

社会開発調査部報告書

REPUBLIC OF THE PHILIPPINES
METROBOHEAN WATERWORKS AND SEWERAGE SYSTEM
STUDY FOR THE GROUNDWATER DEVELOPMENT
IN
METRO MANILA

JUNE 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

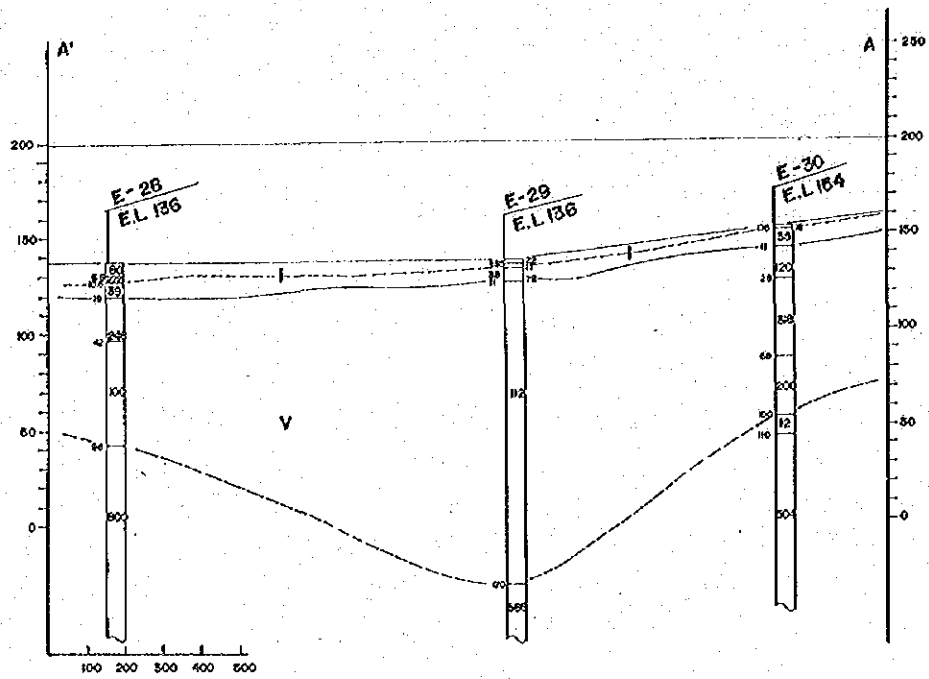
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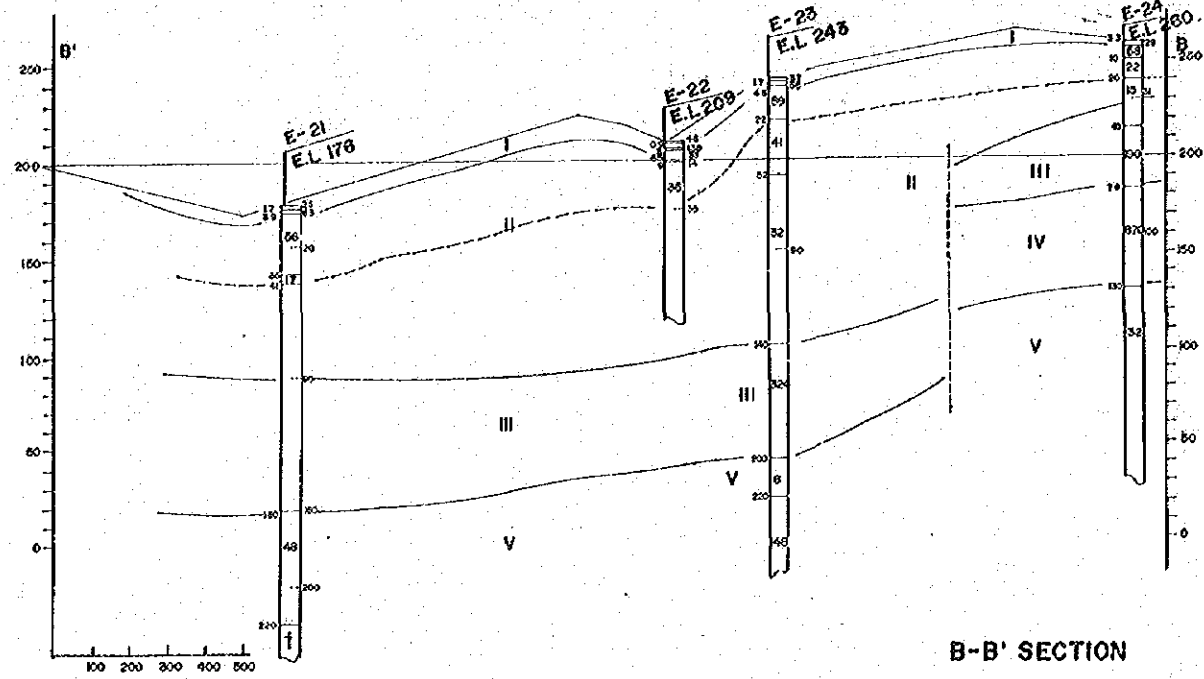
1. RESISTIVITY PROFILE OF ANTIPOLO (NO.1 - NO.3)
2. WELL LOCATION MAP (NO.1 - NO.3)
3. GEOLOGICAL MAP OF THE STUDY AREA (1/50,000)
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NO.5 QUEZON CITY, NO.6 BARAS, NO.7 CAVITE,
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13. GEOLOGIC COLUMNAR SECTIONS OF LAS PIÑAS (NO.1 - NO.2)

国際協力事業団

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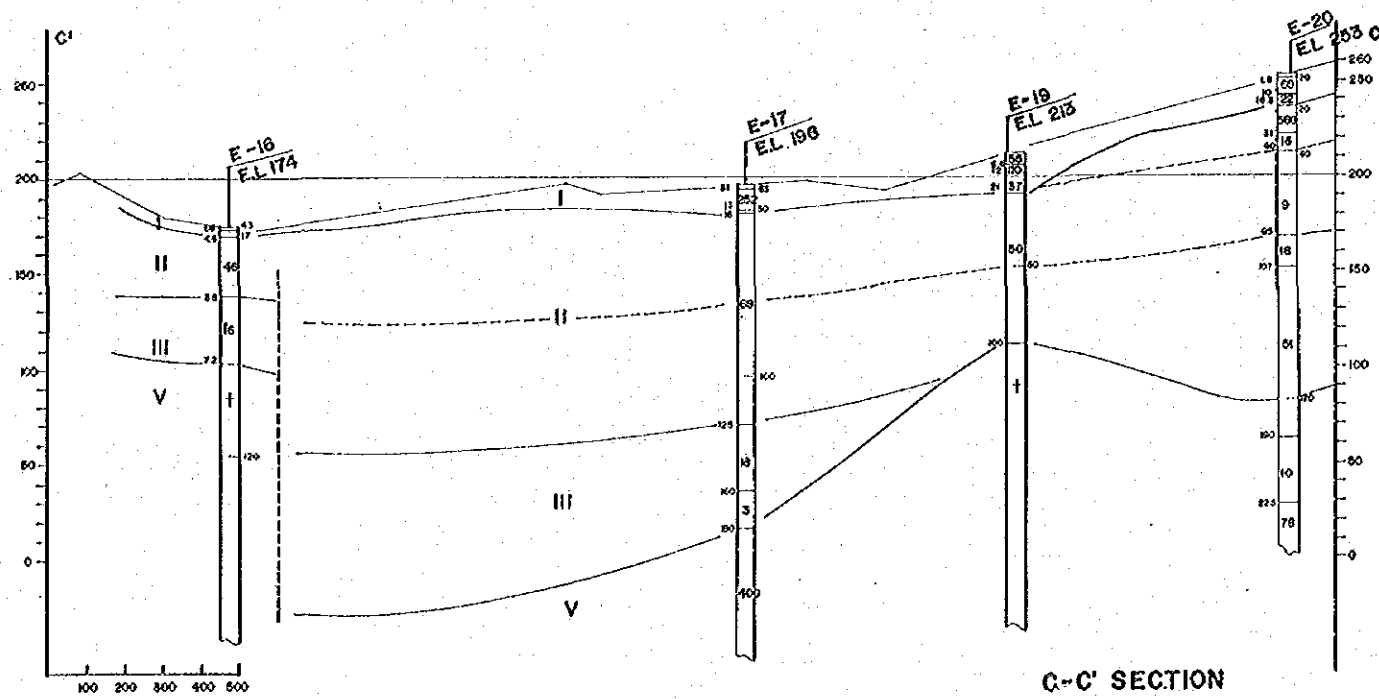
A-A' SECTION



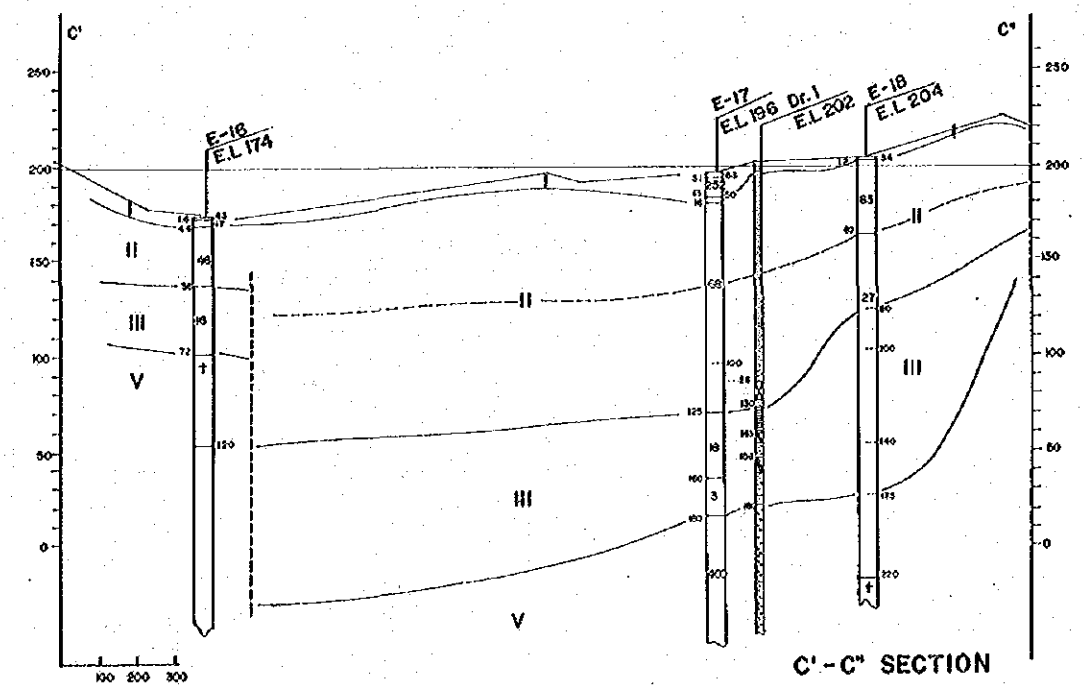
B-B' SECTION

LEGEND

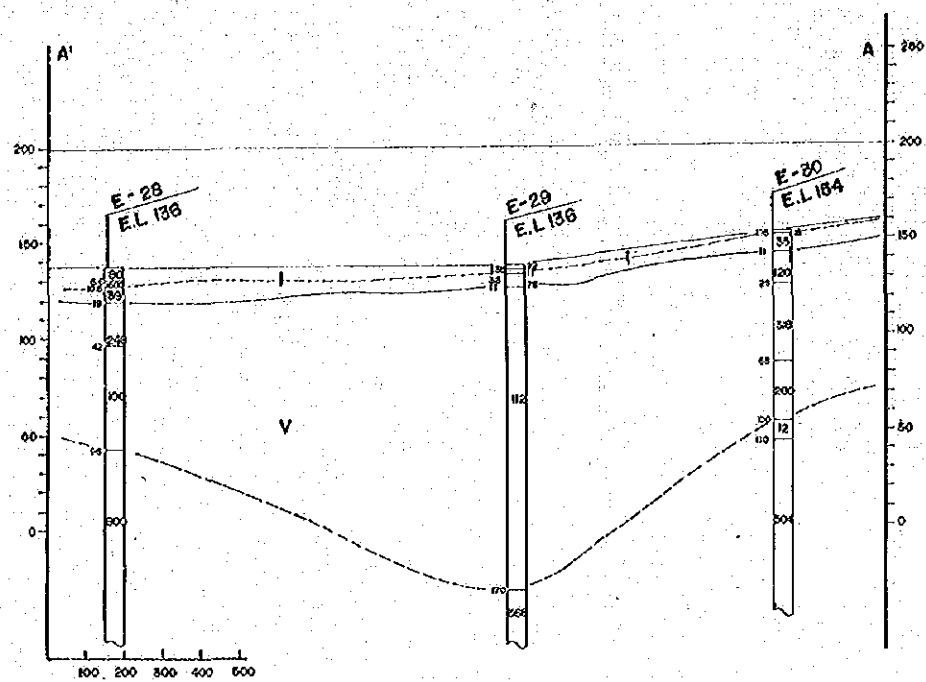
Strata Classification	Resistivity (A·m)	Corr Formation
I	10 100	Surface layer
II	20 70	Gudatupe Formation
III	20 300	
IV	870	Angat Formation
V	50 800	Antipolo Kinobuda
VI		Antipolo Basal Flupa



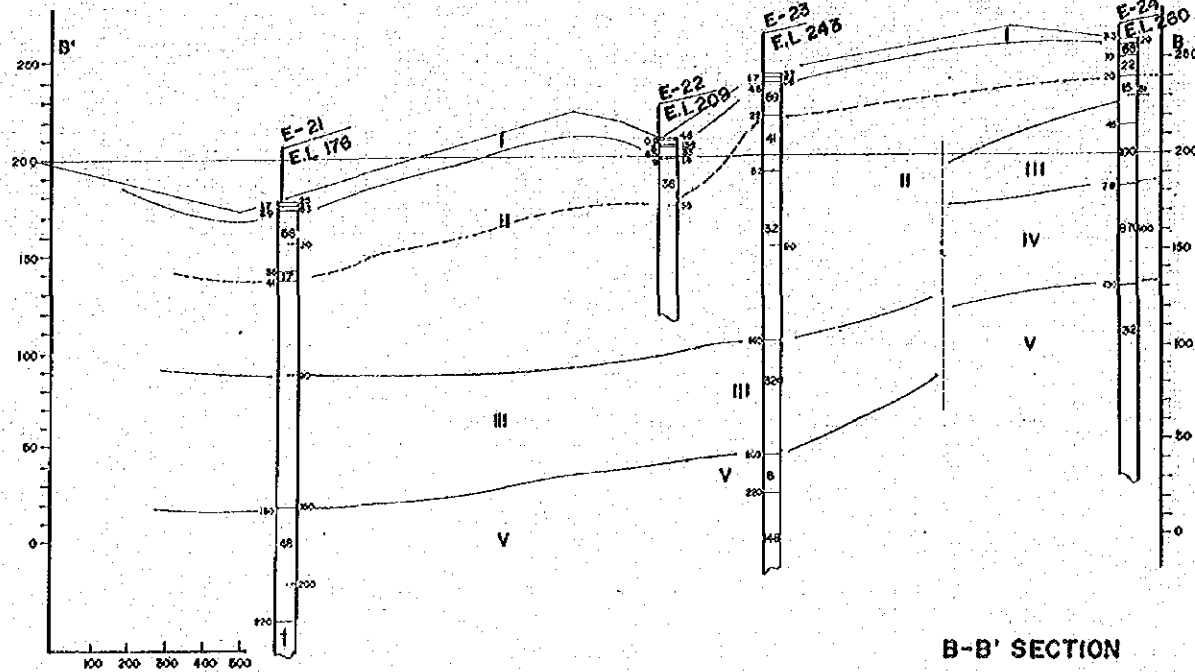
C-C' SECTION



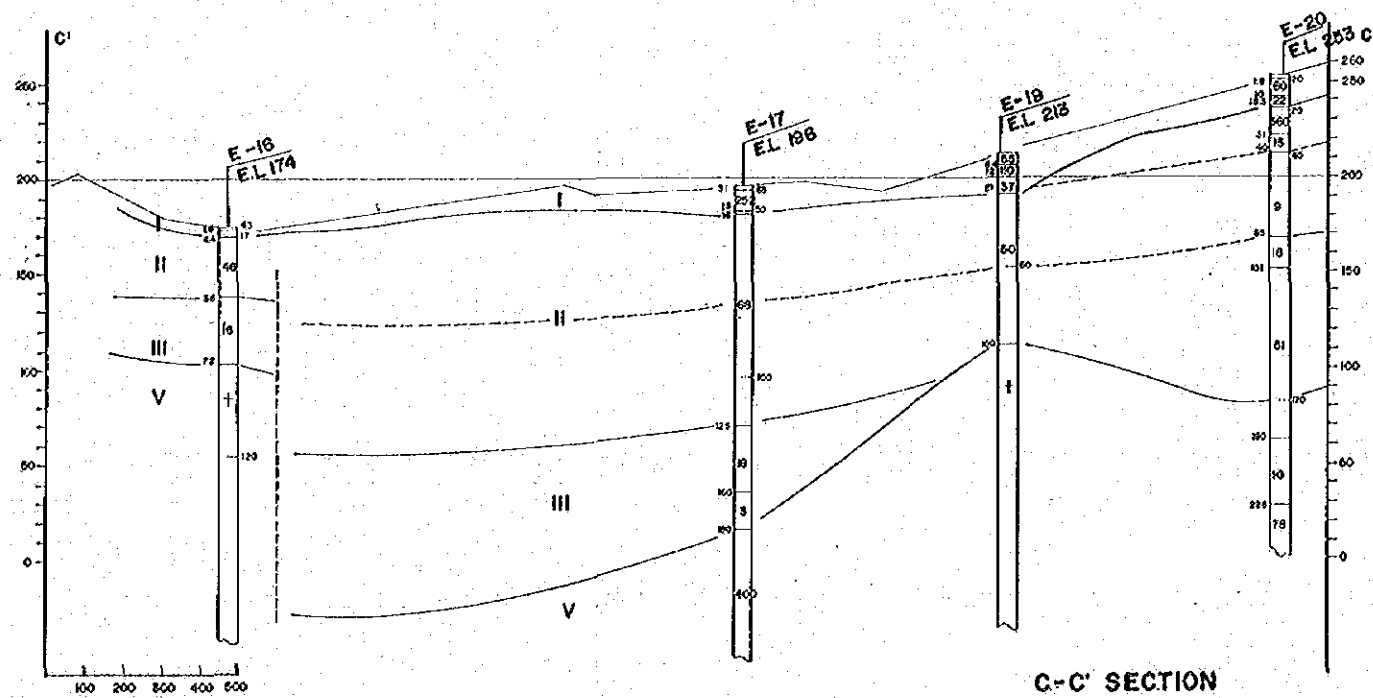
C'-C'' SECTION



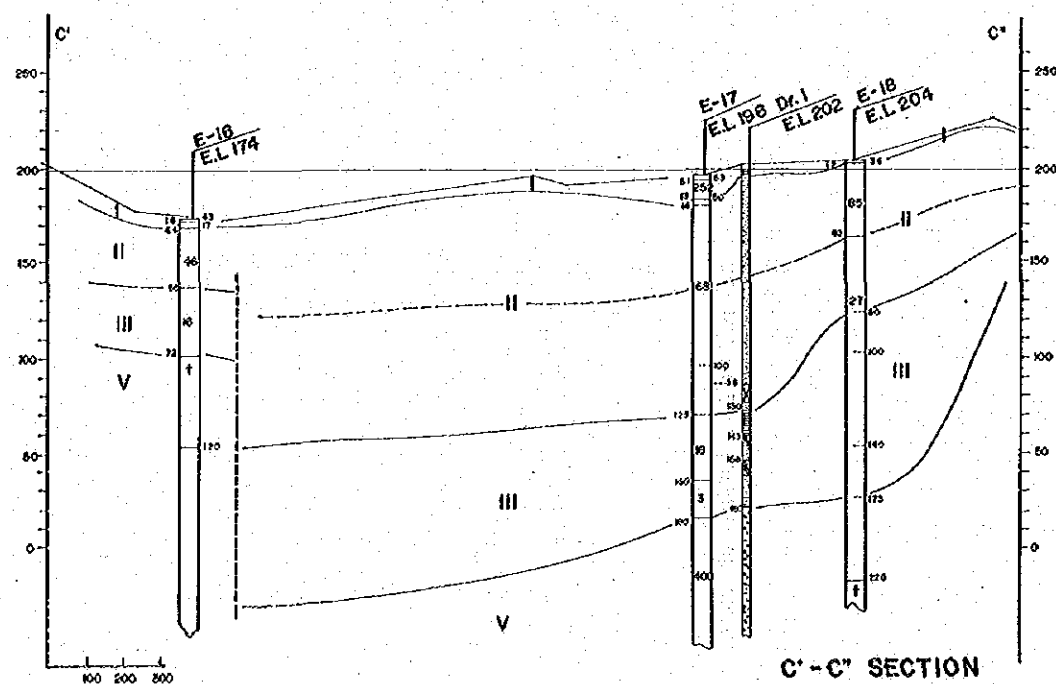
A-A' SECTION



B-B' SECTION



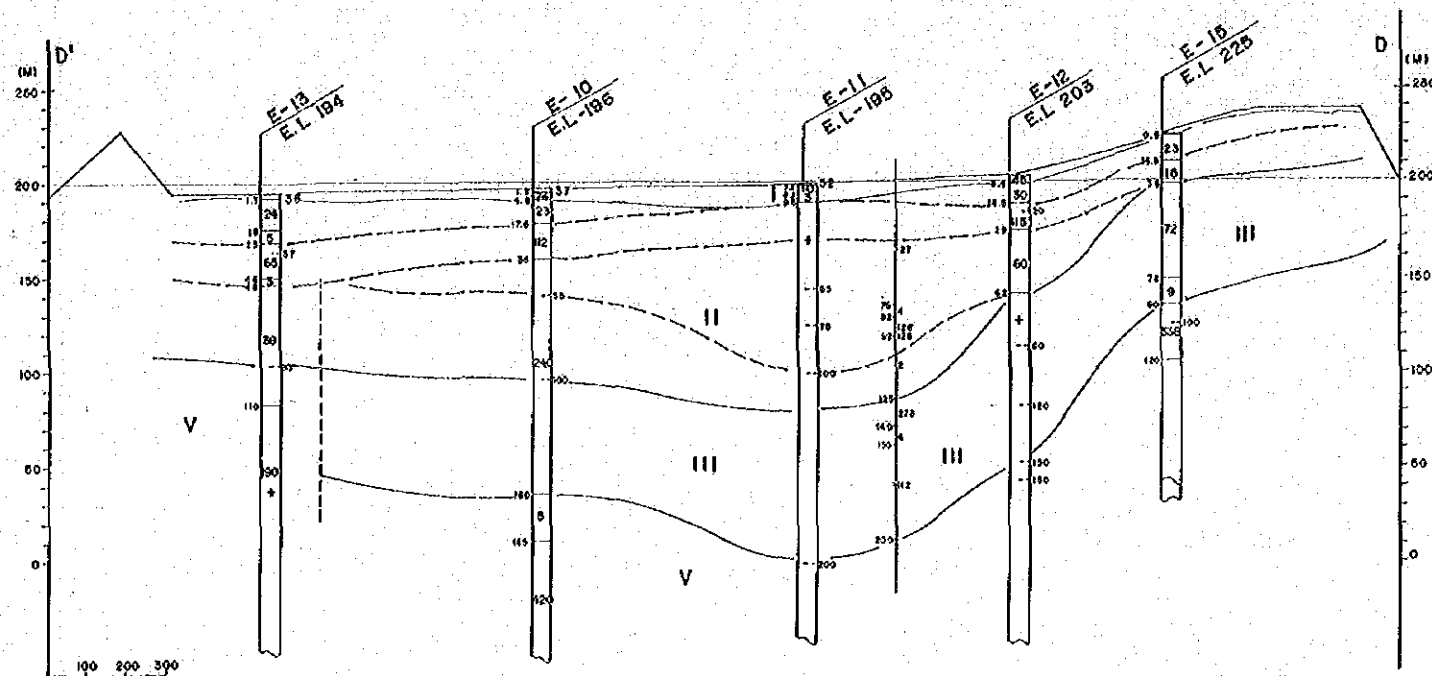
C-C' SECTION



C'-C' SECTION

LEGEND

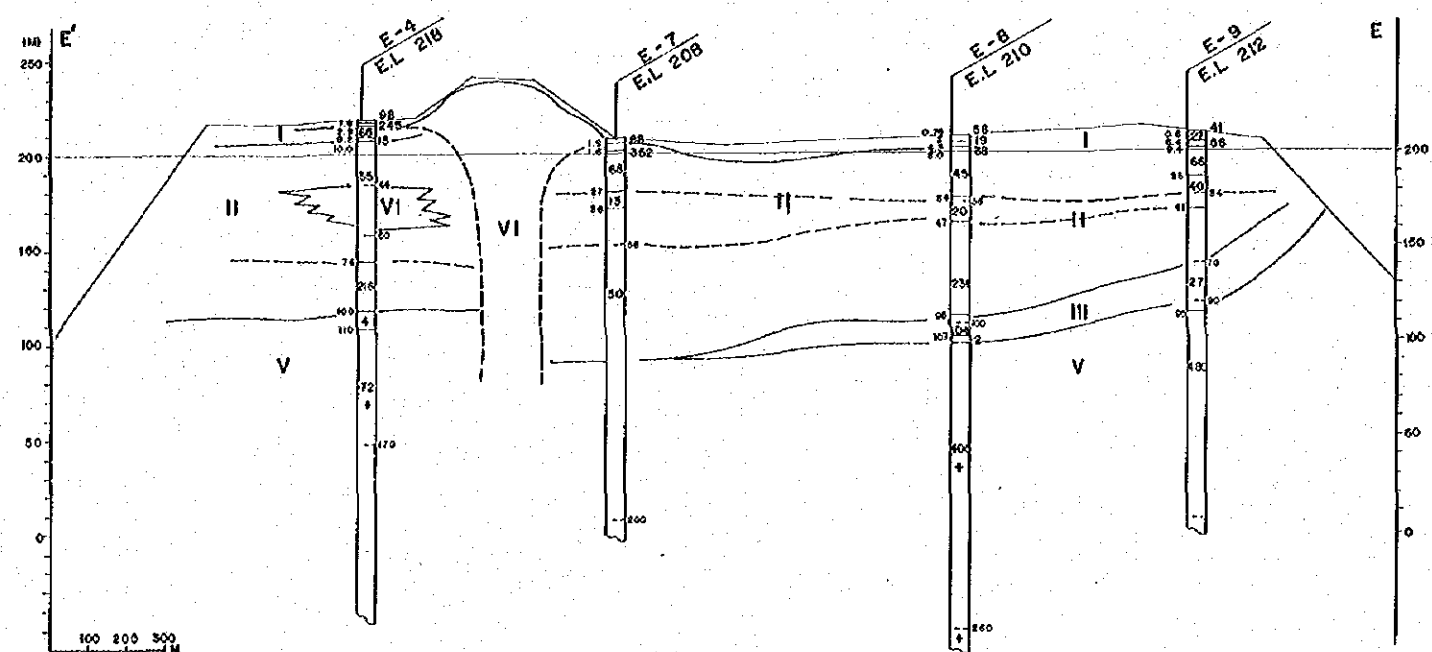
Strata Classification	Resistivity (n. - m)	Corresponding Formation		
		Formation	Geologic Age	Lithology
I	10 100	Surface layer	Quaternary	Soil Humus Weathered rock
II	20 70	Guadalupe Formation	Pleistocene	Tuff breccia Welded tuff Lapilli tuff
III	20 300		Pliocene	Tuffaceous sandstone Mudstone Sandstone Conglomerate
IV	870	Angel Formation	Neogene Miocene	Limestone
V	50 800	Antipolo Dike Kinabuan F.	Paleogene CRETACEOUS	Diorite Porphyry Altered Spilitic Basalt
VI		Antipolo Basalt Porphyry	Pleistocene Pliocene	Basalt Porphyry Dyke and sheet



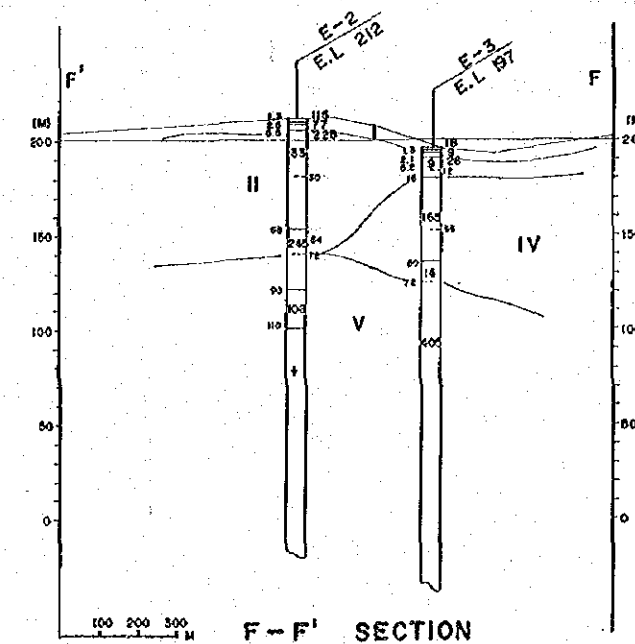
D-D' SECTION

LEGEND

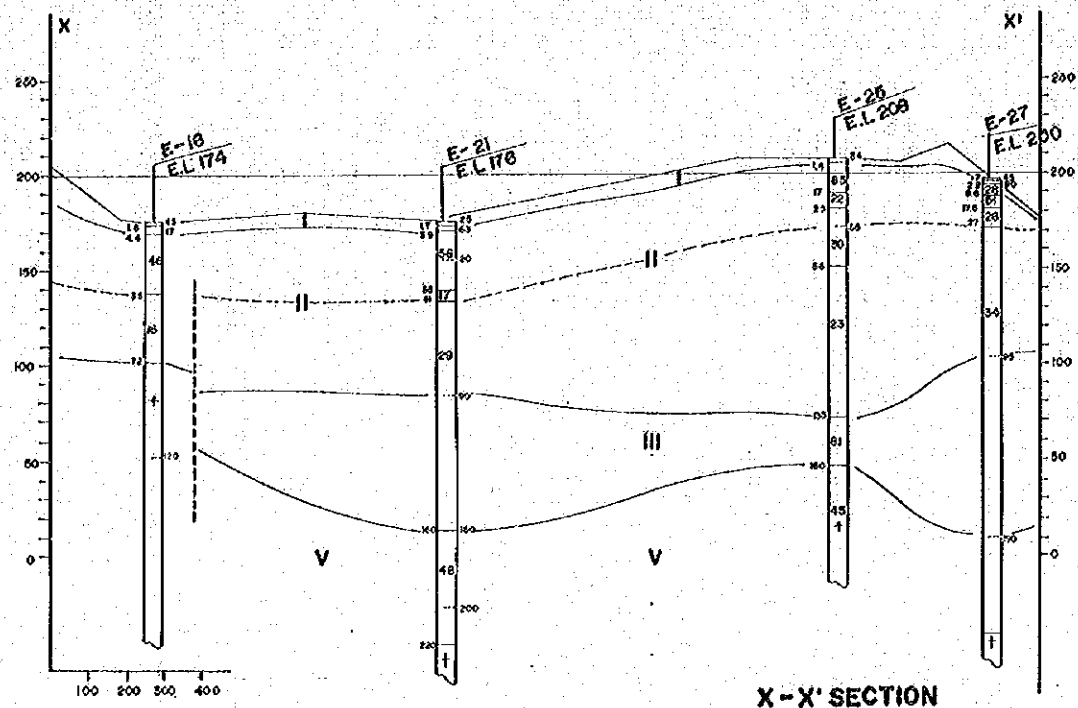
Strata Classification	Resistivity ($\Omega \cdot m$)	Corresponding Formation		
		Formation	Geologic Age	Lithology
I	10~100	Surface layer	Quaternary Holocene	Soil Humus Weathered rock
II	25~230	Guadalupe Formation	Pliocene	Tuff breccia Welded tuff Lapilli tuff Tuffaceous Sandstone
III	30~100		Pliocene	Mudstone Sandstone Conglomerate
IV	105	Angol Formation	Neogene Miocene	Limestone
V	70~400	Antipolo Duffo	Palaeogene CRETACEOUS	Diorite Pyroxite Altered Spaltic Basalt
VI	350+	Antipolo Basalt Porphyry	Pliocene	Basalt Porphyry dyke and sheet



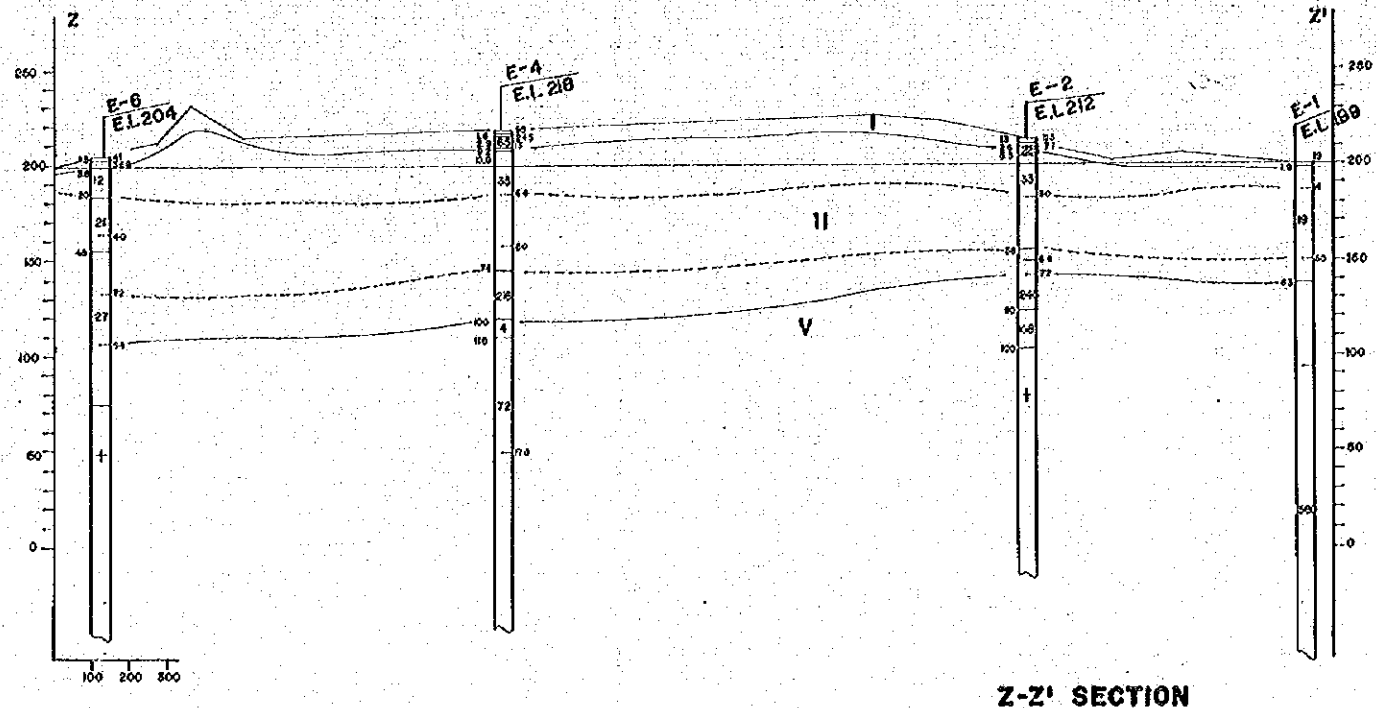
E-E' SECTION



F-F' SECTION



X-X' SECTION

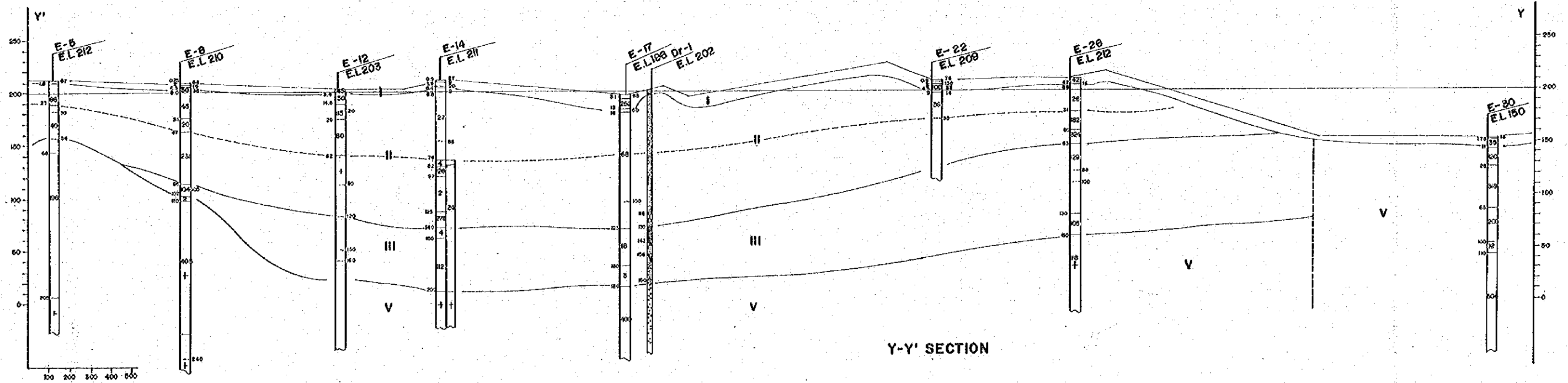


Z-Z' SECTION

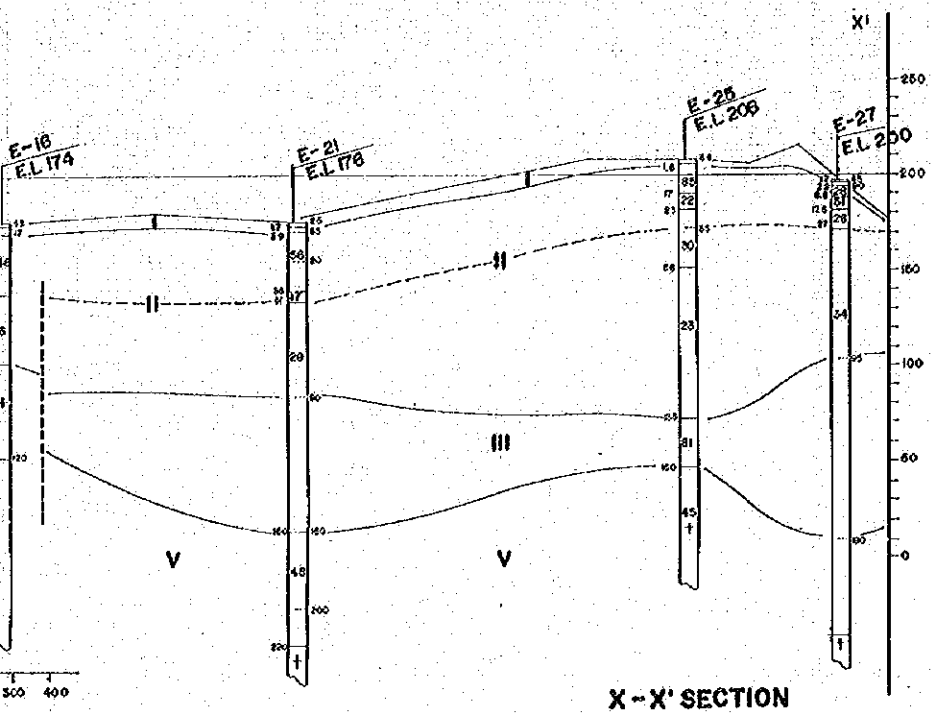
LEGEND

Strata Classification	Resistivity (A-m)
I	20~250
II	20~100
III	20~190
IV	
V	50~400+
VI	

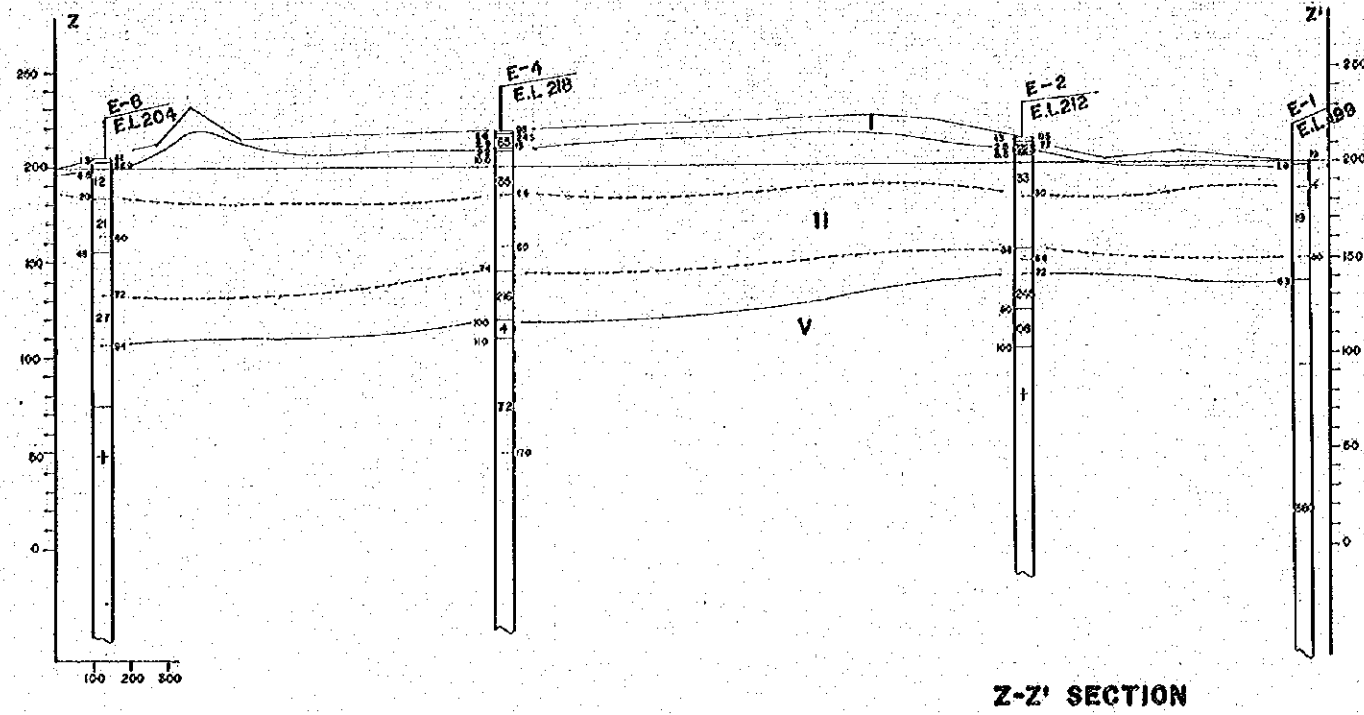
No. E.L. — Elevation (m)
 — Depth (m)
 — Resistivity (A-m)



Y-Y' SECTION



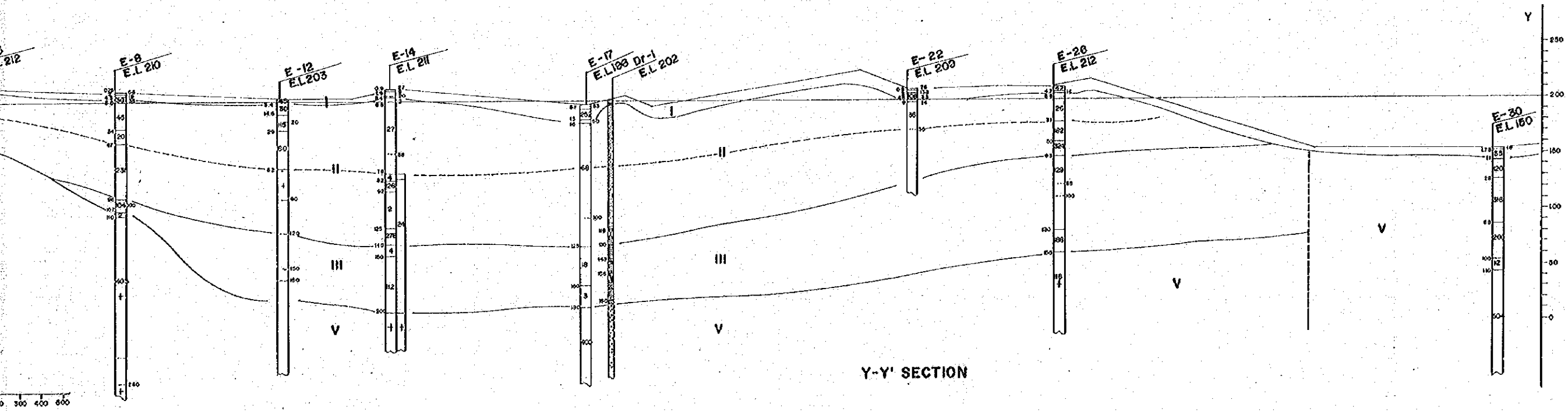
X-X' SECTION



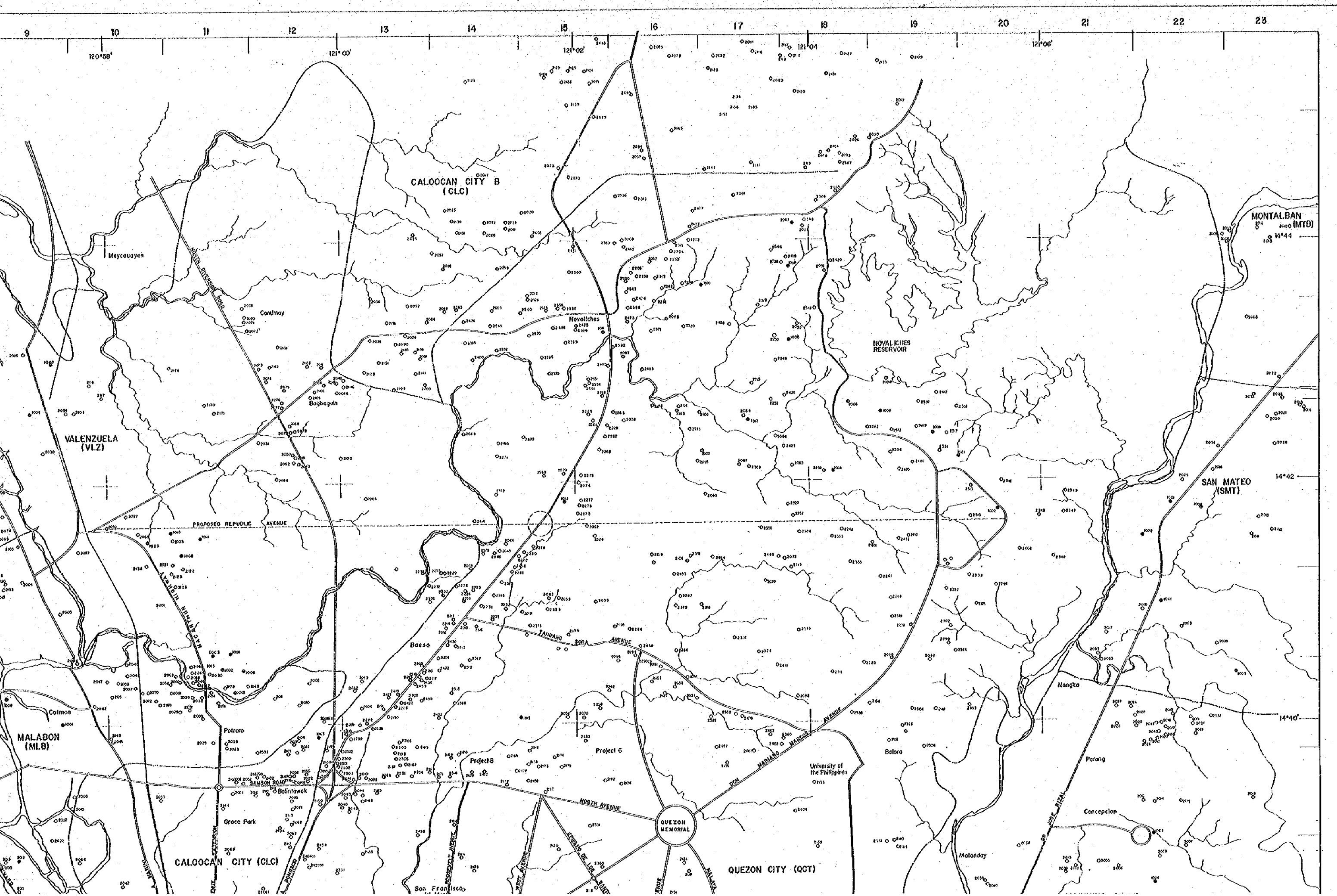
Z-Z' SECTION

LEGEND

Strata Classification	Resistivity (A-m)	Corresponding Formation		
		Formation	Geologic Age	Lithology
I	20~250	Surface layer	Quaternary Holocene	Soil Humus Weathered rock
II	20~100	Guadalupe Formation	Pliocene	Tuff breccia Welded tuff Lignitic Tuffaceous Sandstone
III	20~150		Pliocene	Mudstone Sandstone Conglomerate
IV		Angel Formation	Neogene Miocene	Limestone
V	50~400+	Antipolo Diorite Kinabon F.	Pleistocene CRETACEOUS	Diorite Propylite Altered Spilitic Basalt
VI		Antipolo Basalt Porphyry	Pliocene	Basalt Porphyry dyke and basalt



Y-Y' SECTION



9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

120°58' 121°00' 121°02' 121°04' 121°06'

CALOOCAN CITY B (CLC)

MONTALBAN (MTD)

VALENZUELA (VLZ)

SAN MATEO (SMT)

MALABON (MLB)

CALOOCAN CITY (CLC)

QUEZON CITY (QCT)

Mezcavayan

Contmay

Oros Baybagan

Novaliches

NOVALICHES RESERVOIR

PROPOSED REPUBLIC AVENUE

TAUBANG ROAD

AVENUE

DON MARIANO MARCOS AVENUE

Potrero

Baeso

Project 6

University of the Philippines

QUEZON MEMORIAL

NORTH AVENUE

AVENUE

Nangka

Parang

Concepcion

Malondoy

Son Francisco

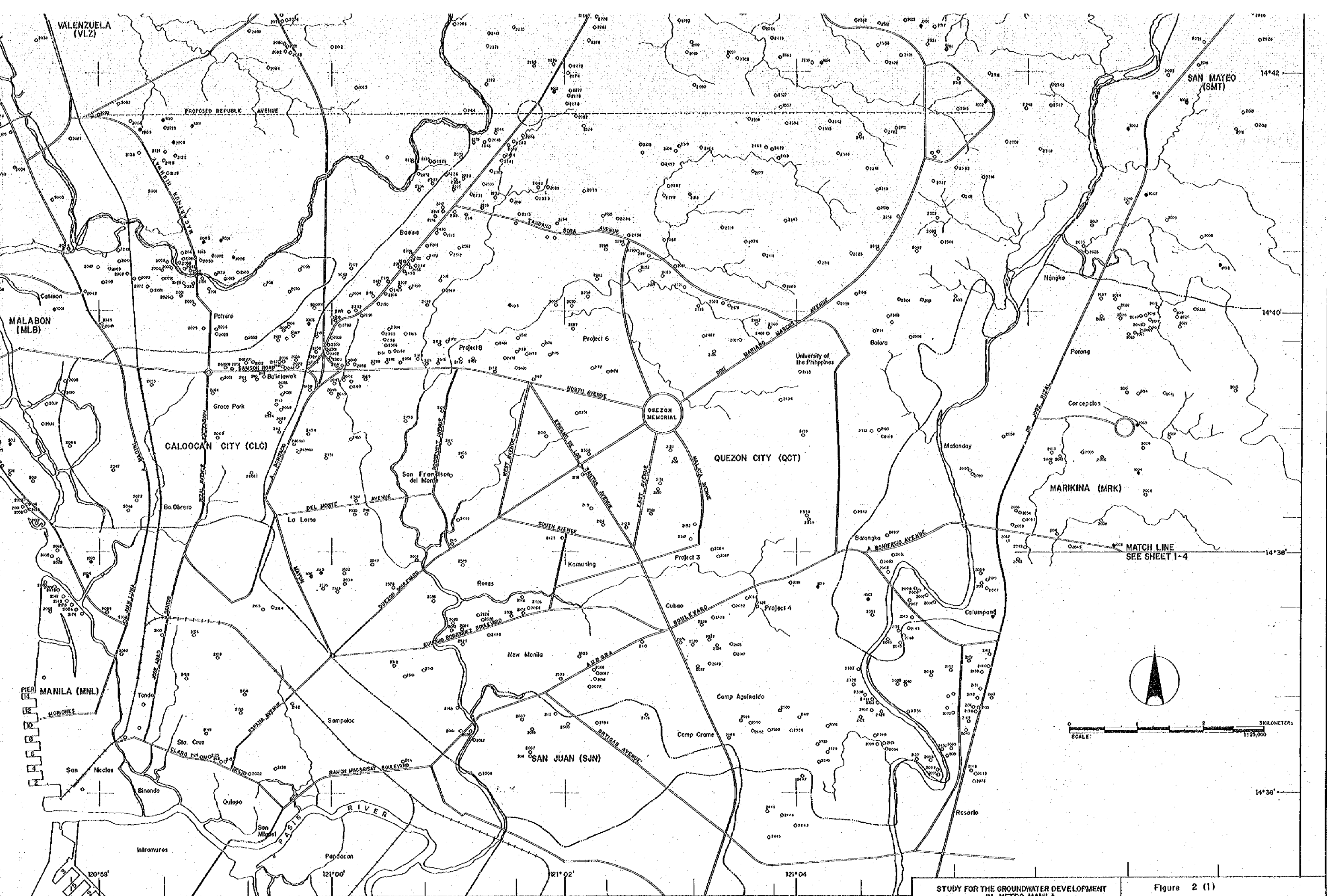


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MATCH LINE
SEE SHEET 1-2

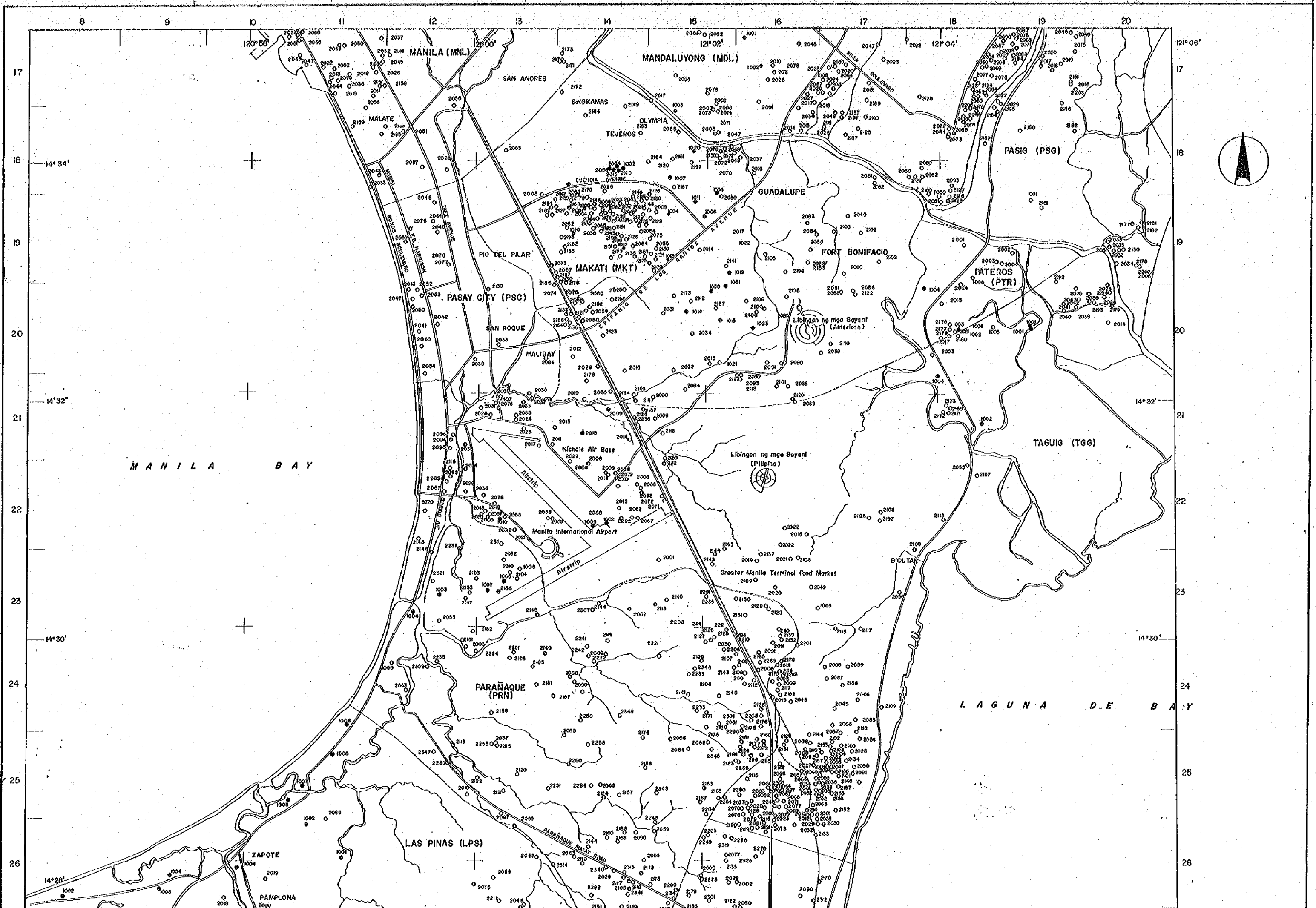
STUDY FOR THE GROUNDWATER DEVELOPMENT
IN METRO MANILA
JAPAN INTERNATIONAL COOPERATION AGENCY

SCALE:



STUDY FOR THE GROUNDWATER DEVELOPMENT
IN METRO MANILA
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2 (1)
WELL LOCATION MAP



MANILA BAY

LAGUNA DE BAY

LAS PINAS (LPS)

PARAÑAQUE (PRN)

PASAY CITY (PSC)

SAN ROQUE

PIO DEL PILAR

MALATE

MANILA (MNL)

MANDALUYONG (MDL)

PASIG (PSG)

TAGUIG (TGG)

GUADALUPE

FORT BONIFACIO

PATEROS (PTR)

MAKATI (MKT)

TEVEROS

OLYMPIA

SAN ANDRES

MANDALUYONG (MDL)

MANDALUYONG (MDL)

MANDALUYONG (MDL)

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MANDALUYONG (MDL)

120° 56'

121° 02'

121° 04'

121° 06'

14° 34'

14° 32'

14° 30'

14° 28'

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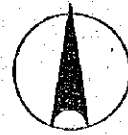
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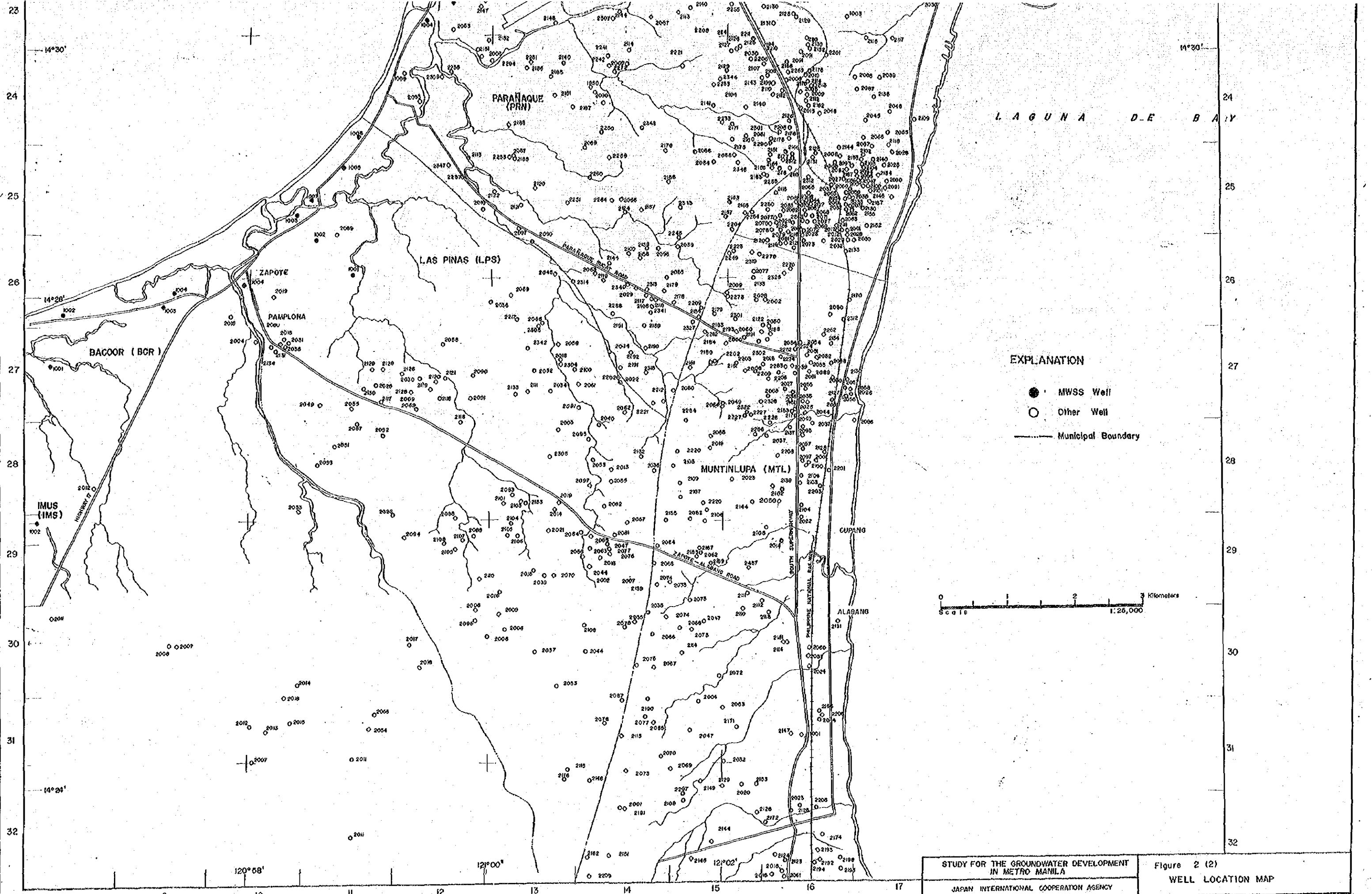
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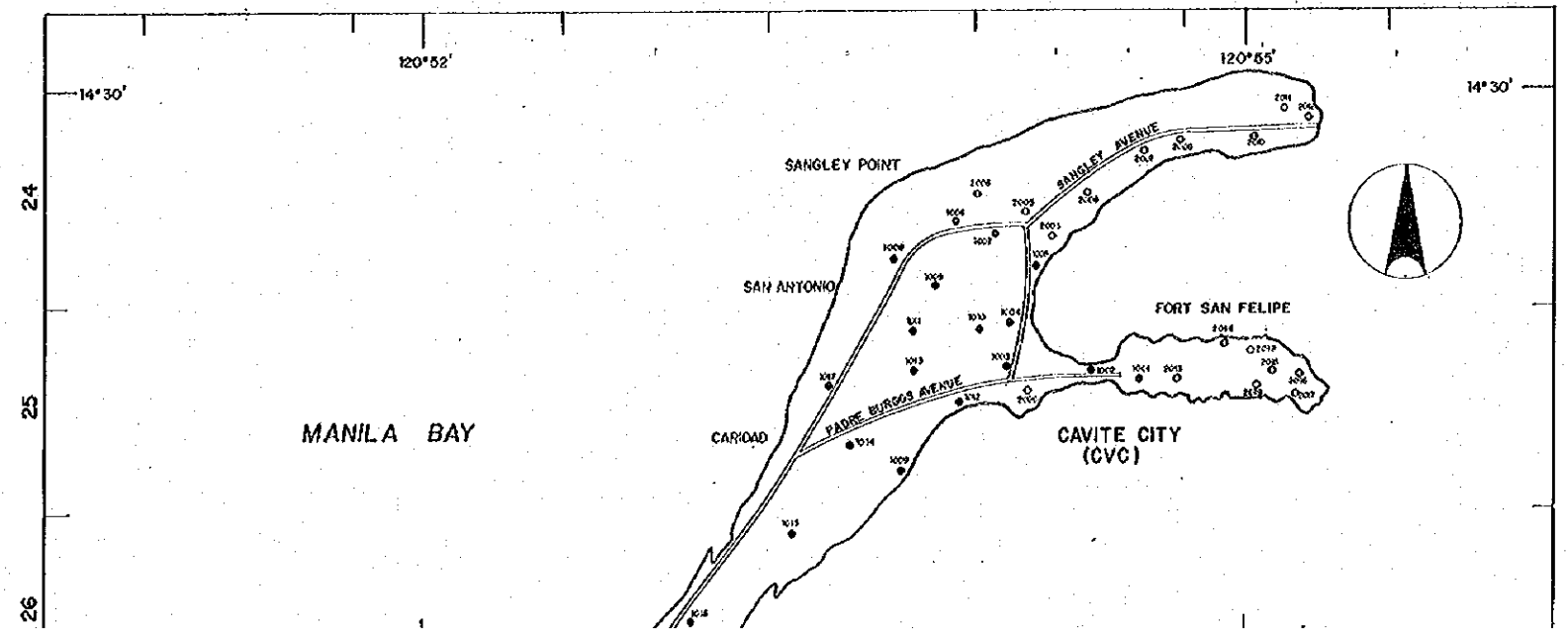
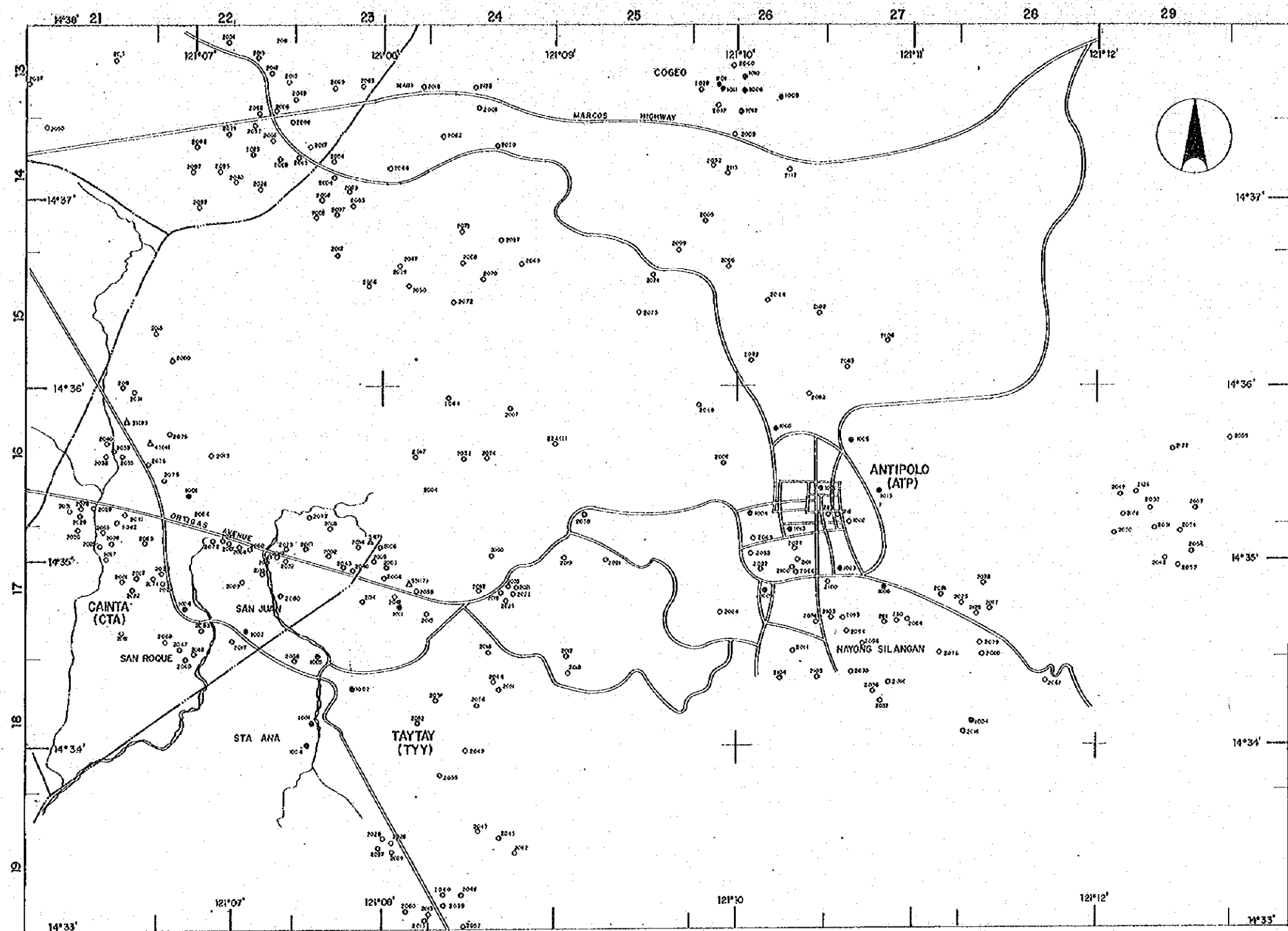
EXPLANATION

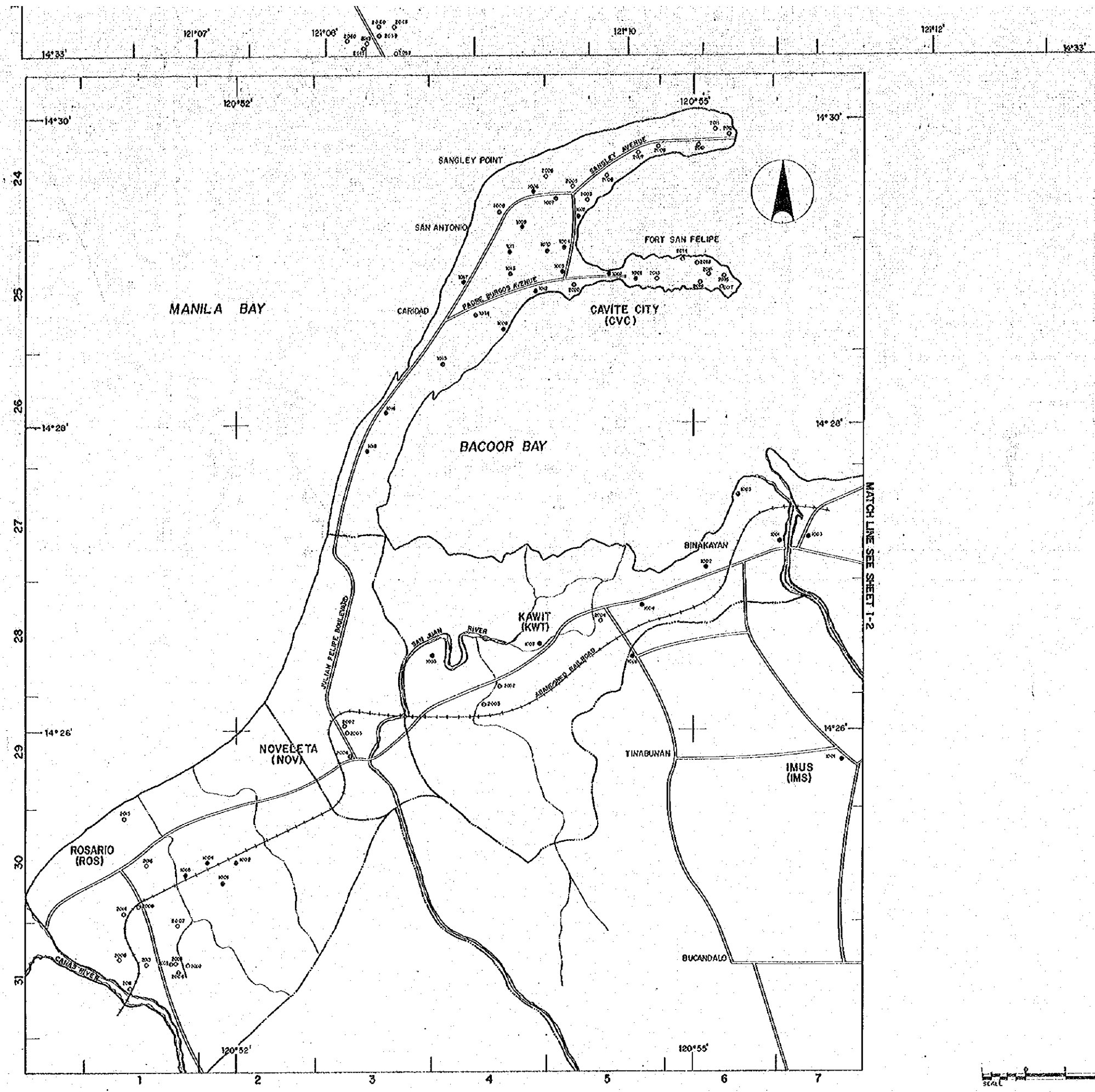
- MWSS Well
- Other Well
- Municipal Boundary

Scale 1:25,000
 0 1 2 3 Kilometers

STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2 (2)
 WELL LOCATION MAP

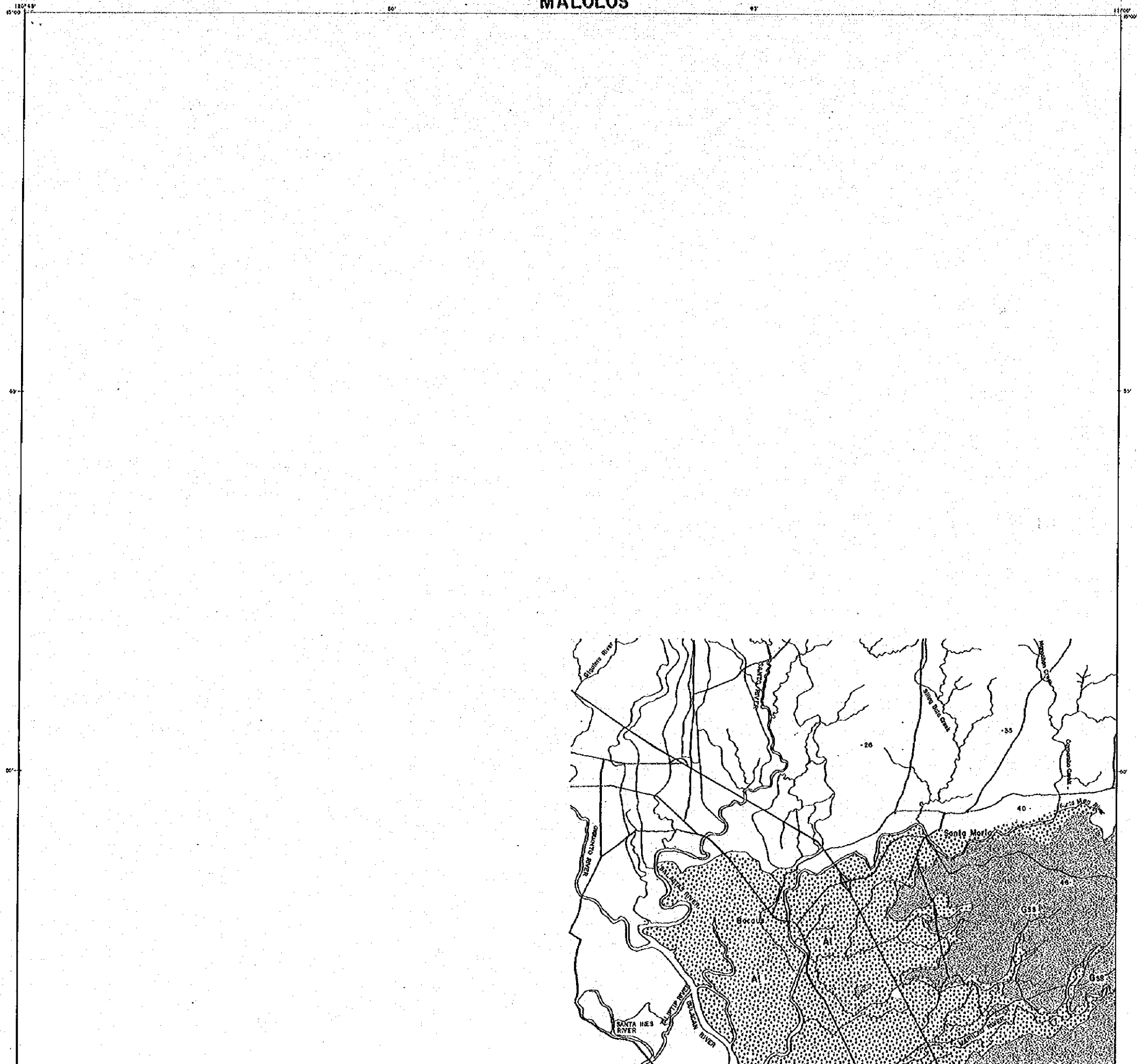




STUDY FOR THE GROUNDWATER DEVELOPMENT
 IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2 (3)
 WELL LOCATION MAP

MALOLOS





SCALE 1:50,000

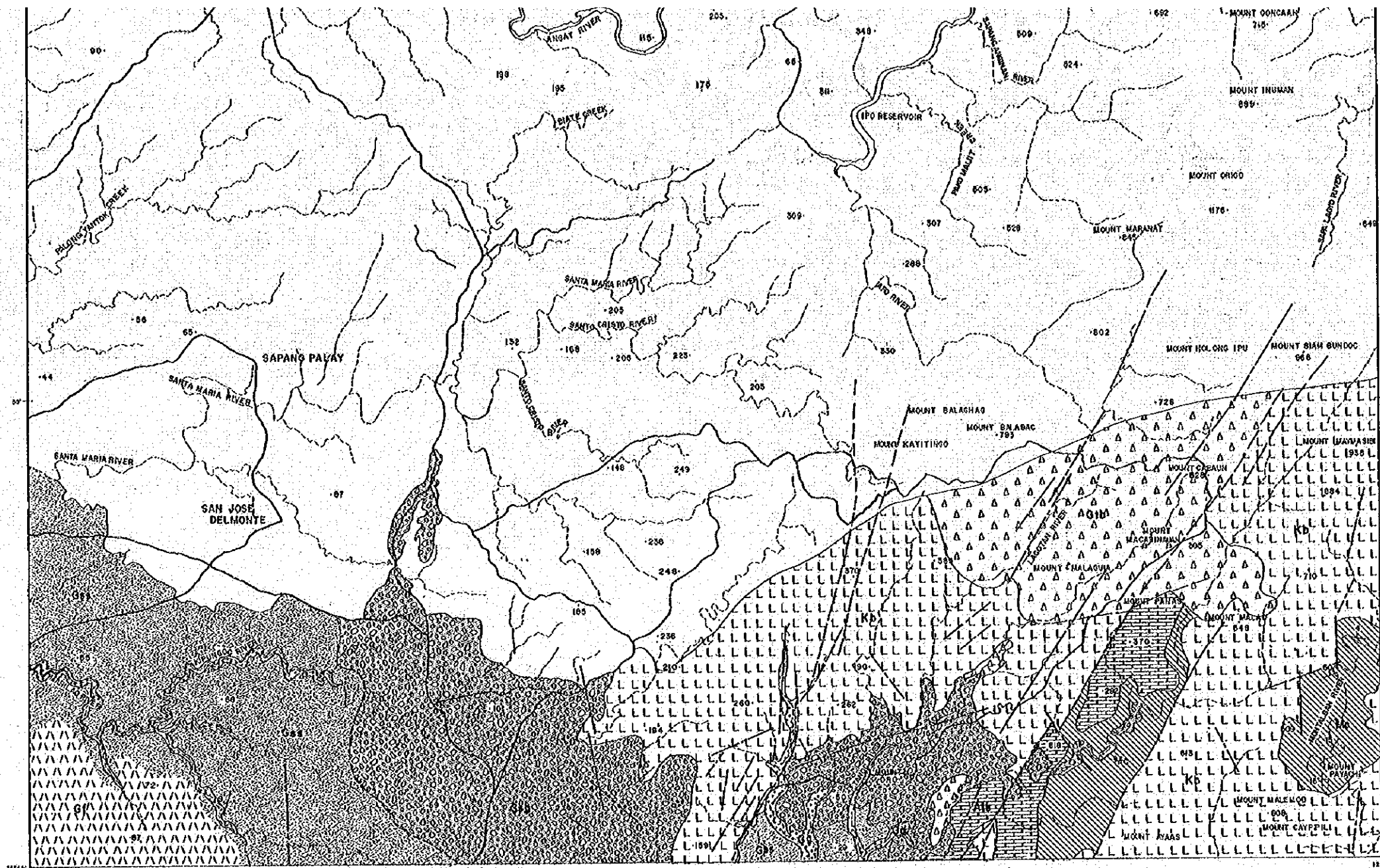
ADJOINING SHEETS

MALOLOS 1	ANGAT 2	MOUNT IRID 3
MANILA 4	QUEZON CITY 5	BARAS 6
CAVITE 7	MUNTINLUPA 8	PAETE 9

Geologic Age	FORMATION AND LITHOLOGY	FEATURE OF AQUIFER	
QUATERNARY	Al ₁ ALLUVIUM TALUS CLAY, SILT, GRAVEL		
	T ₀ TERRACE SAND, SILT, GRAVEL		
	G ₁ TUFF, TUFF-BRECCIA TUFFACEOUS SANDSTONE, MUDSTONE		
	G ₂ TUFF-BRECCIA, AGGLOMERATE		
	Abp GUAHALOPE FORMATION BASALT - PORPHYRY		
	G ₃ TUFFACEOUS SANDSTONE, MUDSTONE ALT.		
	G ₄ LAPILLI TUFF, WELDED TUFF, TUFF-BRECCIA, AGGLOMERATE, SANDSTONE		
	G ₅ CONGLOMERATE, SANDSTONE		
	TERTIARY		M ₁ MADLUM FORMATION CALCAREOUS SANDSTONE, SHALE
			A ₁ ANSAT FORMATION LIVESTONE
A ₂ ANTIPOLO DIORITE DIORITE			
M ₂ WAIKANGI FORMATION SANDSTONE, SHALE, PYROCLASTICS, LIMESTONE			
M ₃ KINABUAN FORMATION ALTERED SPALIC BASALT ANDESITE ALTERED DIORITE SANDSTONE, SHALE, ALT. BASALY ANDESITE			

- RIVER, DRAINAGE
- STRIKE DIP
- ESCARPMENT
- GEOLOGICAL BOUNDARY
- FAULT
- PHOTO LINEATION
- SYNCLINE
- BASEMENT CONTOUR OF GUAHALOPE FORMATION (E.L.)
- ELECTRIC RESISTIVITY SURVEY POINT
- TESTWELL POINT (MCA, 1991)
- MWSS - WELLS
- PRIVATE WELLS
- HYDROGEOLOGY LINE
- SPRING

STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
Figure 3 (1)
GEOLOGICAL MAP OF THE STUDY AREA
NO 1 MALOLOS (1/50,000)
 JAPAN INTERNATIONAL COOPERATION AGENCY



SCALE 1:50,000

LEGEND:

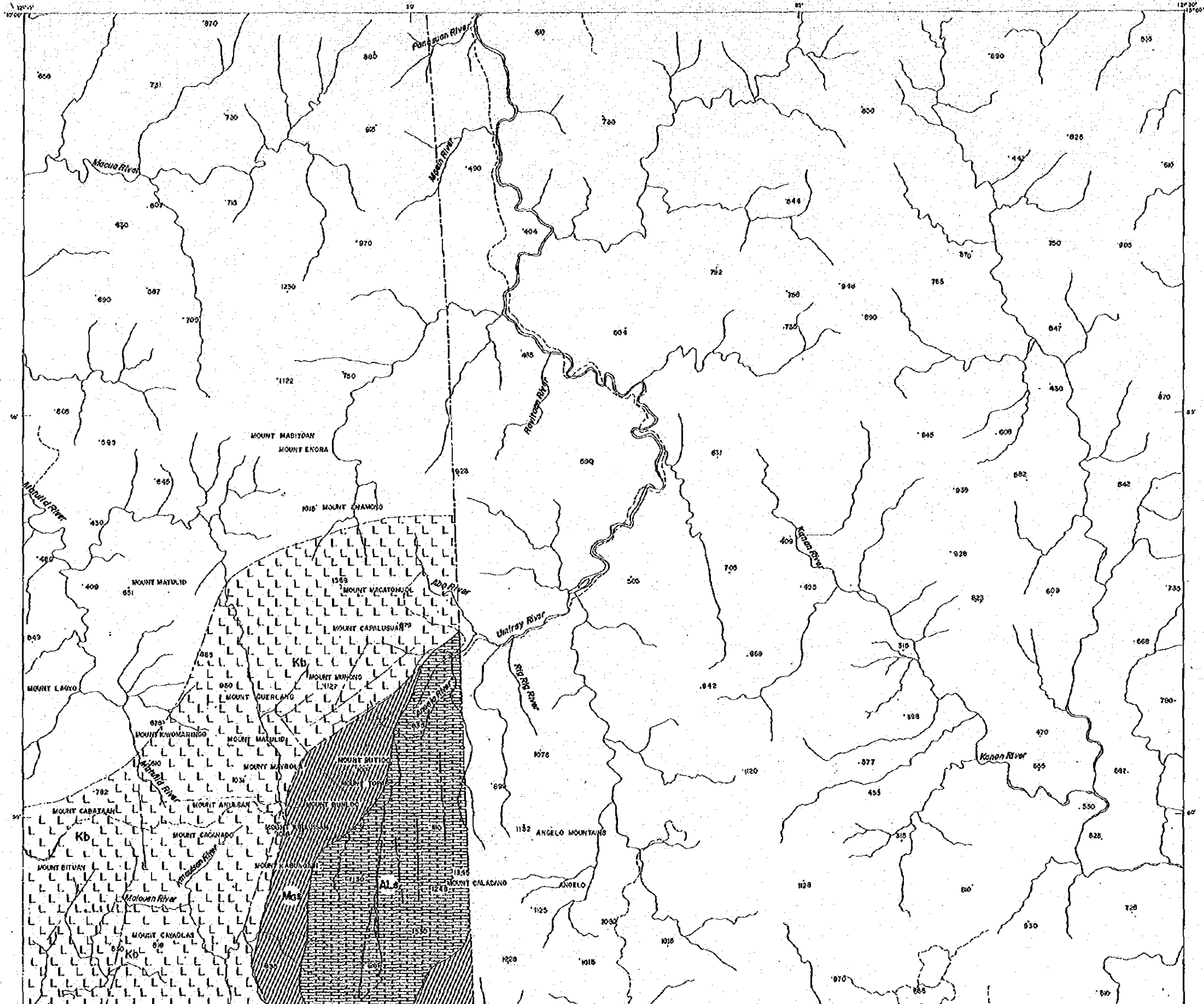
Geologic Age	FORMATION AND LITHOLOGY	FEATURE OF AQUIFER
QUATERNARY	Al ₁ To Talus	
	T ₀ Terrace	
	G _{1a} Tuff, Tuff-Breccia	
	G _{1b} Tuffaceous Sandstone, Mudstone	
	G _{1b} Tuff-Breccia, Agglomerate	
	A _{0p} Basalt - Porphyry	
	G ₀ Guadalupe Formation	
	G ₀ Tuffaceous Sandstone, Mudstone Alt.	
	G _{0q} Lapilli Tuff, Welded Tuff, Tuff-Breccia, Agglomerate, Sandstone	
	G _{0q/G₀} Conglomerate, Sandstone	
TERTIARY	N _c Naolun Formation	
	N _c Calcareous Sandstone, Shale	
	A _{1a} Angat Formation	
	A _{1a} Limestone	
	A _{1d} Antipolo Diorite	
	A _{1d} Diorite	
PALEOGENE - NEOGENE	M _{1a} Maybanyon Formation	
	M _{1a} Sandstone, Shale, Pyroclastics, Limestone	
	K _{1a} Knabuan Formation	
MEZOZOIC CRETACEOUS	K _{1a} Altered Spilitic Basalt, Andesite	
	K _{1a} Altered Basalt, Andesite, Sandstone, Shale, Basalt, Andesite	

- RIVER, DRAINAGE
- STRIKE DIP
- ESCARPMENT
- GEOLOGICAL BOUNDARY
- FAULT
- PHOTO LIANATION
- SYNCLINE
- BASEVENT CONTOUR OF GUADALUPE FORMATION (E.L.)
- ELECTRIC RESISTIVITY SURVEY POINT
- TESTWELL POINT JICA, 1991
- MNS - WELLS
- PRIVATE WELLS
- HYDROGEOLOG LINE
- SPRING

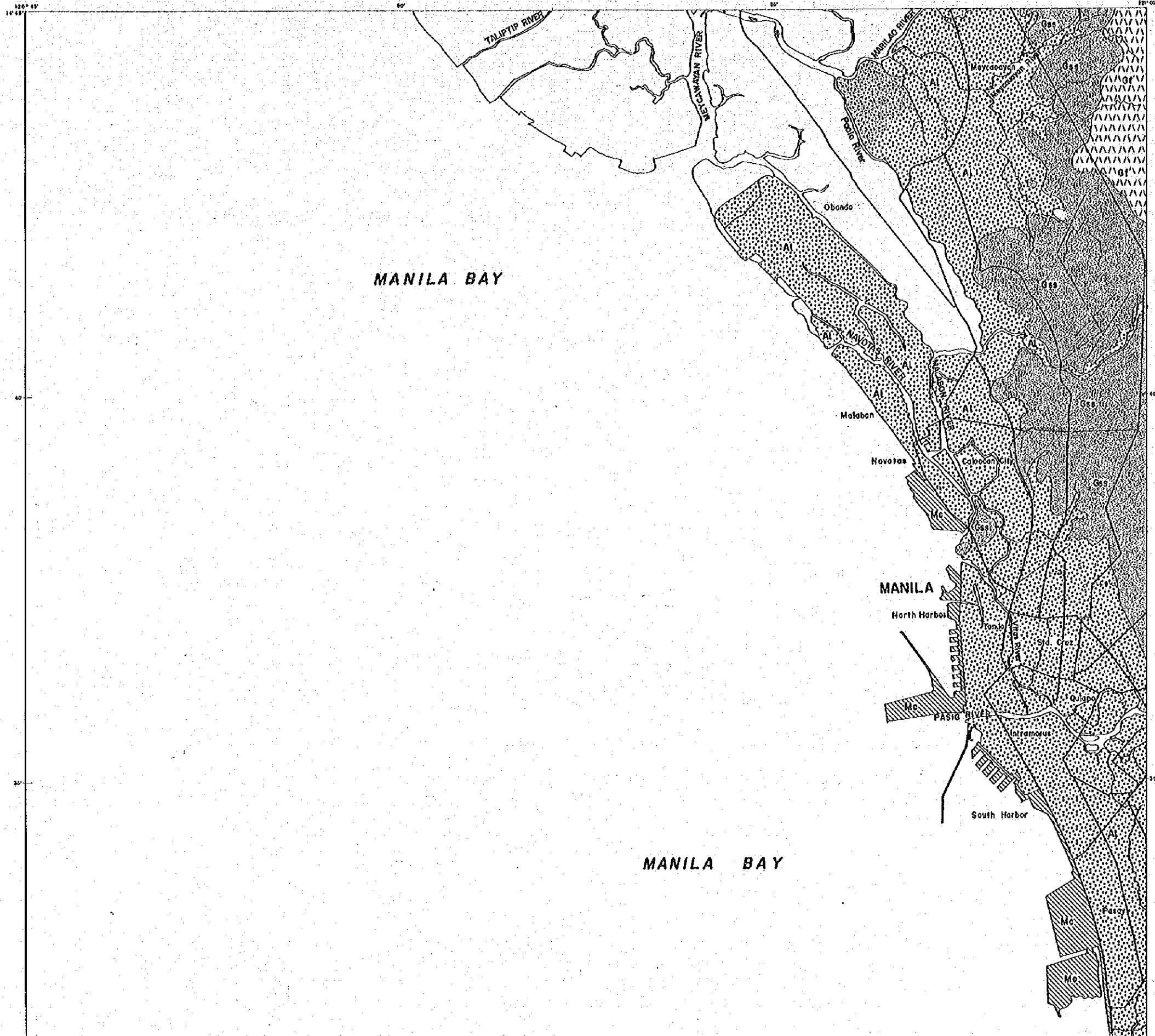
MALOLOS	ANGAT	MOUNT IRID
1	2	3
MANILA	QUEZON CITY	BARAS
4	5	6
CAVITE	MUNTINGLUPA	PAETE
7	8	9

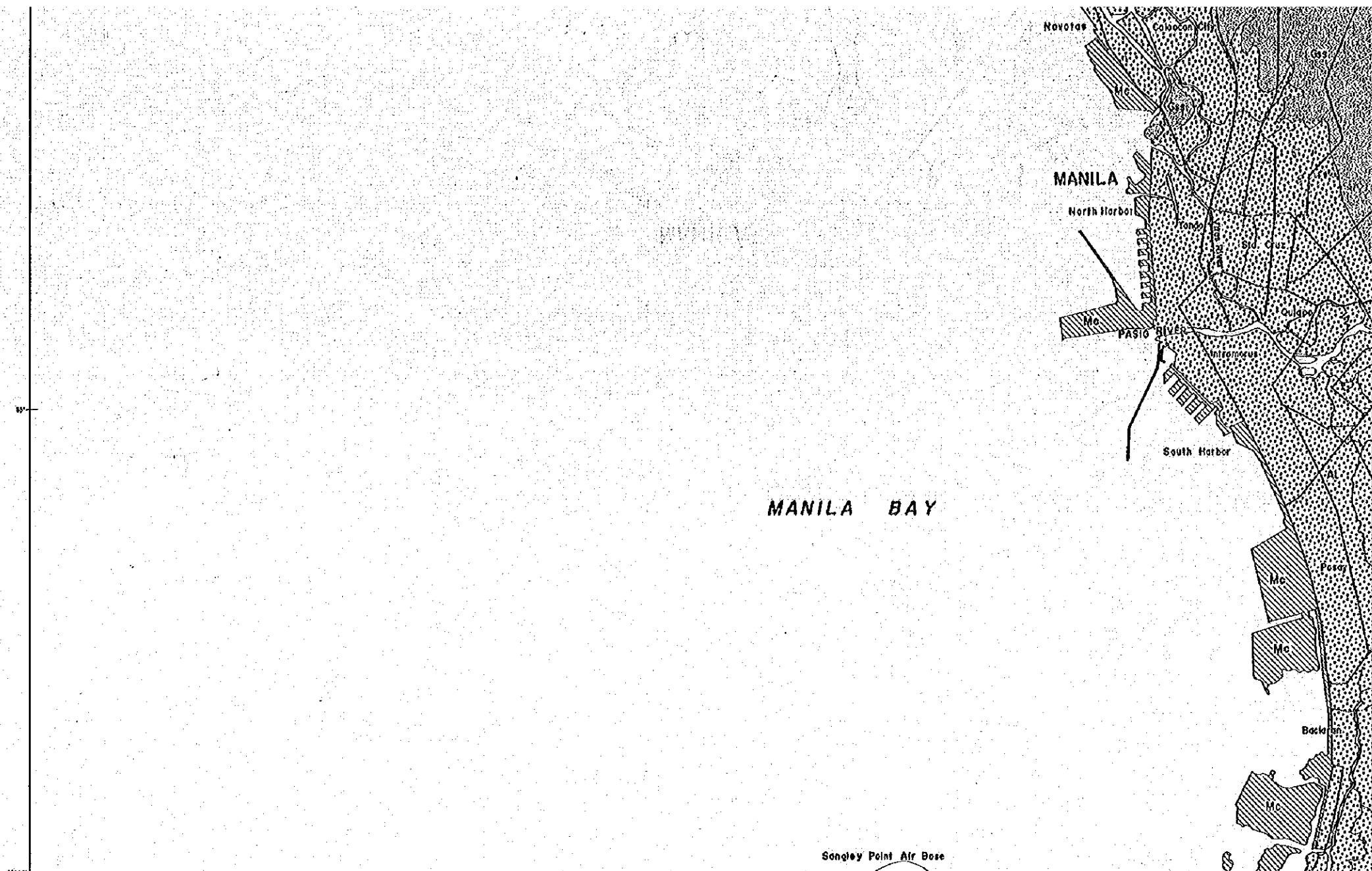
STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY
 Figure 3 (2)
 GEOLOGICAL MAP OF THE STUDY AREA
 NO 2 ANGAT (1/50,000)

MOUNT IRID



MANILA





SCALE 1:50,000
Meters 1000 500 0 1 2 3 4 5 Kilometers

ADJOINING SHEET

MALOLOS	ANGAT	MOUNT IRID
1	2	3
MANILA	QUEZON CITY	BARAS
4	5	6
CAVITE	MUNTINGLUPA	PAETE
7	8	9

LEGEND:

FORMATION AND LITHOLOGY		FEATURE OF AQUIFER
QUATERNARY	<p>Al₁₀ ALLUVIUM TALUS CLAY, SILT, GRAVEL</p> <p>Ta TERRACE SAND, SILT, GRAVEL</p> <p>Q_{11a} TUFF, TUFF-BRECCIA TUFFACEOUS SANDSTONE, MUDSTONE</p> <p>Q_{11b} TUFF-BRECCIA, AGGLOMERATE</p> <p>Q_{11c} BASALT - PORPHYRY</p> <p>Q_{11d} TUFFACEOUS SANDSTONE MUDSTONE ALT.</p> <p>Q_{11e} LAPILLI TUFF, WELDED TUFF, TUFF-BRECCIA, AGGLOMERATE, SANDSTONE</p> <p>Q_{11f} CONGLOMERATE, SANDSTONE</p>	<p>UNCONFINED AQUIFER</p> <p>RICH AQUIFER</p> <p>RICH AQUIFER</p> <p>RICH AQUIFER</p> <p>IMPERMEABLE BEDROCK</p> <p>LOCAL OR DISCONNECTED AQUIFERS</p> <p>IFISSURE CONTROLLED AQUIFER</p>
TERTIARY	<p>Mc MACKAY FORMATION CALCAREOUS SANDSTONE, SHALE</p> <p>Al₁₁ ANGAT FORMATION LIMESTONE</p> <p>Ad ANTIPOLO DIORITE</p> <p>Mv MAYBAHON FORMATION SANDSTONE, SHALE, PYROCLASTICS, LIMESTONE</p> <p>Kv KINABUAN FORMATION ALTERED EOLITIC BASALT, ANDESITE SANDSTONE, SHALE, ALT. BASALT ANDESITE</p>	
PALEOGENE-NEOGENE		
PALEOGENE		
PLIOCENE		
PLEISTOCENE		
QUATERNARY		

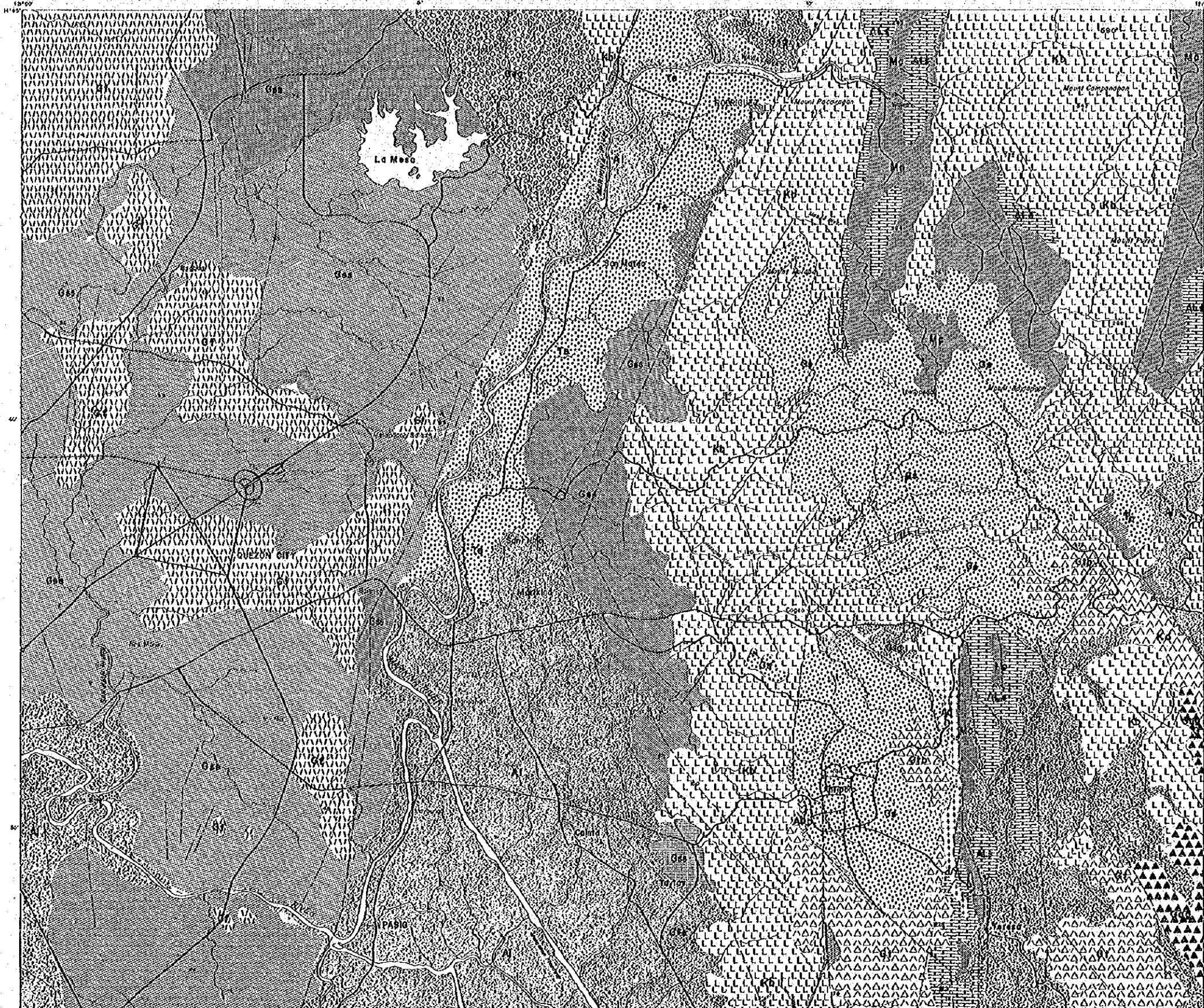
- 10' CONTOUR (E.L.)
- GEOLOGICAL BOUNDARY
- 10' BEDDING
- FAULT
- PHOTO-LINEAMENT
- SYNDCLINE
- ANTICLINE
- SPRING
- SPOT HEIGHT (E.L.M.)

STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

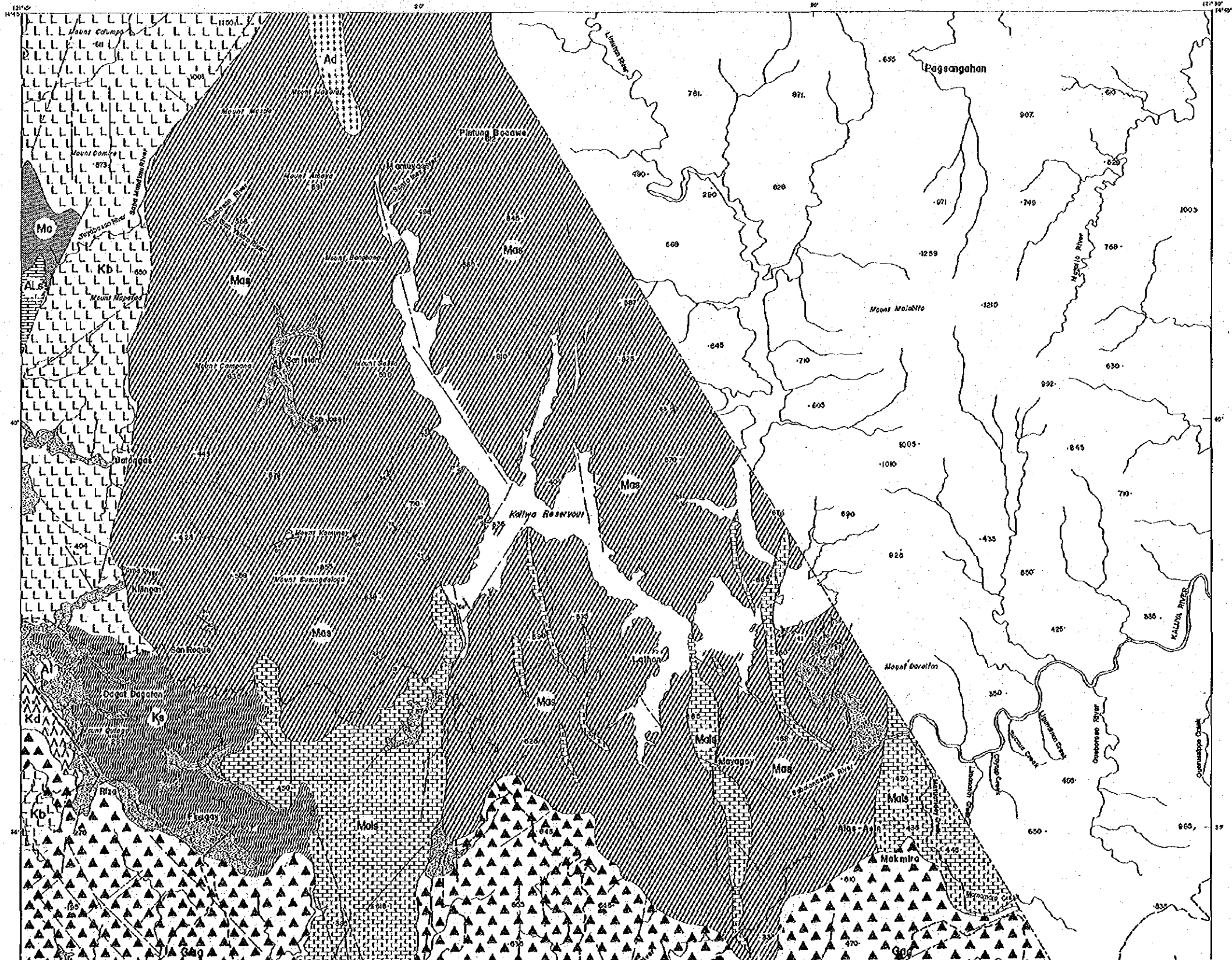
Figure 3 (4)
 GEOLOGICAL MAP OF THE STUDY AREA
 NO. 4 MANILA (1/50,000)

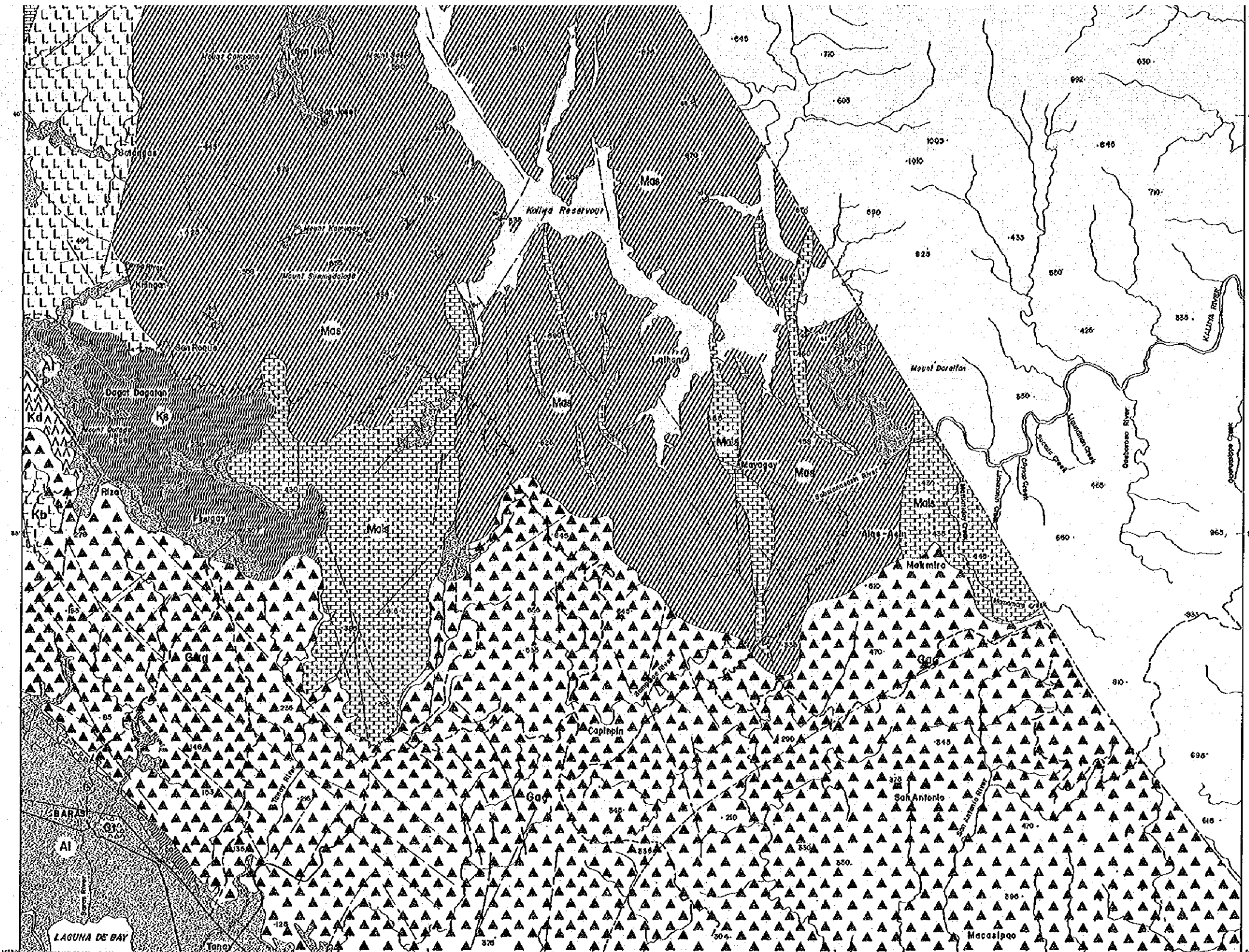
PHILIPPINES 1:50,000

QUEZON CITY



BARAS





LEGEND

FORMATION AND LITHOLOGY		ACQUIFERS	TOPOGRAPHY
Quaternary	ALLUVIAL TALUS CLAY, SILT, GRAVEL	UNCONFINED ACQUIFERS RICH ACQUIFER	CONTOUR (E.L.)
	TERRACE SAND, SILT, GRAVEL		GEOLOGICAL BOUNDARY
QUATERNARY	TUFF, TUFF-BRECCIA TUFFACEOUS SANDSTONE, MUDSTONE	CONFINED ACQUIFERS RICH ACQUIFER	BEDDING
	BASALT-PORPHYRY		FAULT
	QUADALUPE FORMATION TUFF-BRECCIA, AGLOMERATE		PHOTO-LINEAMENT
	TUFFACEOUS SANDSTONE, MUDSTONE ALT.		SYNCLINE
TERTIARY	MIZELUM FORMATION CALCAREOUS SANDSTONE, SHALE	IMPERMEABLE BEDROCK LOCAL OR DISCONNECTED ACQUIFERS	ANTICLINE
	ANGAT FORMATION LIMESTONE		SPRING
	ANTIPOLO DIORITE DIORITE		SPOT HEIGHT (E.L.)
	VANBANDAN FORMATION SANDSTONE, SHALE, PYROCLASTICS		
PRE-TERTIARY	ALTERED SPHING BASALT, ANDESITE ALTERED DIORITE SAND, SHALE, ALT. BASALT, ANDESITE		

SCALE 1:50,000

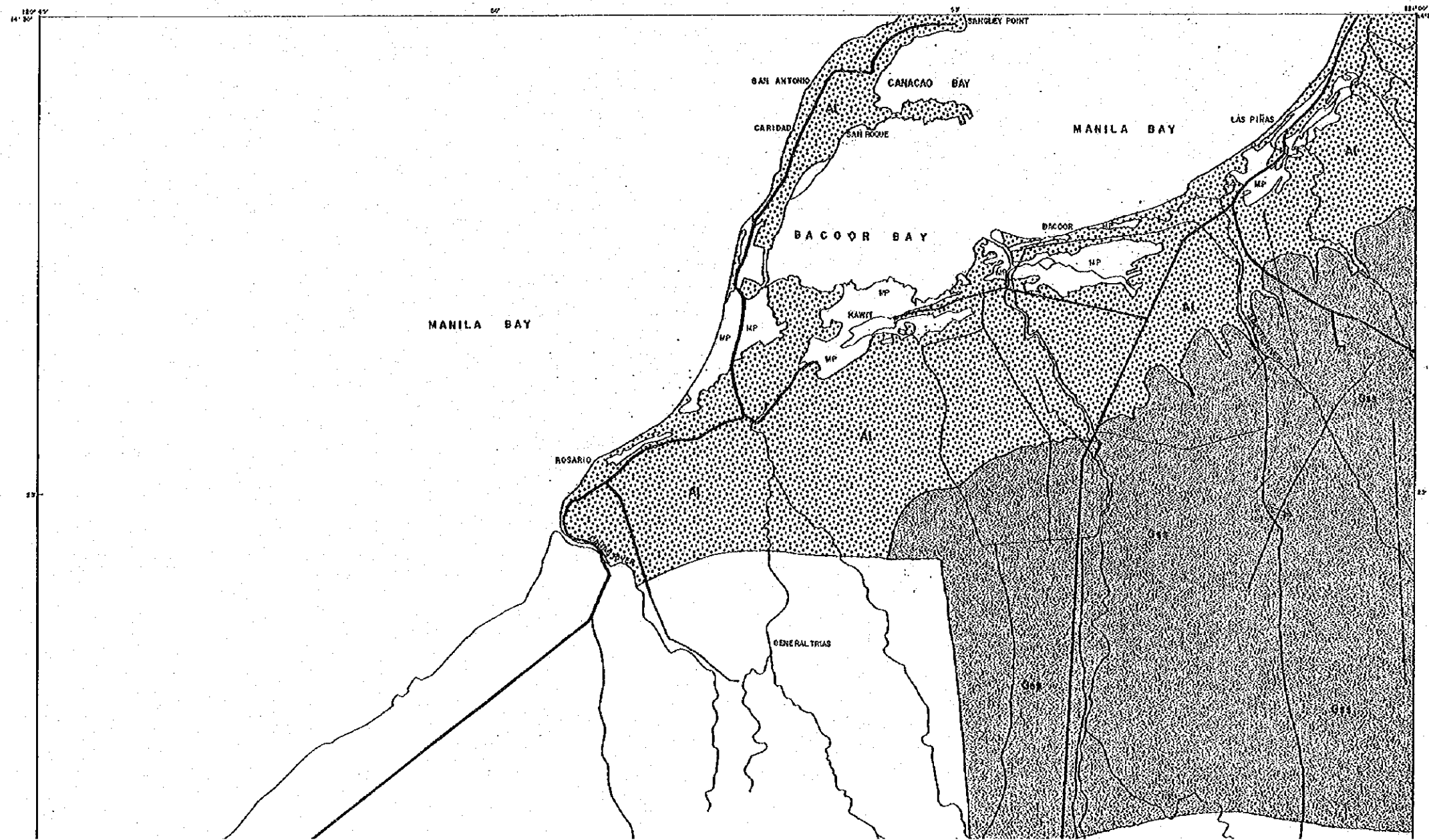
ADJOINING SHEETS

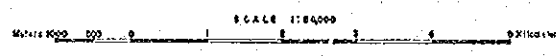
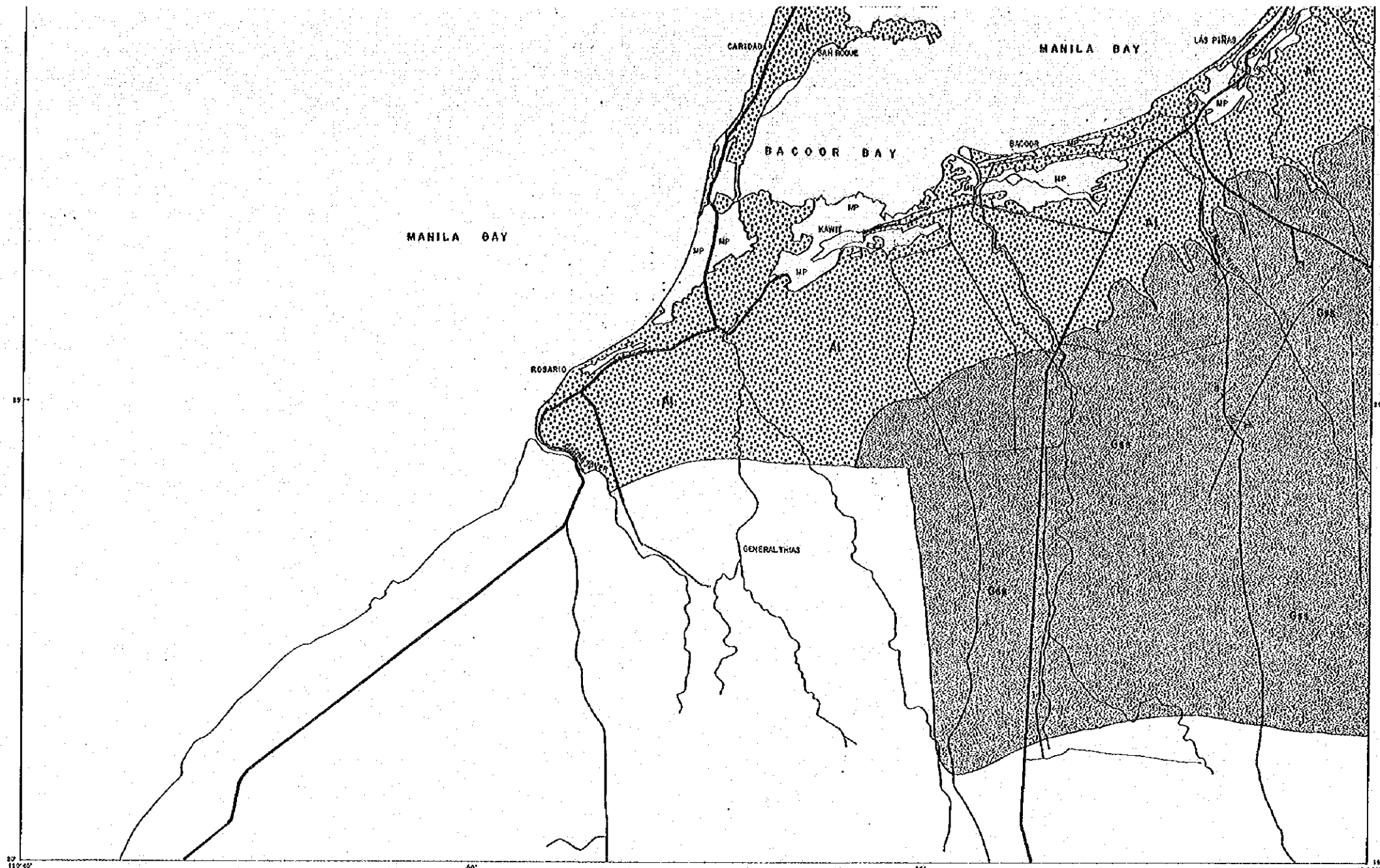
MALOLOS	ANGAT	MOUNT IRID
1	2	3
MANILA	QUEZON CITY	BARAS
4	5	6
CAVITE	MUNTINGLUPA	PARTE
7	8	9

STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
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Figure 3 (6)
GEOLOGICAL MAP OF THE STUDY AREA
 NO. 6 BARAS (1/50,000)

CAVITE





ADJOINING SHEETS

MALOLOS	ANGAT	MOUNT IRID
1	2	3
MANILA	QUEZON CITY	BARAS
4	5	6
CAVITE	MUNTINGLUPA	PAETE
7	8	9

LEGEND:

Geologic Age	FORMATION AND LITHOLOGY	FEATURE OF AQUIFER
QUATERNARY	Al ₁ ALLUVIUM TALUS CLAY, SILT, GRAVEL	
	T ₁ TERRACE SAND, SILT, GRAVEL	
	Q ₁ TUFF, TUFF-BRECCIA, TUFFACIOUS SANDSTONE, MUDDSTONE	
	Q _{1b} TUFF-BRECCIA, AGGLOMERATE	
	A _{1p} BASALT - PORPHYRY	
	Q ₁ QUADALUPE FORMATION TUFFACIOUS SANDSTONE, MUDDSTONE ALT.	
	Q ₁ LAPILLI TUFF, WELDED TUFF, TUFF-BRECCIA, AGGLOMERATE, SANDSTONE	
	Q _{2/3} CONGLOMERATE, SANDSTONE	
	M ₁ MADLIR FORMATION CALCAREOUS SANDSTONE, SHALE	
	A ₁ ANGAT FORMATION LIMESTONE	
TERTIARY	A ₁ ANTIPOLLO DIORITE DIORITE	
	M ₁ MAYBANGIR FORMATION SANDSTONE, SHALE, PYROCLASTICS, LIMESTONE	
	M ₁ KINABUAN FORMATION ALTERED SPHATIC BASALT, ANDESITE SANDSTONE, SHALE, ALT. BASALT ANDESITE	

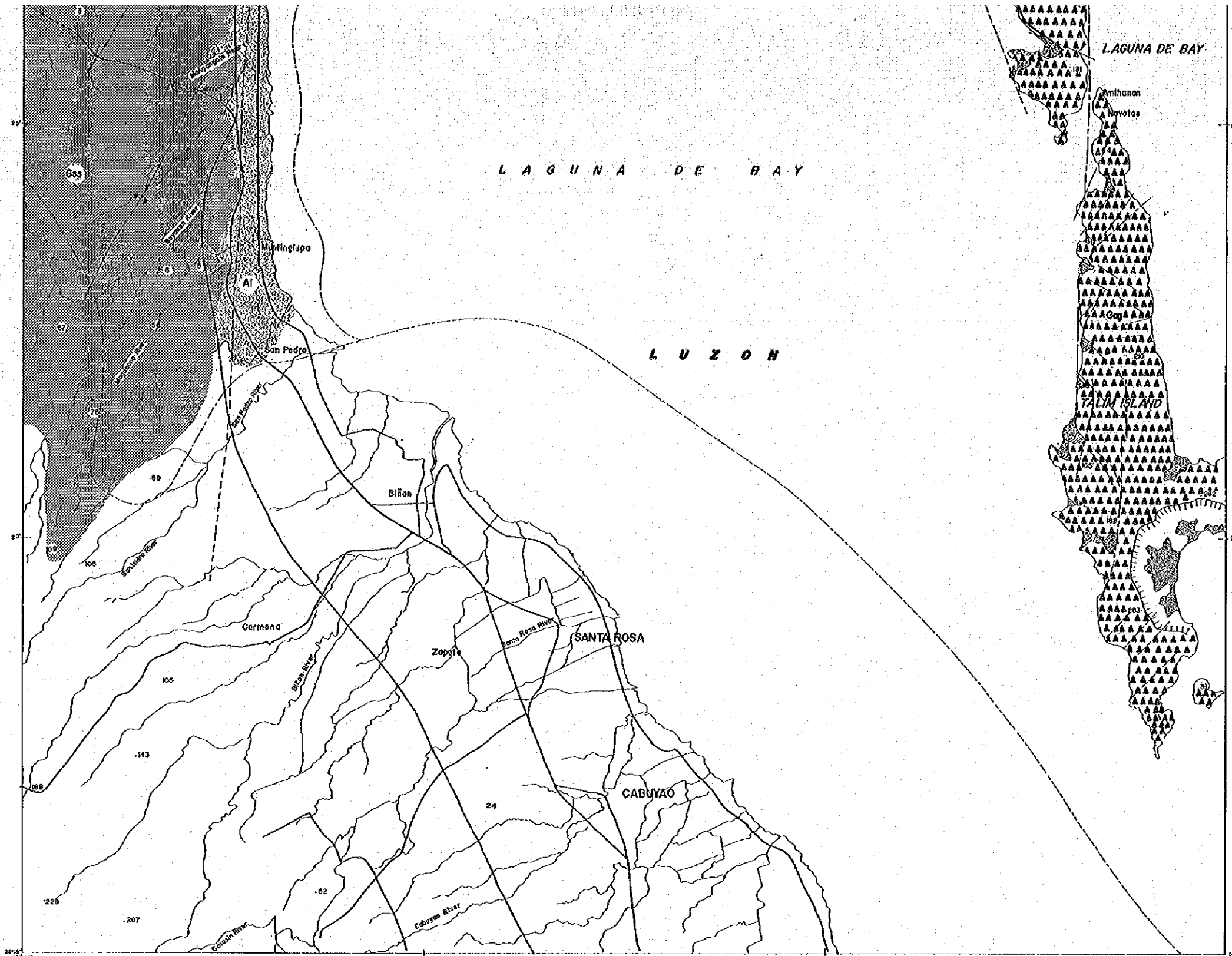
- RIVER, DRAINAGE
- STRIKE DIP
- ESCARPMENT
- GEOLOGICAL BOUNDARY
- FAULT
- PHOTO LINEATION
- SYNCLINE
- BASEMENT CONTOUR OF QUADALUPE FORMATION (E.L.)
- ELECTRIC RESISTIVITY SURVEY POINT
- TESTWELL POINT JICA, 1991
- MWSB - WELLS
- PRIVATE WELLS
- HYDROGEOLOGIC LINE
- SPRING

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 JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 3 (7)
 GEOLOGICAL MAP OF THE STUDY AREA
 NO. 7 CAVITE (1/50,000)

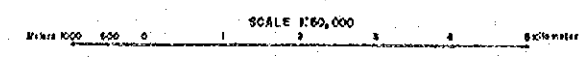
MUNTINGLUPA





LEGEND

Geologic Age	FORMATION AND LITHOLOGY	ACQUIFERS	SYMBOLS
QUATERNARY	Al T ₀	ALUVIAN TALUS CLAY, SILT, GRAVEL	CONTOUR (E.L.) GEOLOGICAL BOUNDARY BEDDING FAULT PHOTO-LINEAMENT SYNCLINE ANTICLINE SPRING SPOT HEIGHT (E.L.M)
	T ₀	TERRACE SAND, SILT, GRAVEL	
	Q ₁ Q ₂ Q ₃	TUFF, TUFF-BRECCIA TUFFACEOUS SANDSTONE, MUDSTONE BASALT-PORPHYRY	
	Abp	QUADALLE FORMATION TUFF-BRECCIA, AGGLOMERATE	
	Q ₄	TUFFACEOUS SANDSTONE, MUDSTONE ALY.	
	Q ₅ Q ₆ Q ₇ Q ₈ Q ₉	LAPILLI TUFF, WELDED TUFF TUFF-BRECCIA, AGGLOMERATE, SANDSTONE CONGLOMERATE, SANDSTONE	
	M ₀	MADLUM FORMATION CALCAREOUS SANDSTONE SHALE	
	AL ₁	ANGAT FORMATION LIMESTONE	
	AS	ANGILOPORO DIORITE DIORITE	
	M ₁ M ₂ M ₃ M ₄ M ₅	MAYBANGSAN FORMATION SANDSTONE, SHALE, PYROCLASTICS	
M ₆ M ₇ M ₈ M ₉	MARASMAN FORMATION ALTERED EPHEMIC BASALT, ANDESITE SANDST, SHALE, ALY. BASALT, ANDESITE		



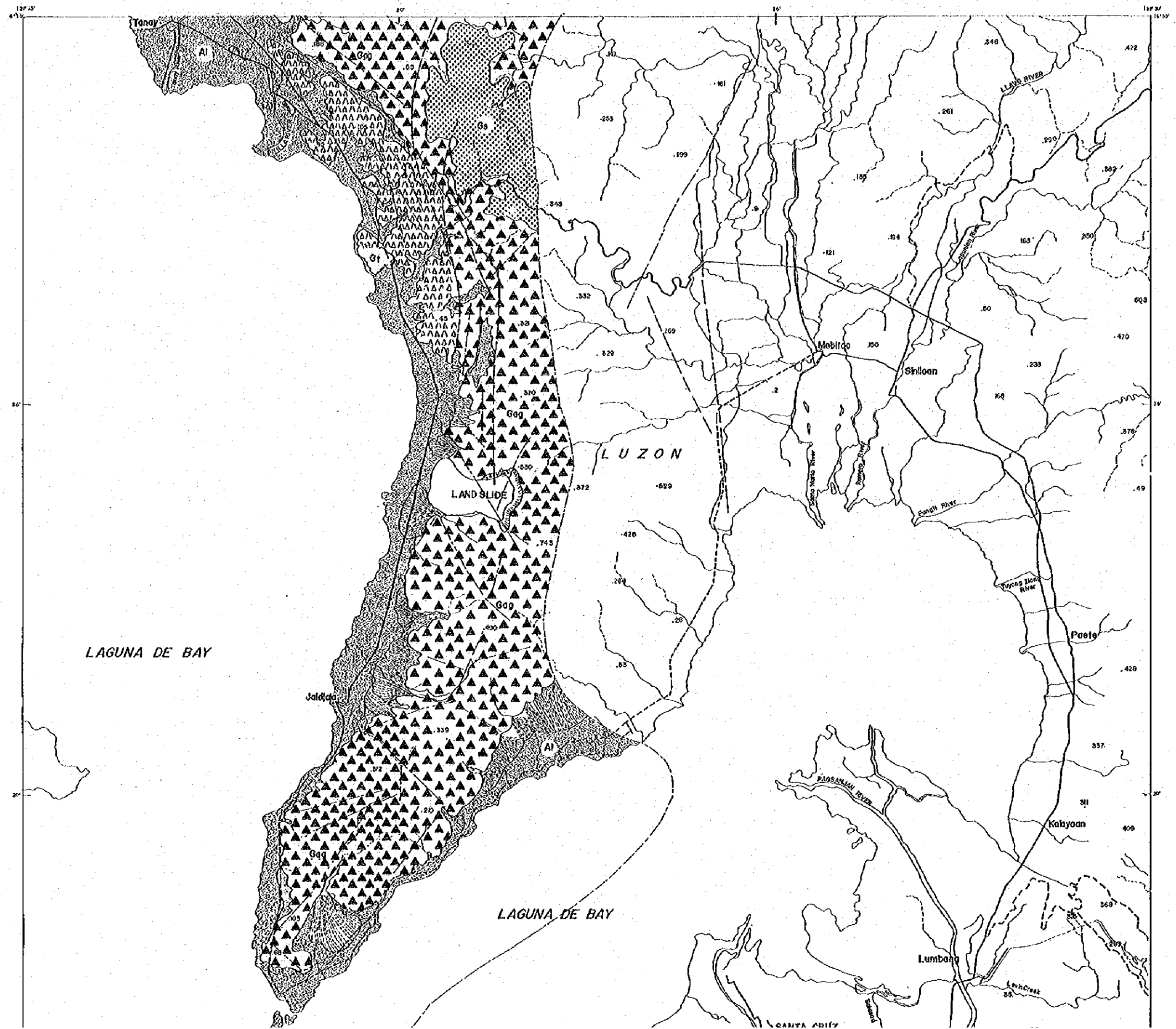
ADJOINING SHEETS

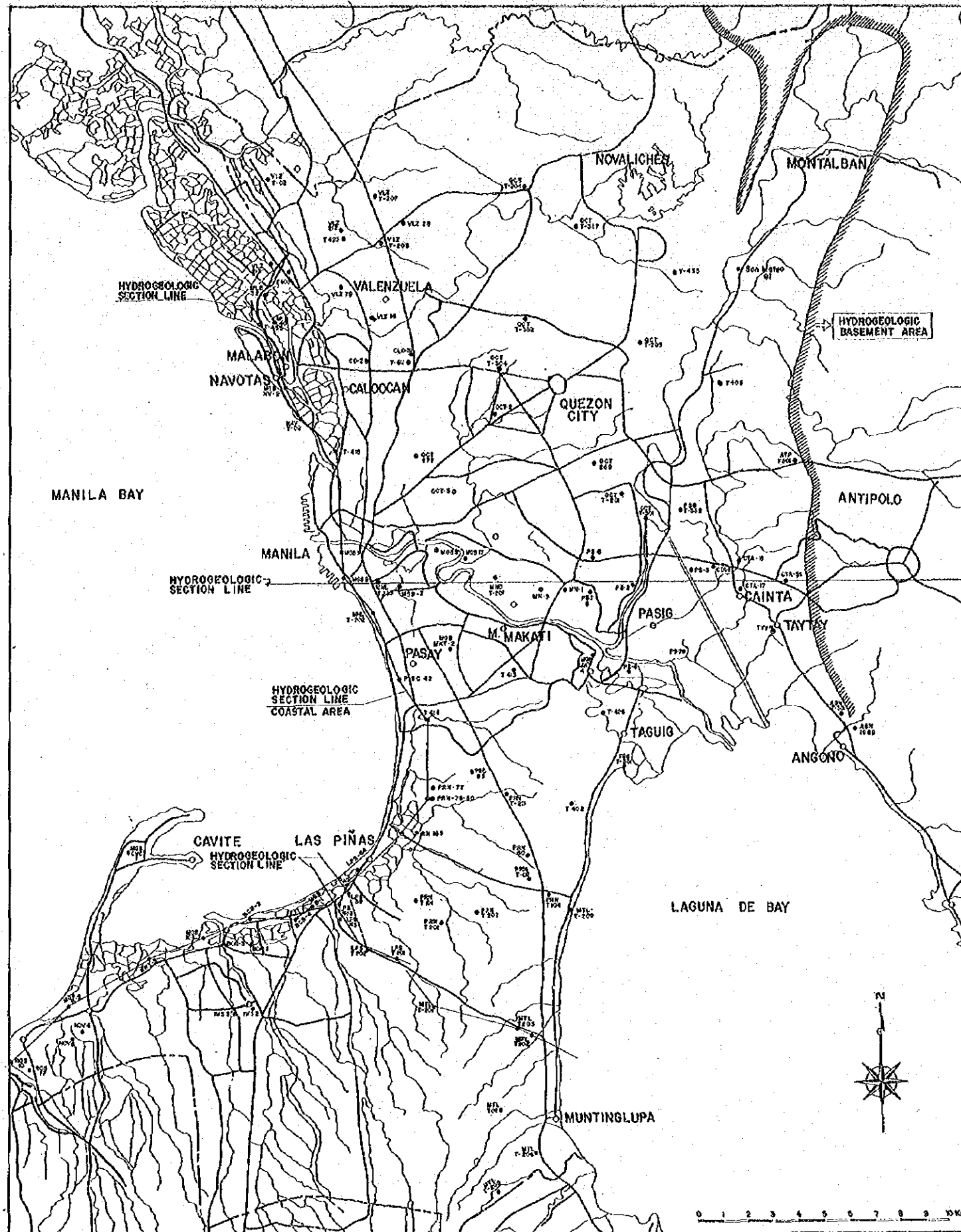
MALOLOS	ANGAT	MOUNT IRIO
1	2	3
MANILA	QUEZON CITY	BARAS
4	5	6
OAVITE	MUNTINGLUPA	PAETE
7	8	9

STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 3 (8)
 GEOLOGICAL MAP OF THE STUDY AREA
 NO.8 MUNTINGLUPA (1/50,000)

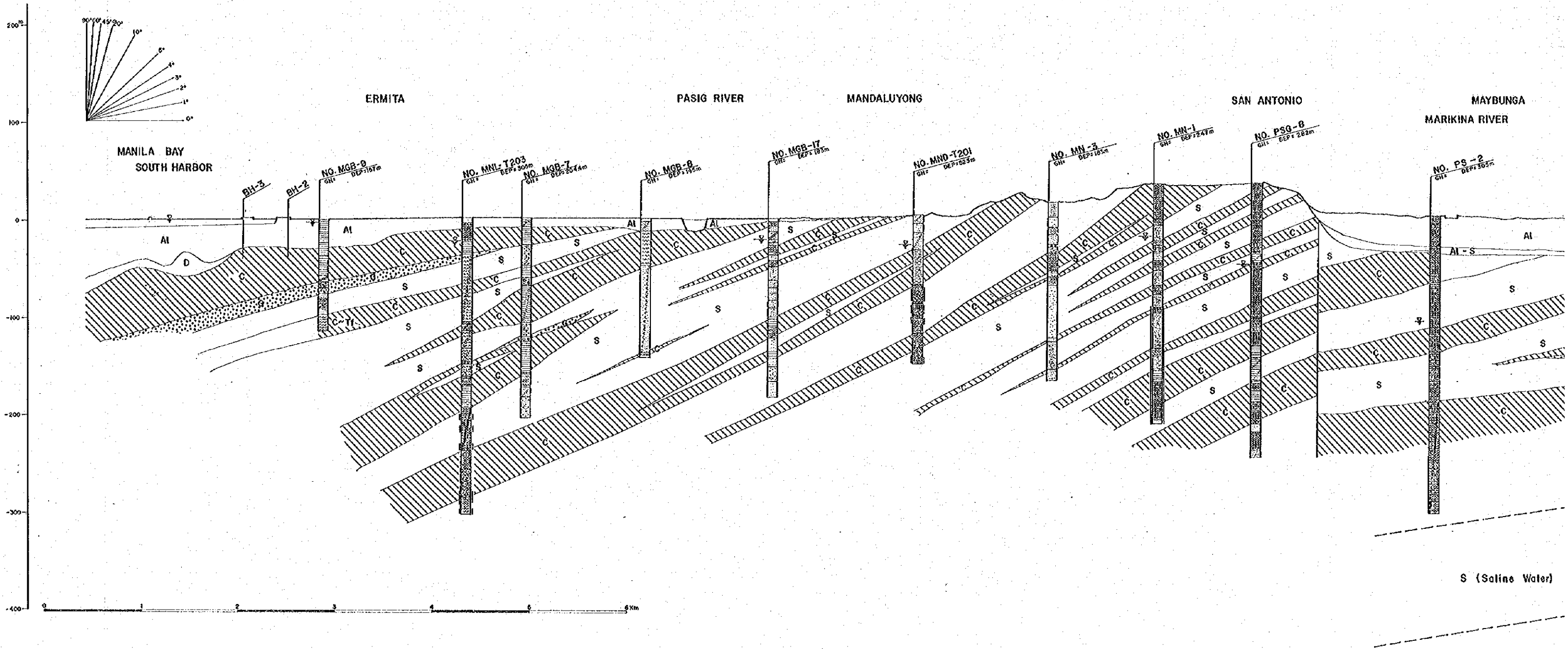
PAETE

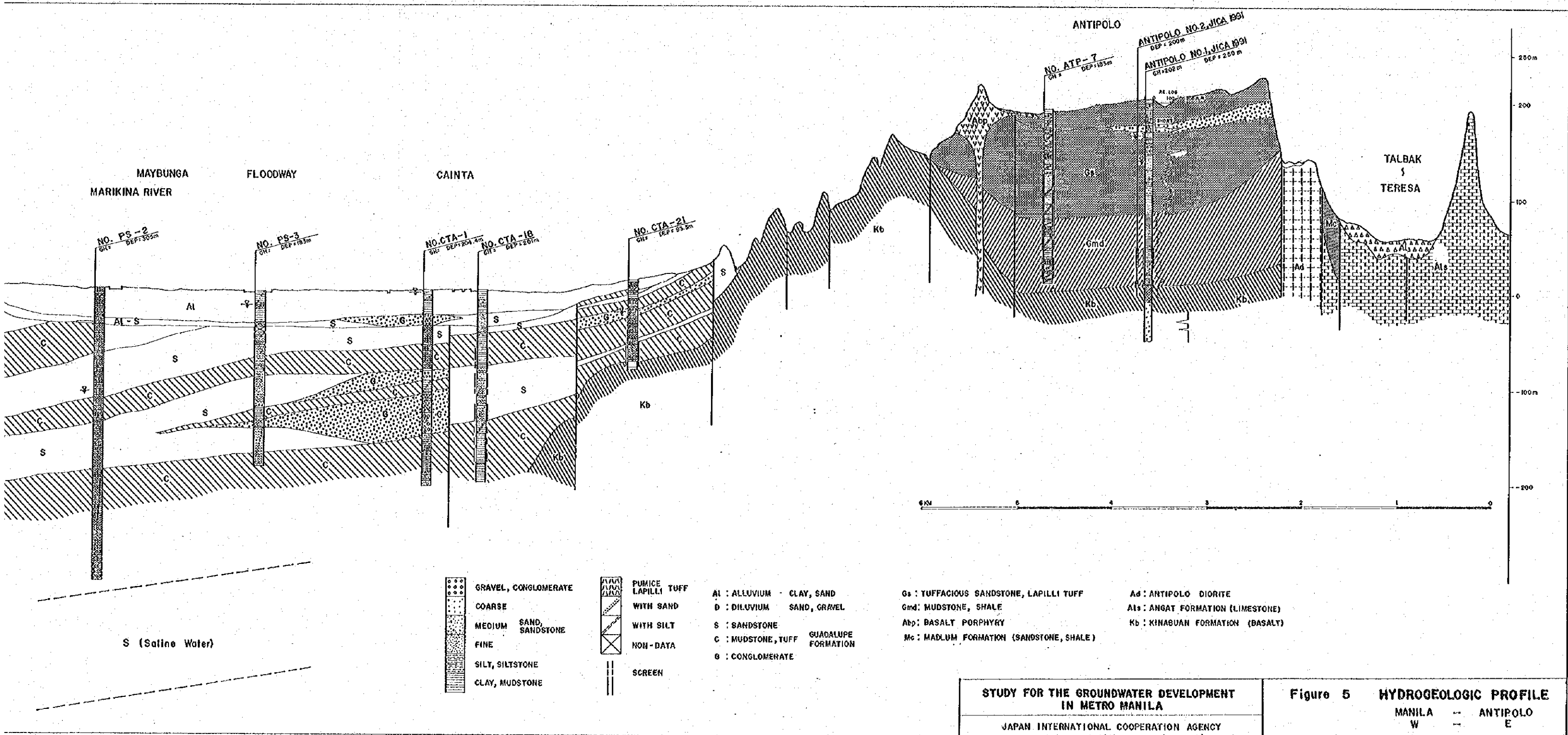


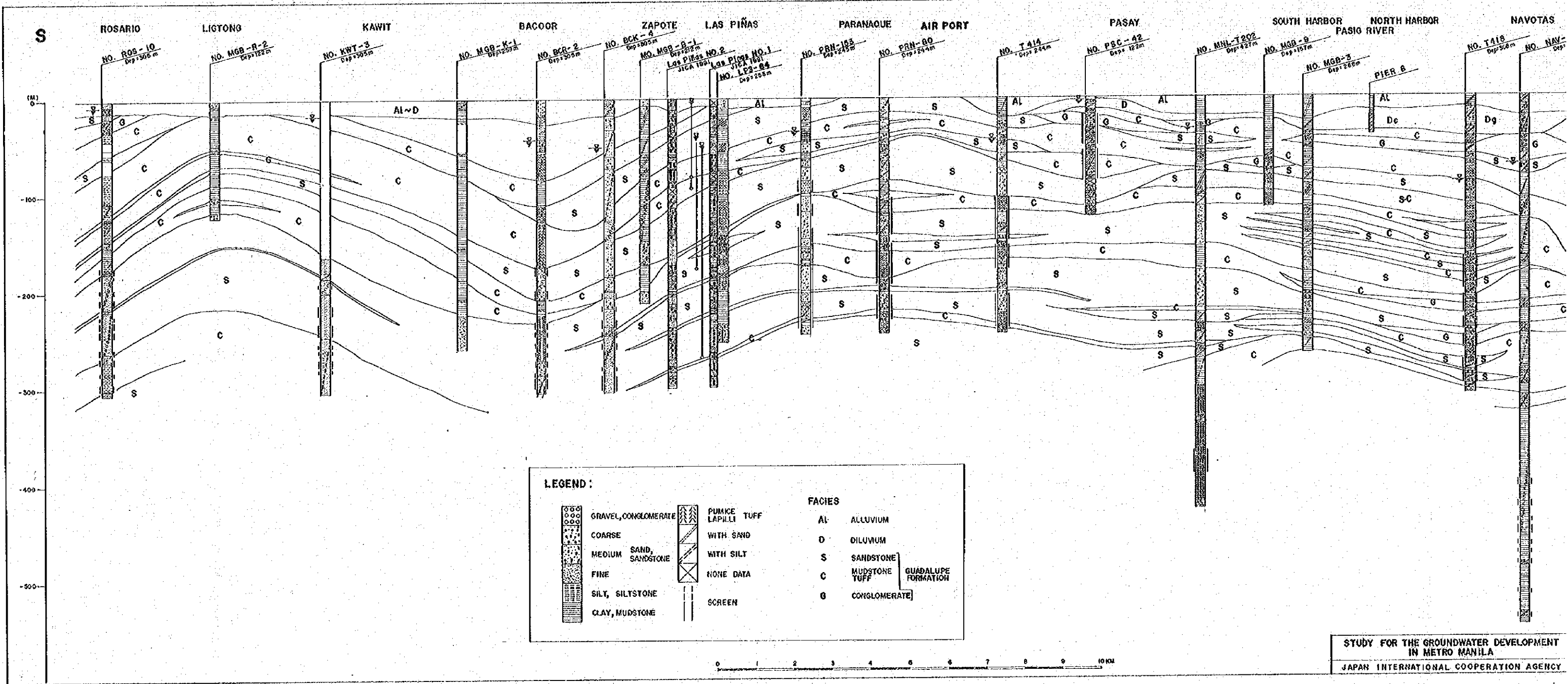


STUDY FOR THE GROUNDWATER DEVELOPMENT
 IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 4
 LOCATION OF SECTION LINE





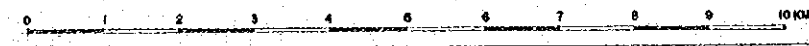


S

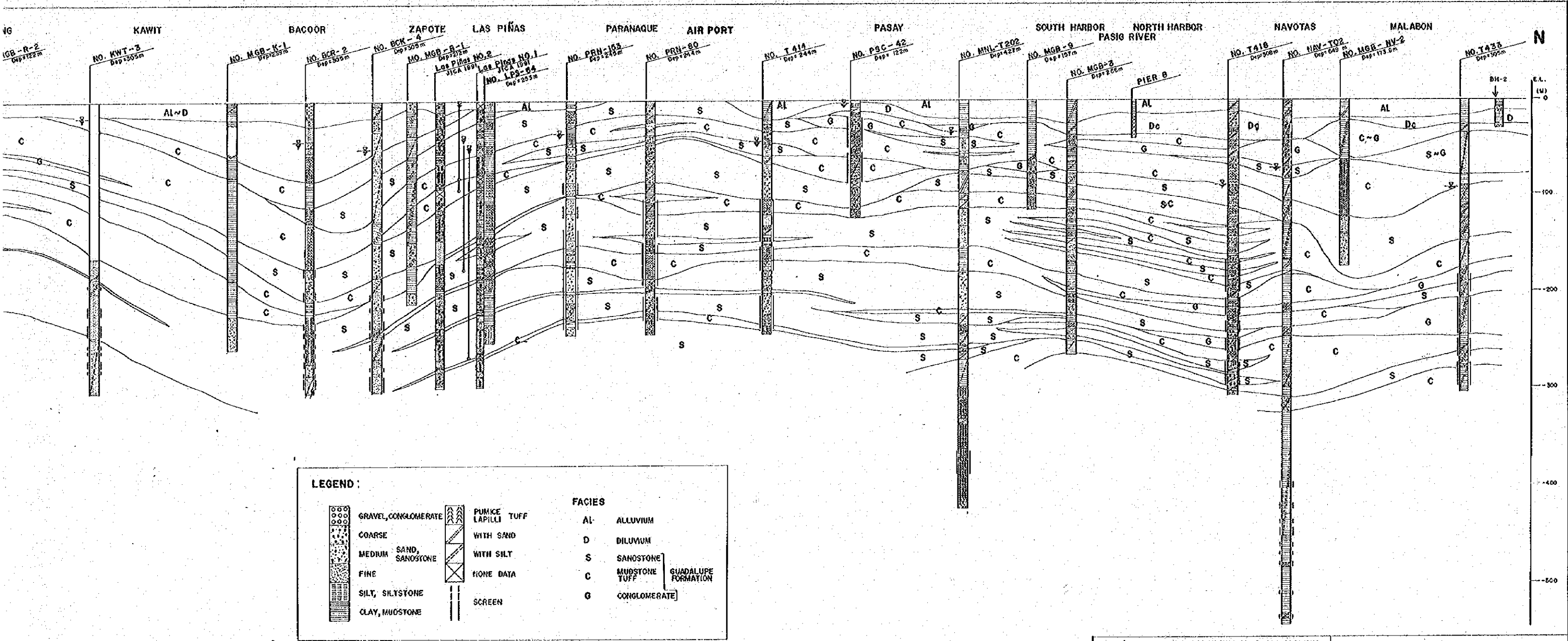
(M)
0
-100
-200
-300
-400
-500

LEGEND :

	GRAVEL, CONGLOMERATE		PUMICE LAPILLI TUFF	FACIES AL ALLUVIUM D DILUVIUM S SANDSTONE C MUDSTONE TUFF G CONGLOMERATE
	COARSE SAND		PUMICE LAPILLI TUFF WITH SAND	
	MEDIUM SAND, SANDSTONE		PUMICE LAPILLI TUFF WITH SILT	
	FINE SAND		NONE DATA	
	SILT, SILTSTONE		SCREEN	
	CLAY, MUDSTONE			GUADALUPE FORMATION



STUDY FOR THE GROUNDWATER DEVELOPMENT
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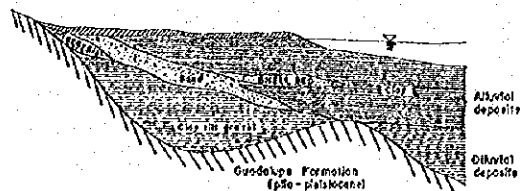
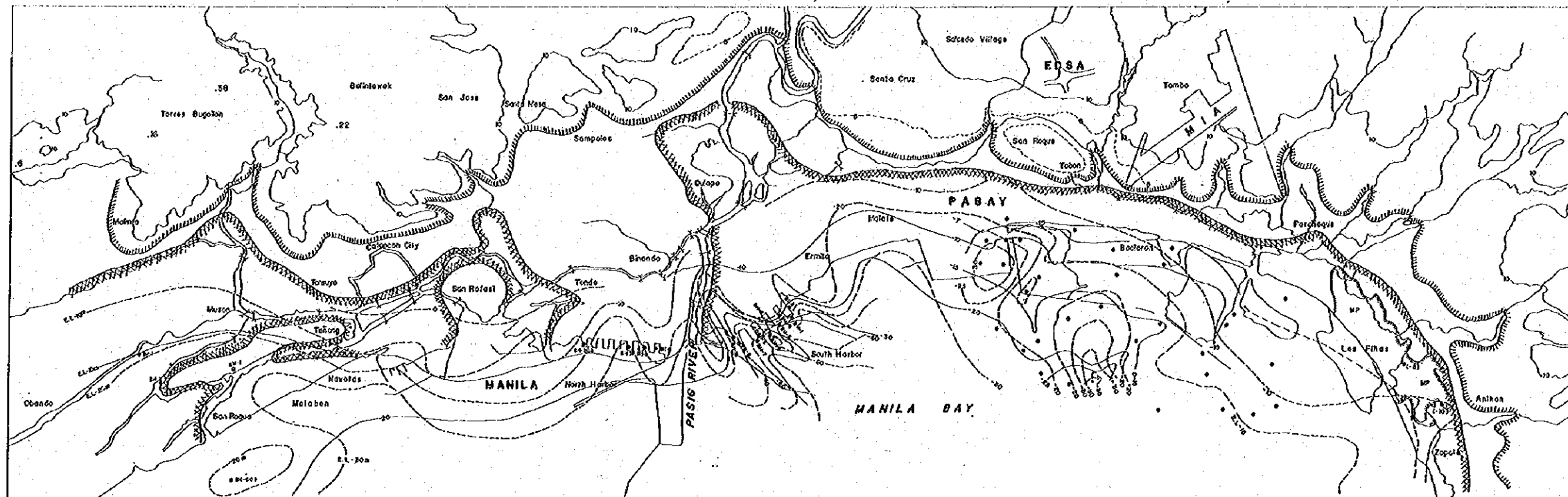


LEGEND :

	GRAVEL, CONGLOMERATE		PUMICE LAPILLI TUFF	FACIES	AL- ALLUVIUM
	COARSE SAND, SANDSTONE		WITH SAND		D- DILUVIUM
	MEDIUM SAND, SANDSTONE		WITH SILT	S- SANDSTONE	GUADALUPE FORMATION
	FINE SAND, SANDSTONE		NONE DATA	C- MUDSTONE TUFF	
	SILT, SILTSTONE		SCREEN	G- CONGLOMERATE	
	CLAY, MUDSTONE				

STUDY FOR THE GROUNDWATER DEVELOPMENT
IN METRO MANILA
JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 6 HYDROGEOLOGIC PROFILE
(COASTAL AREA OF MANILA BAY)

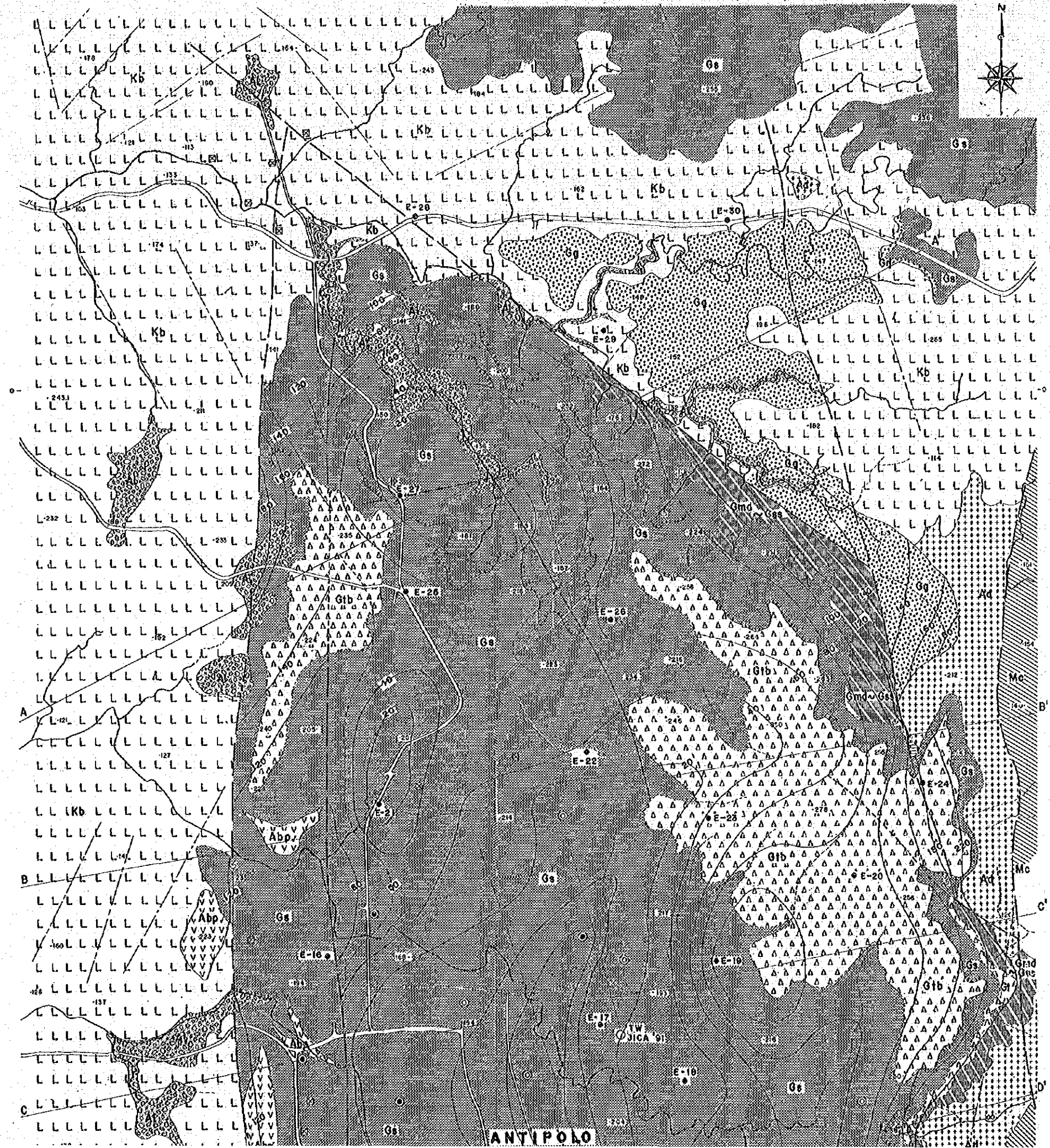


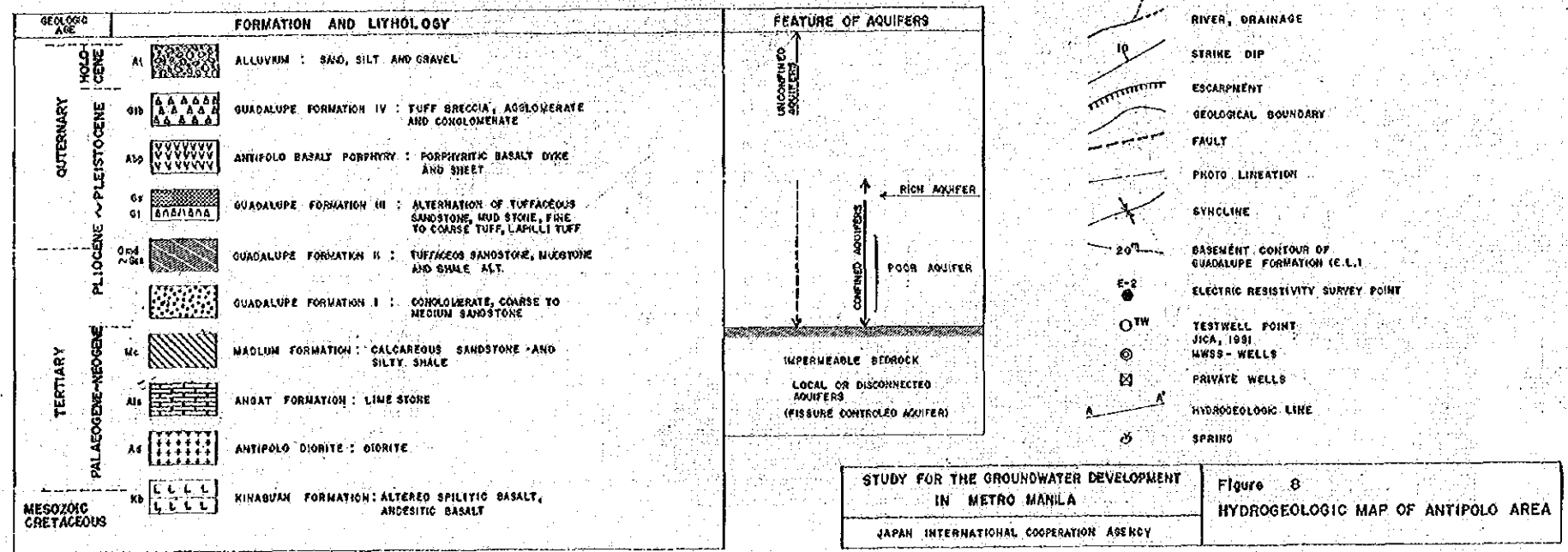
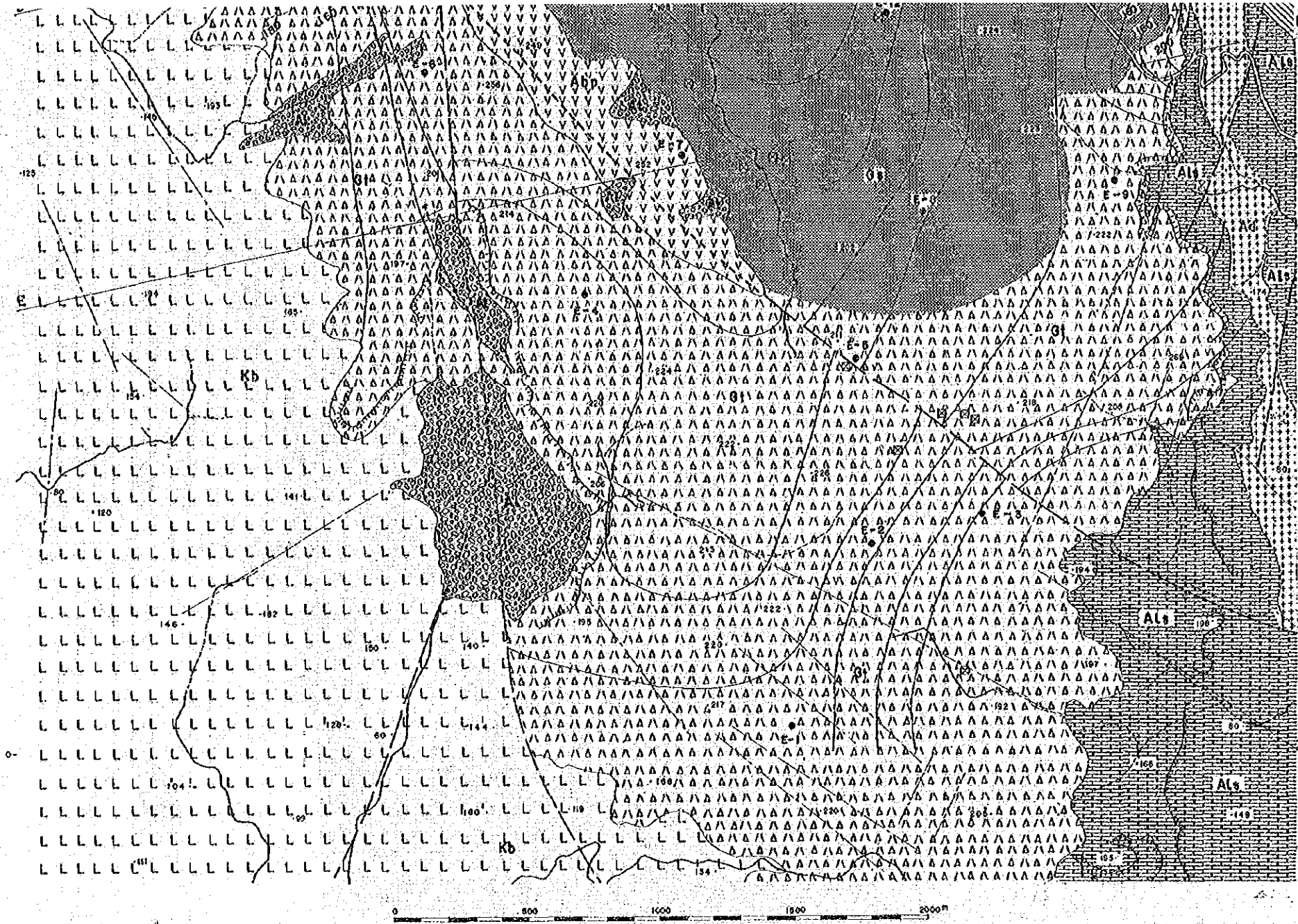
Profile of Coastal Area

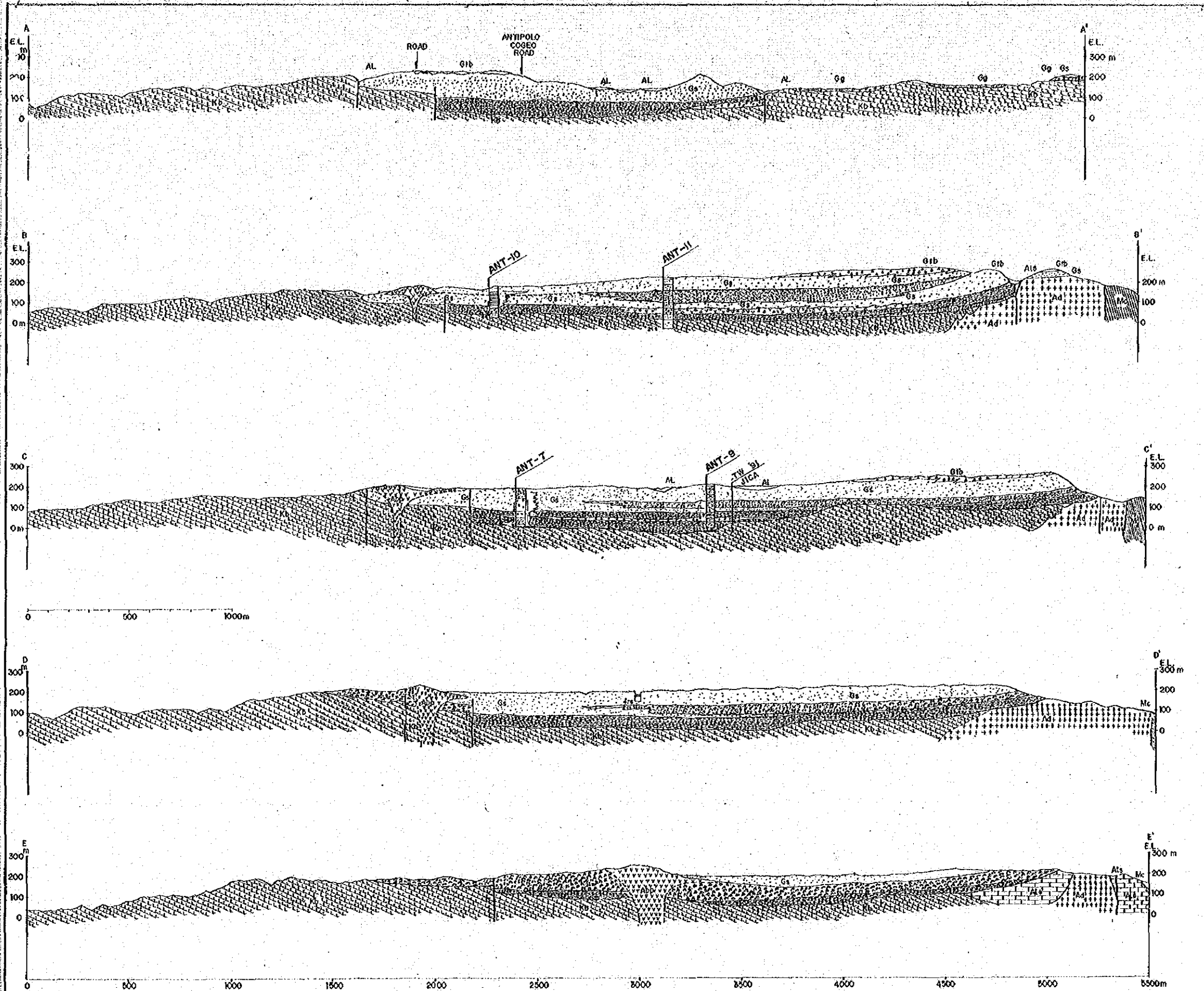
LEGEND:

- Guadalupe F. Alluvium
- Coastal Plane (less than 2m E.L.)
- Surface of Alluvium (E.L.)
- Surface of Guadalupe Formation (E.L.)
- Borehole Point

Figure 7
DISTRIBUTION OF QUATERNARY SEDIMENT
STUDY FOR THE GROUNDWATER DEVELOPMENT
IN METRO MANILA
JAPAN INTERNATIONAL COOPERATION AGENCY

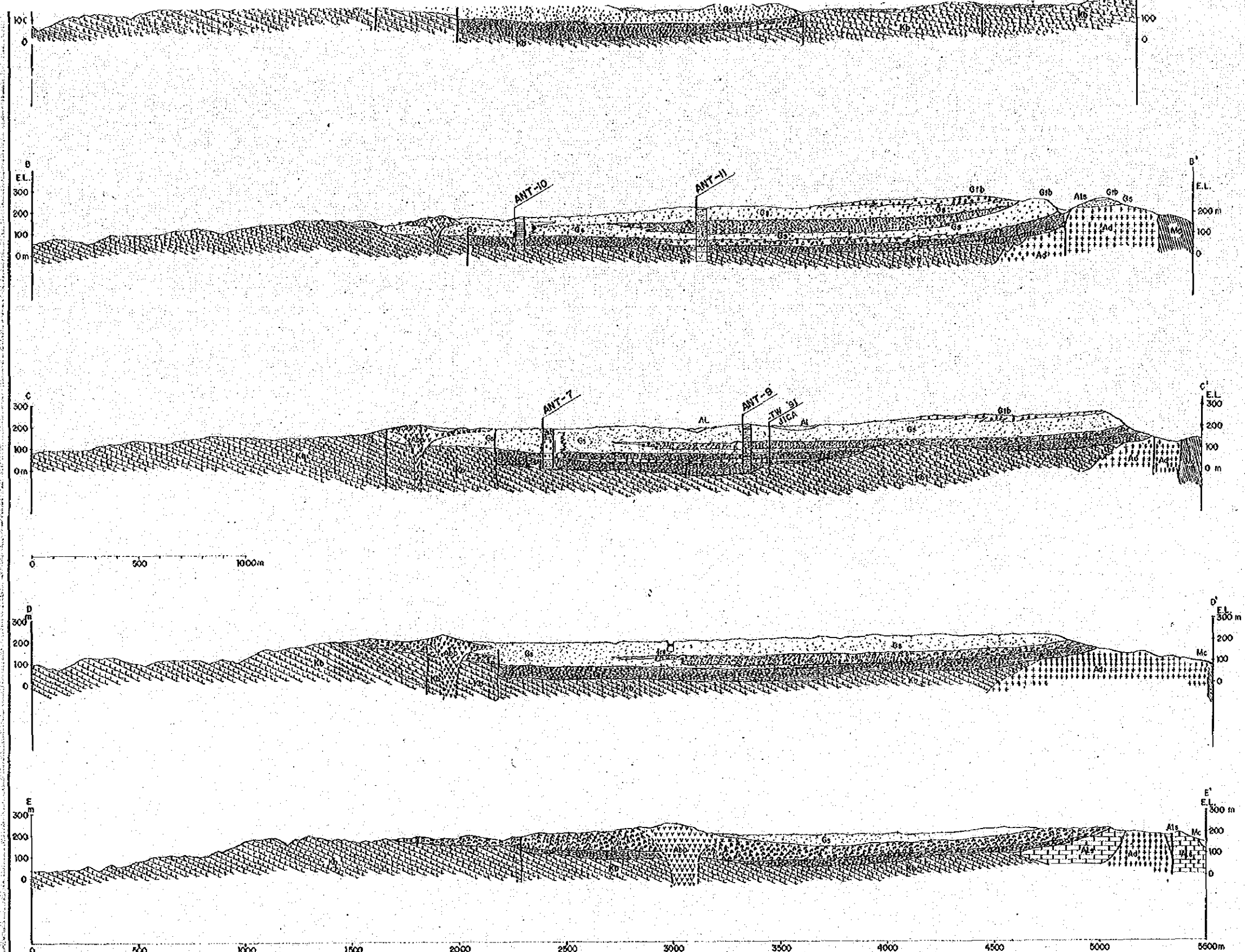






LEGEND :

DRILLING DATA RESISTIVITY 0 100 200	GEOLOGIC AGE HOLOCENE Al	FORMATION AND LITHOLOGY ALLUVIUM : SAND, SILT AND GRAVEL	TERTIARY LAEOGENE NEOGENE Mc	FORMATION AND LITHOLOGY MADLUM FORMATION : CALCAREOUS SANDSTONE AND SILTY SHALE	MOSOZOIC CRETACEOUS Kb	FORMATION AND LITHOLOGY KINABUAN FORMATION : ALTERED SPLITIC BASALT AND ANDESITIC BASALT
	OCENE G1b	GUADALUPE FORMATION : TUFF BRECCIA, AGGLOMERATE AND CONGLOMERATE	Als	ANGAY FORMATION : LIMESTONE		



LEGEND :

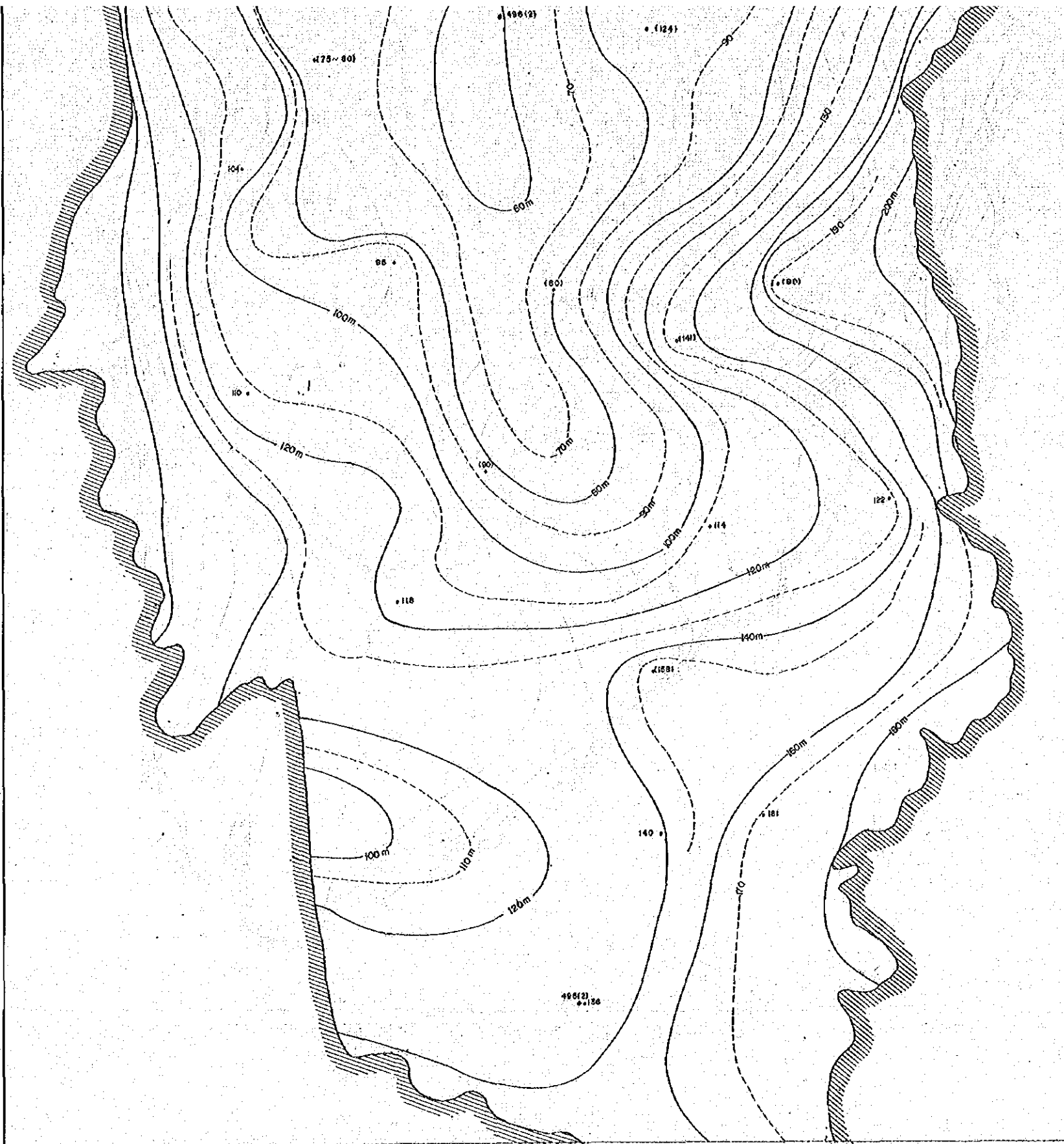
DRILLING DATA

GEOLOGIC AGE		FORMATION AND LITHOLOGY		FORMATION AND LITHOLOGY			
HOLOCENE	A1		ALLUVIUM : SAND, SILT AND GRAVEL	MESOZOIC CRETACEOUS	Kb		KINABUAN FORMATION : ALTERED SPLINTIC BASALT ANDESITIC BASALT
QUATERNARY PLIOCENE-PLEISTOCENE	Gyb		GUADALUPE FORMATION I : TUFF BRECCIA, AGGLOMERATE AND CONGLOMERATE	TERTIARY PALEOGENE NEOGENE	Mc		MADLUM FORMATION : CALCAREOUS SANDSTONE AND SILTY SHALE
	Abp		ANTIPOLO BASALT PORPHYRY : PORPHYRITIC BASALT DYKE AND SHEET	Alt		ANGAT FORMATION : LIMESTONE	
	G3		GUADALUPE FORMATION II : ALTERNATION OF TUFFACEOUS SANDSTONE, WELDED TUFF, TUFF BRECCIA & LAPILLI TUFF	Ad		ANTIPOLO DIORITE : DIORITE	
	Gv		GUADALUPE FORMATION III : TUFFACEOUS SANDSTONE, MUOSTONE & SHALE ALT.				
	Gsd-Gsa		GUADALUPE FORMATION IV : CONGLOMERATE, COARSE-MEDIUM SANDSTONE				

STUDY FOR THE GROUNDWATER DEVELOPMENT
IN METRO MANILA

Figure 9
HYDROGEOLOGIC PROFILE OF ANTIPOLO AREA

JAPAN INTERNATIONAL COOPERATION AGENCY

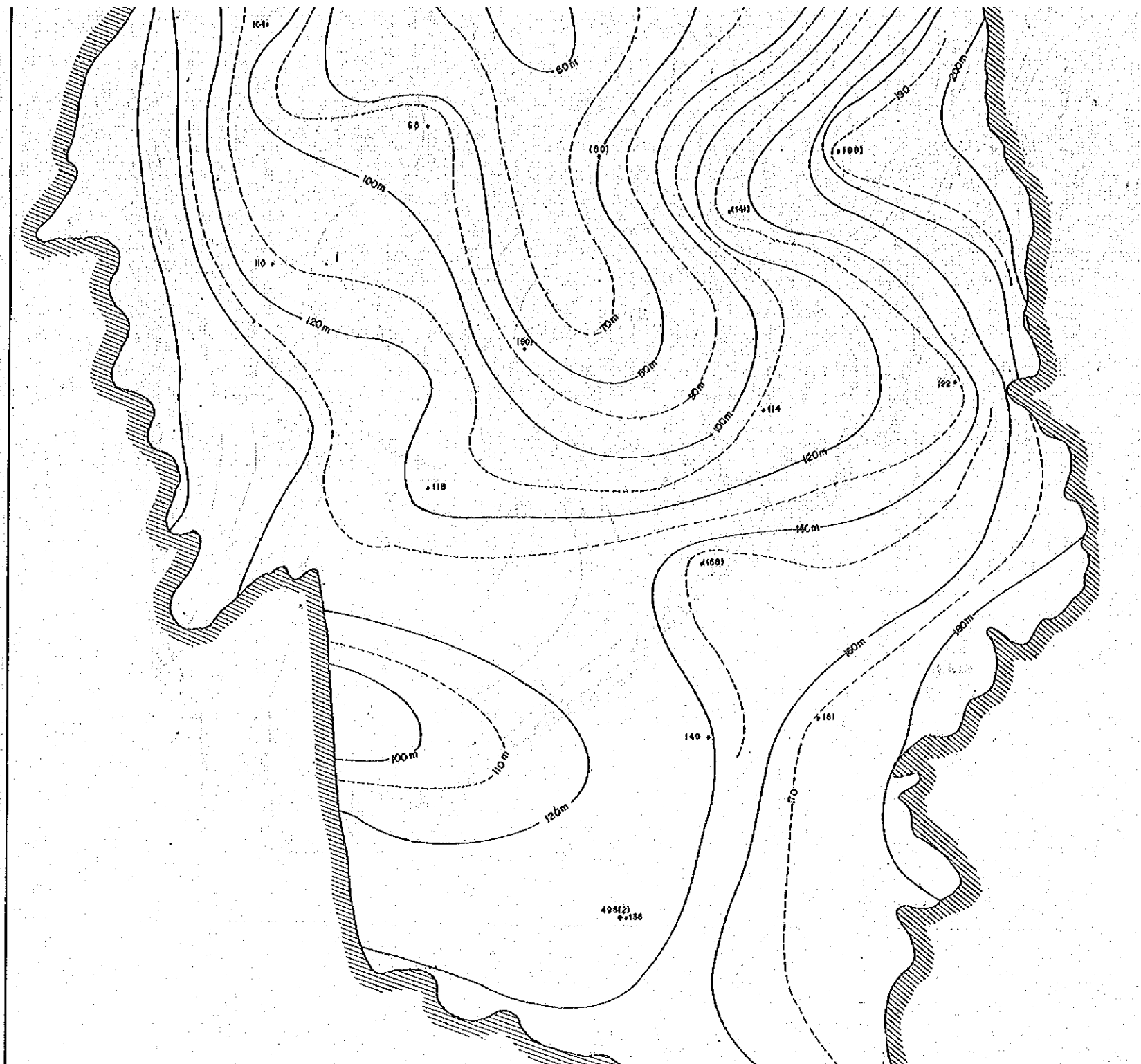


LEGEND


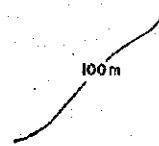


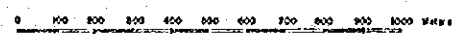
HYDROGEOLOGIC BASEMENT

0 100 200 300 400 500 600 700 800 900 1000 METERS

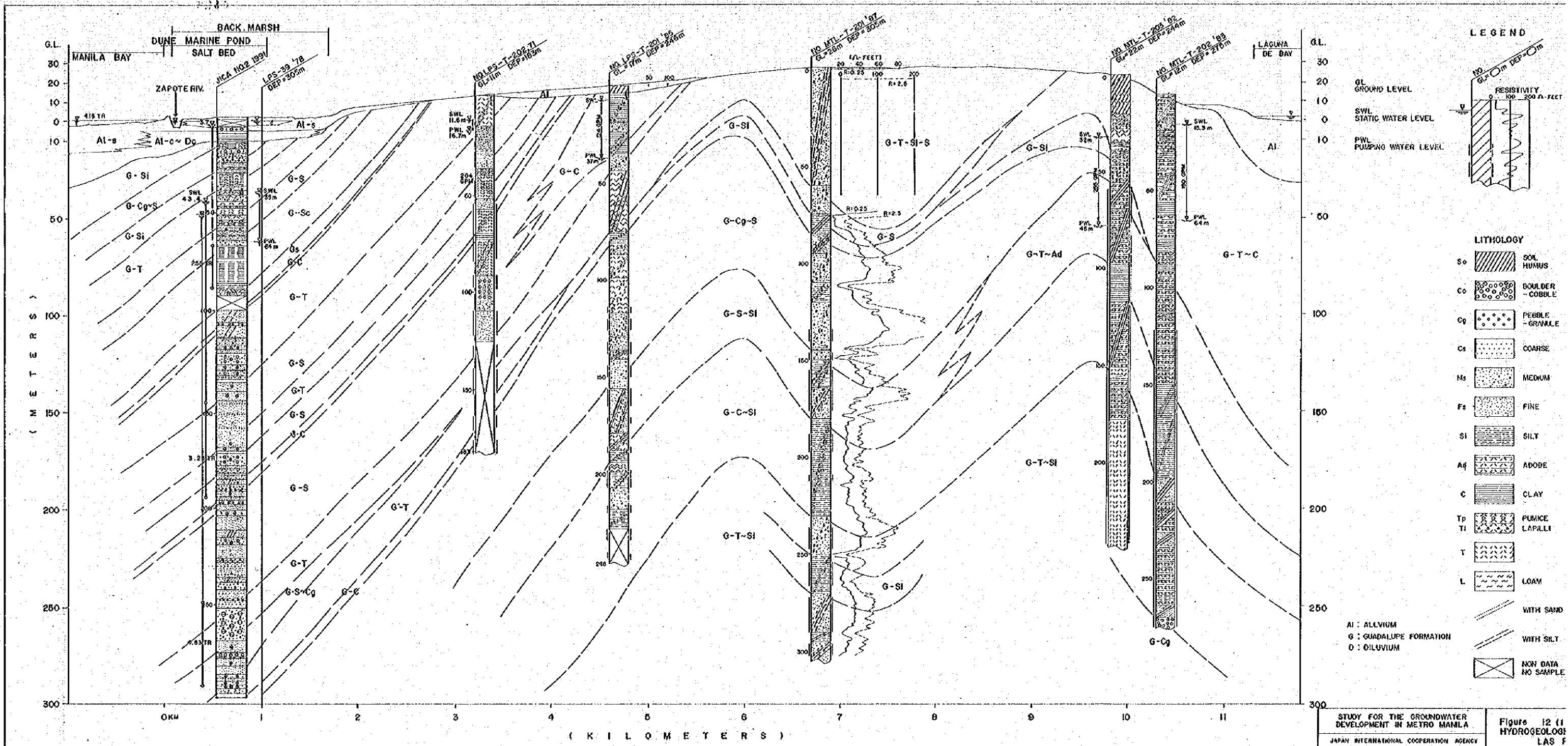


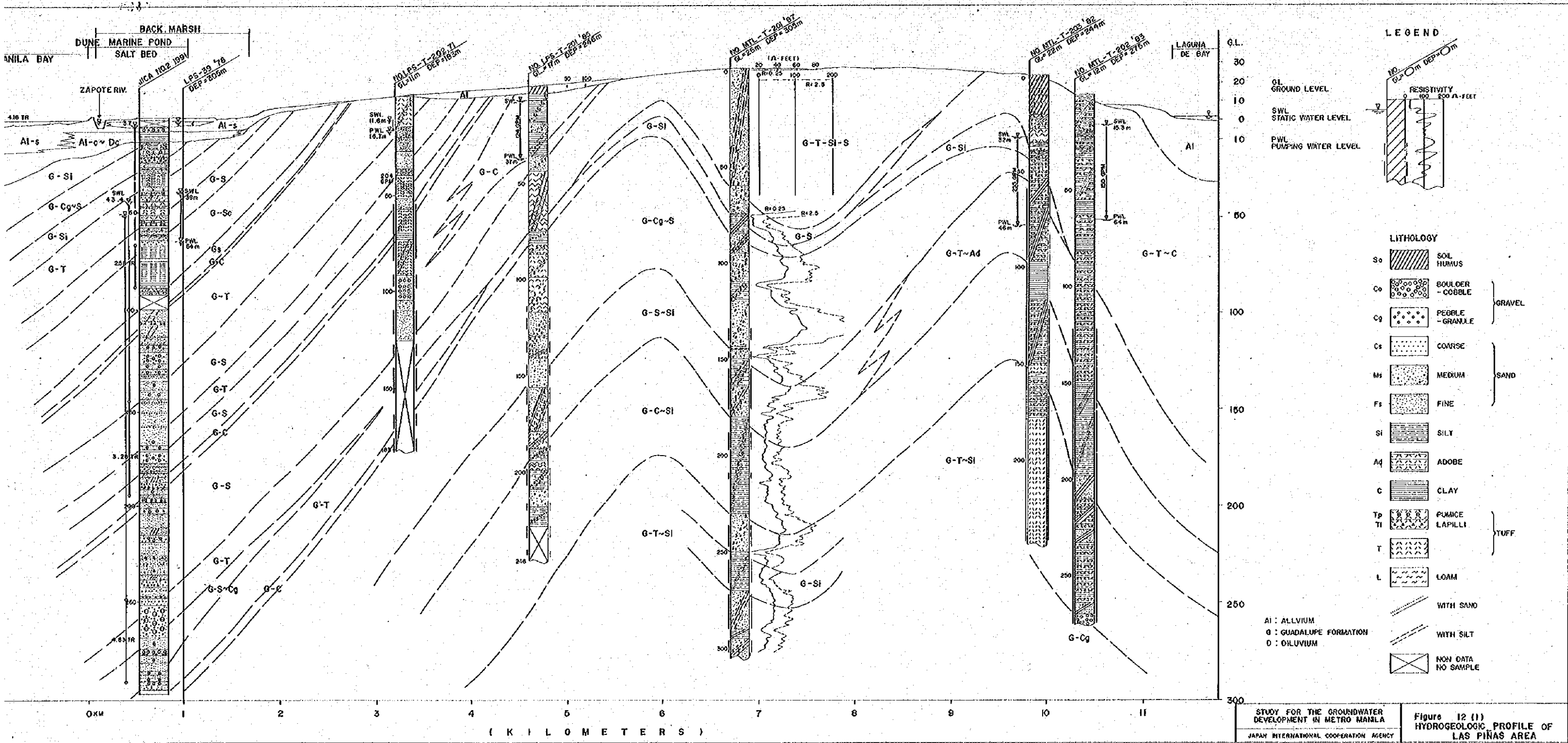
LEGEND

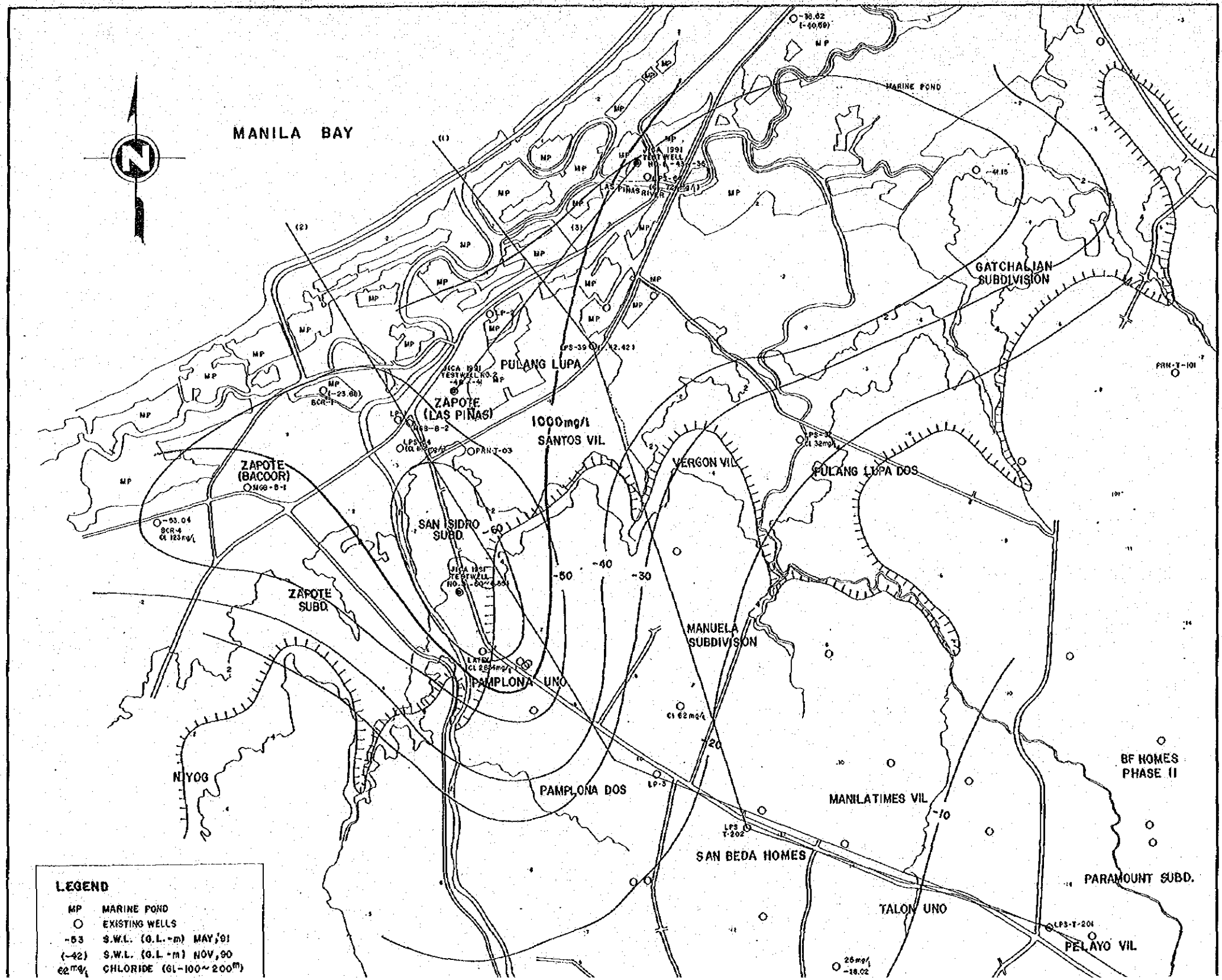
- 
HYDROGEOLOGIC BASEMENT
- 
CONTOUR OF HYDROGEOLOGIC BASEMENT ELEVATION



STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA	Figure 10 HYDROGEOLOGIC BASEMENT MAP OF ANTIPOLO AREA
JAPAN INTERNATIONAL COOPERATION AGENCY	

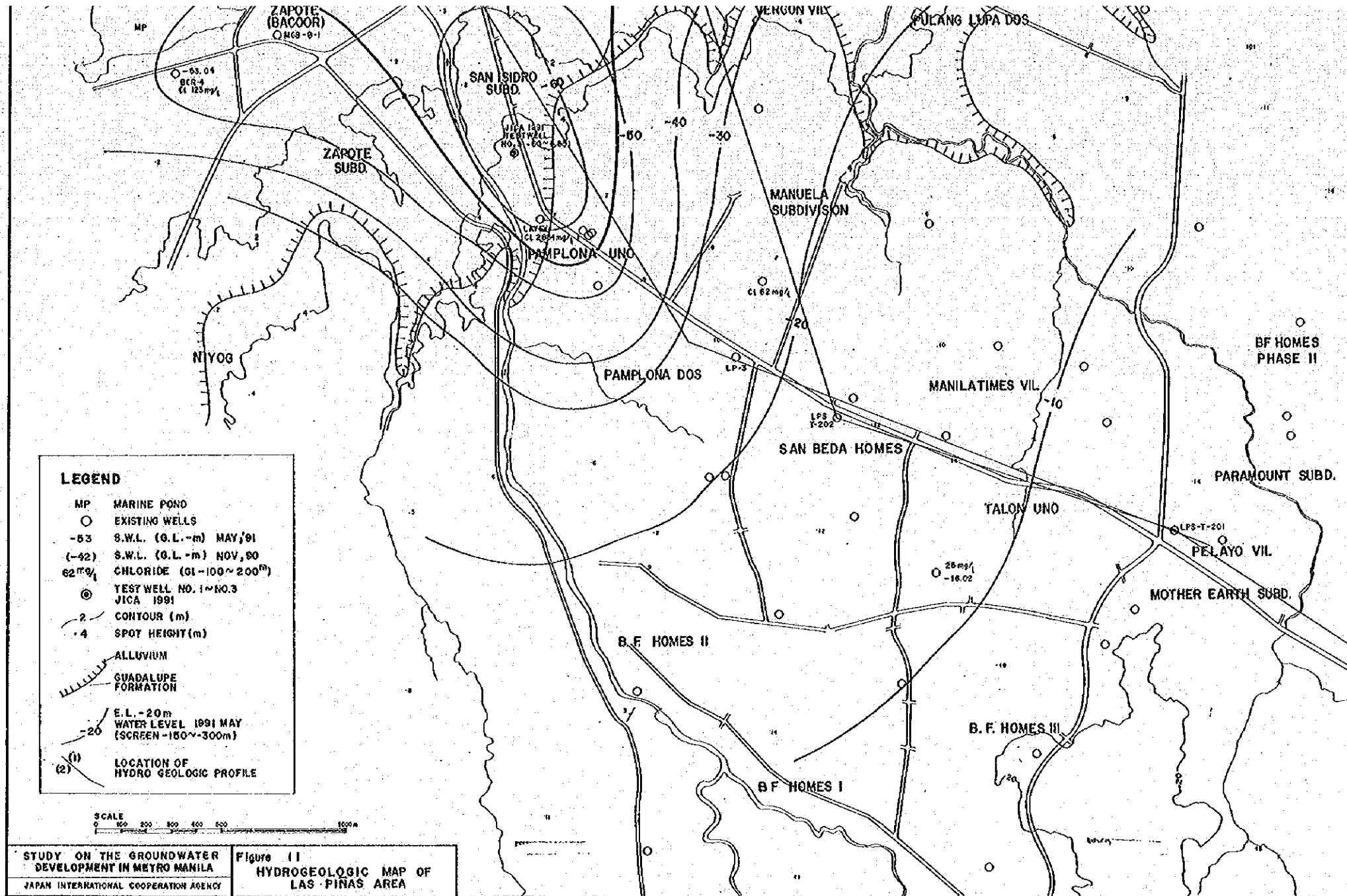






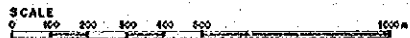
LEGEND

- MP MARINE POND
- EXISTING WELLS
- 53 S.W.L. (G.L. - m) MAY, '91
- (-42) S.W.L. (G.L. - m) NOV, '90
- 62 mg/l CHLORIDE (G.L. - 100 ~ 200 mg/l)



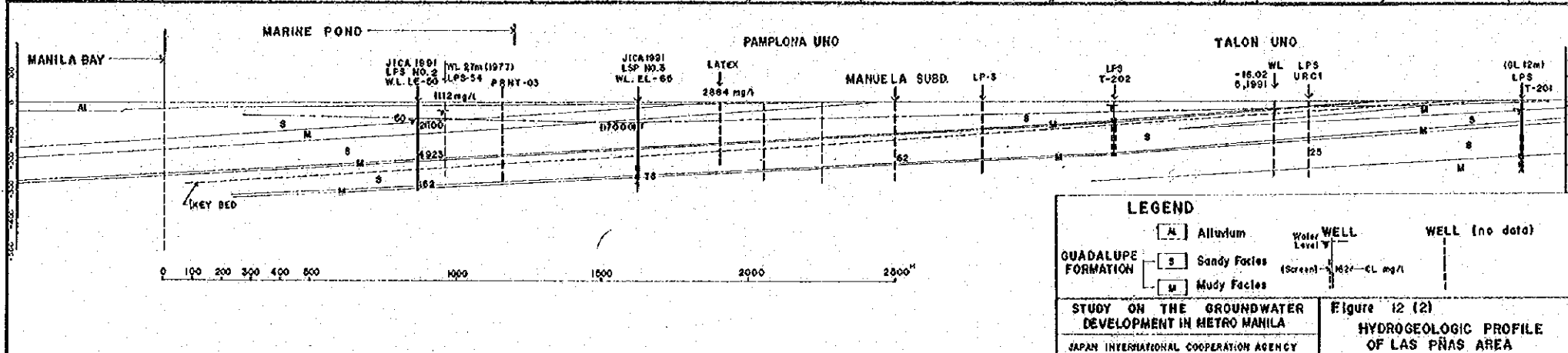
LEGEND

- MP MARINE POND
- EXISTING WELLS
- 53 S.W.L. (G.L. -m) MAY, '91
- (-42) S.W.L. (G.L. -m) NOV, '90
- 62 mg/l CHLORIDE (GL-100~200^{mg})
- ⊙ TEST WELL NO. 1~NO.3 JICA 1991
- 2 — CONTOUR (m)
- 4 SPOT HEIGHT (m)
- ALLUVIUM
- GUADALUPE FORMATION
- E.L. -20m WATER LEVEL 1991 MAY (SCREEN -150~300m)
- (1) LOCATION OF HYDROGEOLOGIC PROFILE
- (2)



STUDY ON THE GROUNDWATER DEVELOPMENT IN METRO MANILA
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Figure 11
 HYDROGEOLOGIC MAP OF LAS PINAS AREA

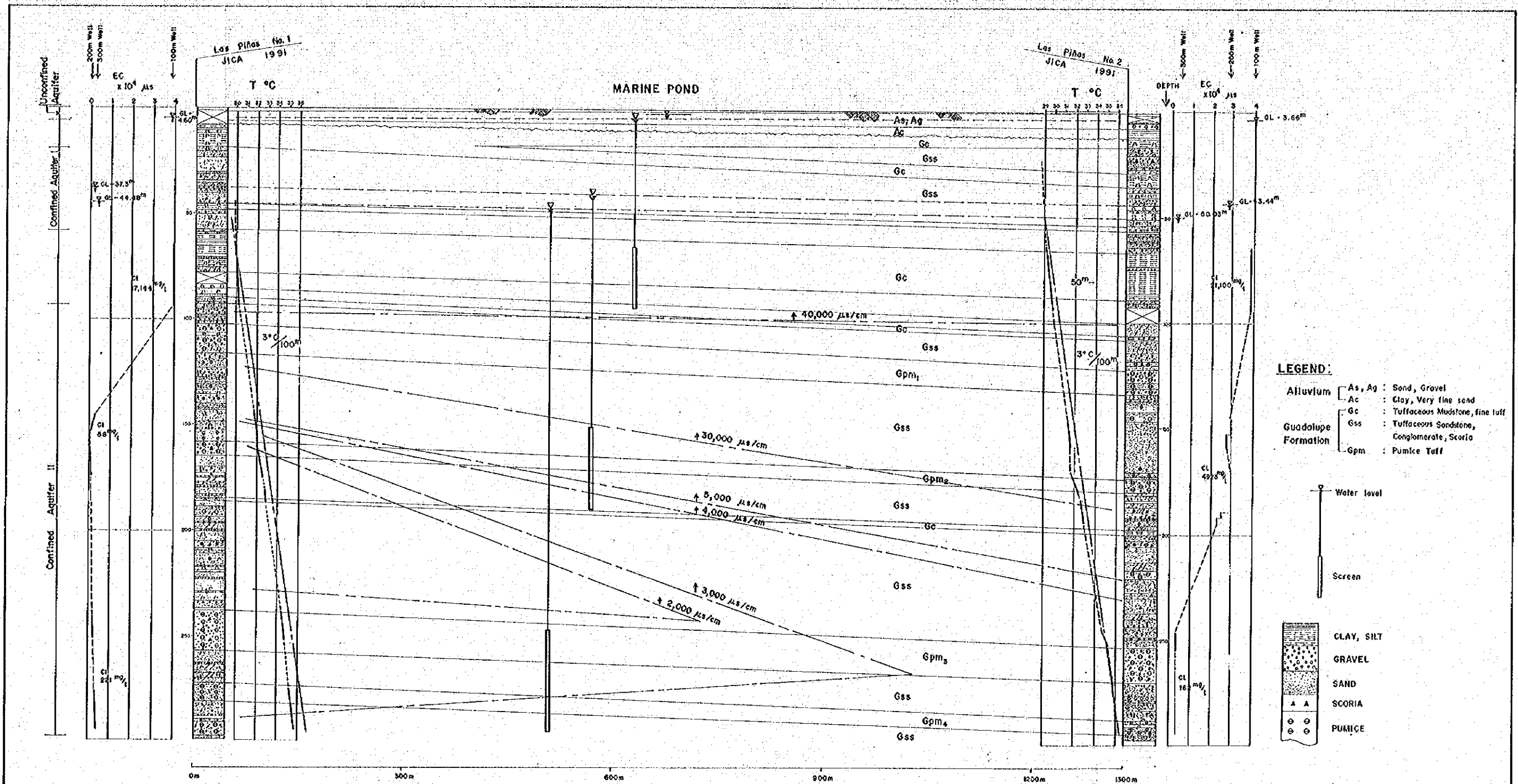


LEGEND

- [A] Alluvium
- [S] Sandy Facies
- [M] Muddy Facies
- Water WELL
- WELL (no data)
- (Screen) -16.02 -EL mg/l

STUDY ON THE GROUNDWATER DEVELOPMENT IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

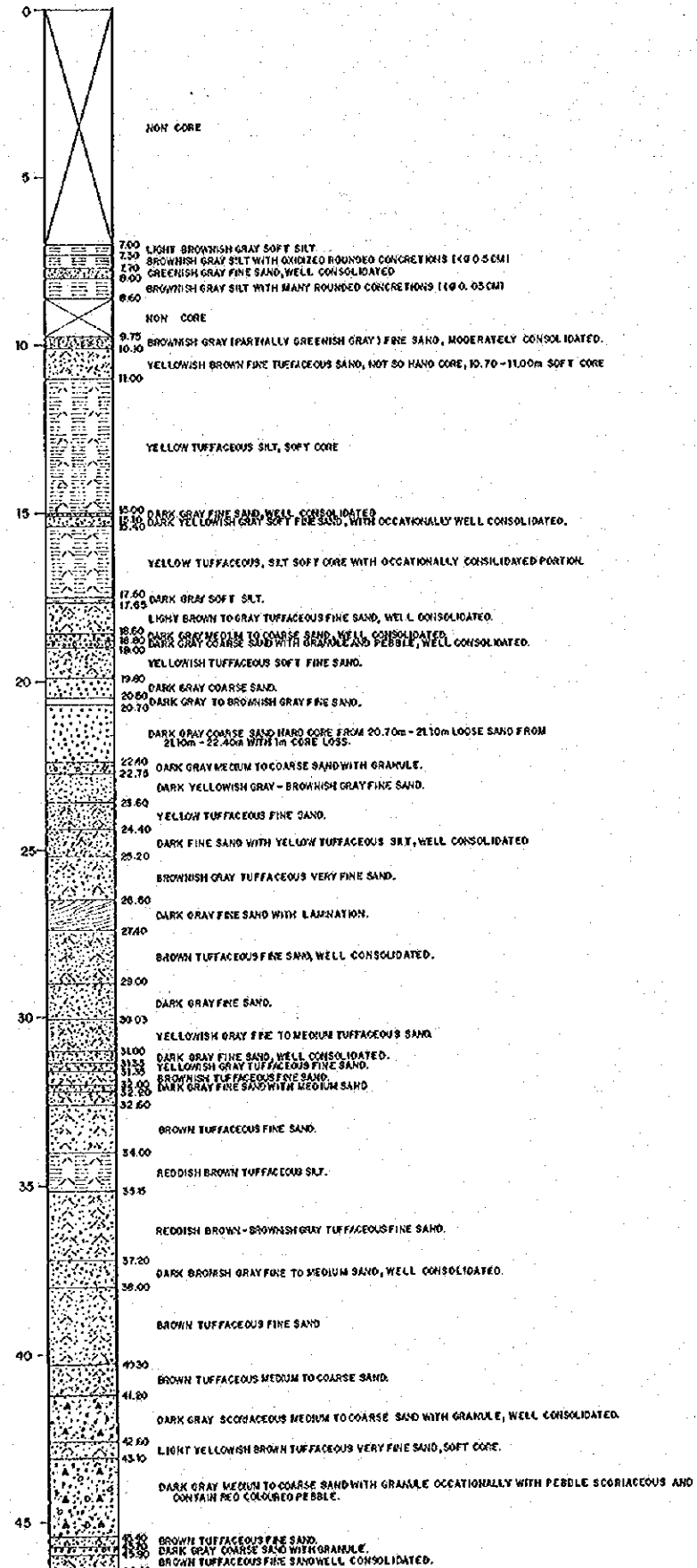
Figure 12 (2)
 HYDROGEOLOGIC PROFILE OF LAS PINAS AREA

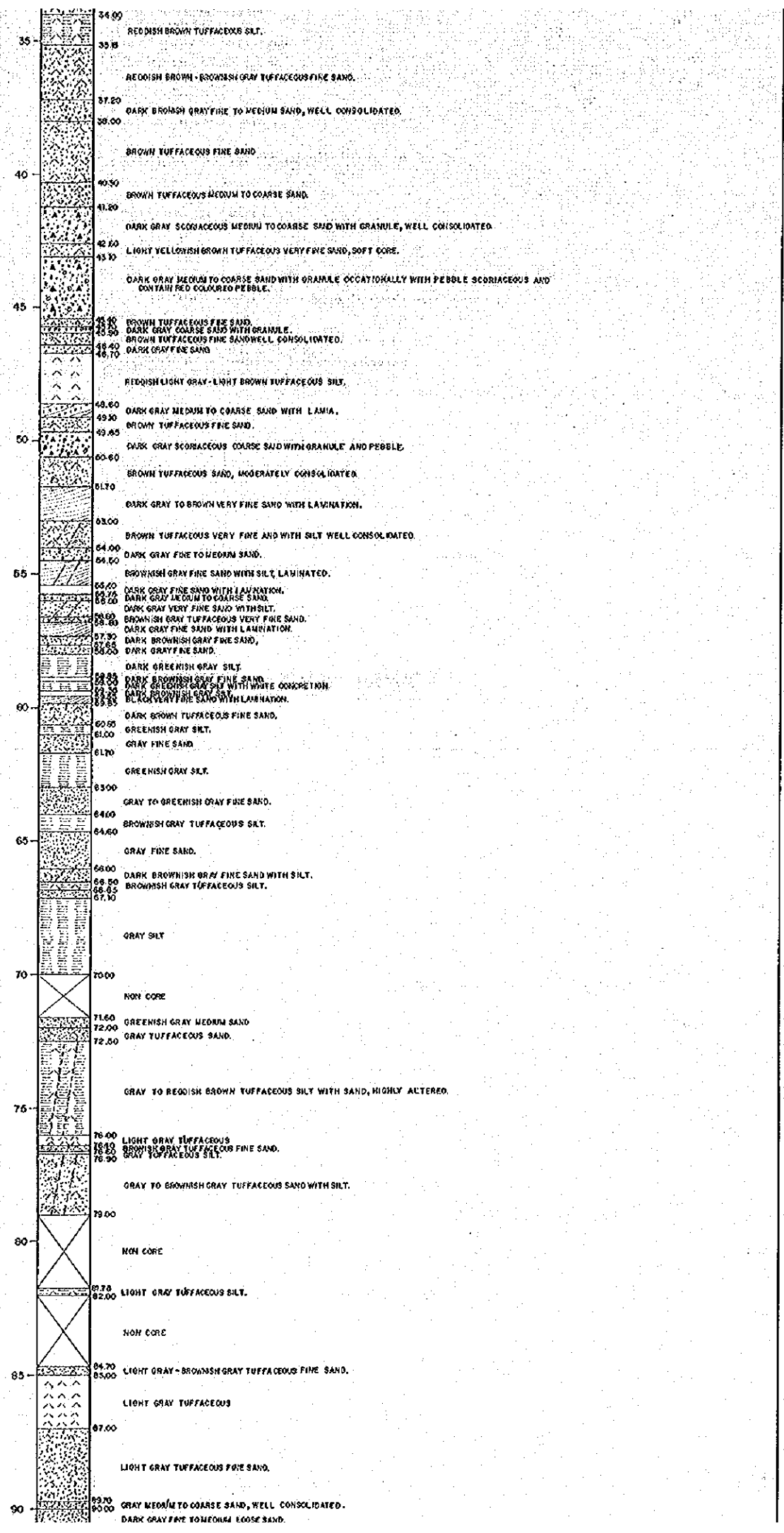


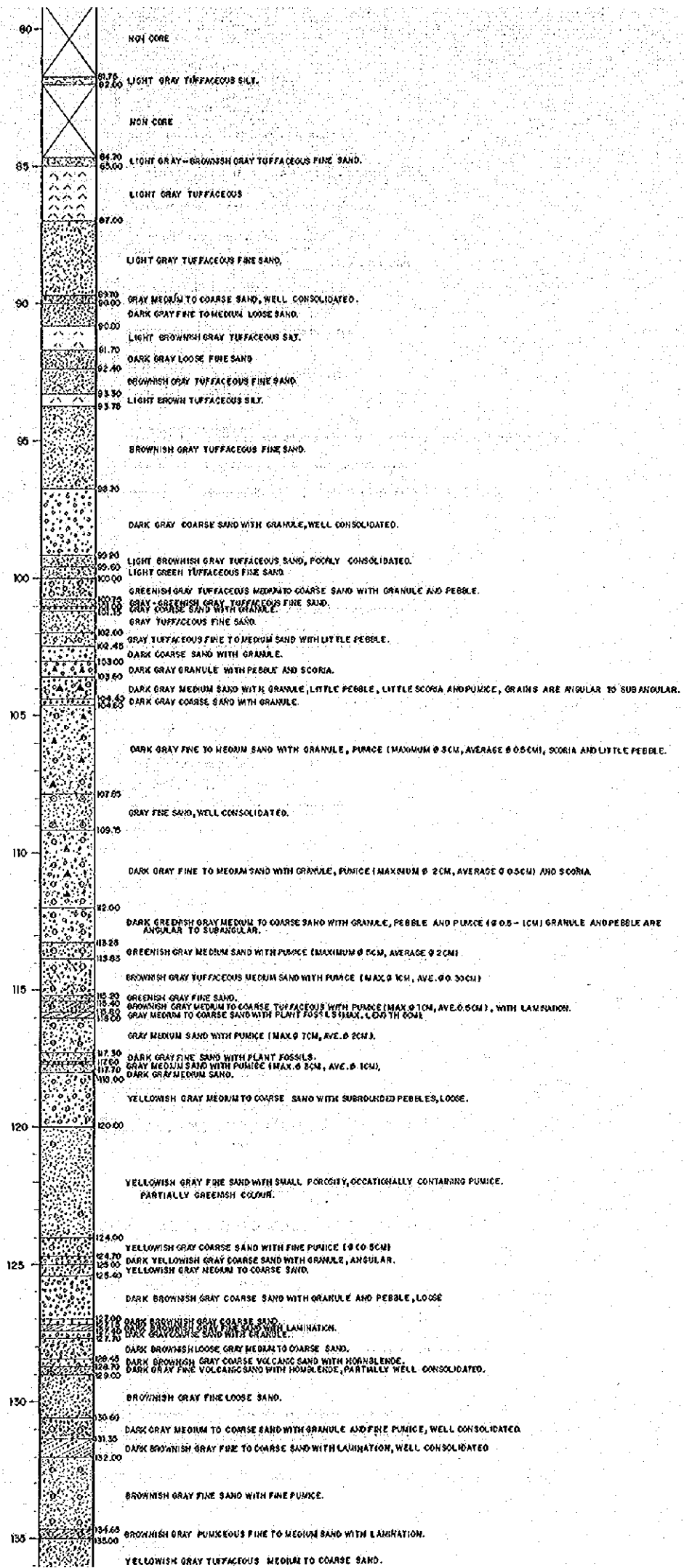
STUDY FOR THE GROUNDWATER DEVELOPMENT IN METRO MANILA
 JAPAN INTERNATIONAL COOPERATION AGENCY

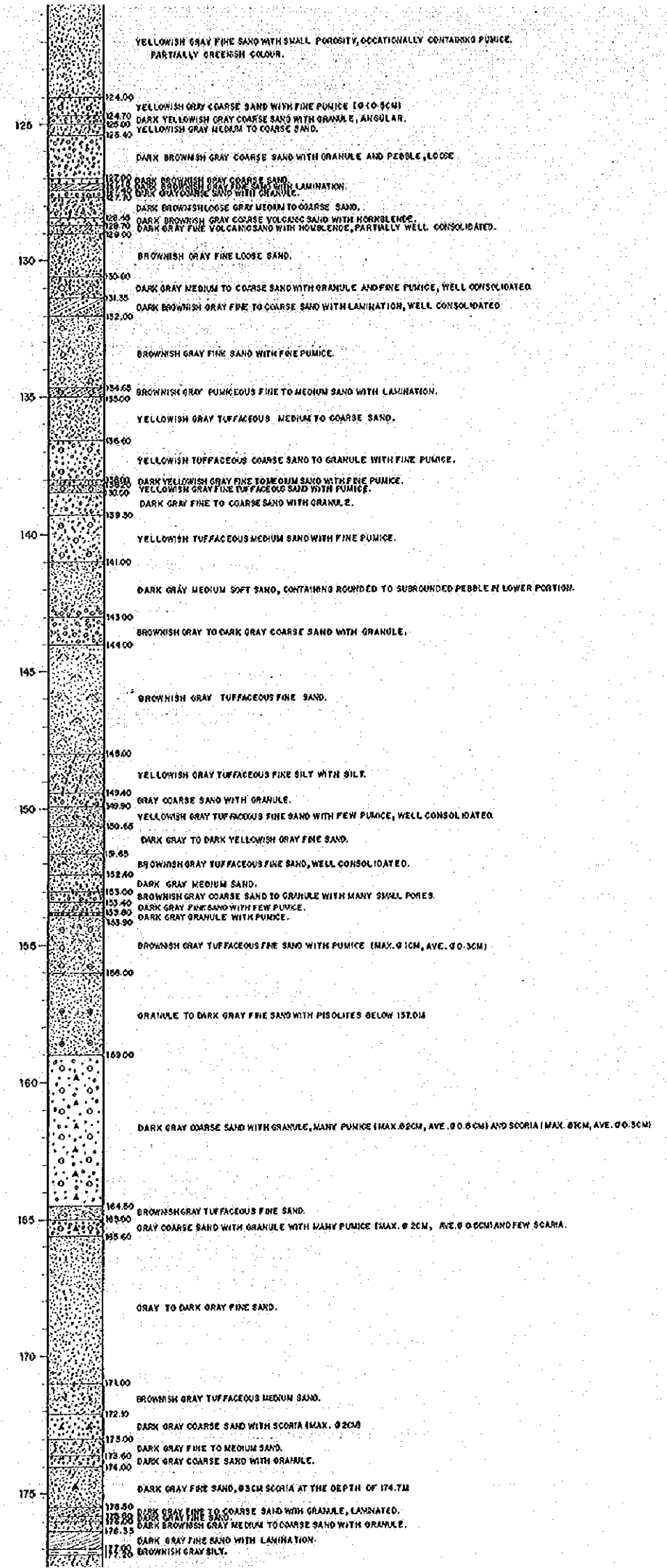
Figure 12 (3)
 HYDROGEOLOGIC PROFILE OF LAS PIÑAS AREA

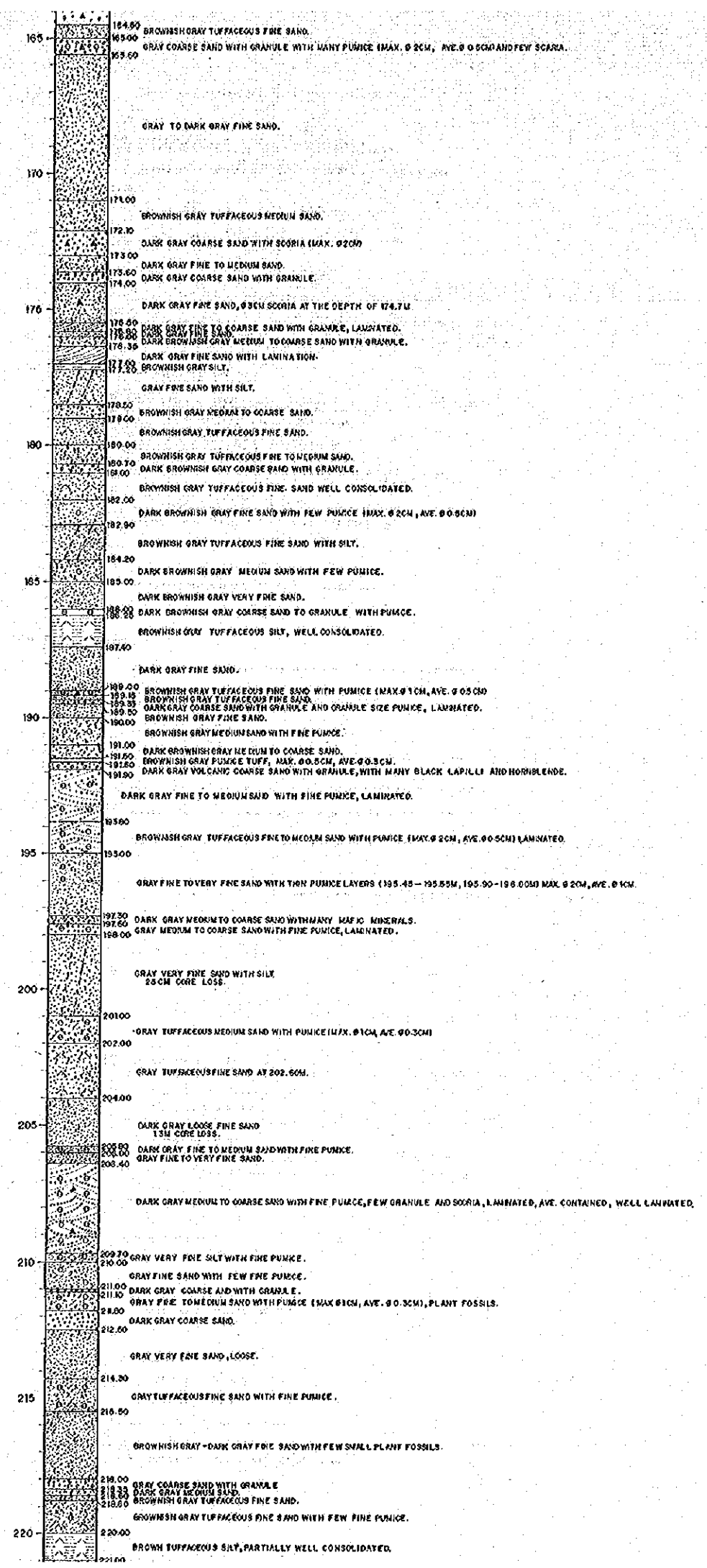
SITE NO. 1 LAS PIÑAS

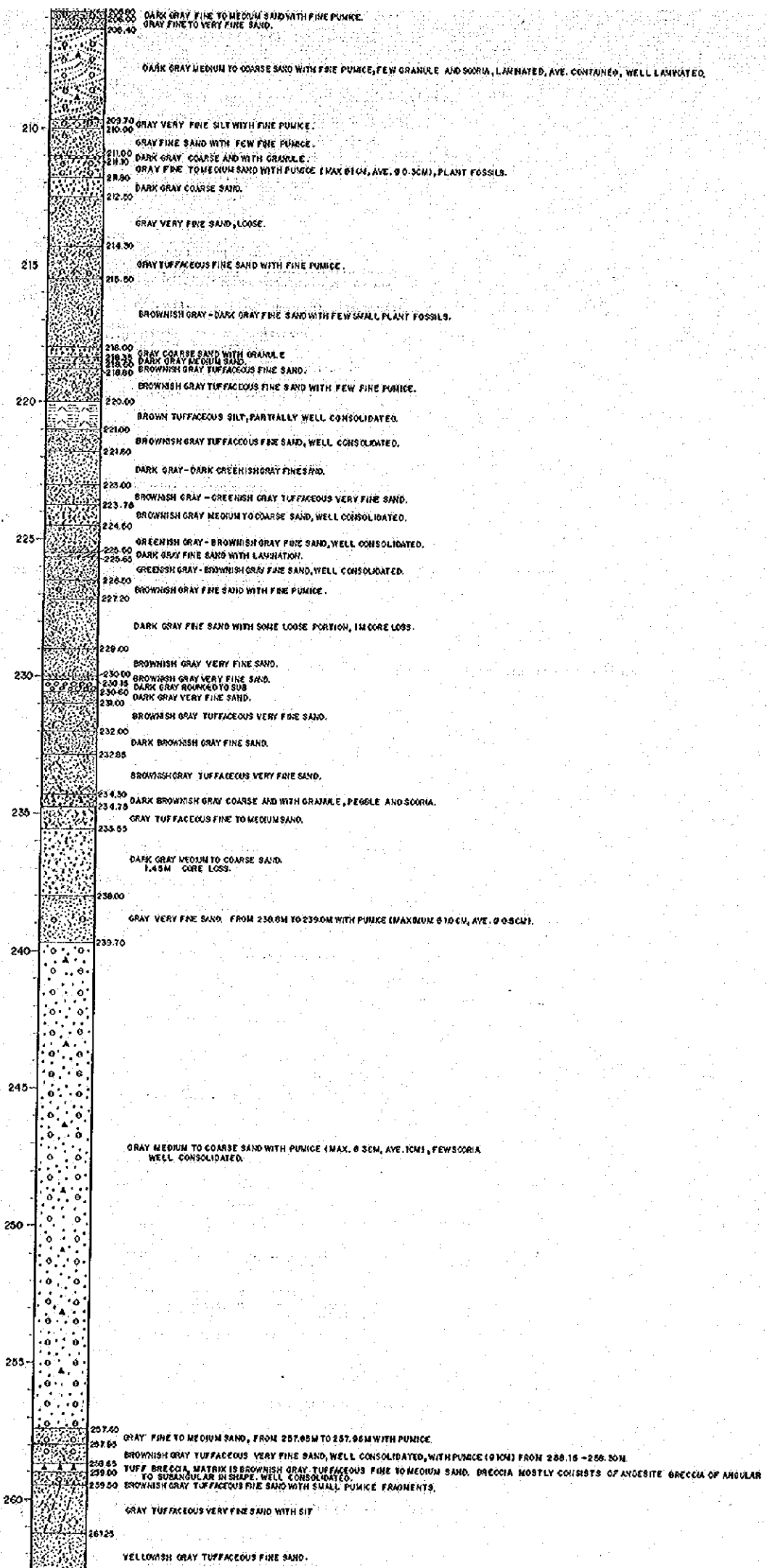


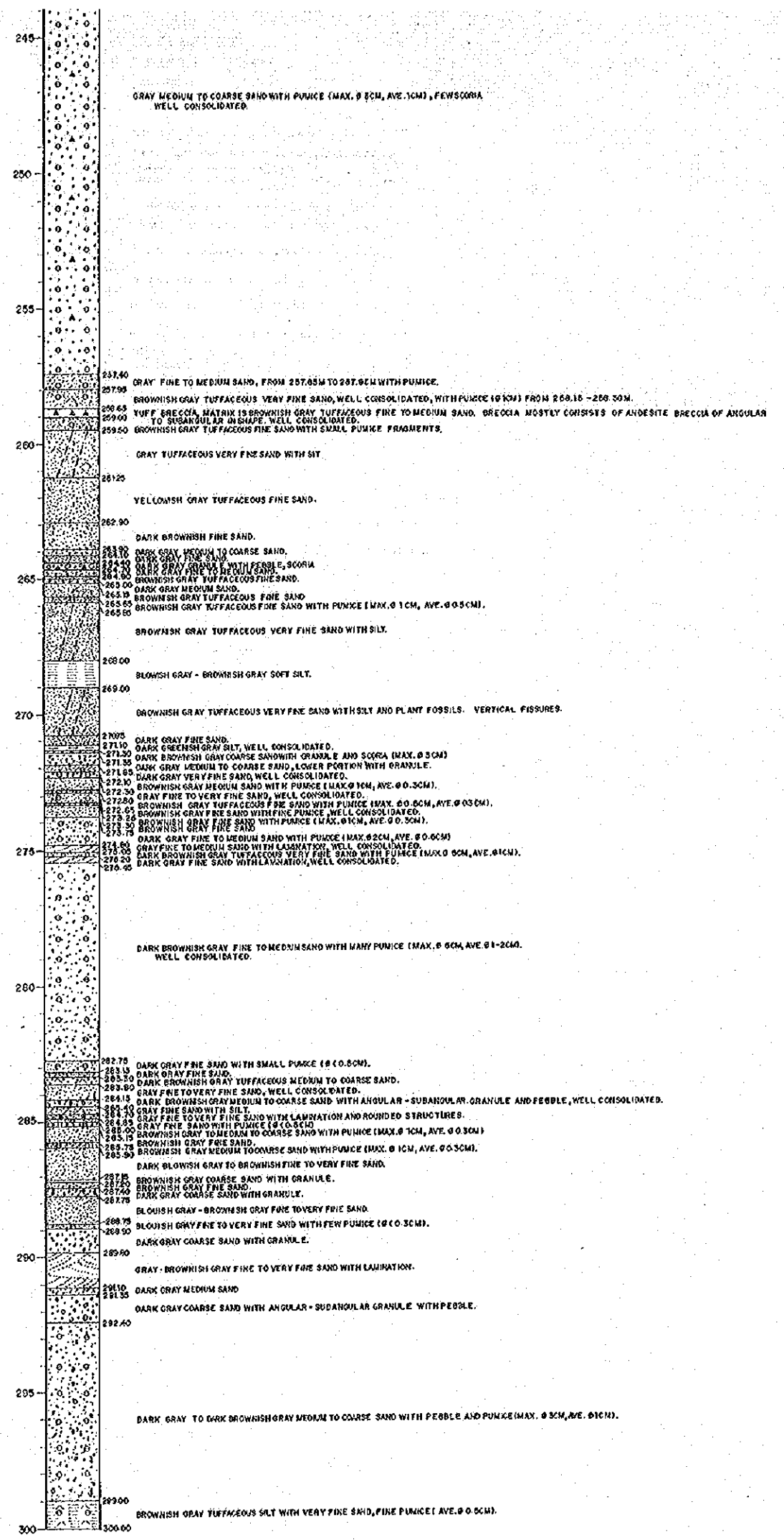




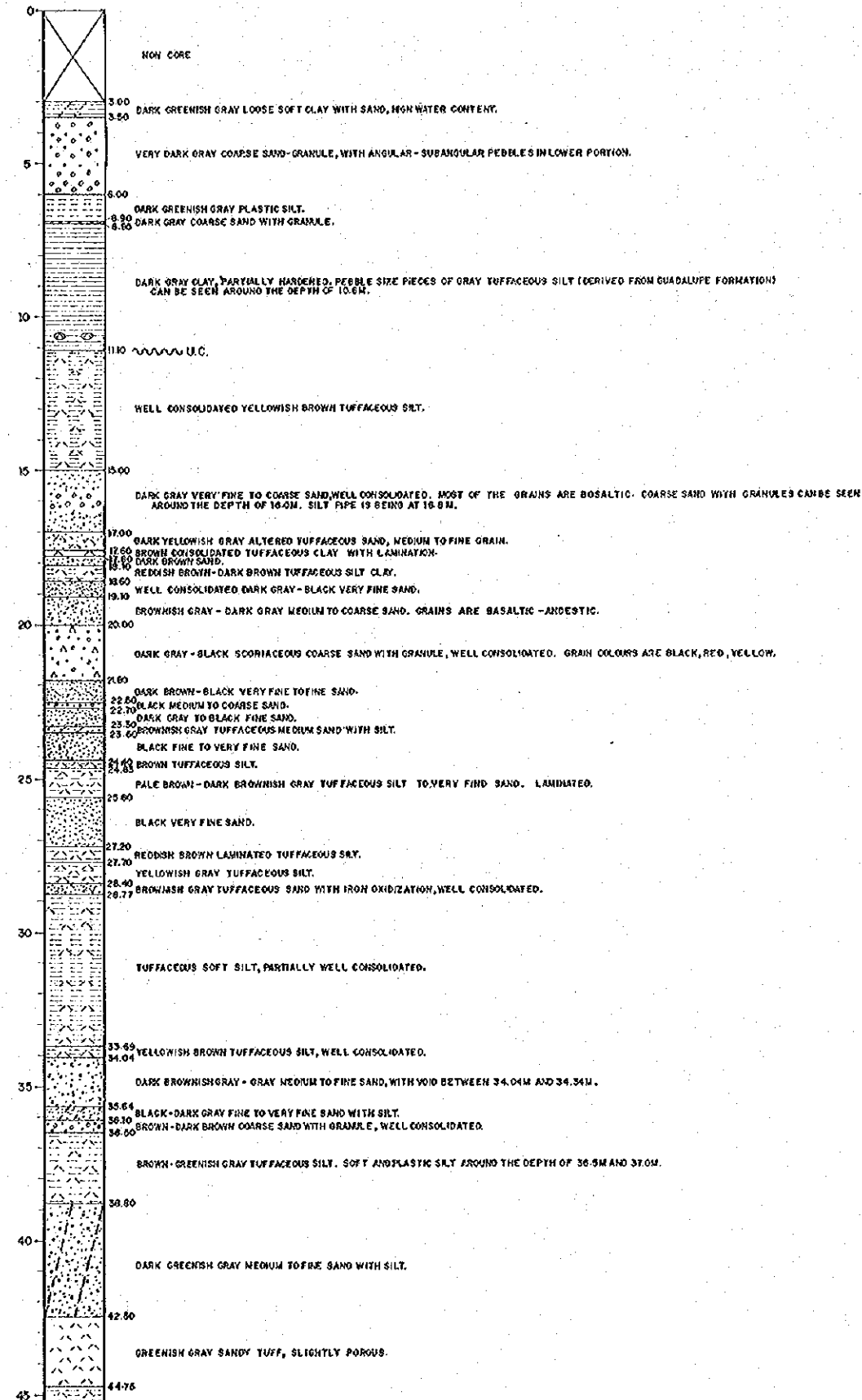


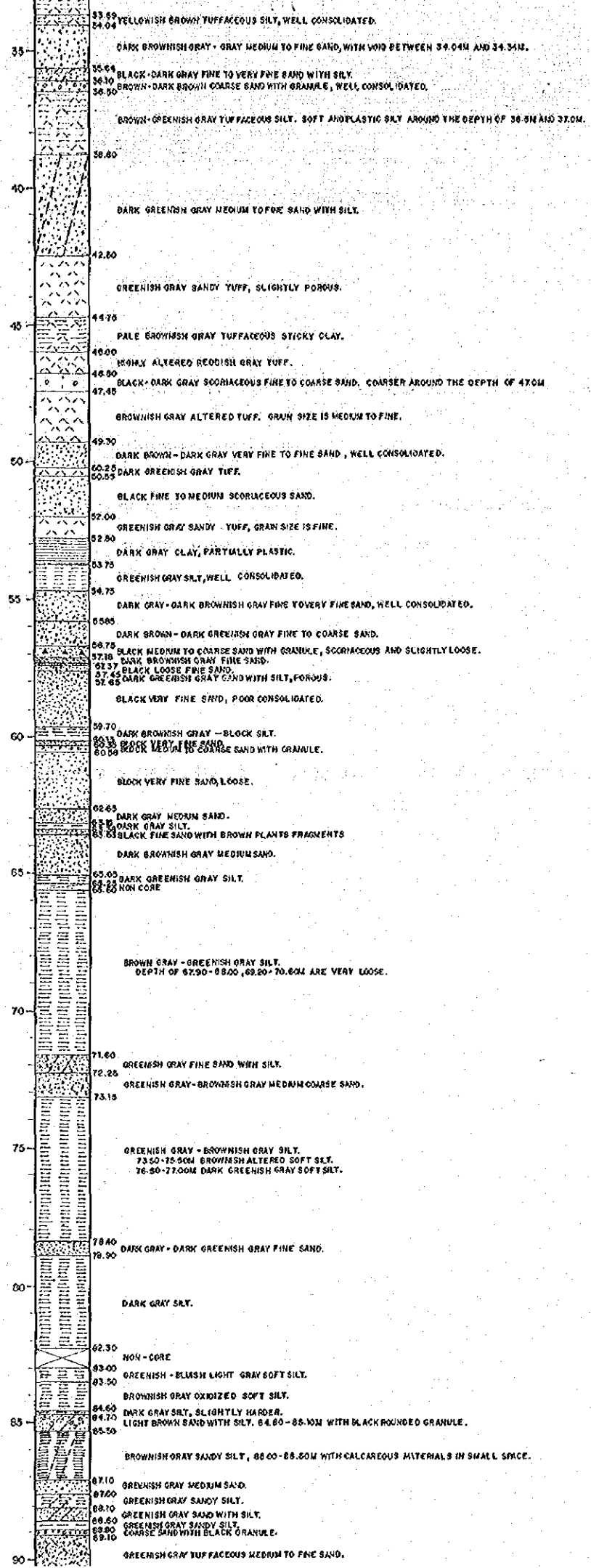


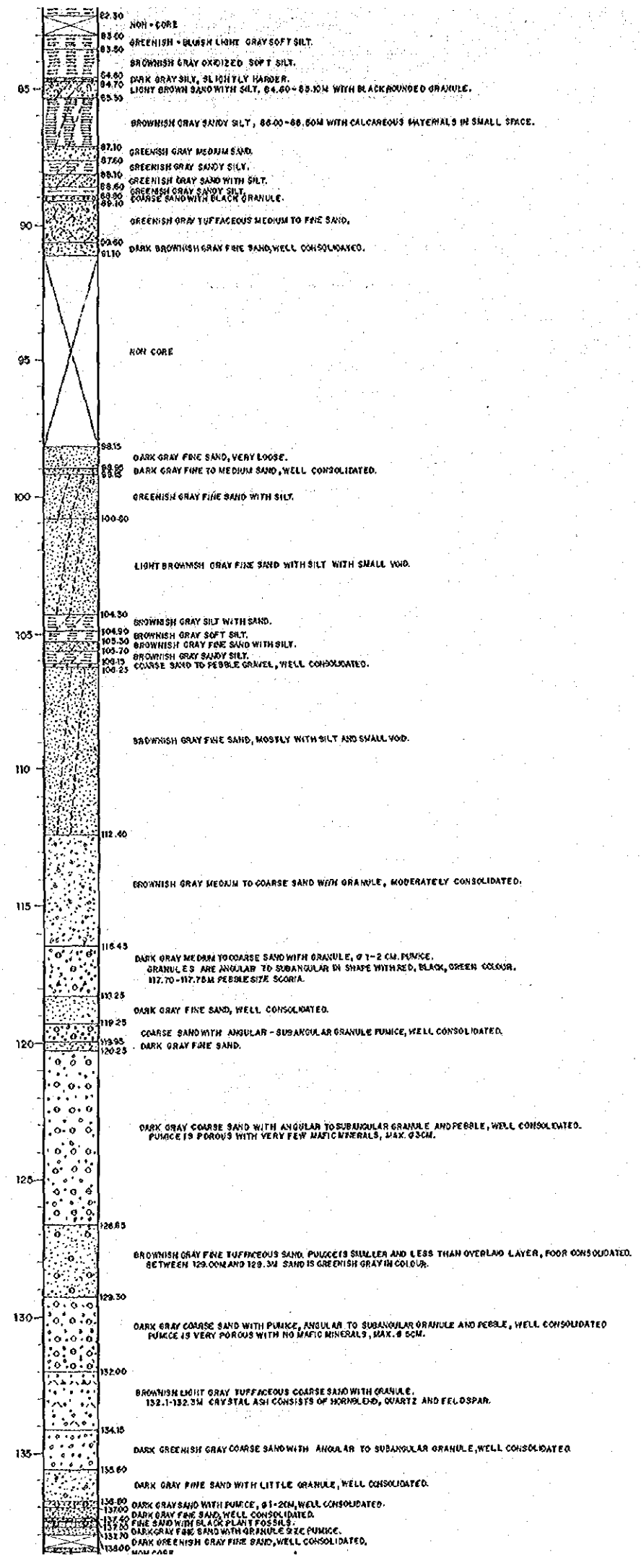


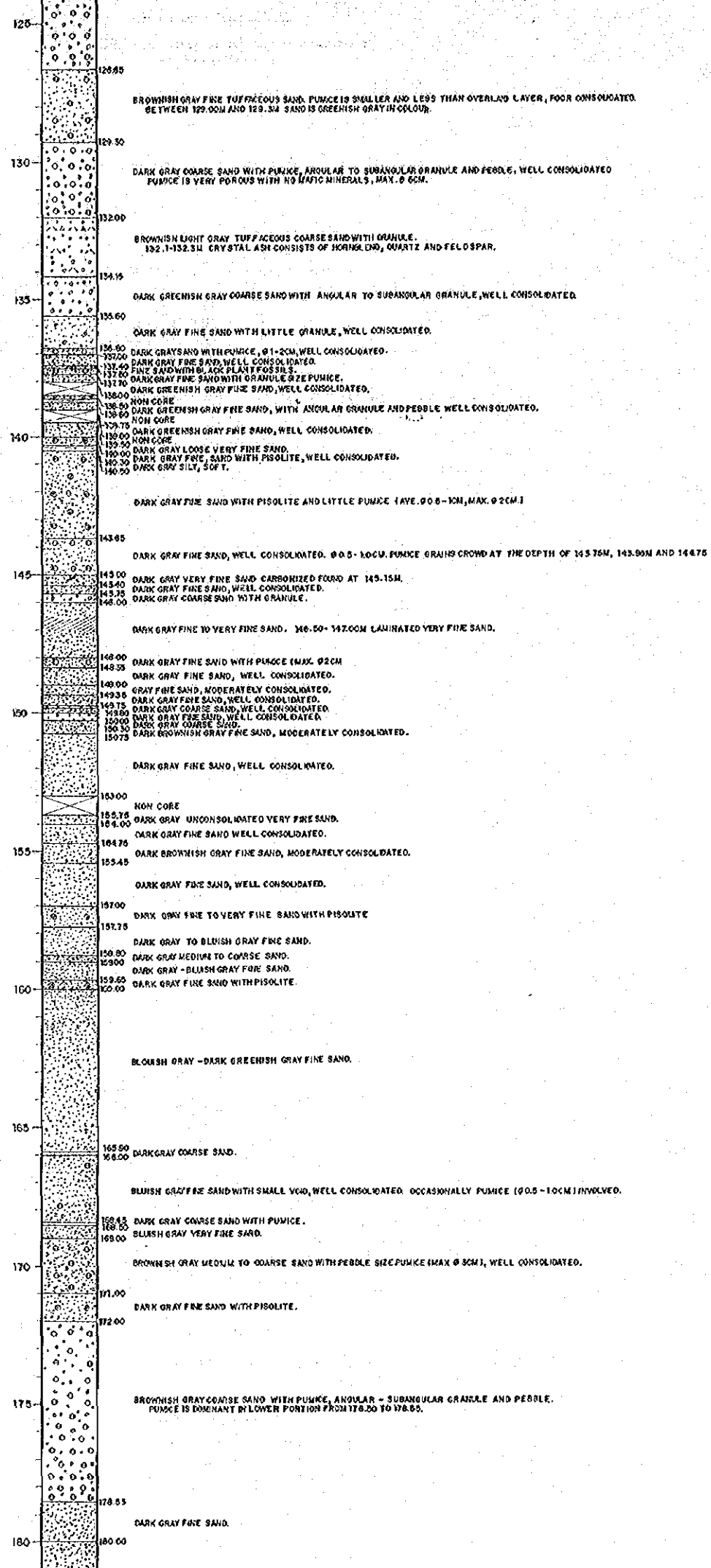


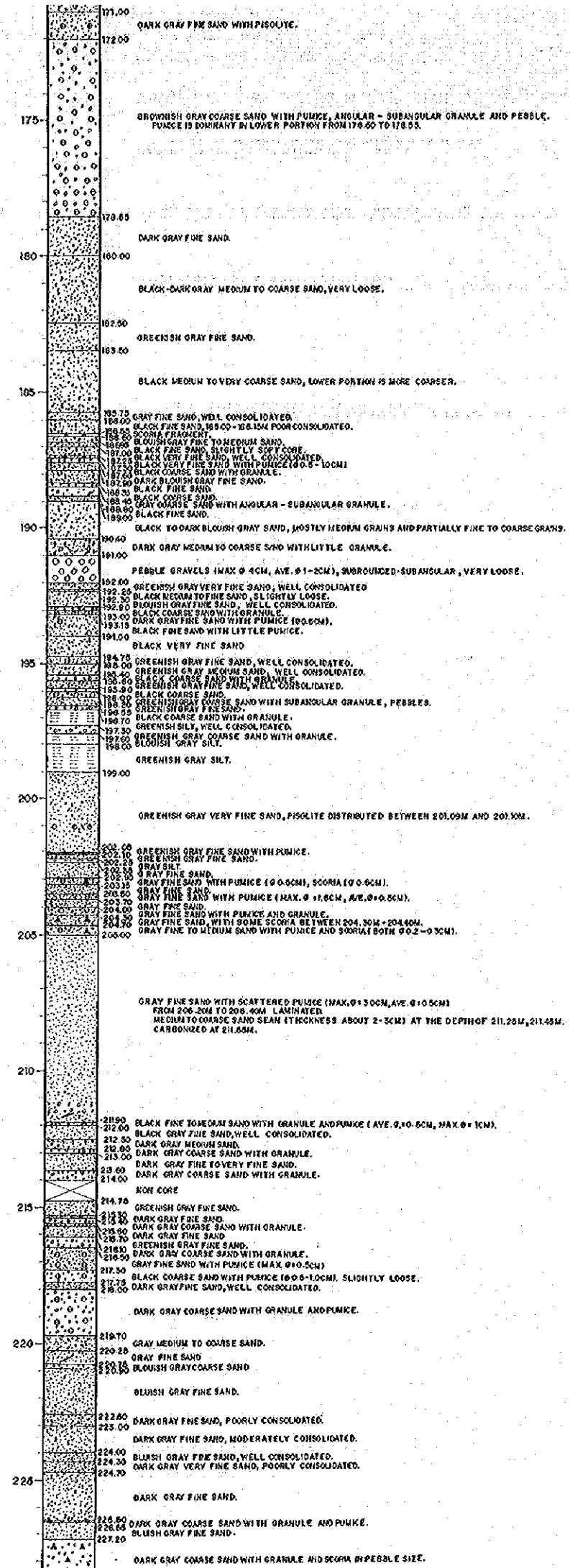
WELL COLUMNAR SECTION AT SITE NO.2 , LAS PINAS (DEPTH= 300M)

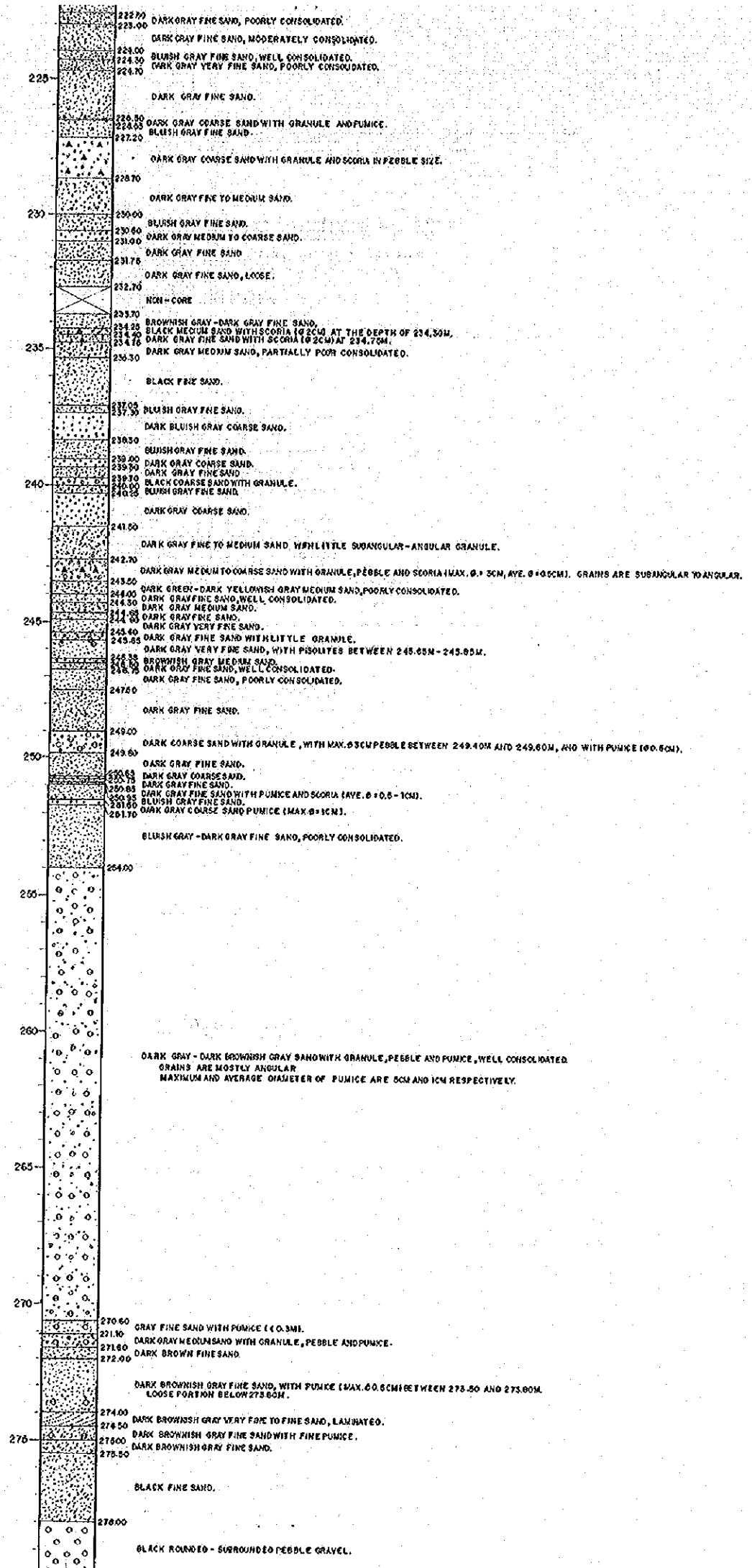


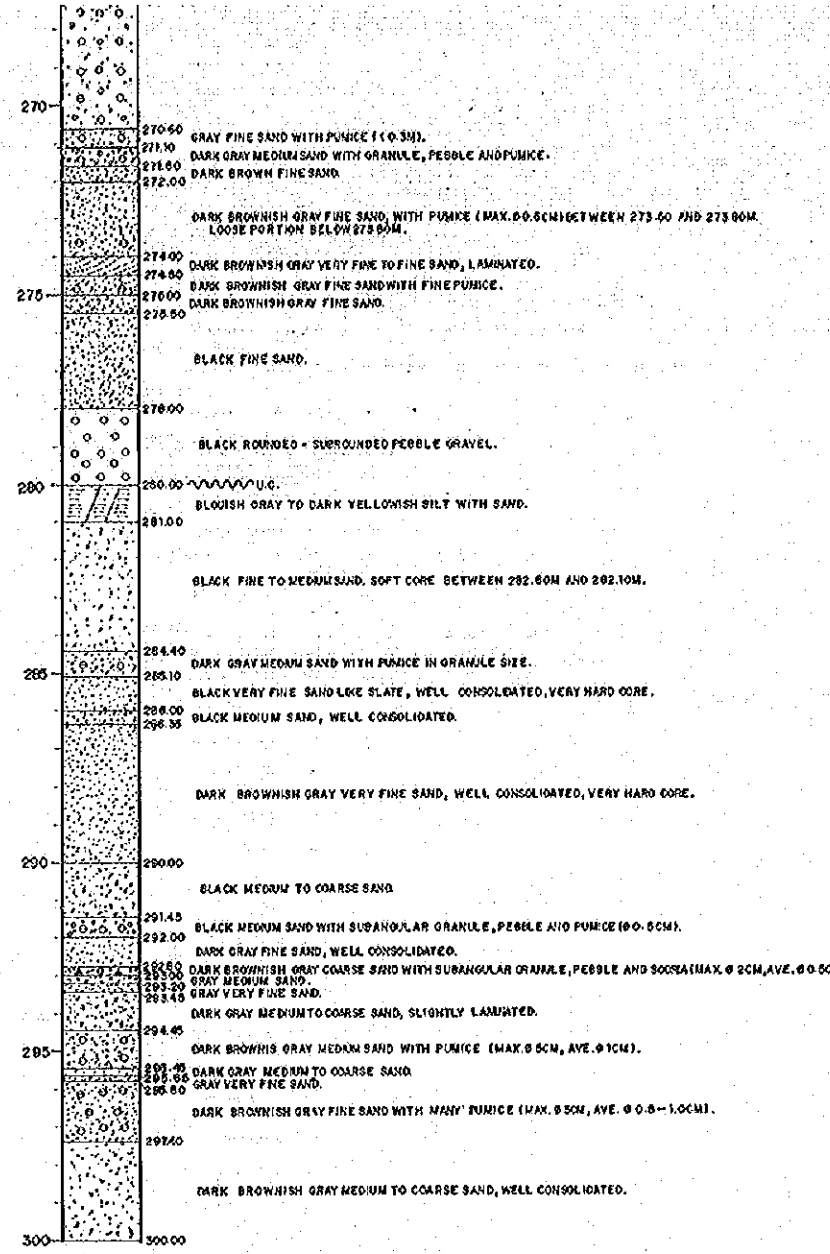












STUDY FOR THE GROUNDWATER DEVELOPMENT IN
 METRO MANILA
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FIGURE 13 (2)
 GEOLOGIC COLUMNAR SECTIONS OF LAS PIÑAS NO. 2

JICA