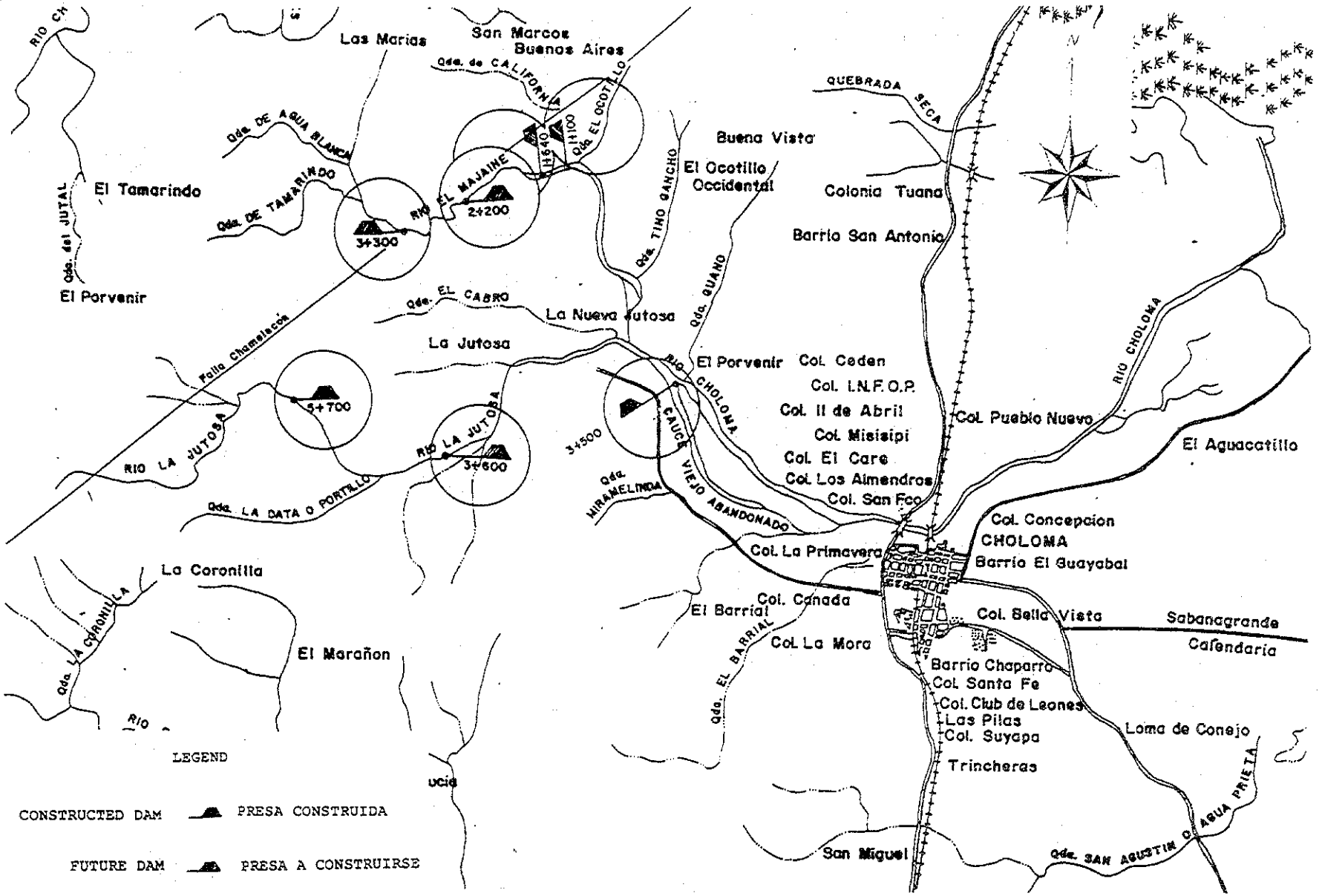


SOURCE: SECOPT

FIG. D.1.4 DEBRIS CONTROL PLAN BY SECOPIT

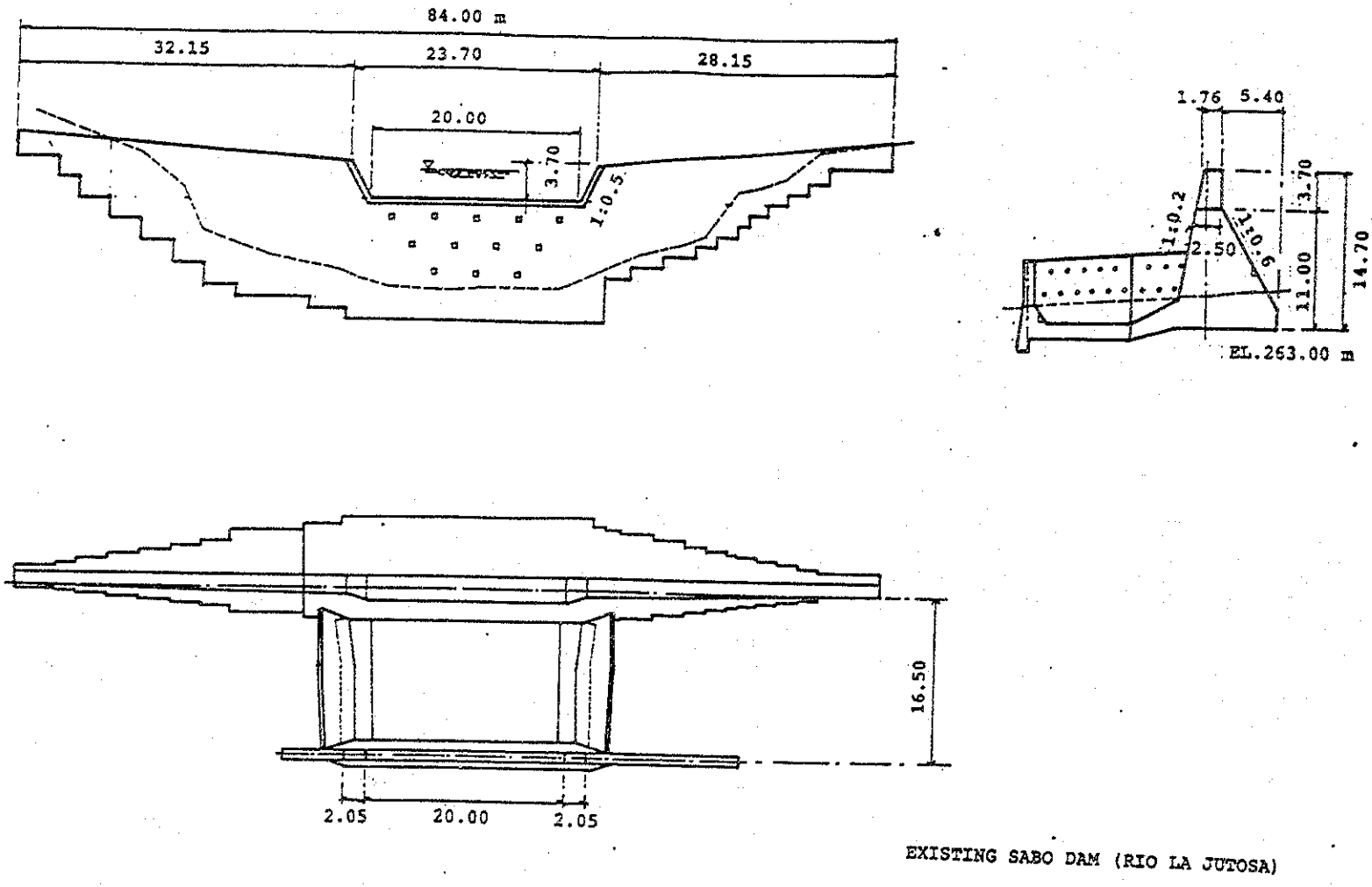


FIG. D.1.5 MAIN FEATURES OF EXISTING CHECK DAM

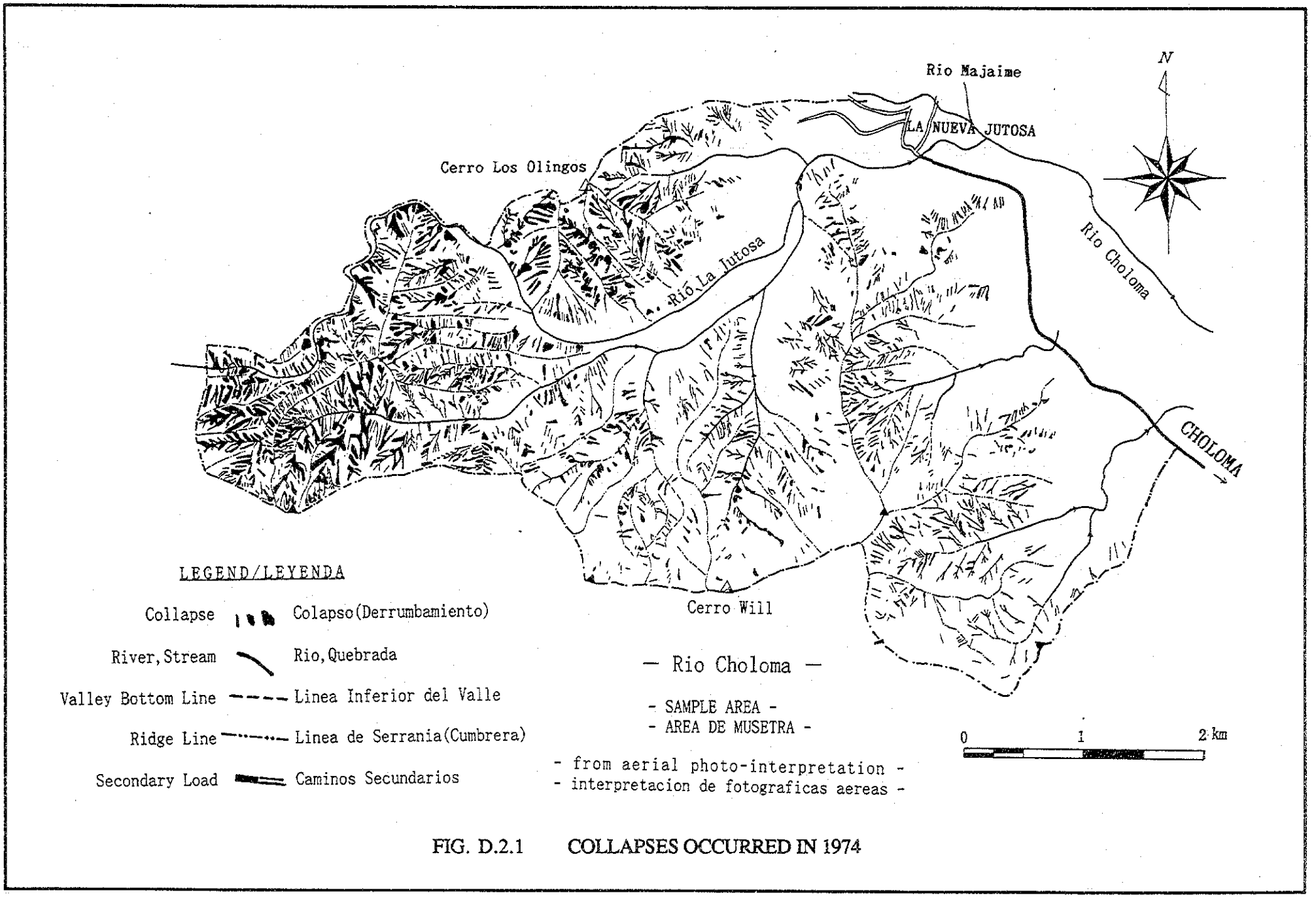


FIG. D.2.1 COLLAPSES OCCURRED IN 1974

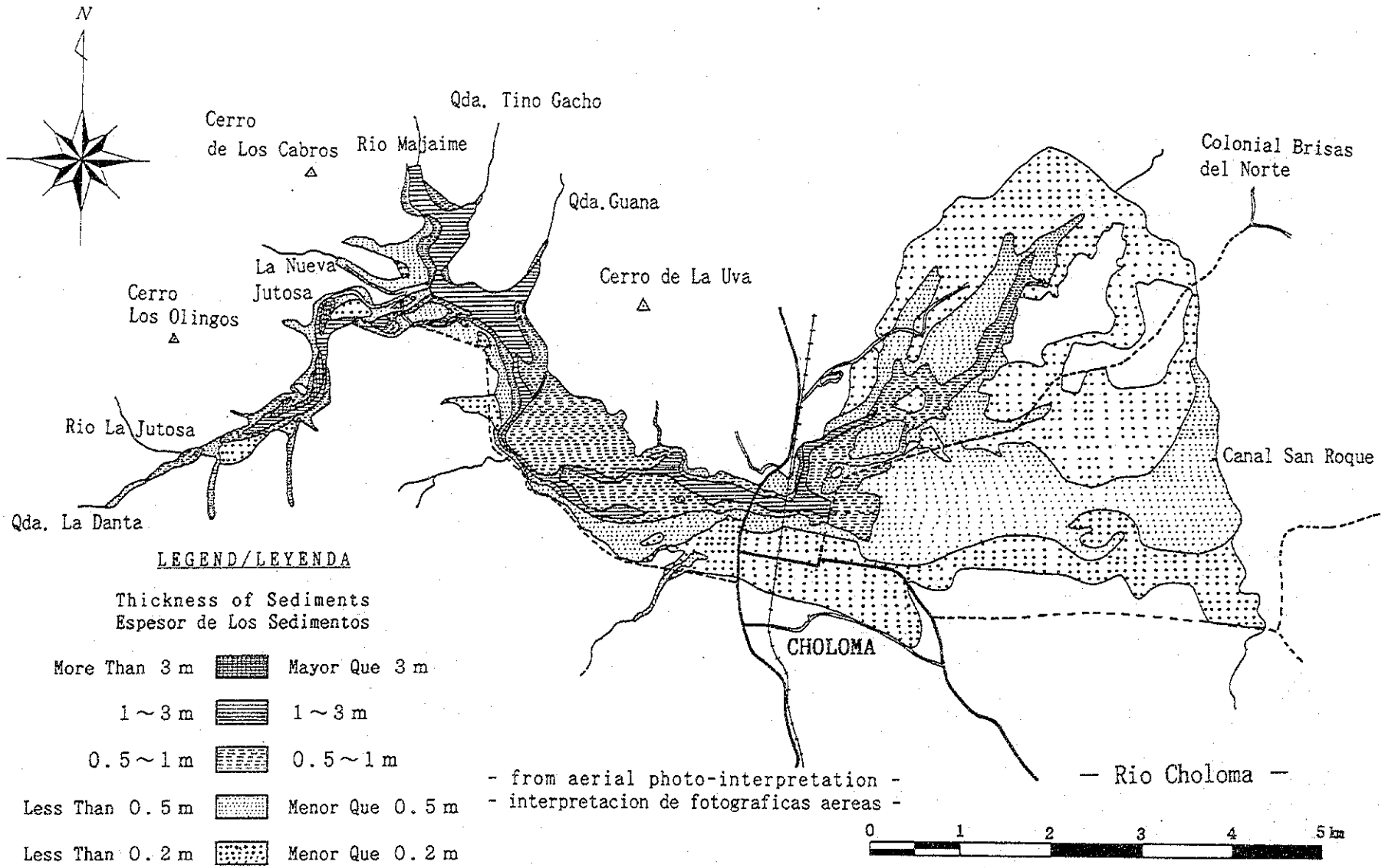


FIG. D.2.2 (1) THICKNESS OF OVERFLOWING SEDIMENTS - 1974 FLOOD (RIO CHOLOMA)

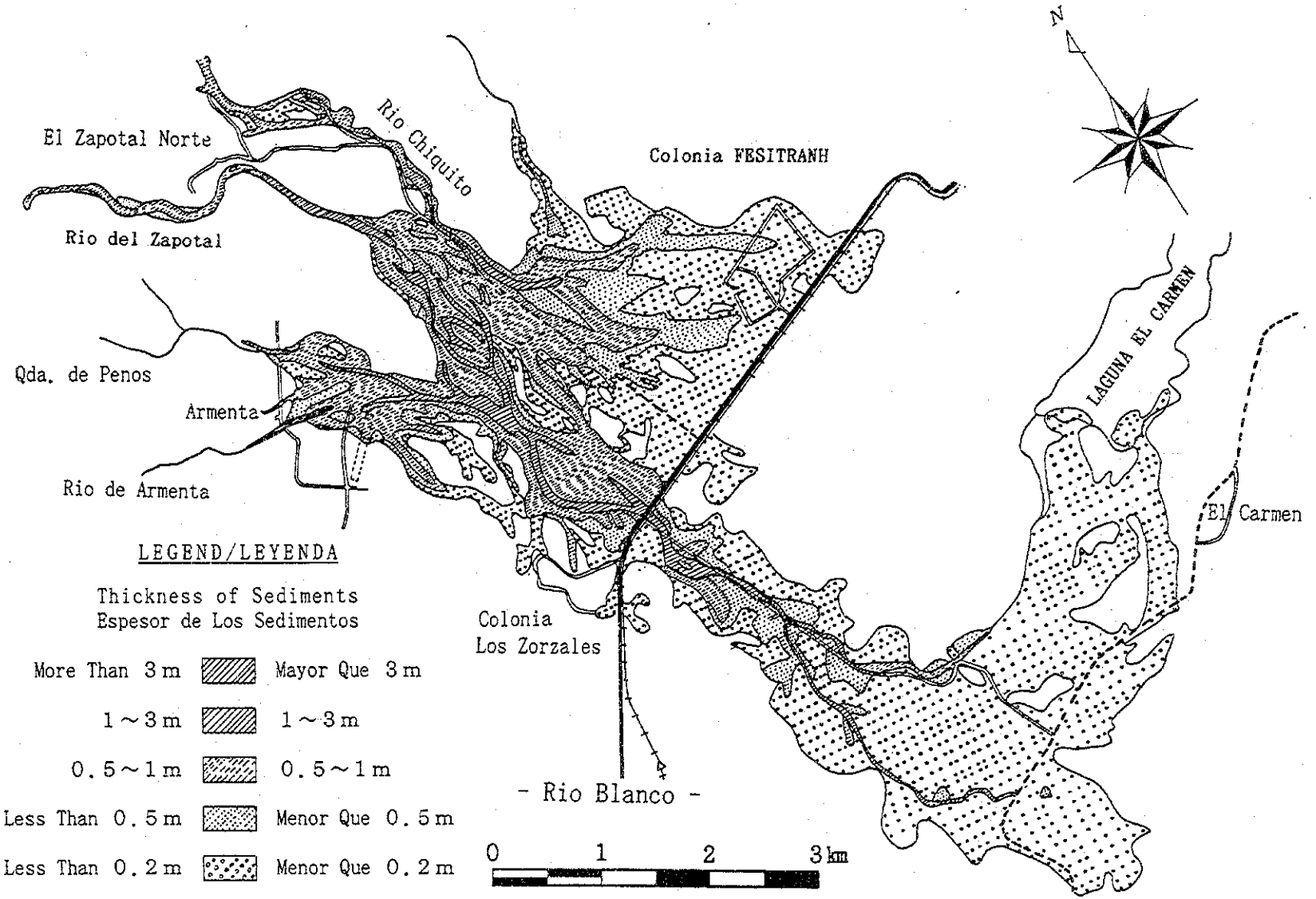
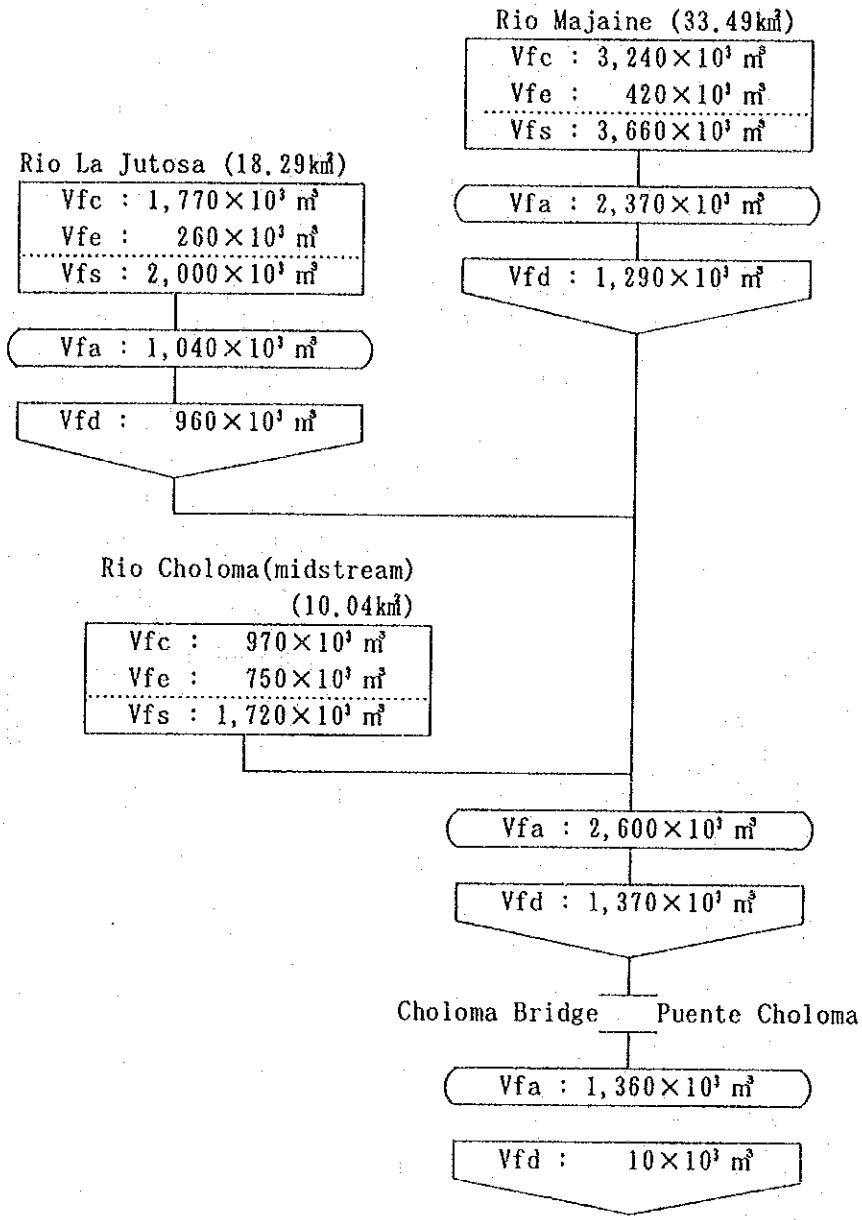


FIG. D.2.2 (2) THICKNESS OF OVERFLOWING SEDIMENTS - 1974 FLOOD (RIO BLANCO)



Vfc : Produced sediment volume from collapsed area
/ Volumen de sedimentos producido por colapsada

Vfe : Eroded sediment volume of the river course
/ Volumen de sedimentos erosionada en el curse del rio

Vfs : Supplied sediment volume
/ Volumen de sedimentos suministrado(=Vfc+Vfe)

Vfa : Accumulated sediment volume
/ Volumen de sedimentos acumulado

Vfd : Sediment discharge volume
/ Volumen de descarge de sedimentos(=Vfs+Vfd)

(km²) : Mountain slope area / Area de montañosa

FIG. D.2.3 SEDIMENT BALANCE AT THE RIO CHOLOMA BASIN (1974 FLOOD)

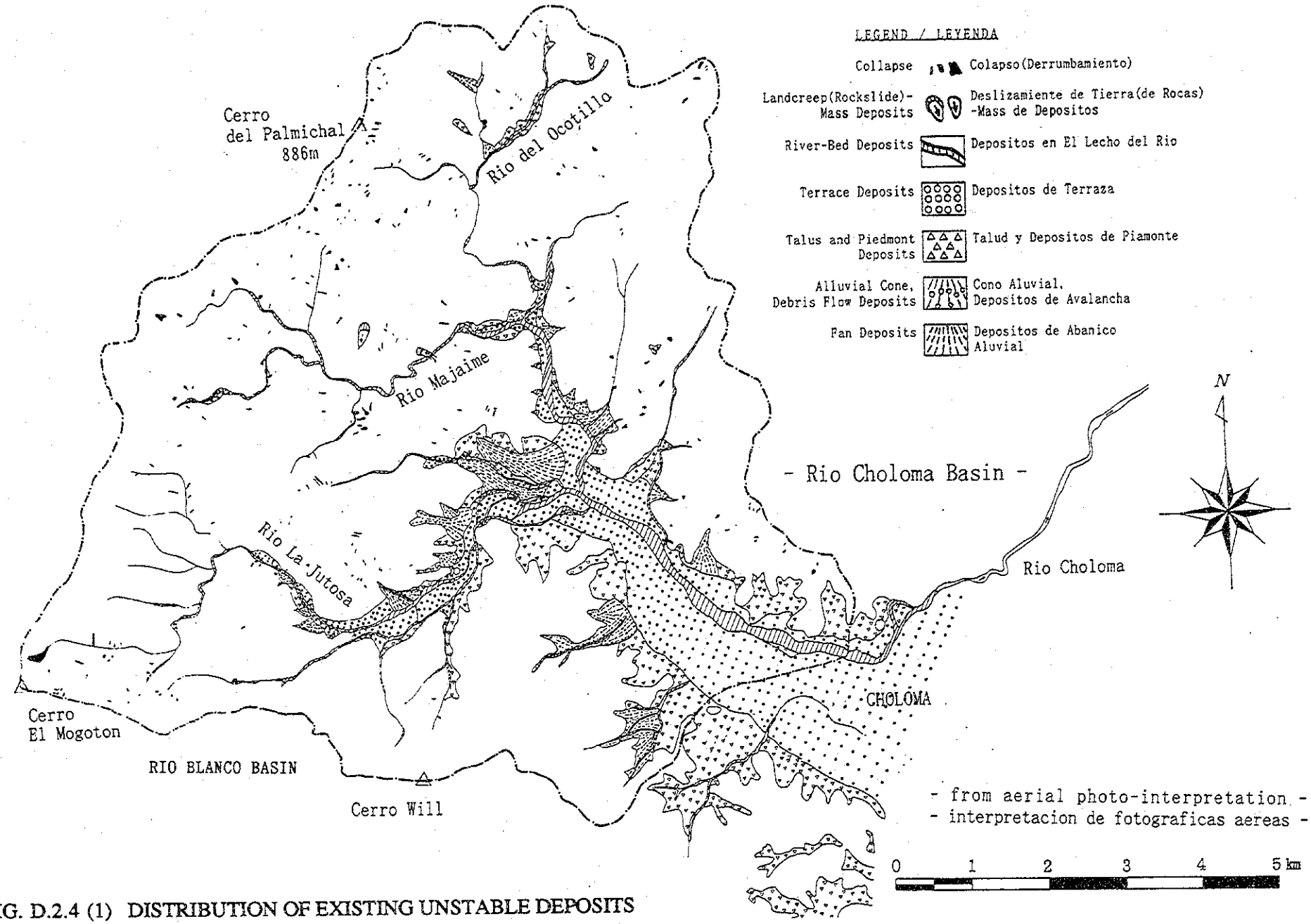


FIG. D.2.4 (1) DISTRIBUTION OF EXISTING UNSTABLE DEPOSITS

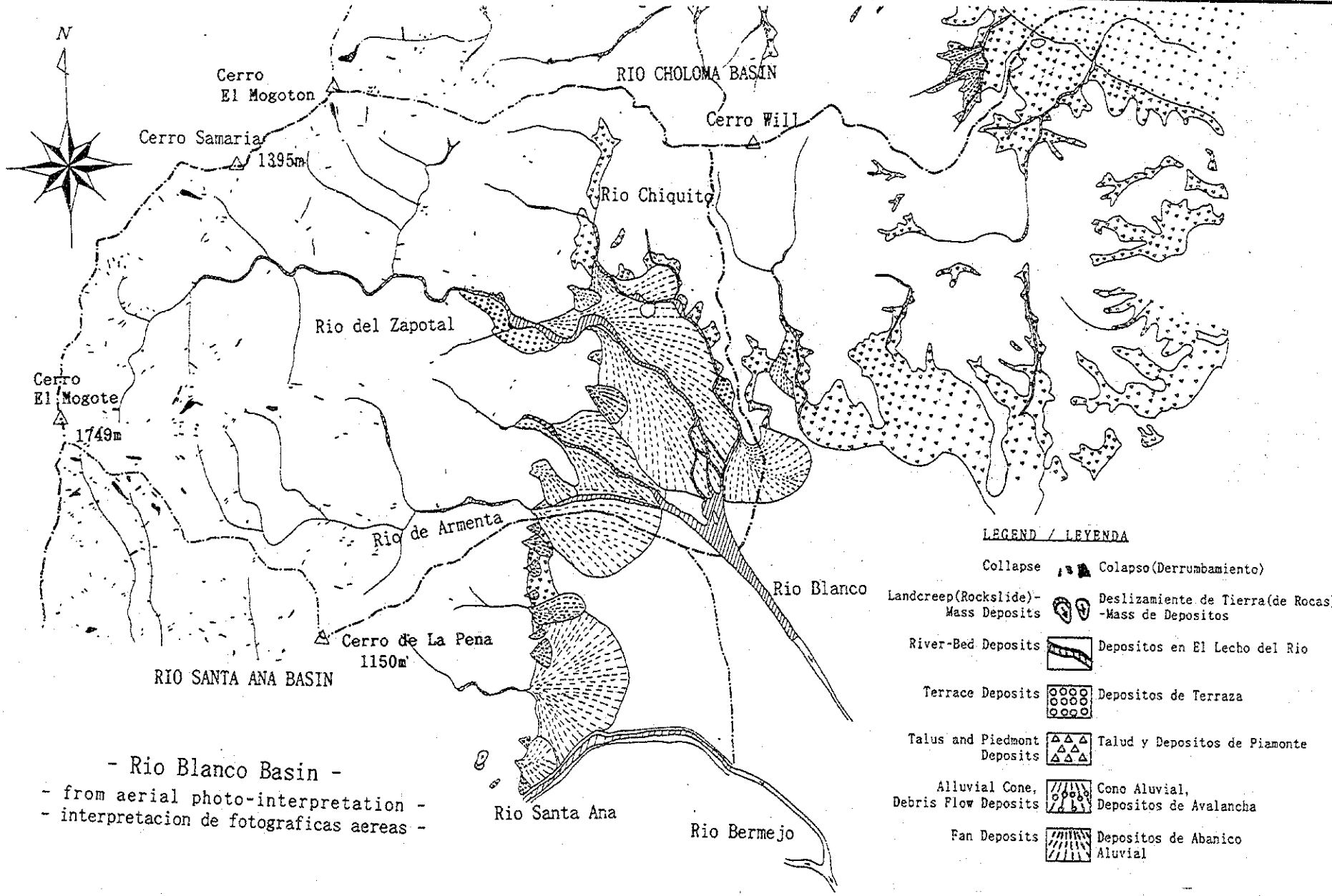


FIG. D.2.4 (2) DISTRIBUTION OF EXISTING UNSTABLE DEPOSITS

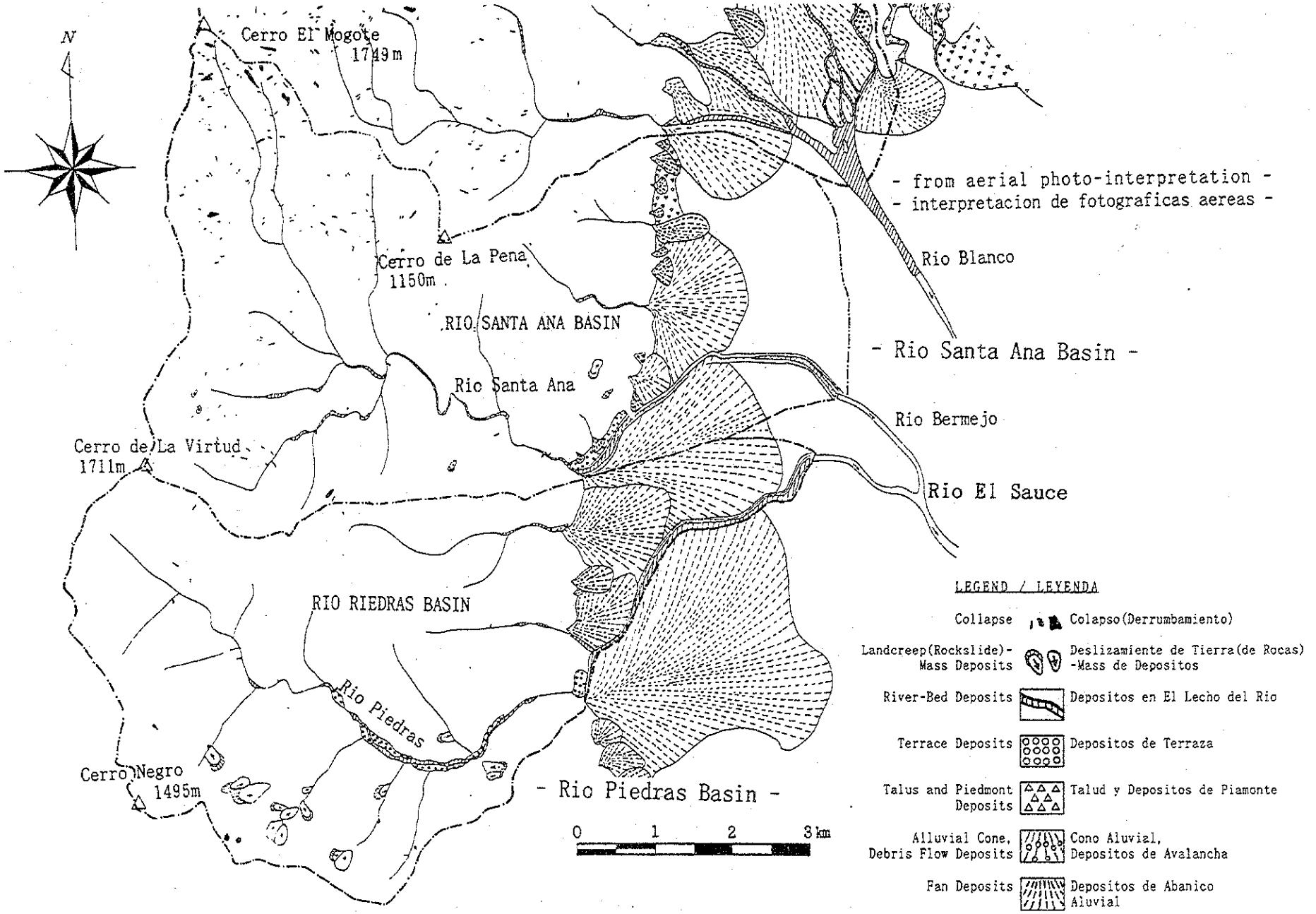


FIG. D.2.4 (3) DISTRIBUTION OF EXISTING UNSTABLE DEPOSITS

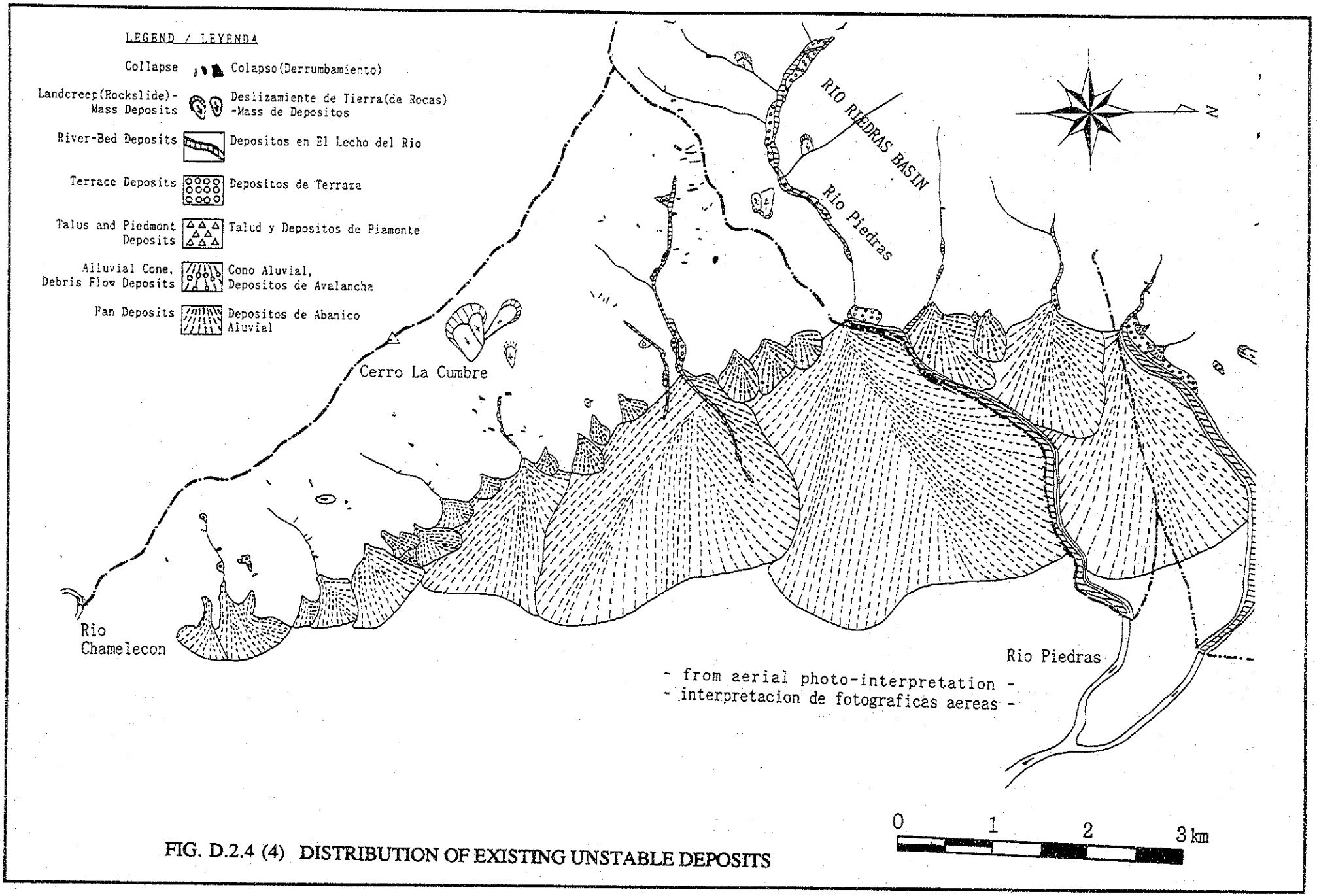


FIG. D.2.4 (4) DISTRIBUTION OF EXISTING UNSTABLE DEPOSITS

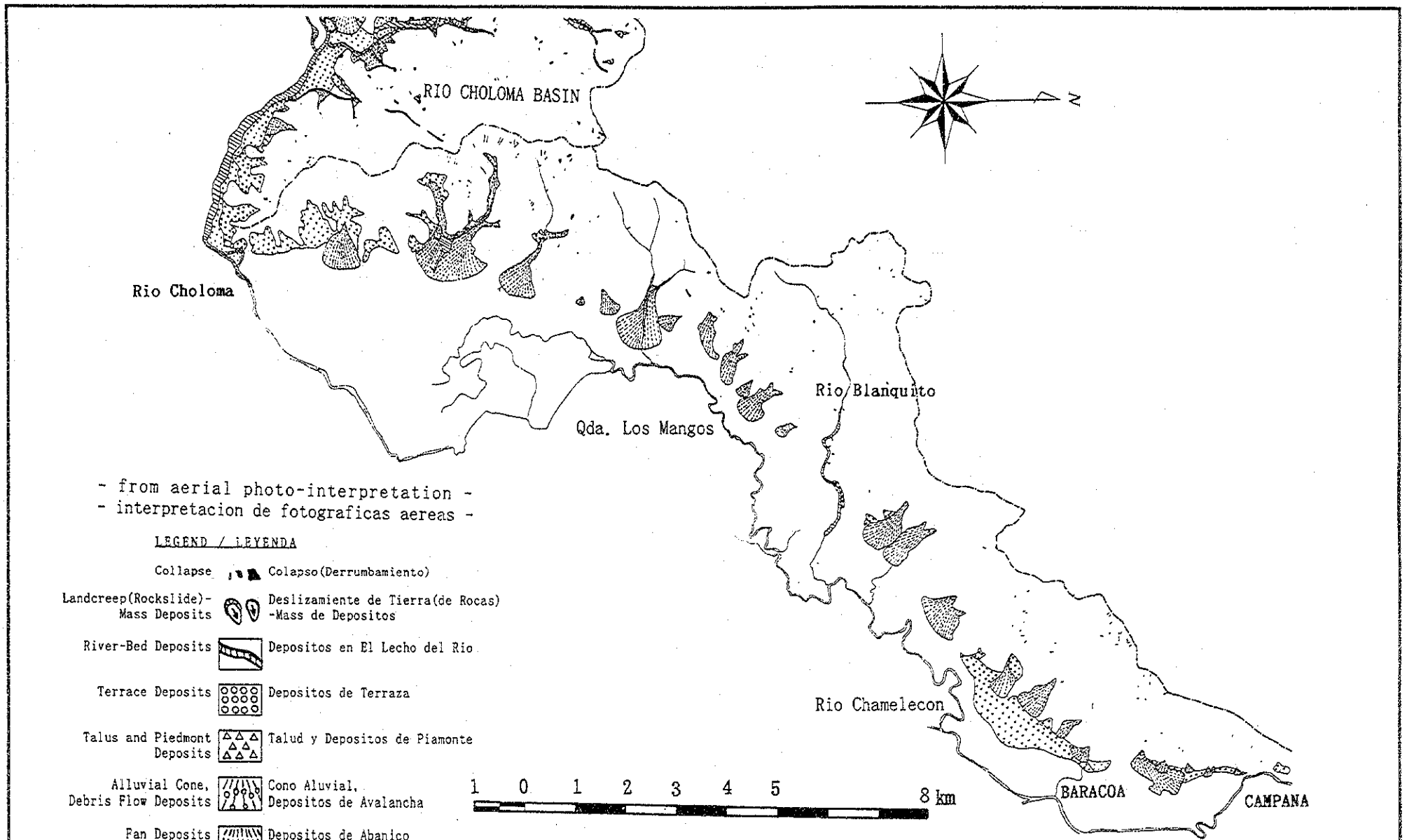
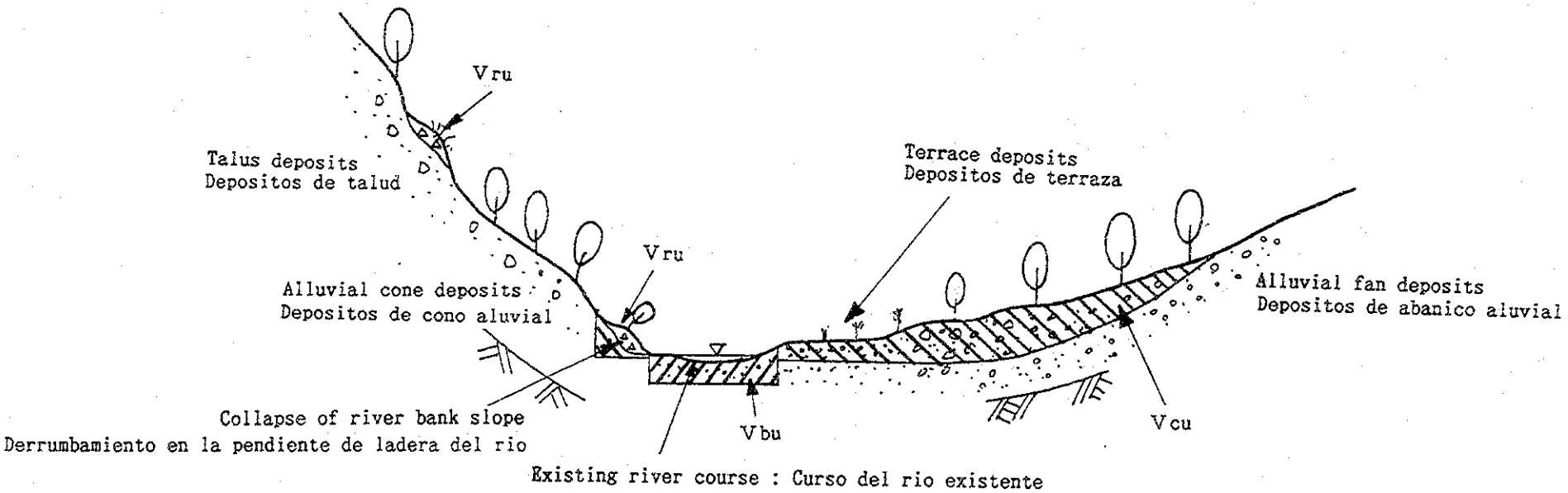
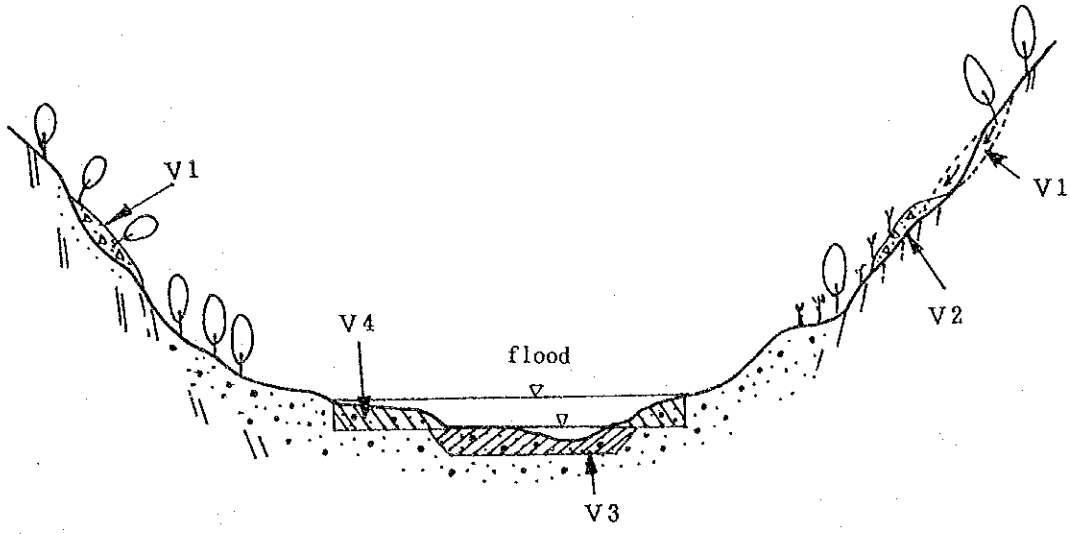


FIG. D.2.4 (5) DISTRIBUTION OF EXISTING UNSTABLE DEPOSITS



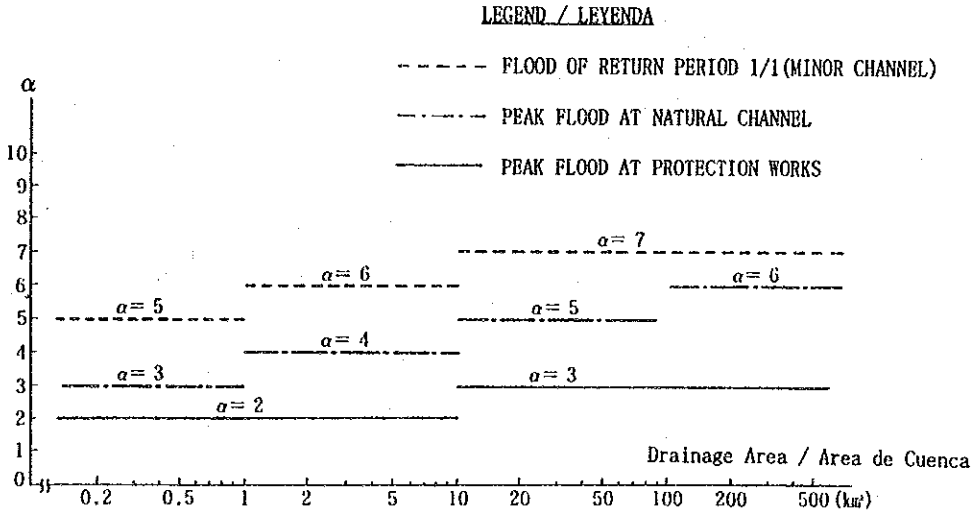
Vru : Residual unstable deposits existing of past collapsed area
Depositos residuales inestables existentes del area derrumbada anteriormente
Vbu : Unstable riverbed deposits
Depositos inestables en el lecho del rio
Vcu : Unstable deposits along the river course
Depositos inestables a lo largo del curso del rio

FIG. D.2.5 EXPLANATORY DIAGRAM OF UNSTABLE DEPOSITS DISTRIBUTION AND DISCHARGE ZONE



V1=Sediment yield of expanding collapsed area
Produccion de sedimentos de areas derrumbadas en expansion
V1=Sediment yield of newly collapsed area
Produccion de sedimento de nueva area derrumbada
V2=Residual collapsed sediment yield of existing past collapsed area
Produccion de sedimentos residuales existentes debido a areas derrumbadas anteriormente
V3=Sediment yield of surrounding riverbed area
Produccion de sedimentos alrededor en el area de lecho del rio
V4=Sediment yield due to river bank erosion
Produccion de sedimentos debido a la erosion de la ribera del rio
V10=design sediment yield / Produccion de sedimentos de diseño(=V1+V2+V3+V4)

FIG. D.3.1 EXPLANATORY DIAGRAM OF DESIGN SEDIMENT YIELD



FLOOD OF RETURN PERIOD 1/1(MINOR CHANNEL) / PERIODO DE RETORNO DEL FLUJO 1/1(CANAL MENOR)
PEAK FLOOD AT NATURAL CHANNEL / FLUJO MAXIMO EN CANAL NATURAL
PEAK FLOOD AT PROTECTION WORKS / FLUJO MAXIMO EN TRABAJOS DE PROTECCION

FIG. D.3.2 DRAINAGE AREA - COEFFICIENT α OF REGIME THEORY

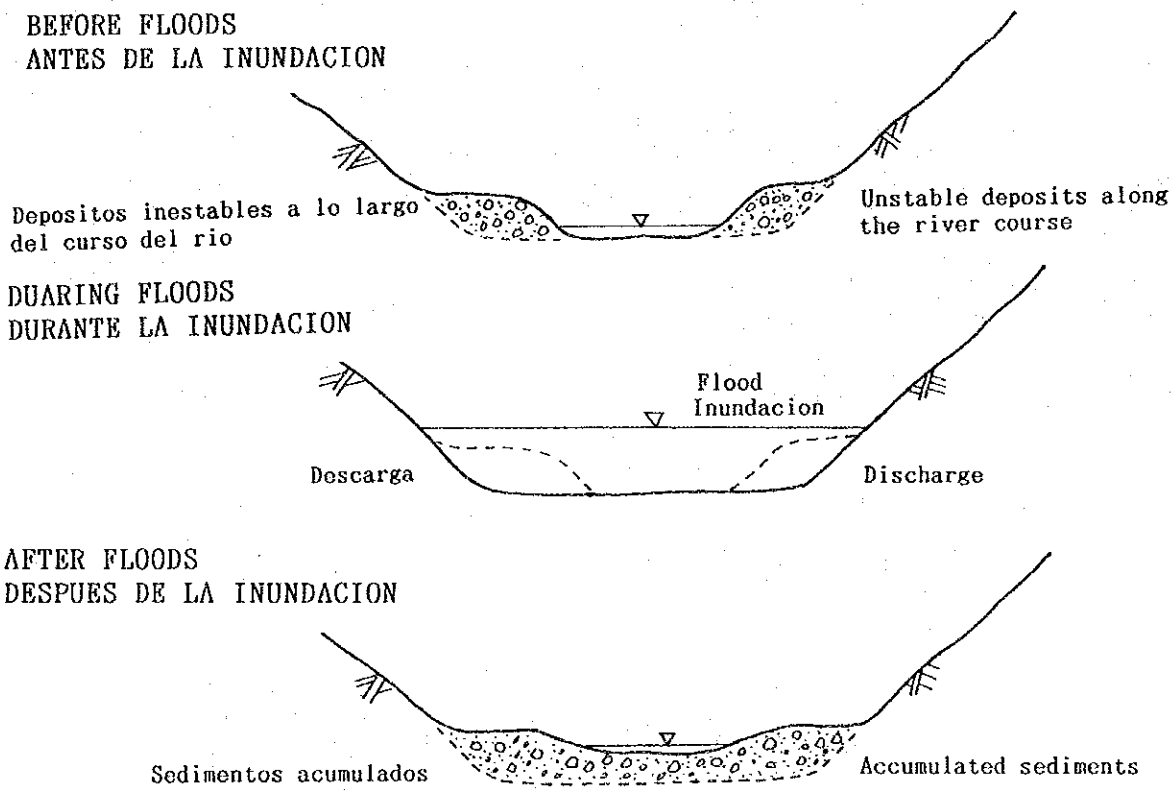
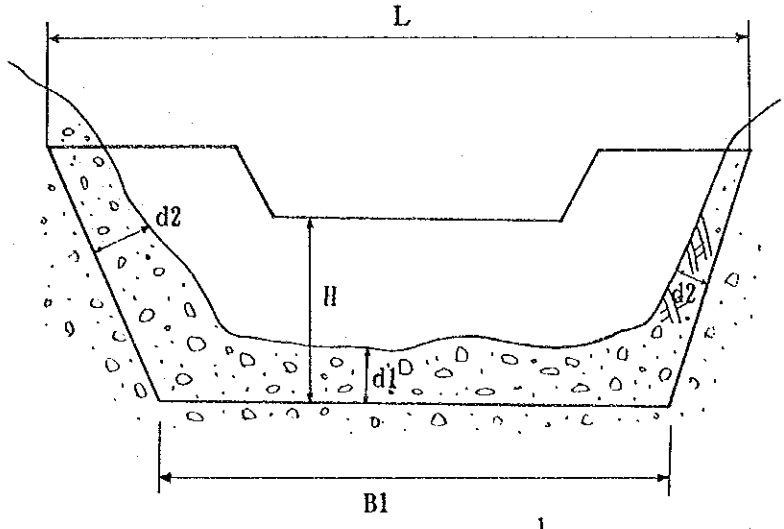
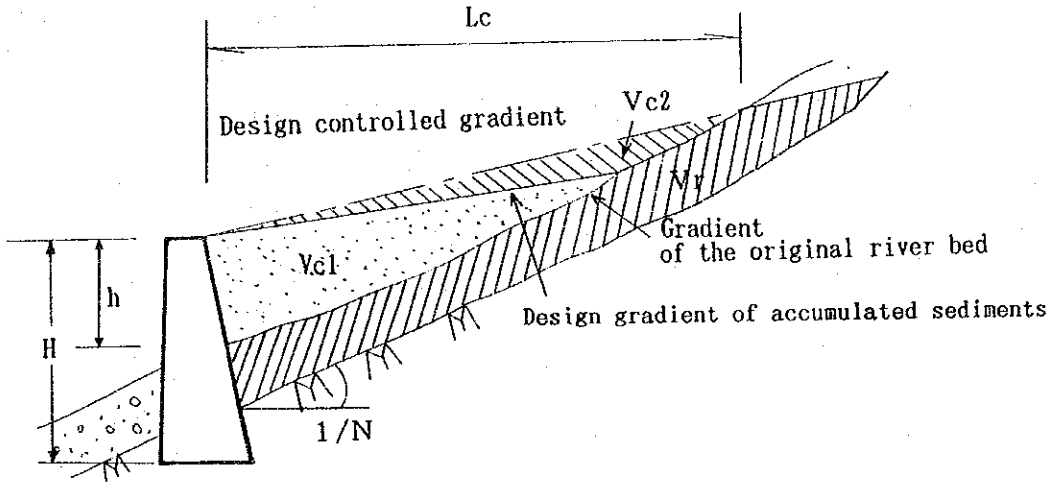


FIG. D.3.3 EXPLANATORY DIAGRAM OF NATURALLY CONTROLLED SEDIMENT DISCHARGE

CHECK DAM



h : Effective dam height / Altura efectiva de presa
B1 : Riverbed width / Anchura del lecho del rio
B2 : Average width of sedimentation area / Anchura promedio de la area de sedimentacion
d1 : Thickness of riverbed deposits / Espesor de sedimentos en del cauce del rio
d2 : Thickness of sediments at river bank slope / Espesor de sedimentos en la ribera del Rio
1/N : Riverbed gradient / Inclinacion del cauce del rio
Lc : Length of sedimentation area / Longitud de area de sedimentacion(=2XNXh)

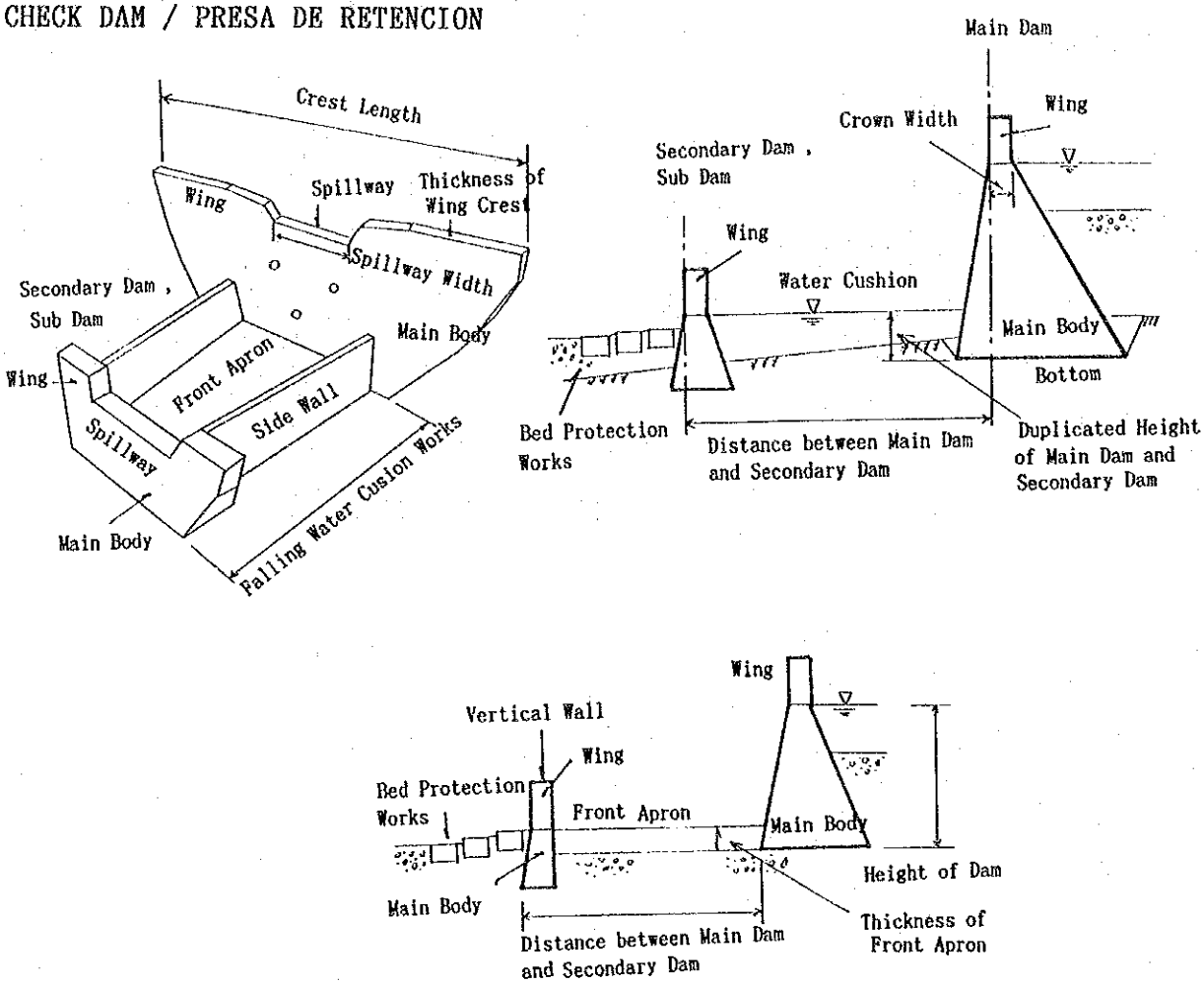


Vc1 : Sediment trap capacity(=NXB2Xh2)
Capacidad de la trampa de sedimentos
Vc2 : Contorolled sediment discharge capability(0.1XVc1)
Capacidad de descarga de sedimentos controlada
Vr : Sediment discharge suppression capability(=LcX(hXd2+B1Xd1))
Capacidad de descarga de sedimentos represiro
Vc2+Vr : Volume of facility effectiveness
Volumen de capacidad efectiva por instalacion

Design controlled gradient / Diseño de la gradiente controlada
Gradient of the original riverbed / Gradiente del lecho original
Design gradient of accumulated sediments / Diseño del gradiente de sedimentos acumulada

FIG. D.3.4 EXPLANATORY DIAGRAM OF VC1, VC2 AND VR

CHECK DAM / PRESA DE RETENCION



Bed Protection Works : Trabajos de Proteccion del Lecho
Bottom : Base
Crest Length : Longitud de Cresta
Crown Width : Anchos de Corona
Distance between Main Dam and Sub Dam : Distancia entre Presa Principal y Presa Secundaria,
Duplicated Height of Main Dam and Secondary Dam : Altura Duplicada de Presa
Falling Water Cusion Works : Trabajos de Almohadon para Agua de Caida
Front Apron : Disipador de Energia(Delantal)
Height of Dam: Altora de la Presa
Main Dam : Presa Principal
Main Body : Cuerpo Principal
Secondary Dam(Sub Dam) : Presa Secundaria(Contra Presa)
Side Wall : Pared de Proteccion
Spillway : Vertedero
Spillway Width : Ancho de Vertedero
Thickness of Front Apron : Espesor del Delantal Disipador
Thickness of Wing Crest : Espesor de la Cresta(Manga)
Vertical Wall : Pared Vertical
Water Cushion : Almohadon de Agua
Wing : Ala(Manga)

FIG. D.3.5 BASIC FORM OF CHECK DAM (SABO DAM)

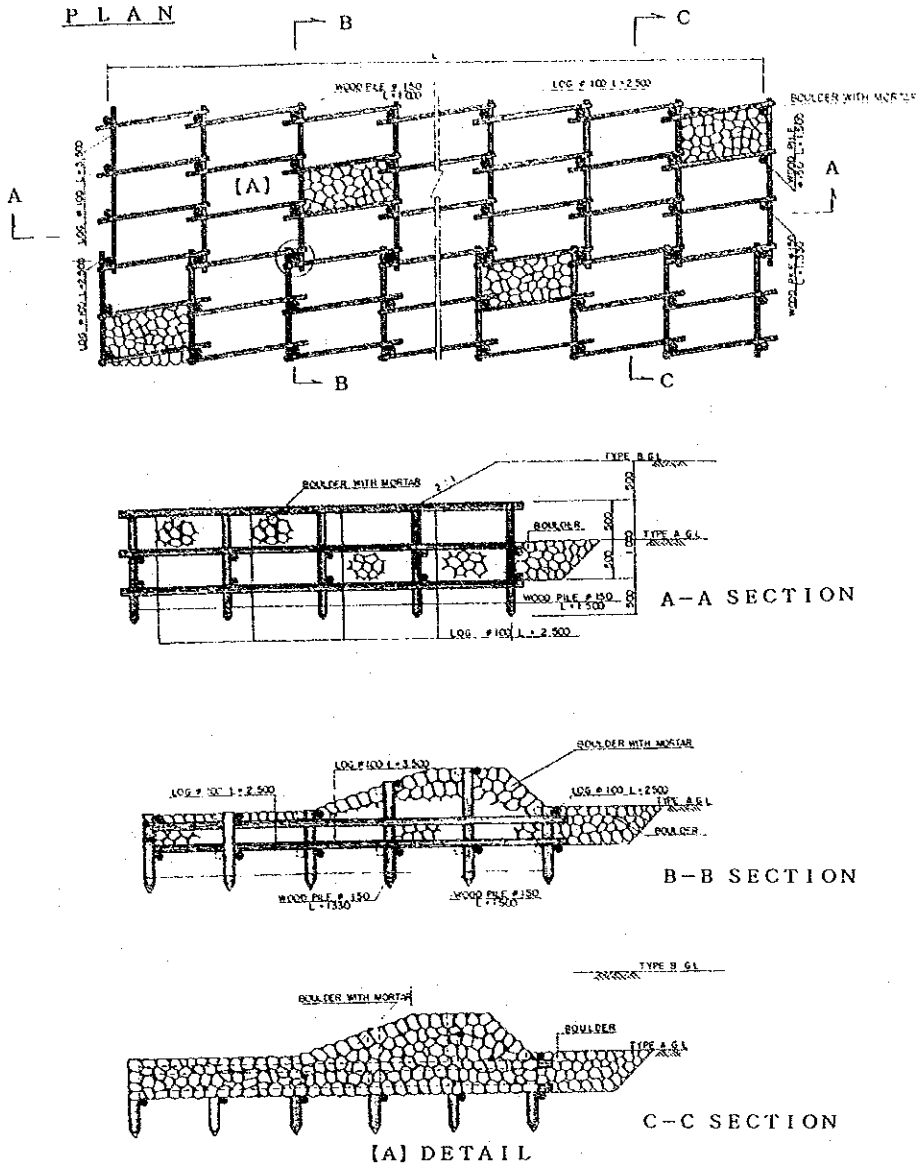


FIG. D.3.6 PROPOSED BASIC DESIGN OF CONSOLIDATION WORKS USING GABION

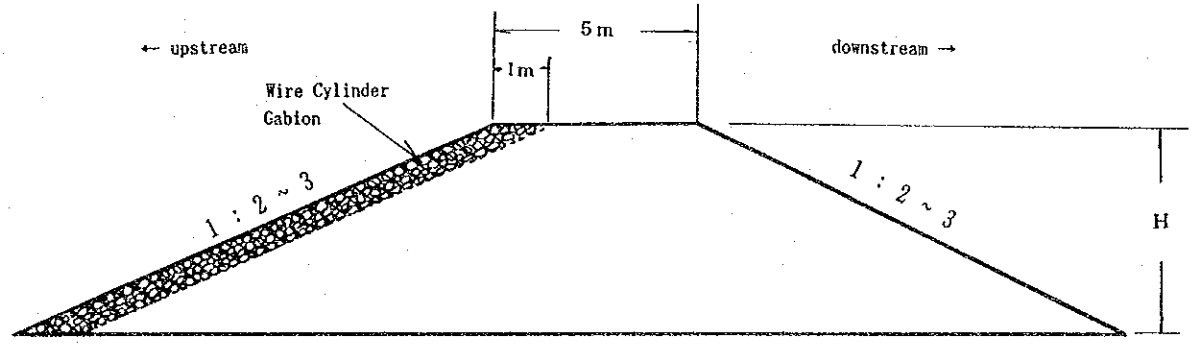


FIG. D.3.7 PROPOSED BASIC DESIGN OF TRAINING LEVEE (DEBRIS CONTROL LEVEE)

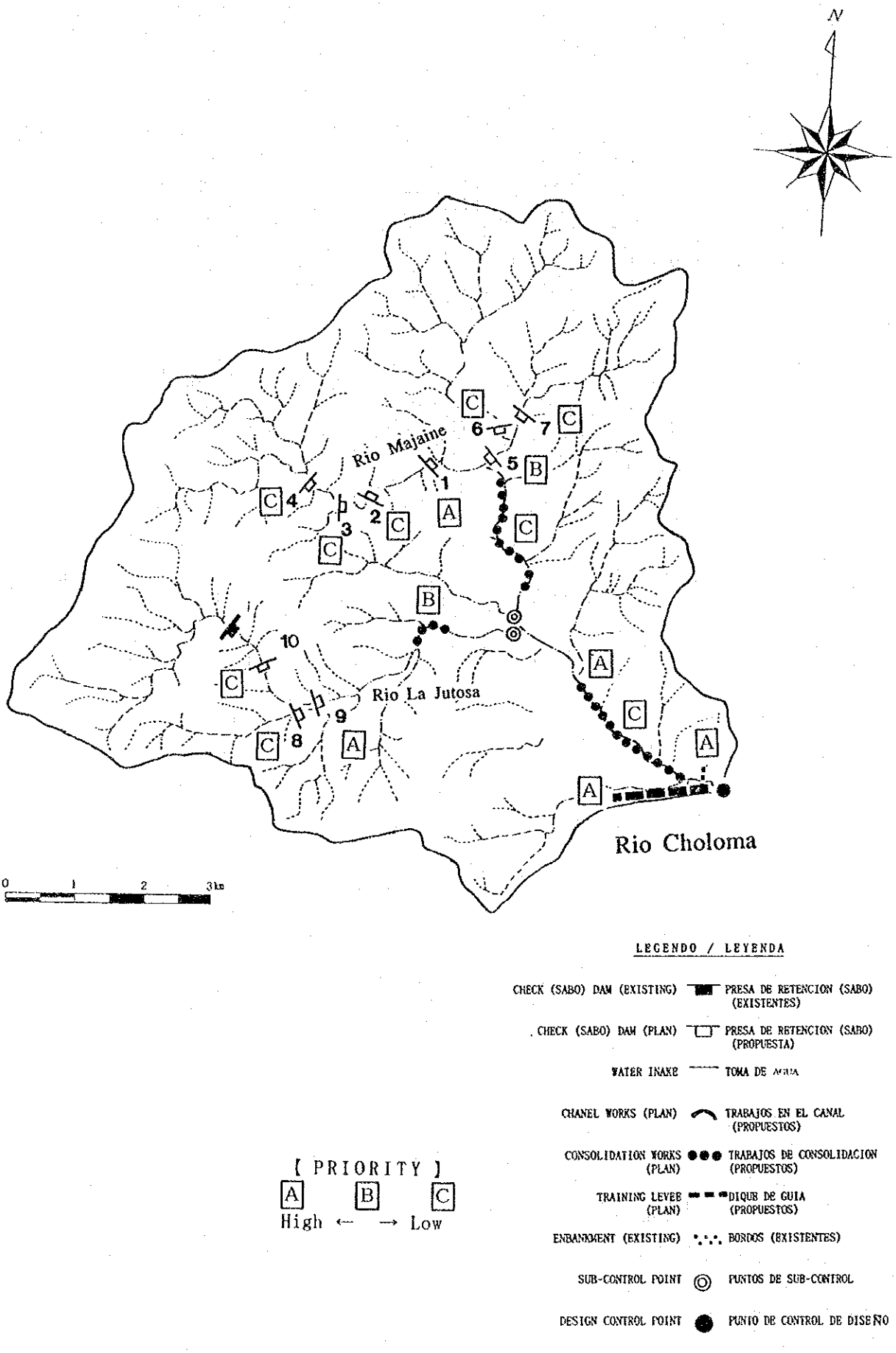
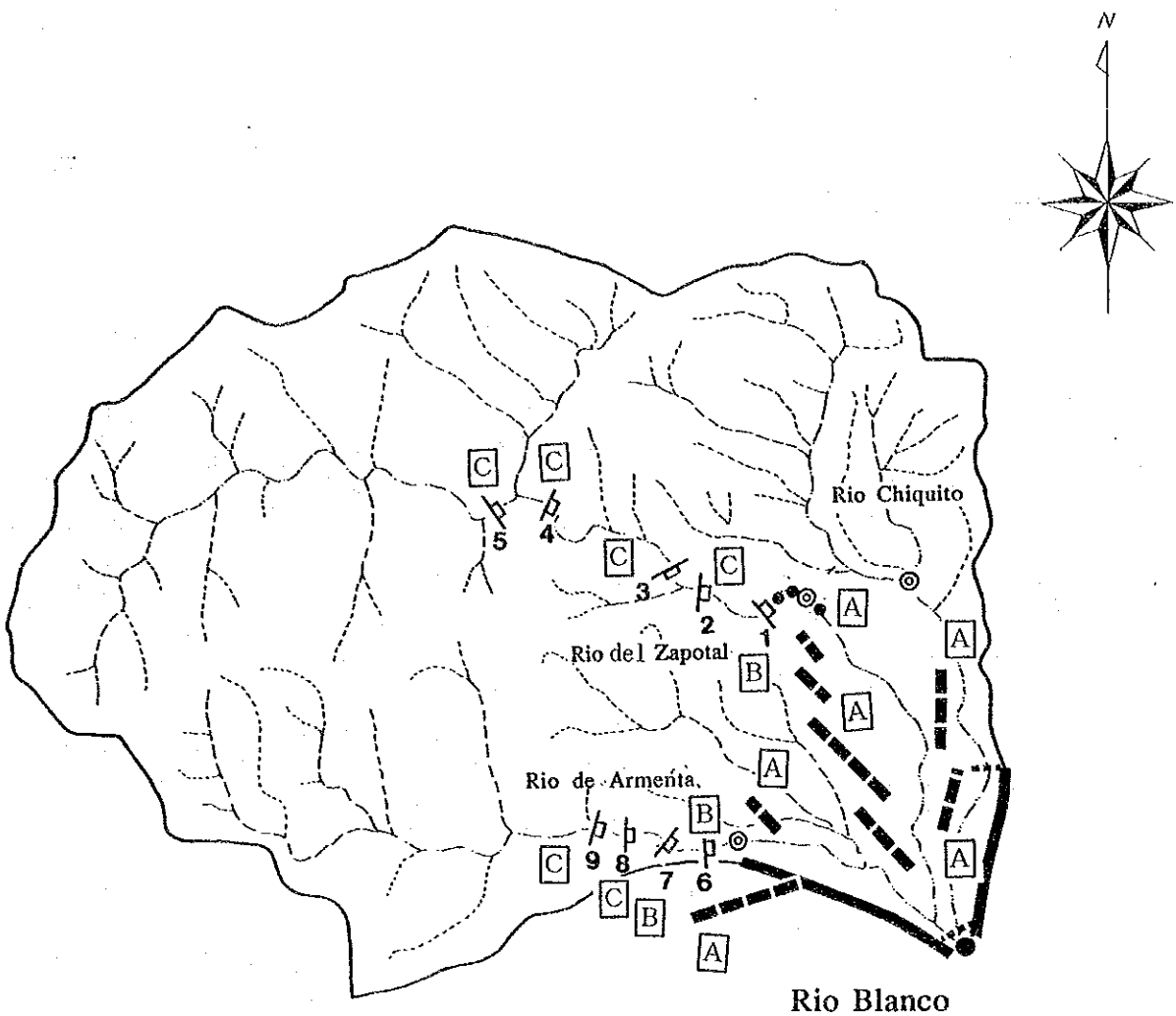


FIG. D.3.8 (1) LOCATION OF EROSION CONTROL FACILITY AND PRIORITY SEQUENCE (RIO CHOLOMA)



0 1 2 3km

[PRIORITY]

A B C

High ← → Low

LEGENDO / LEYENDA

CHECK (SABO) DAM (EXISTING)	PRESA DE RETENCION (SABO) (EXISTENTES)
CHECK (SABO) DAM (PLAN)	PRESA DE RETENCION (SABO) (PROPUESTA)
WATER INAKE	TOMA DE AGUA
CHANEL WORKS (PLAN)	TRABAJOS EN EL CANAL (PROPUESTOS)
CONSOLIDATION WORKS (PLAN)	TRABAJOS DE CONSOLIDACION (PROPUESTOS)
TRAINING LEVEE (PLAN)	DIQUE DE GUIA (PROPUESTOS)
ENBANKMENT (EXISTING)	BORDOS (EXISTENTES)
SUB-CONTROL POINT	PUNTOS DE SUB-CONTROL
DESIGN CONTROL POINT	PUNTO DE CONTROL DE DISEÑO

FIG. D.3.8 (2) LOCATION OF EROSION CONTROL FACILITY AND PRIORITY SEQUENCE (RIO BLANCO)

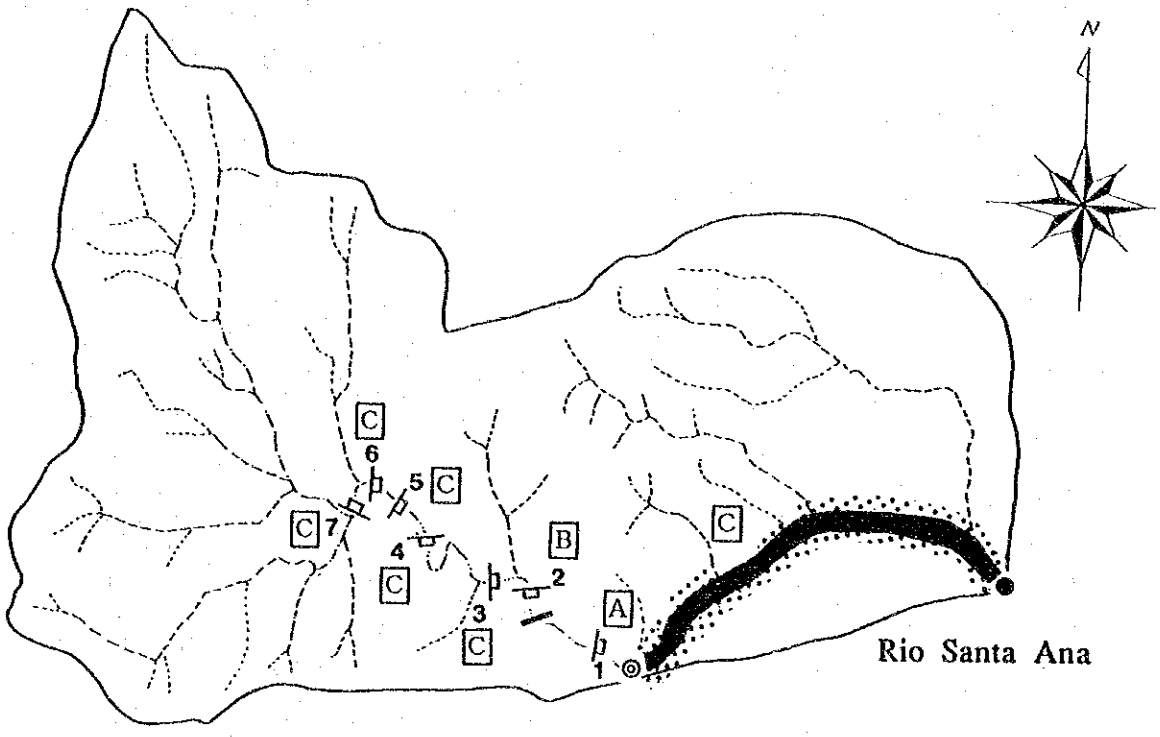


FIG. D.3.8 (3) LOCATION OF EROSION CONTROL FACILITY AND PRIORITY SEQUENCE (RIO SANTA ANA)

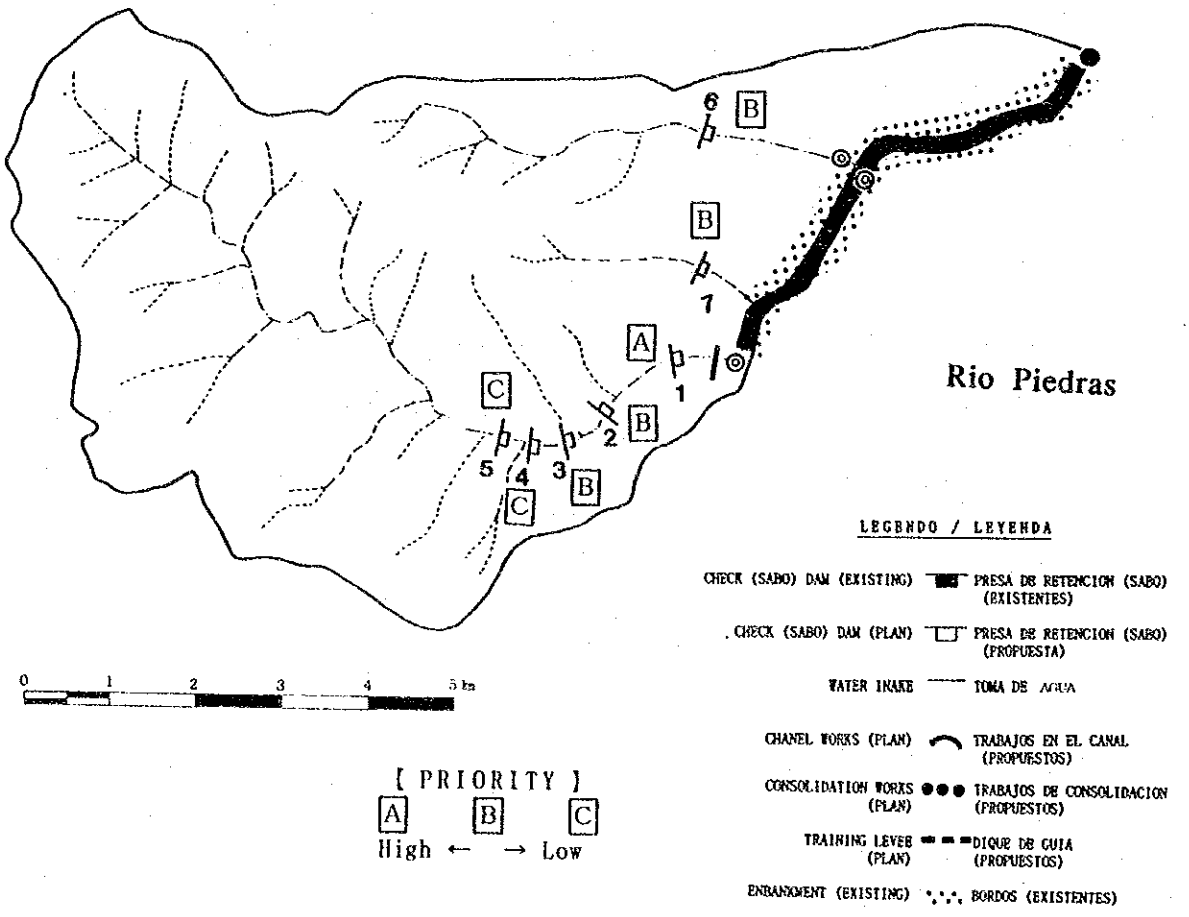


FIG. D.3.8 (4) LOCATION OF EROSION CONTROL FACILITY AND PRIORITY SEQUENCE (RIO PIEDRAS)

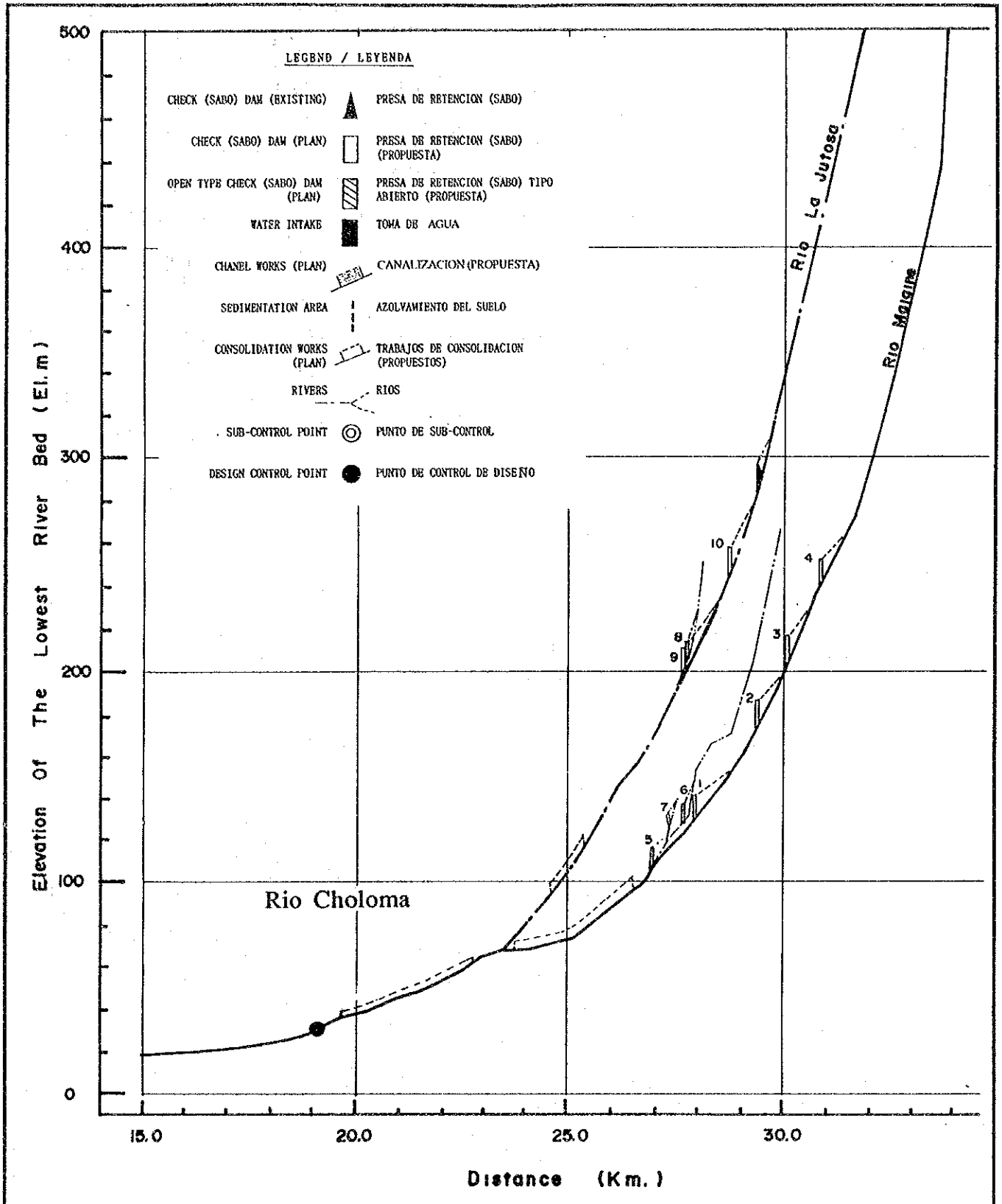


FIG. D.3.9 (1) LONGITUDINAL PROFILE OF EROSION CONTROL FACILITY ARRANGEMENT (RIO CHOLOMA)

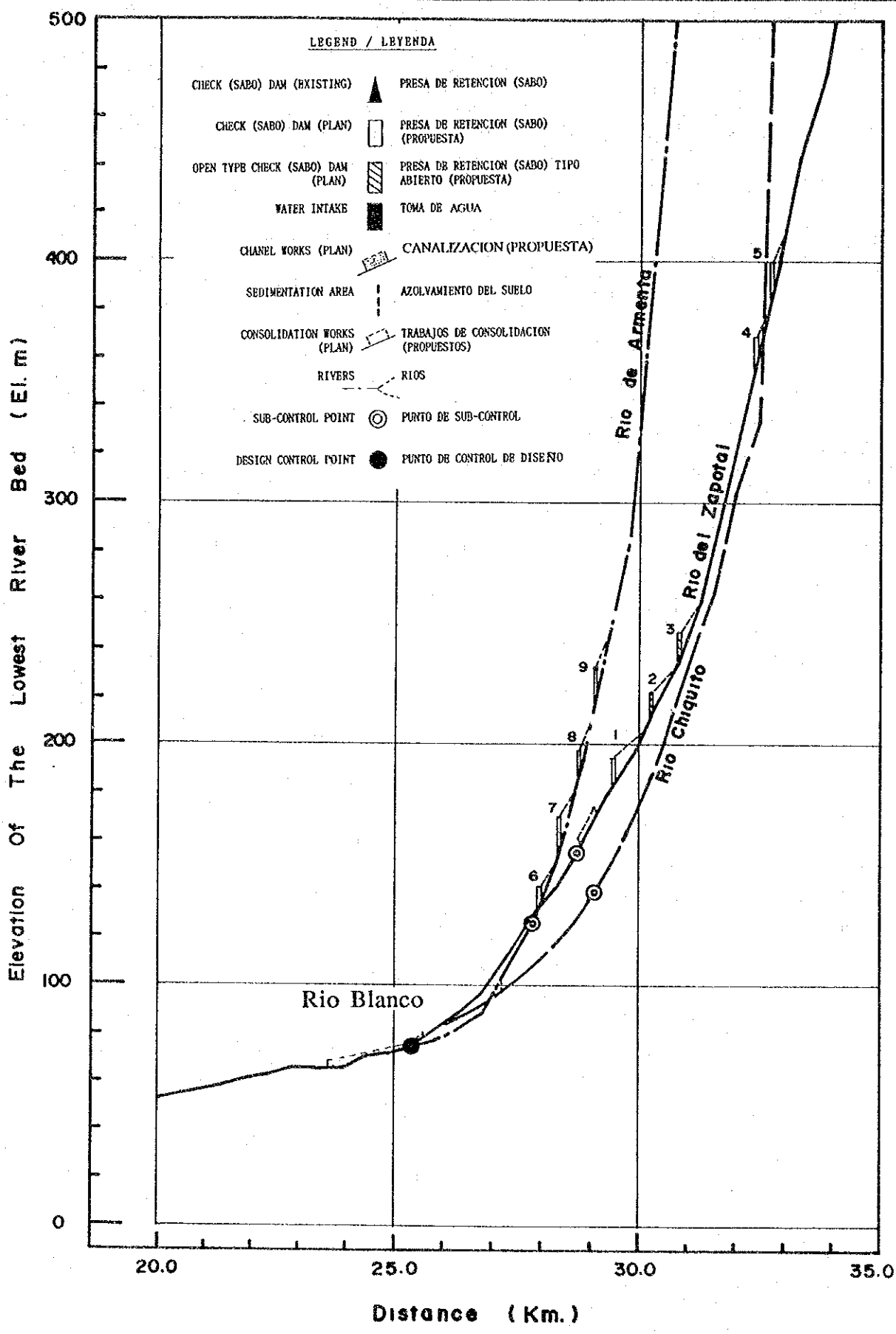


FIG. D.3.9 (2) LONGITUDINAL PROFILE OF EROSION CONTROL FACILITY ARRANGEMENT (RIO BLANCO)

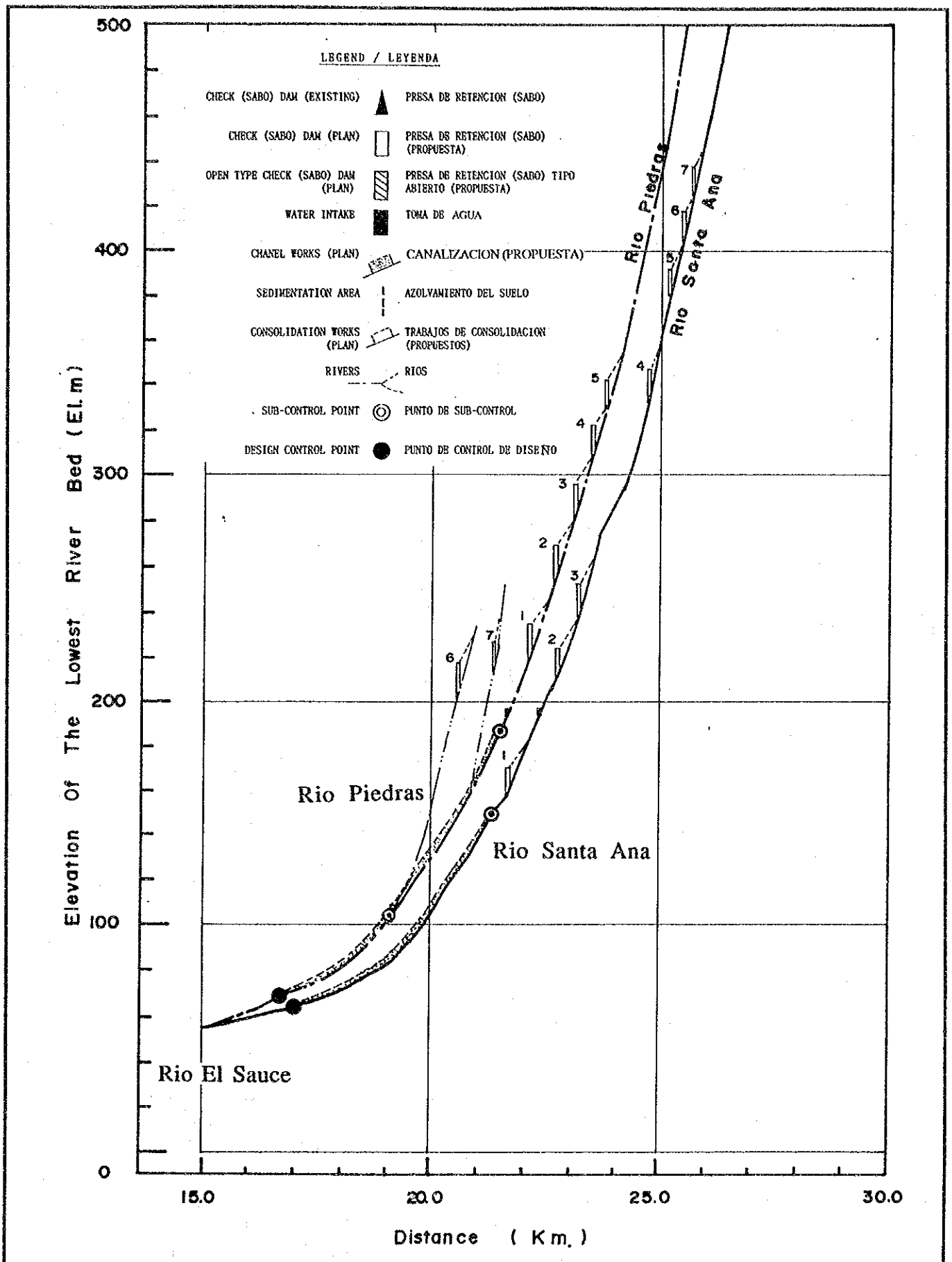


FIG. D.3.9 (3) LONGITUDINAL PROFILE OF EROSION CONTROL FACILITY ARRANGEMENT (RIO EL SAUCE)

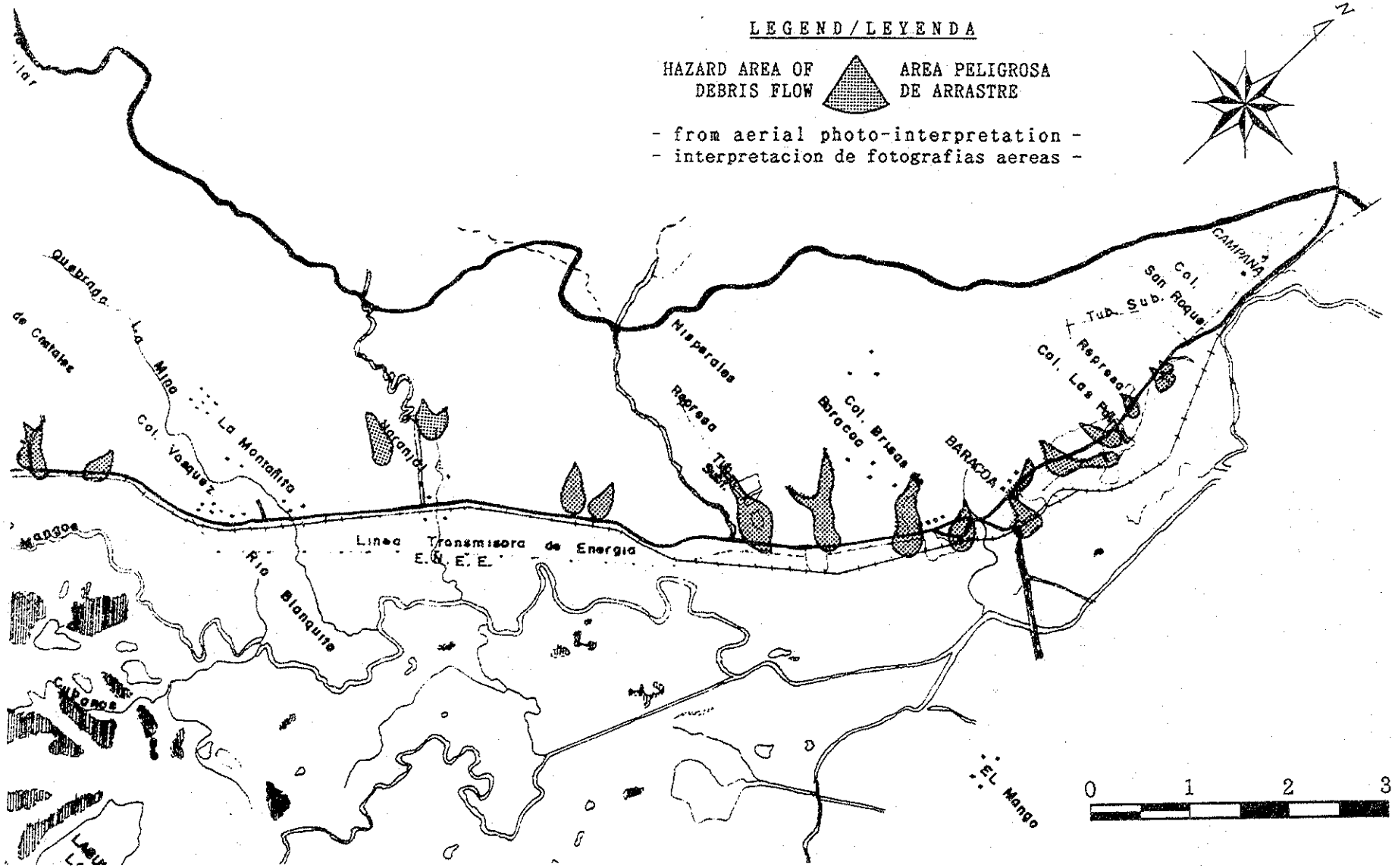


FIG. D.4.1 (1) POTENTIAL DEBRIS FLOW HAZARD AREA

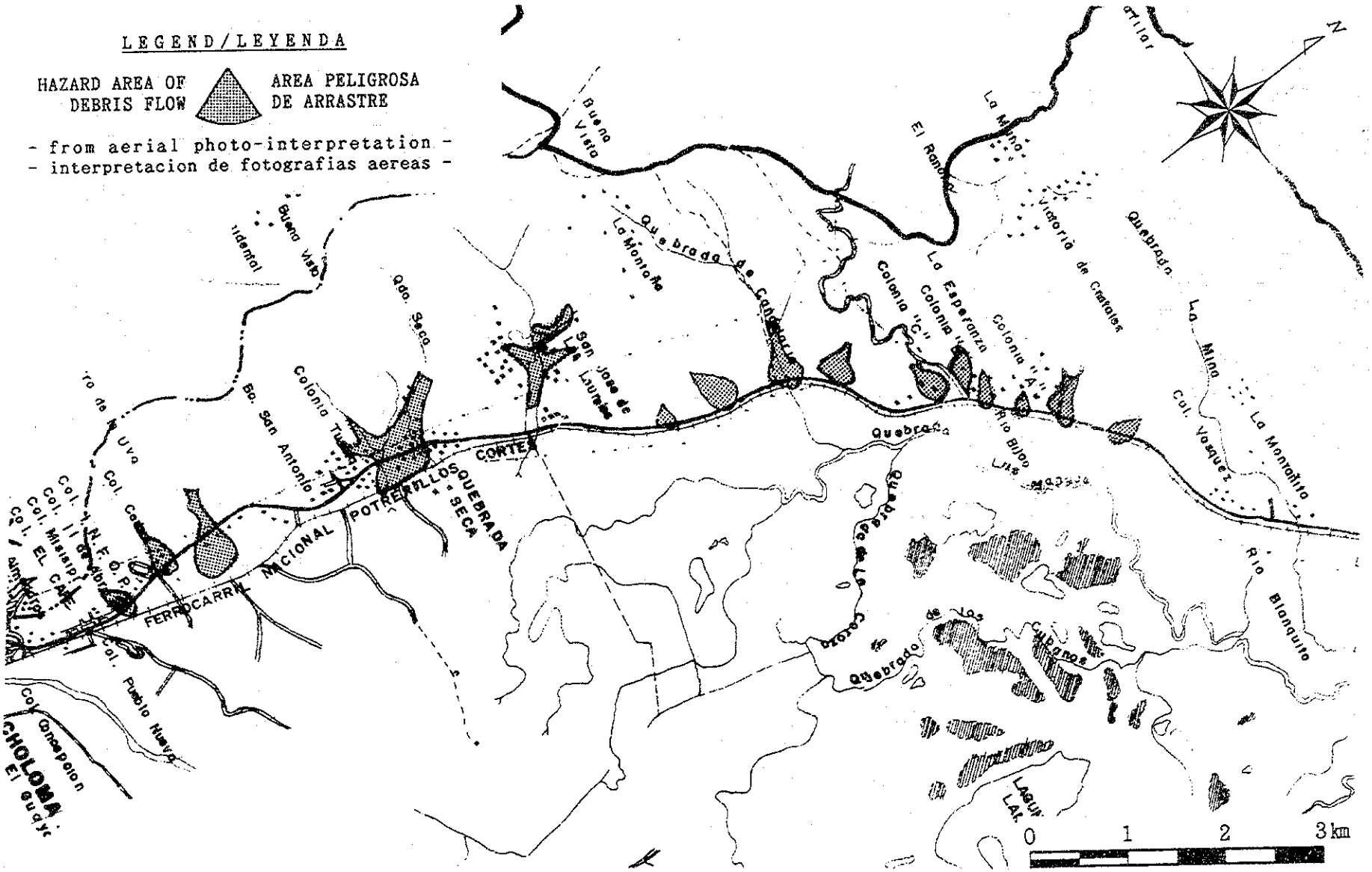


FIG. D.4.1 (2) POTENTIAL DEBRIS FLOW HAZARD AREA

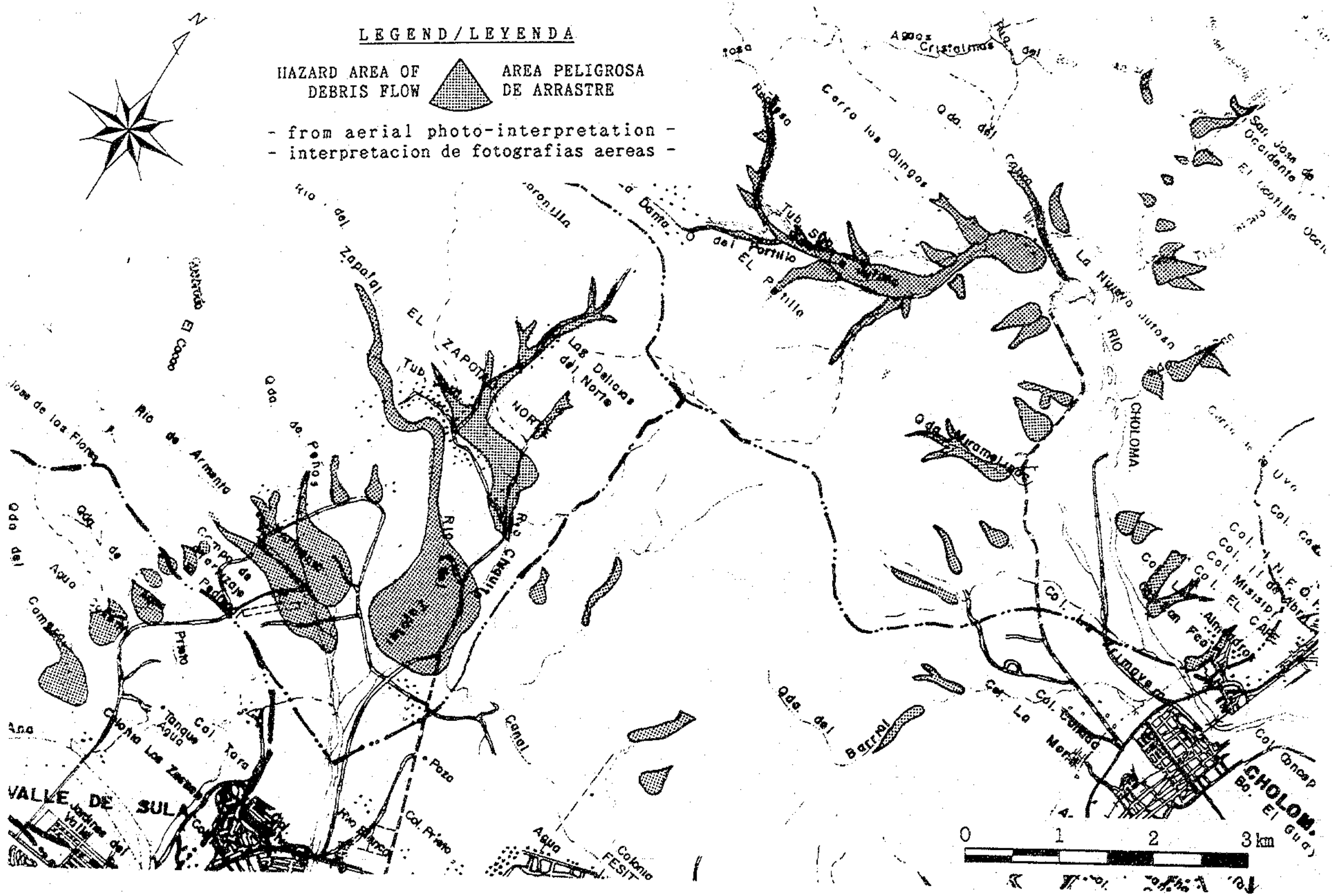


FIG. D.4.1 (3) POTENTIAL DEBRIS FLOW HAZARD AREA

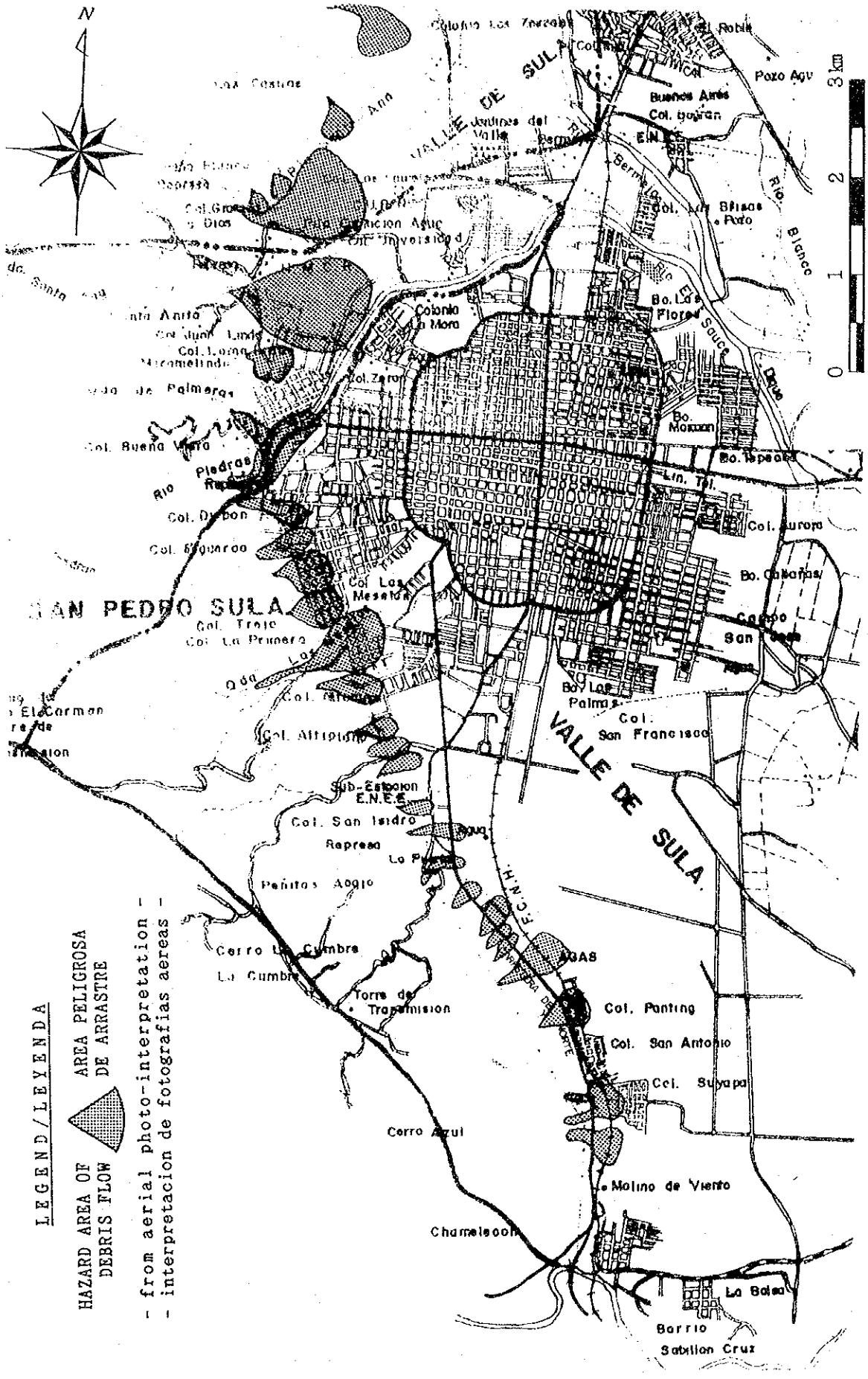


FIG. D.4.1 (4) POTENTIAL DEBRIS FLOW HAZARD AREA

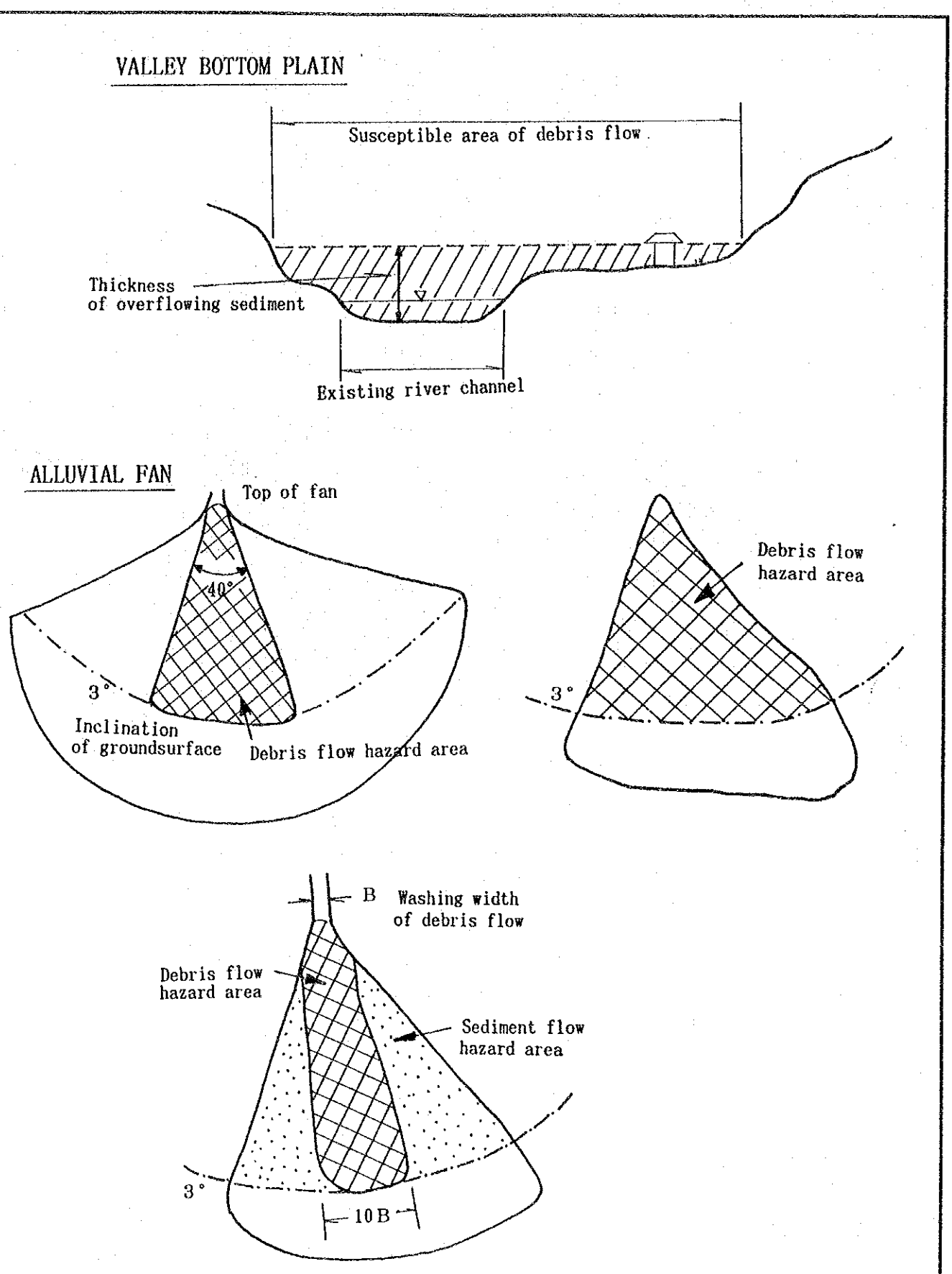


FIG. D.4.2 PRESUMPTION OF DEBRIS FLOW OVERFLOWING AREA

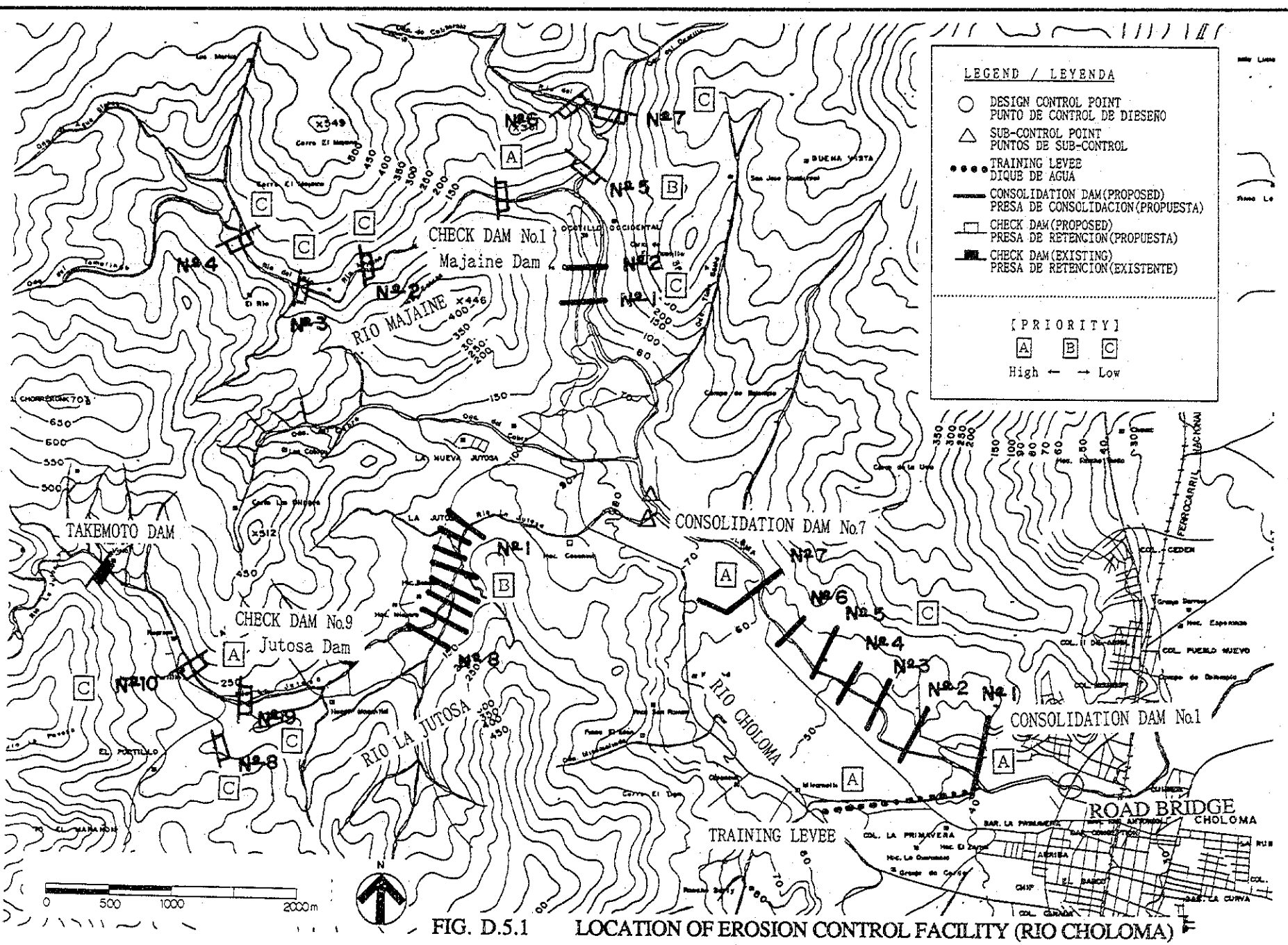
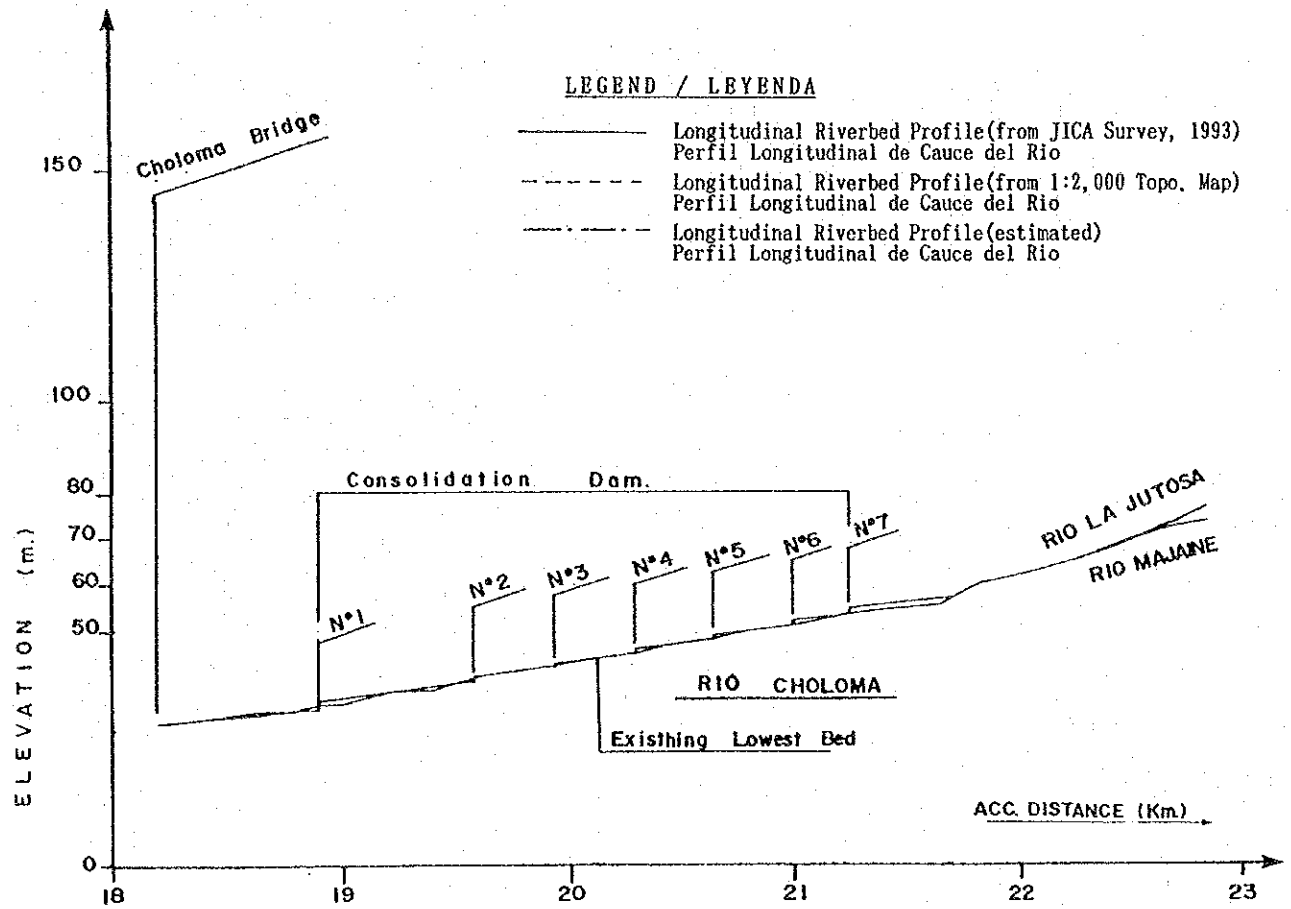


FIG. D.5.1 LOCATION OF EROSION CONTROL FACILITY (RIO CHOLOMA)



Section Rio La Jutosa	Design Acc. Dist. (Km.)	Lowest Bed El. Rio La Jutosa
JU-001	22.435	68.33
JU-002	22.635	72.11
JU-003	22.835	76.66

Section Rio Choloma & Majane	Design Acc. Dist. (Km.)	Lowest Bed El. Rio Choloma & Majane
CH-040	18.185	29.93
CH-041	18.395	31.37
CH-042	18.605	32.23
CH-043	18.815	32.76
	18.885	33.80
CH-044	18.995	34.38
CH-045	19.195	36.23
CH-046	19.415	36.62
CH-047	19.585	39.76
	19.625	
CH-048	19.825	41.50
CH-049	19.935	42.59
	20.025	
CH-050	20.235	44.04
	20.285	
CH-051	20.440	46.47
	20.635	
CH-052	20.642	47.98
CH-053	20.845	50.00
CH-054	20.985	51.18
	21.045	
CH-055	21.235	53.41
CH-056	21.435	54.18
CH-057	21.635	55.34
CH-058	21.835	60.38
CH-059	22.035	62.24
CH-060	22.235	64.67
MA-001	22.435	67.54
MA-002	22.635	71.31
MA-003	22.835	73.34

FIG. D.5.2 (1) DESIGN LONGITUDINAL SECTION OF EROSION CONTROL FACILITY

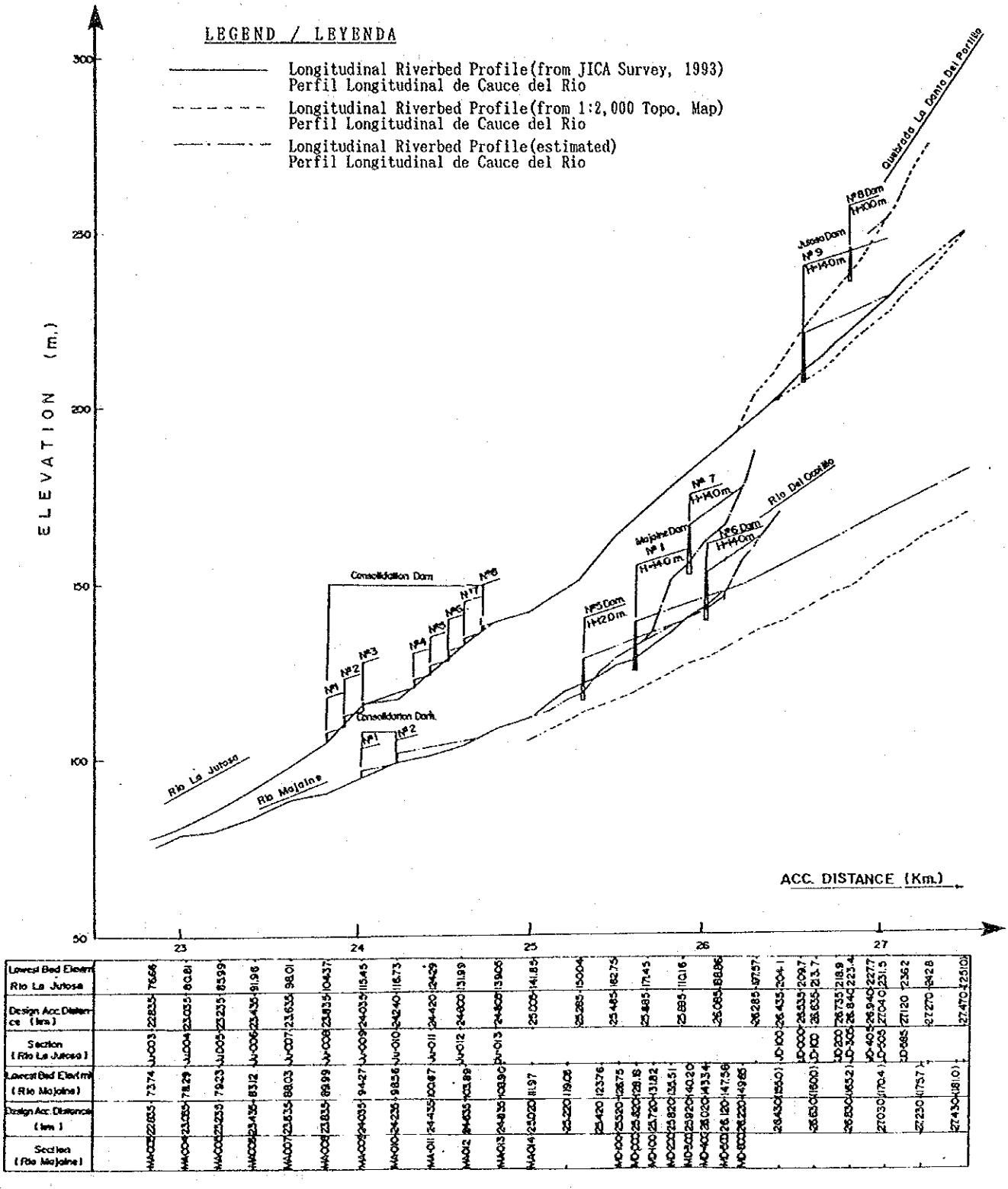
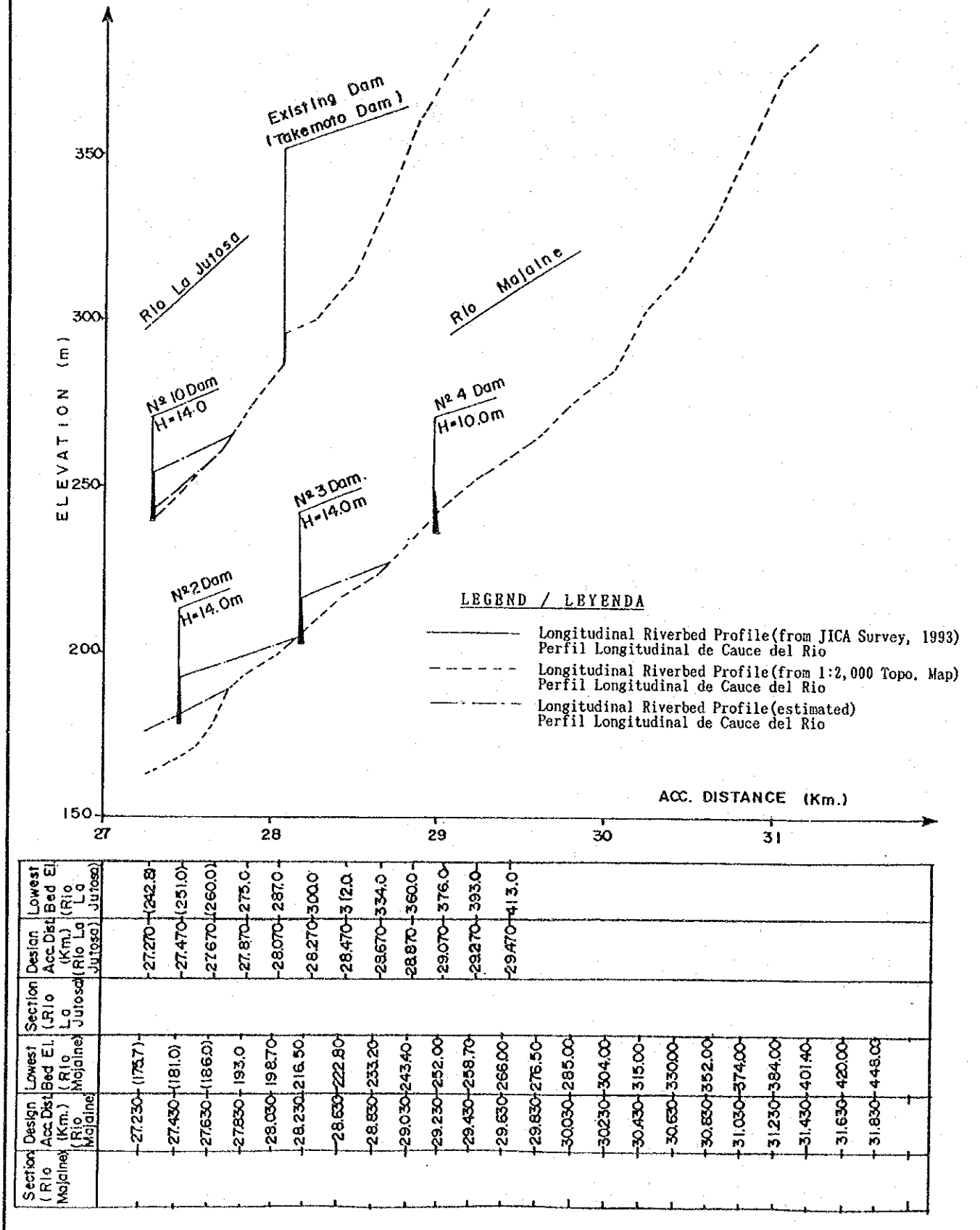
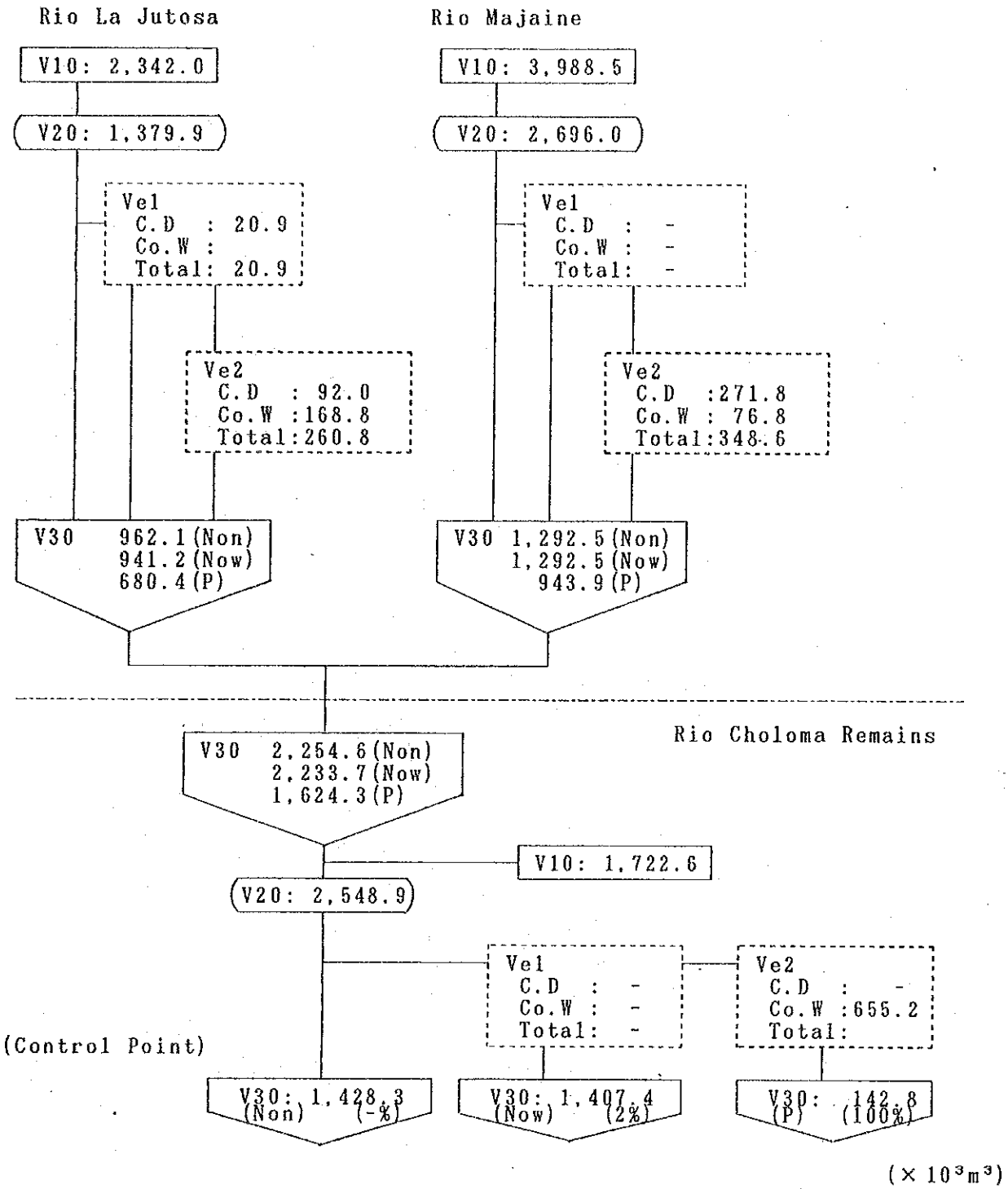


FIG. D.5.2 (2) DESIGN LONGITUDINAL SECTION OF EROSION CONTROL FACILITY



Section (Rio Majaine)	Design Acc.Dist (Km.) (Rio Majaine)	Lowest Bed El. (Rio Majaine)	Section (Rio La Jutosa)	Design Acc.Dist (Km.) (Rio La Jutosa)	Lowest Bed El. (Rio La Jutosa)
	27.230	(175.7)		27.270	(242.8)
	27.430	(181.0)		27.470	(251.0)
	27.630	(186.0)		27.670	(260.0)
	27.830	193.0		27.870	275.0
	28.030	198.70		28.070	287.0
	28.230	216.50		28.270	300.0
	28.630	222.80		28.470	312.0
	28.830	233.20		28.670	334.0
	29.030	243.40		28.870	360.0
	29.230	252.00		29.070	376.0
	29.430	258.70		29.270	393.0
	29.630	266.00		29.470	413.0
	29.830	276.50			
	30.030	285.00			
	30.230	304.00			
	30.430	315.00			
	30.630	330.00			
	30.830	352.00			
	31.030	374.00			
	31.230	384.00			
	31.430	401.40			
	31.630	420.00			
	31.830	448.03			

FIG. D.5.2 (3) DESIGN LONGITUDINAL SECTION OF EROSION CONTROL FACILITY



V10 : Design sediment yield
V20 : Naturally controlled sediment discharge along the river course
V30 : Design sediment discharge
(Non):Without facility, (Now):present conditions, (Plan):Plan
Ve1 : Facility effect(Existing), Ve2 : Facility effect(Plan)
C.D:Check dam, Co.W:Consolidation works
% : Sediment settlement percentage

FIG. D.5.3 SEDIMENT BALANCE IN THE RIO CHOLOMA BASIN

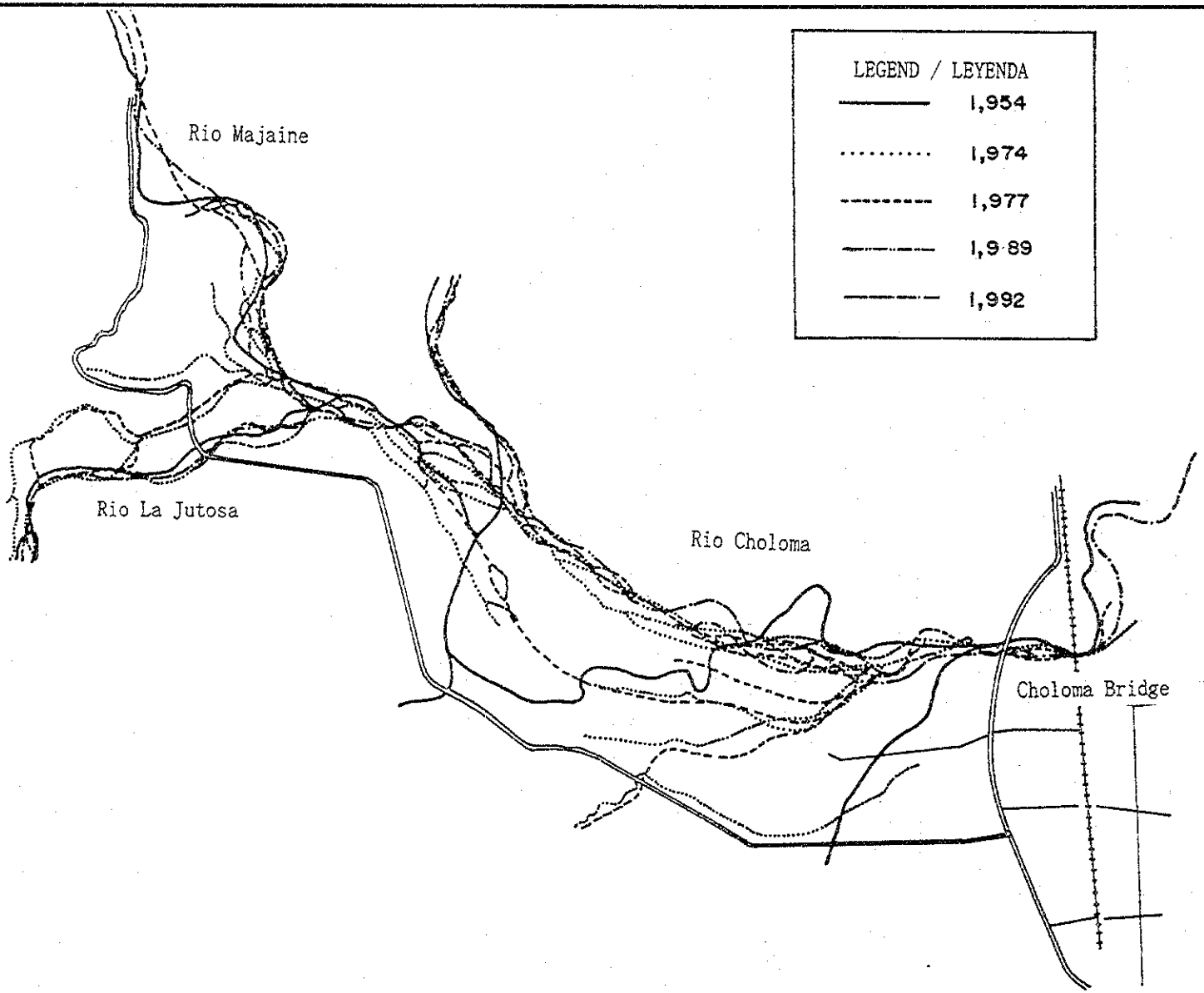


FIG. D.5.4 HISTORICAL MAIN STREAM COURSE IN THE RIO CHOLOMA

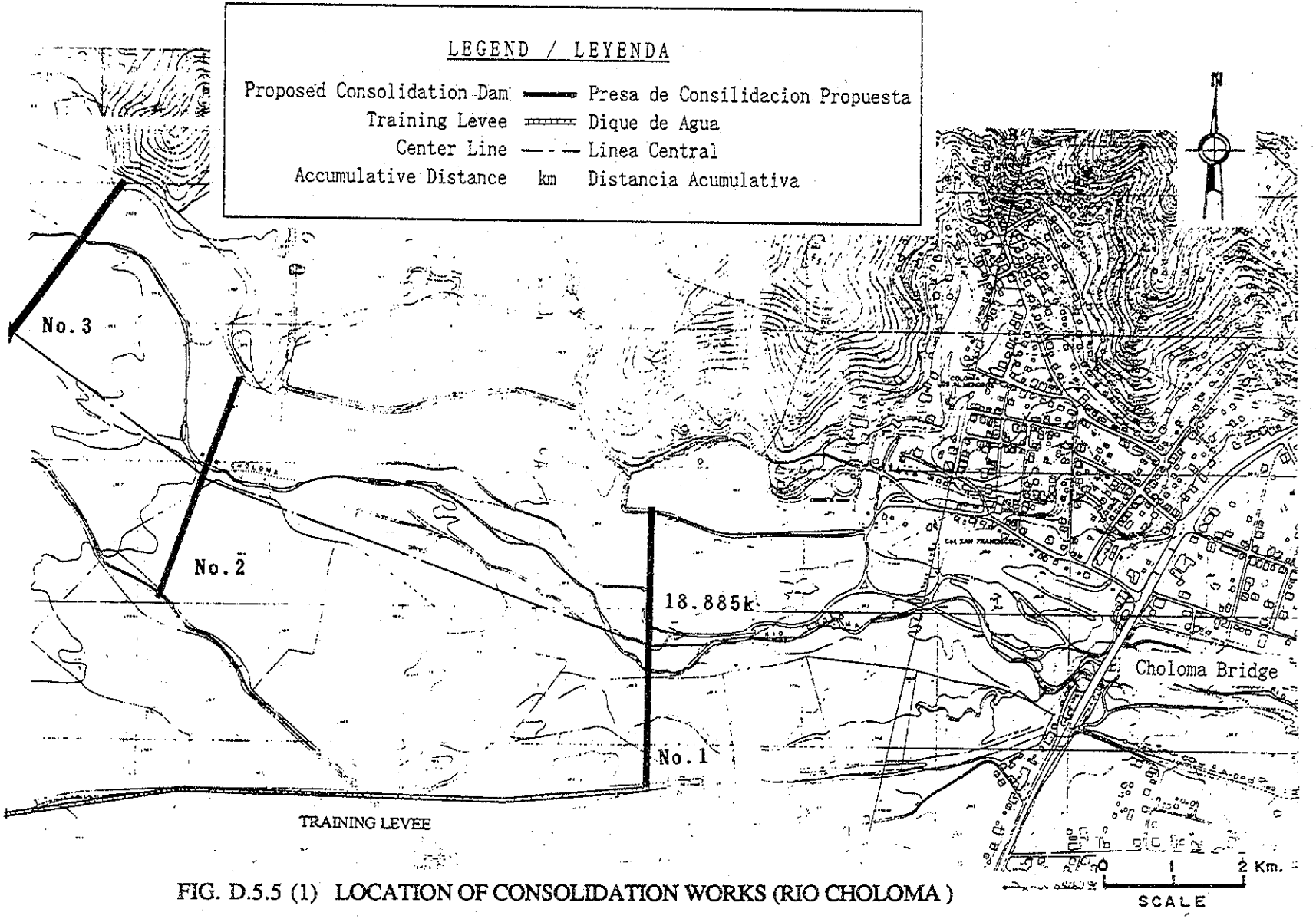


FIG. D.5.5 (1) LOCATION OF CONSOLIDATION WORKS (RIO CHOLOMA)

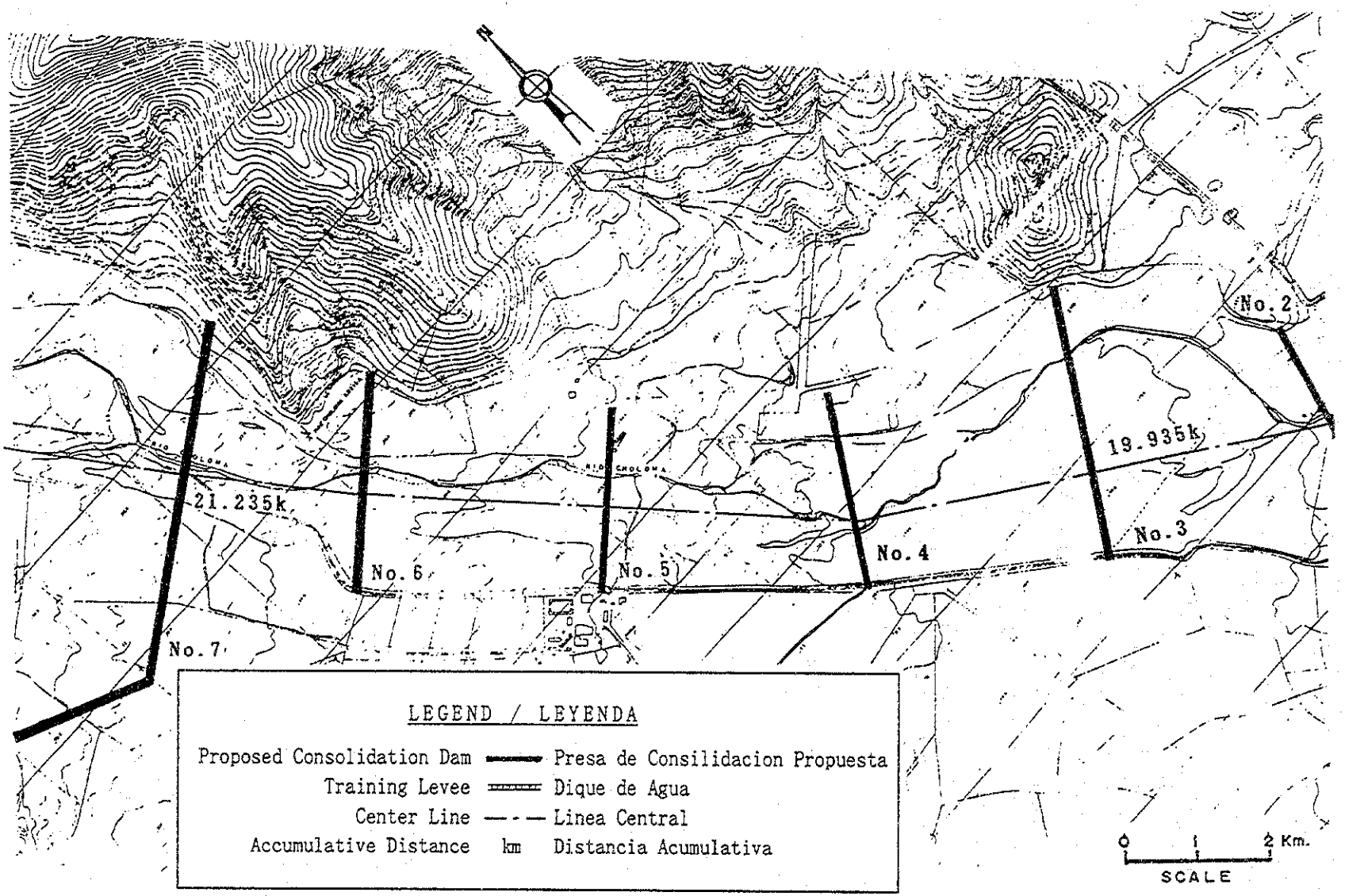


FIG. D.5.5 (2) LOCATION OF CONSOLIDATION WORKS (RIO CHOLOMA)

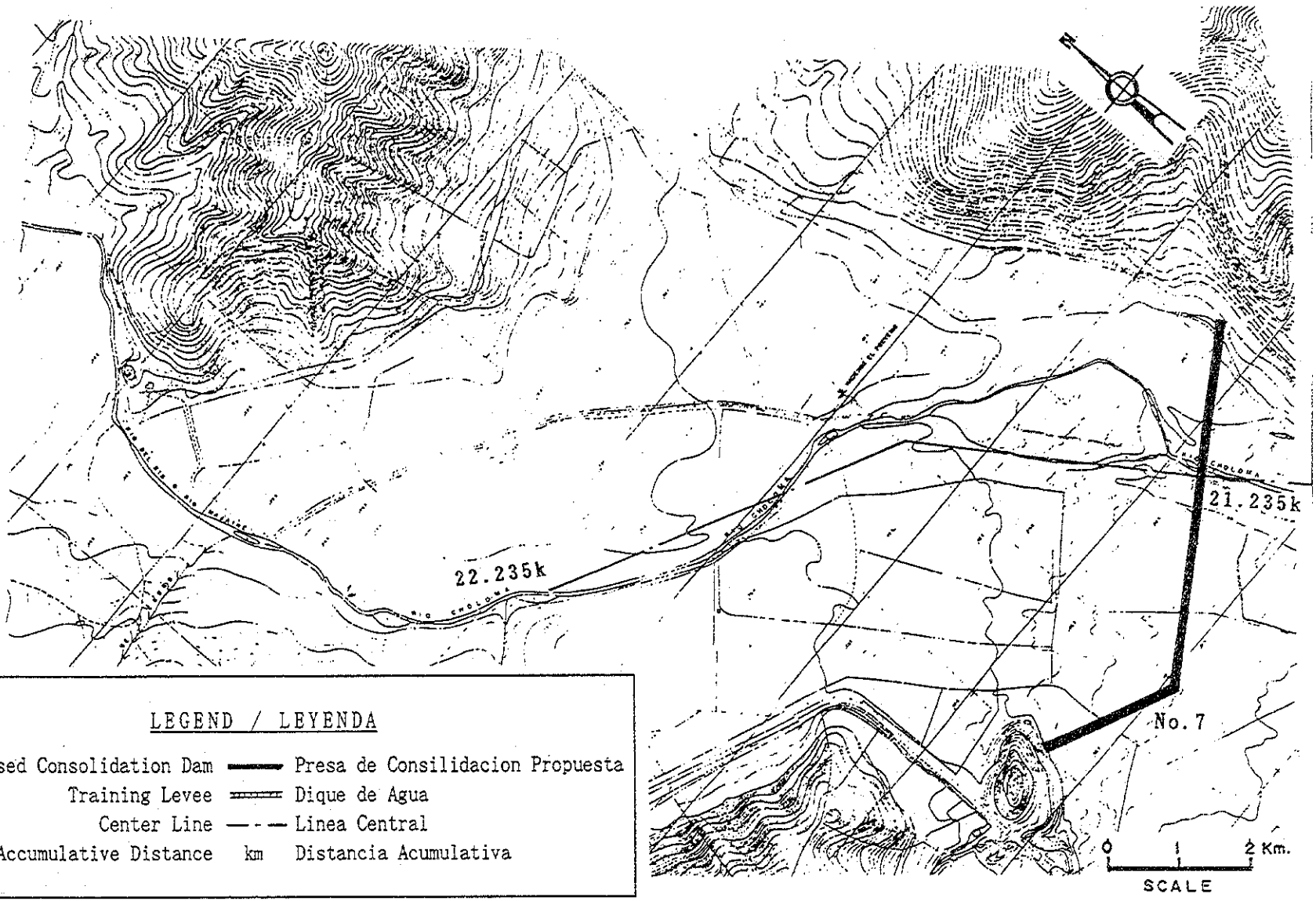


FIG. D.5.5 (3) LOCATION OF CONSOLIDATION WORKS (RIO CHOLOMA)

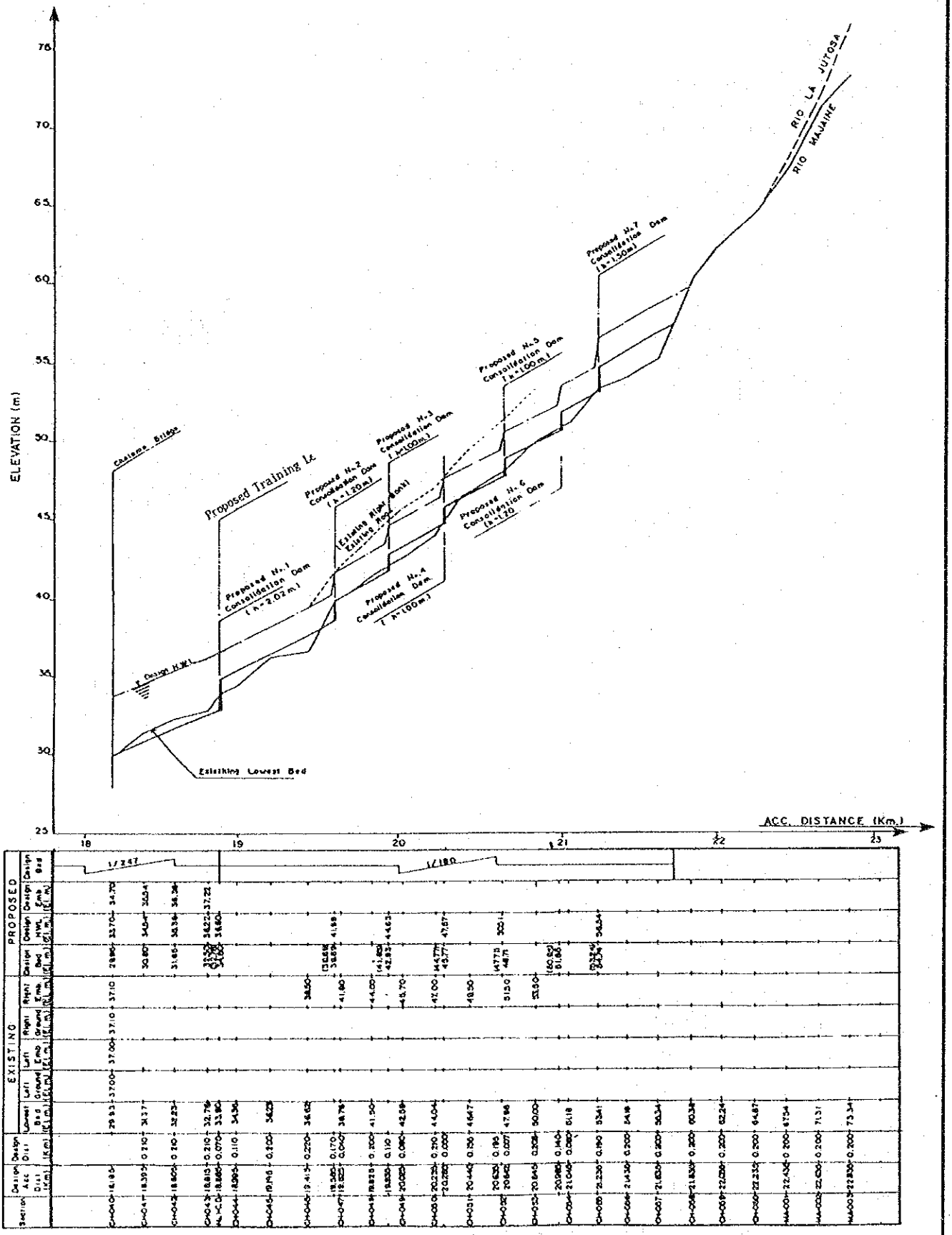


FIG. D.5.6 DESIGN LONGITUDINAL SECTION OF CONSOLIDATION WORKS (RIO CHOLOMA)

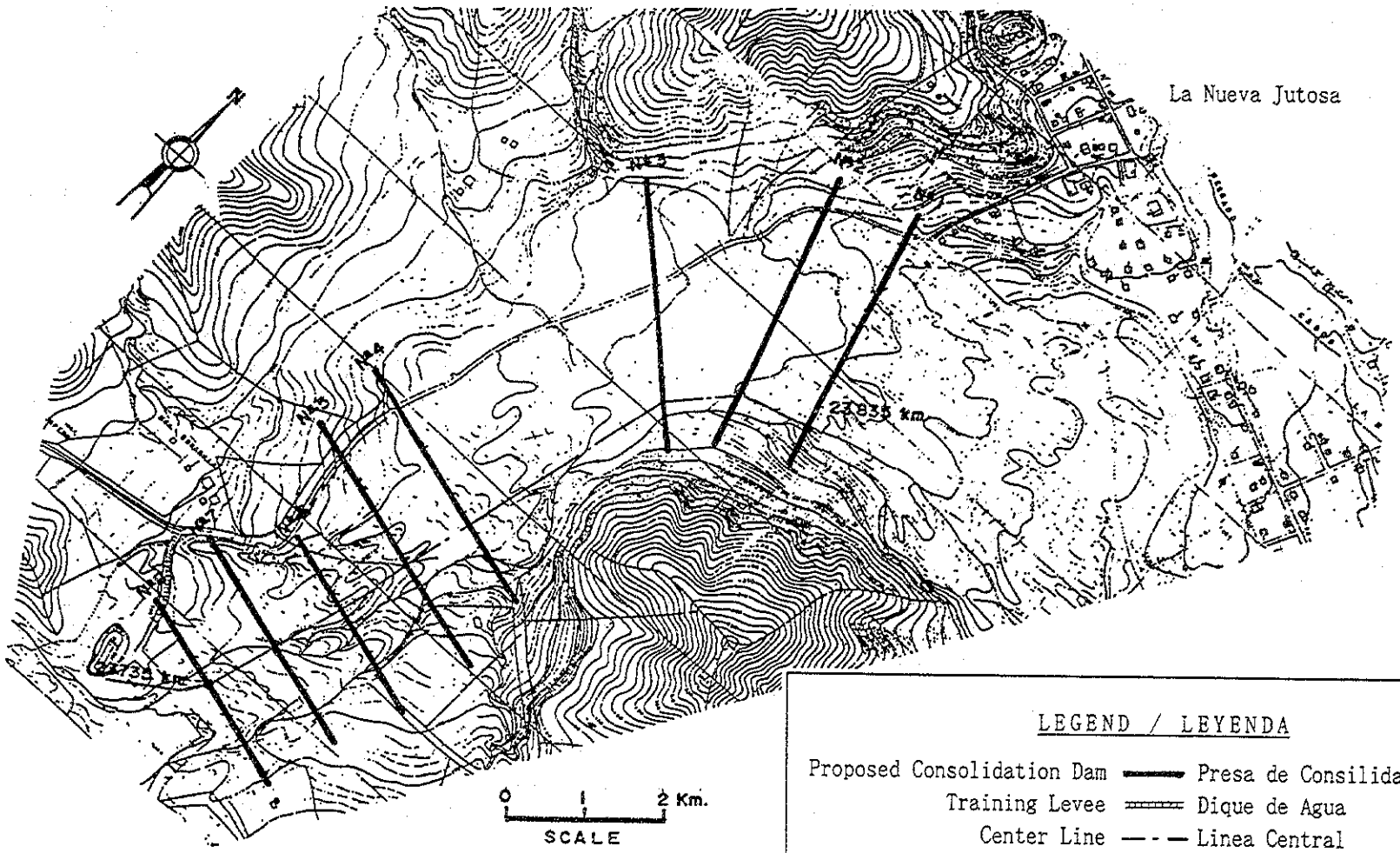
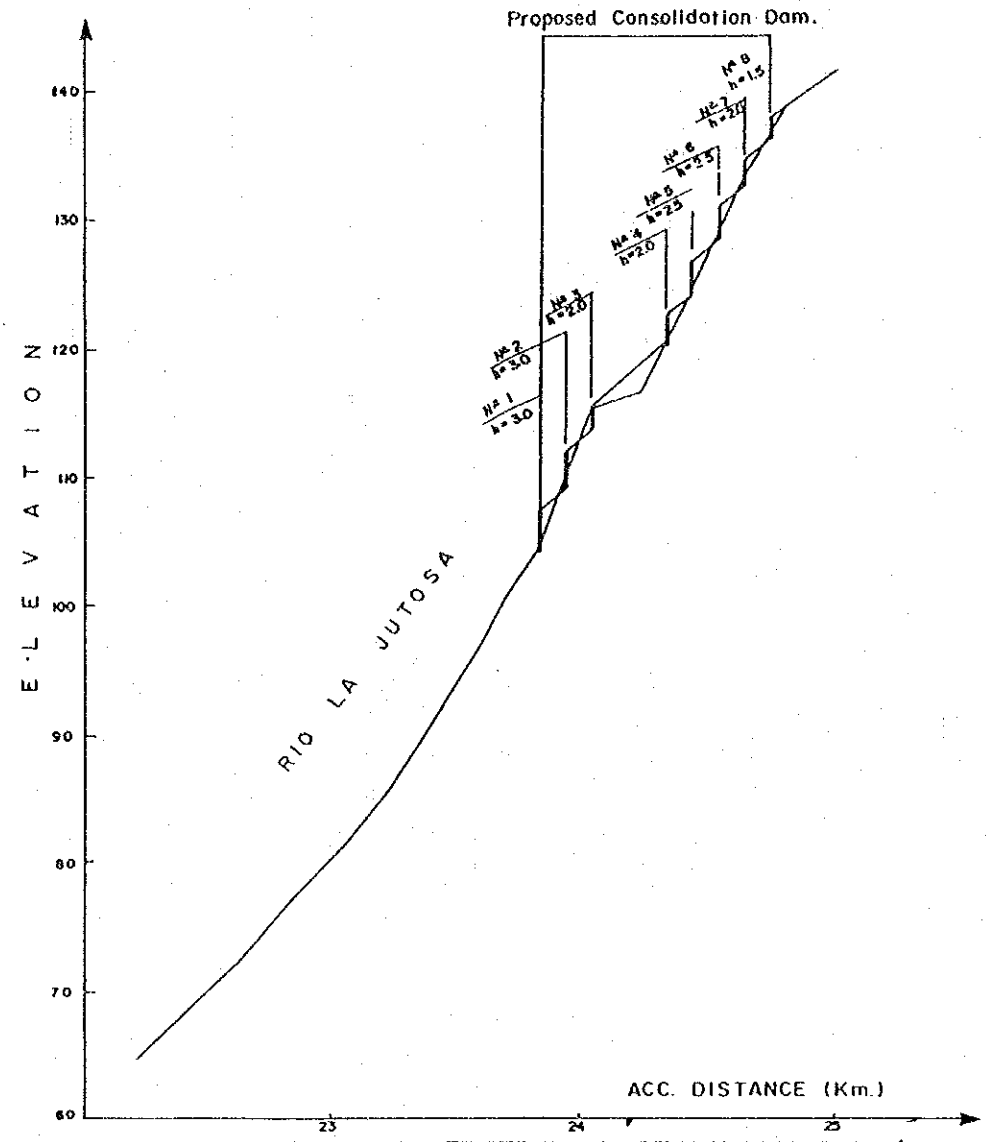


FIG. D.5.7 LOCATION OF CONSOLIDATION WORKS (RIO LA JUTOSA)



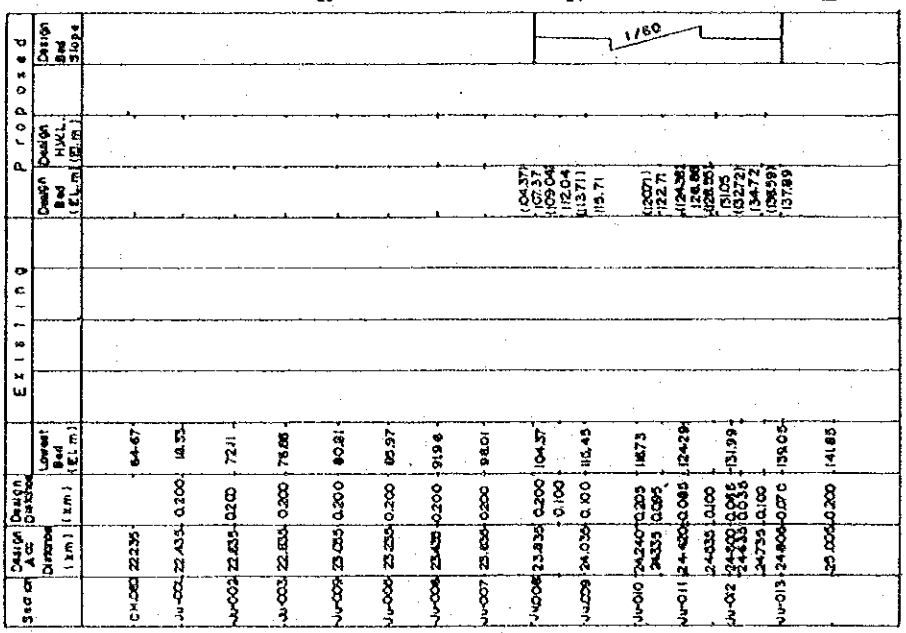


FIG. D.5.8 DESIGN LONGITUDINAL SECTION OF CONSOLIDATION WORKS (RIO LA JUTOSA)

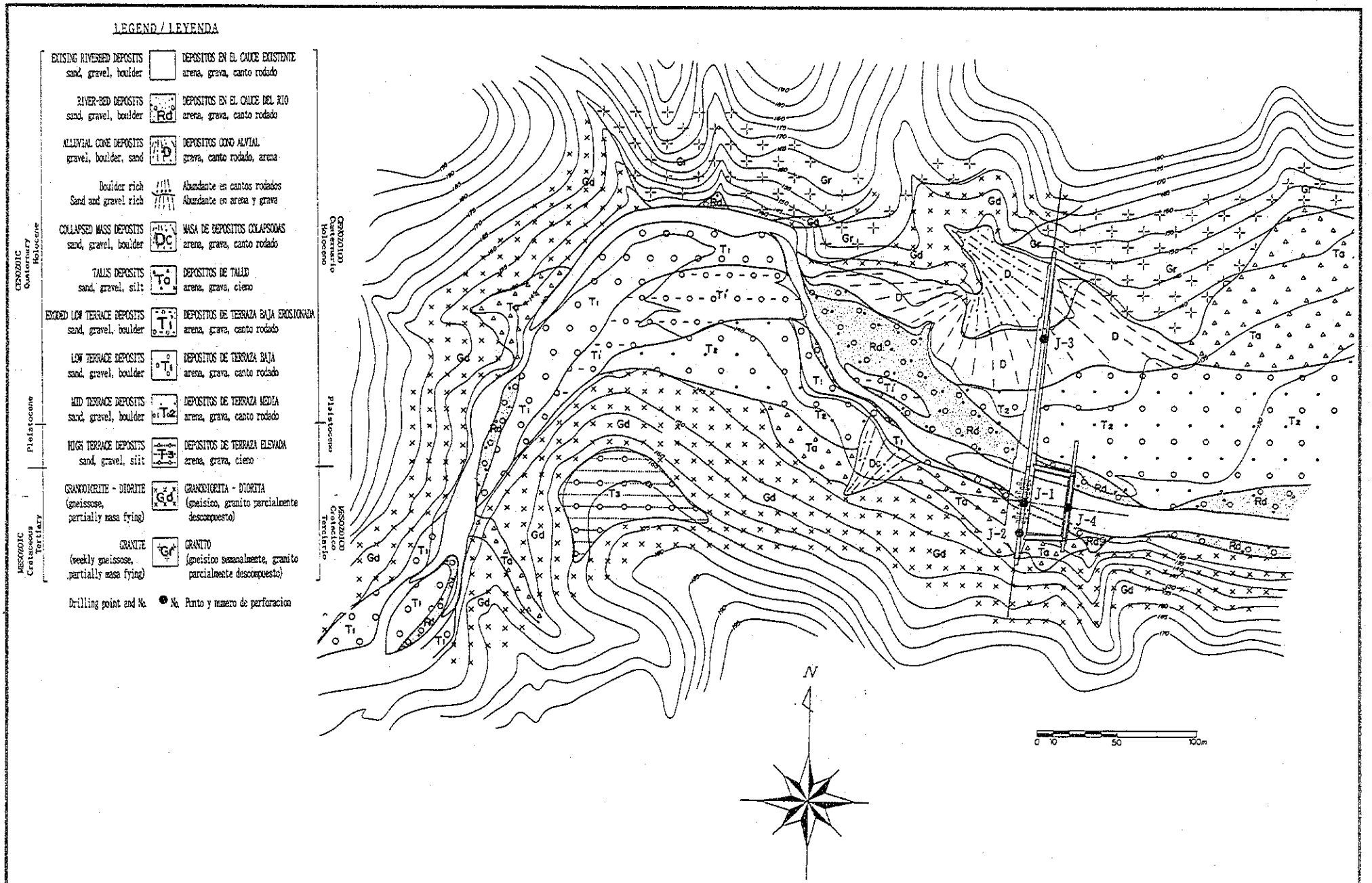


FIG. D.5.9 (1) SUBSURFACE GEOLOGICAL MAP (RIO MAJAINE)

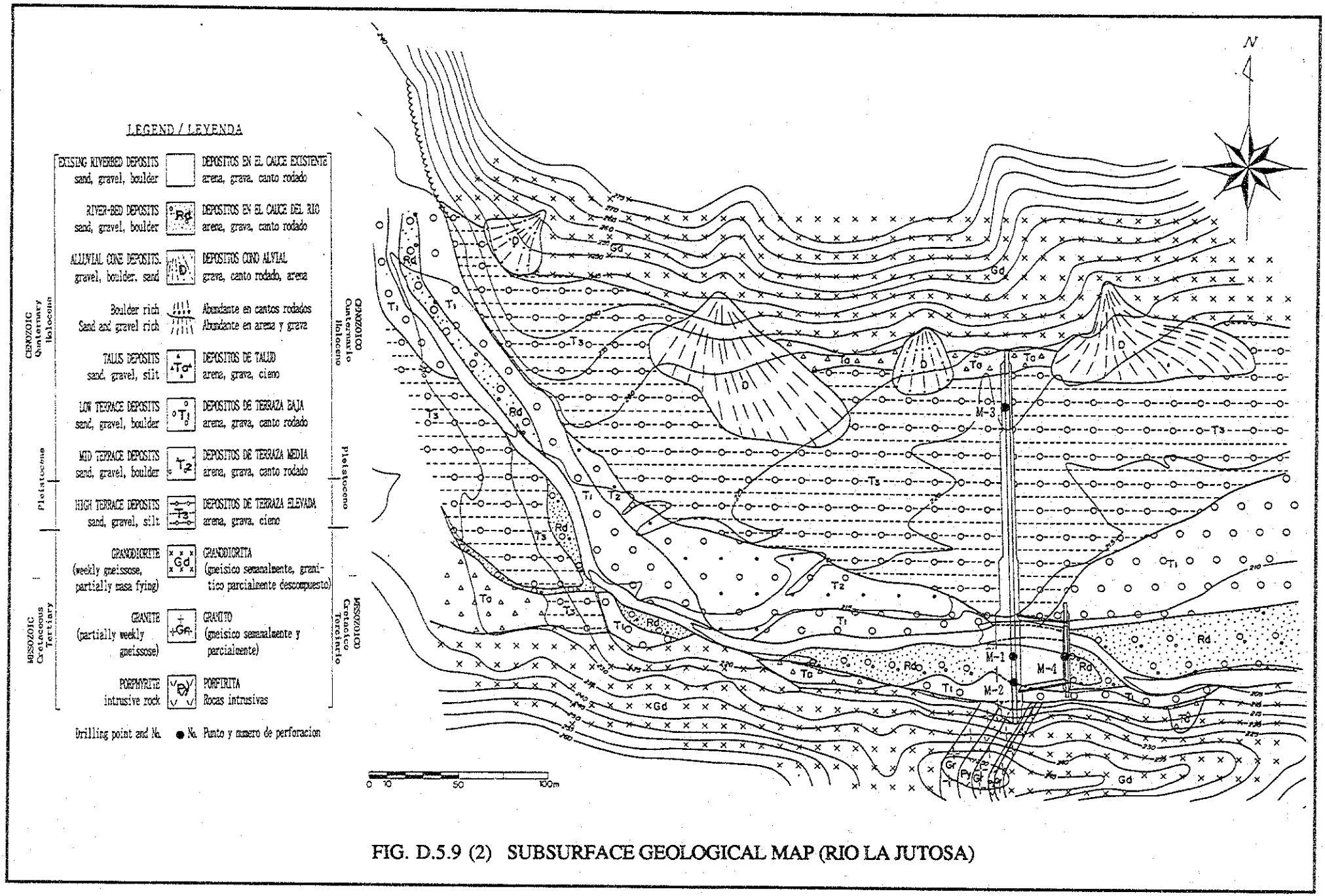


FIG. D.5.9 (2) SUBSURFACE GEOLOGICAL MAP (RIO LA JUTOSA)

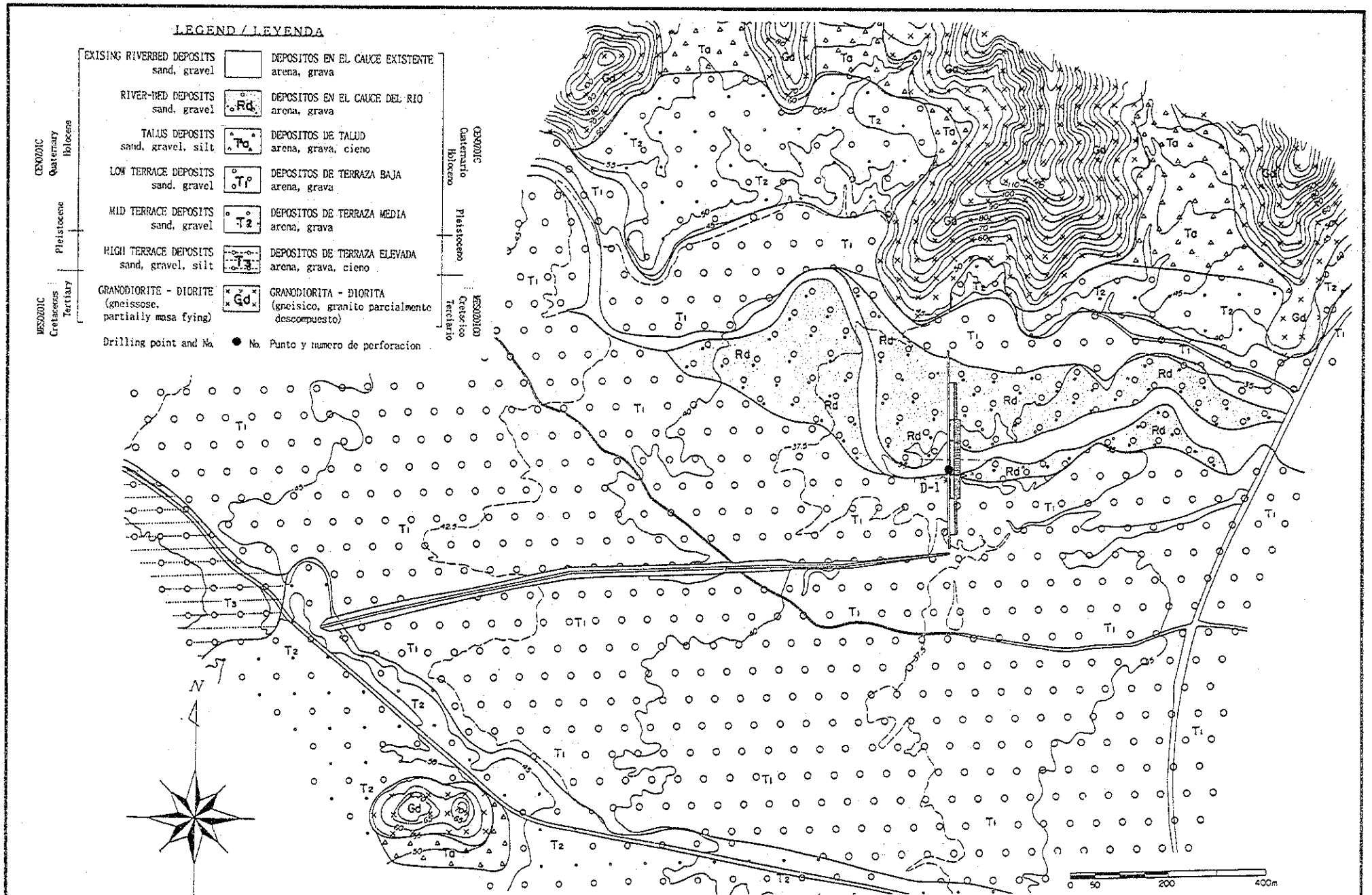


FIG. D.5.9 (3) SUBSURFACE GEOLOGICAL MAP (RIO CHOLOMA DOWNSTREAM)

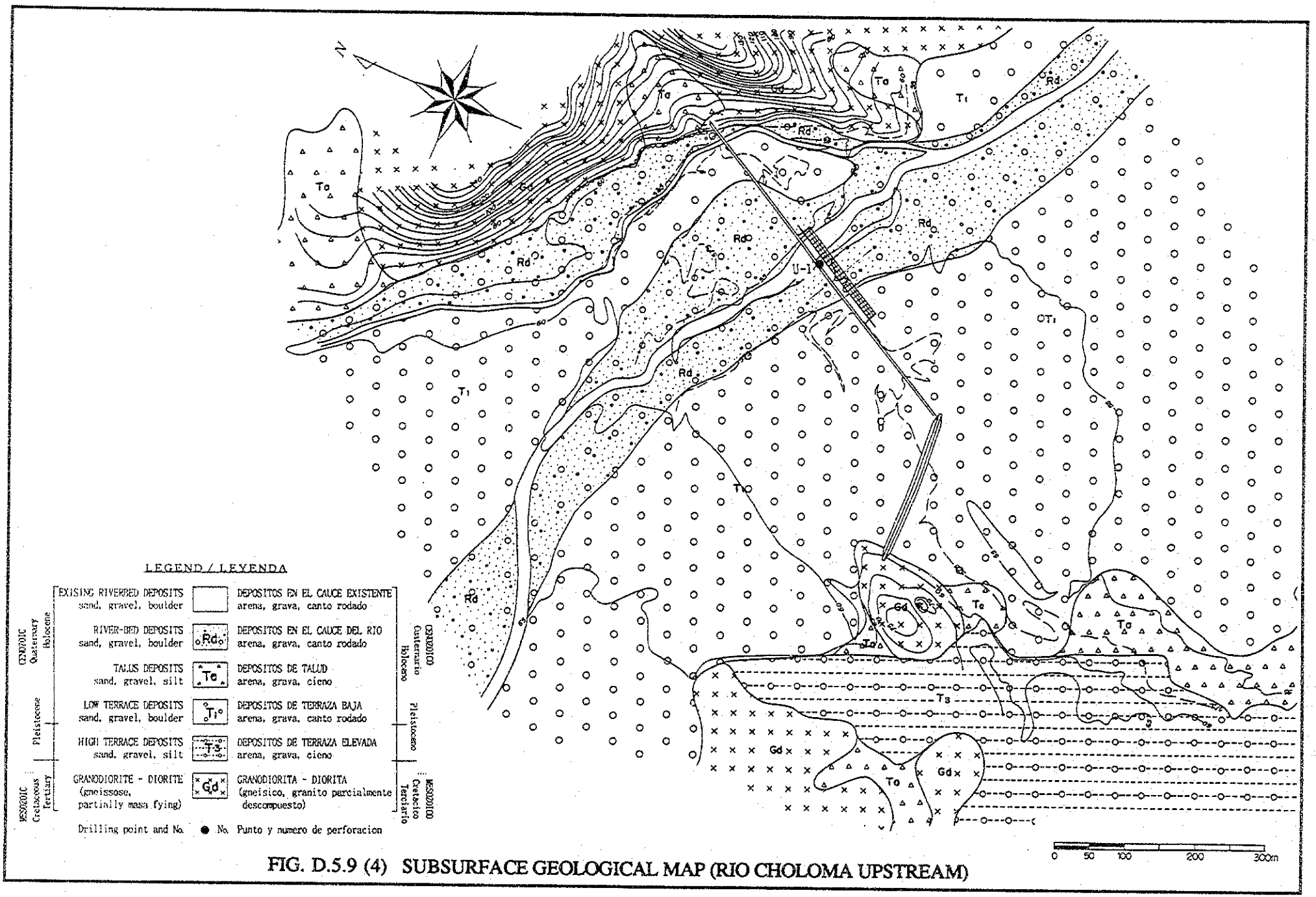
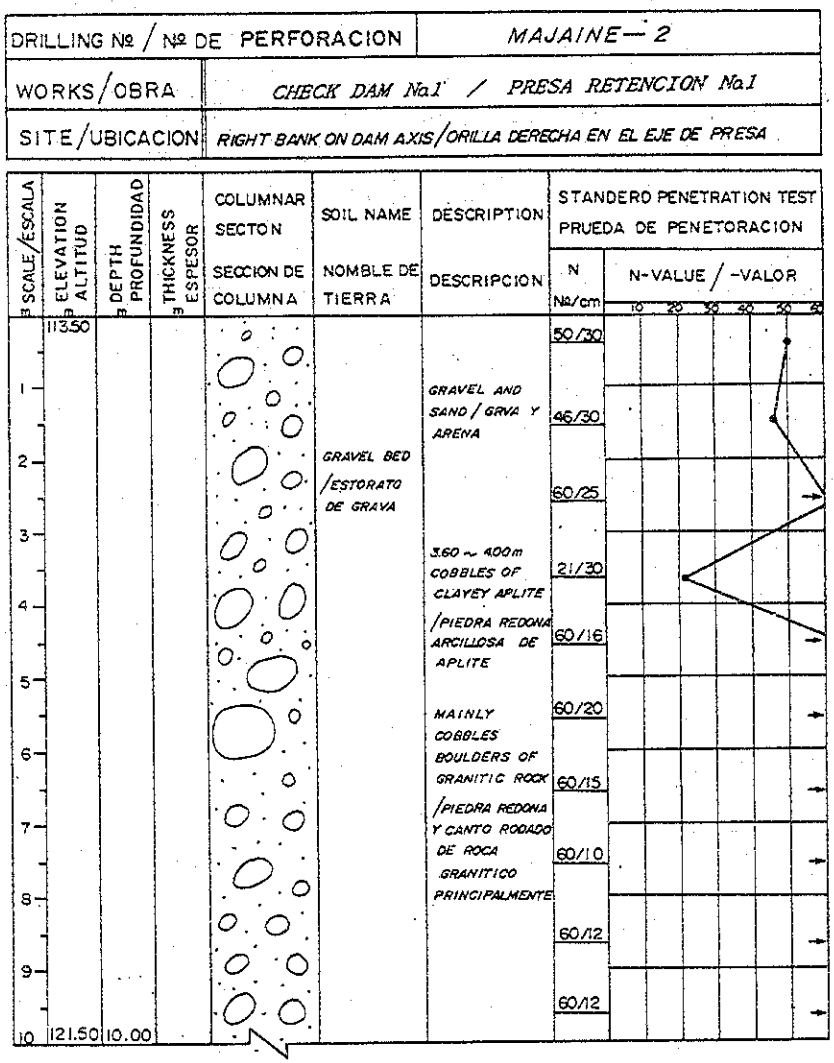


FIG. D.5.9 (4) SUBSURFACE GEOLOGICAL MAP (RIO CHOLOMA UPSTREAM)



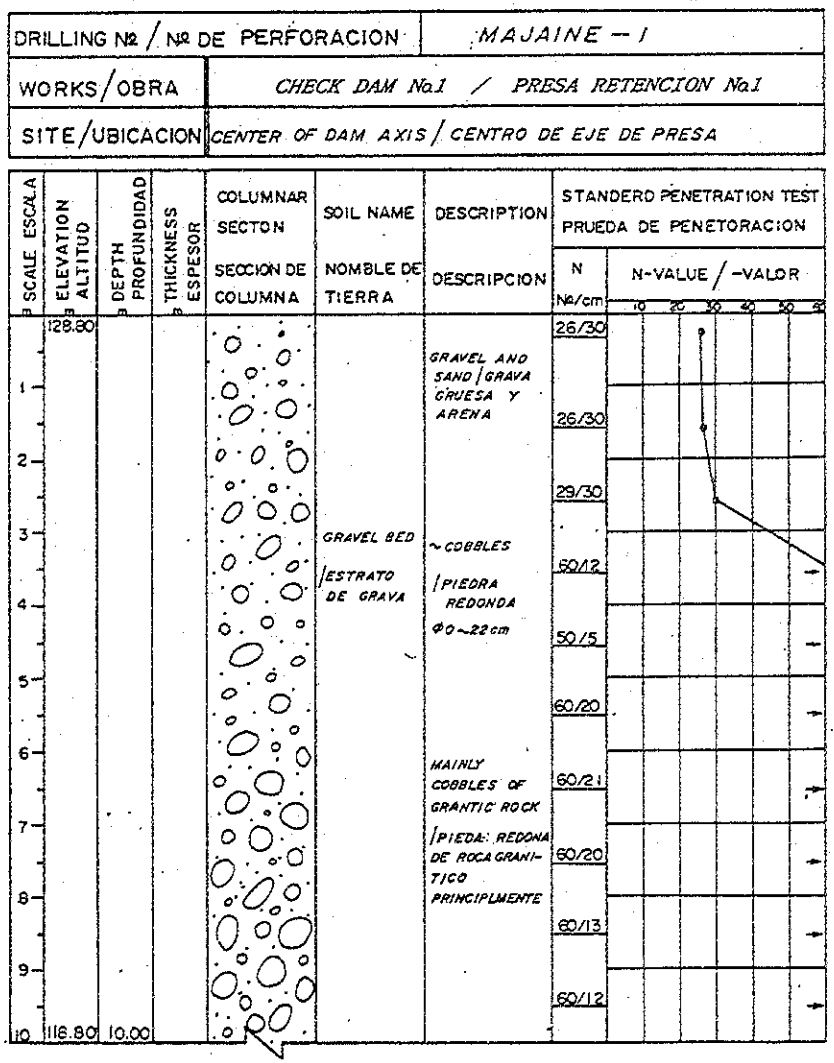
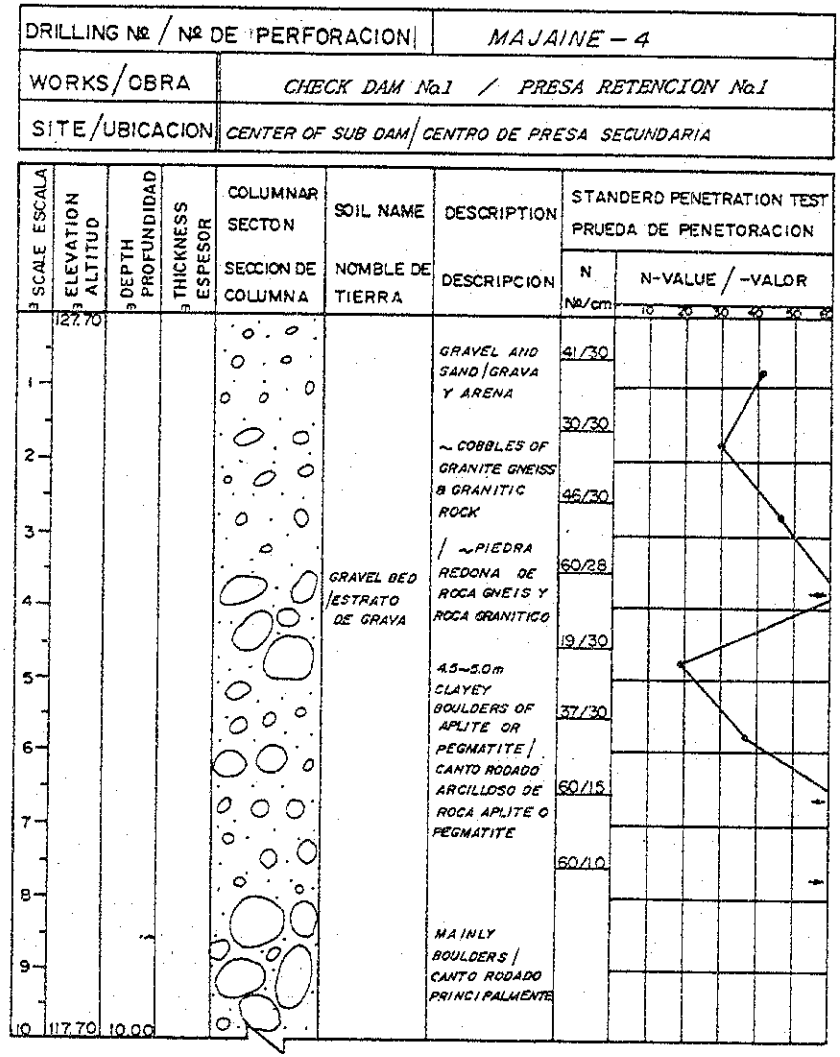


FIG. D.5.10 (1) BOREHOLE LOG (RIO MAJAINE)



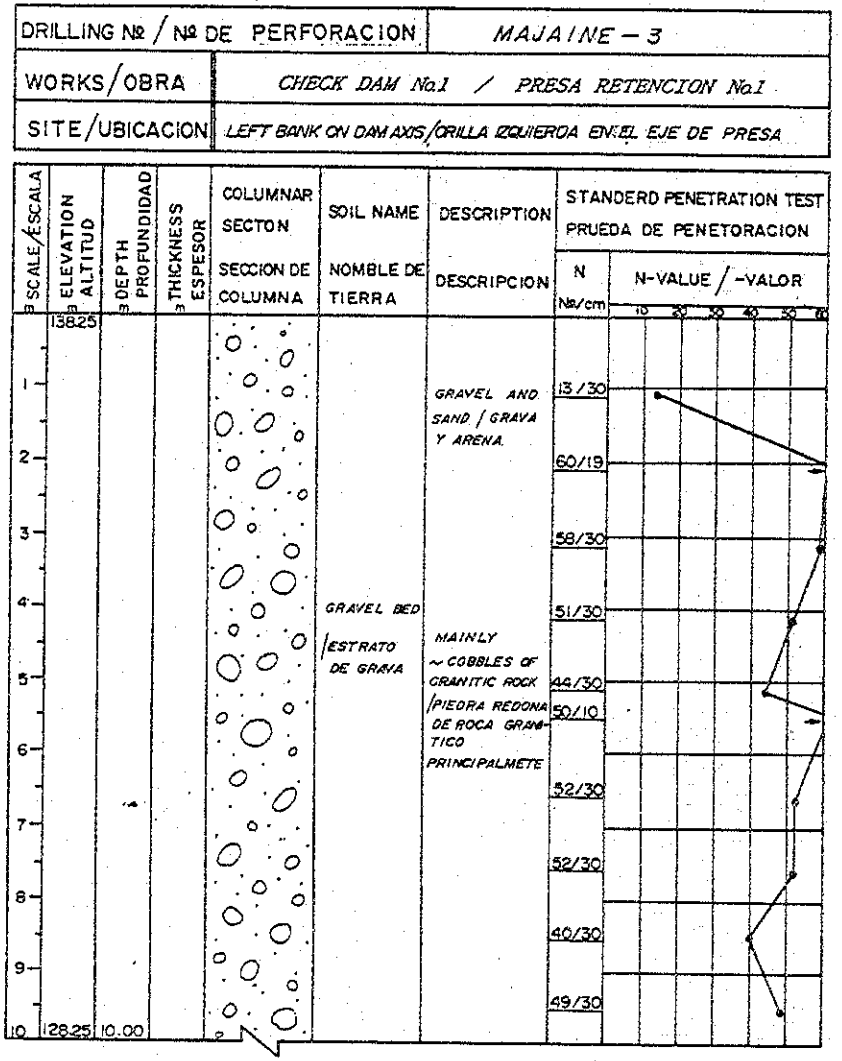
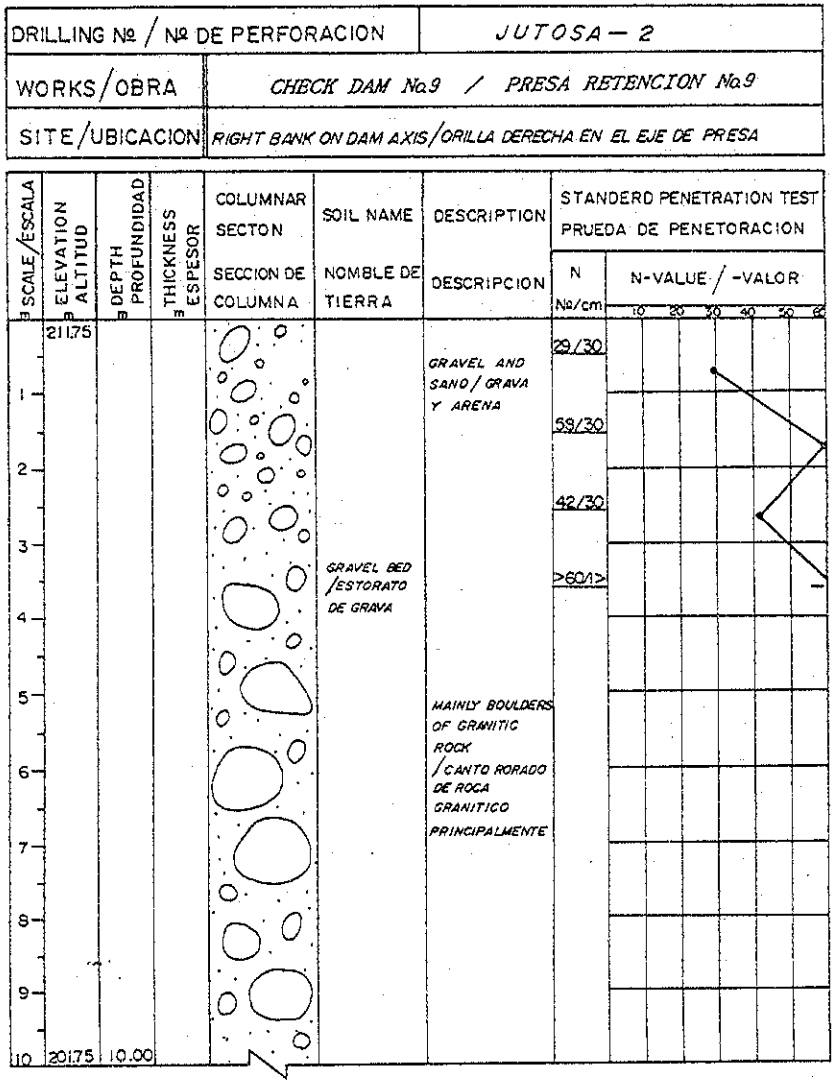


FIG. D.5.10 (1) BOREHOLE LOG (RIO MAJAINE)



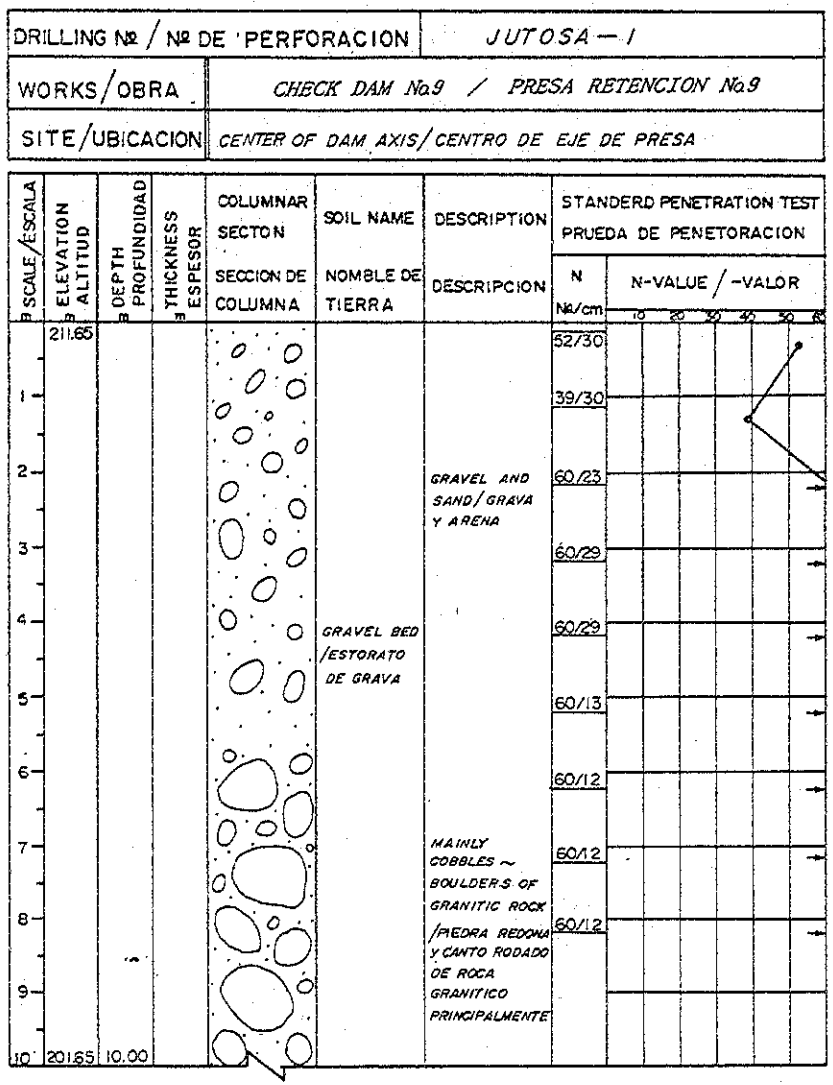
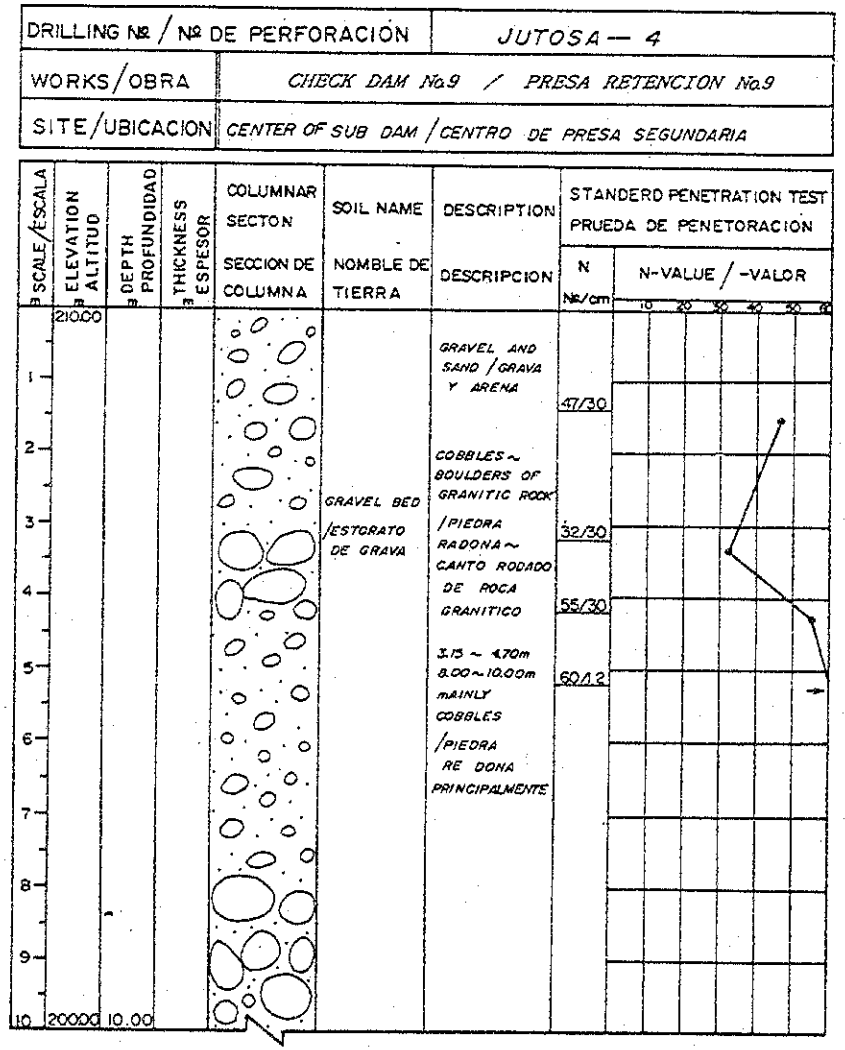


FIG. D.5.10 (2) BOREHOLE LOG (RIO LA JUTOSA)



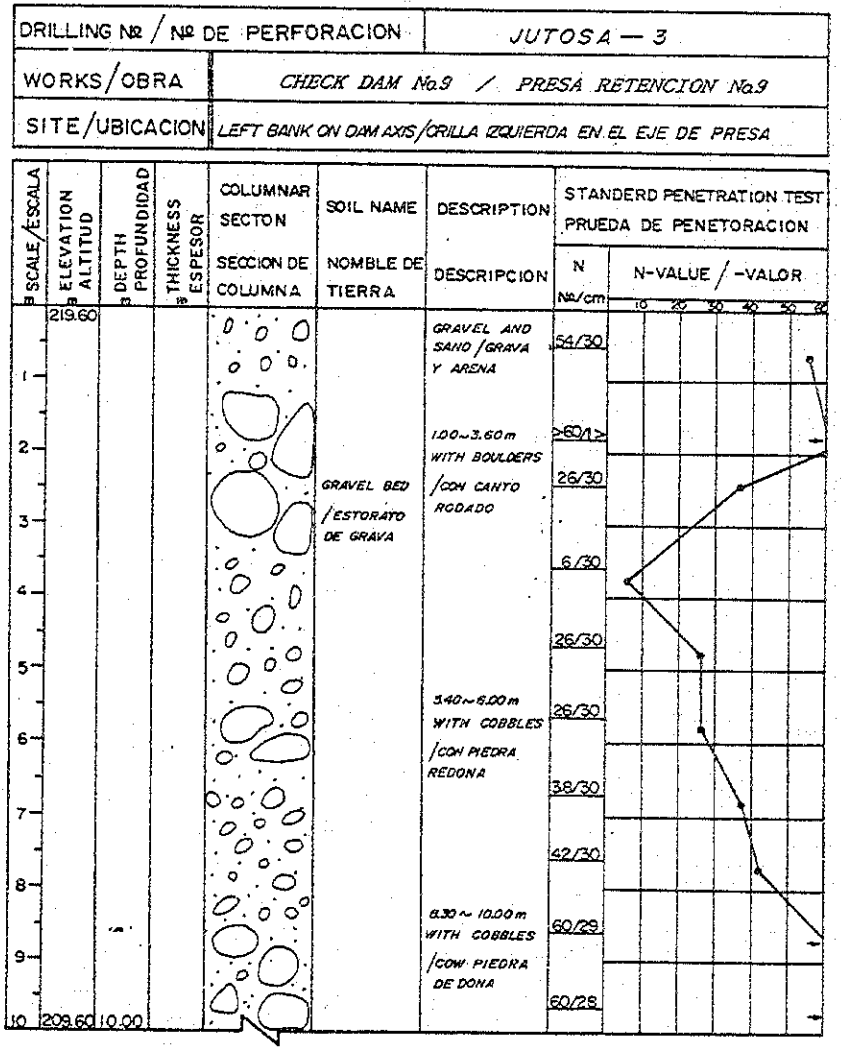


FIG. D.5.10 (2) BOREHOLE LOG (RIO LA JUTOSA)

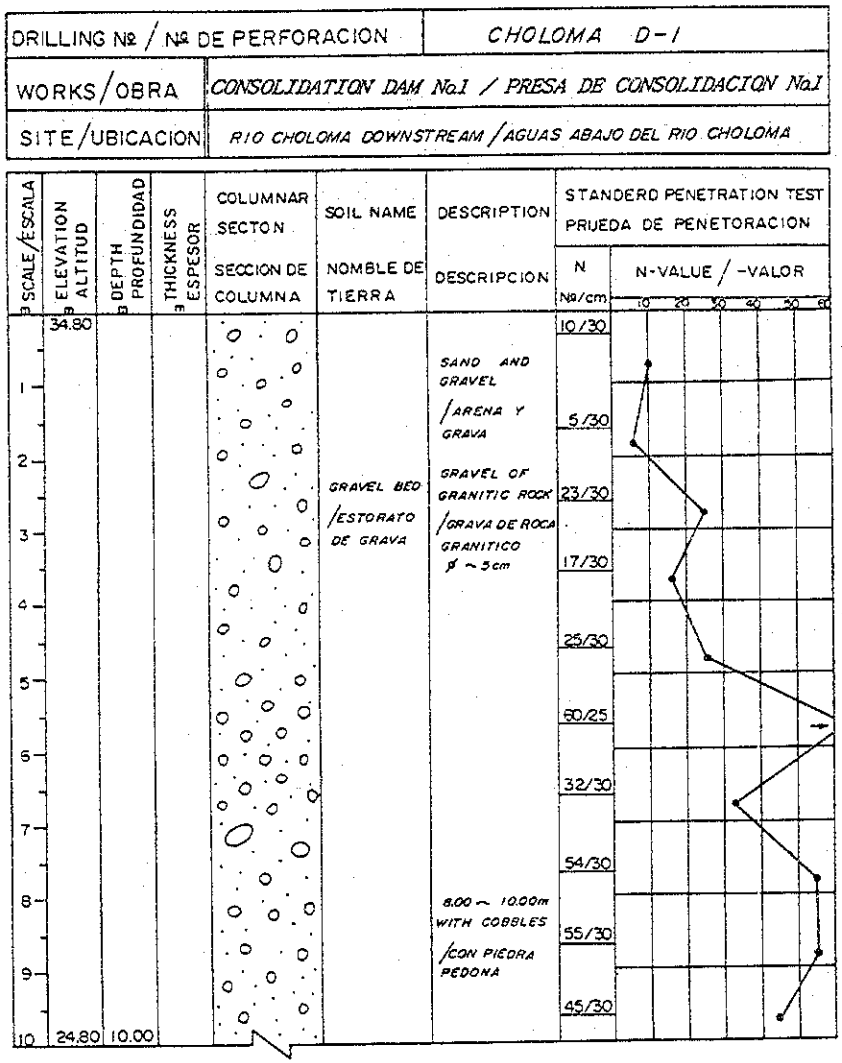


FIG. D.5.10 (3) BOREHOLE LOG (RIO CHOLOMA DOWNSTREAM)

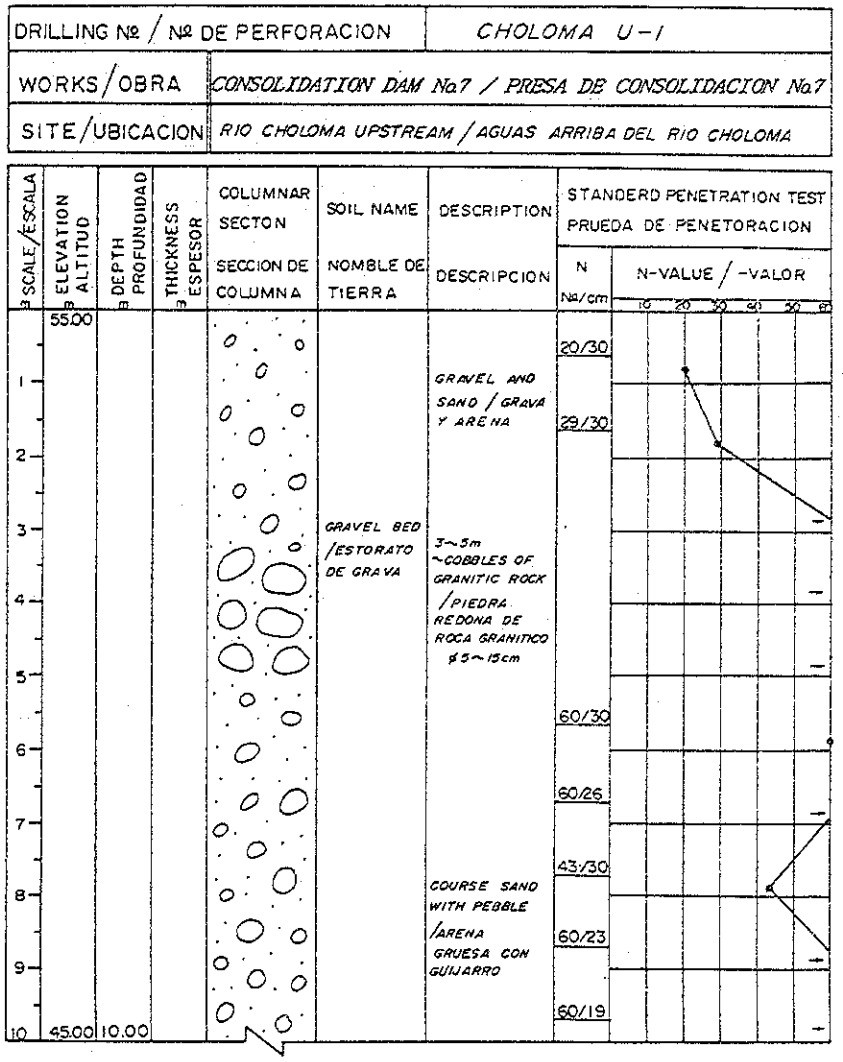


FIG. D.5.10 (4) BOREHOLE LOG (RIO CHOLOMA UPSTREAM)

FRONT VIEW OF DOWNSTREAM SIDE - CHECK DAM No.1, MAJAINE DAM -

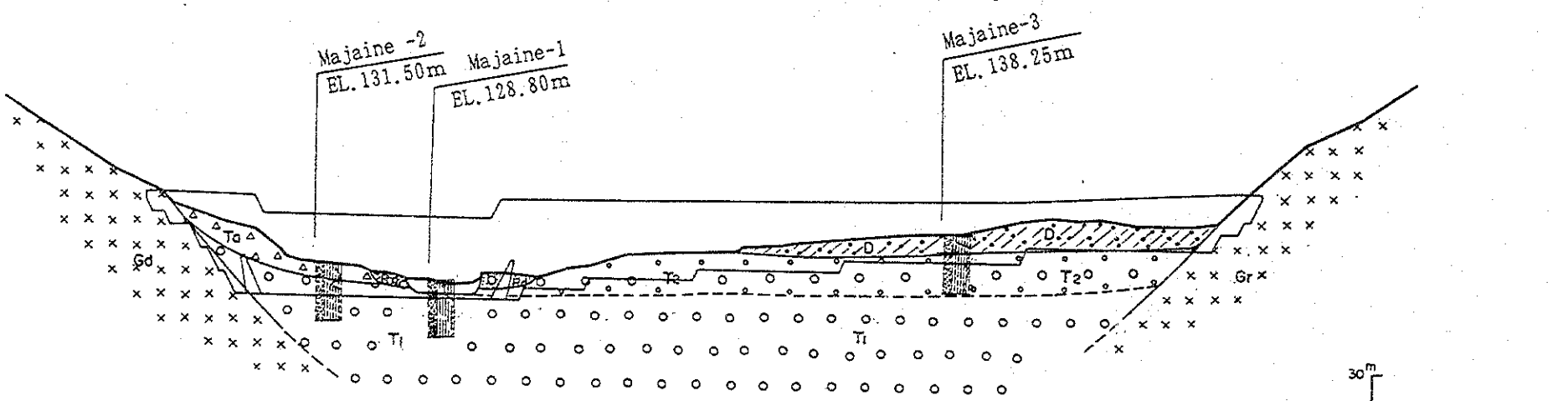


FIG. D.5.11 (1) SYNTHETIC GEOLOGICAL PROFILE (RIO MAJAINE)

FRONT VIEW OF DOWNSTREAM SIDE - CHECK DAM No.9, JUTOSA DAM -

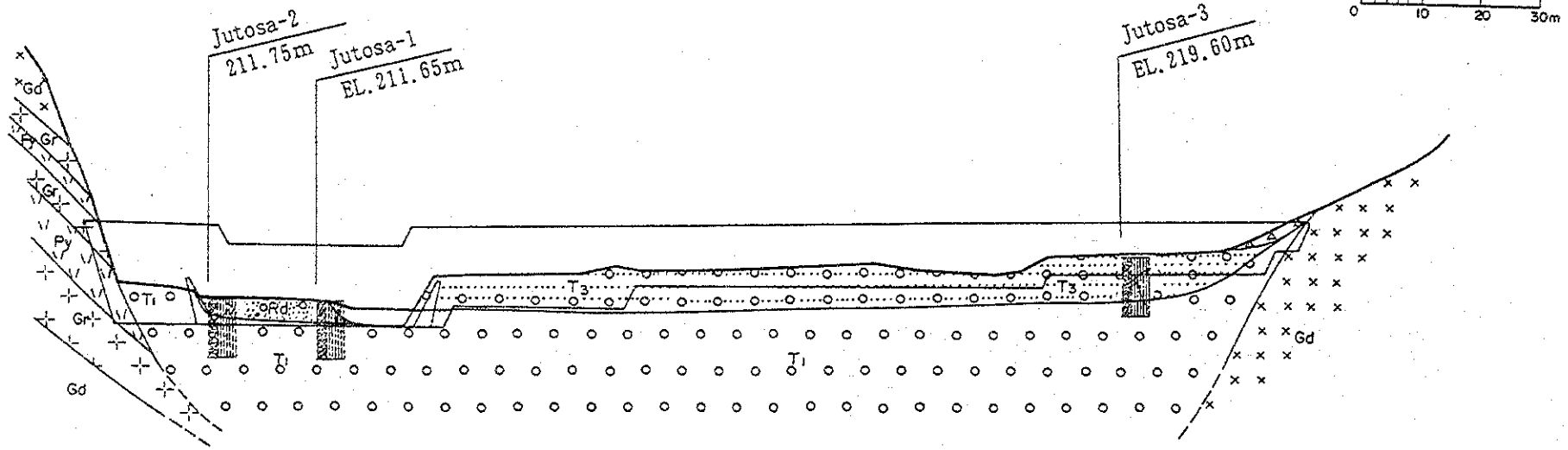
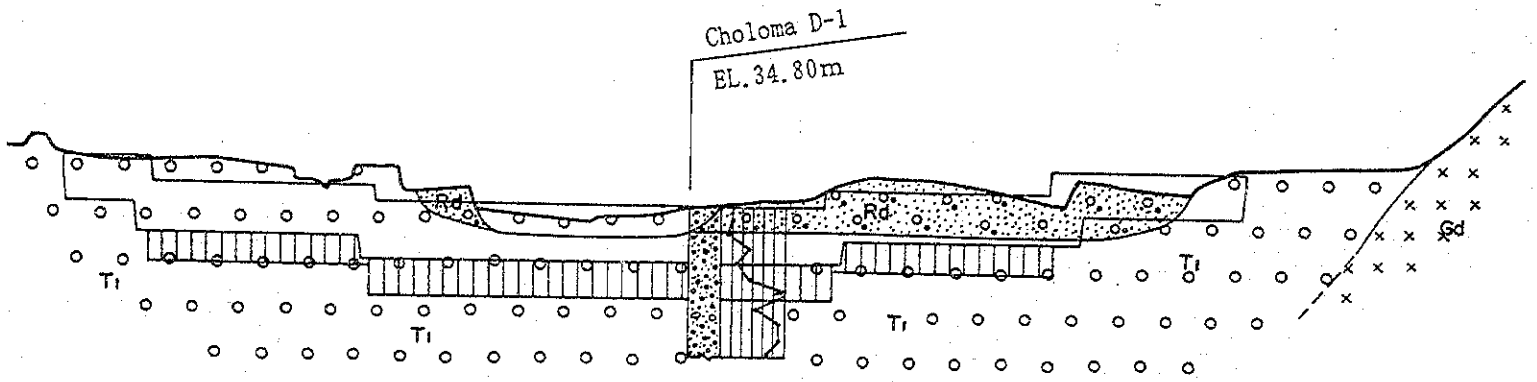


FIG. D.5.11 (2) SYNTHETIC GEOLOGICAL PROFILE (RIO LA JUTOSA)



FRONT VIEW OF DOWNSTREAM SIDE - CONSOLIDATION DAM No.1 -

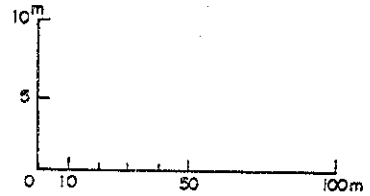
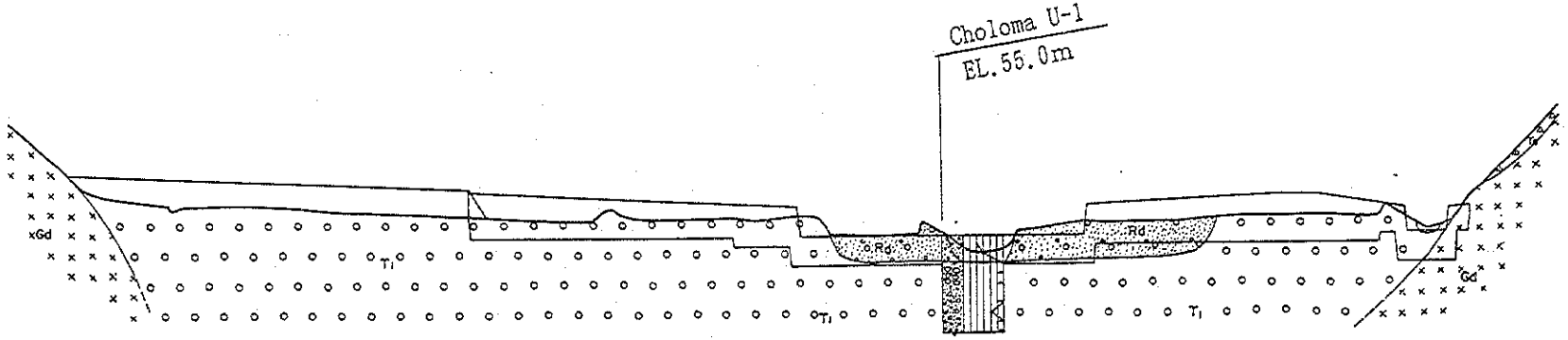


FIG. D.5.11 (3) SYNTHETIC GEOLOGICAL PROFILE (RIO CHOLOMA DOWNSTREAM)



FRONT VIEW OF DOWNSTREAM SIDE - CONSOLIDATION DAM No.7 -

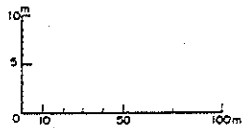


FIG. D.5.11 (4) SYNTHETIC GEOLOGICAL PROFILE (RIO CHOLOMA UPSTREAM)

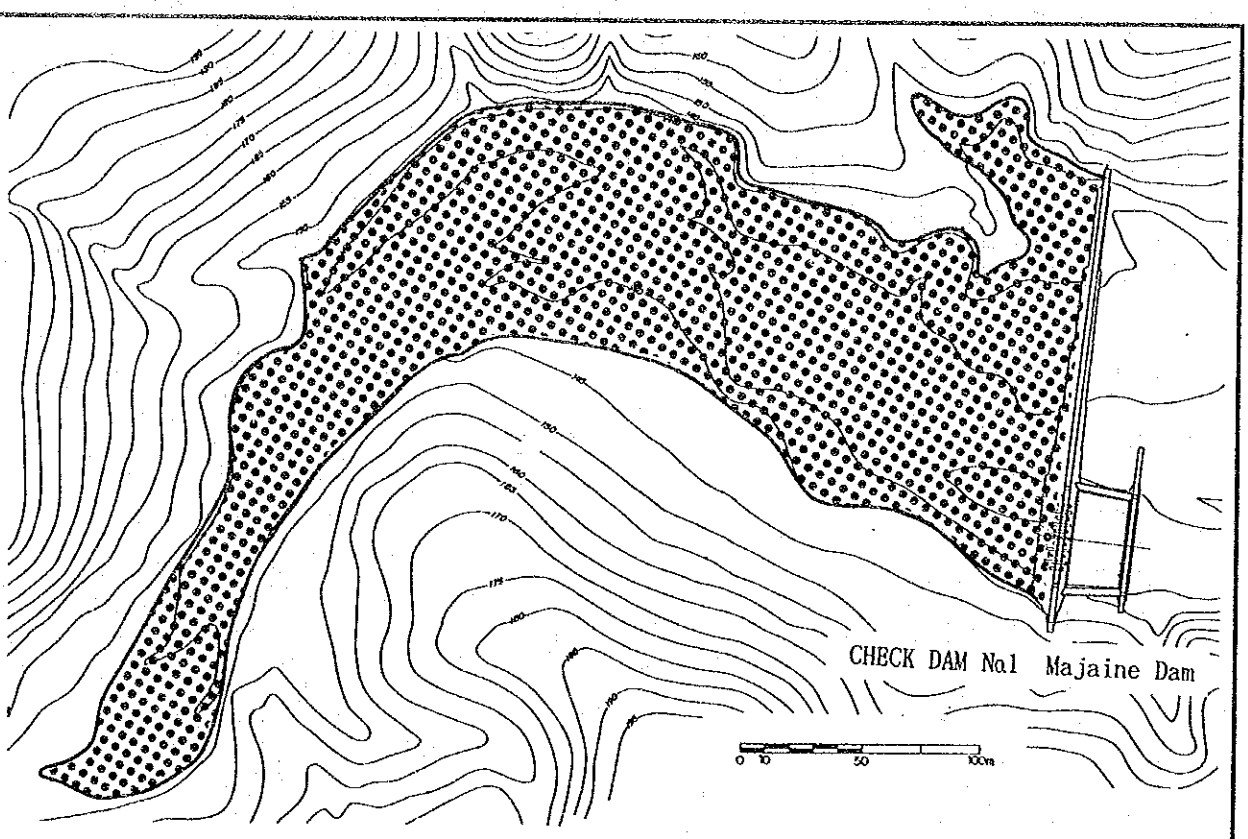


FIG. D.5.12 (1) PREDICTED SEDIMENTATION AREA (MAJAINE DAM)

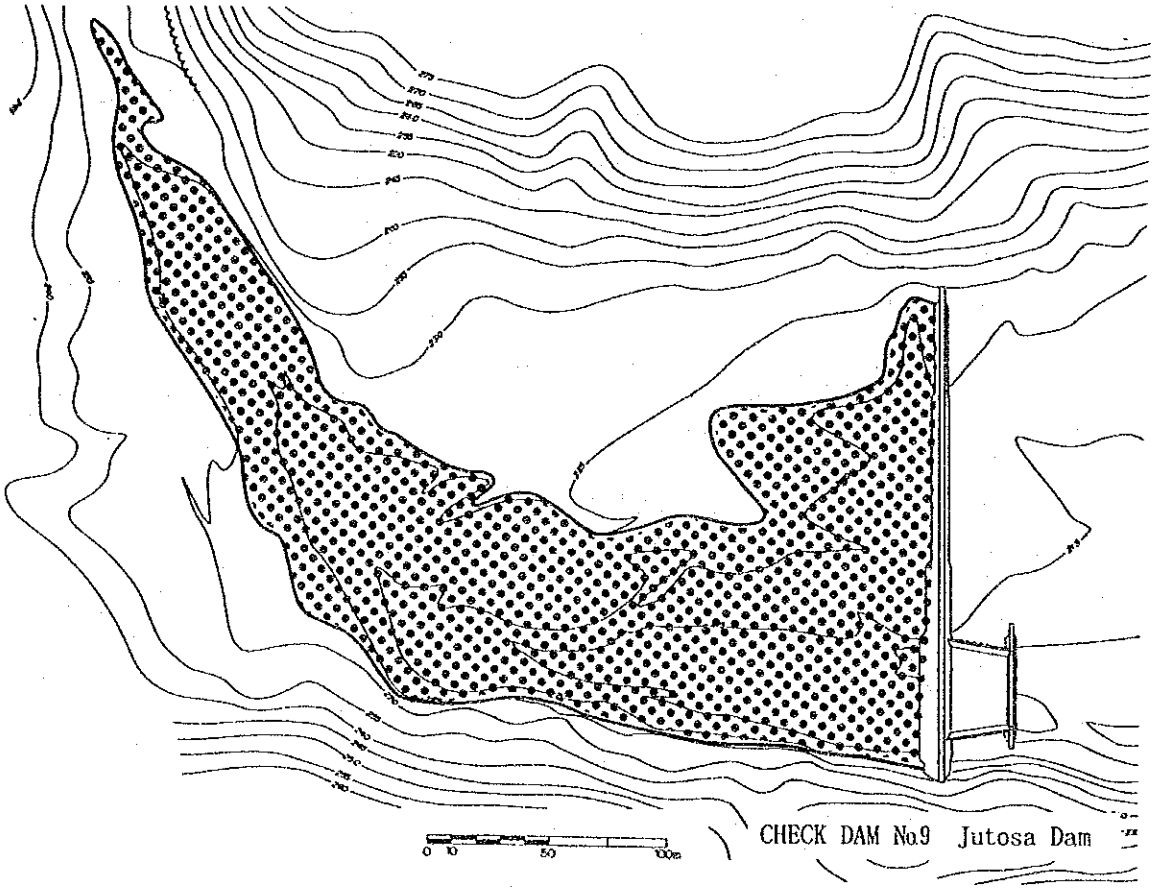


FIG. D.5.12 (2) PREDICTED SEDIMENTATION AREA (JUTOSA DAM)

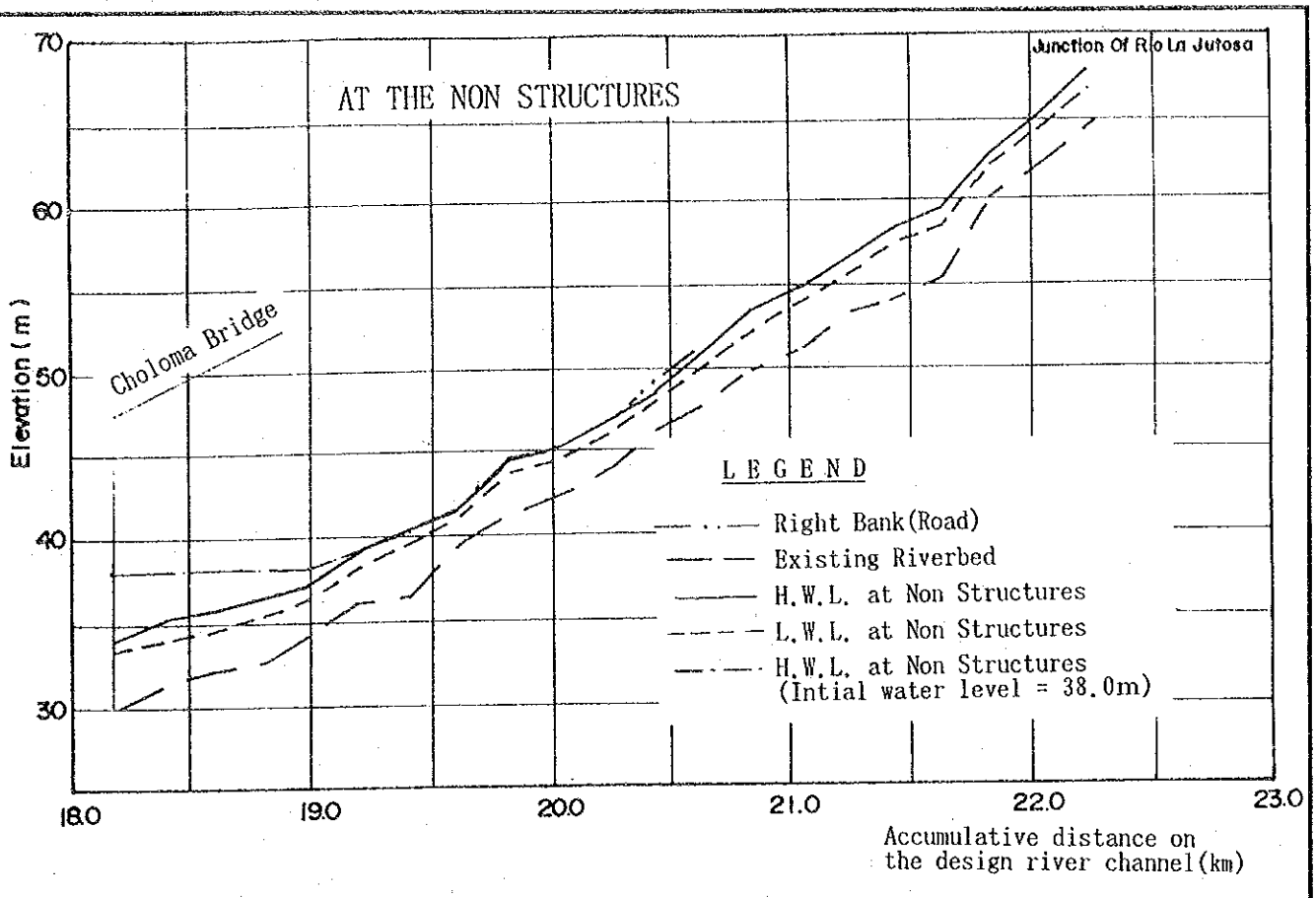


FIG. D.5.13 RESULTS OF NON-UNIFORM FLOW CALCULATION - PRESENT CONDITIONS

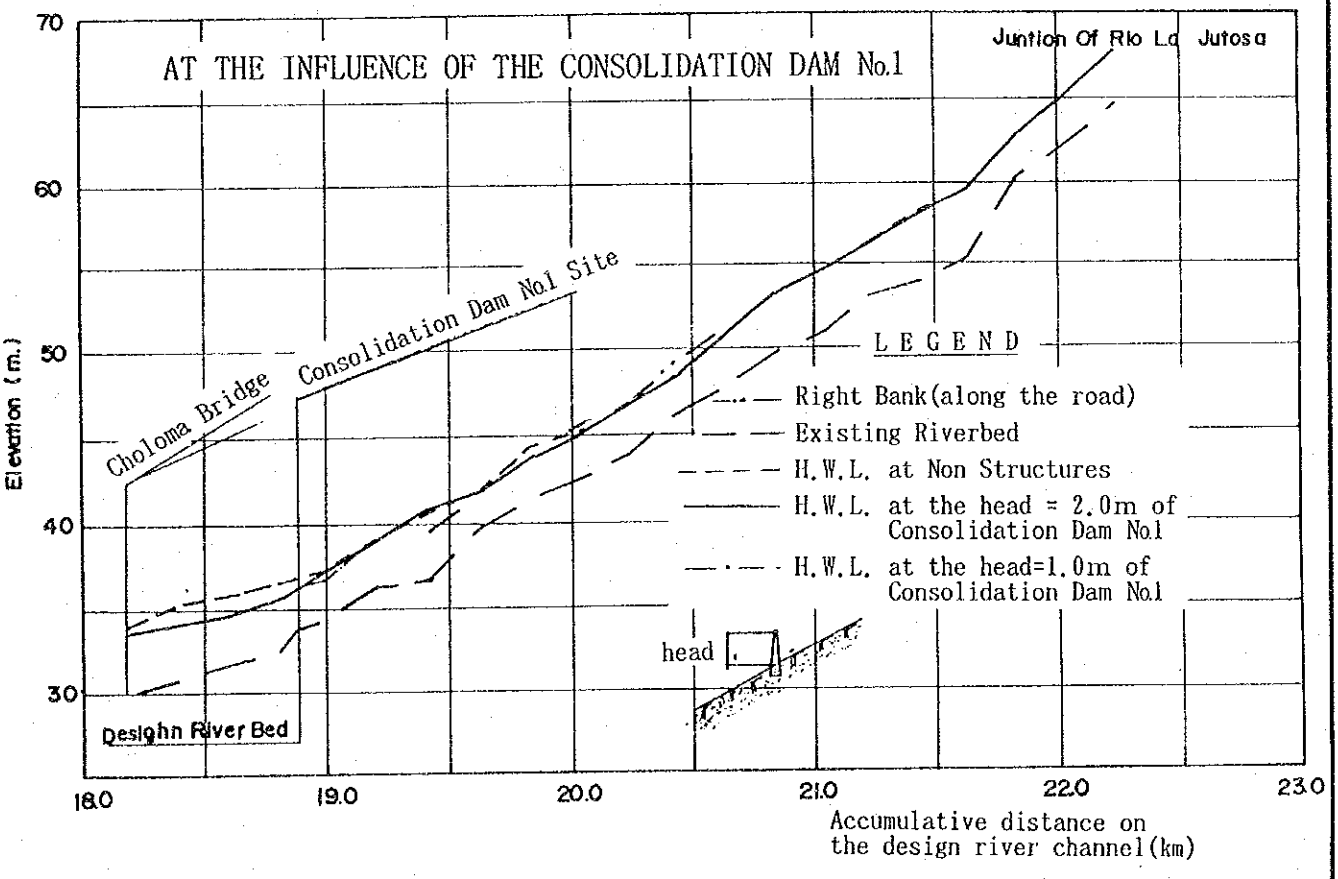


FIG. D.5.14 (1) RESULTS OF NON-UNIFORM FLOW CALCULATION - INFLUENCE OF CONSOLIDATION DAM NO. 1

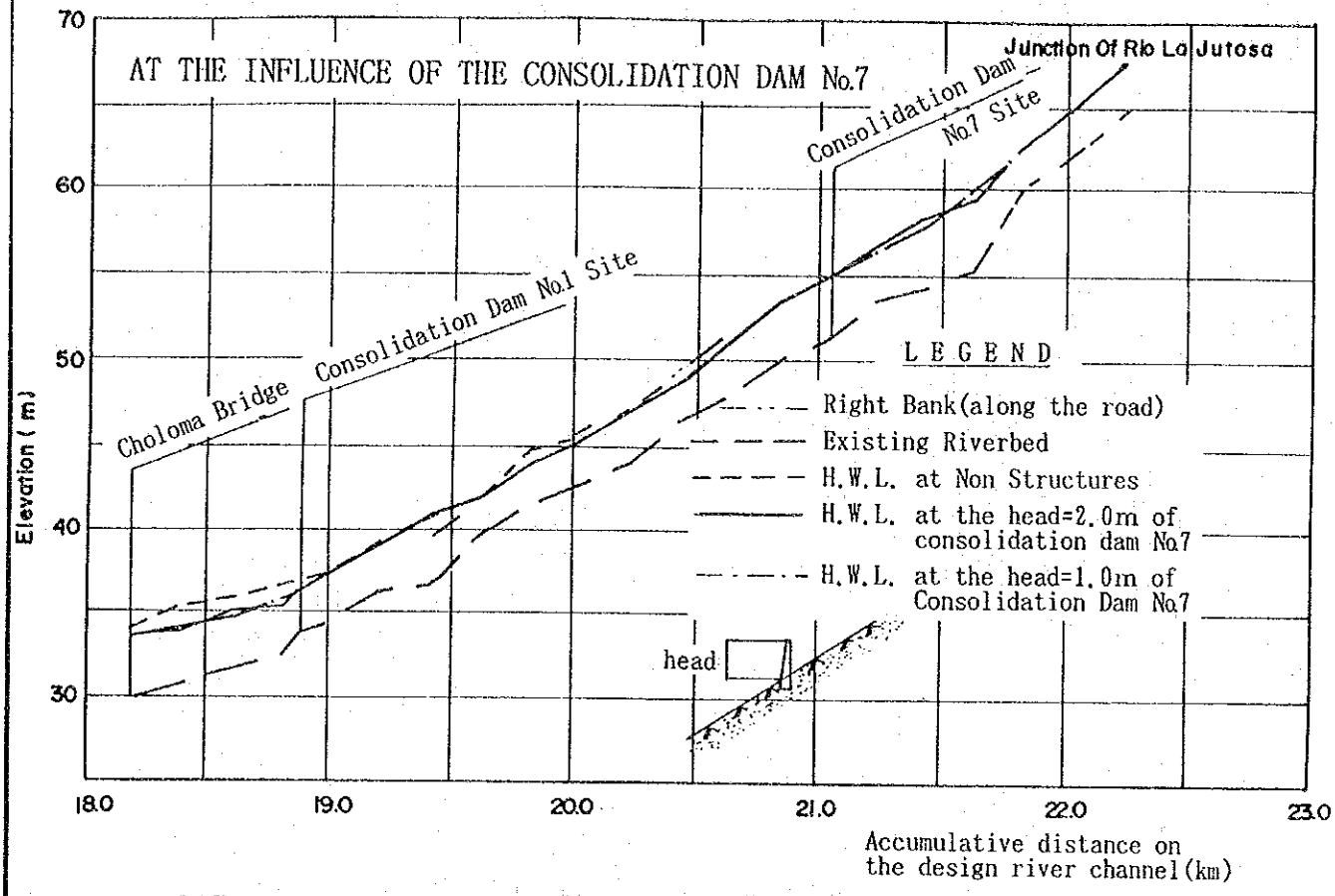


FIG. D.5.14 (2) RESULTS OF NON-UNIFORM FLOW CALCULATION
- INFLUENCE OF CONSOLIDATION DAM NO. 7

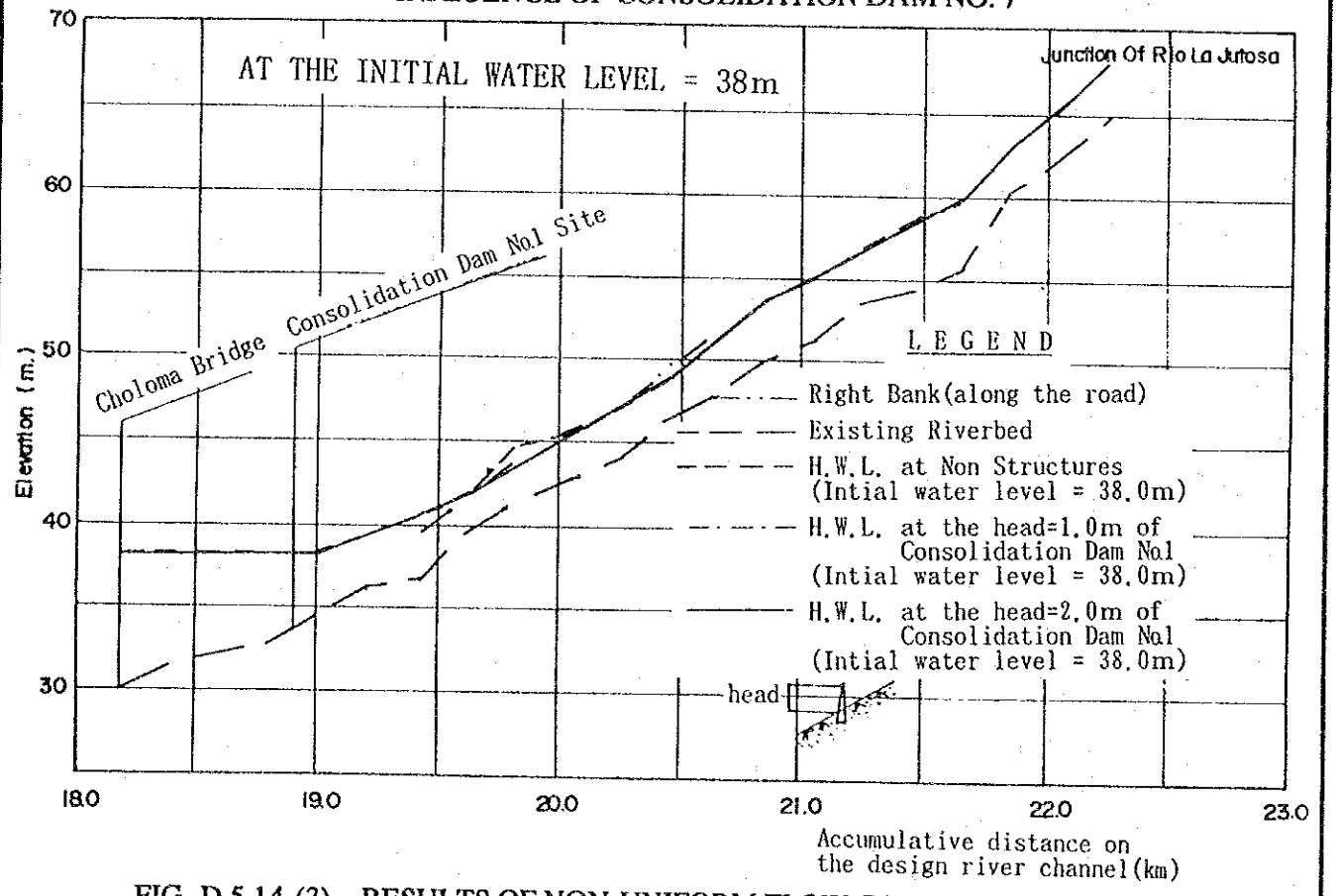


FIG. D.5.14 (3) RESULTS OF NON-UNIFORM FLOW CALCULATION
- INFLUENCE OF CHOLOMA BRIDGE OCCLUSION

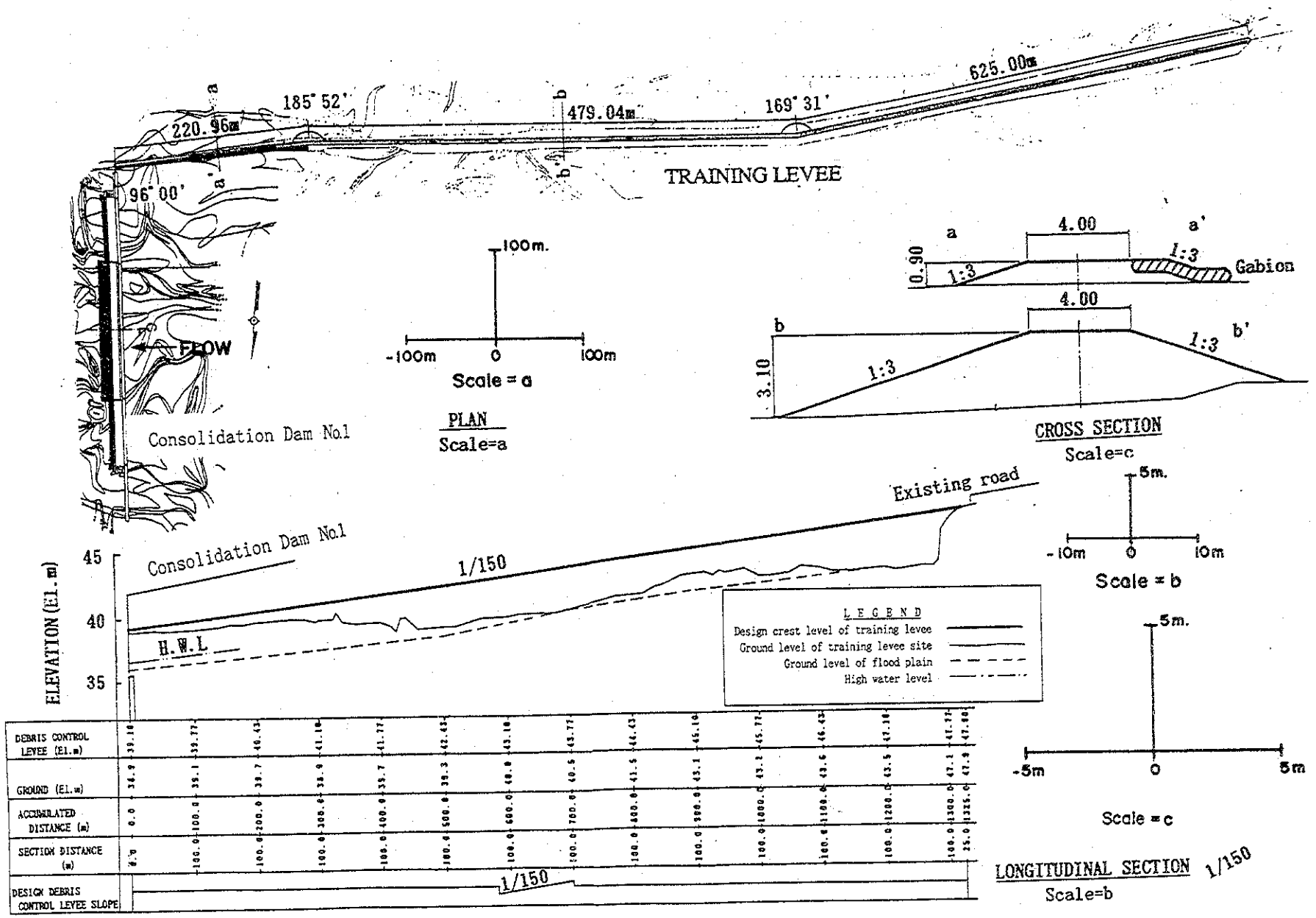


FIG. D.5.15 PROPOSED TRAINING LEVEE

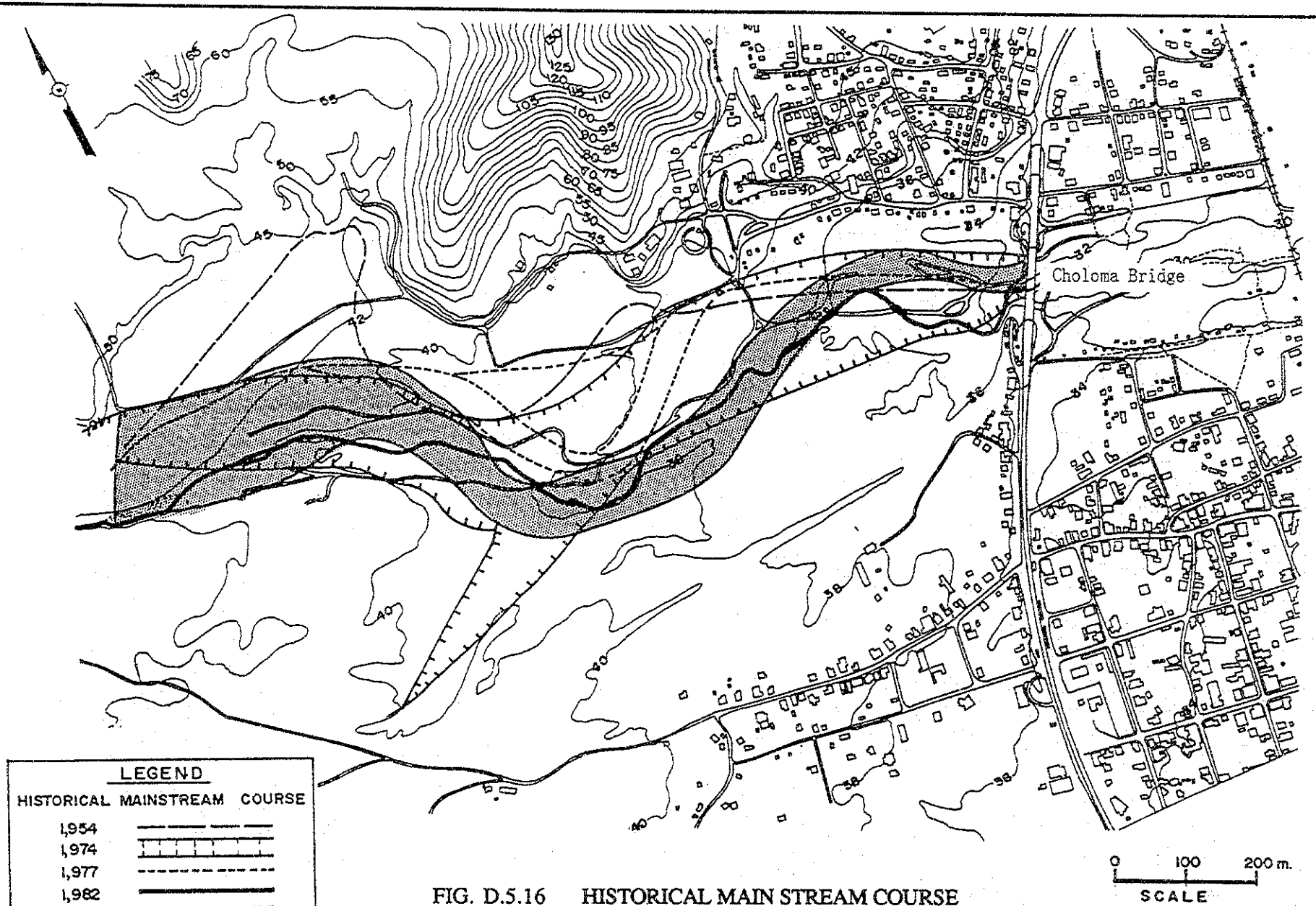
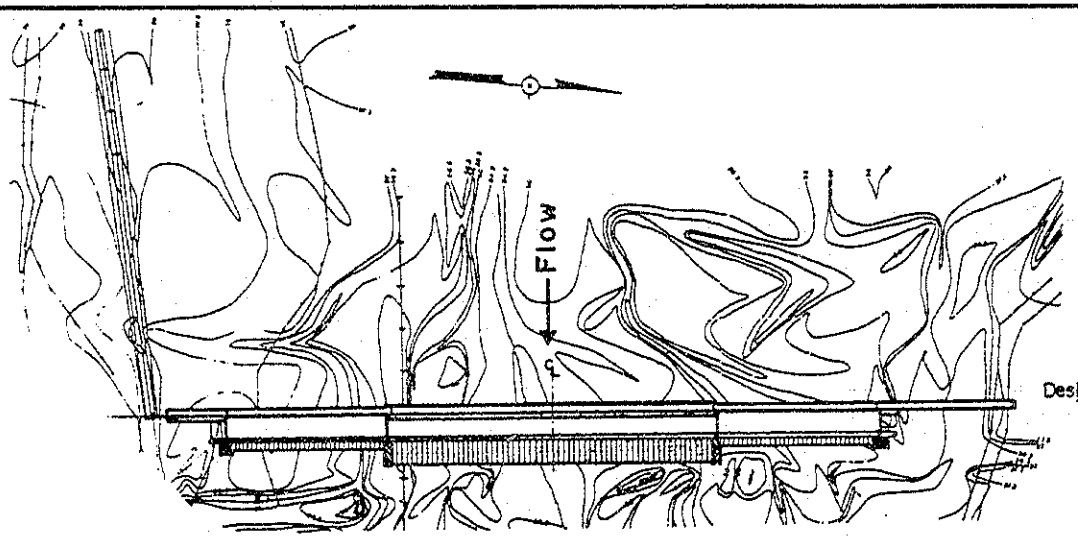
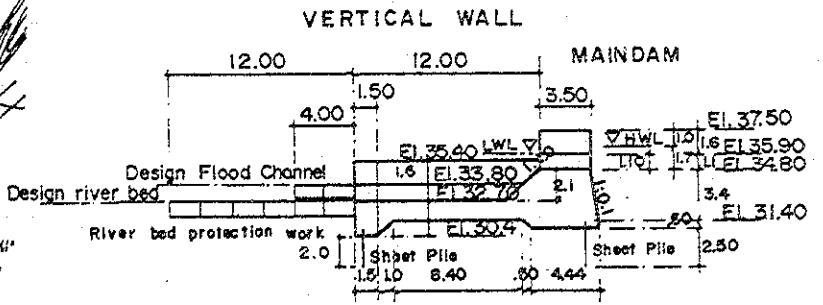


FIG. D.5.16 HISTORICAL MAIN STREAM COURSE
(NEARBY CONSOLIDATION DAM NO. 1)

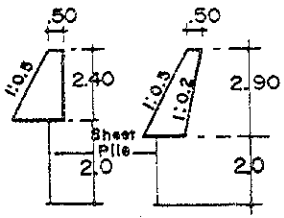
JICA



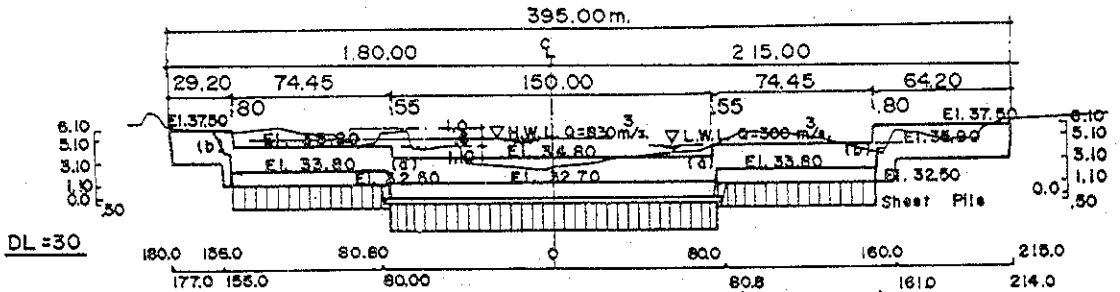
PLAN (Scale = a)



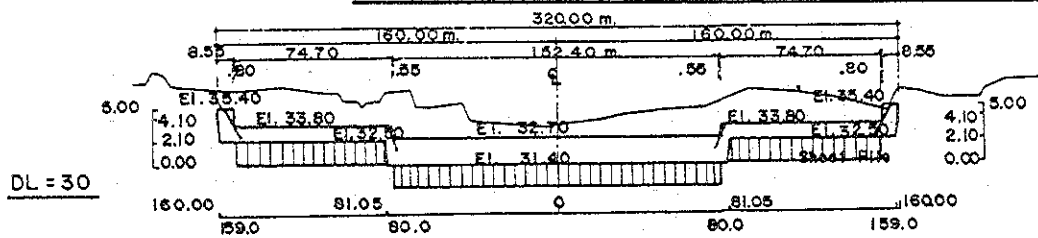
CROSS SECTION
Scale = c



SIDE WALL (Scale = d)



DOWNSTREAM ELEVATION (Main Dam) Scale = b



DOWNSTREAM ELEVATION (Vertical Wall)

Scale = b

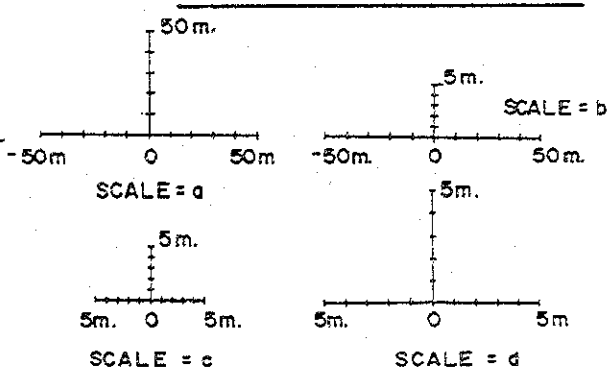


FIG. D.5.17 PROPOSED CONSOLIDATION DAM NO. 1

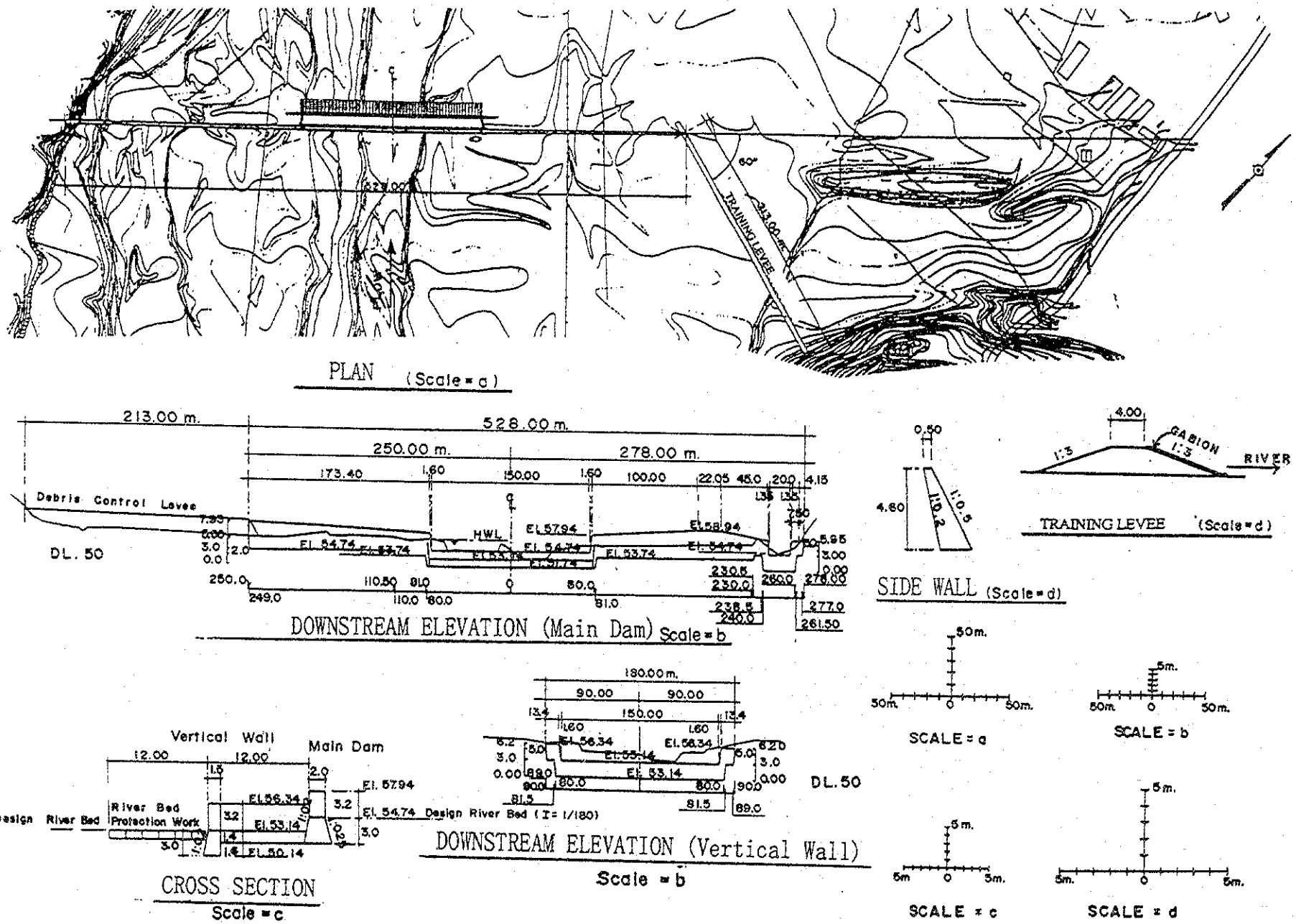


FIG. D.5.18 PROPOSED CONSOLIDATION DAM NO. 7

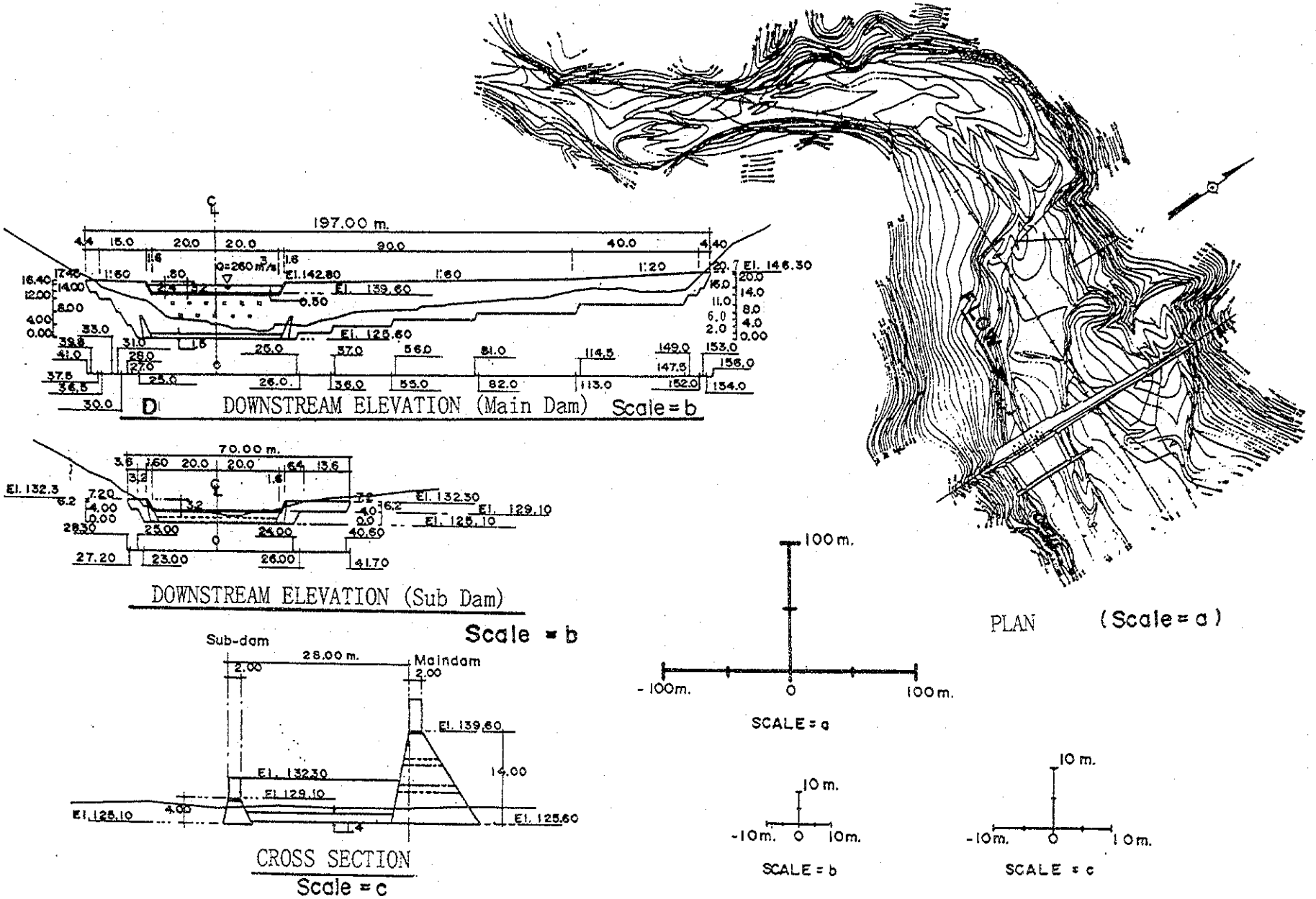


FIG. D.5.19 PROPOSED CHECK DAM NO. 1 (MAJAINE DAM)

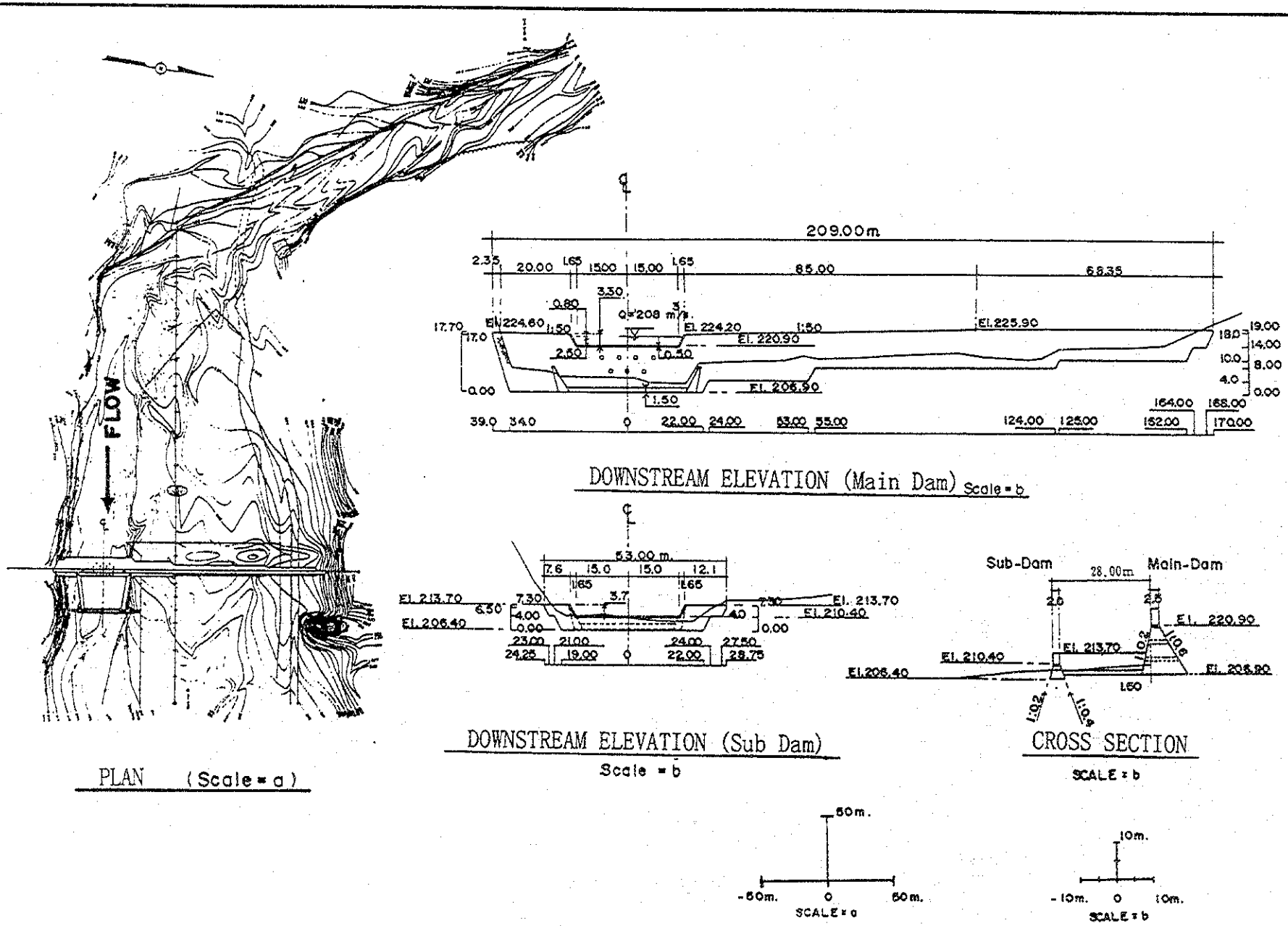


FIG. D.5.20 PROPOSED CHECK DAM NO. 9 (JUTOSA DAM)

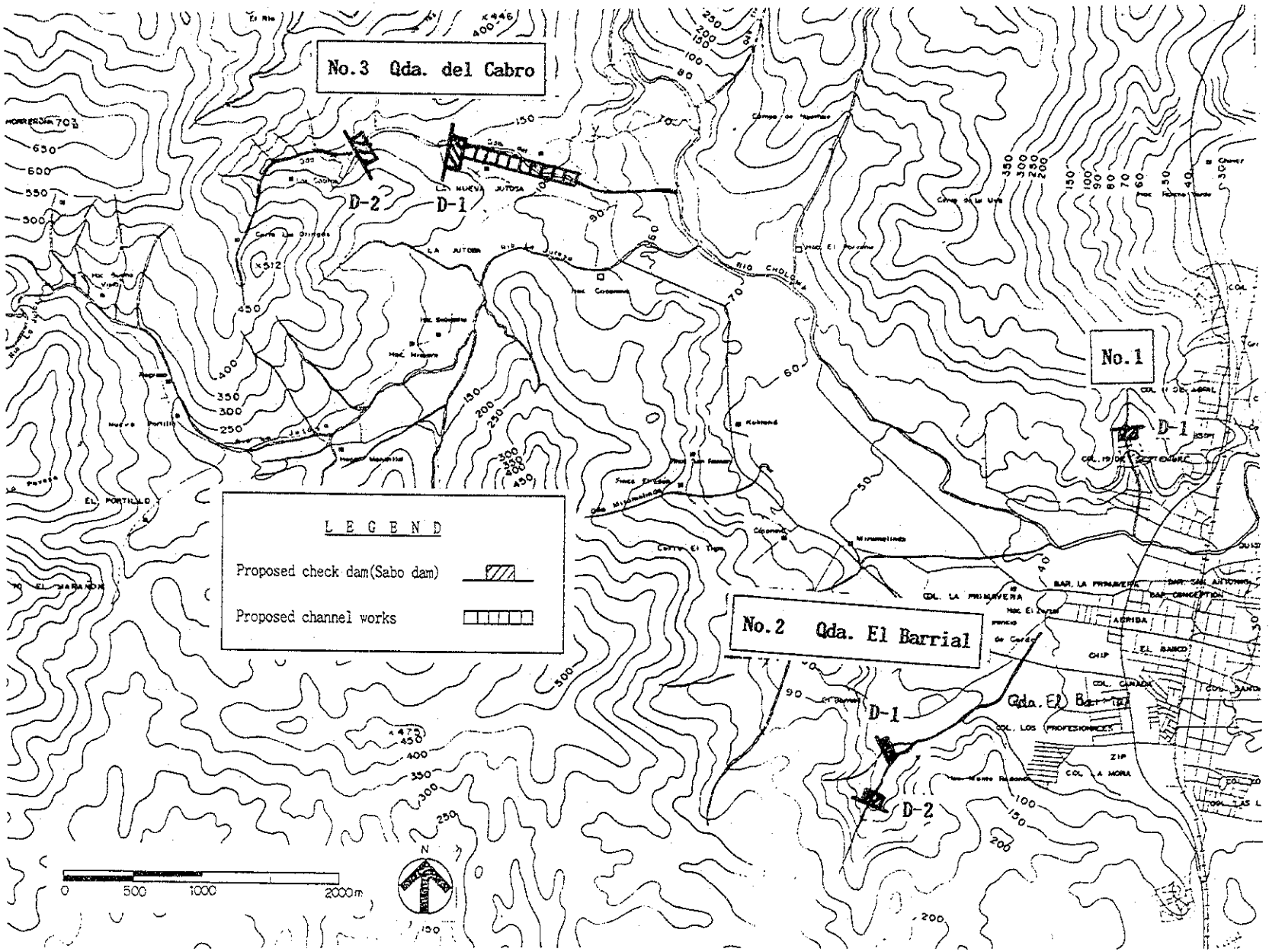


FIG. D.5.21 PROPOSED LOCAL EROSION CONTROL PLAN

SUPPORTING REPORT E
SEDIMENTOLOGY

SUPPORTING REPORT E SEDIMENTOLOGY

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SUPPORTING REPORT E SEDIMENTOLOGY

1. SEDIMENTOLOGICAL STUDY IN THE MASTER PLAN STUDY STAGE

1.1 General

In the Study area, there are three major tributaries and several other small tributaries of the Rio Chamelecon. The major tributaries are the Rio Choloma(catchment area 106.89 km^2), the Rio Blanco(catchment area 190.24 km^2) and the Rio El Sauce (catchment area 118.33 km^2). The quantities of sediment discharge of these rivers are informed to be very large. The sediment deposition can be observed especially in the midstream and downstream reaches of these rivers and this also causes the sediment problems including aggradation of river bed and reducing the flood discharge capacity.

On the contrary, in the midstream reach of the Rio Blanco, degradation of the river bed can be observed. By this degradation of the river bed, the footing and the wooden pile of the foundation of the Railway Bridge have been exposed above the river bed and the Railway Bridge is becoming to be in a dangerous condition. This degradation seems to be caused by the excessive sand taking in the midstream reach of the Rio Blanco. This kind of degradation of the river bed also generally causes the sediment problem such as the collapse of foundation of revetment of river banks as well as collapse of foundation of river structures including bridge.

Hence, for the stabilization of river channel, it is necessary to keep the dynamic equilibrium condition of sediment discharge of the channel which means the balance of sediment inflow into the upstream sections of the channel and the sediment outflow from the downstream sections of the channel through the river course from the upstream reach to the downstream reach.

Considering the above sediment problems, the purpose of the sedimentological study in this supporting report is composed of following items ;

(1) For the present condition of the rivers of the study area including the Rio Choloma, the Rio Blanco and the Rio El Sauce,

a) To estimate the sediment discharge capacity of the present rivers of the Study area,

b) To evaluate the tendency of aggradation and degradation of the river bed of the present rivers,

c) To evaluate the sediment discharge balance in terms of the stabilization of the channels of the present rivers,

(2) For the future condition of the rivers of the study area including the Rio Choloma, the Rio Blanco and the Rio El Sauce,

a) To estimate the sediment discharge capacity of the future rivers of the Study area,

b) To evaluate the sediment discharge balance in terms of the stabilization of the channels of the future rivers,

c) To find the appropriate design of future river cross sections and longitudinal profile in the aspect of stabilization of the channels considering also the flood control.

1.2 History of Sediment Flow Condition of the Rivers

In this chapter, recent history of sediment flow conditions such as deposition of sand, aggradation or degradation of river bed of the rivers in the Study area including the Rio Choloma, the Rio Blanco and the Rio El Sauce is described.

1.2.1 The Rio Choloma

By the hurricane "Fifi" in September 1974, the largest debris flow among the records was occurred. By this debris flow, a huge quantity of sediment was deposited along the river course. The depth of the deposition of the sediment by this debris flow is estimated to be between 0.5 and 3.0 m in the upstream reach between the road bridge and the junction of the Rio Choloma with the Rio La Jutosa (distance about 5 km) and between 0.5 m and 1.0 m in the downstream reach of the road bridge (distance about 7 km).

After "Fifi", in order to improve the flood condition of the downstream area of the Rio Choloma, the Canal San Roque and the Canal San Roque-Cuabanos were constructed in 1977 and 1978. The Rio Choloma joints with the Canal San Roque and flows into the Rio Chamelecon first through the Canal San Roque-Cuabanos and second through the under-constructed Canal Copen-Higuero-Cuabanos. Furthermore, SECOPT conducted the dredging in the downstream reach from the road bridge of the Rio Choloma in 1979 to ensure the flood flow capacity.

In spite of these river improvements relating to the Rio Choloma, as the quantity of the sediment discharge from the upstream reach of the Rio Choloma has been very large, sediment deposition and aggradation of the river bed have been occurred until now.

One of the evidence of the sediment deposition and aggradation can be found at the most downstream reach of the Canal San Roque-Cuabanos of about 700 m length which is the connection reach of the Canal San Roque-Cuabanos with the Canal Copen-Higuero-Cuabanos as shown in *Fig.* E.1.1. In this reach, the Comision Ejecutiva Valle de Sula (Commission of the Sula Valley) conducted the river dredging of the existing channel of the Canal San Roque-Cuabanos (about 200 m) and excavating the new cut-off channel between the original channel of the Canal San Roque-Cuabanos and the Canal Copen-Higuero-Cuabanos (about 500 m) in 1992. The sediment deposition and aggradation of the river bed of about 1.0 m to 2.0 m can be observed by this figure. This sediment deposition is included in the sediment deposition between 1977 and 1992.

1.2.2 The Rio Blanco

By the hurricane "Fifi" in September 1974, the largest debris flow among the records also occurred in the Rio Blanco. By this debris flow, a huge quantity of sediment was deposited along the river course. The depth of the deposition of the sediment by this debris flow is estimated to be about 1.0 m to 3.0 m in the upstream reach between the Road Bridge and the most upstream portions of the alluvial fans of the Rio del Zapotal and the Rio de Armenta (distance about 4 to 5 km) and about 1.0 m to 0.2 m in the downstream reach from the Road Bridge (distance about 3 km).

After "Fifi", river improvement of the Rio Blanco was conducted in 1978 by SECOPT and Municipality of San Pedro Sula based on the flood control study of Sir William Halcrow & Partners in 1975. By this river improvement, excavation of the river bed of

which the depth was about 2.0 m to 3.0 m in the downstream reach and about 3.0 m and 4.0 m in the upstream reach was conducted as well as the widening and diking of the channel.

In spite of above river improvement, as the quantity of sediment discharge from the upstream reach as well as from the large quantity of sediment deposition made by the debris flow of "Fifi" had been large, aggradation of the river bed about 2.0 to 3.0 m was observed at the Road Bridge in around 1980.

On the contrary, degradation of the river bed by the excessive sand taking for construction materials can be observed in the midstream reach in 1992, and this causes a structural problem to both the Railway Bridge and the Road Bridge as described in Section 1.1. The depth of the degradation at the Railway Bridge is estimated to be more than 2.0 m.

1.2.3 The Rio El Sauce

Even by the hurricane " Fifi" in September 1974, large debris flow like the debris flow of the Rio Choloma and the Rio Blanco did not occur in the Rio El Sauce and its tributaries of the Rio Santa Ana/Rio Bermejo and the Rio Piedras. But the sediment deposition can be estimated to be about 2.0 m in the downstream reach of the Rio Santa Ana/Rio Bermejo according to the present trace of sediment deposition made in 1974.

After " Fifi", river improvement of the Rio El Sauce, the Rio Santa Ana/Rio Bermejo and the Rio Piedras was conducted by Municipality of San Pedro Sula and SECOPT in 1976 and 1977. By this river improvement, excavation of the river bed about 1.0 m to 2.0 m depth in these rivers were conducted.

The quantity of the aggradation or degradation of the river bed after the above river improvement is not clear until now.

1.3 Present Sediment Flow Condition of the Rivers

In this section, present sediment flow conditions of the rivers in the Study area is described in terms of pattern of sediment flow of the rivers and the bed materials of the rivers.