


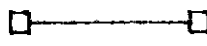
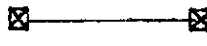
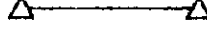
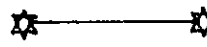





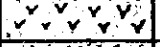

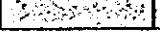


Geological Age	Formation	Acronym of map	Symbol	Rock Facies	DMR geological map
Holocene	Alluvial deposit	Qa		River gravel, Sand and Clay	Qa
	Flood plain deposit	Qf		Unconsolidated Sand, Silt and Gravel	Qf
Pleistocene	Terrace deposit	Qt		Unconsolidated red soil, Sand, Silt and Gravel	Qt
Tertiary	Huai Sico	Ths		Semiconsolidated clay, Silt with Sandstone	ng
Jurassic	Mae Tam	Jmt		Shale, Sandstone	ms5
	ms 5-3	ms5-3		Tuff, Shale and Sandstone	ms5-3
	Phu Kham	Jpk		Quartzitic sandstone, Shale	ms4
	ms 3-5	ms3-5		Sandstone, Shale, Tuff	ms3-5
	Na Ngan	Jnn		Sandstone, Shale, Conglomerate	ms3
	ms 3	ms3		Conglomerate, Sandstone	ms1
Middle-Upper	Doi Pong Nok	TRpn		Sandstone, Shale, Tuff and Lapilly Tuff	ms1
Triassic	Pa Lac	TRpl		Limestone	h,p2-1
	Huai Fak	TRhf		Sandstone, Tuff interbedded with Shale	t-p
Triassic-Permian	PTR	PTR		Sandstone, Shale and Tuff	t-p
Permian	P3	P3		Sandstone, Shale, Slate, Tuff and Limestone	t-p
	P2	P2		Limestone	p2-1
Permian-Carboniferous	Huai Krai	CPhk		Metasandstone interbedded with Slate	p-h
	Nam Bong	CPnb		Slate, Quartzitic interbedded with Sandstone foliated	p-h
	Doi Mun	CPdm		Schist, Phyllite, Slate interbedded with Metasandstone	p-h

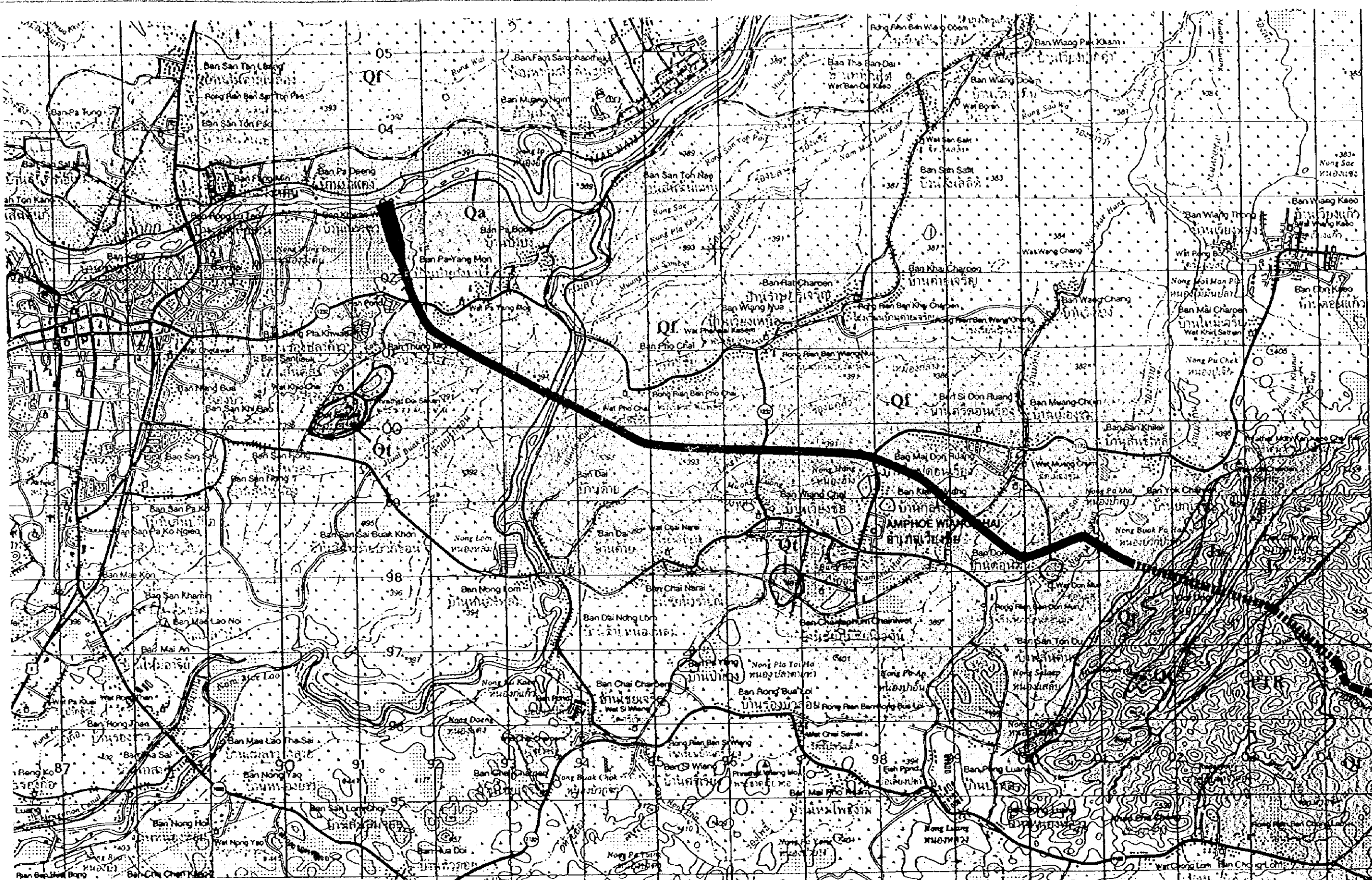
### Legend

	Tunnel alignment
	Canal alignment
	Borehole location
	Refraction survey
	Reflection survey
	TMB (Time domain electromagnetic survey for shallow portion)
	TDEM (Time domain electromagnetic survey for deep portion)
	PS (Point sounding)
	Fault line (presumed)

### Igneous Rocks

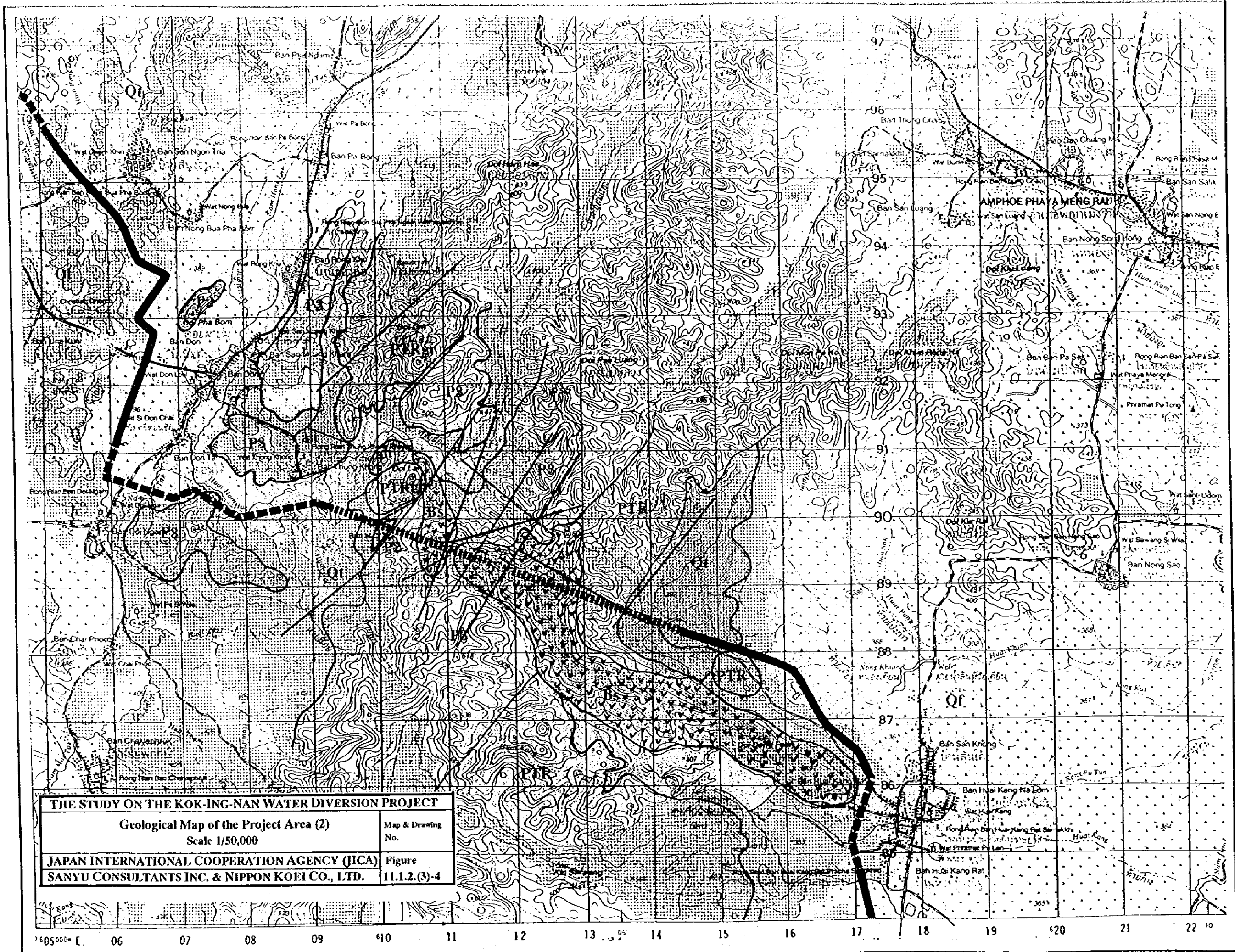
Tertiary	Basalt	Bs		Basalt	B-ng
Jurassic	Tuff	Jv,ms <sub>v</sub>		Rhyolite, Tuff	Lms2
	Andesite	an		Andesite	Ltp
Triassic-Permian	ms2	ms2		Conglomerate, Andesite and Rhyolitic tuff	ms2
	PTRv	PTRv		Andesite, Rhyolite, Dacite, Tuff and Agglomerate	Lms2
	Granite	PTRgr		Granite, Porphyry, Granite porphyry, Granodiorite porphyry	G1

THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT	
Legend of Geological Map	Map & Drawing No.
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	Figure 11.1.2.(3)-2



**THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT**

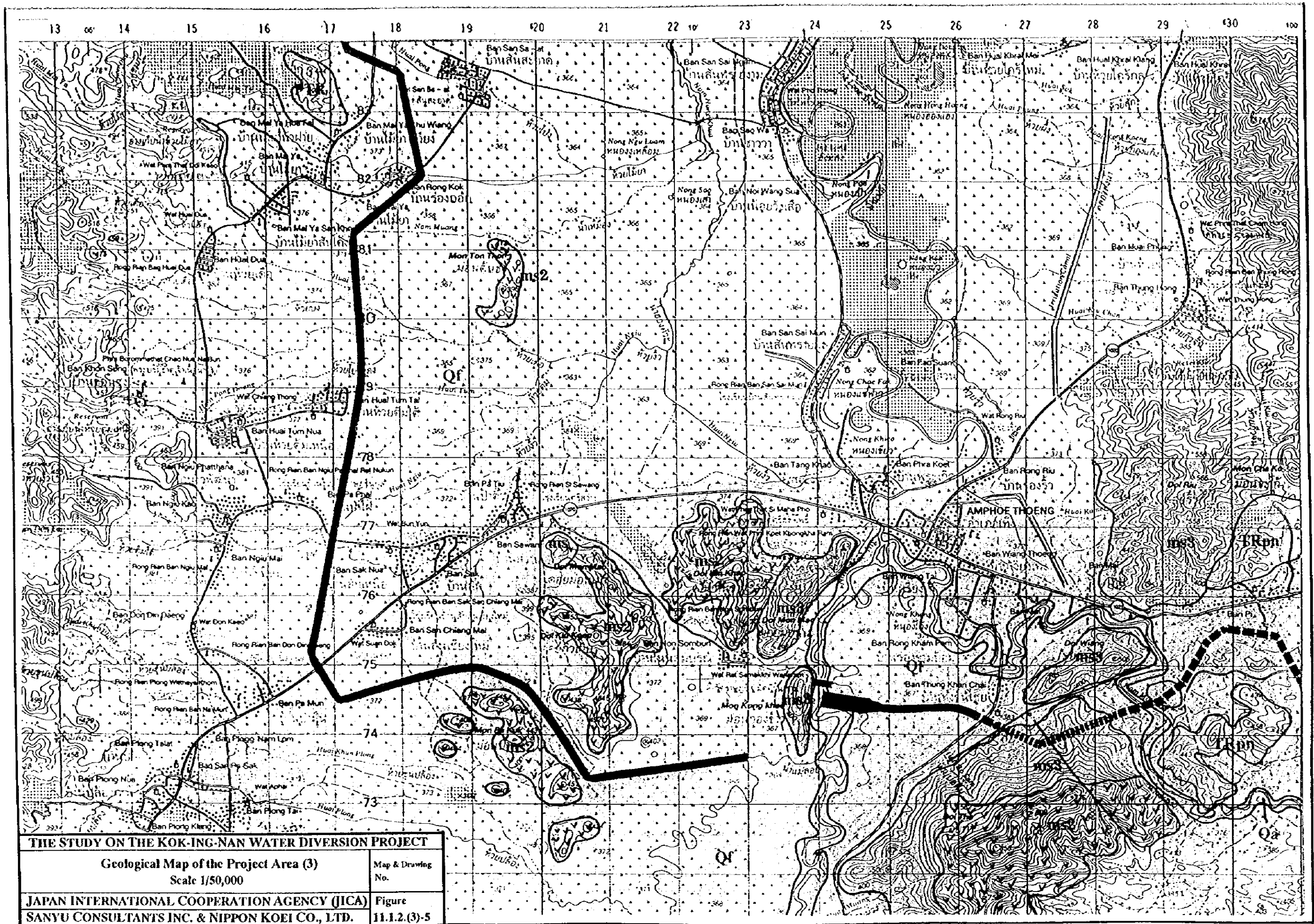
Geological Map of the Project Area (I)		Map & Drawing No.
Scale 1/50,000		
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)		Figure 11.1.2.(3)-3
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.		



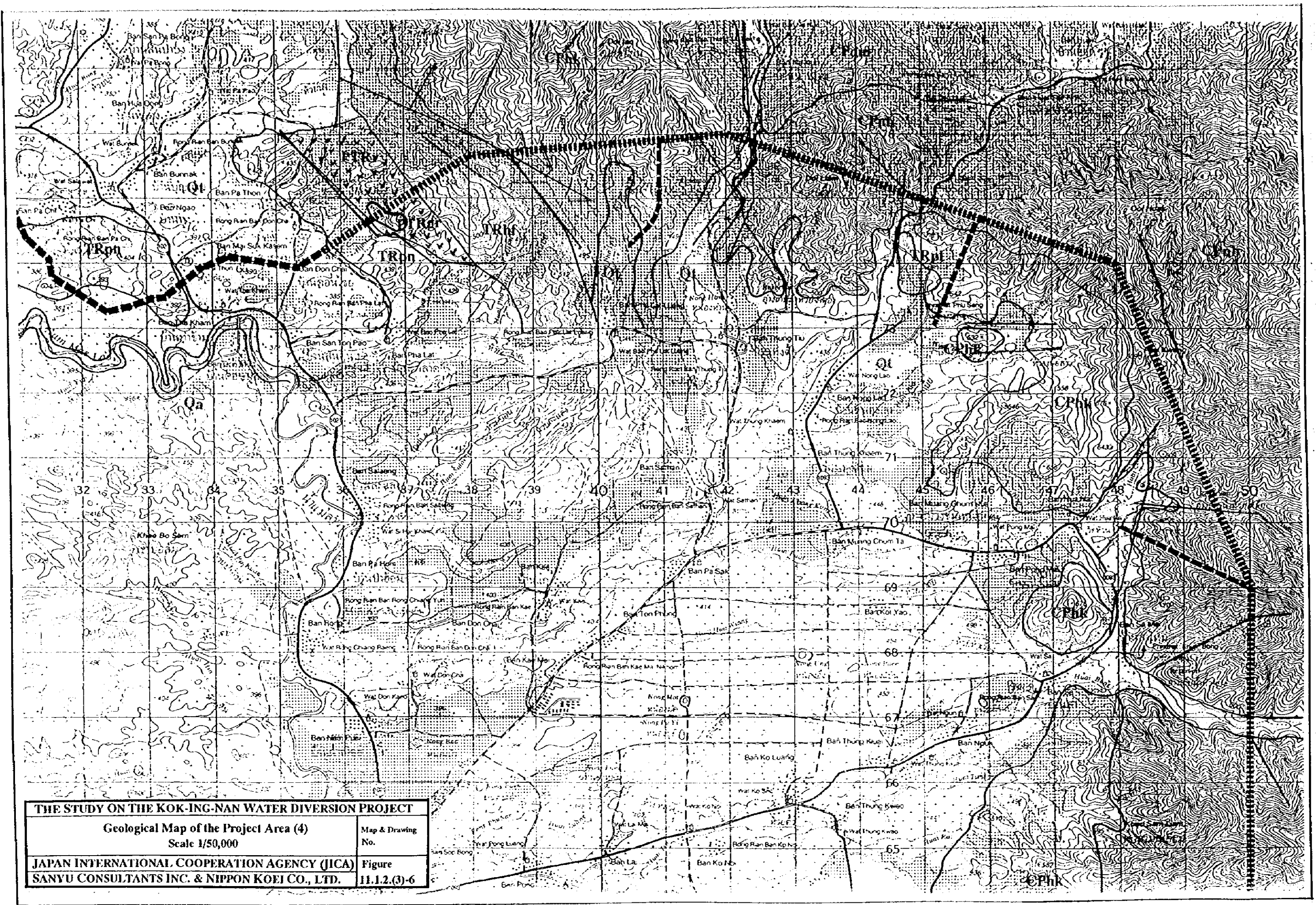
**THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT**

Geological Map of the Project Area (2) Scale 1/50,000	Map & Drawing No.
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Figure
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	11.1.2.(3)-4

105000m E. 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 10



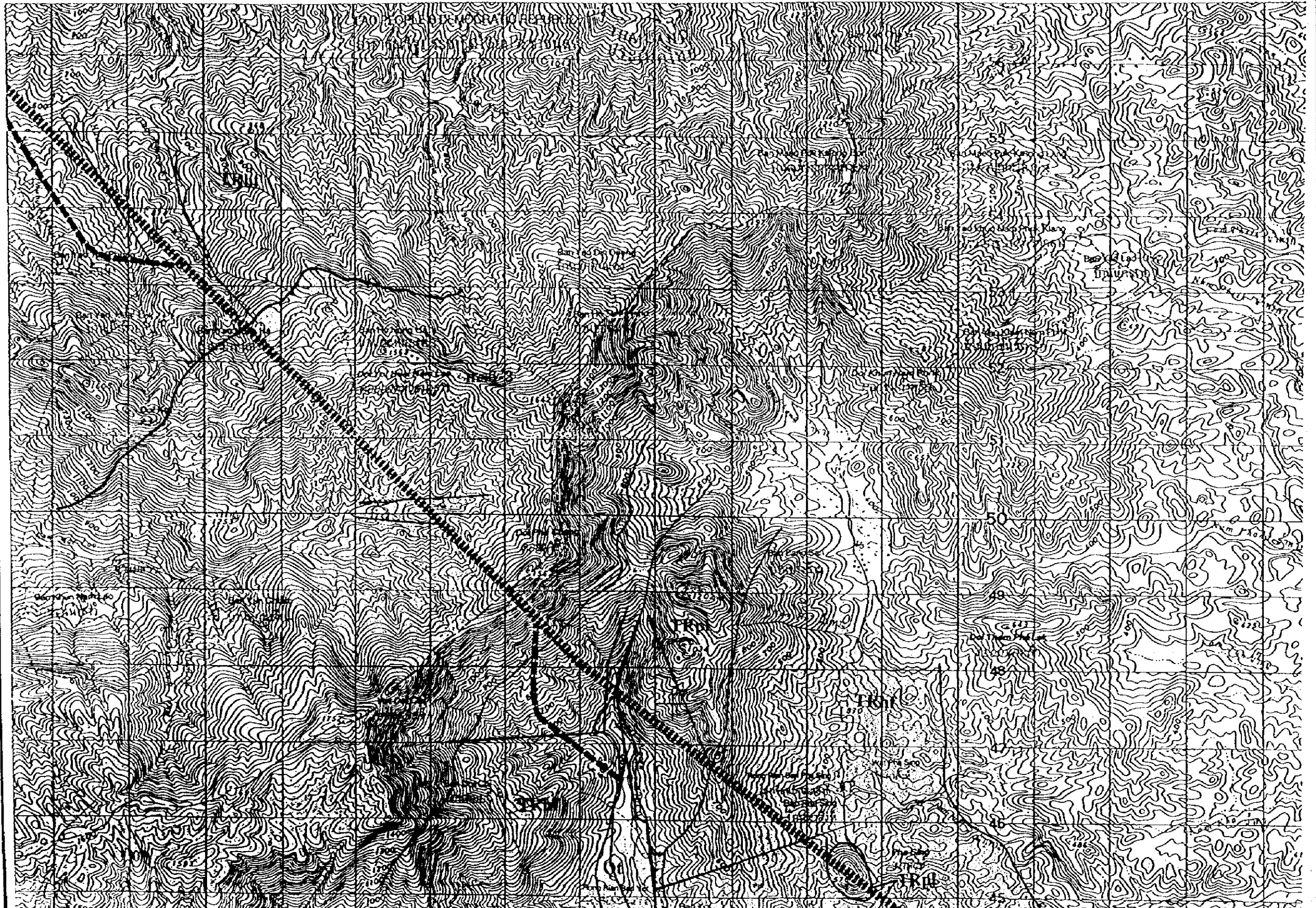
<b>THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT</b>	
Geological Map of the Project Area (3)	Map & Drawing No.
Scale 1/50,000	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Figure
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	11.1.2.(3)-5



<b>THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT</b>	
Geological Map of the Project Area (4)	Map & Drawing No.
Scale 1/50,000	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Figure
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	11.1.2.(3)-6

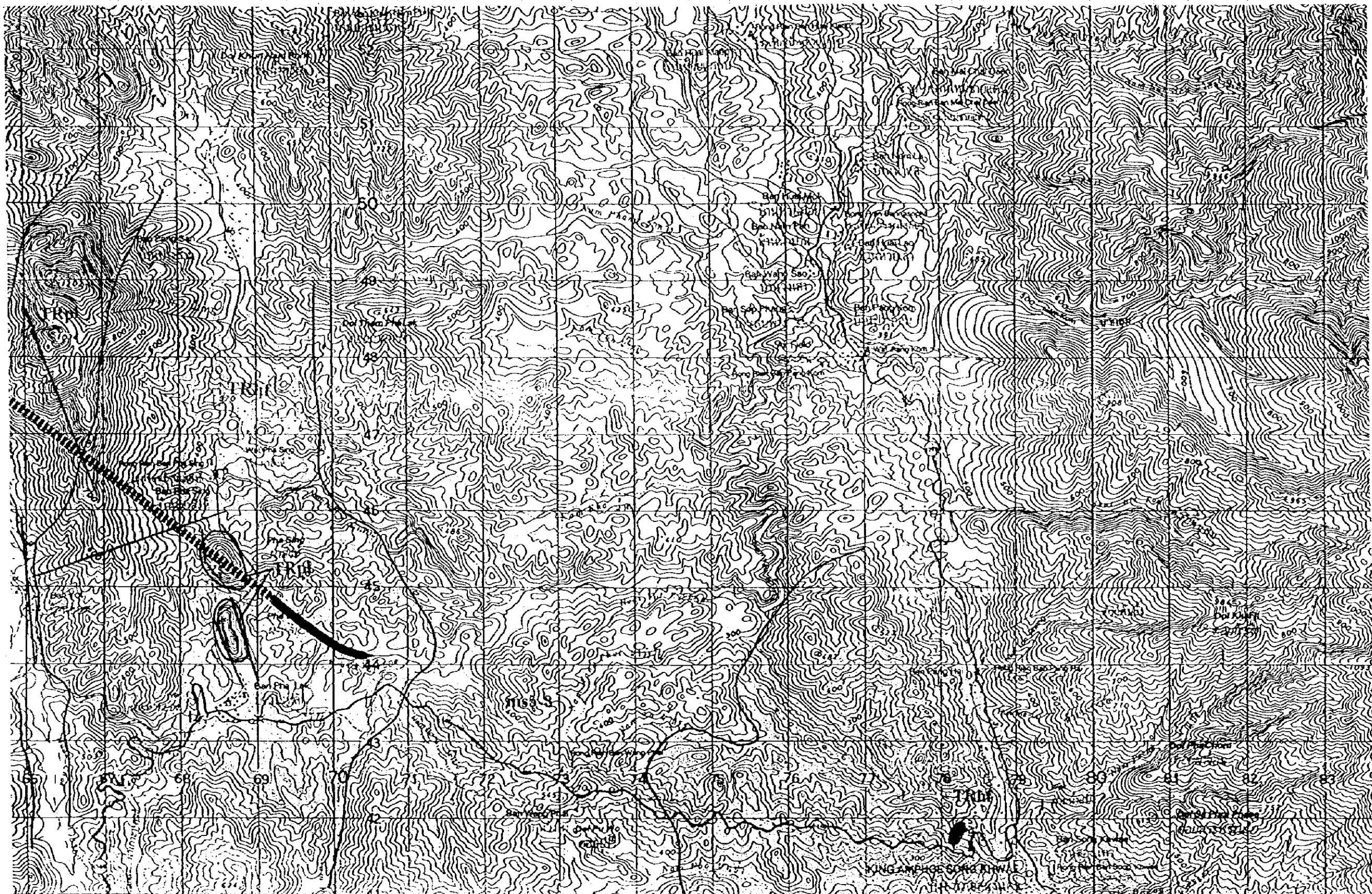


30 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74



<b>THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT</b>	
Geological Map of the Project Area (6) Scale 1/50,000	Map & Drawing No.
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	Figure 11.1.2.(3)-8

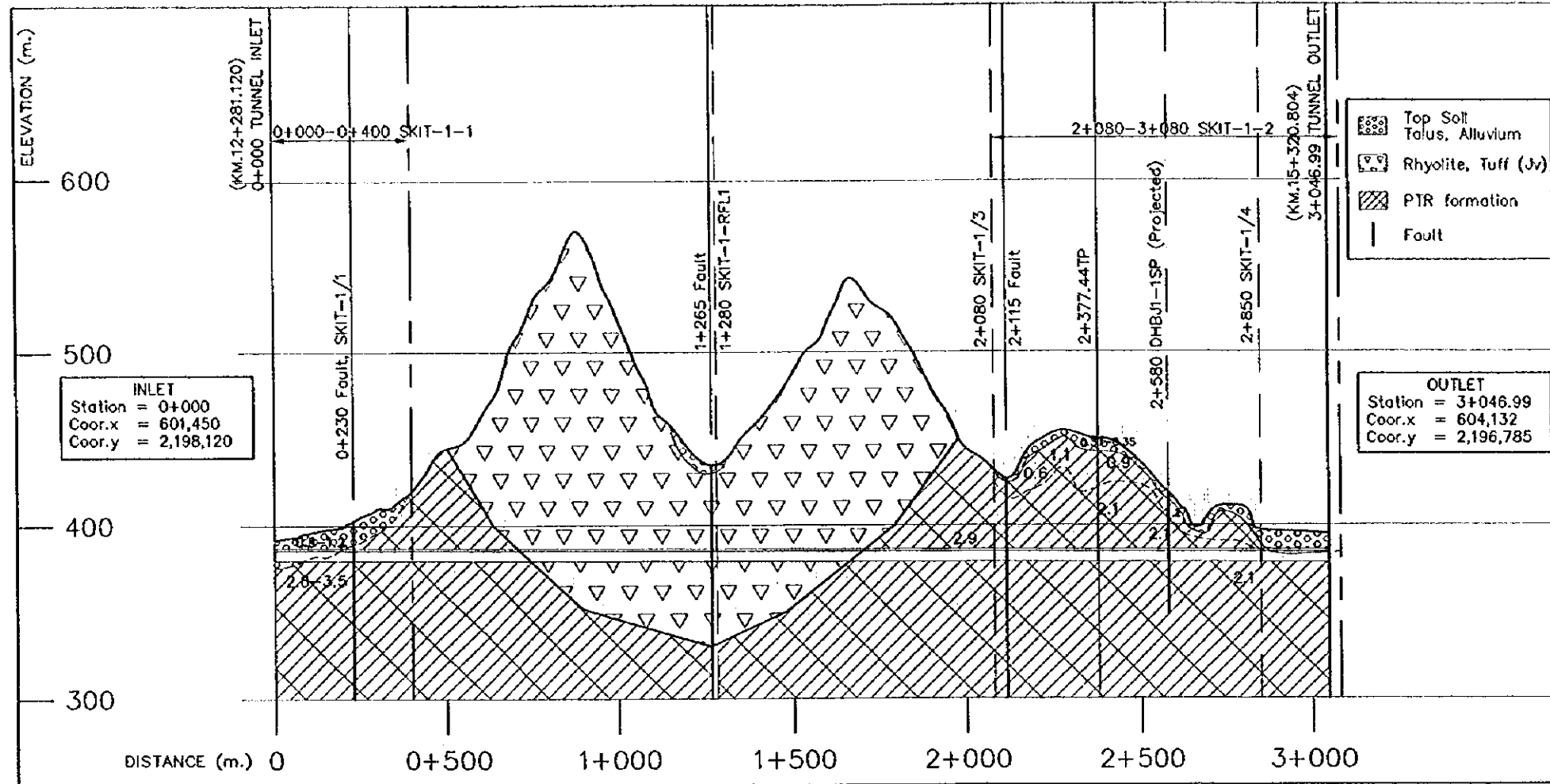
11.1.2.(3)-8



<b>THE STUDY ON THE KOK-ING-NAN WATER DIVERSION PROJECT</b>	
Geological Map of the Project Area (7)	
Scale 1/50,000	
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Map & Drawing No.
SANYU CONSULTANTS INC. & NIPPON KOEI CO., LTD.	Figure 11.1.2.(3)-9



# Geological Profile of Kok-Ing Tunnel No.1



Geological condition	Rock facies, weathering	Talus loose sand clay	Shale (Slate), Sandstone Tuff alternation highly weathered intensely fractured PIR formation	Rhyolite and Tuff, medium hard-soft moderately-slightly weathered Intensely fractured	Shale (Slate), Sandstone, Tuff alternation highly-slightly weathered, moderately-intensely fractured tuff hard massive	Alluvium loose sand clay															
	strike & ( $\alpha$ = closing angle from strike)	SN (61)		29E (90)																	
	Dip & (apparent dip.)	51(50) W		45 (45) W		20~60															
Overburden (m.)	B	55	180	45	160	40 63 14 25 12															
Resistivity (ohm-m)	TEM, TDEM																				
	Borehole logging																				
Seismic (Km/sec)	Refraction Vpr	2.6		2.1		2.1															
	Reflection Vpr																				
Drilling	Borehole logging																				
	RQD	Weathered Shale=0, freshtuff 60-100																			
Rock mass classification (CRIEPI, Japan)	qu (kg/cm <sup>2</sup> )																				
		D	CL	CM	CL	D	CL	CM	CM-CH	CL	D	CL	CM-CH	CL	D						
Tunnel type	E2	E1	D2	D1	C2	D1D2	E1E2	E1D2	D1	C2	D1D2	D2D1	C2C1	C2D2	E1E2	E1D2	D1D2	C2D1	D2	E1	E2
Notice for tunnel geology & counter Measure	Shallow overburden and loose sediment. Forepiling Method		Intensely fractured tuff and fault zone. To make investigation to confirm lithology and water discharge					Shallow overburden and intensely fractured zone and loose sediment. Forepiling method													

THE STUDY ON KOK-ING-NAN WATER DIVERSION PROJECT

GEOLOGICAL PROFILE OF KOK-ING NO.1 TUNNEL

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

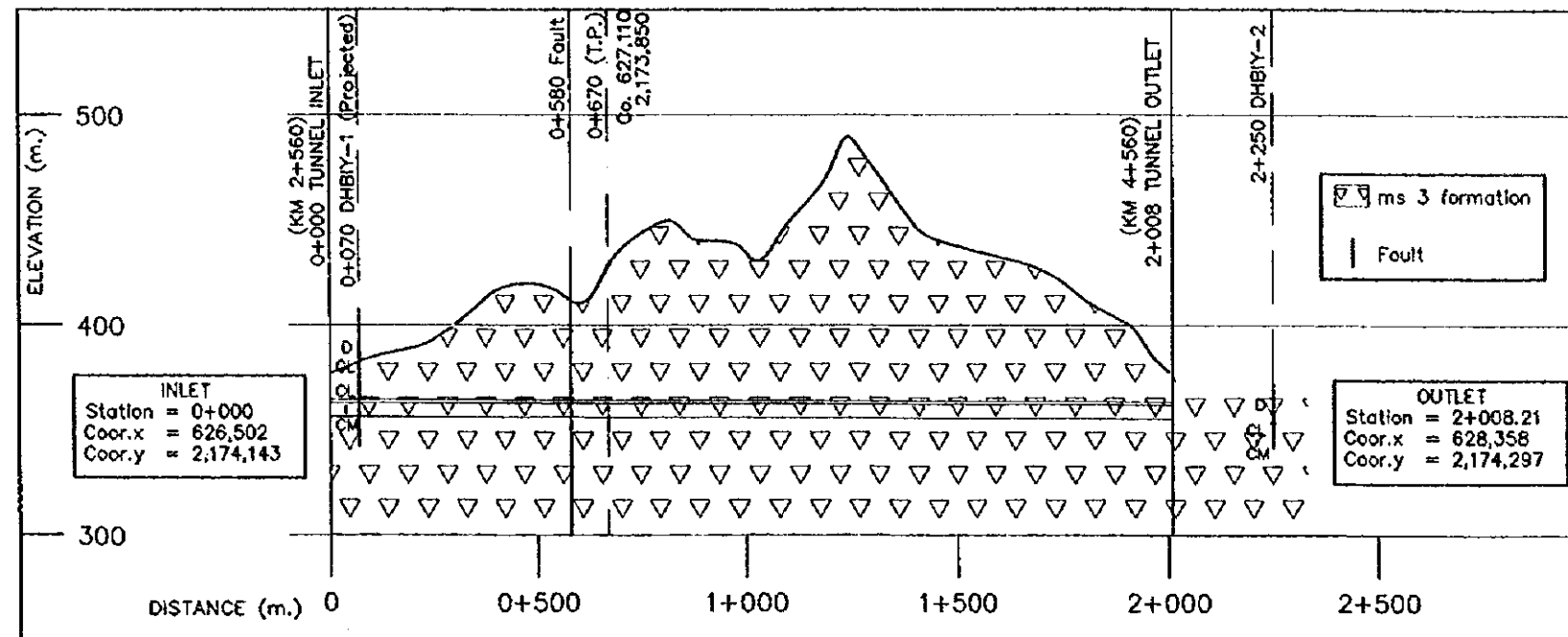
SANYU CONSULTANTS INC. & NIPPON KOEI CO.,LTD.

MAP & Drawing No.

Figure 11.1.2(4)-1



## Geological Profile of Ing-Yot Tunnel No.1



Geological condition	Rock facies, weathering	Conglomerate sandstone. Greenish gray to purple, moderately to highly weathered, medium hard to hard, intensely fractured. Fe-oxide stained. ms3 formation.														
	strike & ( $\alpha$ = closing angle from strike)															
	Dip & (apparent dip.)	30-60														
Overburden (m.)		27	52	33	91	63	129	66	11							
Resistivity (ohm-m)	TEM, TDEM															
	Borehole logging															
Seismic (Km/sec)	Refraction Vpr															
	Reflection Vpr															
	Borehole logging															
Drilling	RQD															
	qu (kg/cm)															
Rock mass classification (CRIEPI, Japan)		CL-D	CL-CM	CL-D	CL-D	CL-CM	CL-D	CL-D	CL-CM	CL-CM	CL-D					
Tunnel type		E2	E1	D2	D1	D2	D1	D2	E1	D2	D1	E2	D1	D2	E1	E2
Notice for tunnel geology & counter Measure		Pay attention to collapse of fractured rock along fault zone and slender shallow overburden and water discharge along fault zone.														

THE STUDY ON KOK-ING-NAN WATER DIVERSION PROJECT	
GEOLOGICAL PROFILE OF ING-YOT TUNNEL NO.1	MAP & Drawing No.
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	Figure
SANYU CONSULTANTS INC. & NIPPON KOEI CO.,LTD.	11.1.2(4)-3