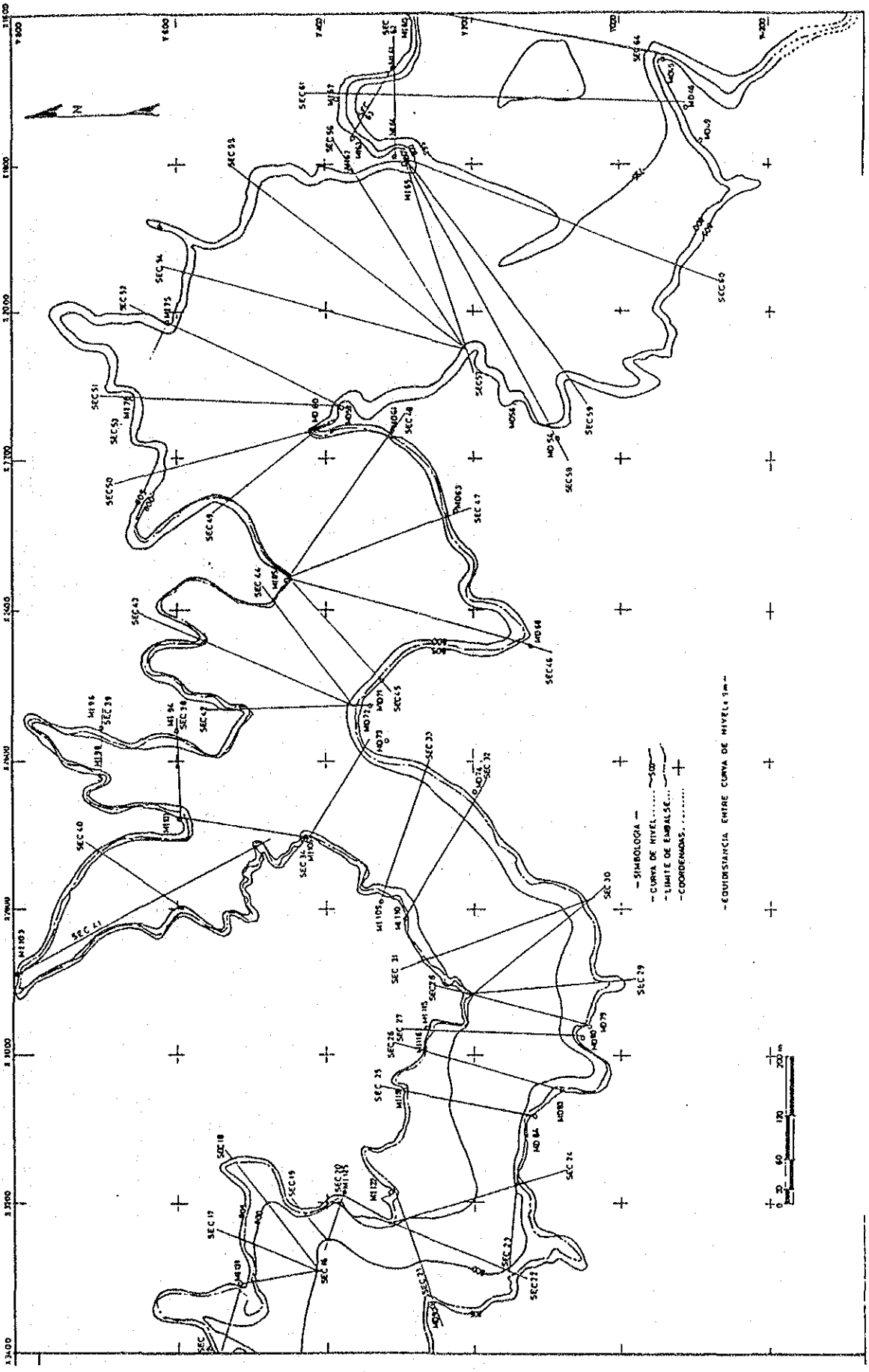
RELATIONSHIP BETWEEN DISCHARGE FOR SEDIMENT FLUSHING AND ENERGY

FIGURE 6.1(1/3)



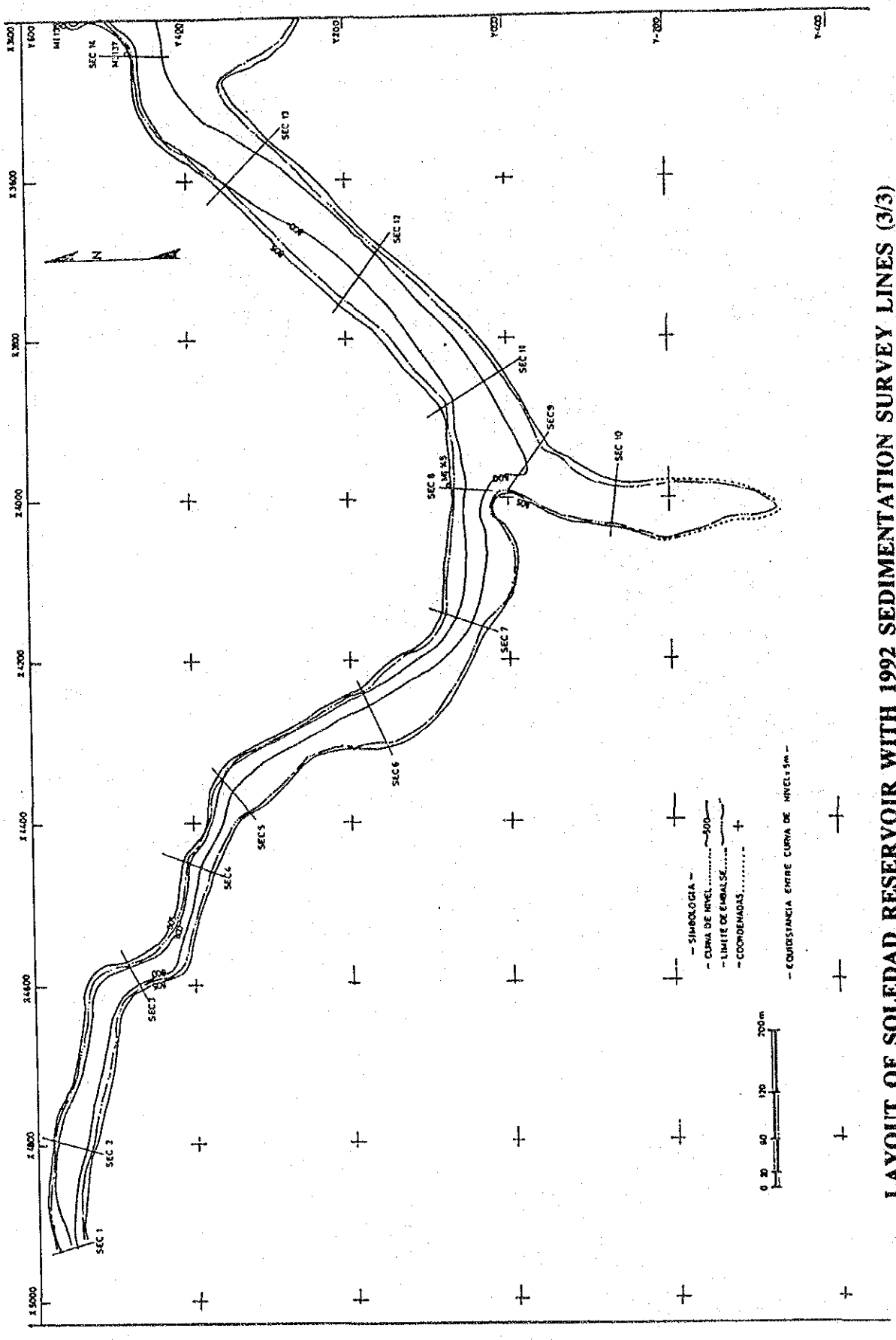
LAYOUT OF SOLEDAD RESERVOIR WITH 1992 SEDIMENTATION SURVEY LINES (1/3)

FIGURE 6.1(2/3)



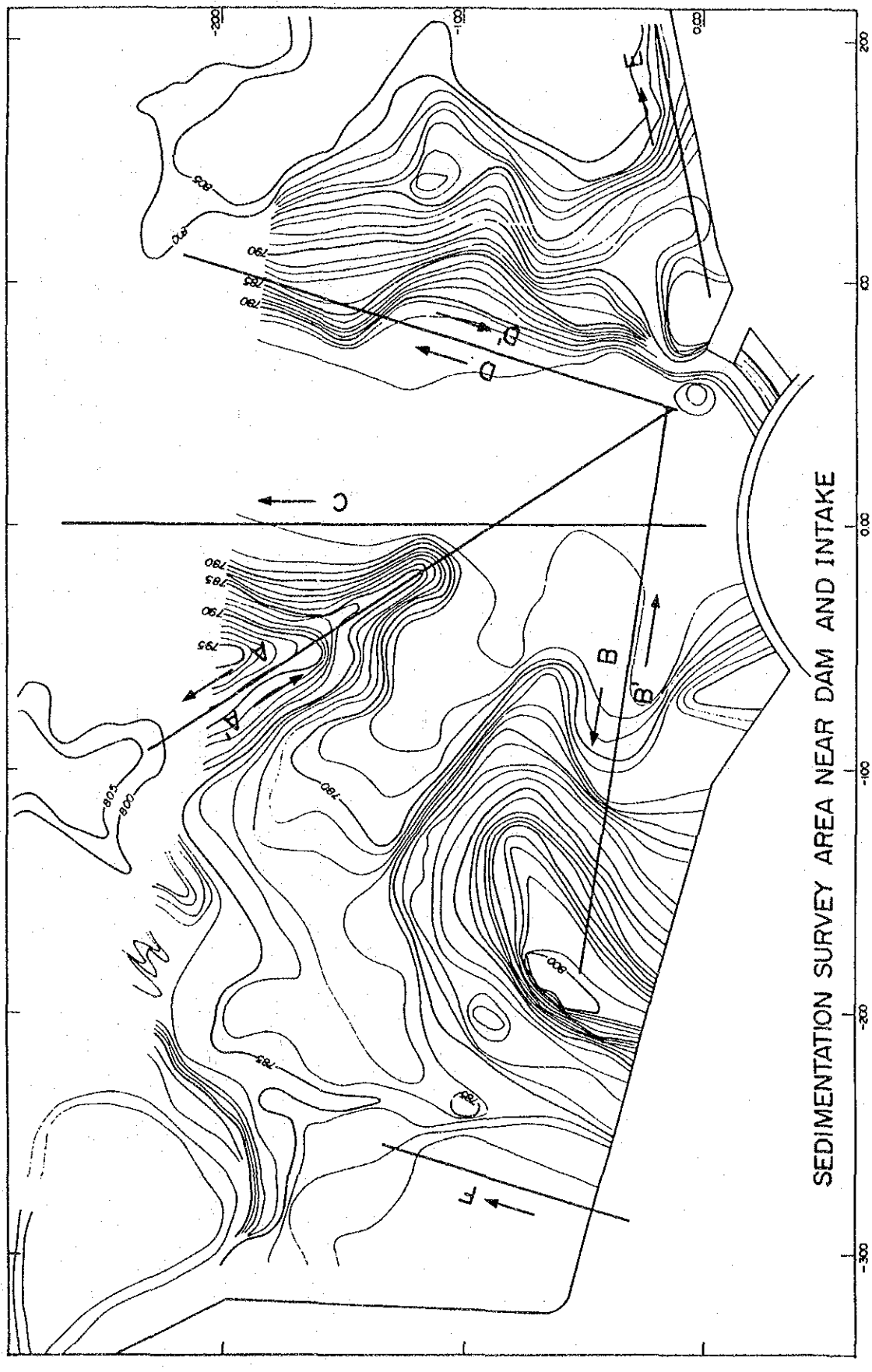
LAYOUT OF SOLEDAD RESERVOIR WITH 1992 SEDIMENTATION SURVEY LINES (2/3)

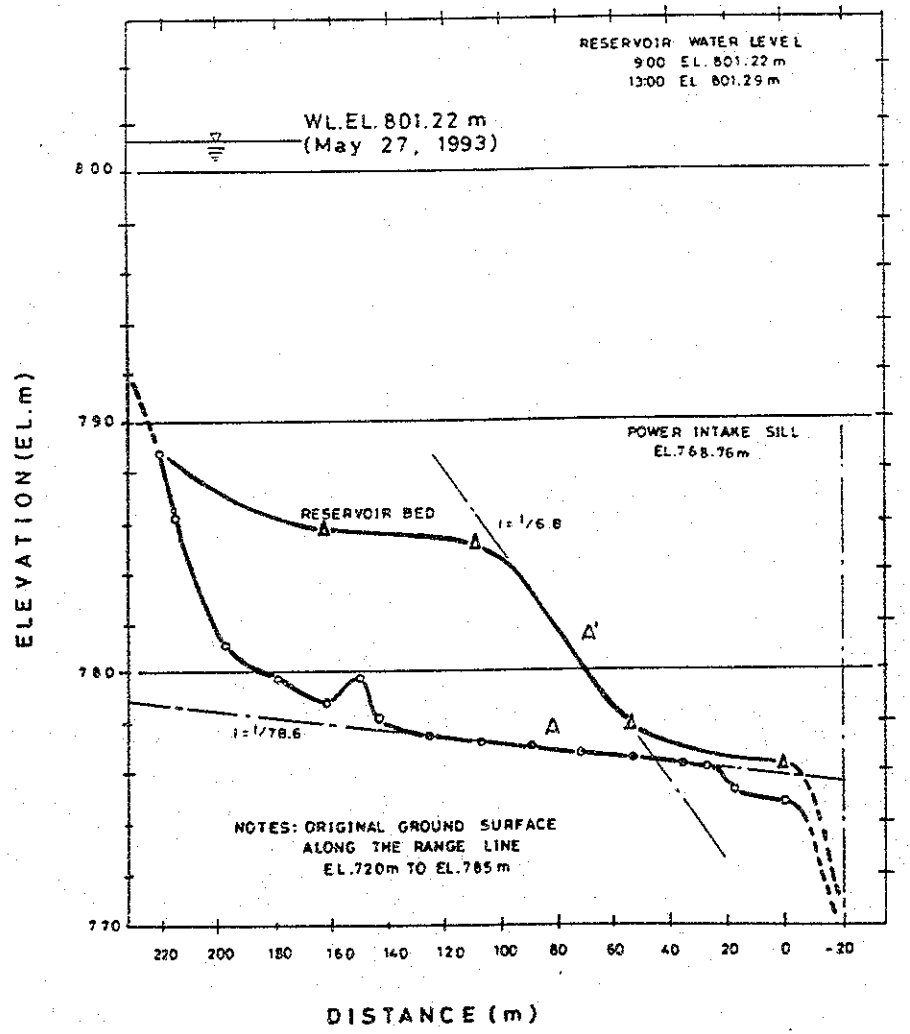
FIGURE 6.1(3/3)



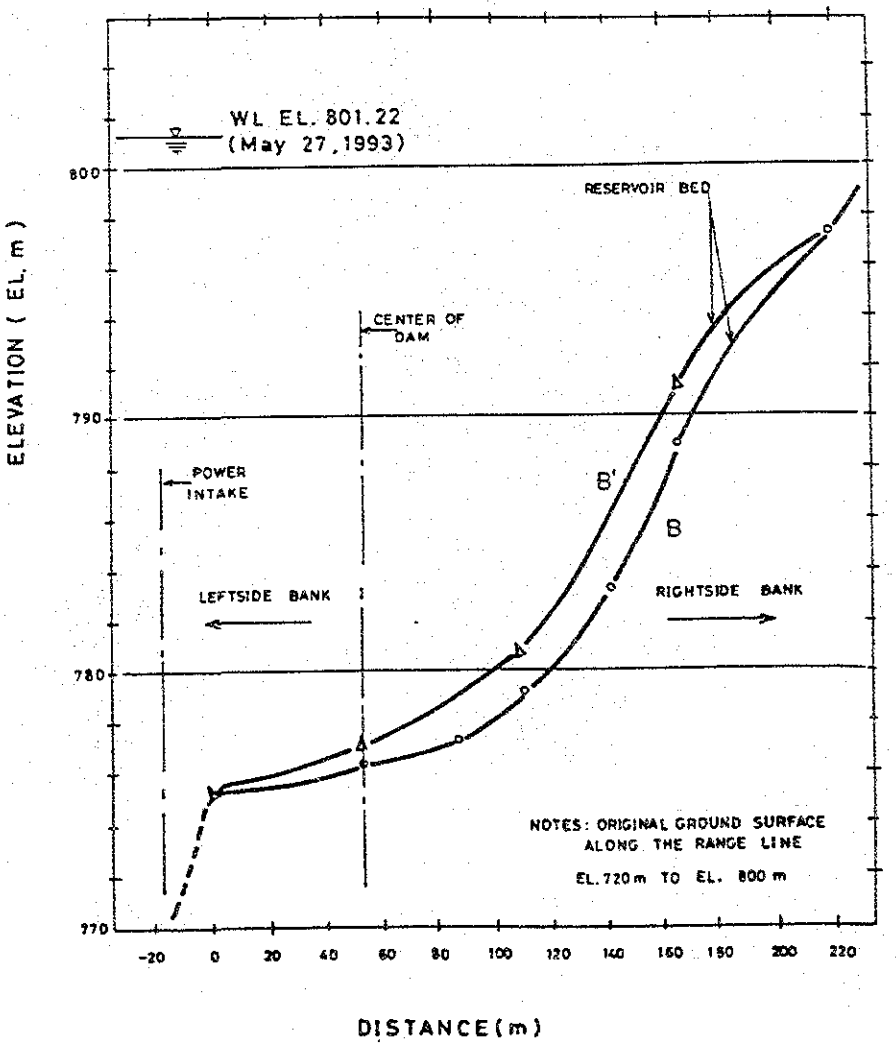
LAYOUT OF SOLEDAD RESERVOIR WITH 1992 SEDIMENTATION SURVEY LINES (3/3)

FIGURE 6.2


SEDIMENTATION SURVEY AREA NEAR DAM AND INTAKE
A
A'
B
B'
C
D
D'
E
F
780
785
790
795
800
805
808



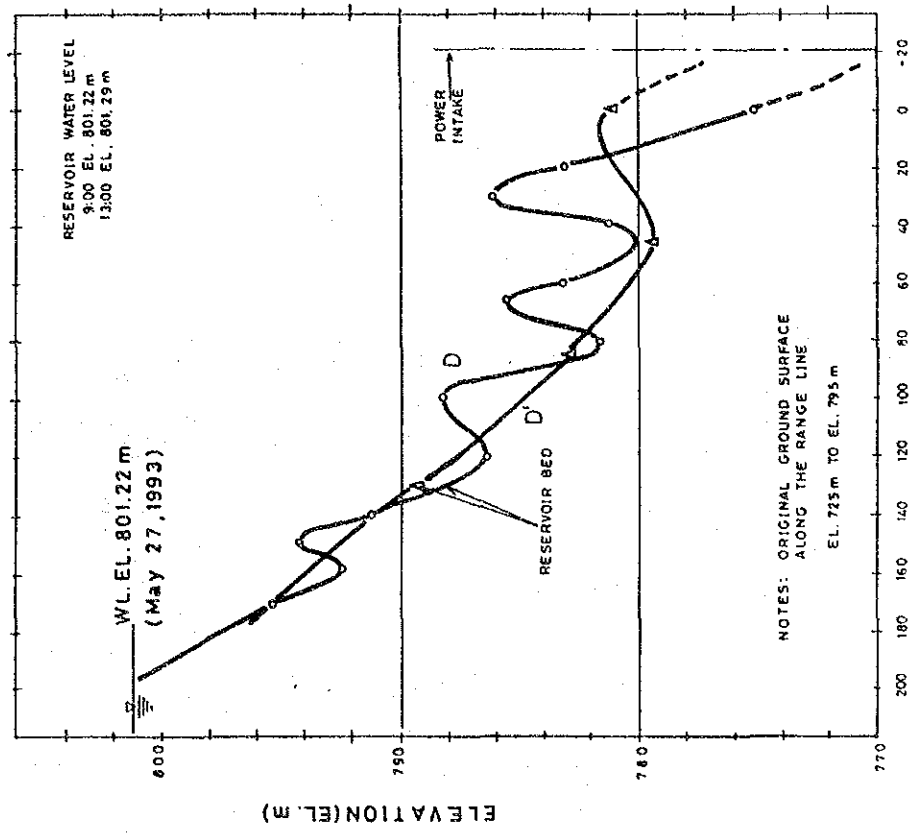
RESERVOIR SEDIMENTATION NEAR DAM AND INTAKE (1/6)



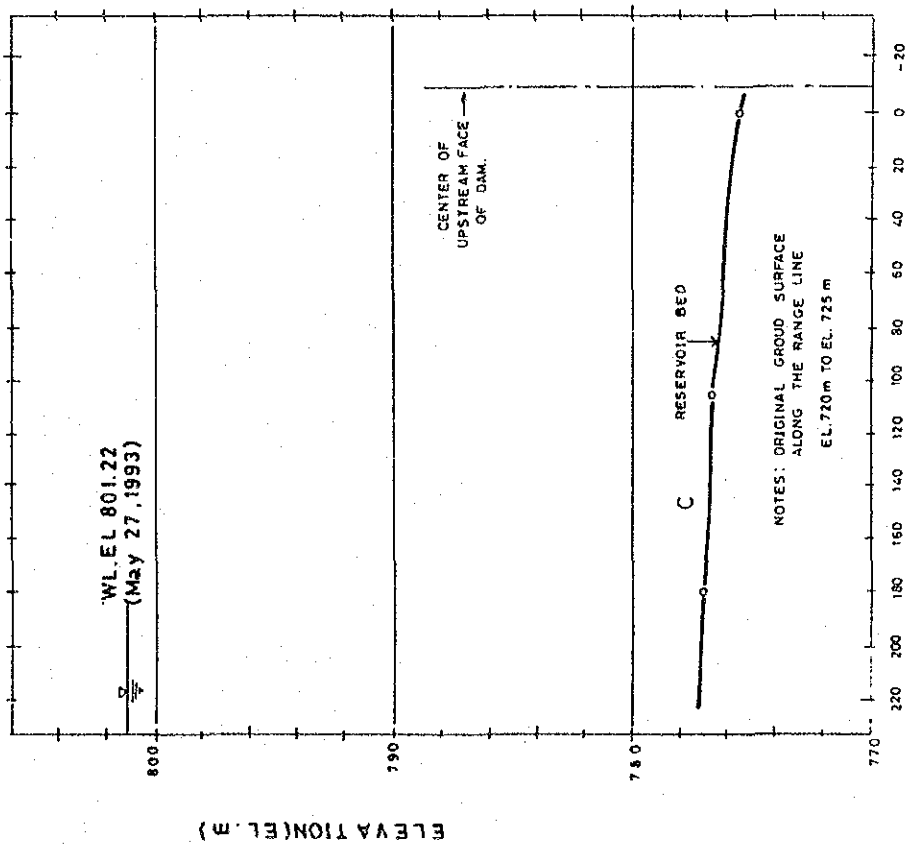
RESERVOIR SEDIMENTATION NEAR DAM AND INTAKE (2/6)

FIGURE 6.3(1/3)

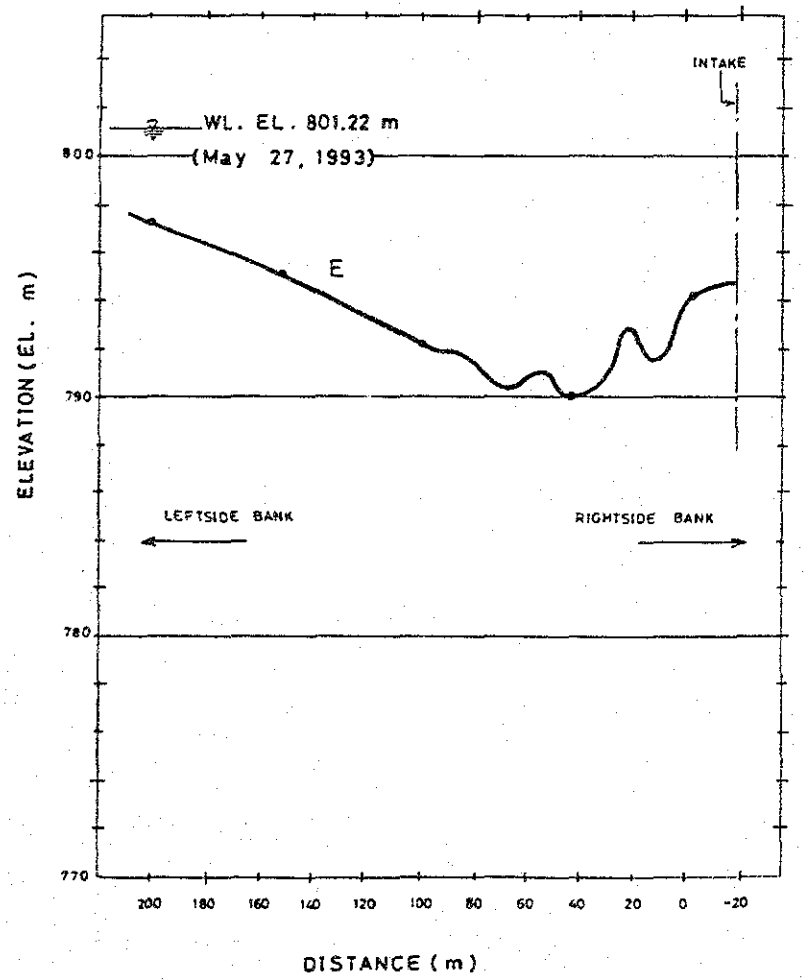
FIGURE 6.3(2/3)



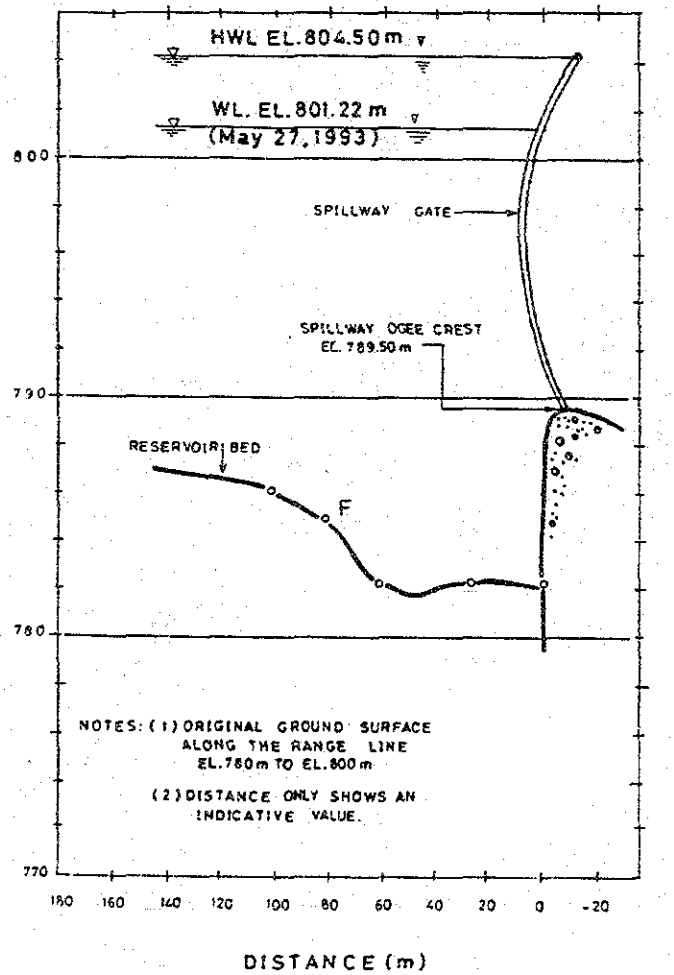
RESERVOIR SEDIMENTATION NEAR DAM AND INTAKE (4/6)



RESERVOIR SEDIMENTATION NEAR DAM AND INTAKE (3/6)



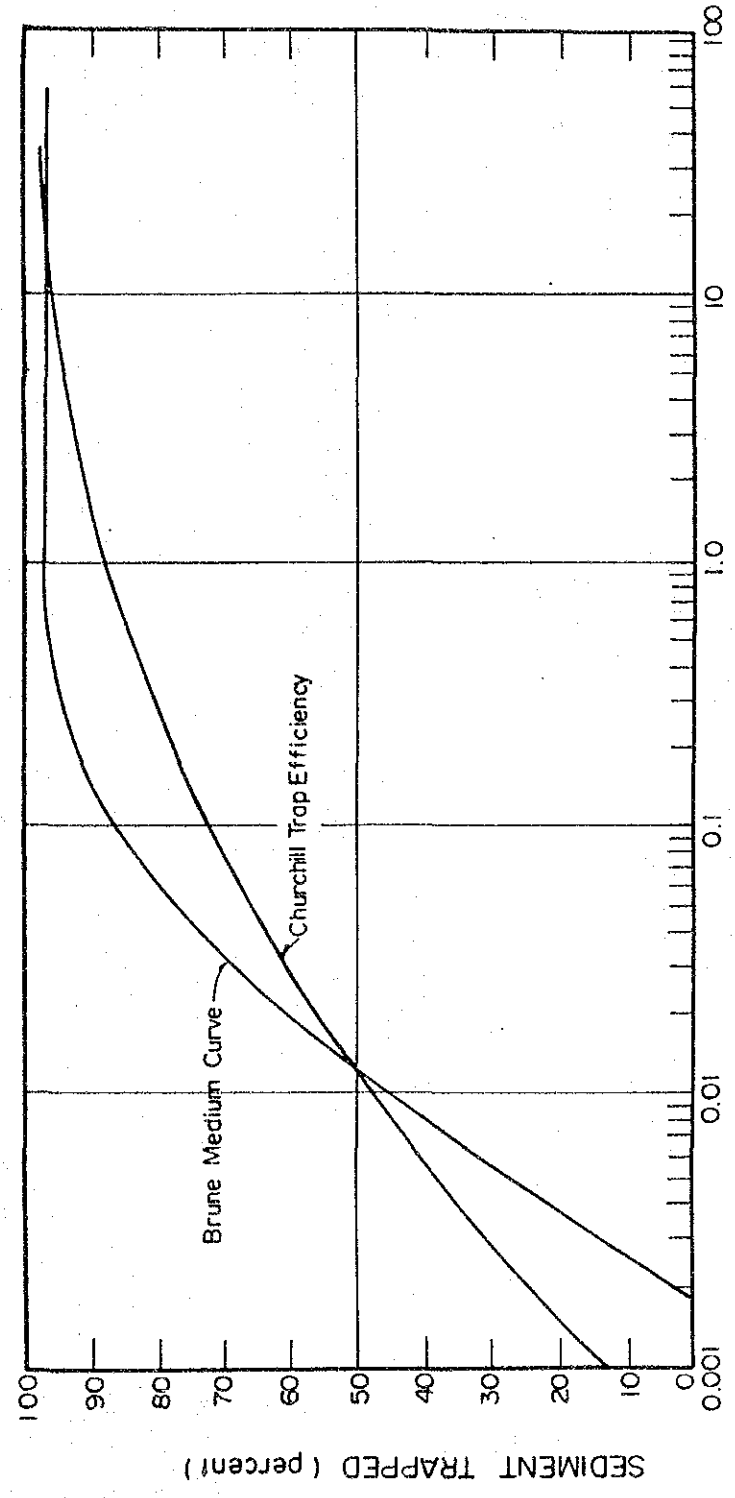
RESERVOIR SEDIMENTATION NEAR DAM AND INTAKE (5/6)



RESERVOIR SEDIMENTATION NEAR DAM AND INTAKE (6/6)

FIGURE 6.3(3/3)

FIGURE 6.4



RESERVOIR TRAP EFFICIENCY CURVES

FIGURE 6.5

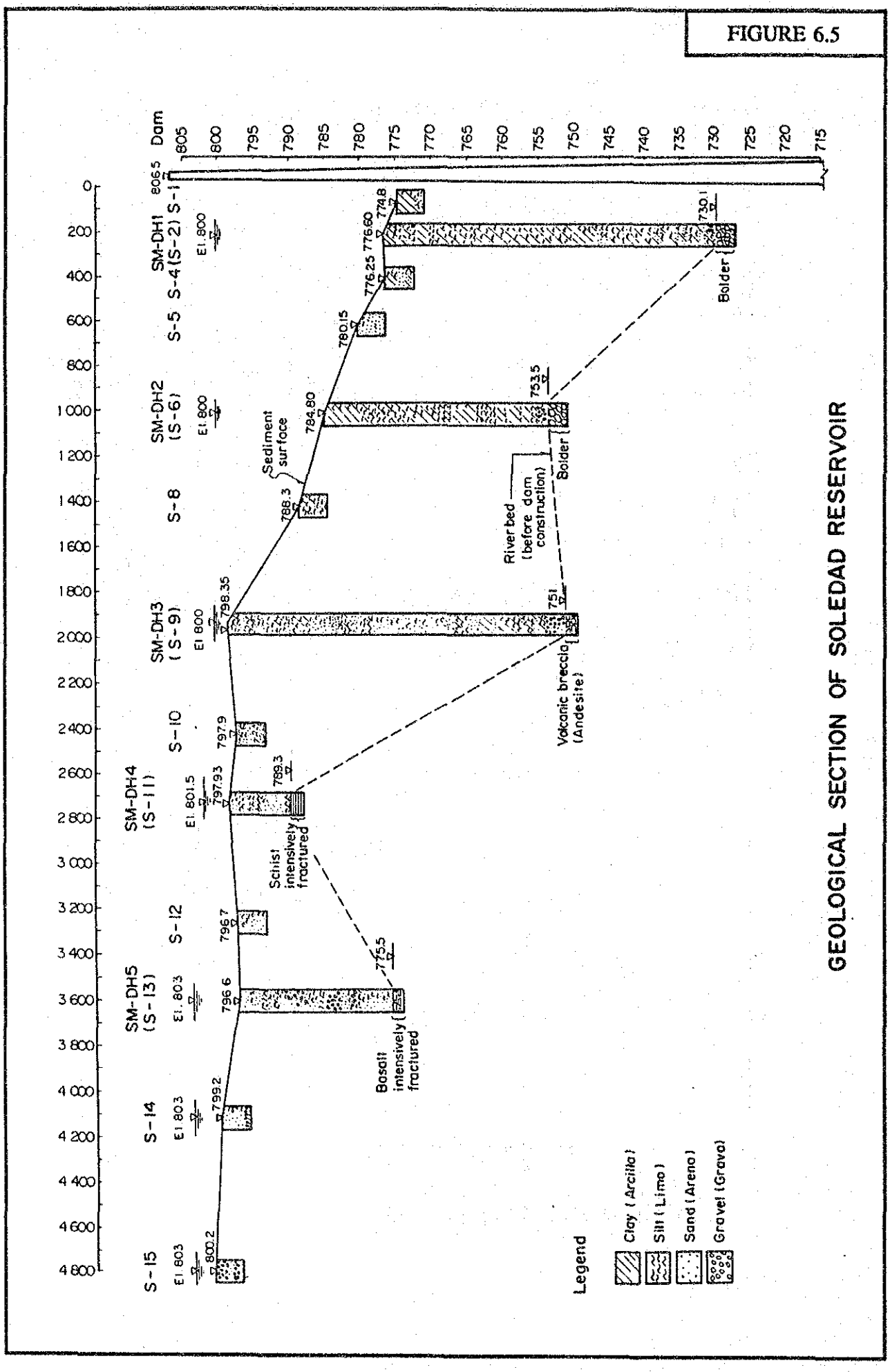
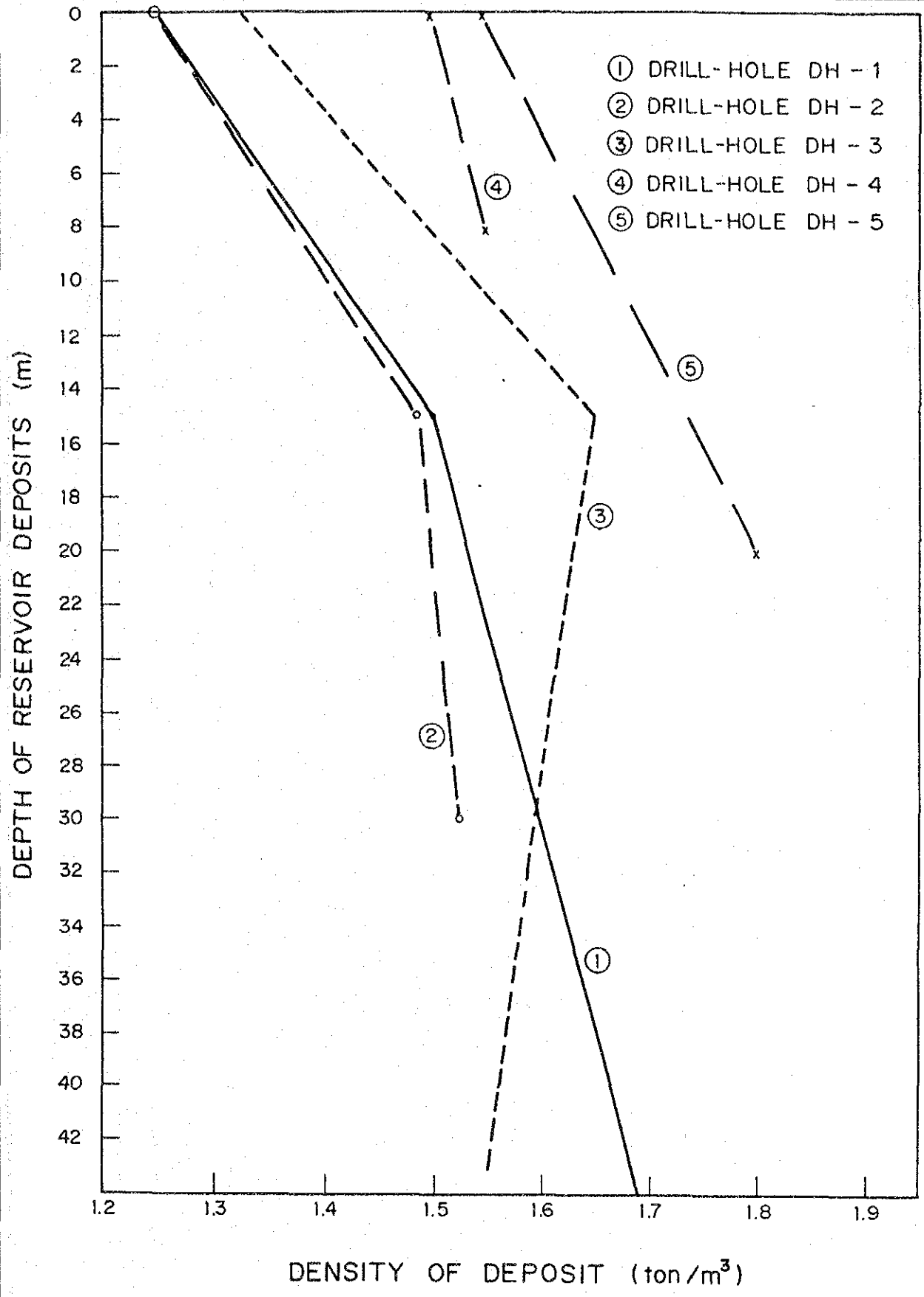
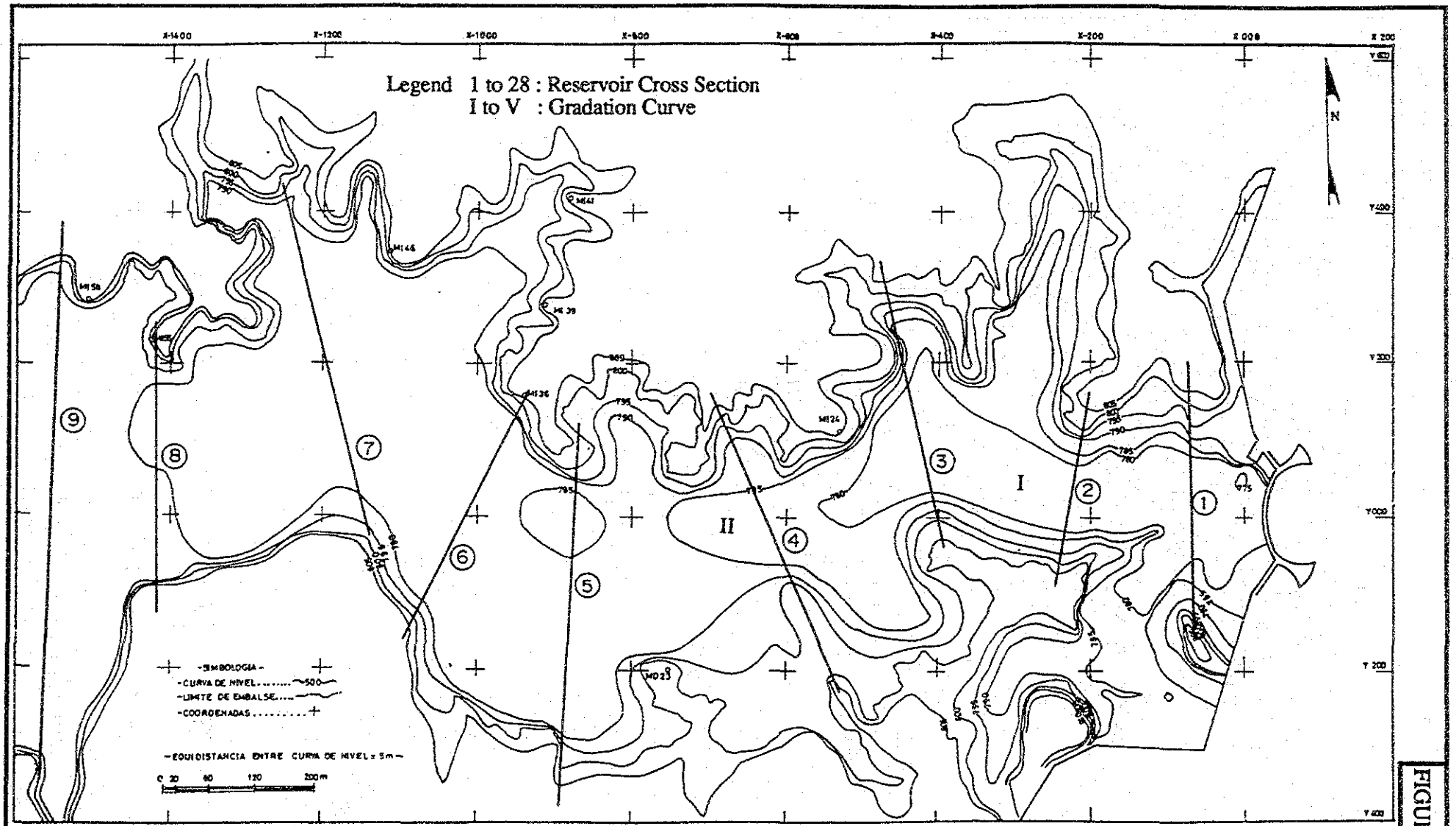

GEOLOGICAL SECTION OF SOLEDAD RESERVOIR
Dam
SM-DH1 (S-2) S-1
SM-DH2 (S-6)
SM-DH3 (S-9)
SM-DH4 (S-11)
SM-DH5 (S-13)
S-4
S-5
S-8
S-10
S-12
S-14
S-15
El 800
El 801.5
El 803
Sediment surface
River bed (before dam construction)
Bolder
Volcanic breccia (Andesite)
Schist intensively fractured
Basalt intensively fractured
Legend
Clay (Arcilla)
Silt (Limo)
Sand (Arena)
Gravel (Gravel)

FIGURE 6.6

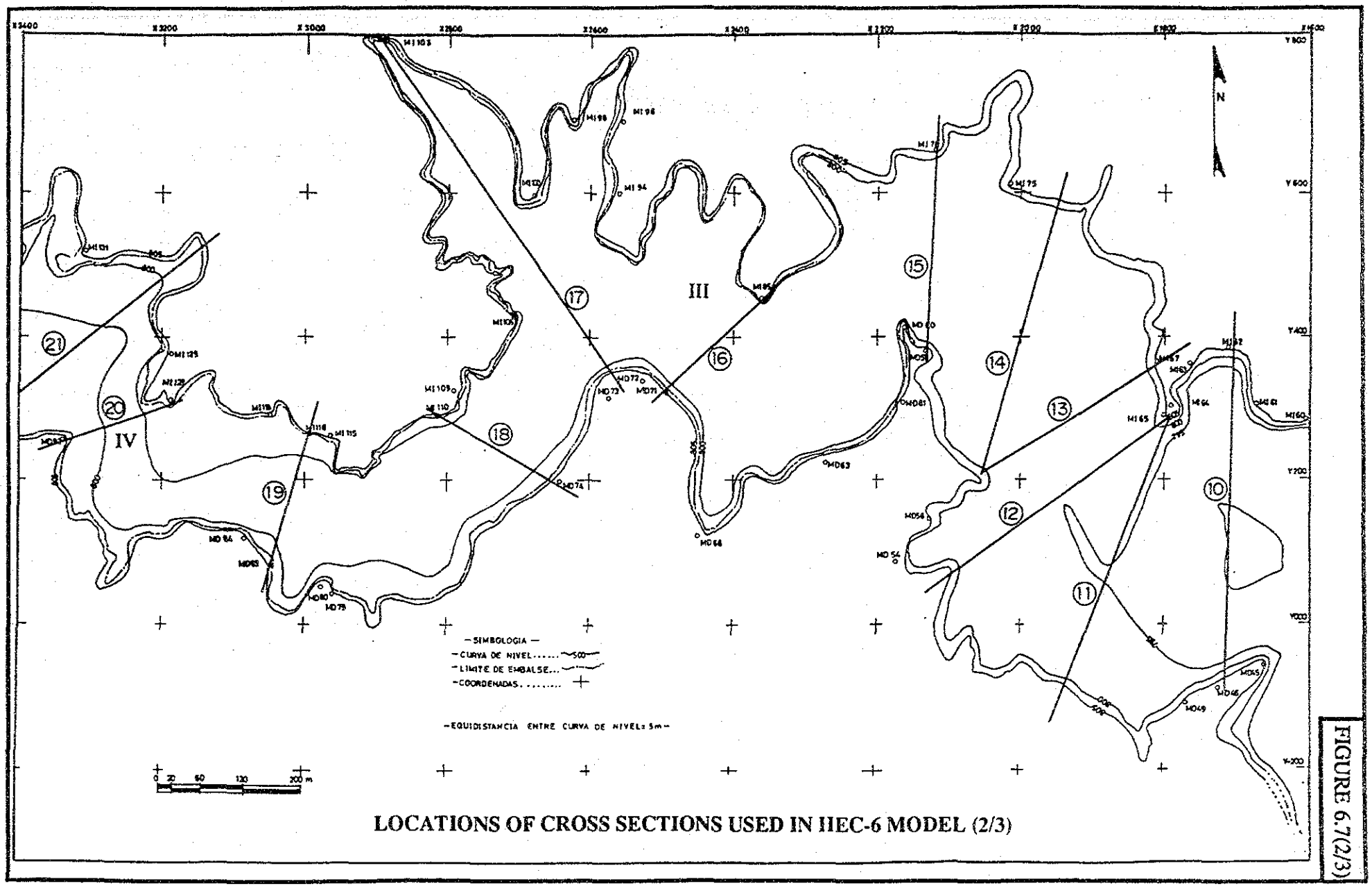


DENSITY-DEPTH RELATIONSHIP OF RESERVOIR SEDIMENT DEPOSIT



LOCATIONS OF CROSS SECTIONS USED IN HEC-6 MODEL (1/3)

FIGURE 6.7(1/3)



LOCATIONS OF CROSS SECTIONS USED IN HEC-6 MODEL (2/3)

FIGURE 6.7(2/3)

FIGURE 6.7(3/3)

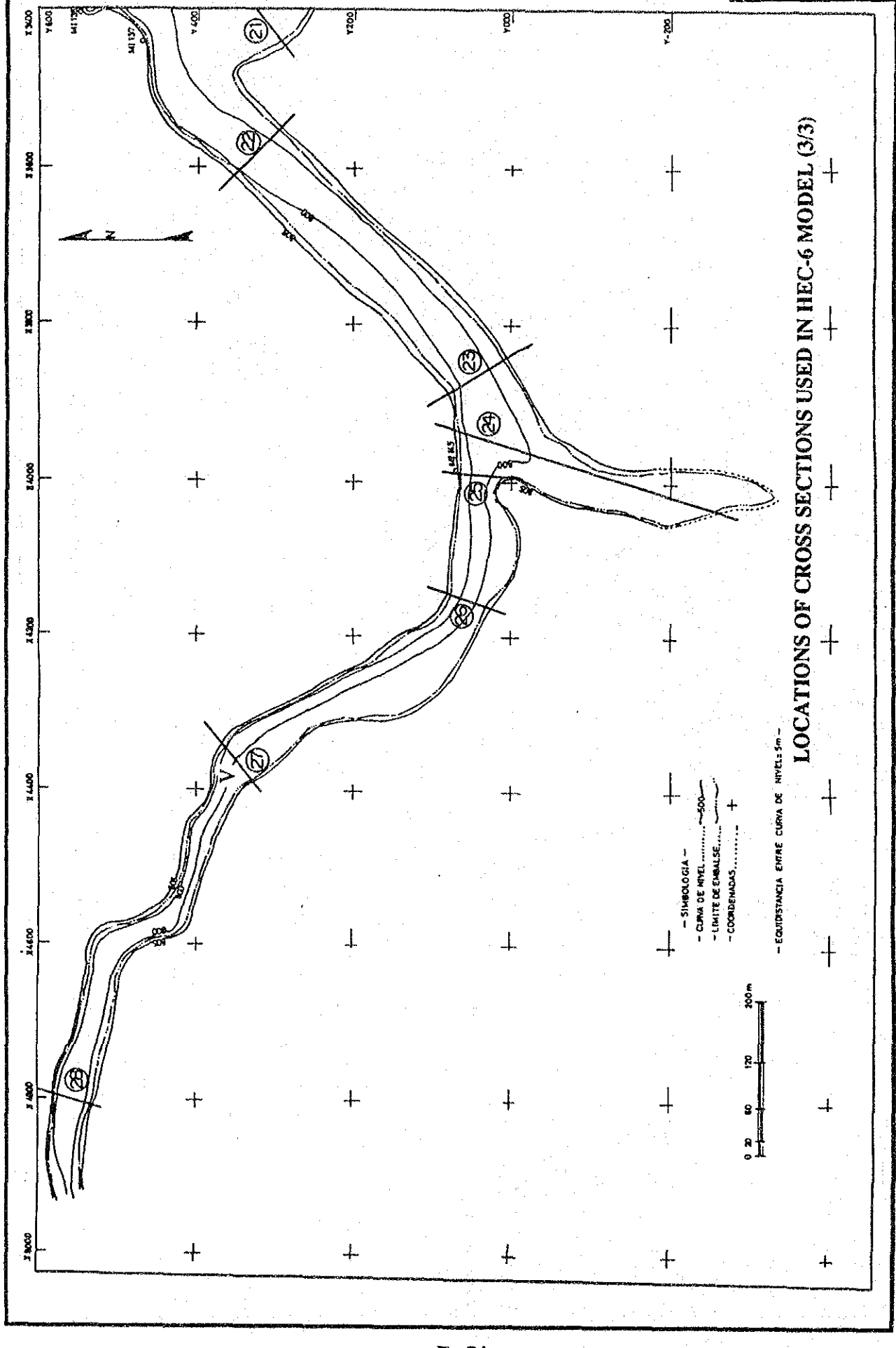
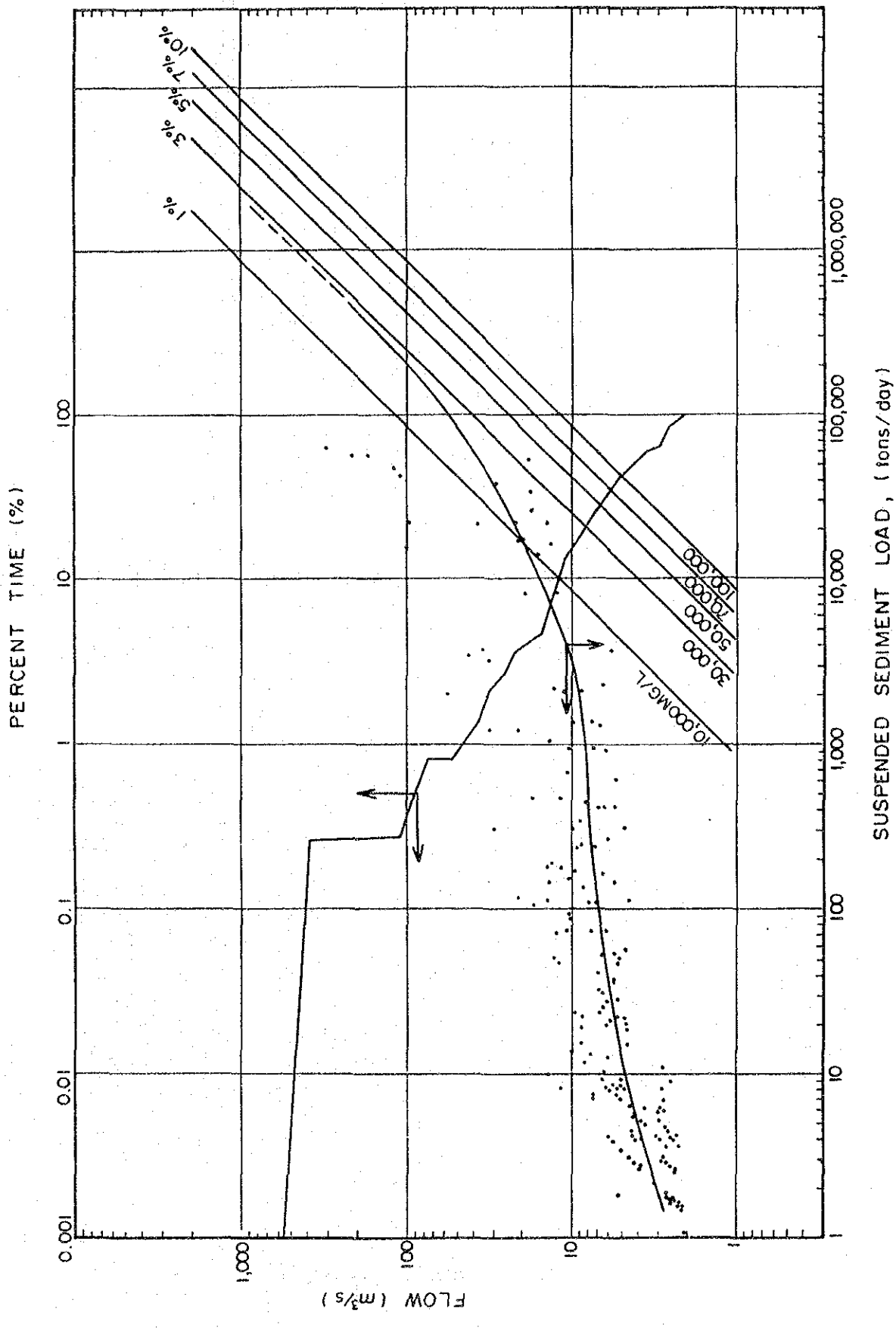
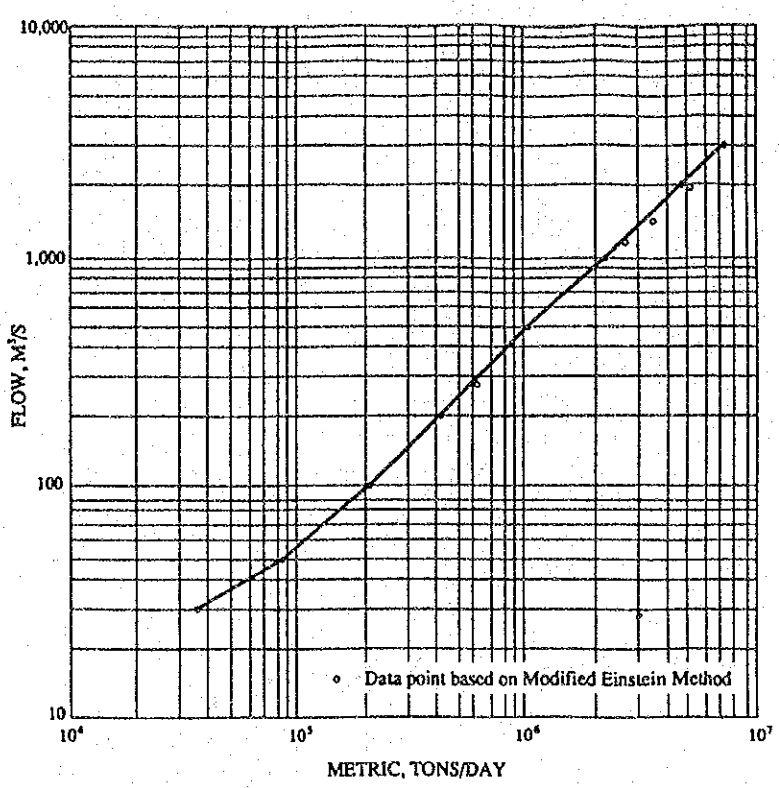

LOCATIONS OF CROSS SECTIONS USED IN HEC-6 MODEL (3/3)
- SIMBOLOGIA -
- CURVA DE NIVEL
- LIMITE DE EMBALSE
- COORDENADAS
- EQUIDISTANCIA ENTRE CURVA DE NIVEL: 5m -
0 20 60 120 200 m

FIGURE 6.8



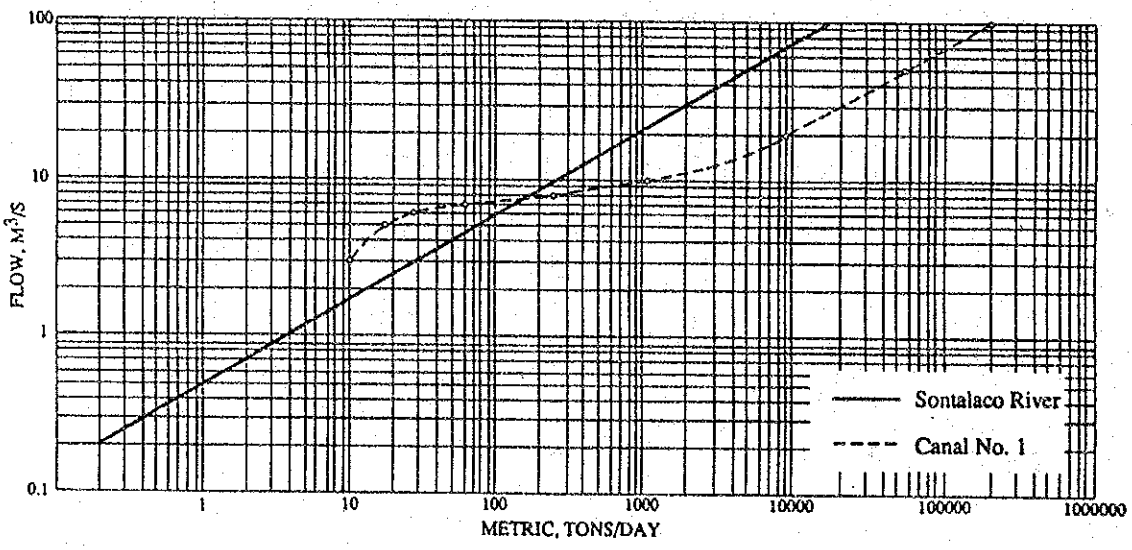
SEDIMENT RATING CURVE AT BUENOS AIRES

FIGURE 6.9

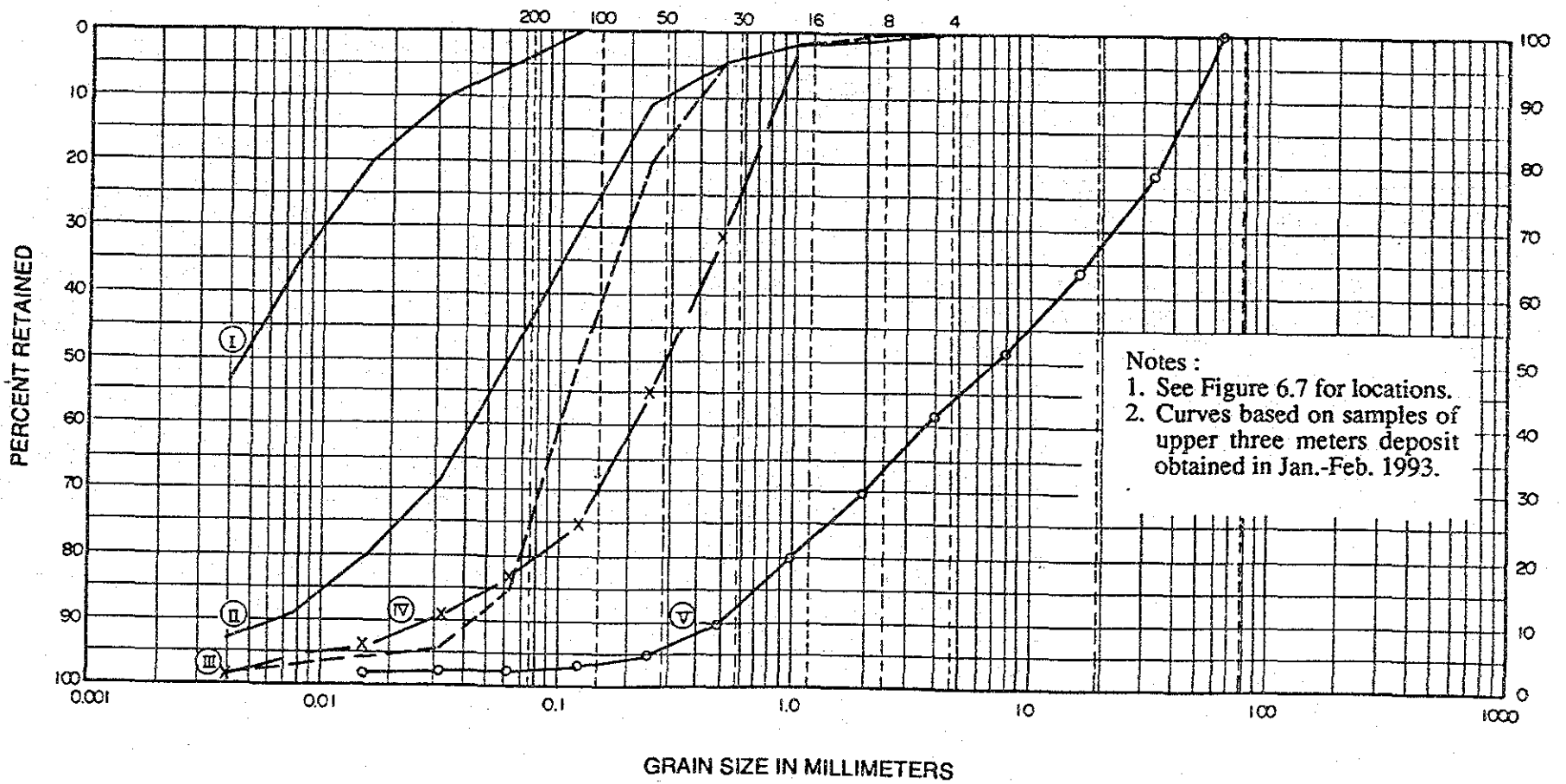


SEDIMENT RATING CURVE, APULCO RIVER AT BUENOS AIRES

FIGURE 6.10



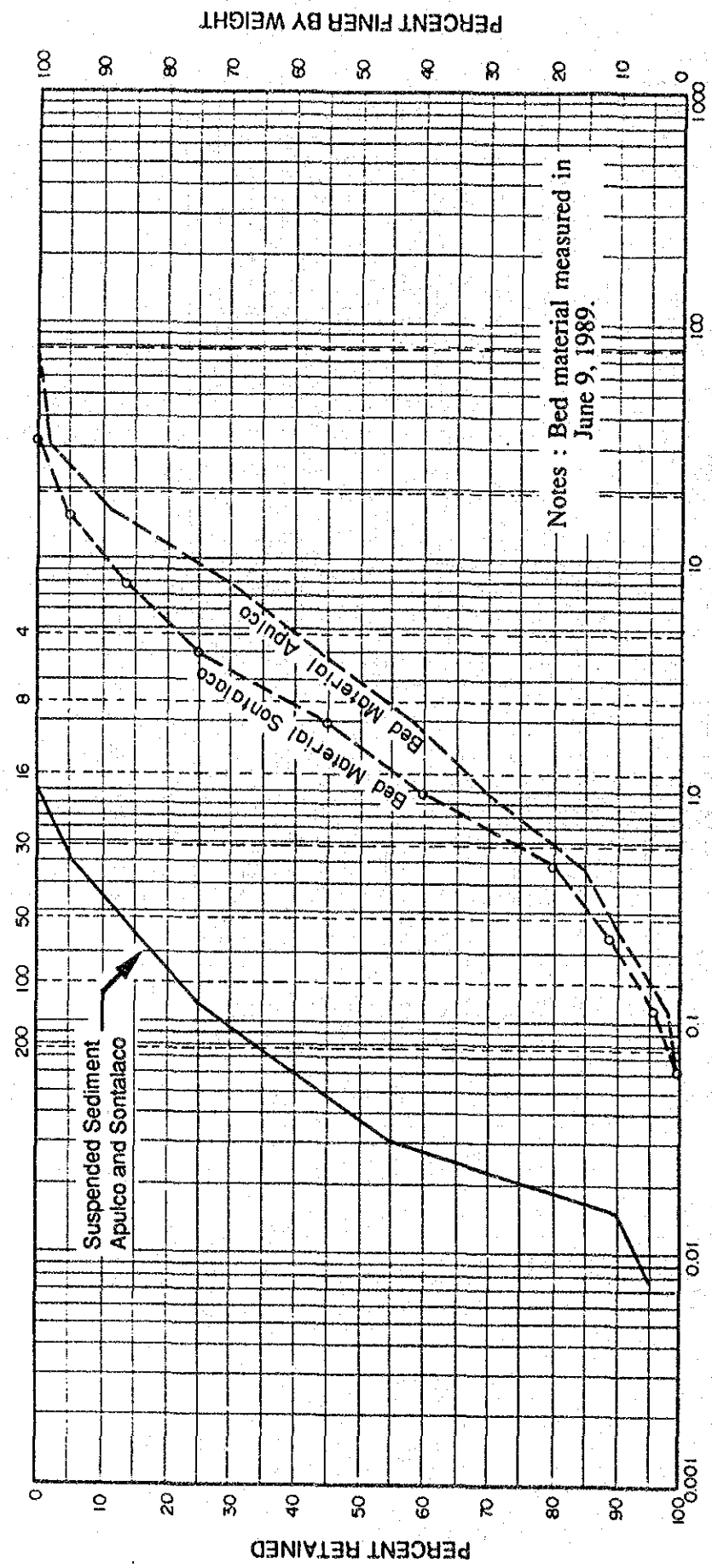
SEDIMENT RATING CURVE AT SONTALACO AND CANAL NO.1



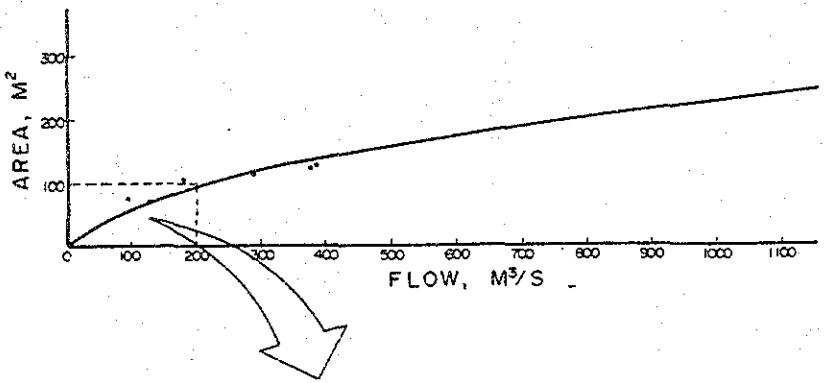
RESERVOIR BED MATERIAL PARTICLE SIZE DISTRIBUTION

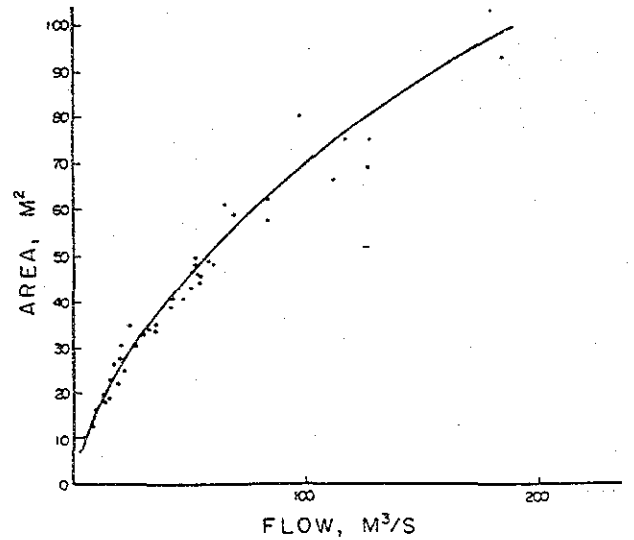
FIGURE 6.11

FIGURE 6.12

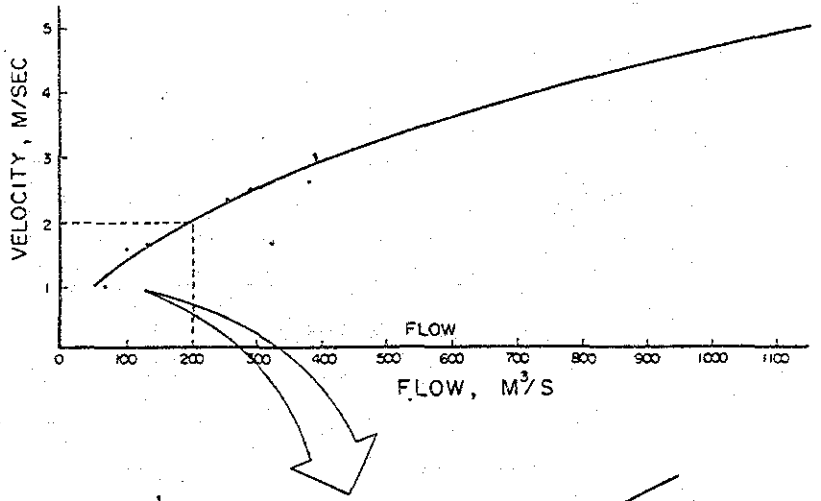


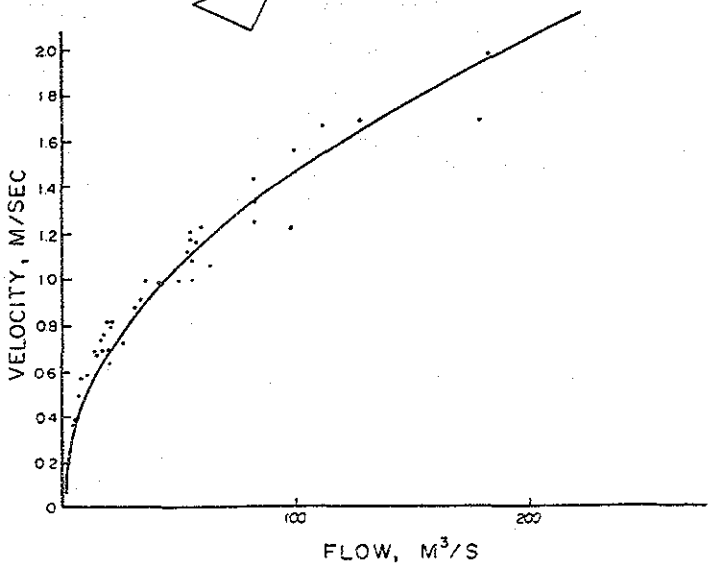
PARTICLE SIZE DISTRIBUTION CURVES





APULCO RIVER AT BUENOS AIRES FLOW-AREA RELATIONSHIP



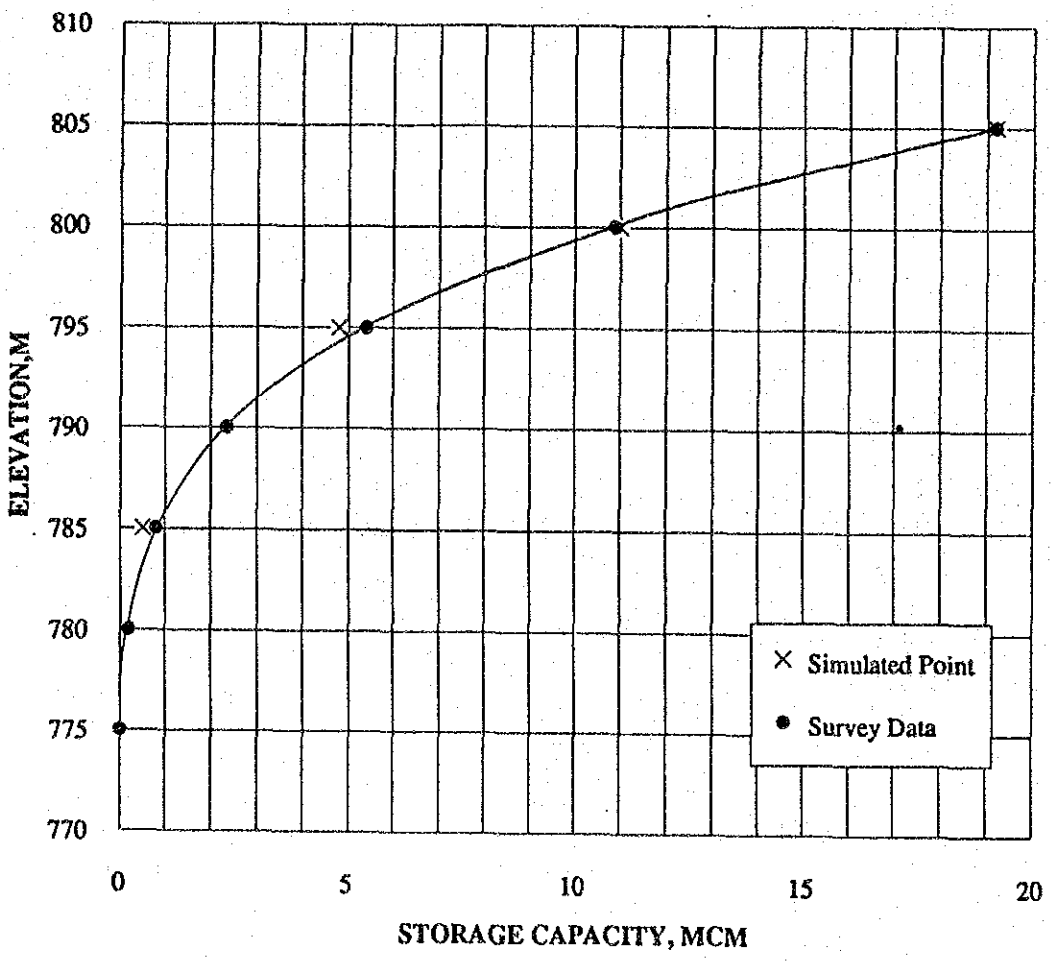


APULCO RIVER AT BUENOS AIRES FLOW-VELOCITY RELATIONSHIP

APULCO RIVER AT BUENOS AIRES FLOW-AREA-VELOCITY RELATIONSHIP

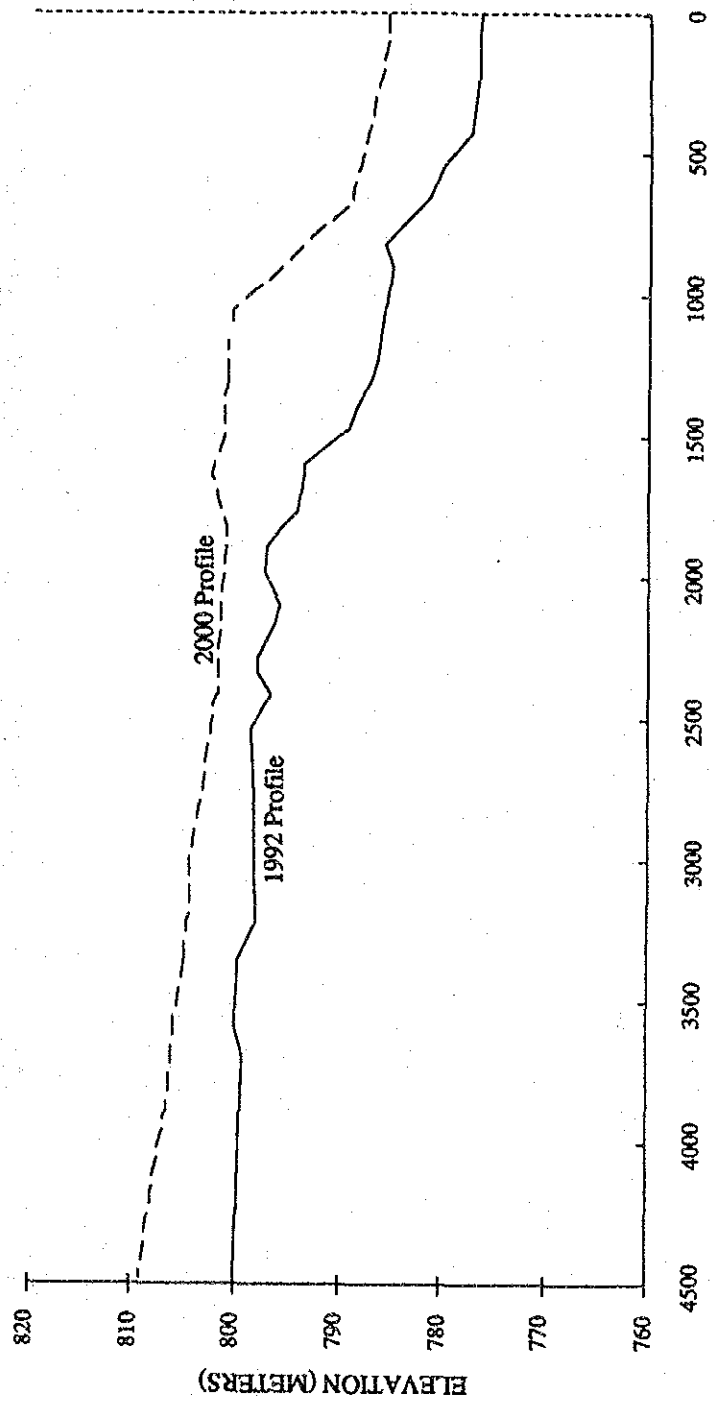
FIGURE 6.13

FIGURE 6.14



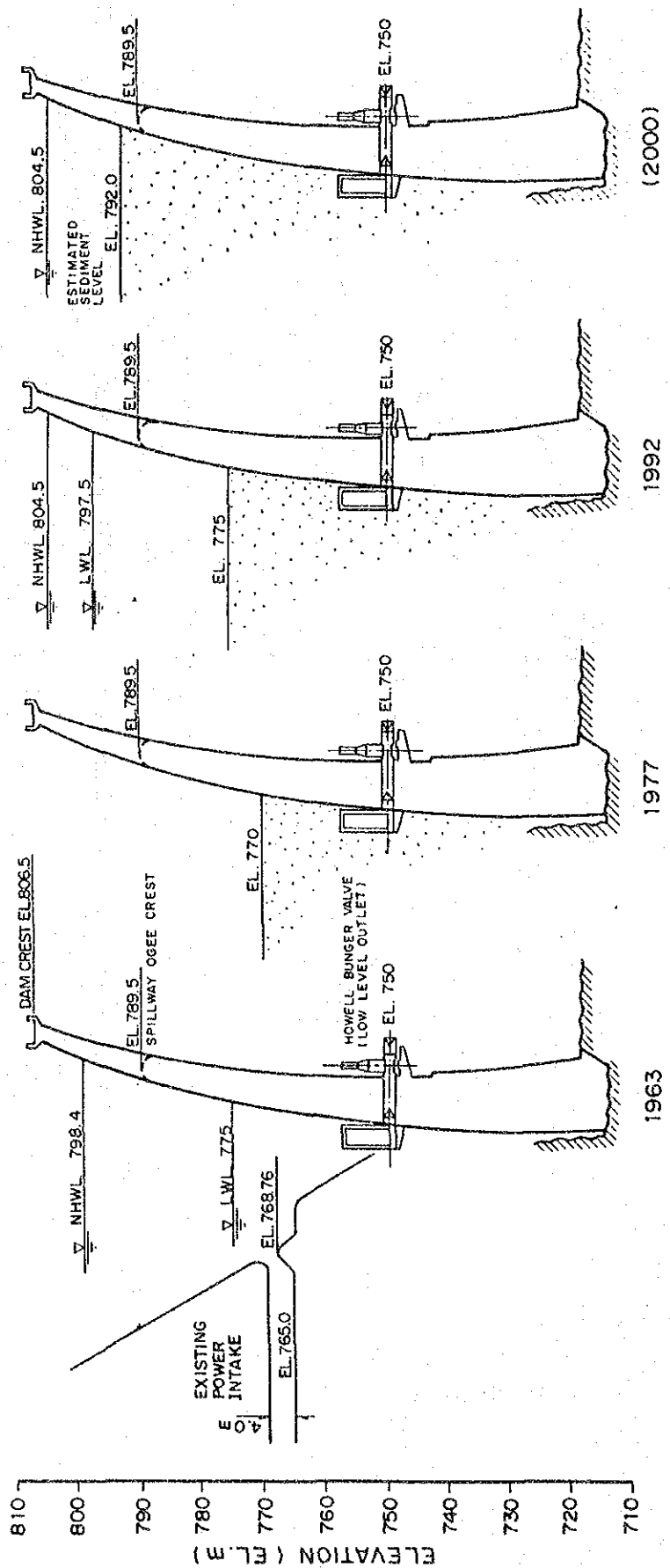
SOLEDAD RESERVOIR 1992 STORAGE-CAPACITY BY AREA-REDUCTION METHOD

FIGURE 6.15



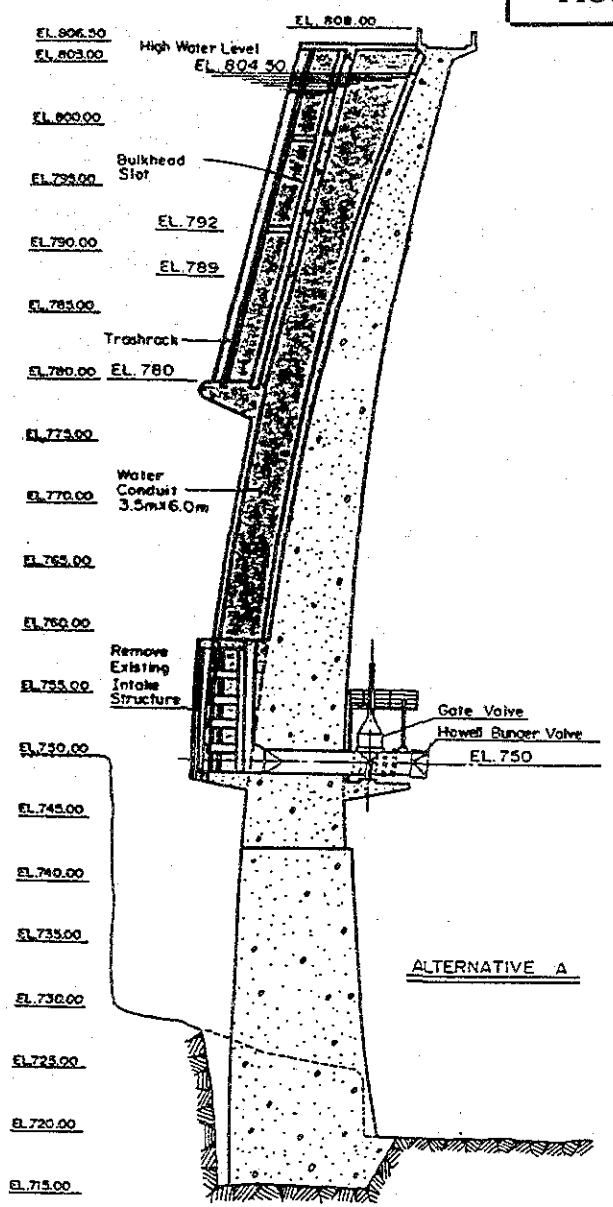
RESERVOIR BED PROFILES BY HEC-6 MODEL

FIGURE 6.16



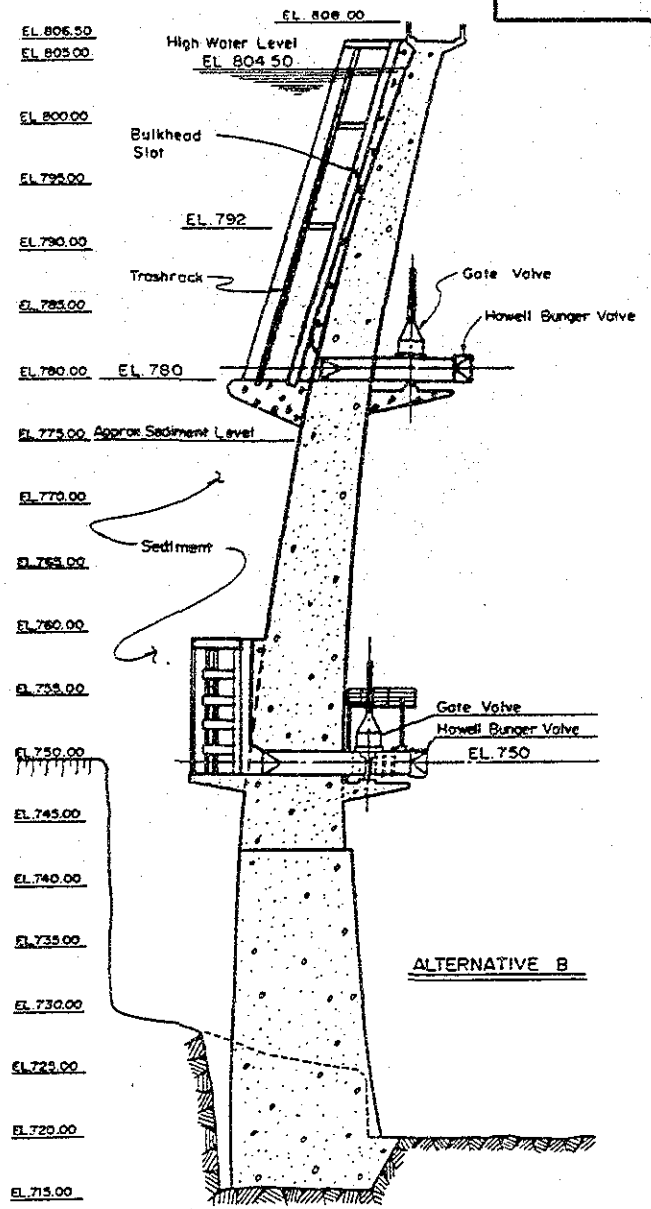
PROGRESS AND PREDICTION OF RESERVOIR SEDIMENTATION

FIGURE 7.1



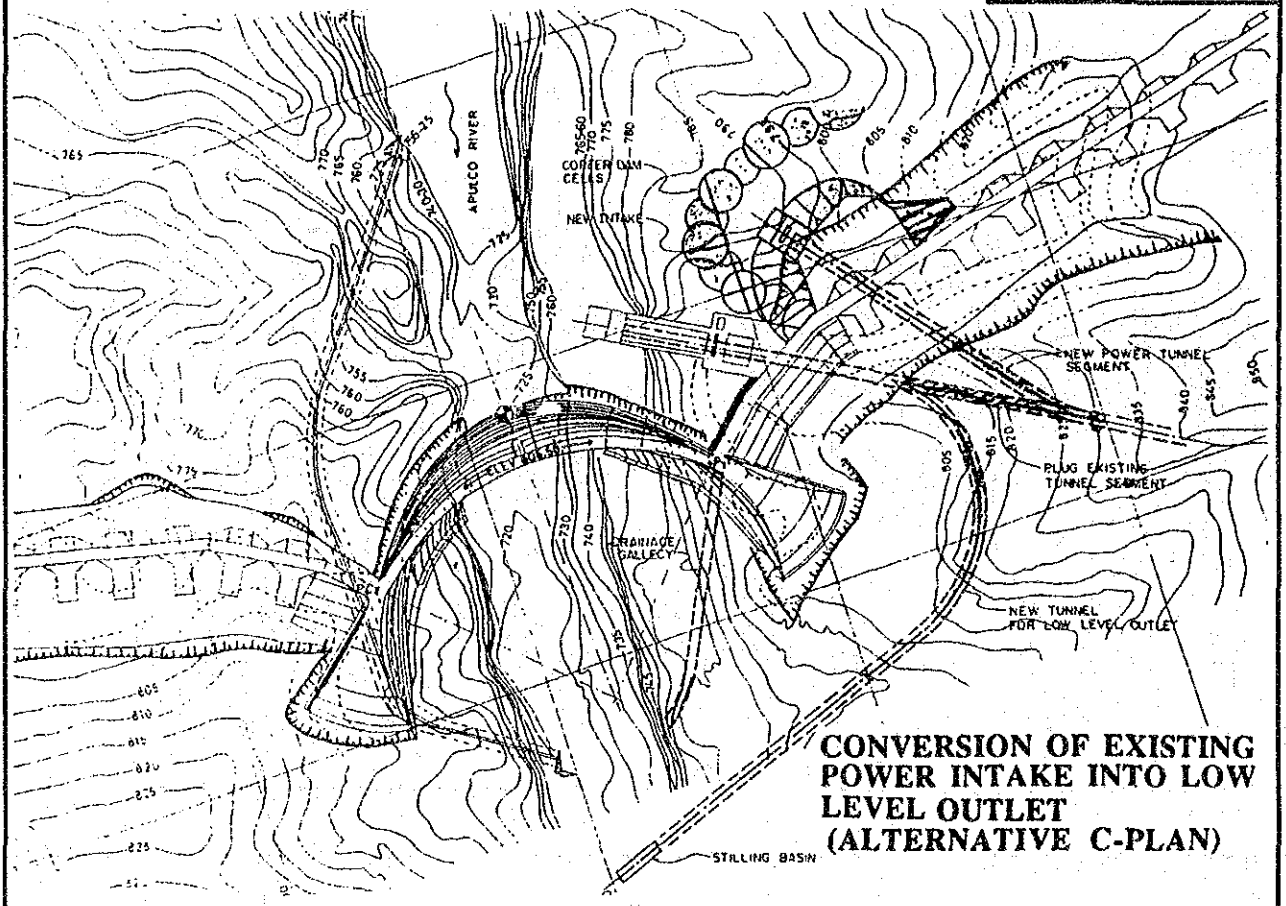
REHABILITATION OF LOW LEVEL OUTLET (ALTERNATIVE A)

FIGURE 7.2



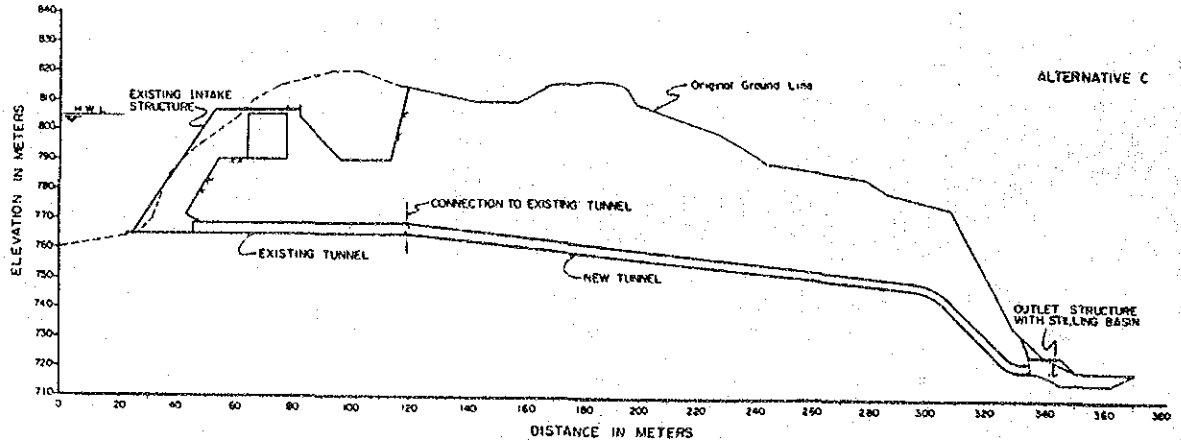
REHABILITATION OF LOW LEVEL OUTLET (ALTERNATIVE B)

FIGURE 7.3



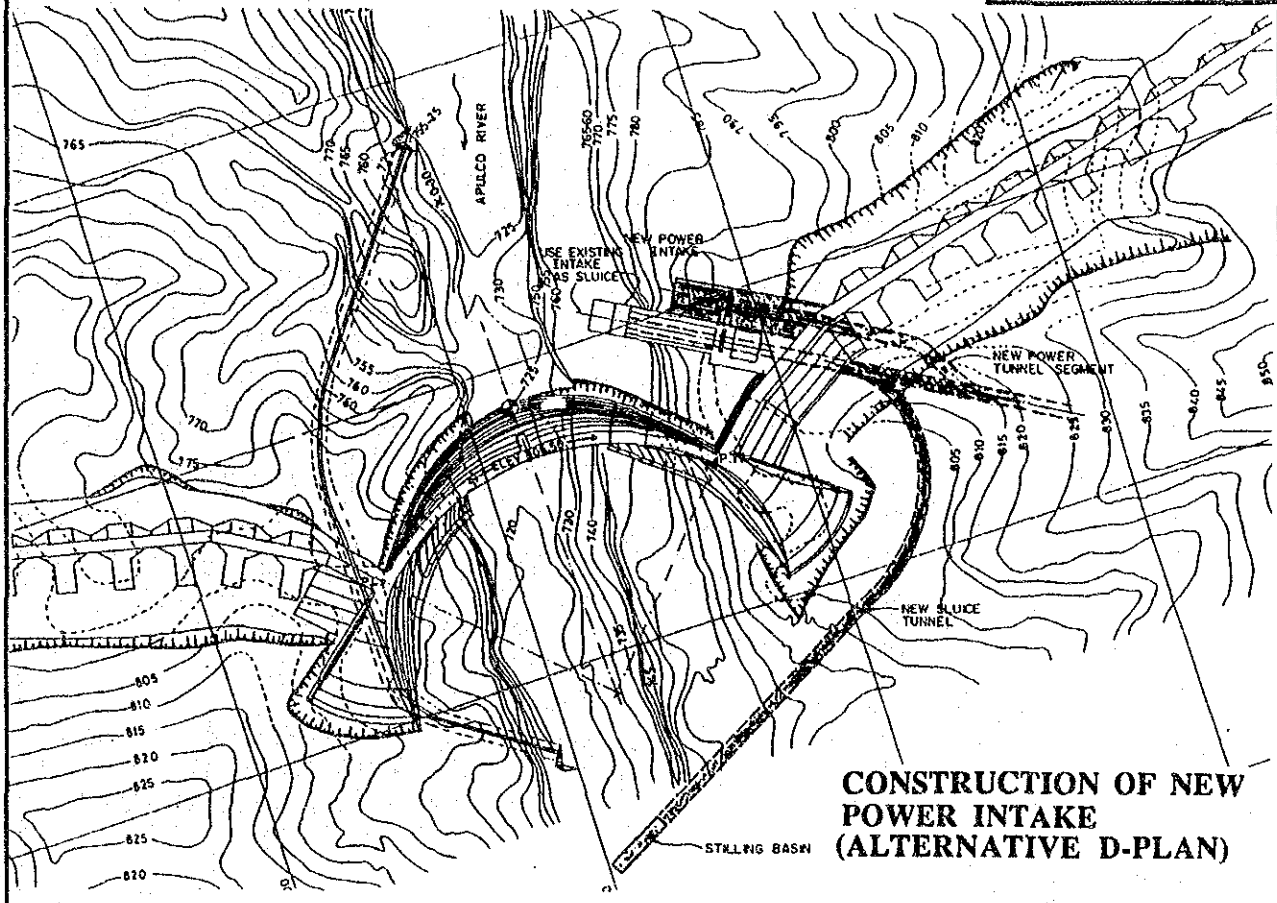
CONVERSION OF EXISTING POWER INTAKE INTO LOW LEVEL OUTLET (ALTERNATIVE C-PLAN)

FIGURE 7.4



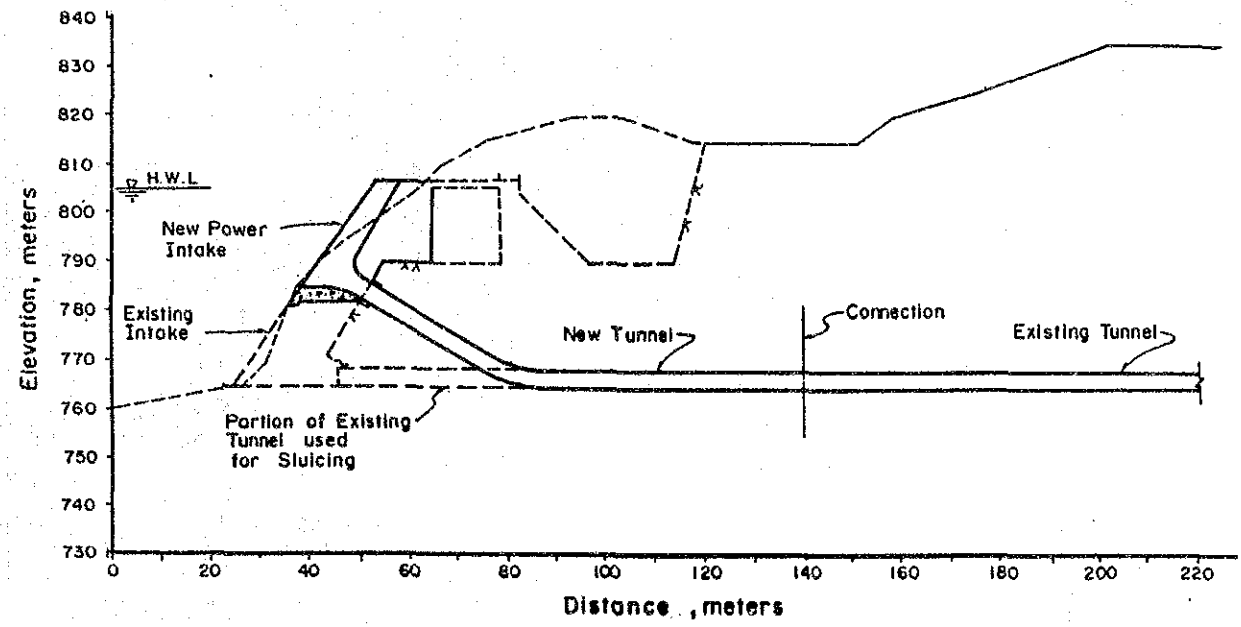
CONVERSION OF EXISTING POWER INTAKE INTO LOW LEVEL OUTLET (ALTERNATIVE C-PROFILE)

FIGURE 7.5



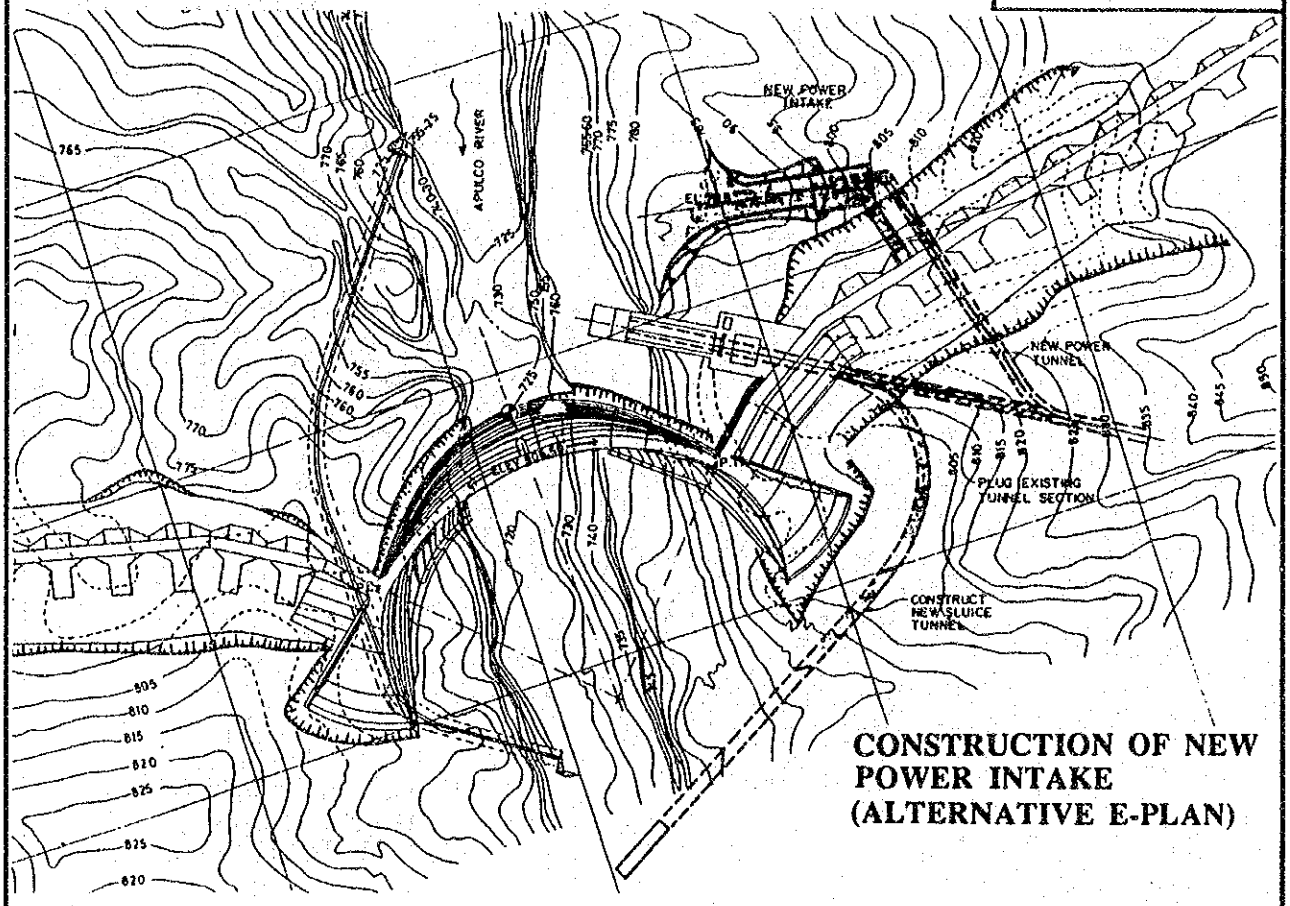
CONSTRUCTION OF NEW POWER INTAKE (ALTERNATIVE D-PLAN)

FIGURE 7.6



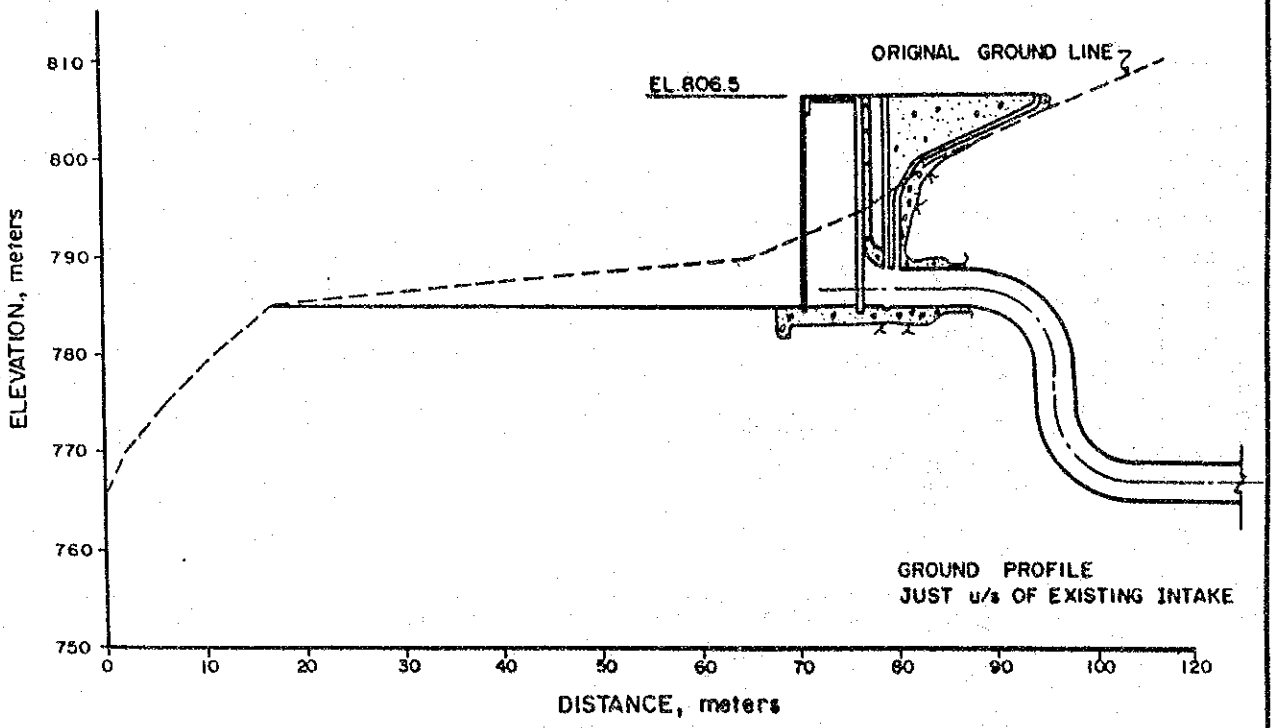
CONSTRUCTION OF NEW POWER INTAKE (ALTERNATIVE D-PROFILE)

FIGURE 7.7



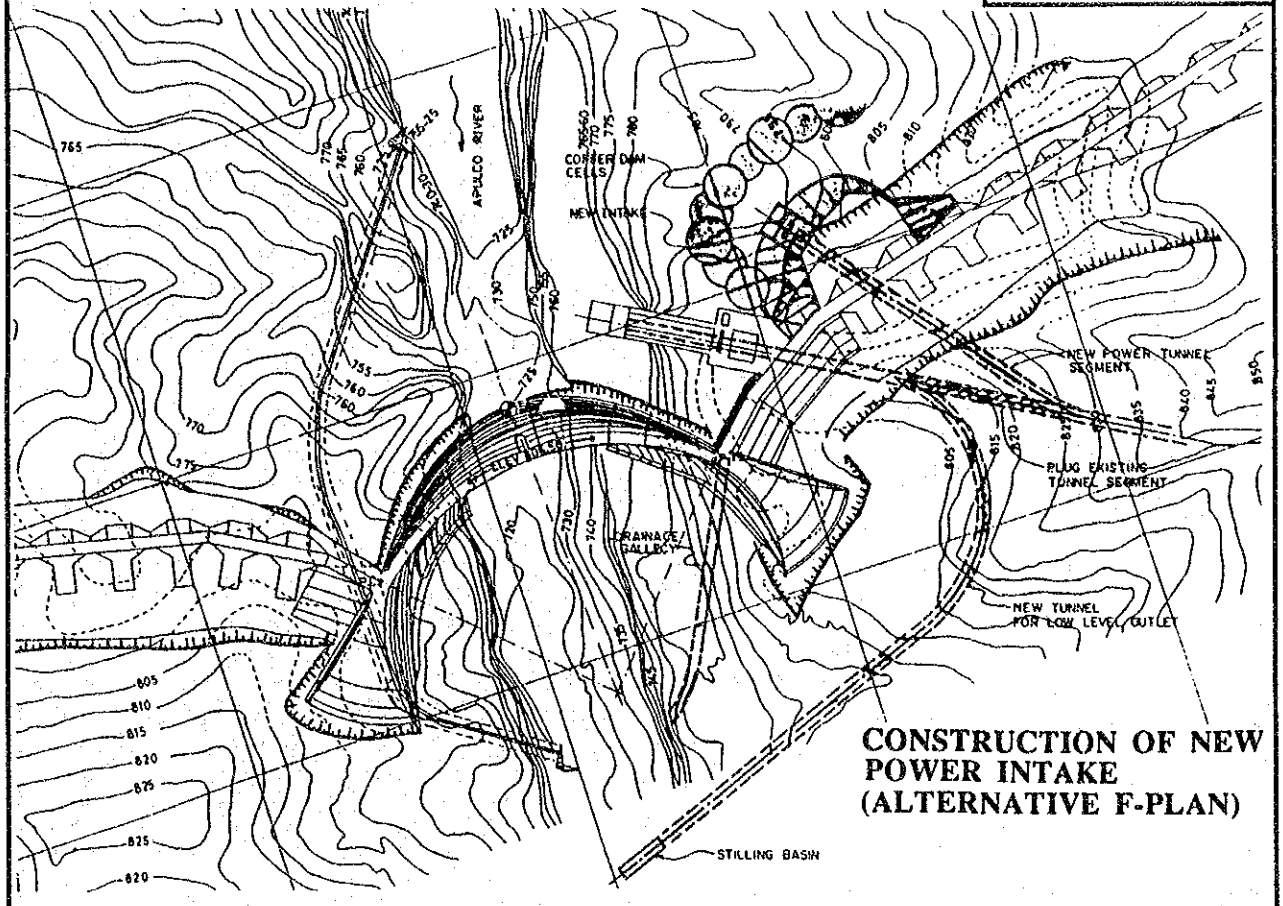
CONSTRUCTION OF NEW POWER INTAKE (ALTERNATIVE E-PLAN)

FIGURE 7.8



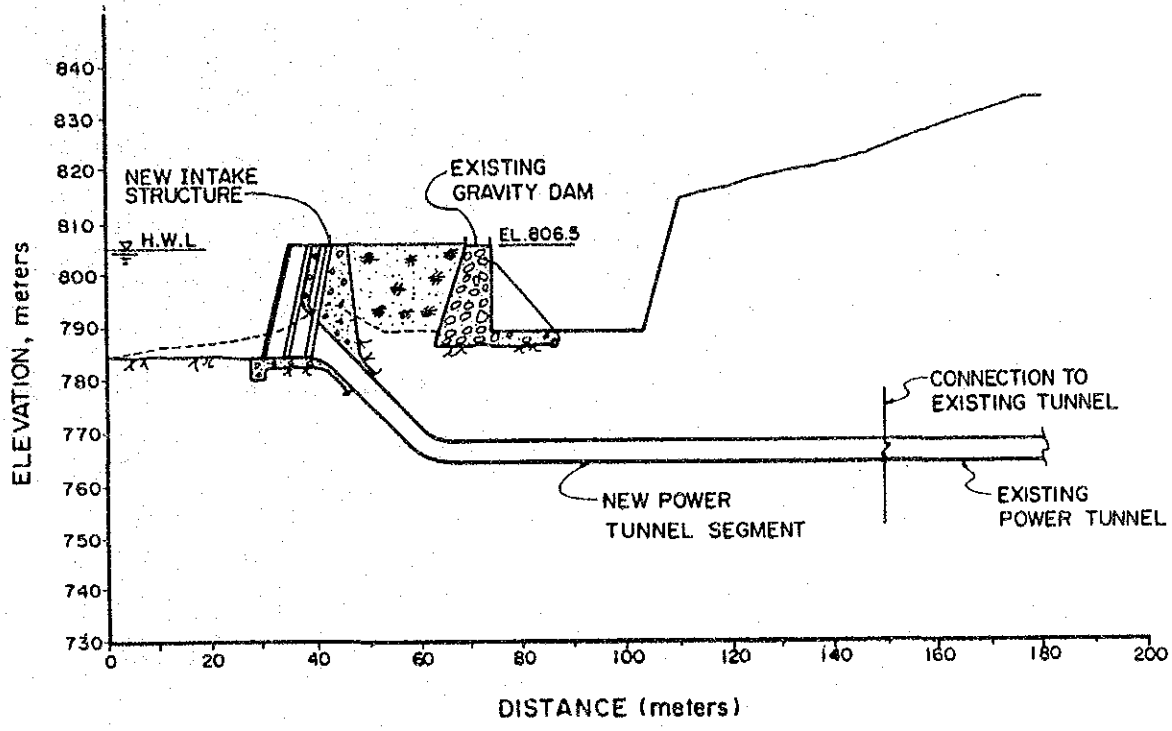
CONSTRUCTION OF NEW POWER INTAKE (ALTERNATIVE E-PROFILE)

FIGURE 7.9



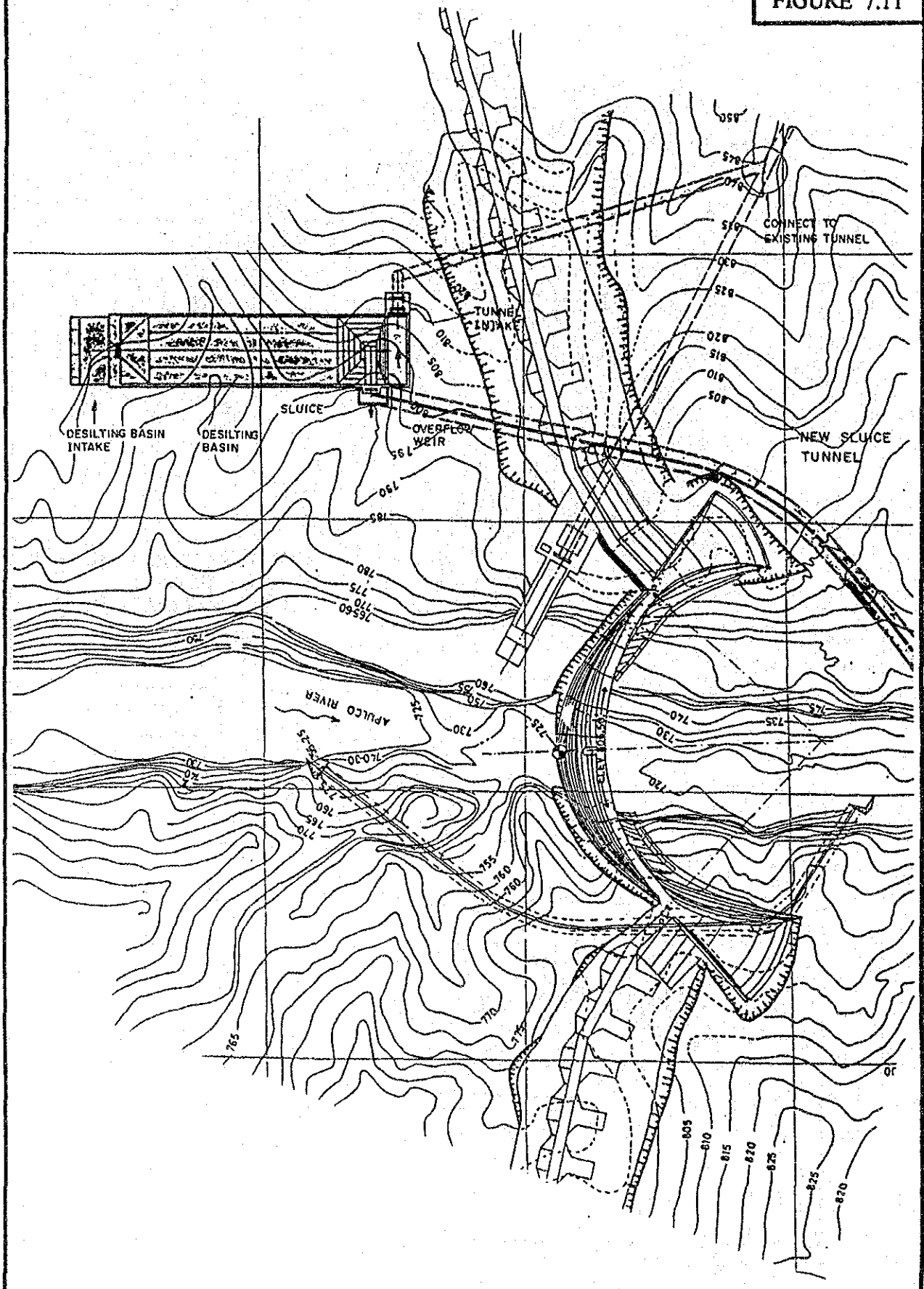
CONSTRUCTION OF NEW POWER INTAKE (ALTERNATIVE F-PLAN)

FIGURE 7.10

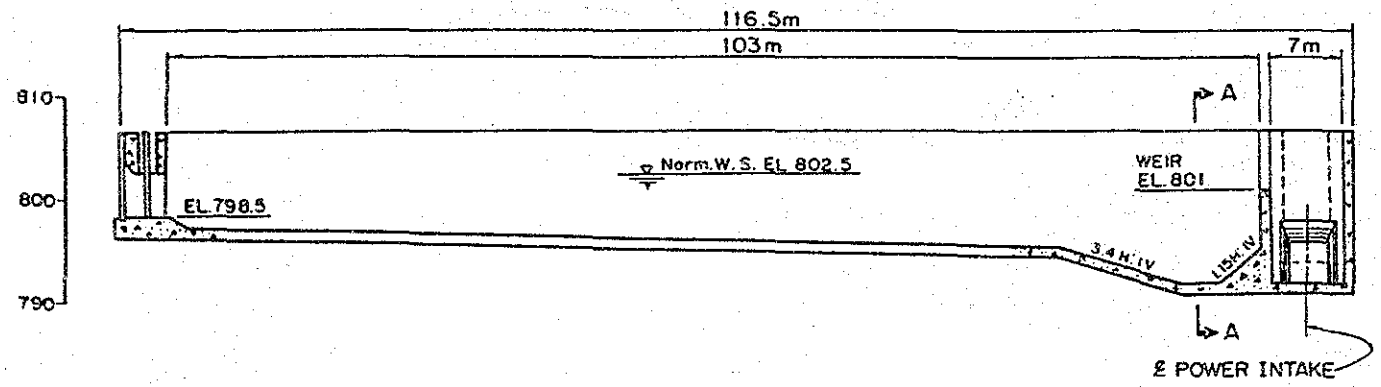


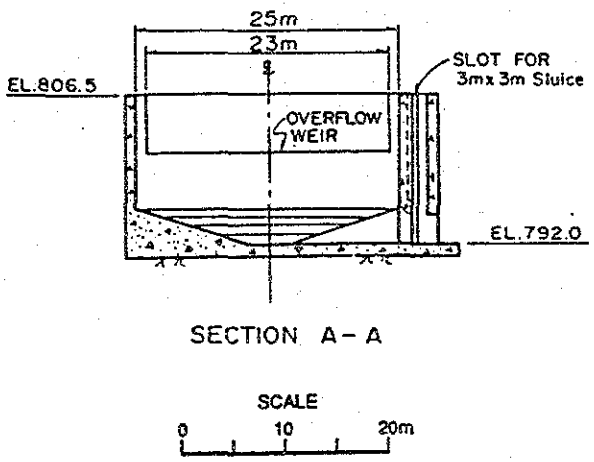
CUNSTRUCTION OF NEW POWER INTAKE (ALTERNATIVE F-PROFILE)

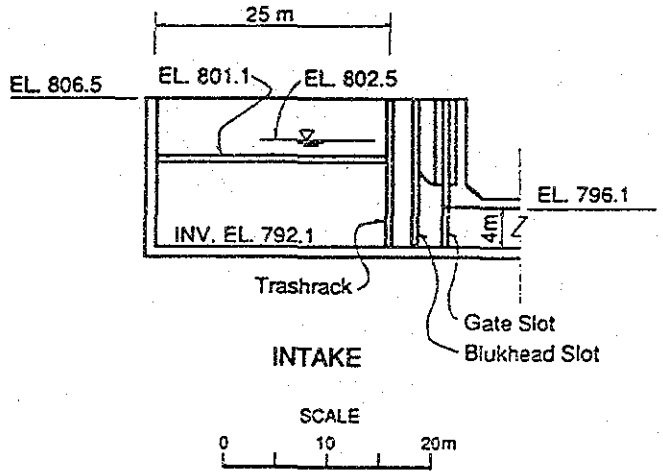
FIGURE 7.11



CONSTRUCTION OF SETTLING BASIN (ALTERNATIVE G-PLAN)





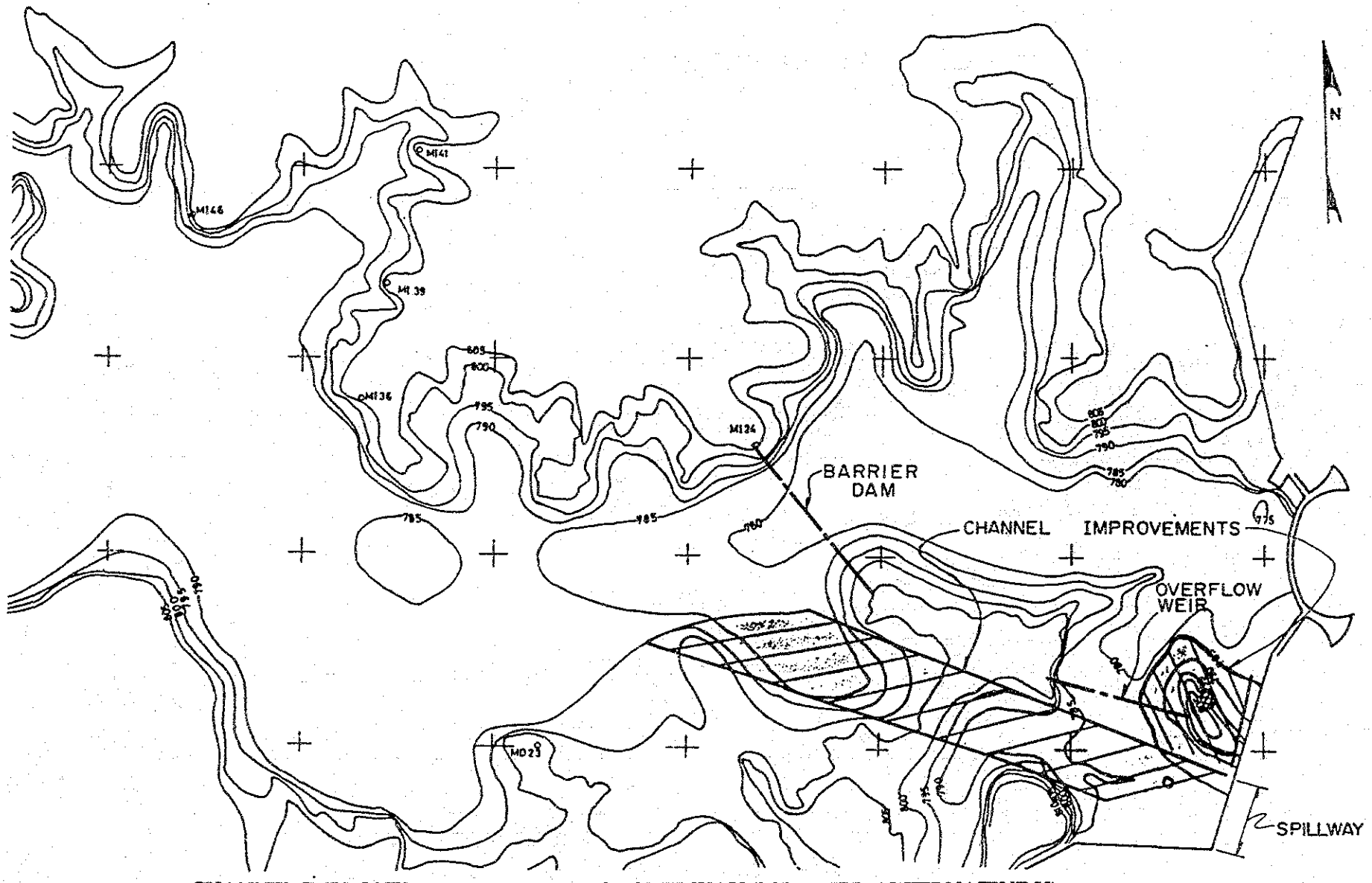


PRELIMINARY DESIGN FOR :

- Maximum Particle Size	:	0.5 mm
- Trap Efficiency for 0.5 mm	:	95%
- Annual Inflow	:	555 x 10^6 m^3/yr
- Total Sediment Inflow	:	122,000 tons/yr
- Volume Retained	:	16,581 m^3/yr
- Basin Dimensions	:	25 m (W) x 103 m (L)
- Sediment Storage Capacity below El. 798.5 m	:	6,550 m^3

CONSTRUCTION OF SETTLING BASIN (ALTERNATIVE G-PROFILE)

FIGURE 7.12



CHANNEL IMPROVEMENT UPSTREAM OF SPILLWAY (MODIFIED ALTERNATIVE H)

FIGURE 7.13

FIGURE 7.14

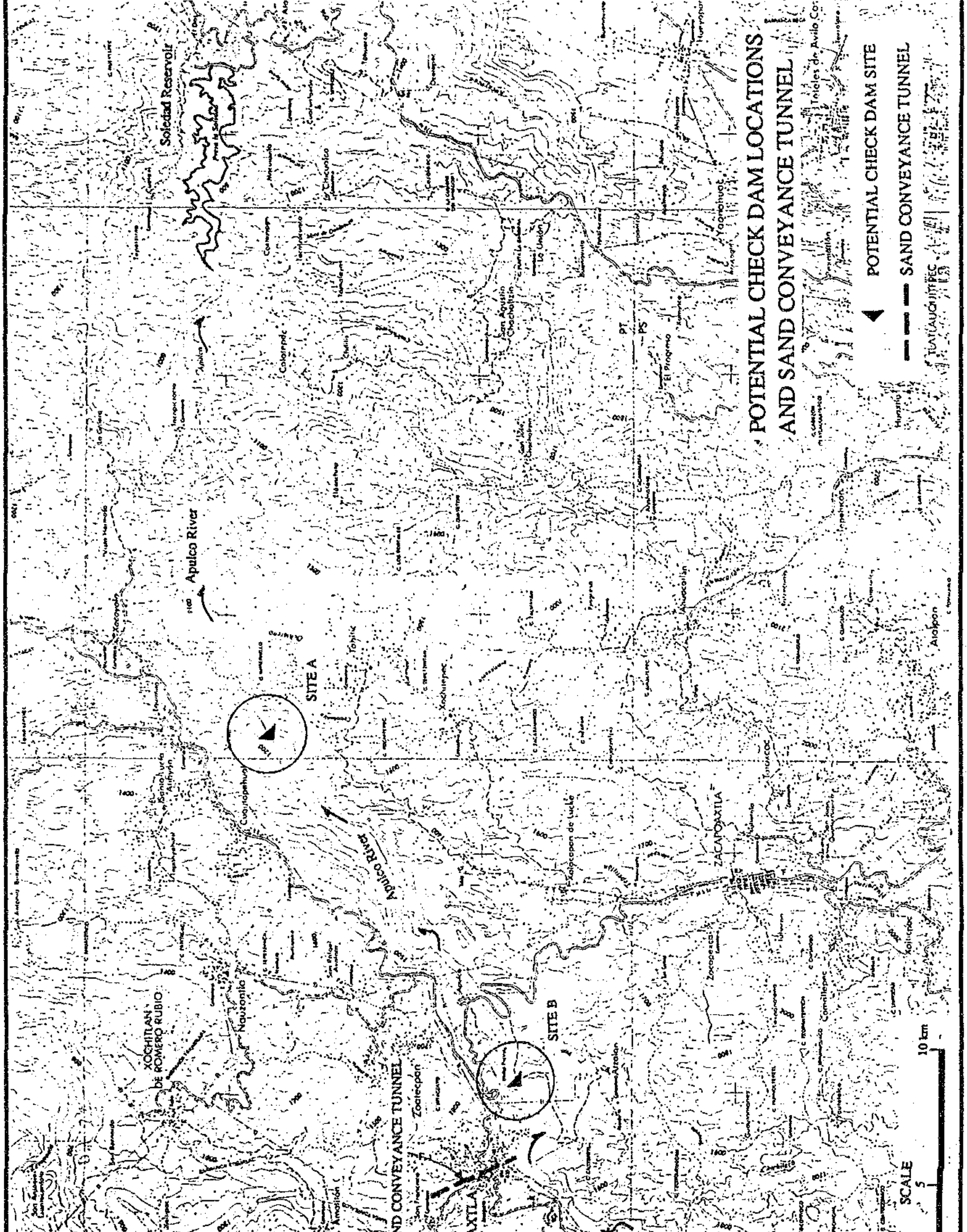
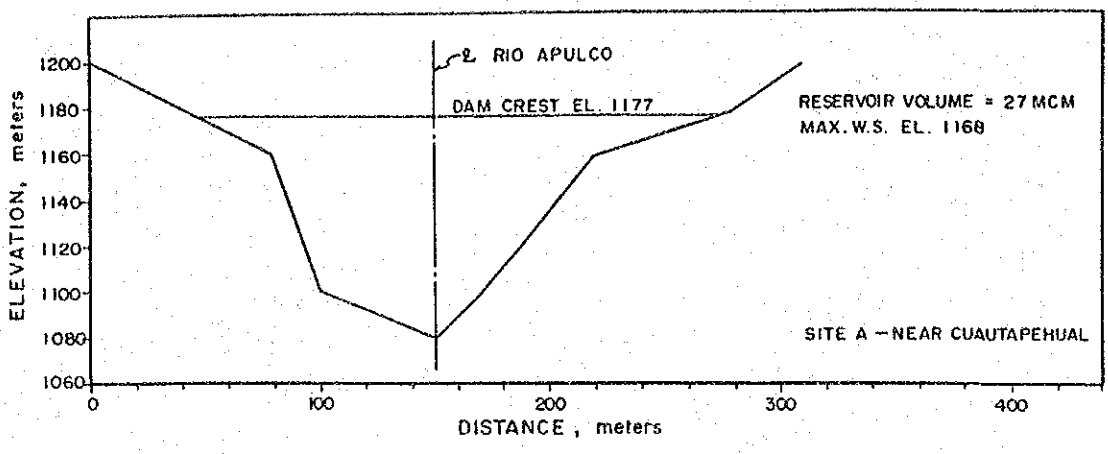
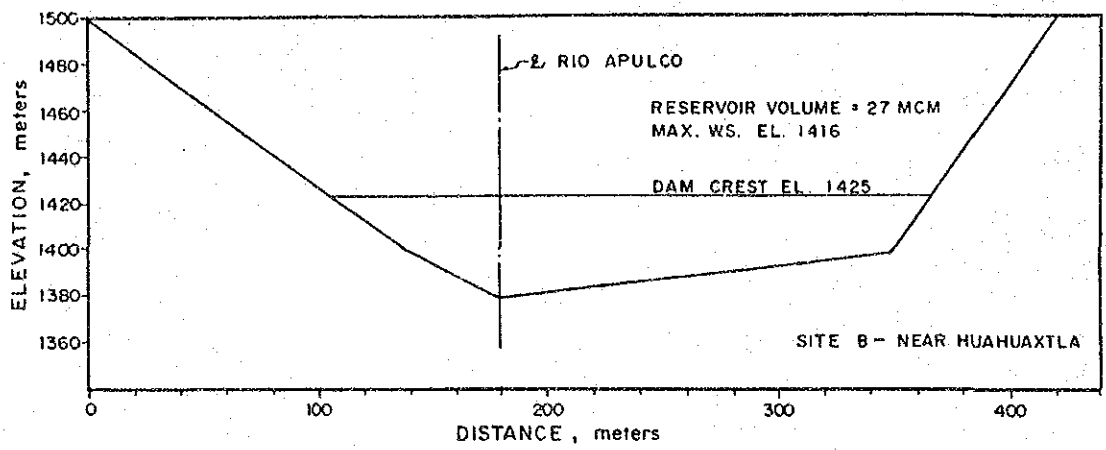
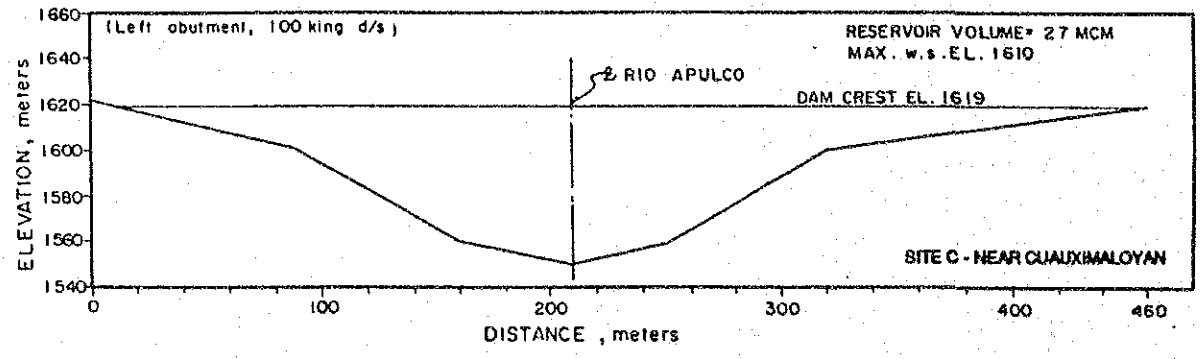

POTENTIAL CHECK DAM LOCATIONS
AND SAND CONVEYANCE TUNNEL
POTENTIAL CHECK DAM SITE
SAND CONVEYANCE TUNNEL
Soledad Reservoir
Apulco River
SITE A
SITE B
SITE C
XOCHITLAN DE ROMERO RUBIO
SAND CONVEYANCE TUNNEL
HUAHUAXTLA
ZACAPOAXTLA
Apulco River
Apulco River
SCALE
0
5
10 km

FIGURE 7.15



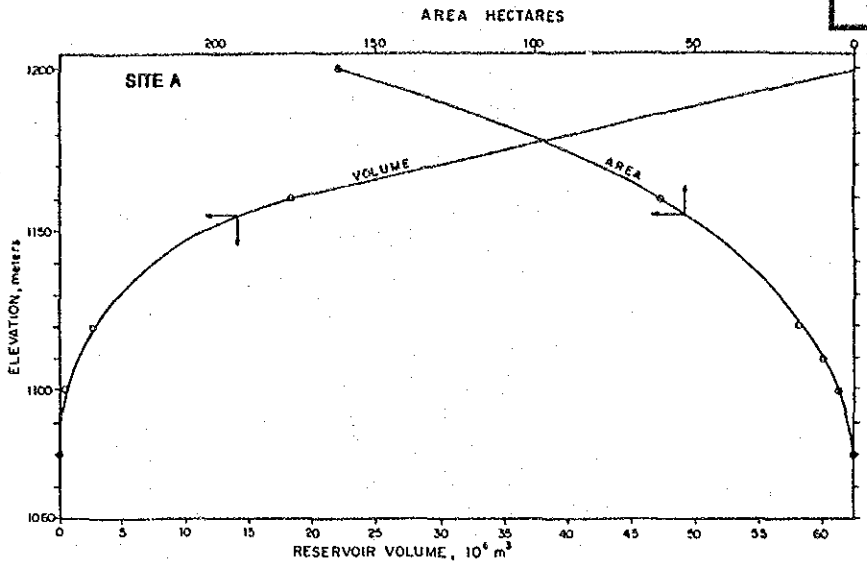


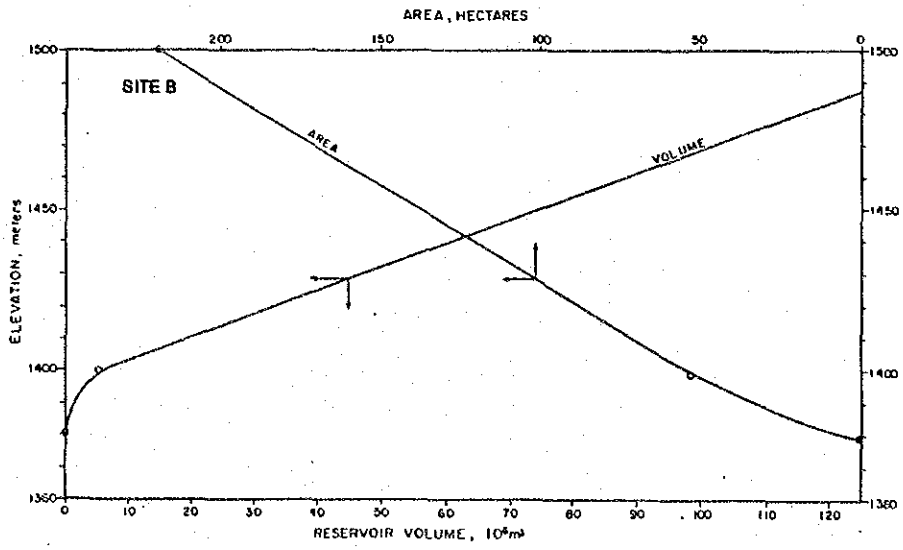


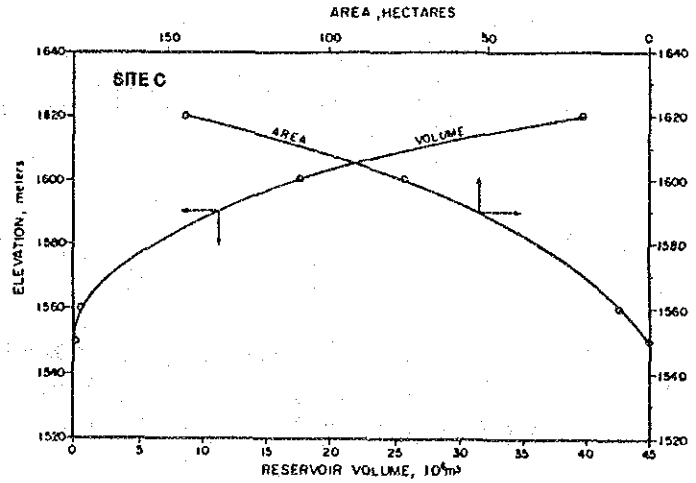
Note: '0' Distorce is left abutment

GRAND SURFACE PROFILES AT ALTERNATIVE CHECK DAM SITES

FIGURE 7.16

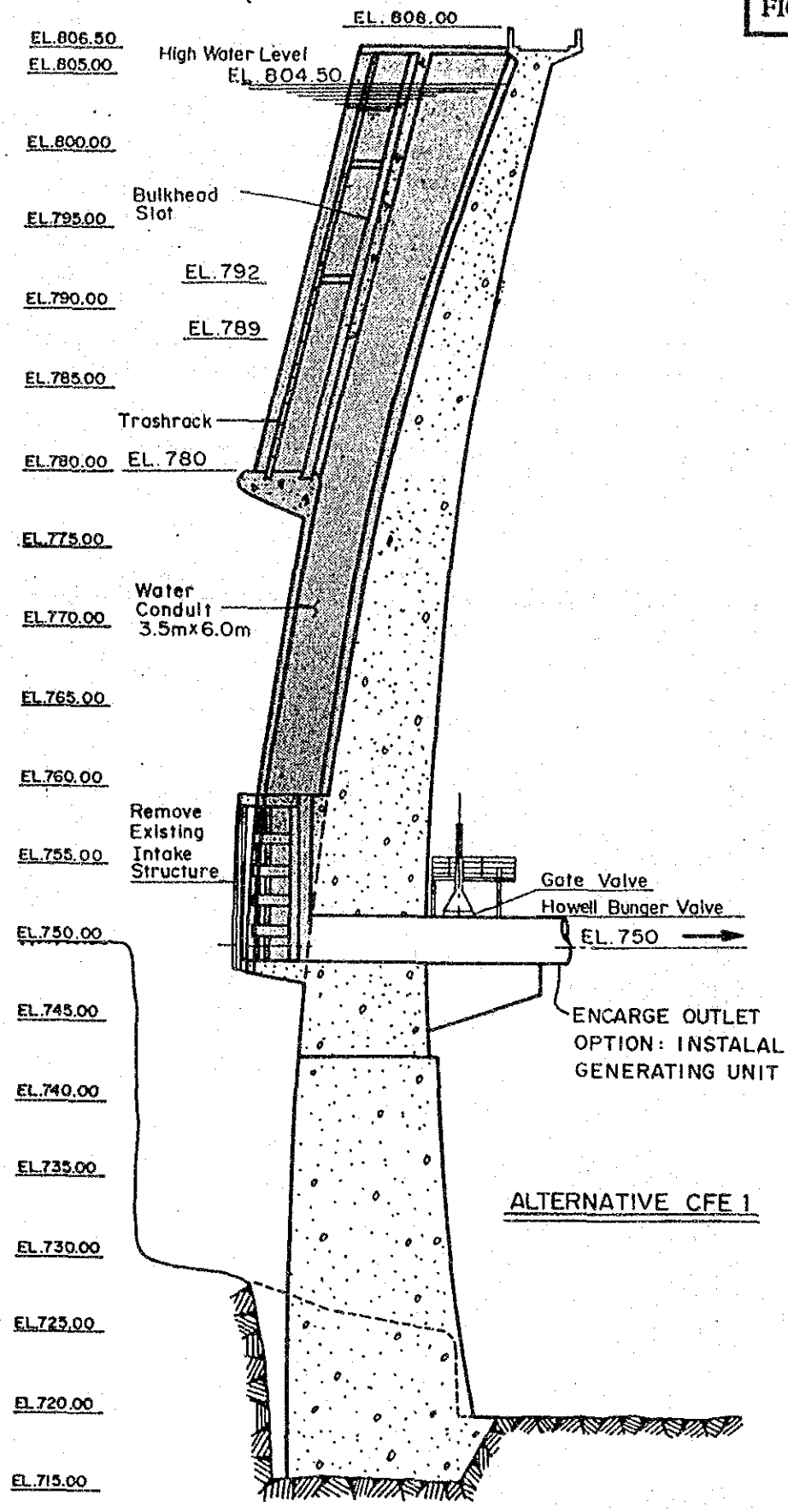






ELEVATION-AREA-VOLUME CURVES FOR CHECK DAM ALTERNATIVES

FIGURE 7.17



REHABILITATION OF LOW LEVEL OUTLET (ALTERNATIVE L)

FIGURE 7.18

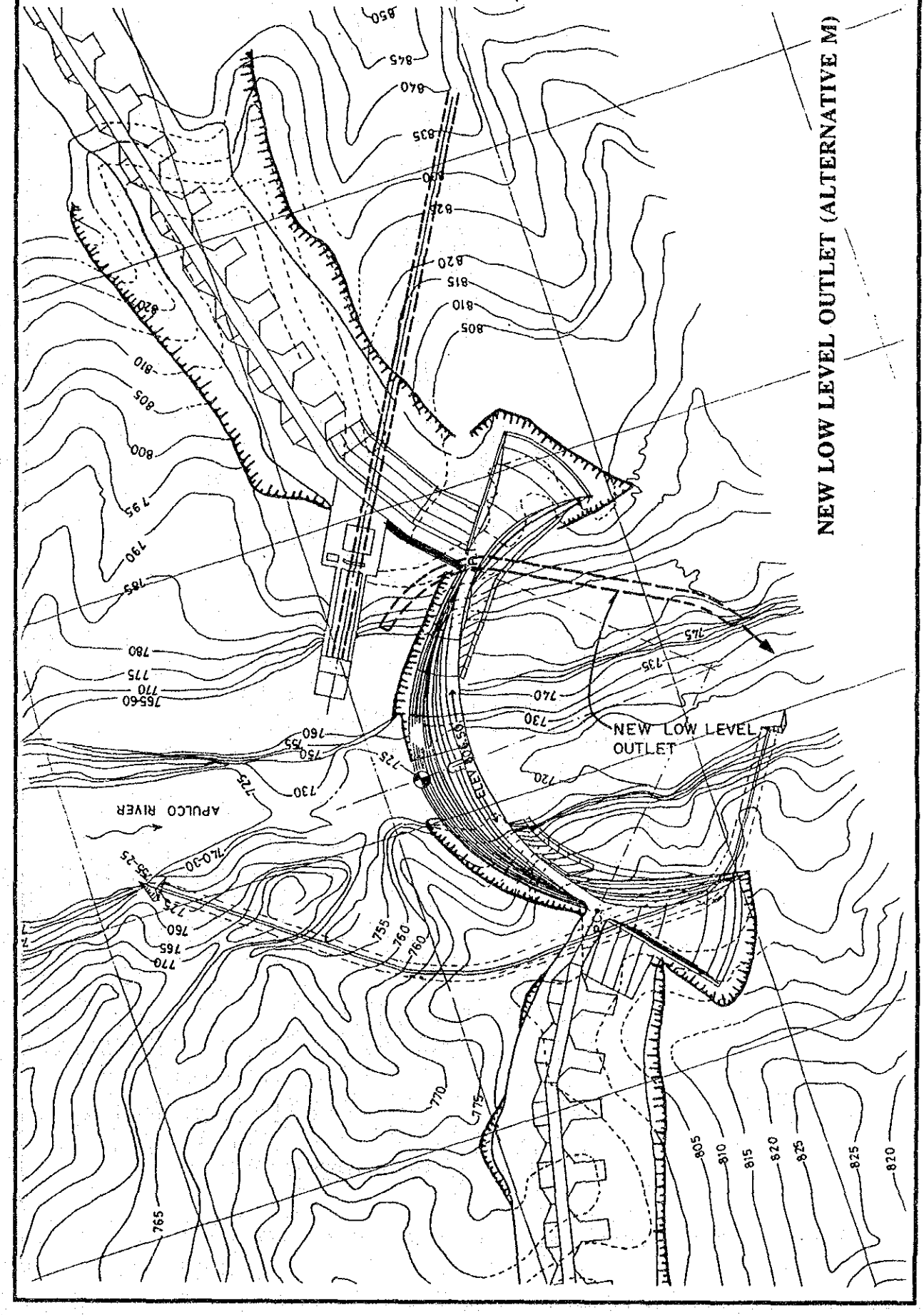
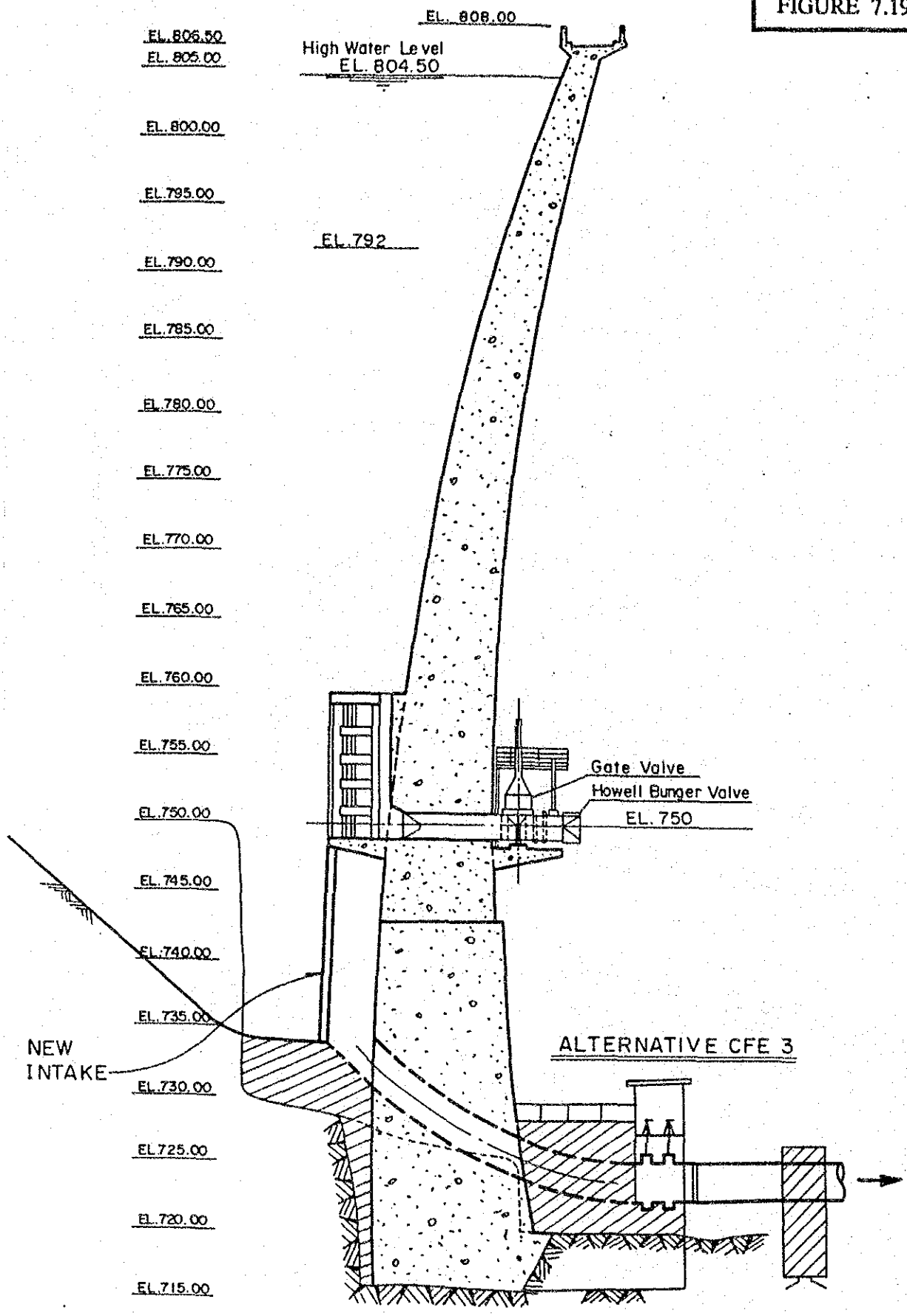
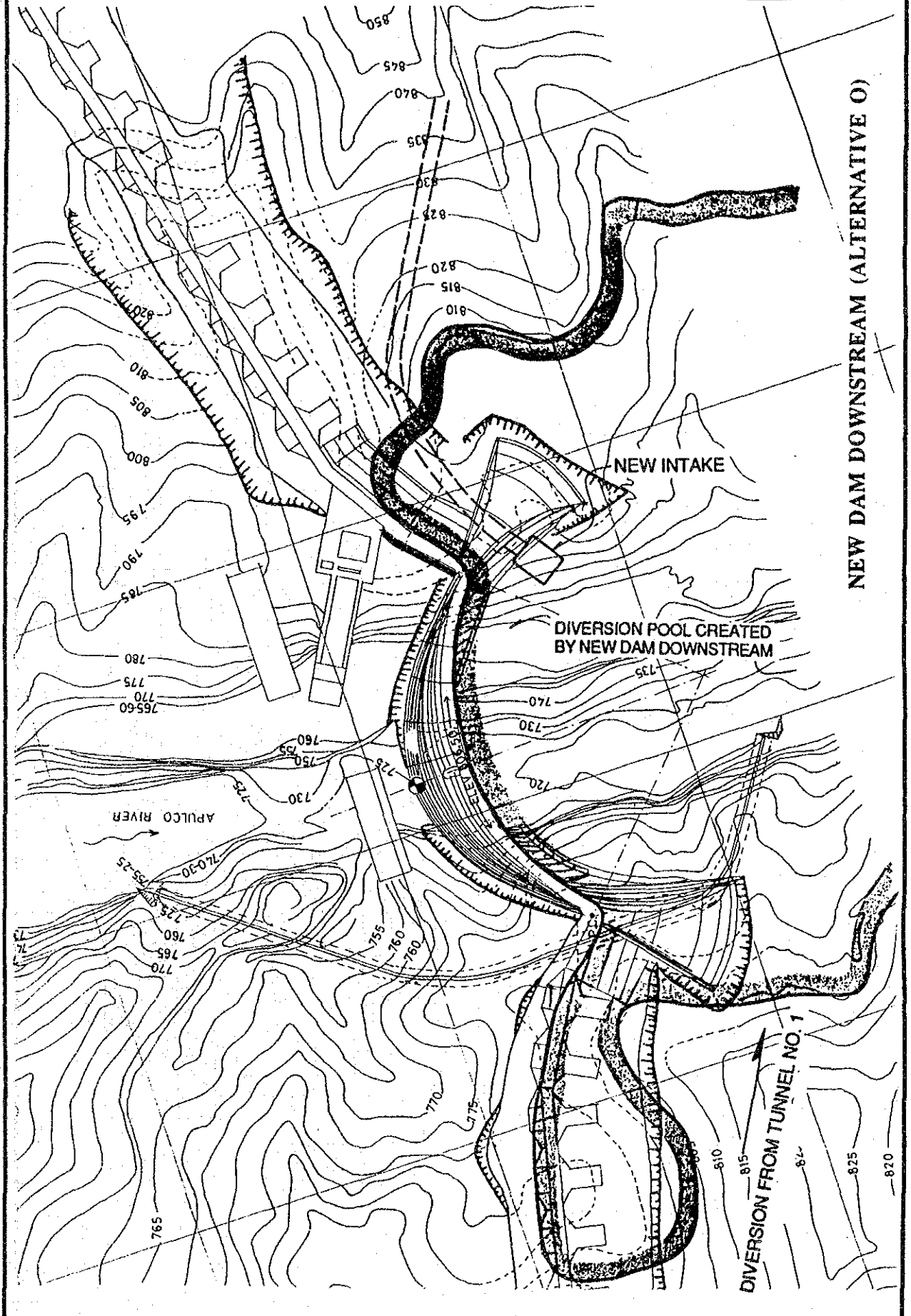

NEW LOW LEVEL OUTLET (ALTERNATIVE M)
NEW LOW LEVEL OUTLET
APULCO RIVER

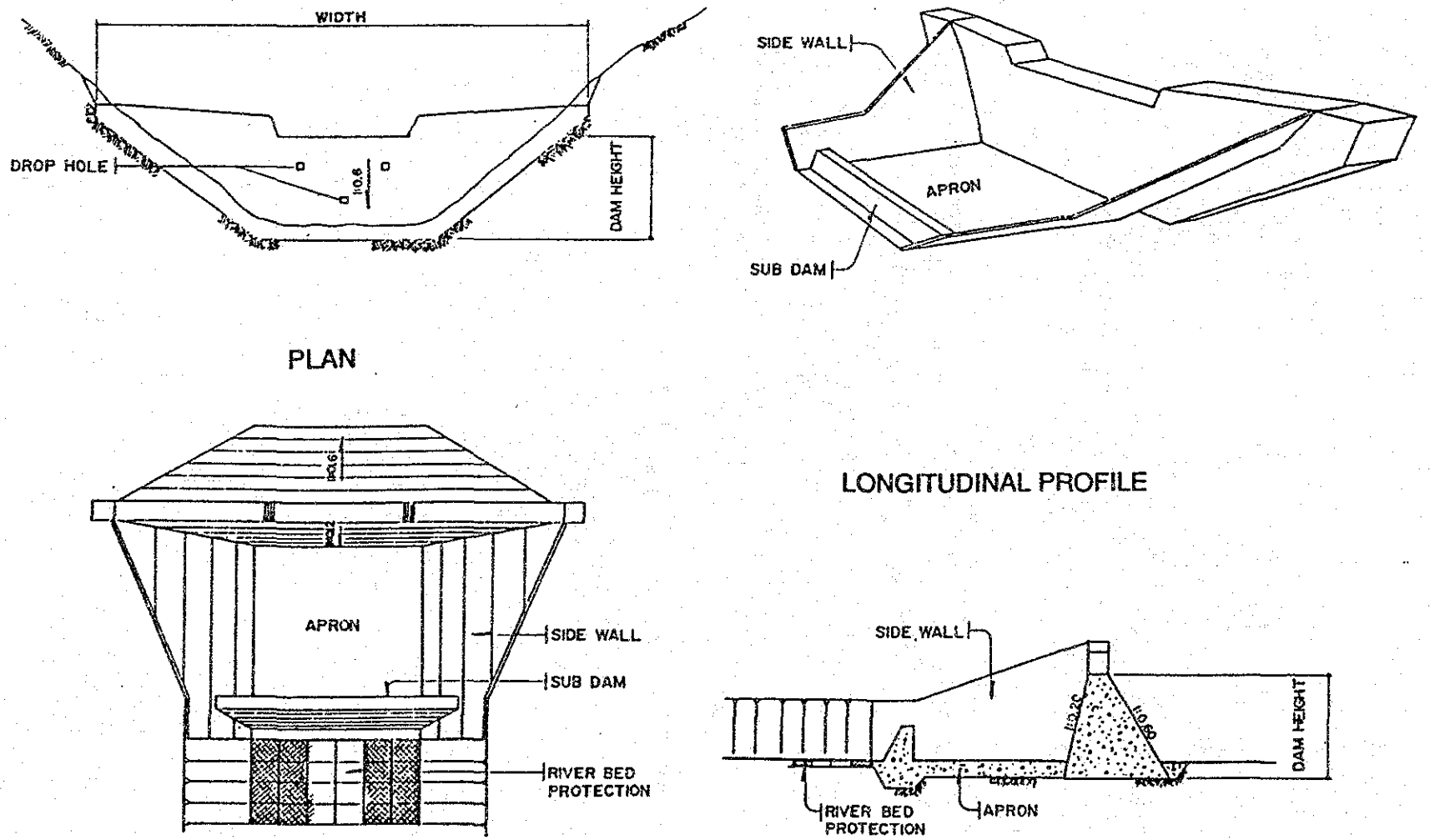
FIGURE 7.19



NEW LOW LEVEL OUTLET (ALTERNATIVE N)

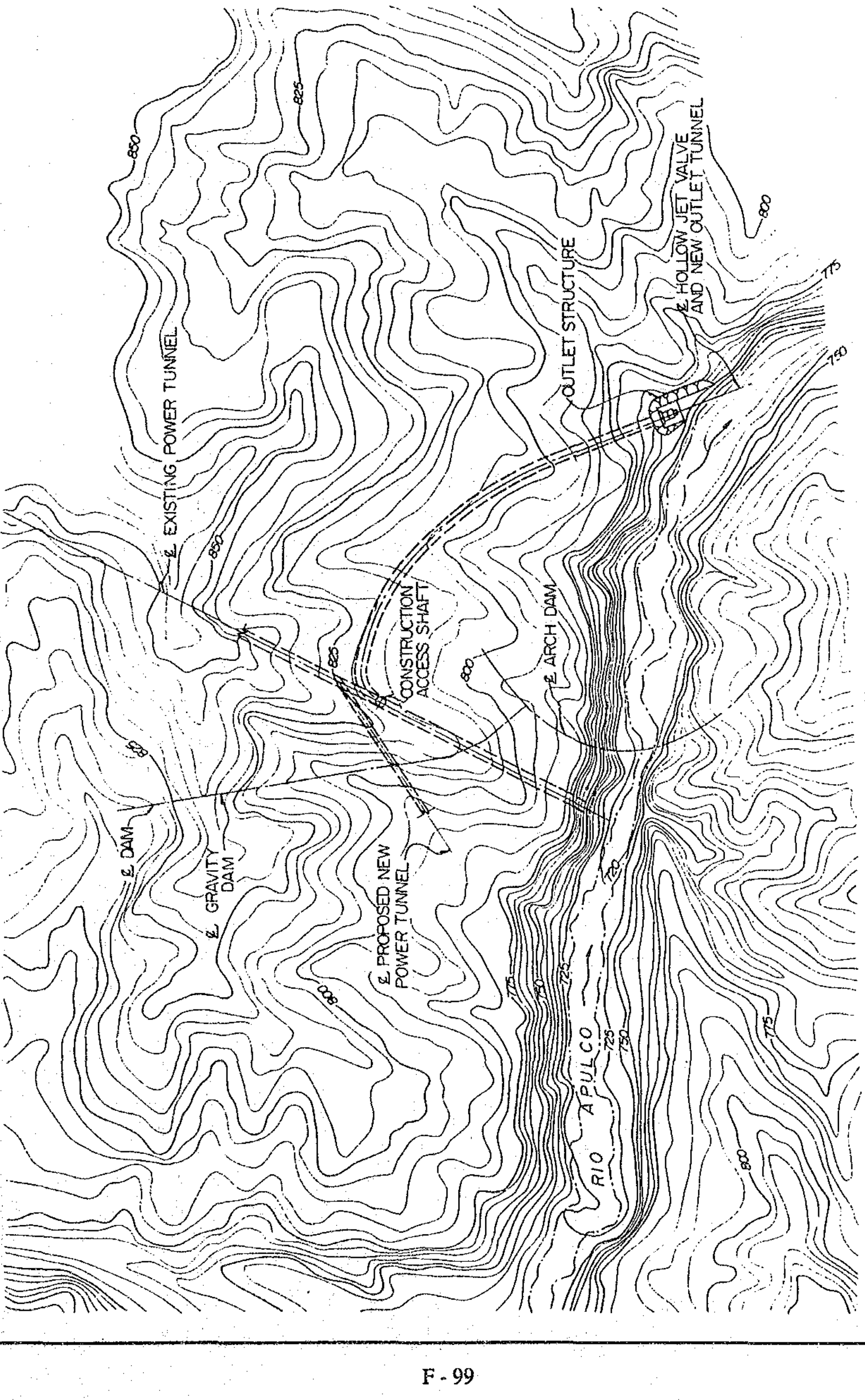
FIGURE 7.20


NEW DAM DOWNSTREAM (ALTERNATIVE O)
NEW INTAKE
DIVERSION POOL CREATED BY NEW DAM DOWNSTREAM
APULCO RIVER
DIVERSION FROM TUNNEL NO. 1



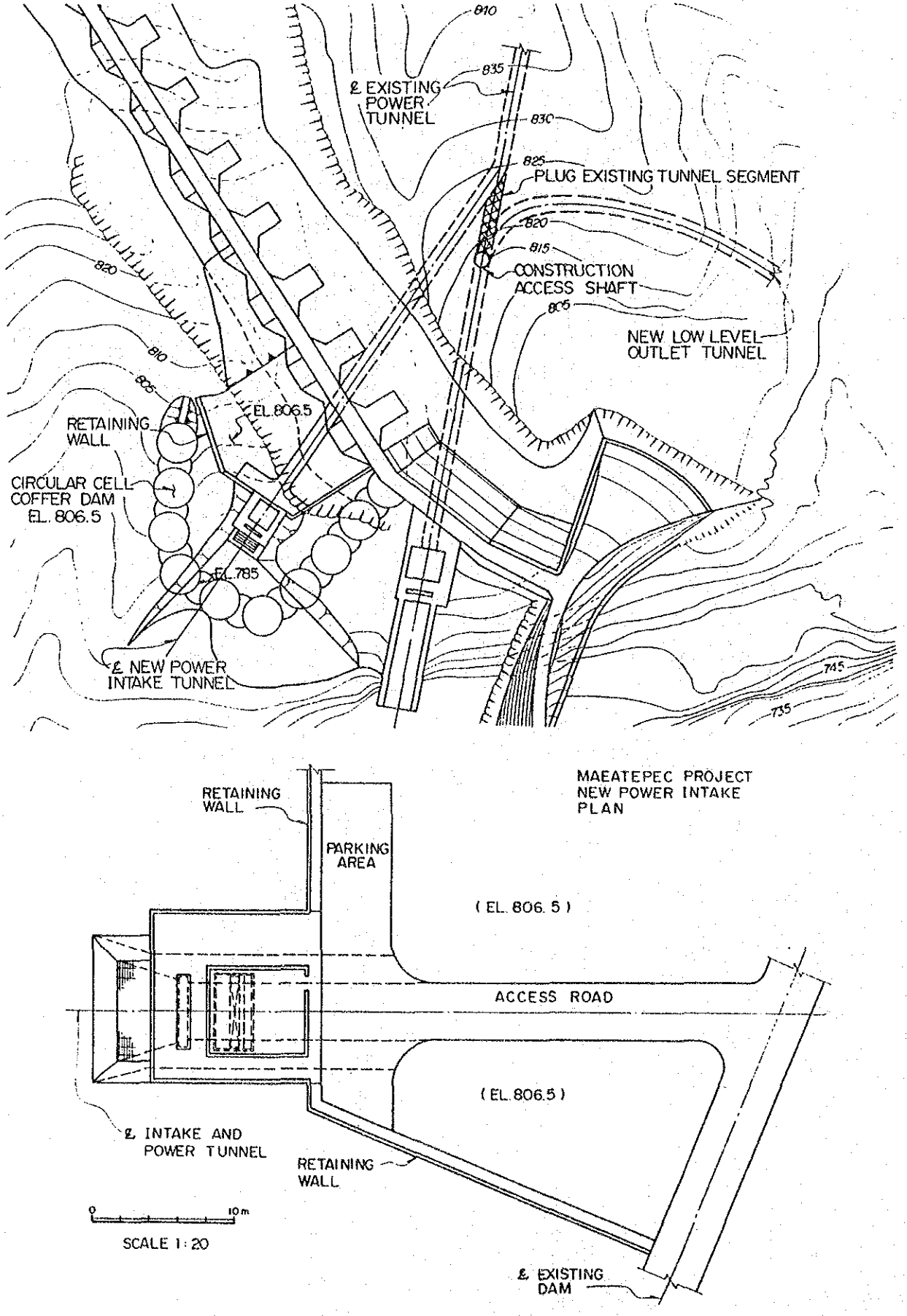
TYPICAL LAYOUT OF LOW CHECK DAM

FIGURE 7.21



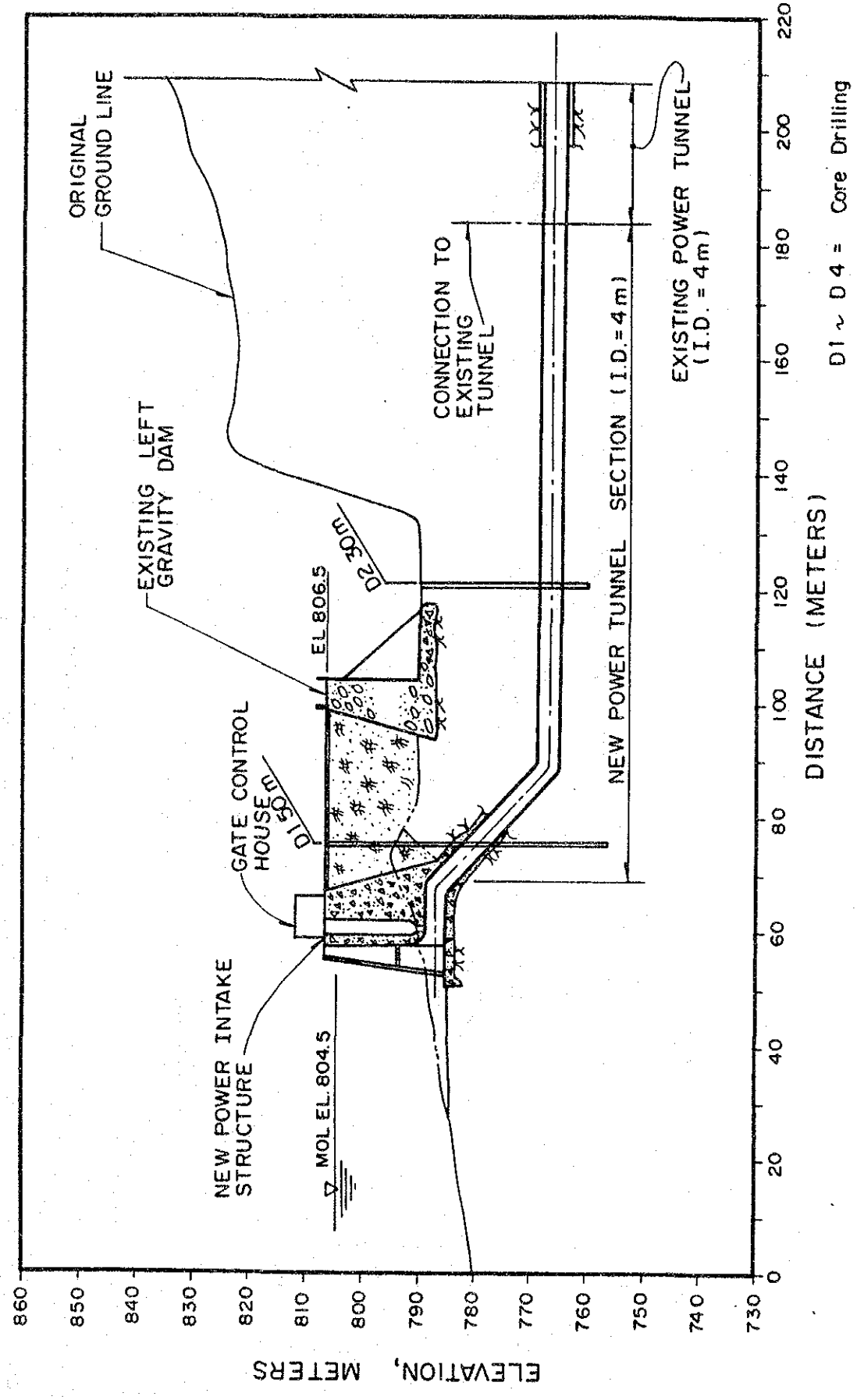
GENERAL PLAN OF NEW LOW LEVEL OUTLET

FIGURE 7.23



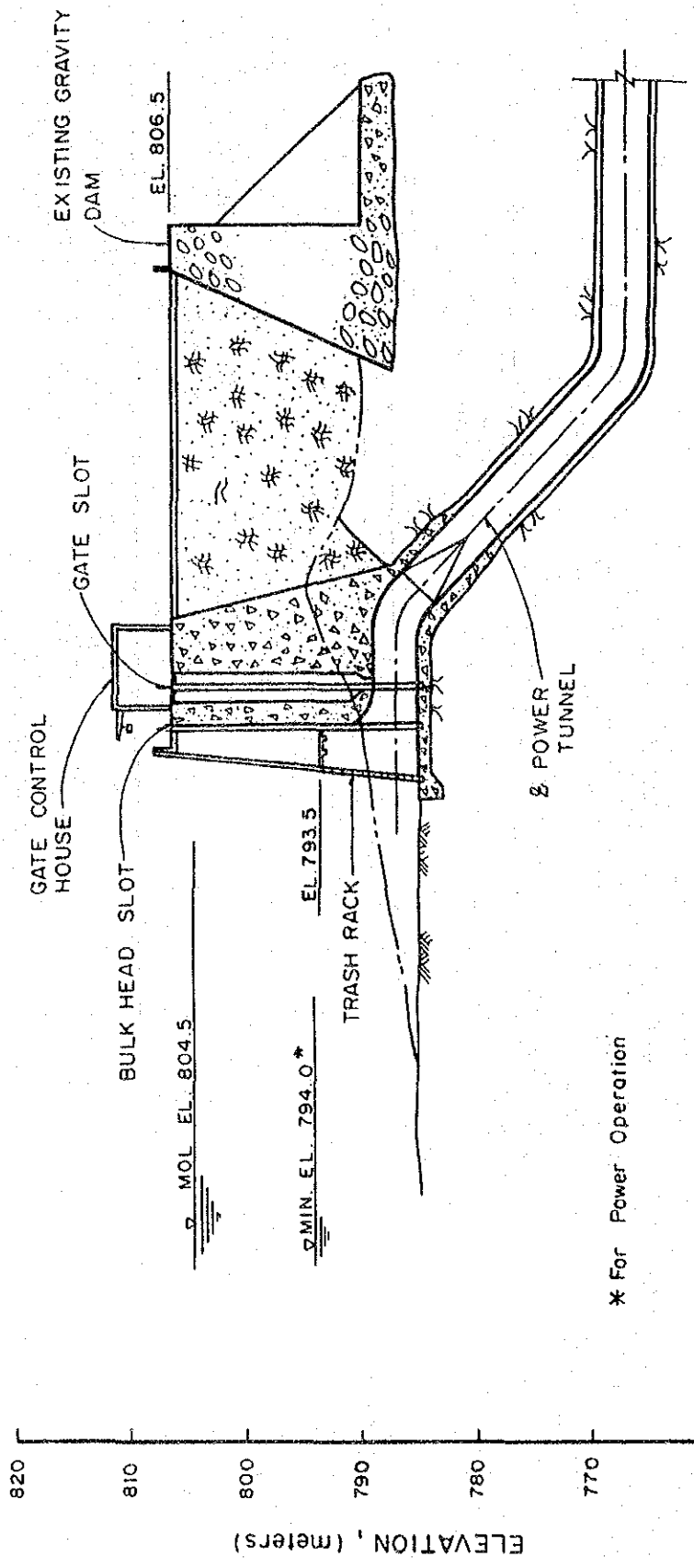
GENERAL PLAN OF NEW POWER INTAKE AND DEWATERING PLAN DURING CONSTRUCTION

FIGURE 7.24(1/2)

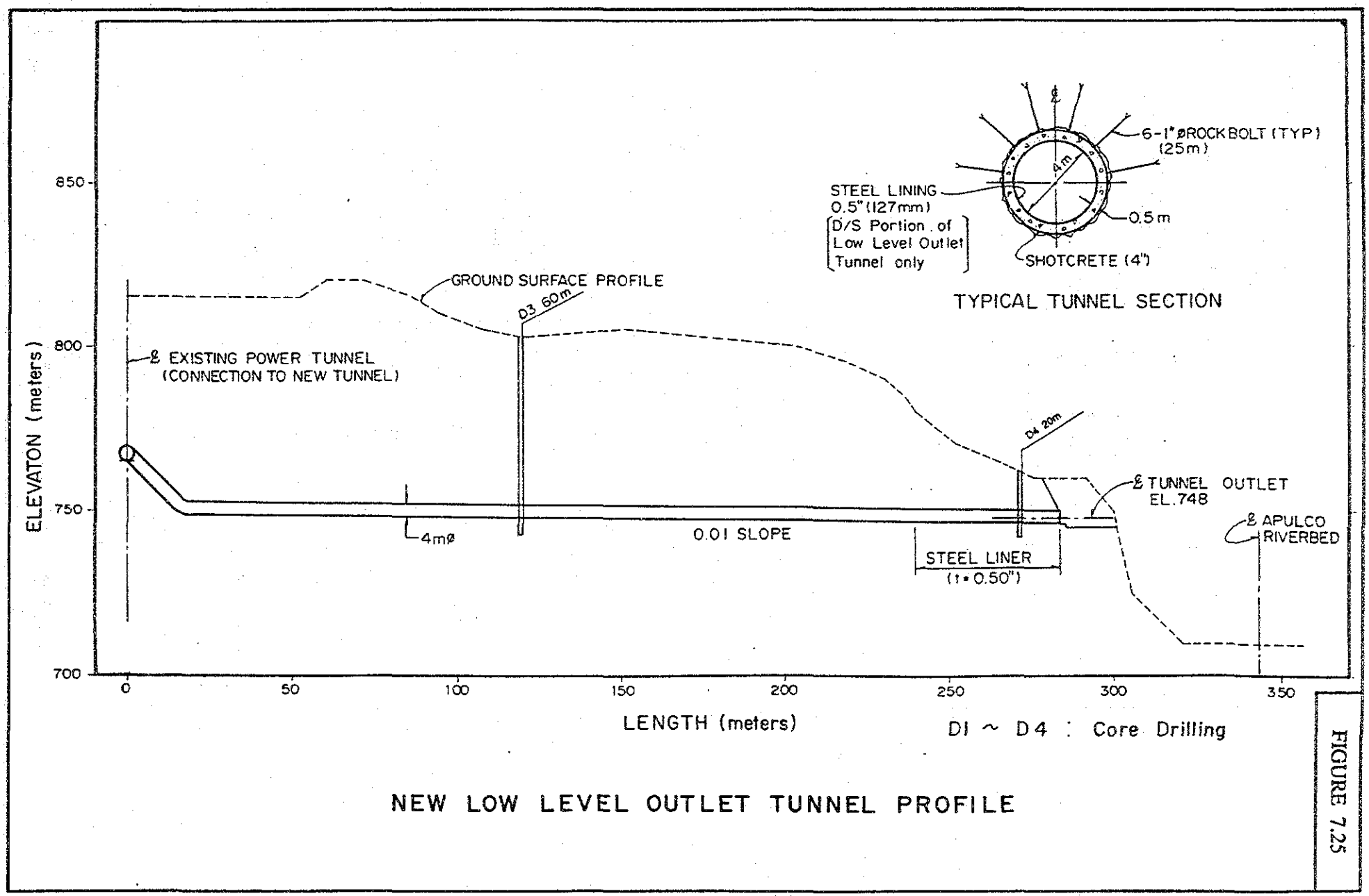


PROFILE OF NEW POWER INTAKE (1/2)

FIGURE 7.24(2/2)



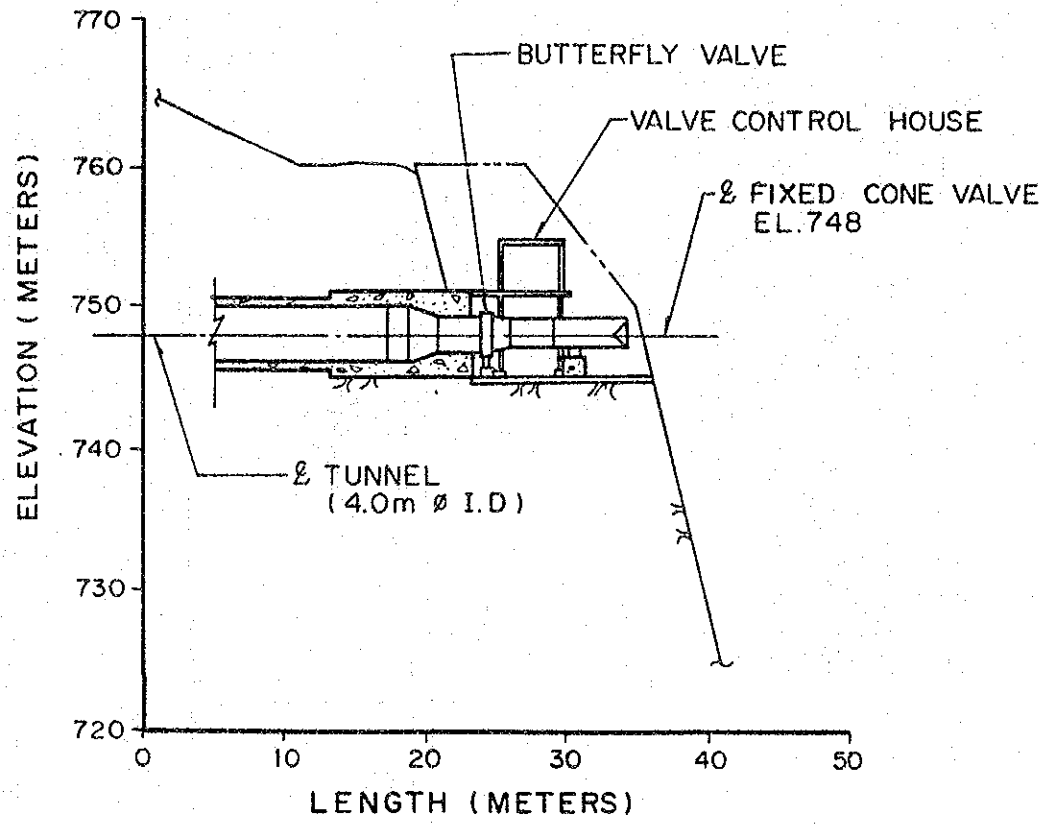
PROFILE OF NEW POWER INTAKE(2/2)



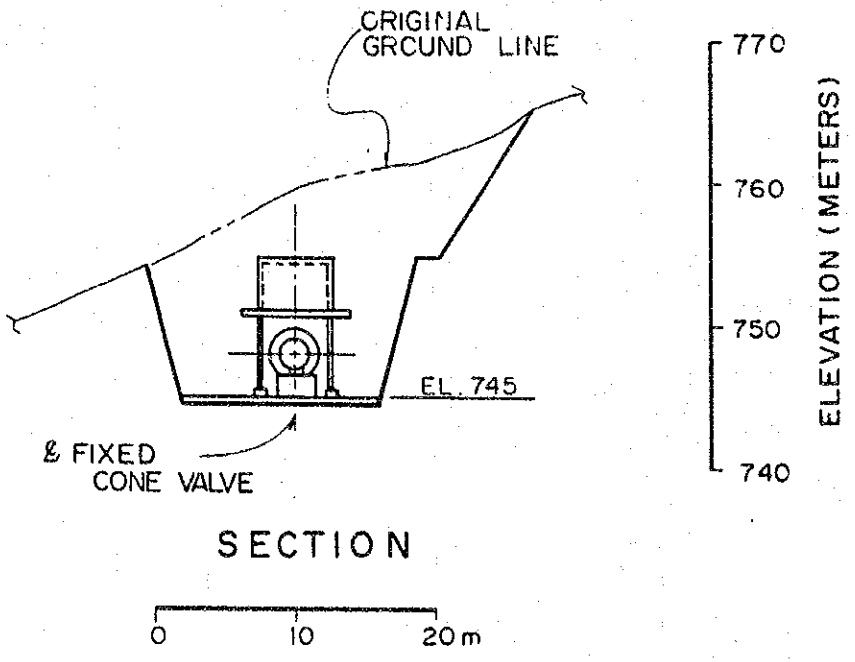
NEW LOW LEVEL OUTLET TUNNEL PROFILE

FIGURE 7.25

FIGURE 7.26



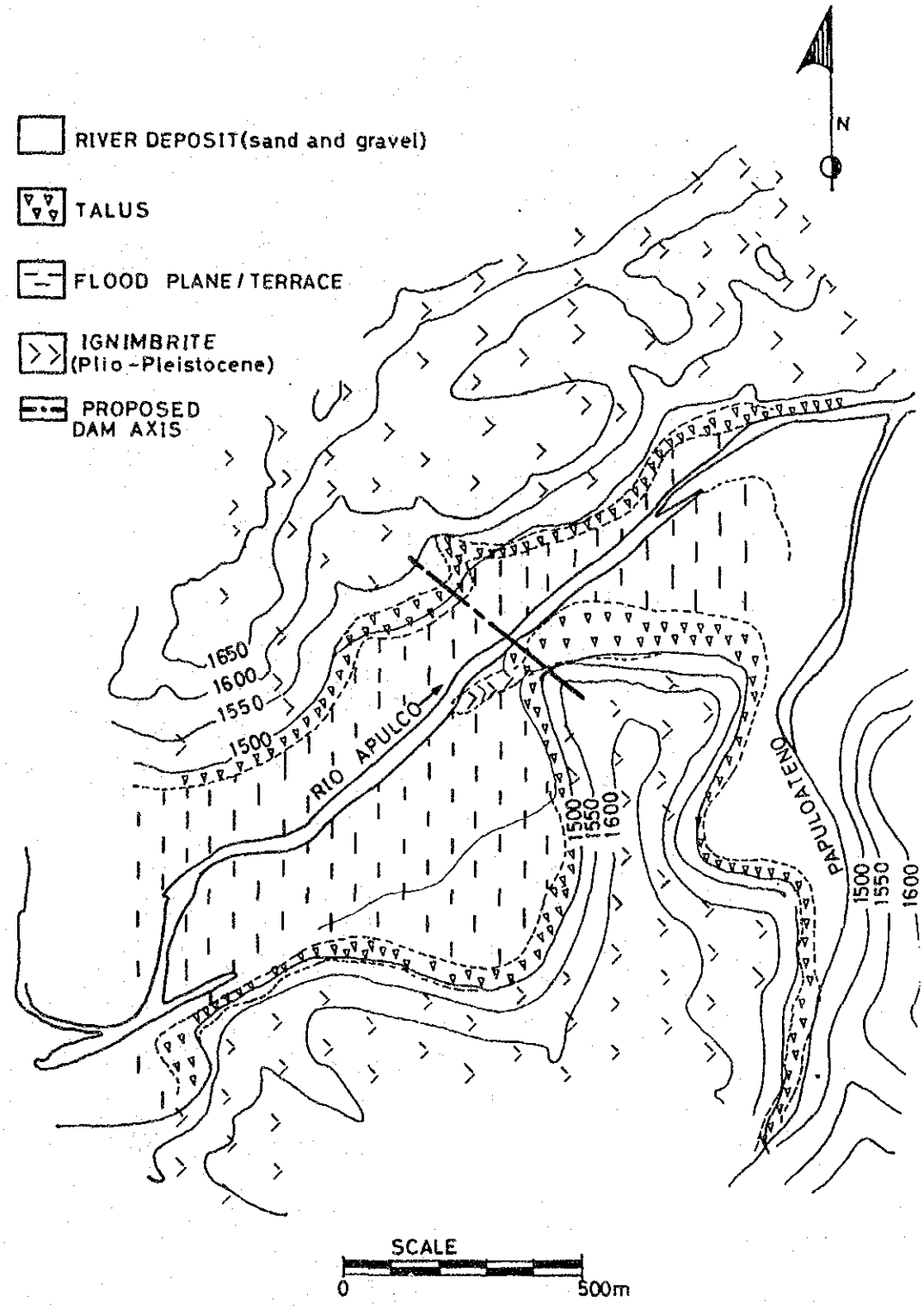
PROFILE



SECTION

LOW LEVEL OUTLET

FIGURE 7.27



GEOLOGICAL SKETCH MAP OF PROPOSED CHECK DAM SITE

FIGURE 7.28

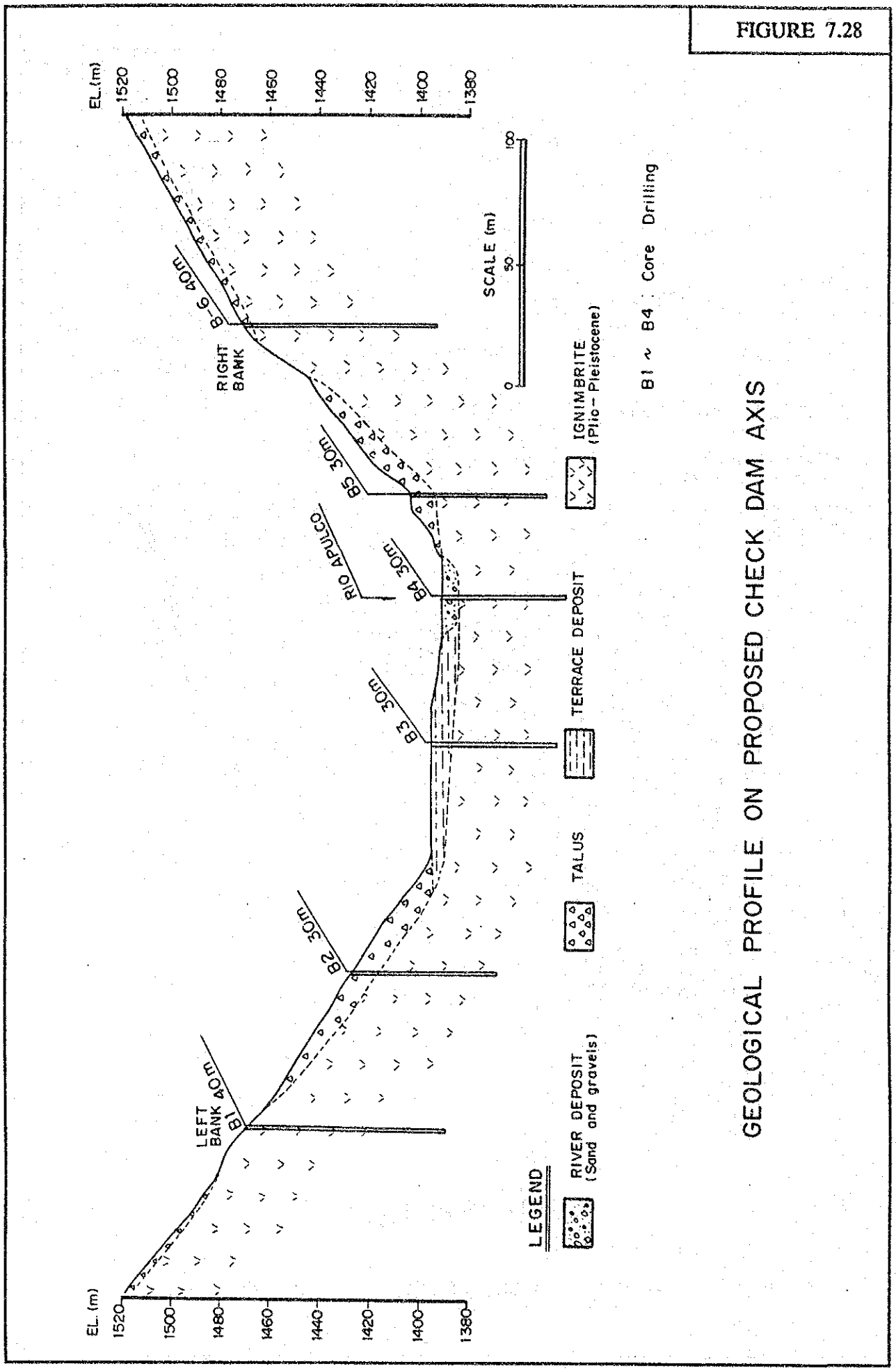
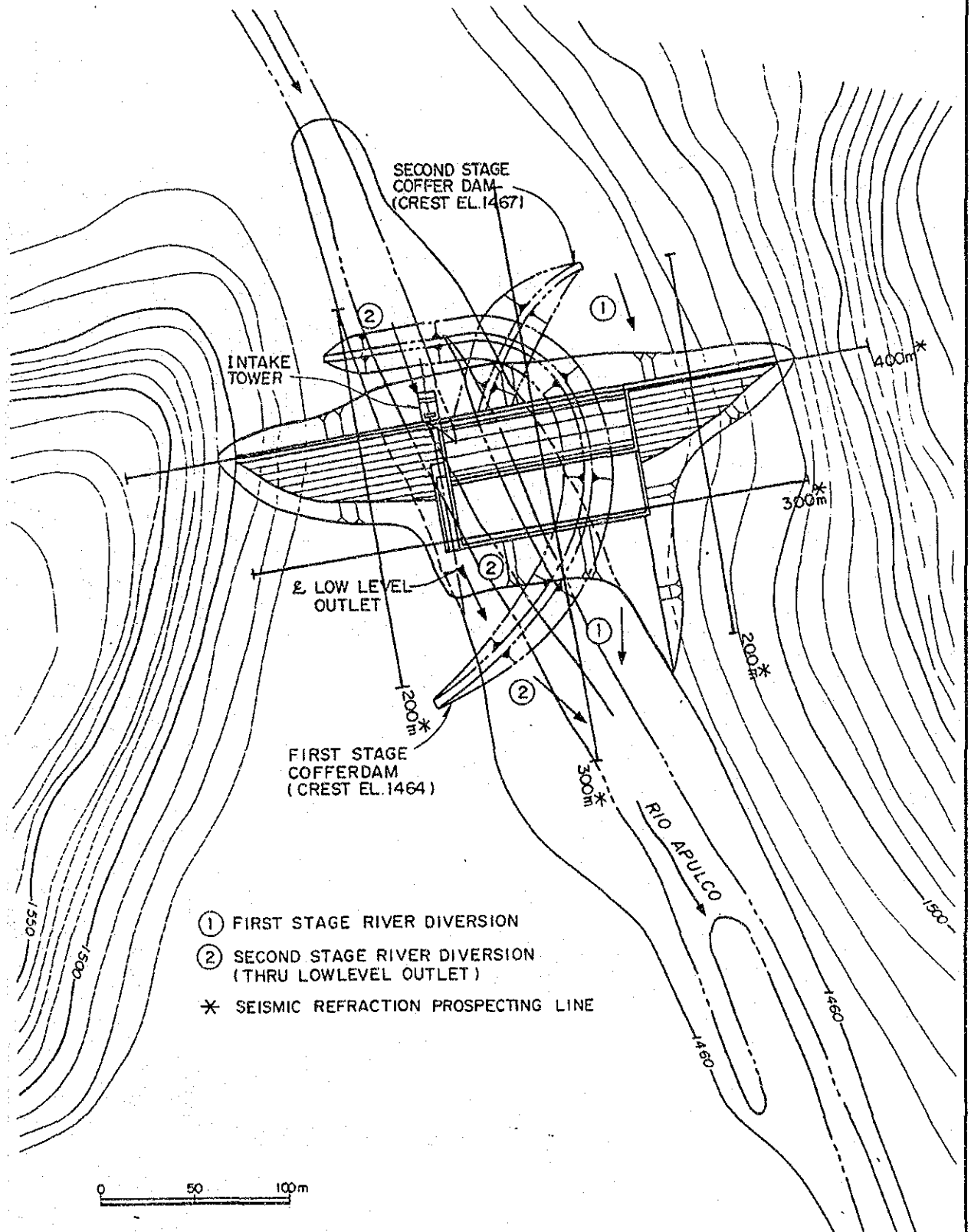
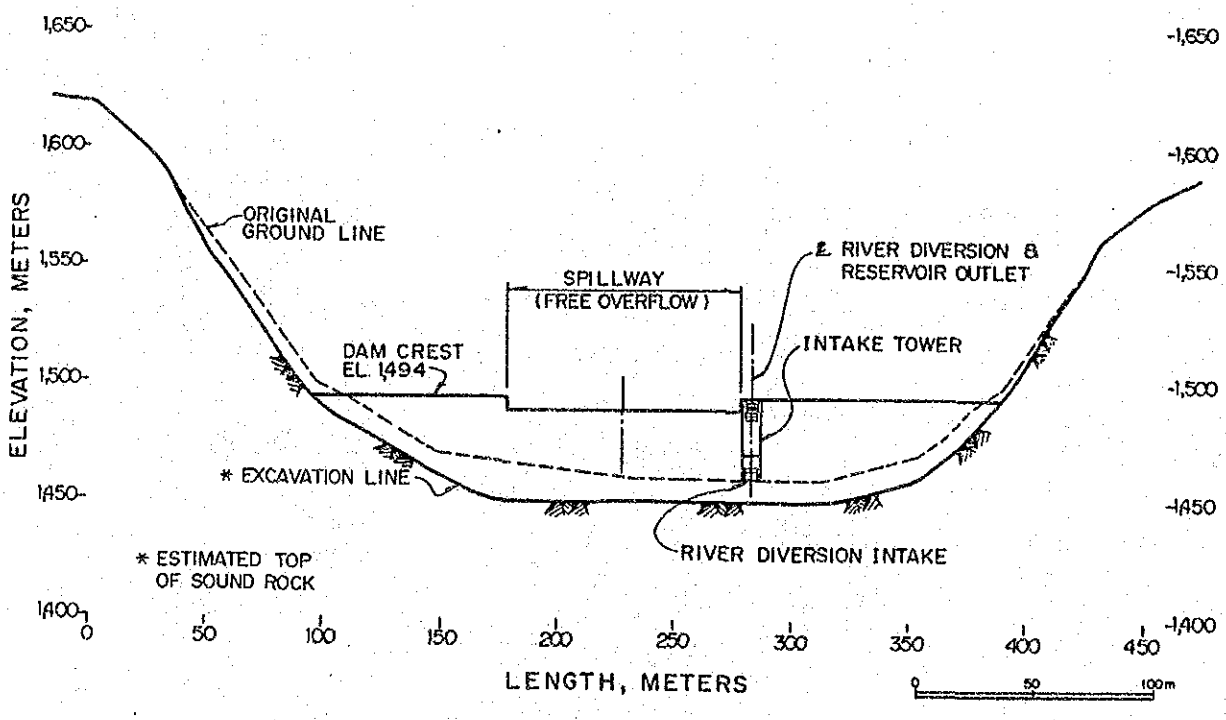

EL.(m)
1520
1500
1480
1460
1440
1420
1400
1380
SCALE (m)
0
50
100
RIGHT BANK
LEFT BANK
B1 40m
B2 30m
B3 30m
B4 30m
B5 30m
B6 40m
RIO APURIMAC
LEGEND
RIVER DEPOSIT (Sand and gravels)
TALUS
TERRACE DEPOSIT
IGNIMBRITE (Plio-Pleistocene)
B1 ~ B4 : Core Drilling
GEOLOGICAL PROFILE ON PROPOSED CHECK DAM AXIS

FIGURE 7.29

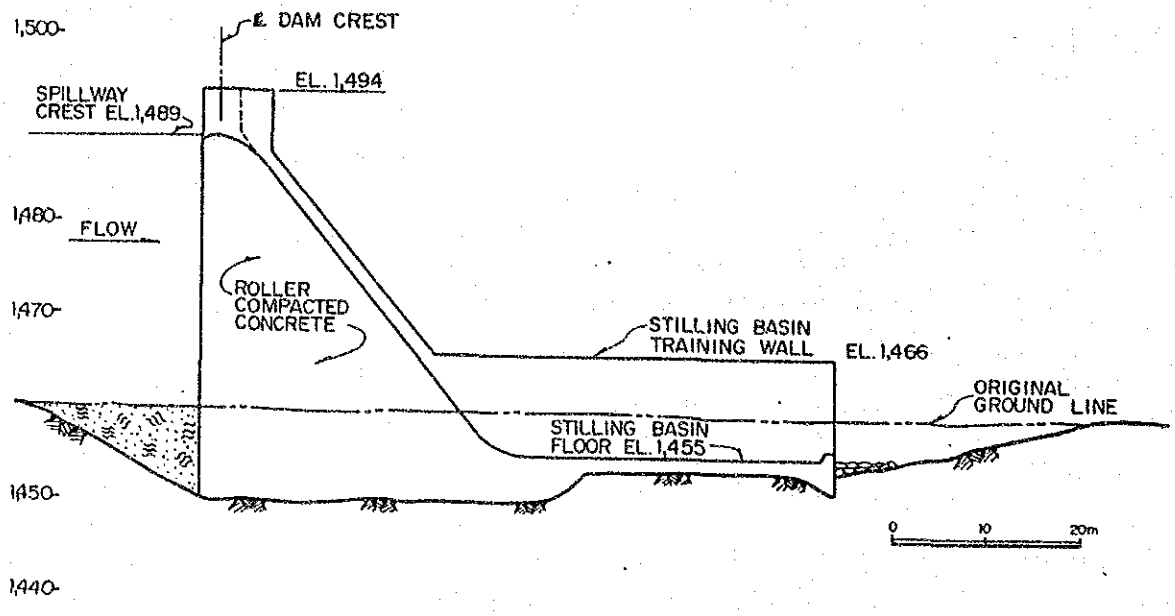


GENERAL LAYOUT AND RIVER DIVERSION SCHEME
OF CHECK DAM (15 YEAR LIFE)

FIGURE 7.30



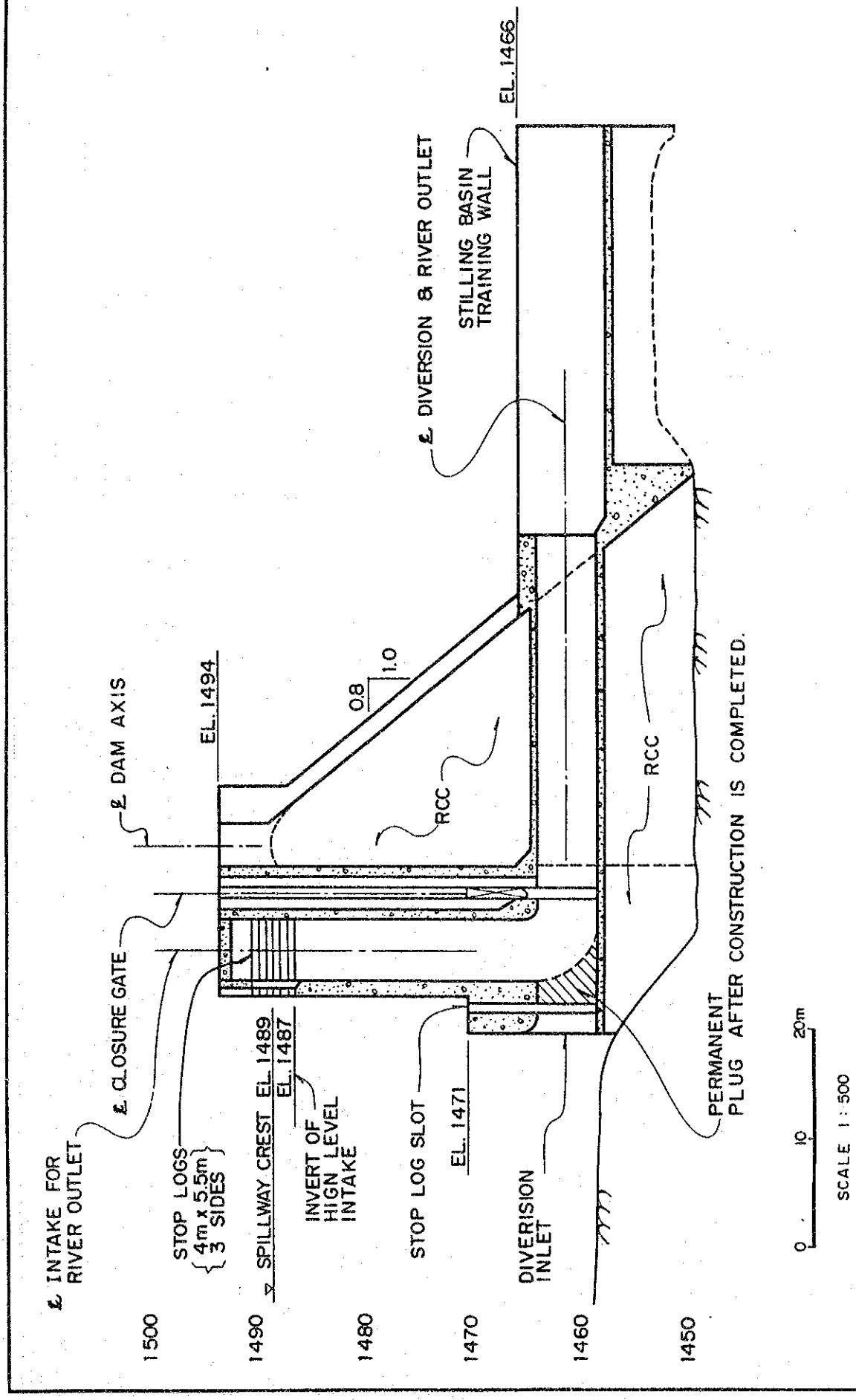
UPSTREAM ELEVATION OF CHECK DAM



SECTION THRU SPILLWAY CENTERLINE CHECK DAM

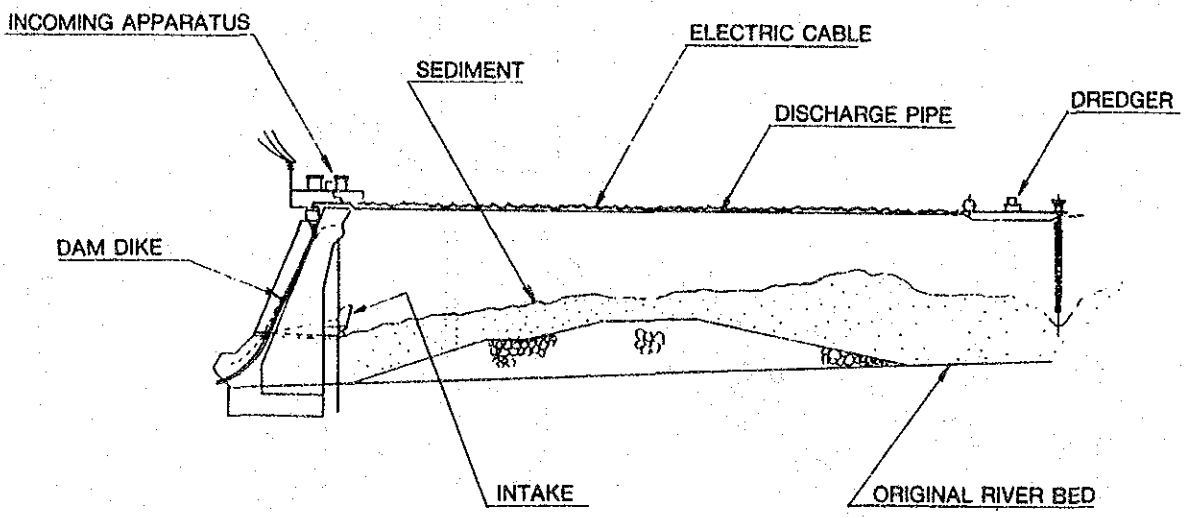
SECTIONS OF CHECK DAM

FIGURE 7.31

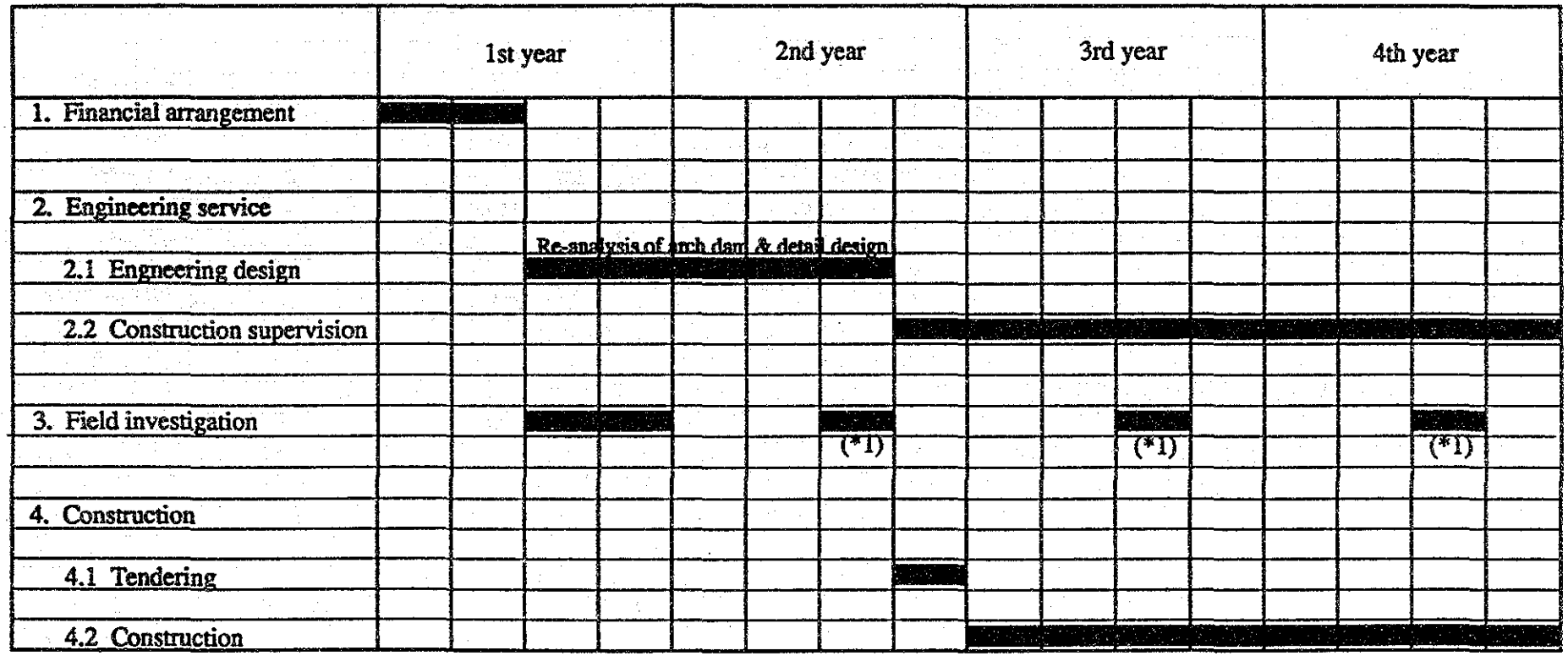


DIVERSION AND RIVER OUTLET OF CHECK DAM

FIGURE 7.32



DREAGING OPERATION IN RESERVIOR



Note: (*1) Bathymetric survey in Soledad Reservoir

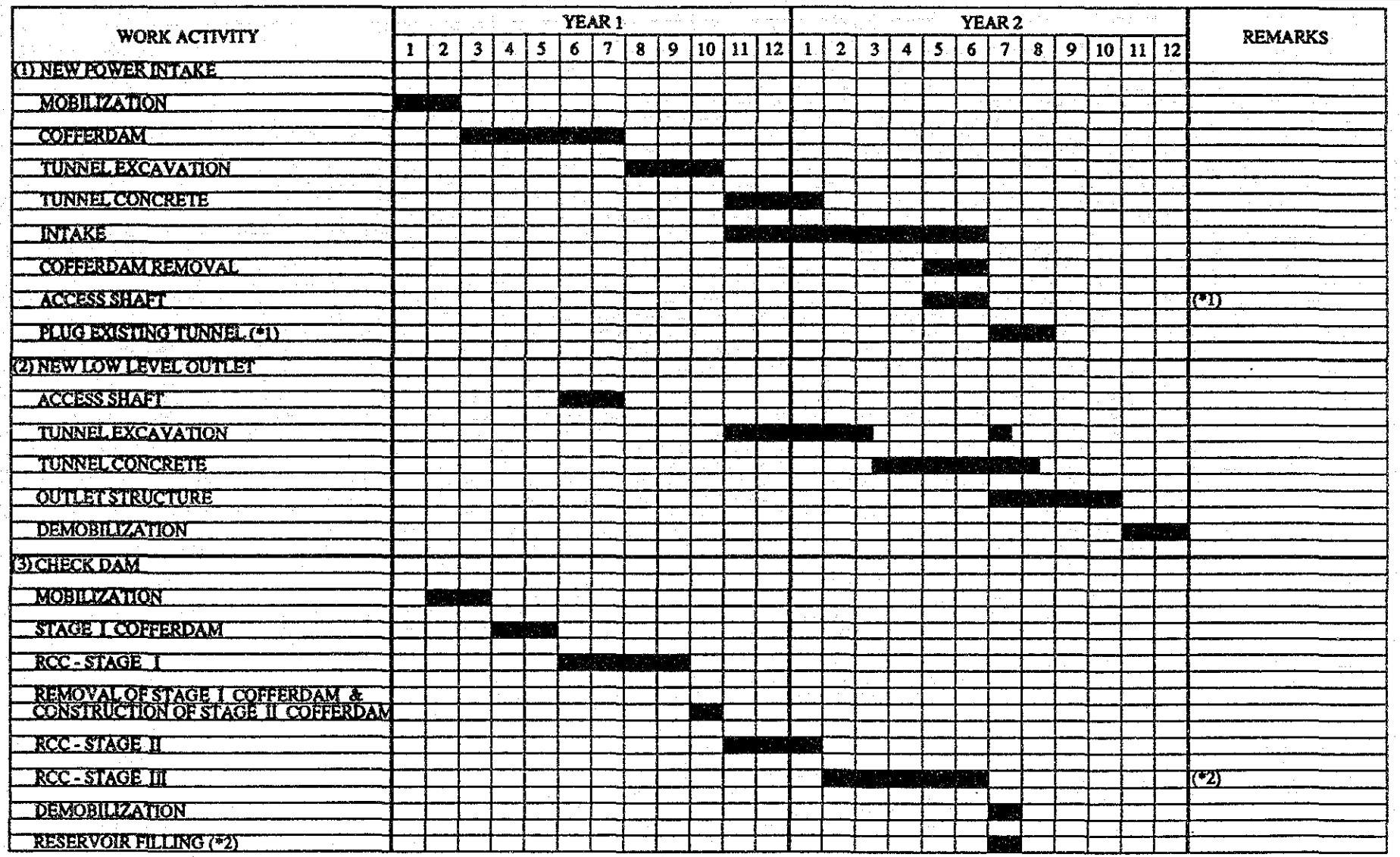
Outline Implementation Schedule of Rehabilitation Plan

FIGURE 8.1

Work Items	Month 1	2	3	4	5	6	7	Remarks
A. Topographic Survey								
A-1 Preparation/Mobilization								
A-2 Aerophotographic mapping								For the proposed reservoir and road relocation,
(1) Shooting								20 km², 1/2,000
(2) Ground control survey								
(3) Levelling								
(4) Mapping								
A-3 Ground Survey								
(1) Profile/Section survey								For the check dam and intake site
(2) Plane table survey								- do -
B. Geological Survey								
B-1 Preparation/Mobilization								
B-2 Seismic refraction prospecting								For check dam site : 1,400 m for 5 lines
B-3 Core drilling								For check dam : 200 m long for 6 holes
								and intake and tunnel : 160 m long for 4 holes
C. Construction Material Survey								
C-1 Sand & gravel								For concrete aggregate for building concrete dam
C-2 Quarry site								
D. Bathymetric Survey of Soledad Reservoir								By using echo sounder at every 6 month.
D-1 Entire reservoir area								
D-2 Dam and intake area								
E. Measurement of Turbidity of Water								
E-1 Reservoir								By using turbidity water at every 6 month.
E-2 Downstream								

FIELD INVESTIGATION SCHEDULE

FIGURE 8.2

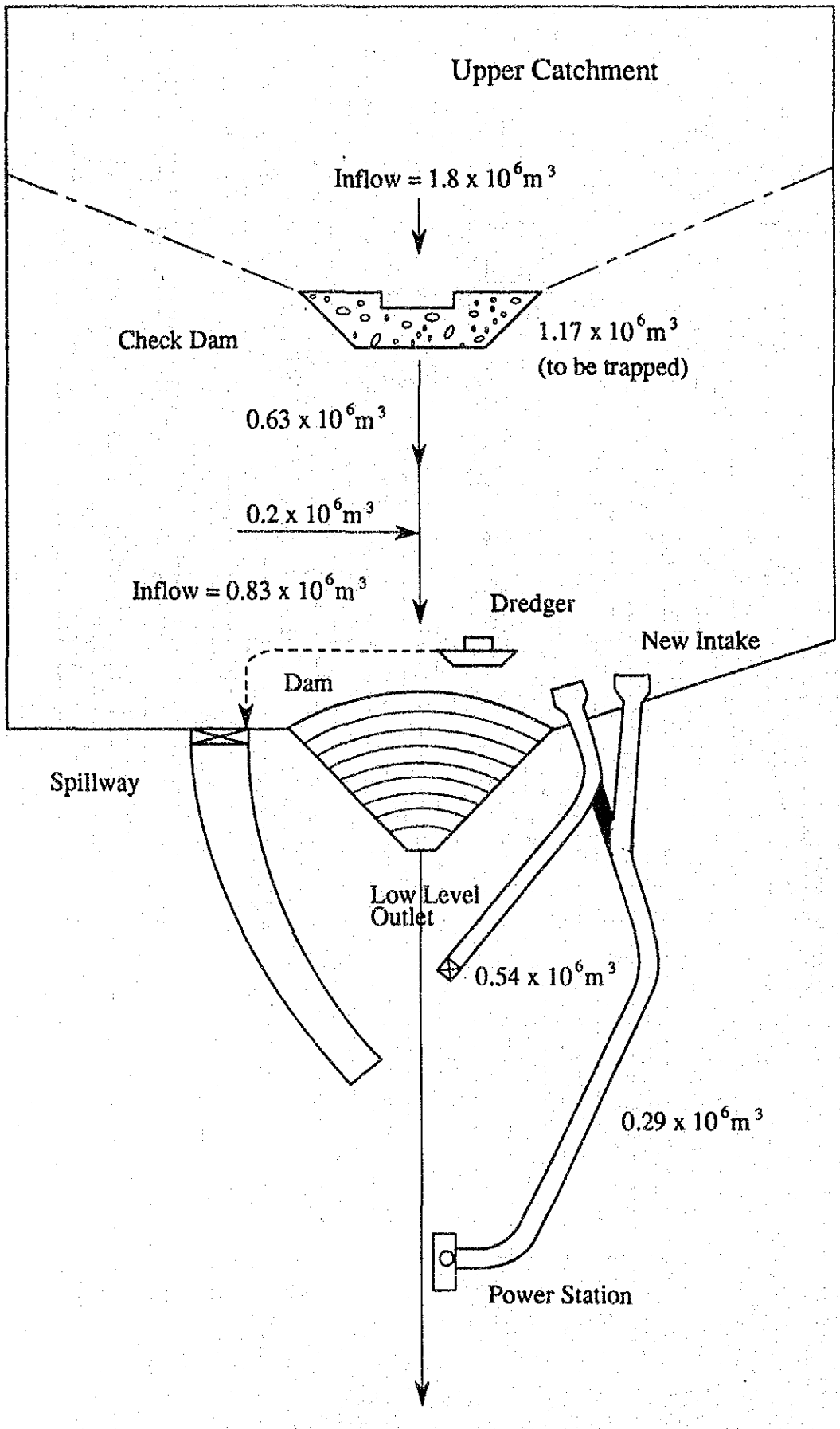


(*1) The existing power tunnel and Mazatepec Powerplant will be shut down during this period.
(*2)Coincides with the shutdown of the Mazatepec Powerplant after construction of the new power intake is complete.

CONSTRUCTION TIME SCHEDULE

FIGURE 8.3

FIGURE 9.1



SEDIMENT BALANCE FOR REHABILITATION PLAN