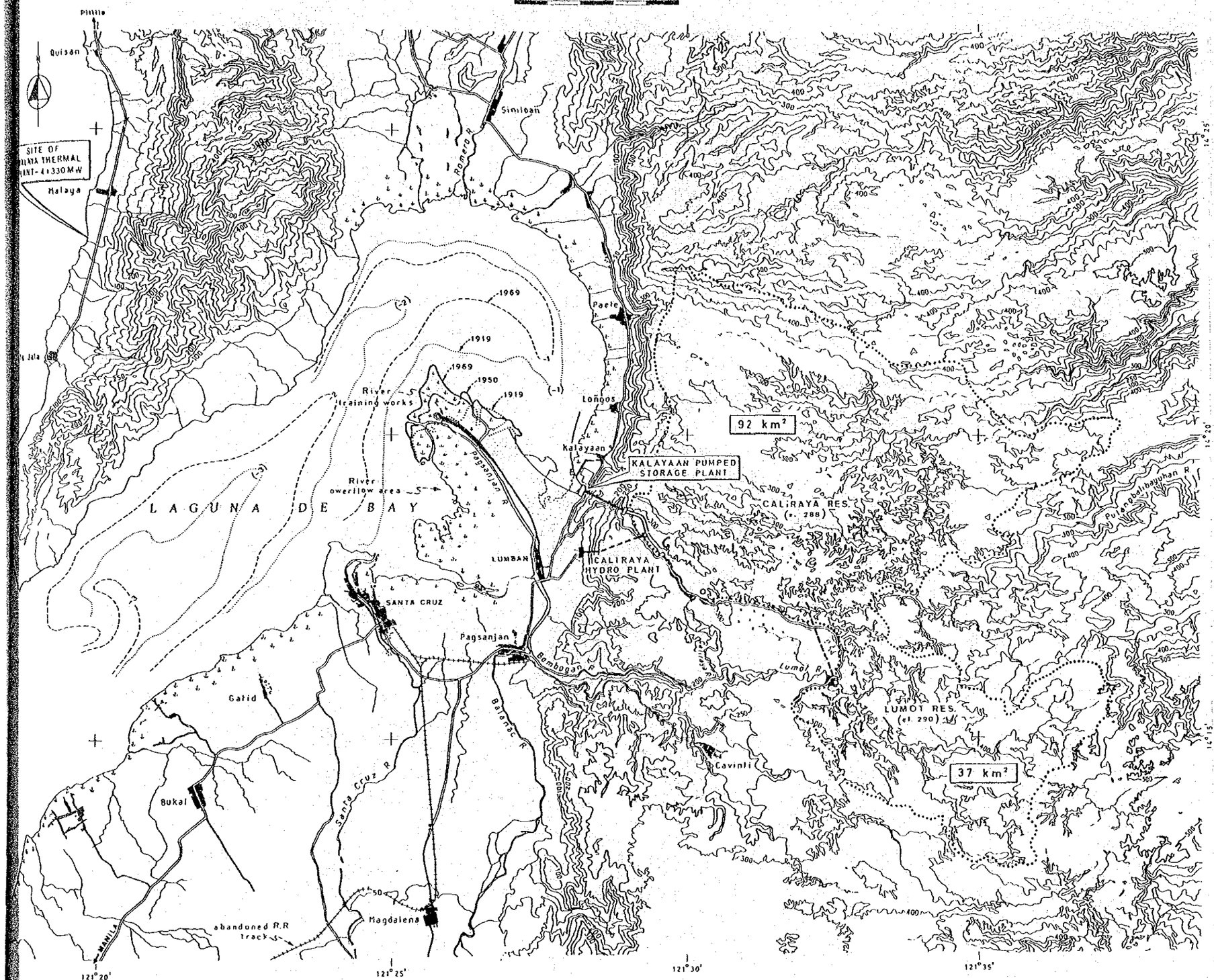
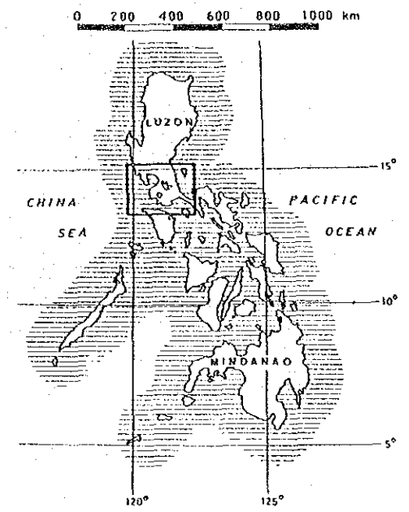
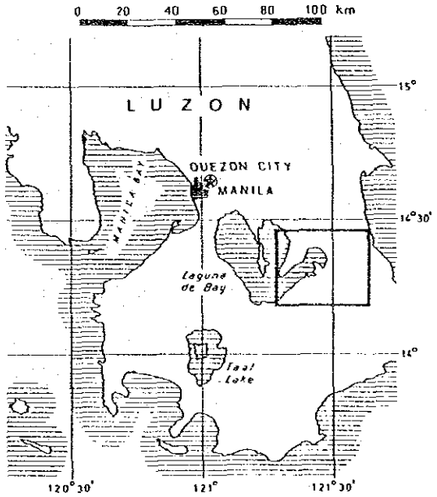


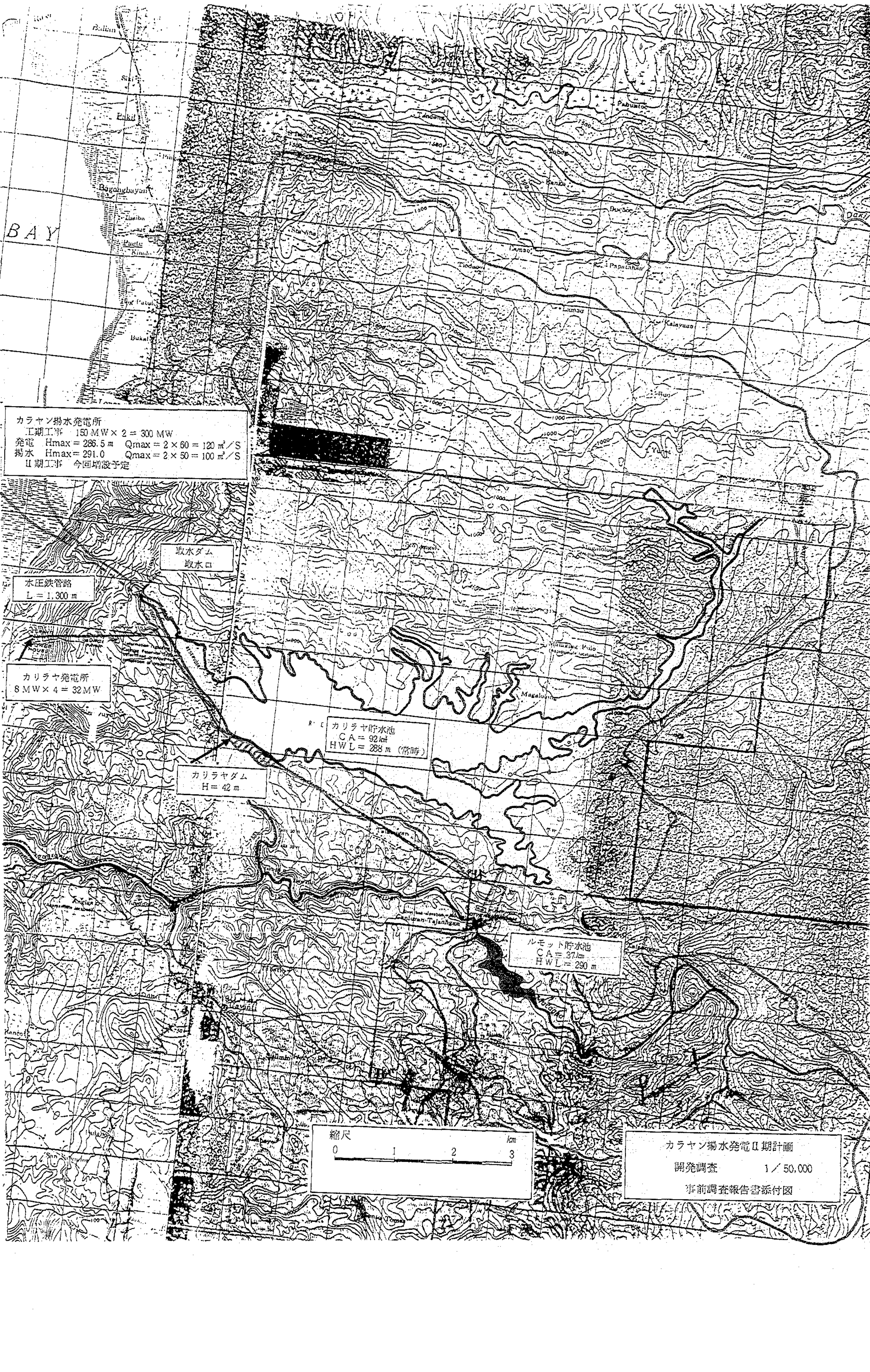


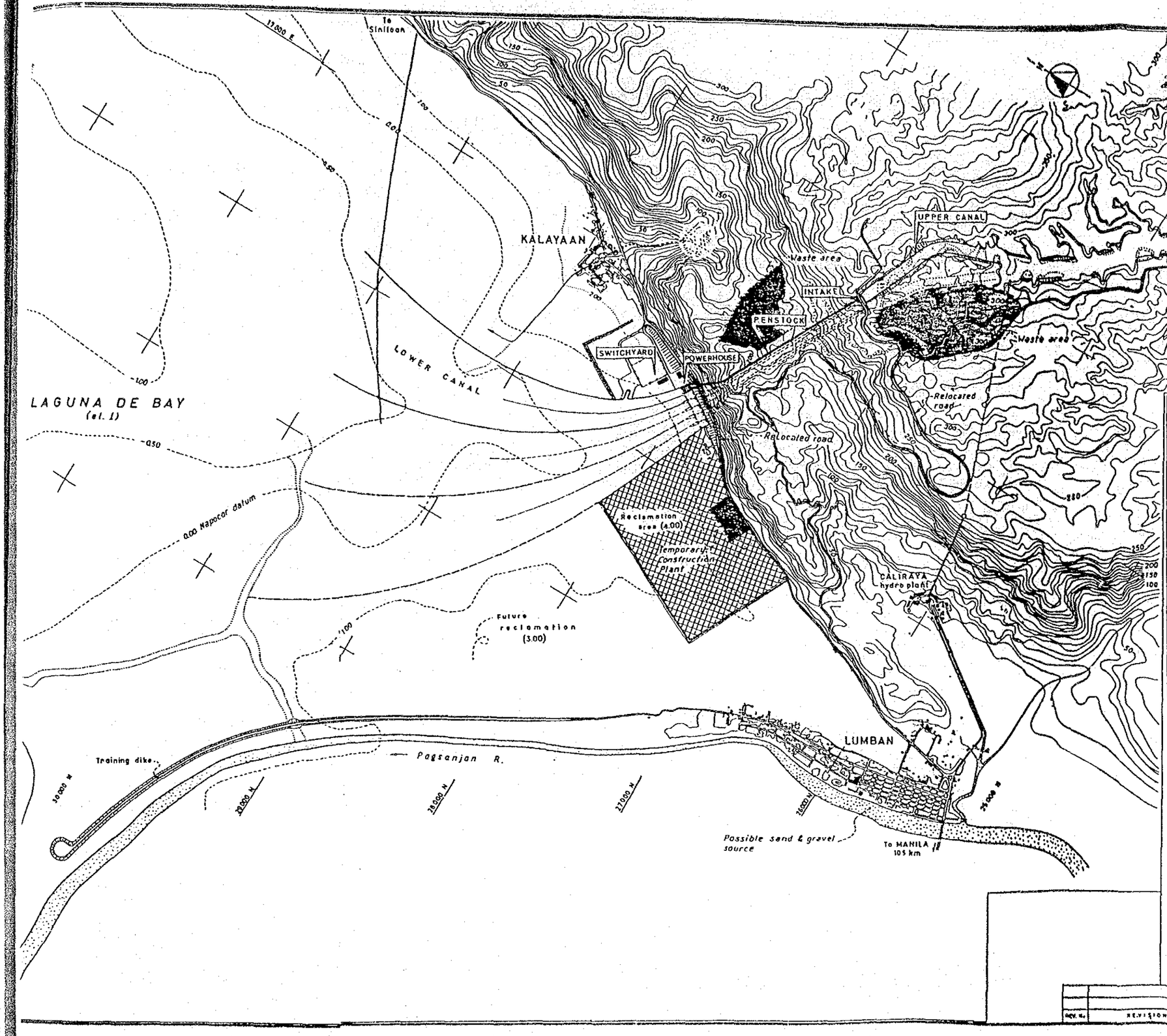


NATIONAL POWER CORPORATION
MANILA, PHILIPPINES
KALIRAYA H. E. PLANT
TECHNICAL FEASIBILITY REPORT

LOCATION MAP

DRAWN	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED GENERAL MANAGER
DATE	


BAY
カラヤン揚水発電所
工期工事　150 MW × 2 = 300 MW
発電　Hmax = 286.5 m　Qmax = 2 × 60 = 120 ㎥/S
揚水　Hmax = 291.0　Qmax = 2 × 50 = 100 ㎥/S
II期工事　今回増設予定
取水ダム
取水口
水圧鉄管路
L = 1,300 m
カリラヤ発電所
8 MW × 4 = 32 MW
カリラヤ貯水池
CA = 92 ㎢
HWL = 288 m（常時）
カリラヤダム
H = 42 m
ルモット貯水池
CA = 37 ㎢
HWL = 290 m
縮尺
0 1 2 3 ㎞
カラヤン揚水発電II期計画
開発調査　1／50,000
事前調査報告書添付図



PROJECT DATA

CATCHMENT AREAS		**POWERHOUSE** *(Stage I)*	
Caliraya	92 km²	Installed Capacity	2×150 MW
Lumot	37 km²	Pump Turbines	
	129 km²	*Max. net head as turbine*	288.50 m
RESERVOIRS		*Max. net head as pump*	291.00 m
Caliraya		*Aprox. rated generating disch.*	2×60 m³/s
Max. Norm. El	288 m.a.s.l.	*Aprox. rated pumping disch.*	2×50 m³/s
Live Storage (el.286-288)	22×10⁶m³	*Synchronous speed*	300 r.p.m.
Lumot		Pony Motors	
Max. Norm. El.	290 m.a.s.l.	*Rated capacity*	2×9 MW
Live Storage (el.286-290)	21×10⁶m³	Generator Motors	
CANALS		*Rating motor/generator*	2×167/167 MVA
Upper Canal *(Stages I II III)*		*Transformers*	
Length	7100 m	*Rated capacity*	2×170 MVA
Max. Capacity	360 m³/s		
Lower Canal *(Stages I and II)*			
Length	2600 m		
Max. Capacity	240 m³/s		
PENSTOCK			
Length	7300 m		
Inside Diameter	6.00÷3.30 m		

NOTE

- *All elevations are referred to NAPOCOR datum which is at +0.36m above average mean sea level of Survey and Geodetic service.*

0 0.2 0.4 0.6 0.8 1 km

NATIONAL POWER CORPORATION
MANILA, PHILIPPINES

KALAYAAN PUMPED STORAGE PLANT

GENERAL LAYOUT

DRAWN _____ SUBMITTED _____
TRACED _____ RECOMMENDED _____
CHECKED _____ APPROVED _____
DATE GENERAL MANAGER

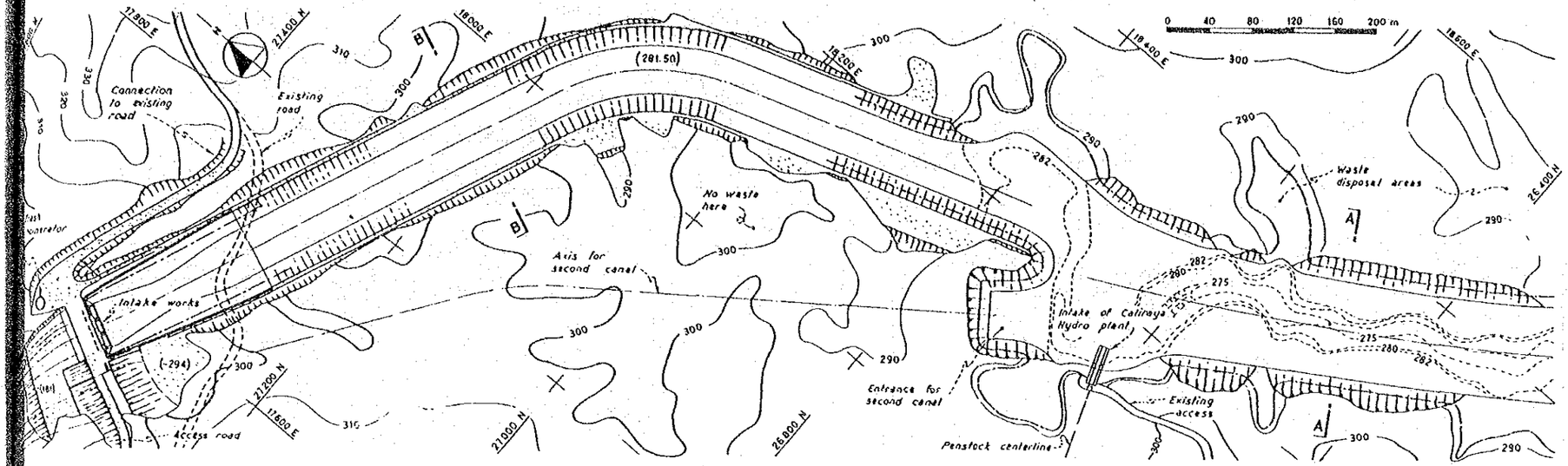
elc electroconsult, via Chiabrera 8 MILANO, ITALY

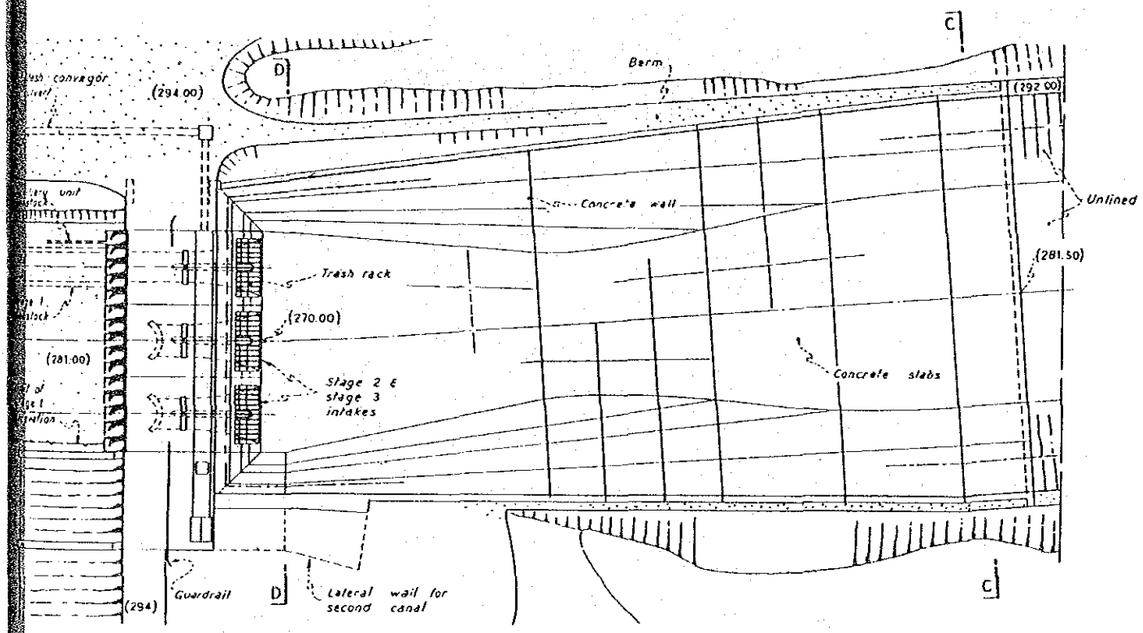
DRAWN _____ CHECKED _____ APPROVED

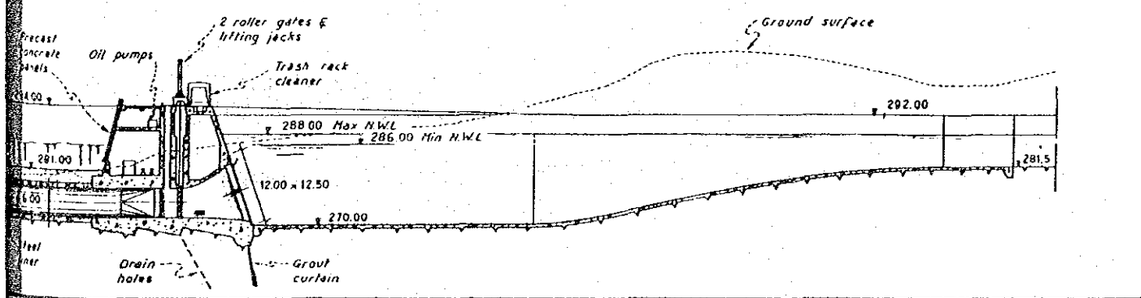
REV. No.	REVISIONS	DRAWN	CH'KD	APP'D	DATE

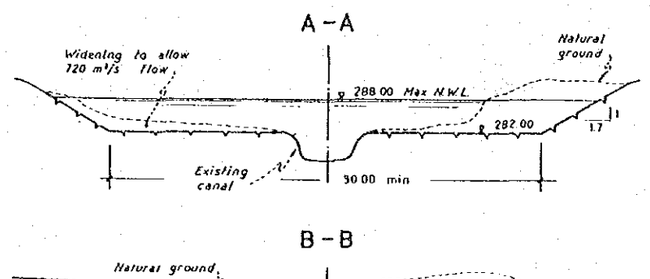
DATE 14-2-'73 SCALE

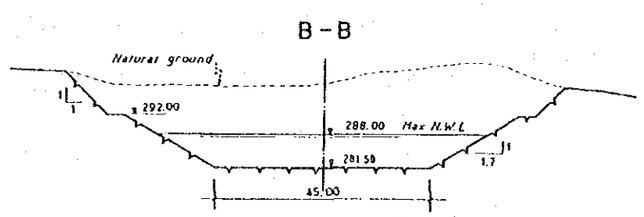
KAL – FR 002

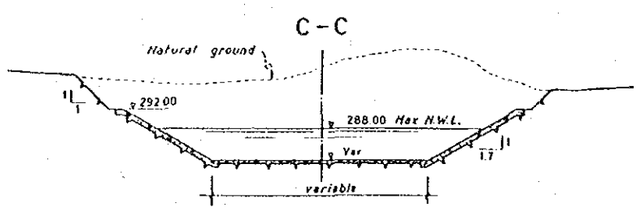


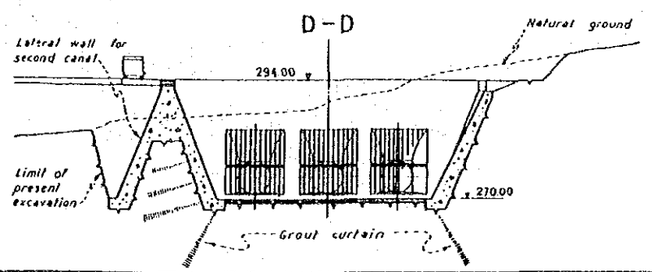


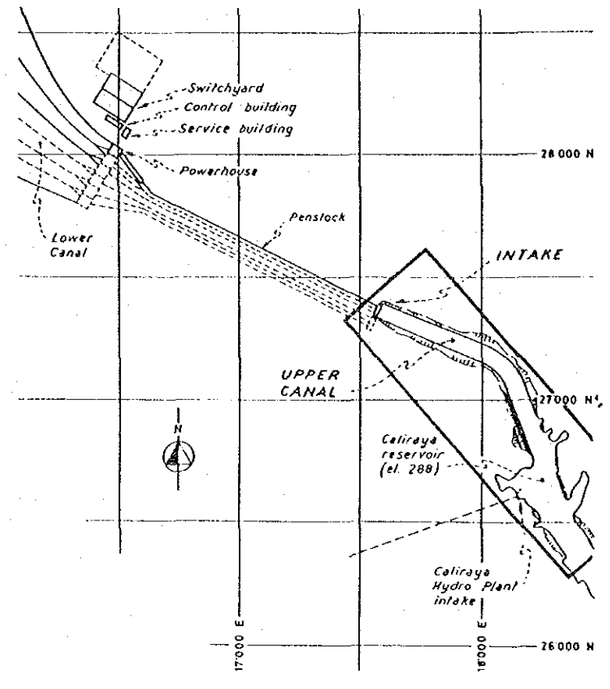












0 10 20 30 40 50 m

NATIONAL POWER CORPORATION
MANILA, PHILIPPINES

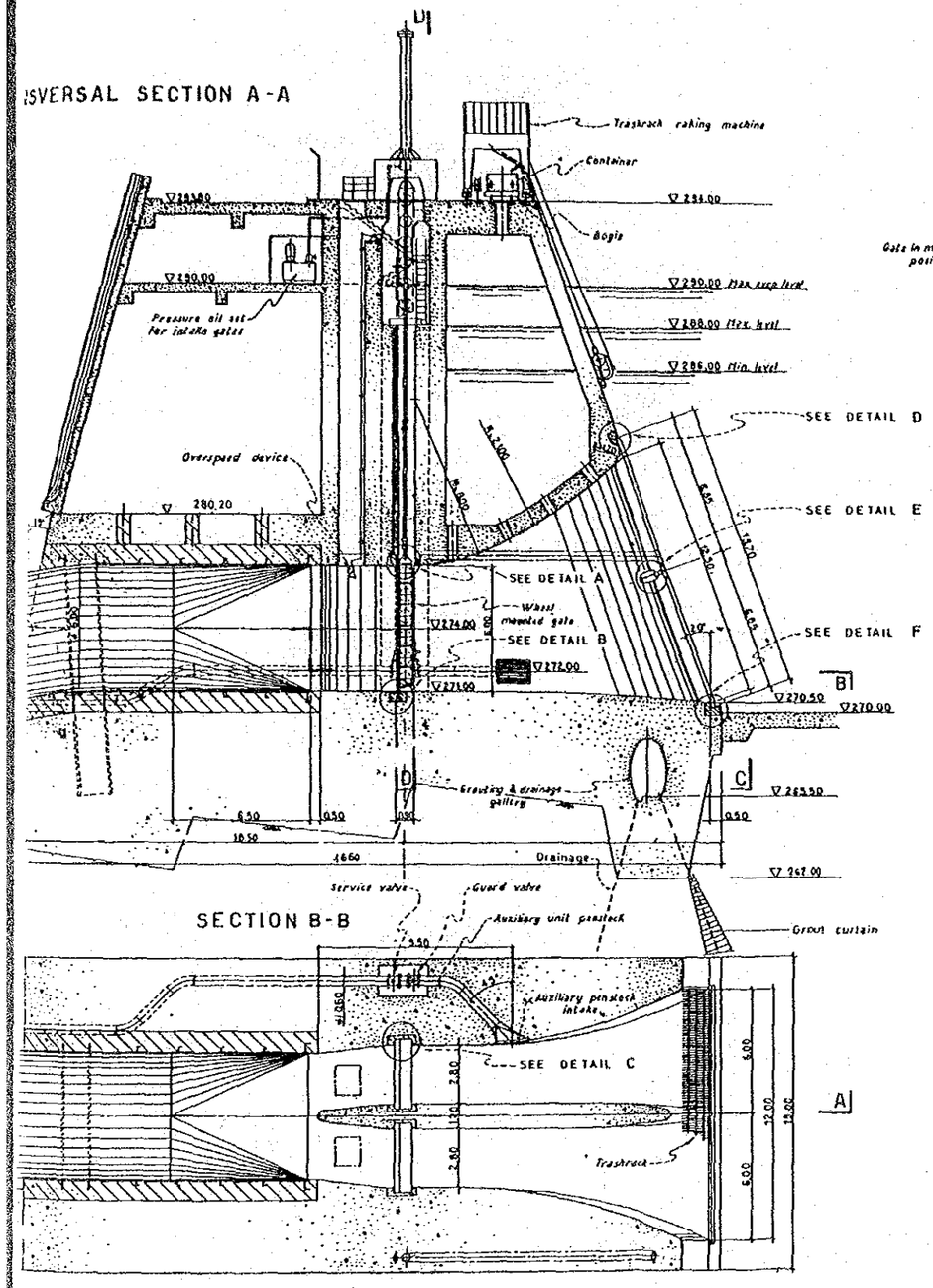
KALAYAAN PUMPED STORAGE PLANT
TECHNICAL FEASIBILITY REPORT

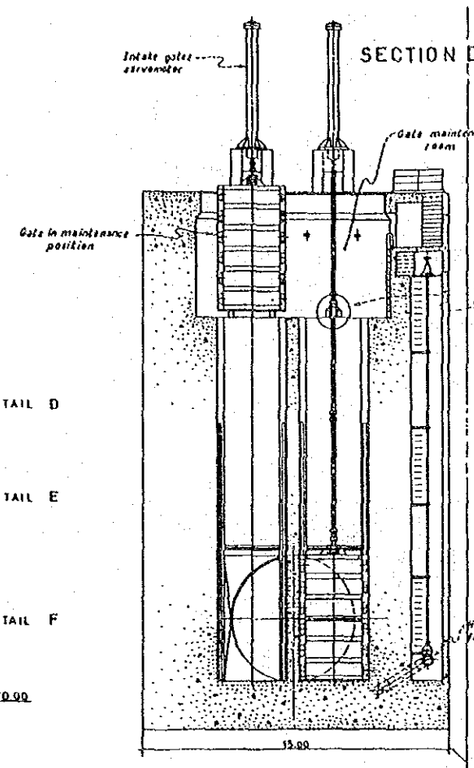
UPPER CANAL & INTAKE

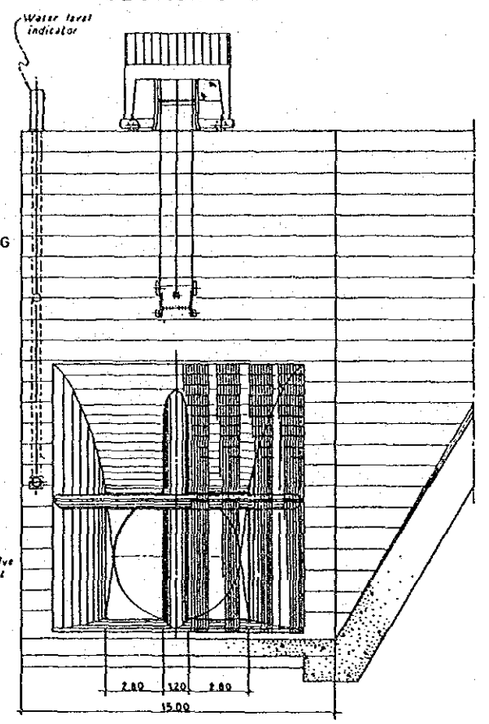
DRAWN		SUBMITTED	
TRACED		RECOMMENDED	
CHECKED		APPROVED	GENERAL MANAGER
	DATE		

elc electroconsult, MILANO, ITALY
EDCOP ENGINEERING & DEVELOP. CORP. MANILA, PHILIPP.

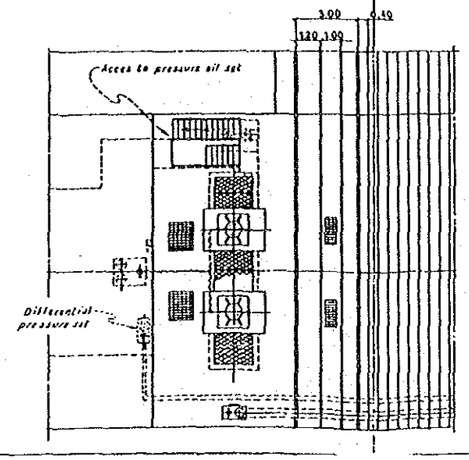
DRAWN	Brambilla	APPROVED	
CHECKED			
DATE	MAY 1973		CAL - 1011
SCALE	1:5'000, 1:1'250		







PLAN AT EL. 294,00



0 2 4 6 8 10 m

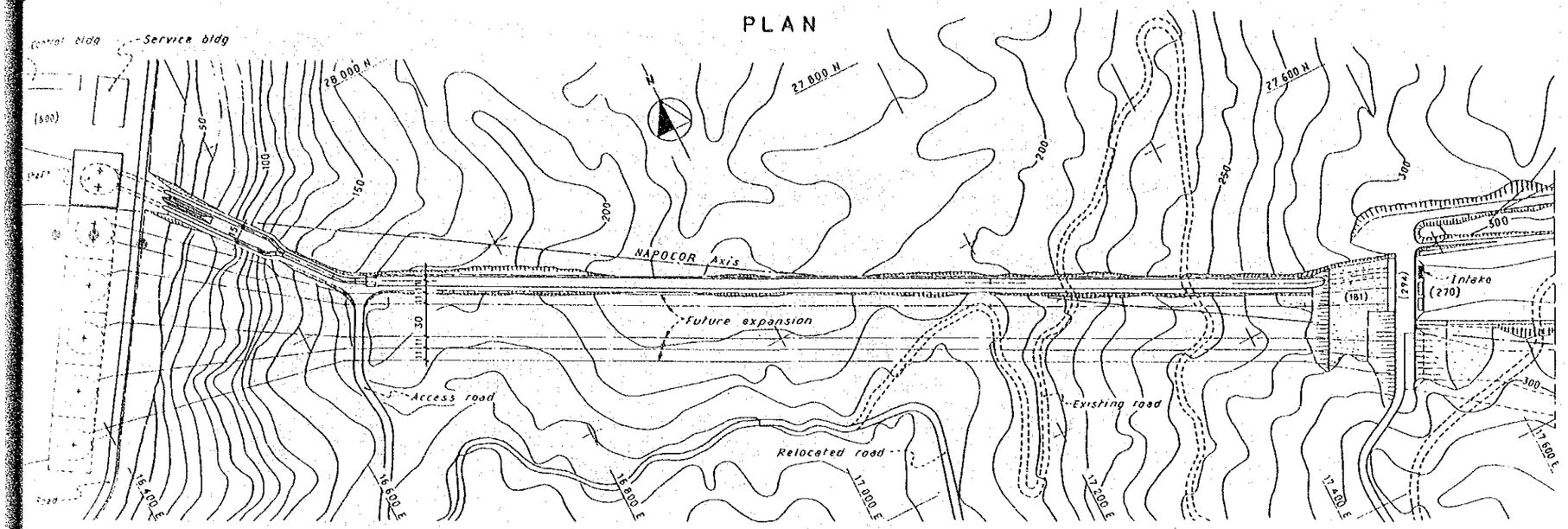
NATIONAL POWER CORPORATION
MANILA, PHILIPPINES
KALAYAAN PUMPED STORAGE PLANT

INTAKE
ELECTROMECHANICAL EQUIPMENT

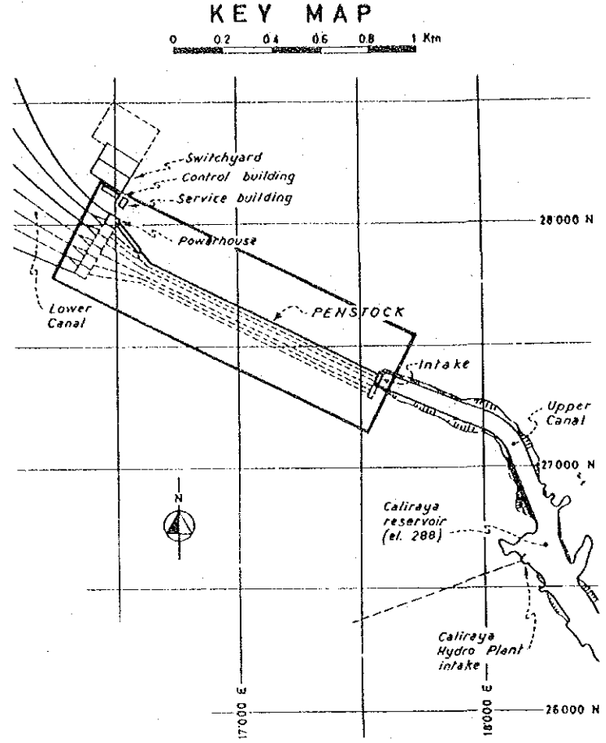
DRAWN ____ SUBMITTED ____
TRACED ____ RECOMMENDED ____
CHECKED ____ APPROVED ____ GENERAL MANAGER
DATE

elc electroconsult, via Cristoforo B MILANO, ITALY
DRAWN ____ CHECKED ____
APPROVED ____
DATE MARCH 83
SCALE
KAL – FR 005

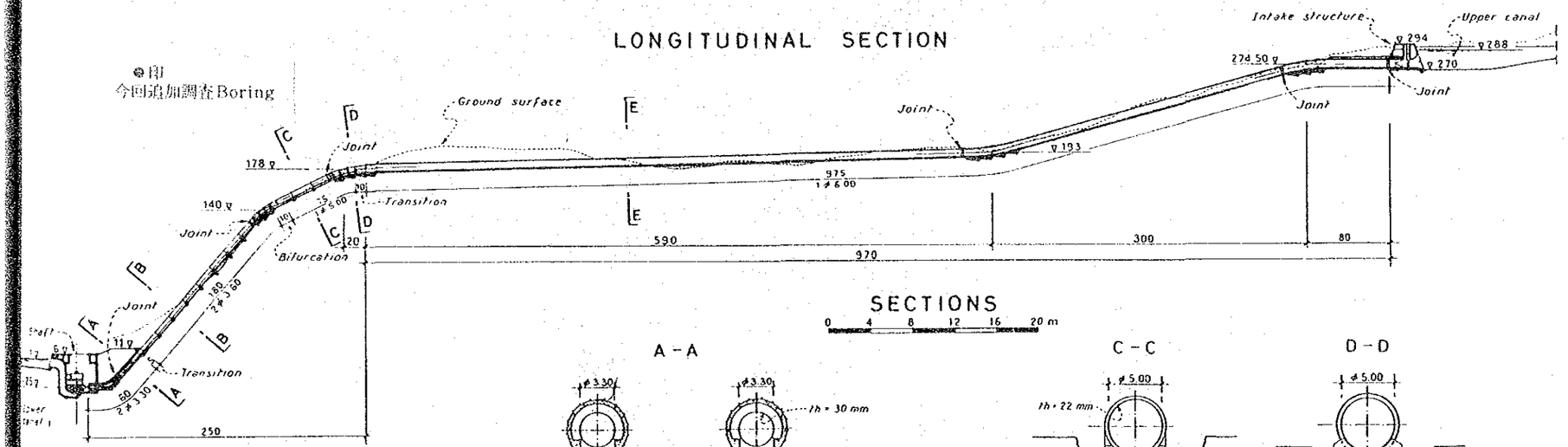
PLAN



KEY MAP



LONGITUDINAL SECTION

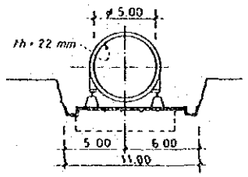


SECTIONS

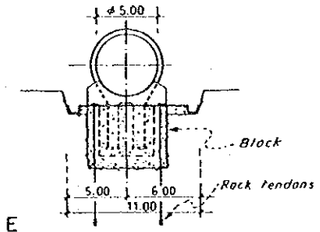
0 4 8 12 16 20 m

A – A

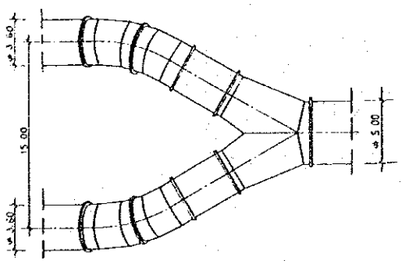
C – C



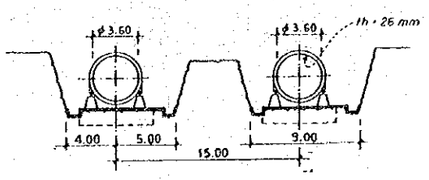
D – D



BIFURCATION



B – B



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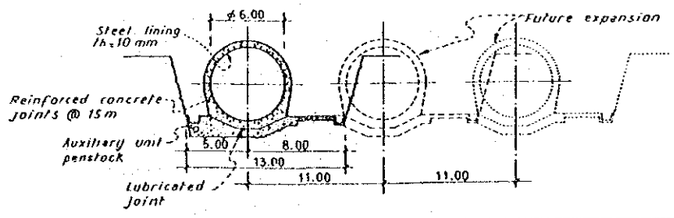


0 40 80 120 160 200 m

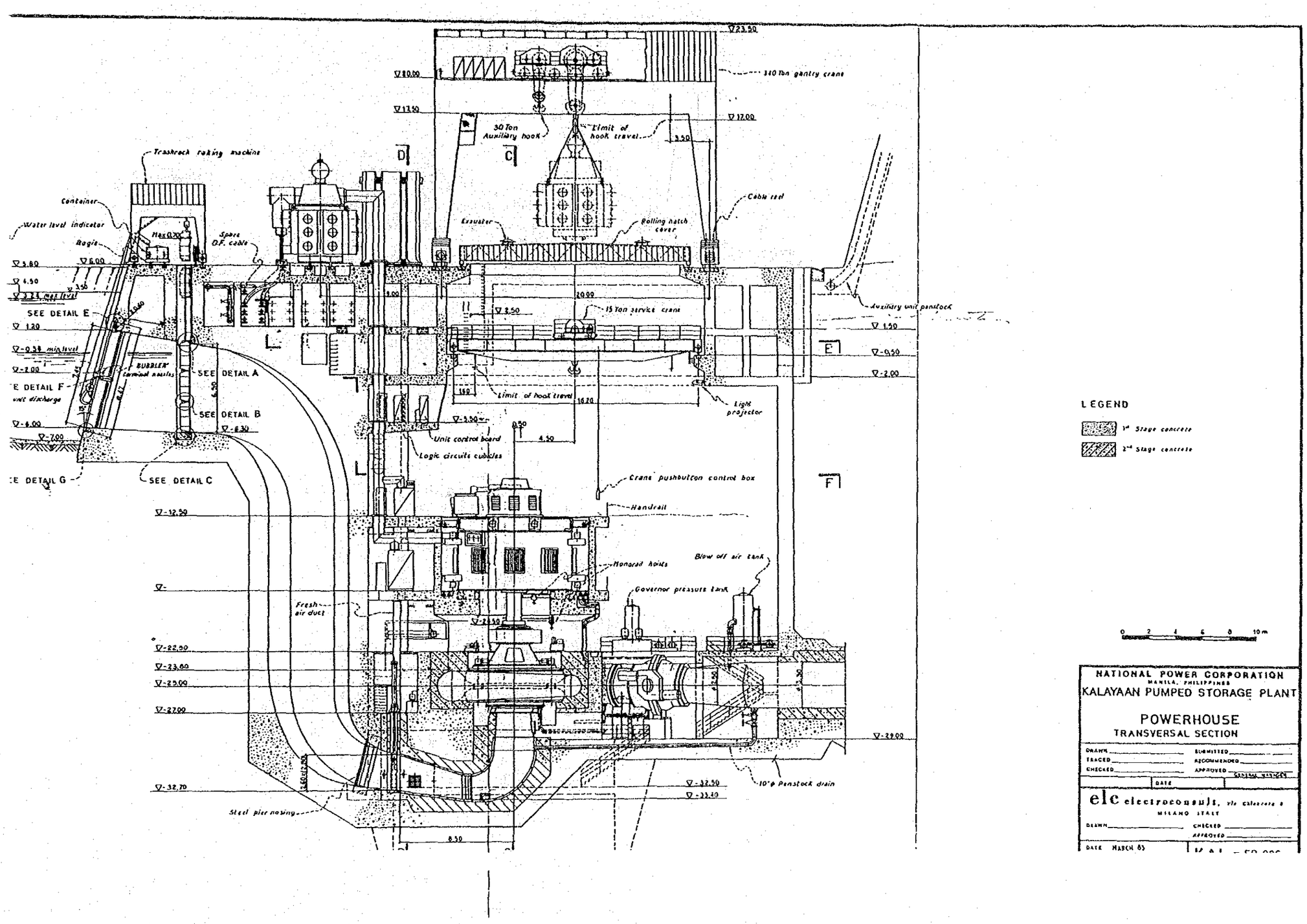
NATIONAL POWER CORPORATION
MANILA, PHILIPPINES
KALAYAAN PUMPED STORAGE PLANT
TECHNICAL FEASIBILITY REPORT

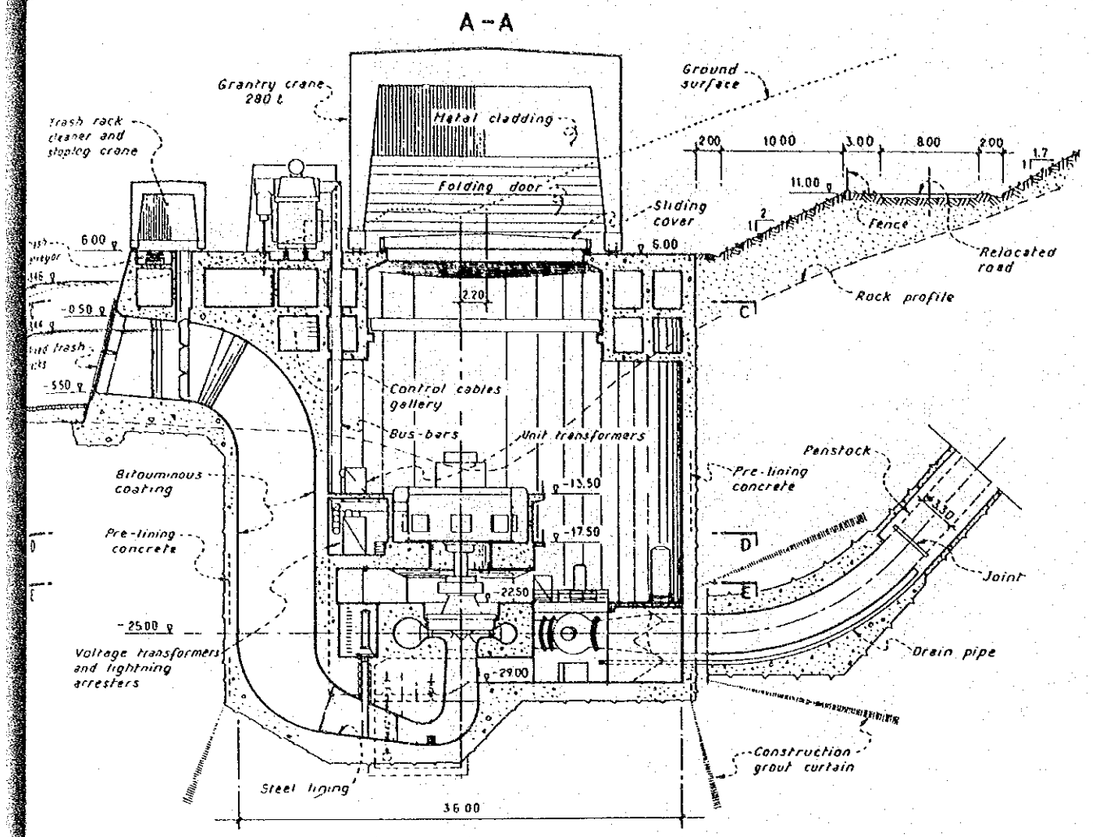
PENSTOCK

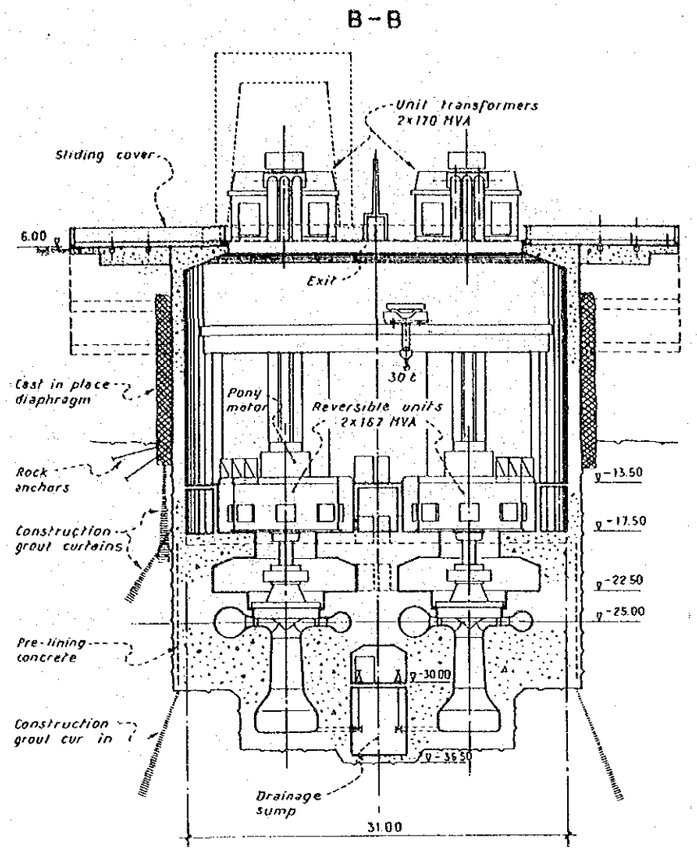
DRAWN — SUBMITTED —
TRACED — RECOMMENDED —
CHECKED — APPROVED — GENERAL MANAGER
DATE

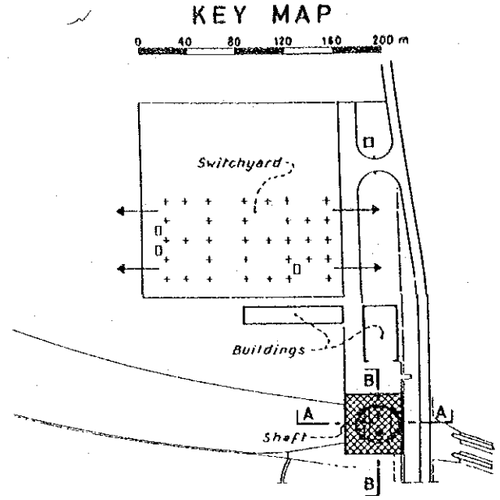
elc electroconsult, MILANO, ITALY
EDCOP ENGINEERING & DEVELOP. CORP., MANILA, PHILIPP.
DRAWN Galagnol' Cobrua APPROVED
CHECKED
DATE MAY 1973
SCALE 1:5000, 1:500

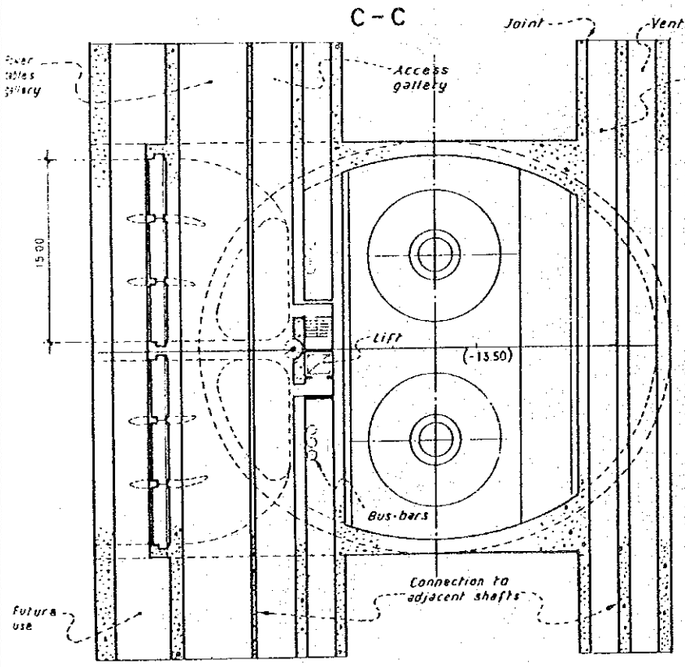
CAL - 1012

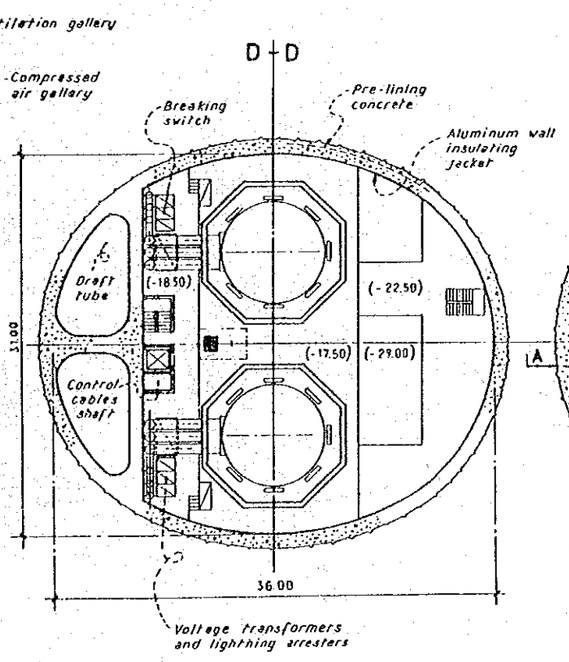

▽23.50
▽20.00
340 Ton gantry crane
▽13.50
30 Ton Auxiliary hook
Limit of hook travel
▽12.00
3.50
Trashrack raking machine
Container
Water level indicator
Bagie
Hex 0.70
Spare O.F. cable
Cable reel
Exciter
Rolling hatch cover
▽5.80
▽4.50
▽3.25 max level
▽6.00
3.50
SEE DETAIL E
▽1.20
▽-0.35 min level
▽-2.00
BUBBLER terminal nozzles
SEE DETAIL A
E DETAIL F
unit discharge
SEE DETAIL B
▽-6.00
▽-7.00
▽-8.30
20.99
15 Ton service crane
▽2.50
Auxiliary unit penstock
▽1.50
▽-0.50
▽-2.00
Limit of hook travel
16.20
Light projector
▽-3.50
Unit control board
Logic circuits cubicles
0.50
4.50
E DETAIL G
SEE DETAIL C
Crane pushbutton control box
Handrail
▽-12.50
Honorad holds
Blow off air tank
Governor pressure tank
Fresh air duct
▽-22.50
▽-23.60
▽-29.00
▽-27.00
▽-29.00
▽-32.70
▽-32.50
▽-33.40
10"ϕ Penstock drain
Steel pier nosing
8.50
LEGEND
1st Stage concrete
2nd Stage concrete
0 2 4 6 8 10 m
NATIONAL POWER CORPORATION
MANILA, PHILIPPINES
KALAYAAN PUMPED STORAGE PLANT
POWERHOUSE
TRANSVERSAL SECTION
DRAWN
TRACED
CHECKED
SUBMITTED
RECOMMENDED
APPROVED
DATE
elc electroconsult, via colleoni 9
MILANO ITALY
DRAWN
CHECKED
APPROVED
DATE MARCH 83

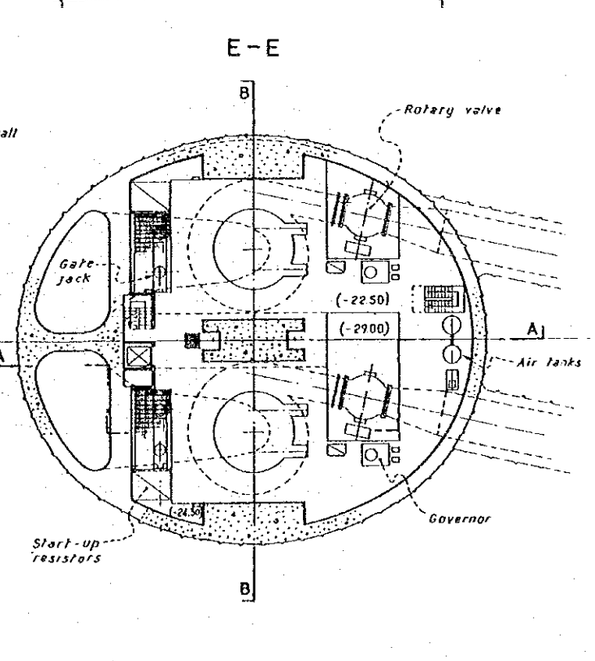












NATIONAL POWER CORPORATION
MANILA, PHILIPPINES

KALAYAAN PUMPED STORAGE PLANT
TECHNICAL FEASIBILITY REPORT

SHAFT & UNITS

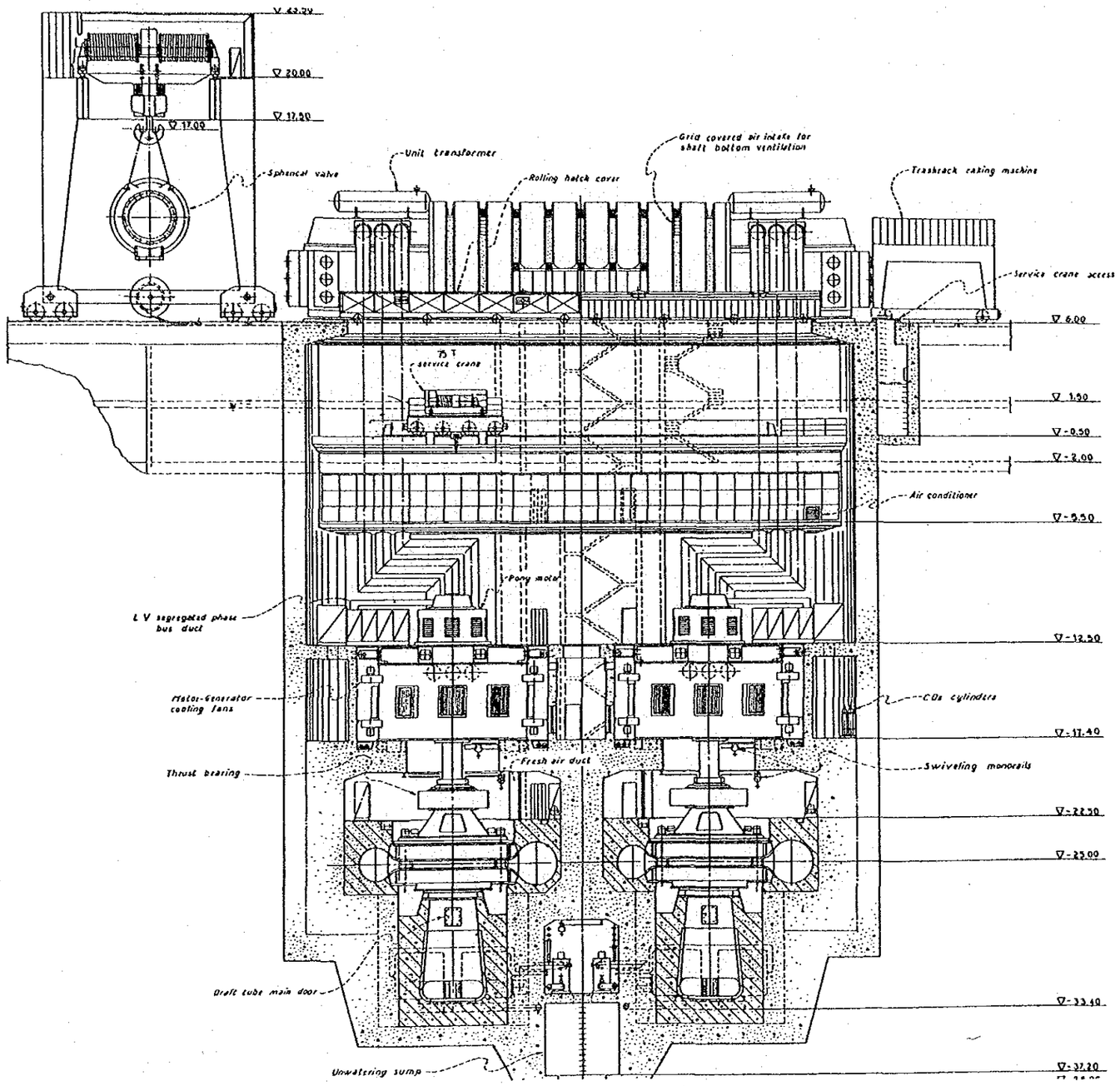
DRAWN | SUBMITTED
TRACED | RECOMMENDED
CHECKED | APPROVED
GENERAL MANAGER
DATE

elc electroconsult, MILANO, ITALY
EDCOP ENGINEERING & DEVELOP. CORP., MANILA, PHILIPP.

DRAWN Galeyard | APPROVED Faulwell
CHECKED Colaneri

DATE MAY 1973 | SCALE 1:500

CAL - 1016



LEGEND

1st Stage concrete

2nd Stage concrete

0 2 4 6 8 10 m

NATIONAL POWER CORPORATION
MANILA, PHILIPPINES

KALAYAAN PUMPED STORAGE PLANT

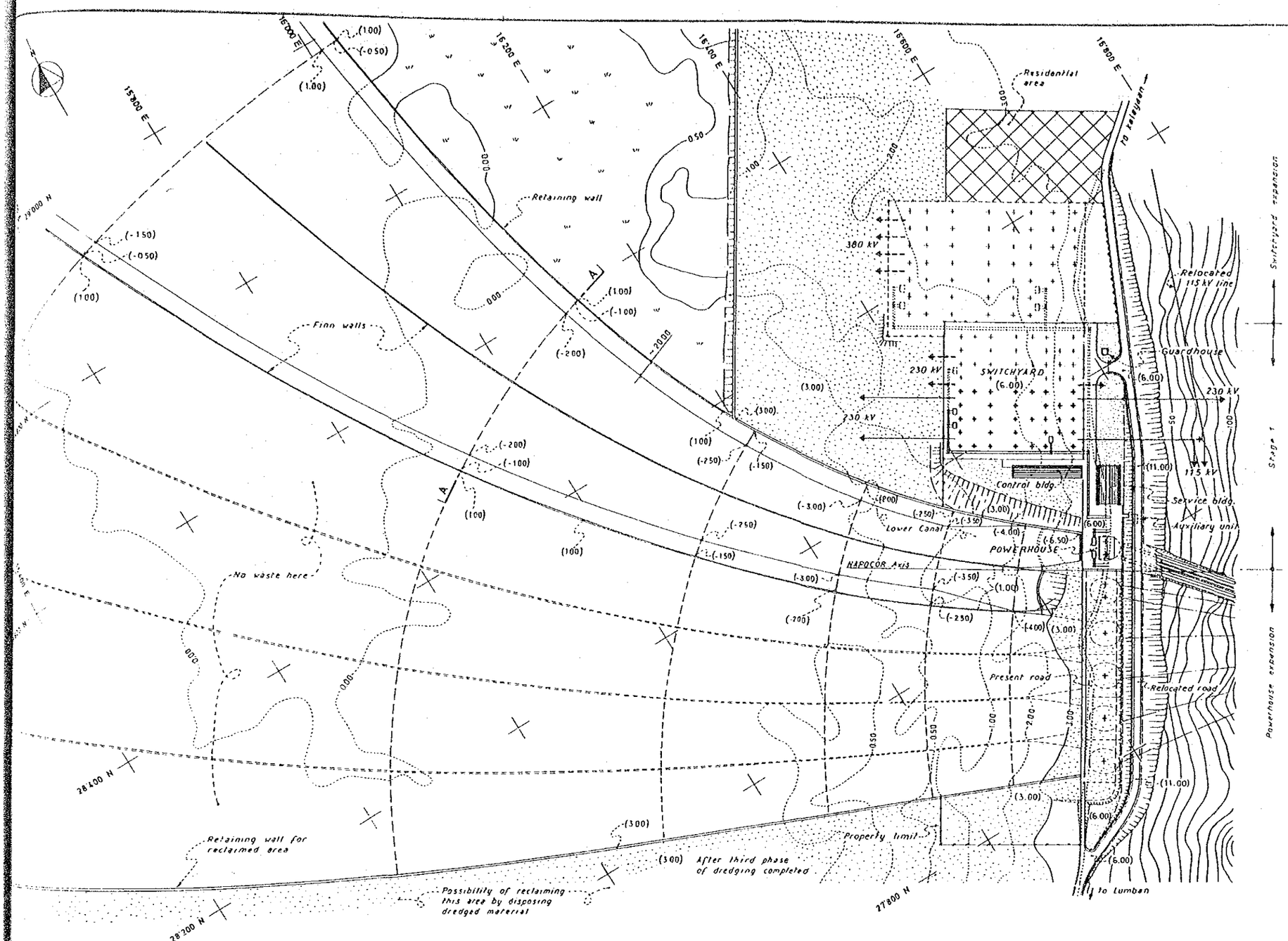
POWERHOUSE
LONGITUDINAL SECTION

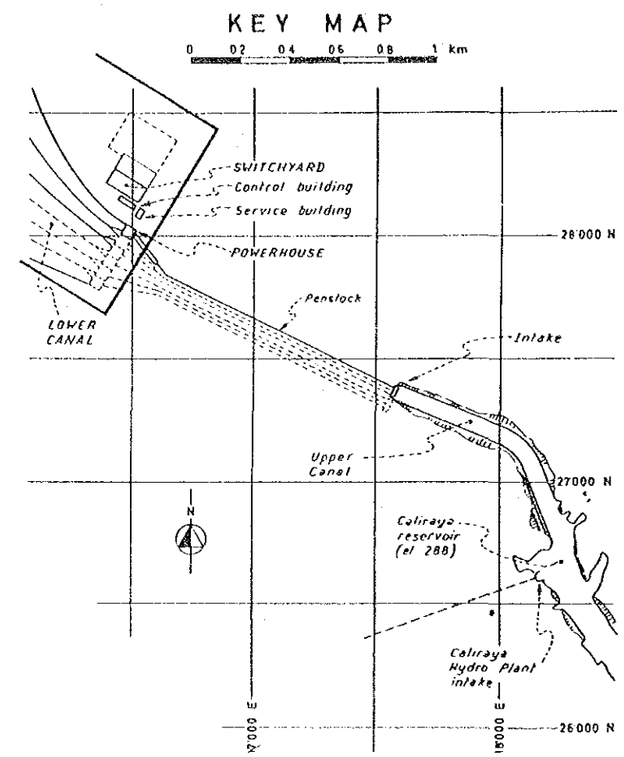
DRAWN _____ SUBMITTED _____
TRACED _____ RECOMMENDED _____
CHECKED _____ APPROVED _____ GENERAL MANAGER
DATE

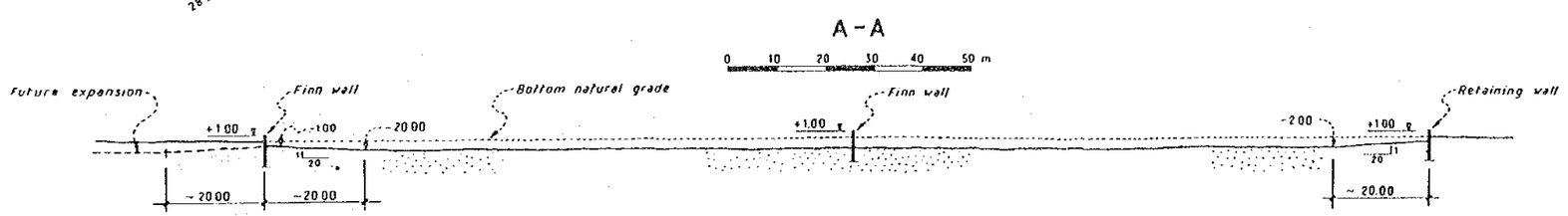
elc electroconsult, via Chiaravalle 8 MILANO, ITALY

DRAWN _____ CHECKED _____
APPROVED _____
DATE MARCH 83

KAL – FR 007







NATIONAL POWER CORPORATION
MANILA, PHILIPPINES

KALAYAAN PUMPED STORAGE PLANT
TECHNICAL FEASIBILITY REPORT

POWERHOUSE, LOWER CANAL & SWITCHYARD

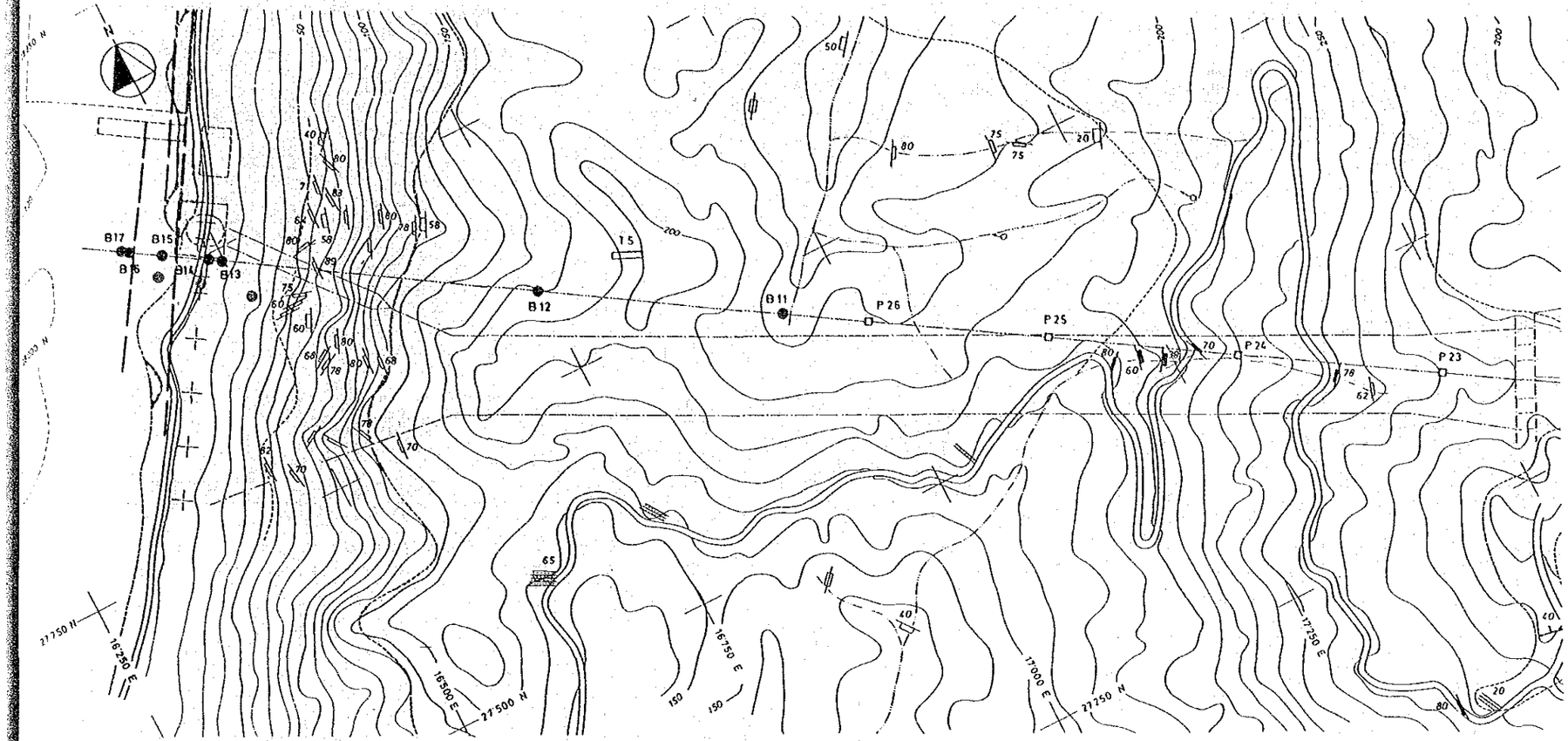
DRAWN	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED GENERAL MANAGER
	DATE

elc electroconsult, MILANO, ITALY
EDCOP ENGINEERING & DEVELOP. CORP., MANILA, PHILIPP.

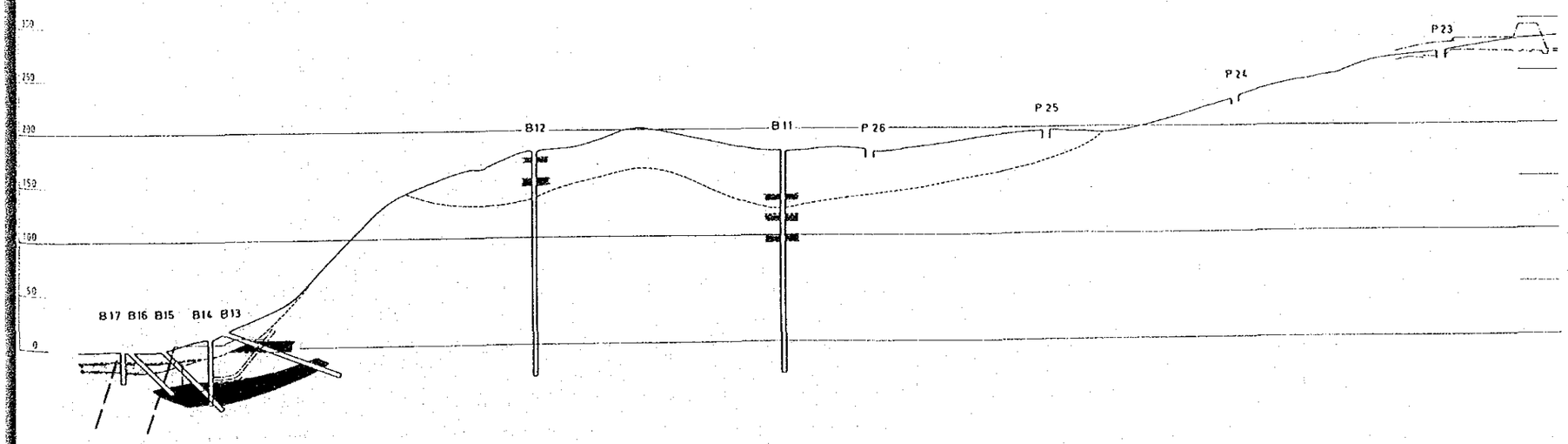
DRAWN M. Colonna APPROVED
CHECKED

DATE MAY 1973
SCALE 1:5000, 1:1250

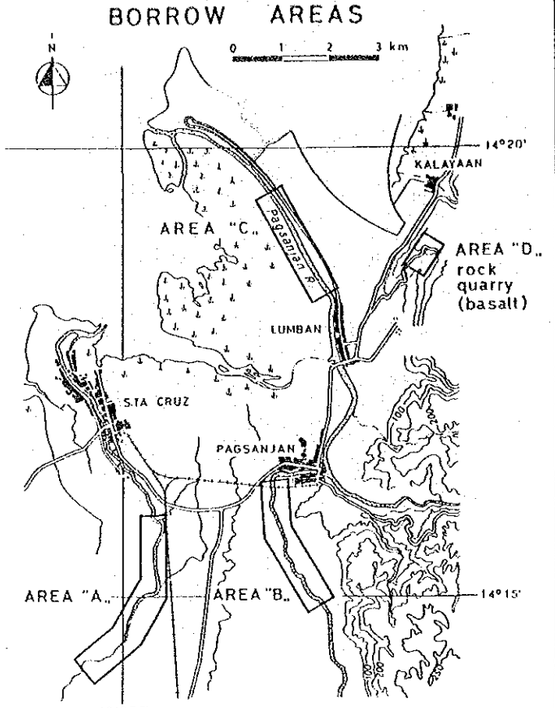
CAL - 1013



●印
今回追加調査Boring



BORROW AREAS



0 40 80 120 160 200 m

NATIONAL POWER CORPORATION
MANILA, PHILIPPINES
KALAYAAN PUMPED STORAGE PLANT
TECHNICAL FEASIBILITY REPORT

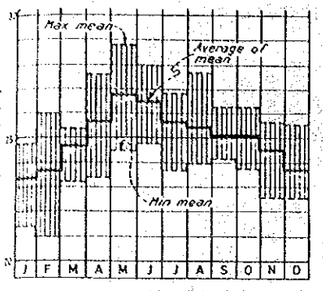
GEOLOGY
PENSTOCK & POWERHOUSE

DRAWN	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED GENERAL MANAGER
DATE	

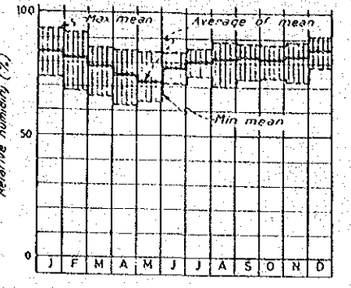
elc electroconsult MILANO, ITALY
EDCOP ENGINEERING & DEVELOP CORP. MANILA, PHILIPP.

DRAWN Minetti	APPROVED
CHECKED Colombo	
DATE MAY 1973	CAL - 1006
SCALE 1:5000	

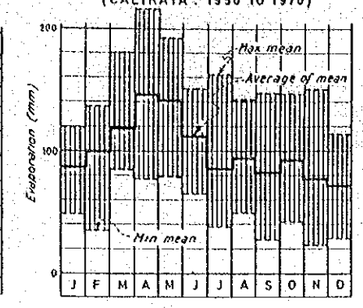
TEMPERATURE (CALIRAYA : 1950 TO 1970)



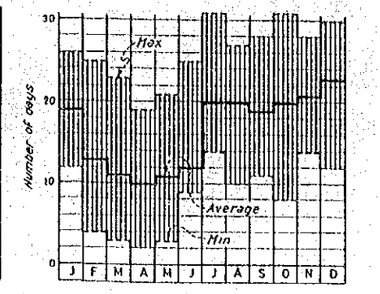
RELATIVE HUMIDITY (CALIRAYA : 1950 TO 1970)



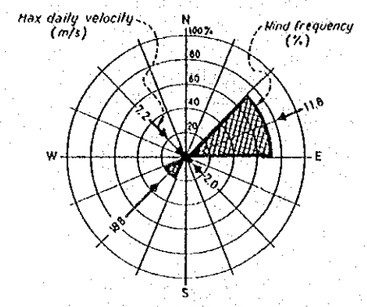
EVAPORATION (CALIRAYA : 1950 TO 1970)



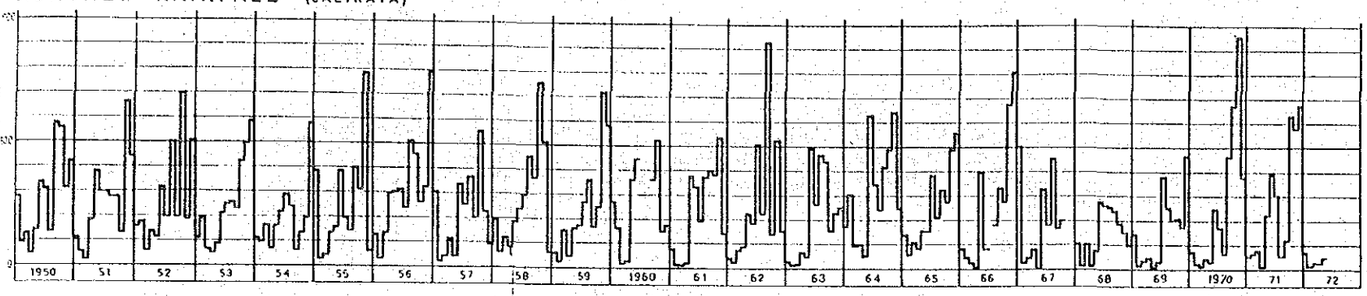
DAYS OF RAINFALL (CALIRAYA : 1942 TO 1972)



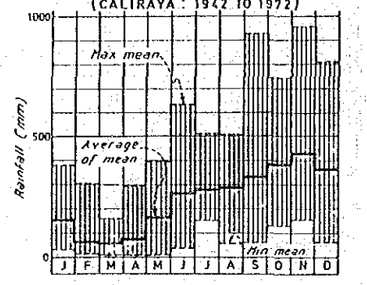
WIND (CALIRAYA : 1969 TO 1972)



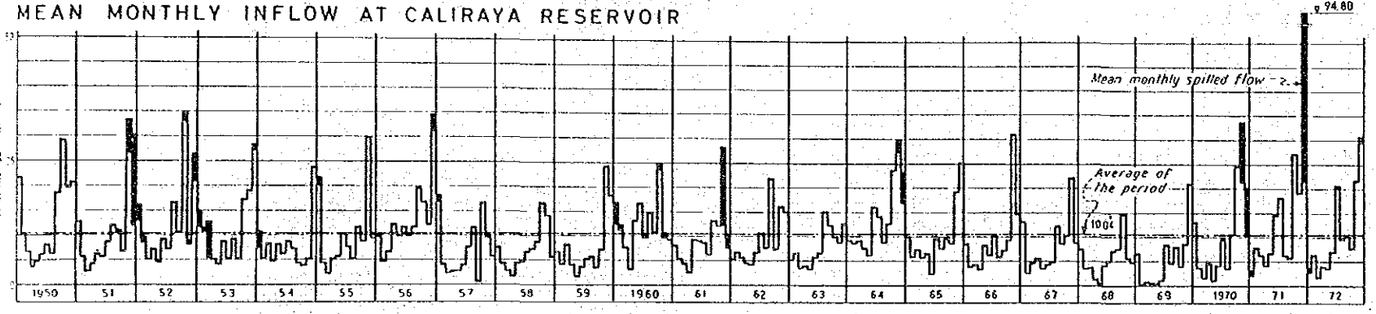
MONTHLY RAINFALL (CALIRAYA)



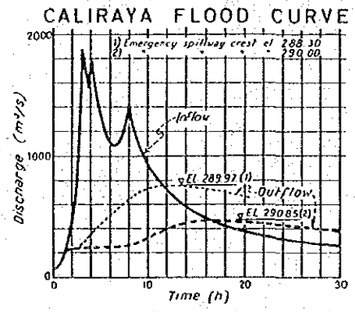
RAINFALL (CALIRAYA : 1942 TO 1972)



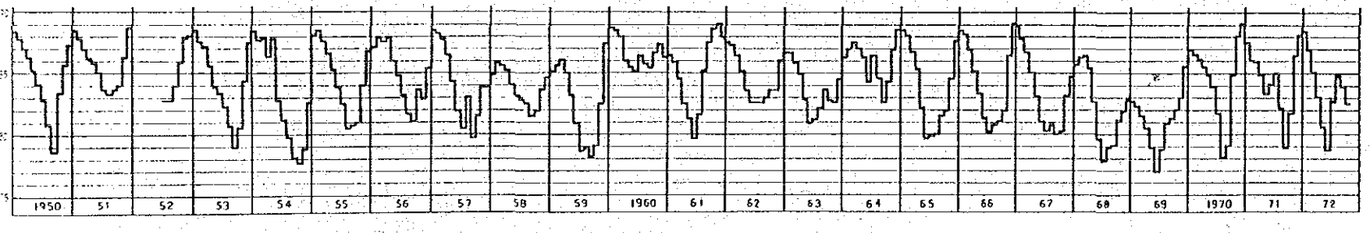
MEAN MONTHLY INFLOW AT CALIRAYA RESERVOIR



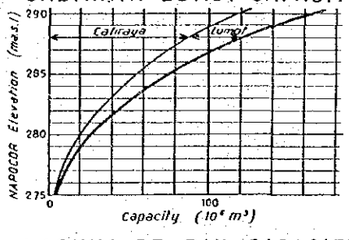
CALIRAYA FLOOD CURVE



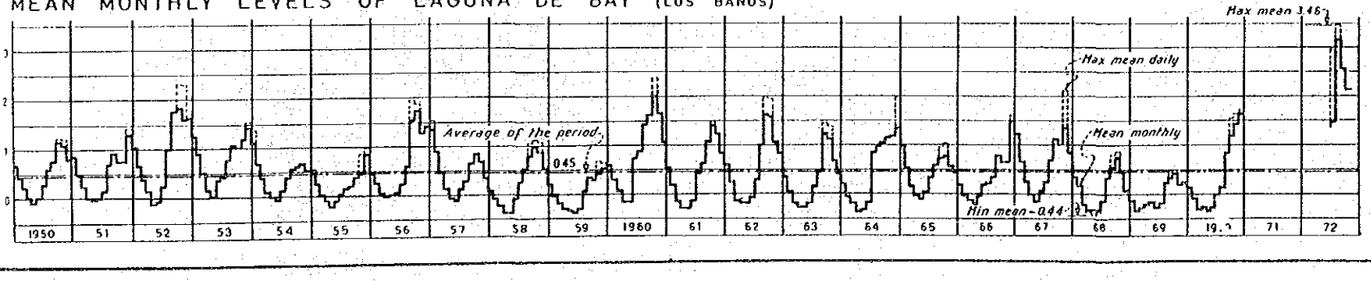
MEAN MONTHLY LEVELS OF CALIRAYA RESERVOIR (LUMOT RESERVOIR LEVELS ASSUMED EQUAL TO CALIRAYA RESERVOIR)



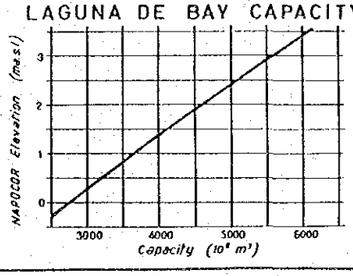
CALIRAYA-LUMOT CAPACITY

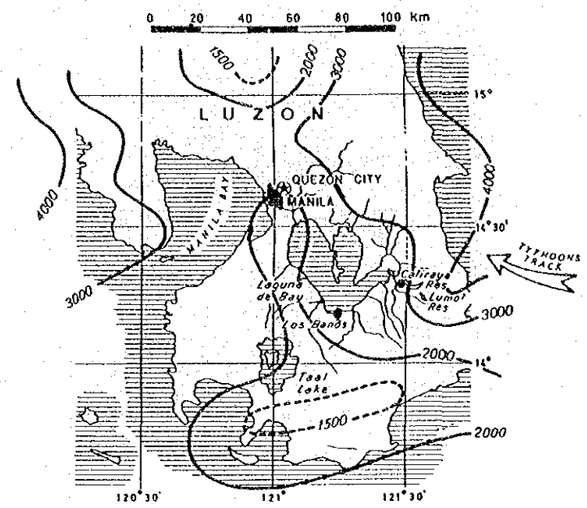


MEAN MONTHLY LEVELS OF LAGUNA DE BAY (LOS BAÑOS)



LAGUNA DE BAY CAPACITY





LEGEND

- Hydrometeorological stations
- Mean annual isohyets (mm)

NOTES

- NAPOCOR datum is at +0.36 m above average mean sea level of Survey and Geodetic Service

NATIONAL POWER CORPORATION
MANILA PHILIPPINES
KALAYAAN PUMPED STORAGE PLANT
TECHNICAL FEASIBILITY REPORT

CLIMATE & HYDROLOGY

DRAWN		SUBMITTED	
TRACED		RECOMMENDED	
CHECKED		APPROVED	GENERAL MANAGER
	DATE		

elc electroconsult, MILANO, ITALY
EDCOP ENGINEERING & DEVELOP. CORP., MANILA, PHILIPP

DRAWN	Fur Sosa	APPROVED	
CHECKED			
DATE	MAY 1973	CAL - 1004	
SCALE	—		