

(Geological Strata)

Age	Formation and Strata Name		
Quaternary	Holocene	Riverbed deposit	
		Talus deposit	
Tertiary-Quaternary	Pliocene-Pleistocene	Damar	Upper Sedimentary Rock Unit
			Upper Pyroclastic Rock Unit
			Middle Sedimentary Rock Unit

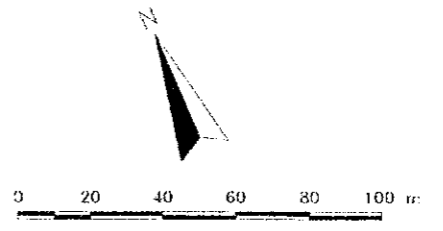
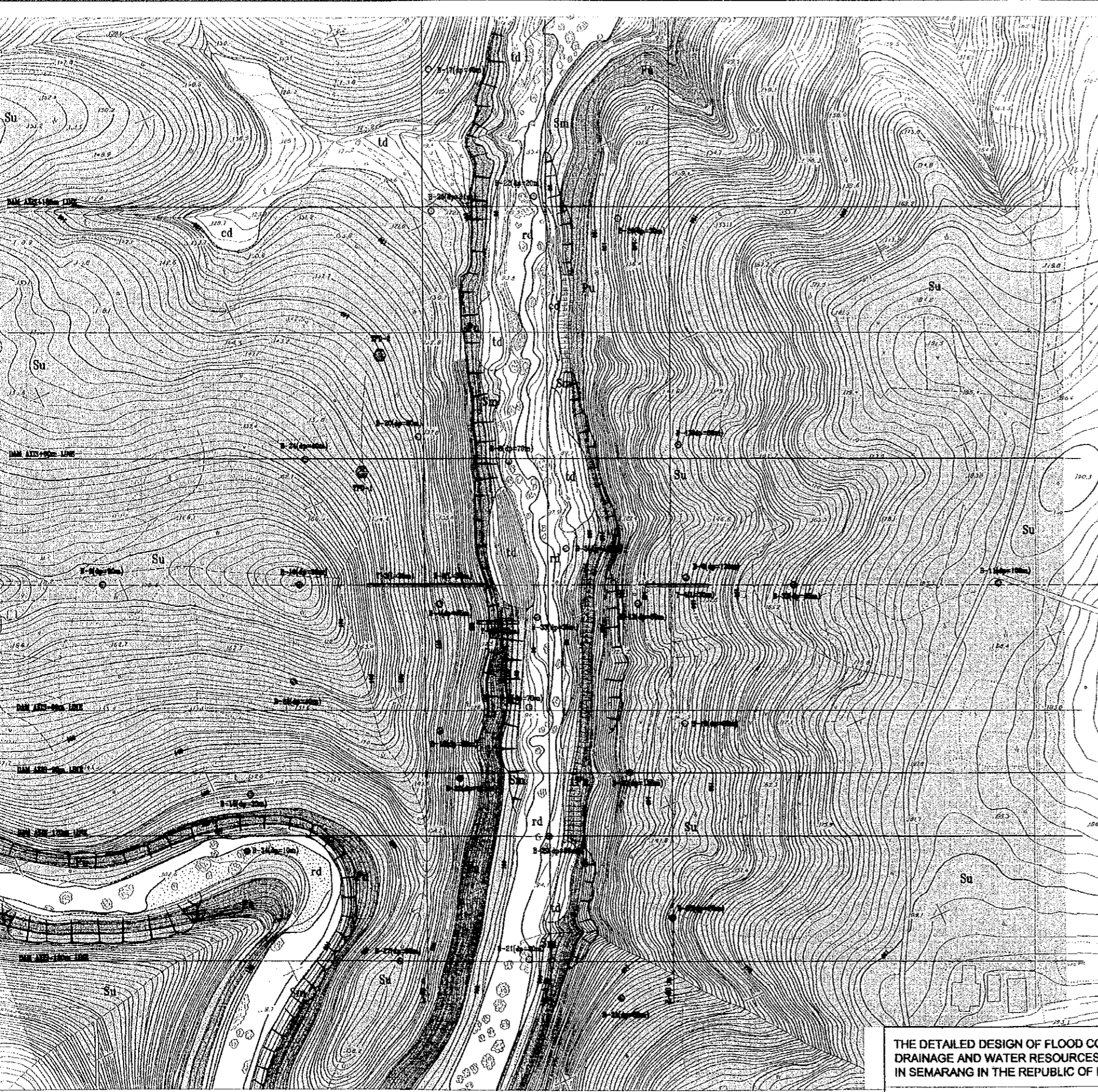
(LOCATION OF BORE HOLE)

(LOCATION OF BORING HOLE)

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5. G





LEGEND

(Geological Strata)

Age	Formation and Strata Name	Symbol	Description
Quaternary Holocene	Riverbed deposit	rd	riverbed deposit consists of Gravel, sand and clay. And it contains the huge fallen rocks in the gorge area, which was made by Kreo river.
	Talus deposit	td	Talus deposit consists of collapse soil and sand, detritus, fallen rocks. And it is accumulated on the foot of mountainside slope and cliff.
Tertiary-Quaternary Pliocene-Pleistocene Initial	Upper Sedimentary Rock Unit	Su	The unit mainly consists of alternation of conglomerate, conglomeratic sandstone, tuffaceous sandstone and sandstone, and partly contains mafic tuff and volcanic conglomerate. The change of grain size of sandstone is big, and lamina is formed partly. The matrix of conglomerate consists of same material of sandstone, and gravel consists of andesite and pumice, and diameter of gravel is smaller than 50cm. Cracks hardly develop in the bedrock, and the degree of cementation of conglomerate, tuffaceous sandstone, sandstone and tuff is comparatively low, and lower cementation layer is formed partly in sandstone, conglomerate.
	Upper Pyroclastic Rock Unit	Pu	The unit mainly consists of volcanic breccia, and partly contains mafic tuff and andesite lava. The volcanic breccia contains fragments of andesite and pumice, and matrix consists of mafic tuff. Cracks hardly develop in the bedrock, and the hardness of rock is comparatively high.
	Middle Sedimentary Rock Unit	Sm	The unit mainly consists of alternation of conglomerate, conglomeratic sandstone, sandstone and tuffaceous sandstone, and partly contains mafic tuff. The faecies of each rock and conditions of bedrock are almost same as the upper sedimentary rock unit.

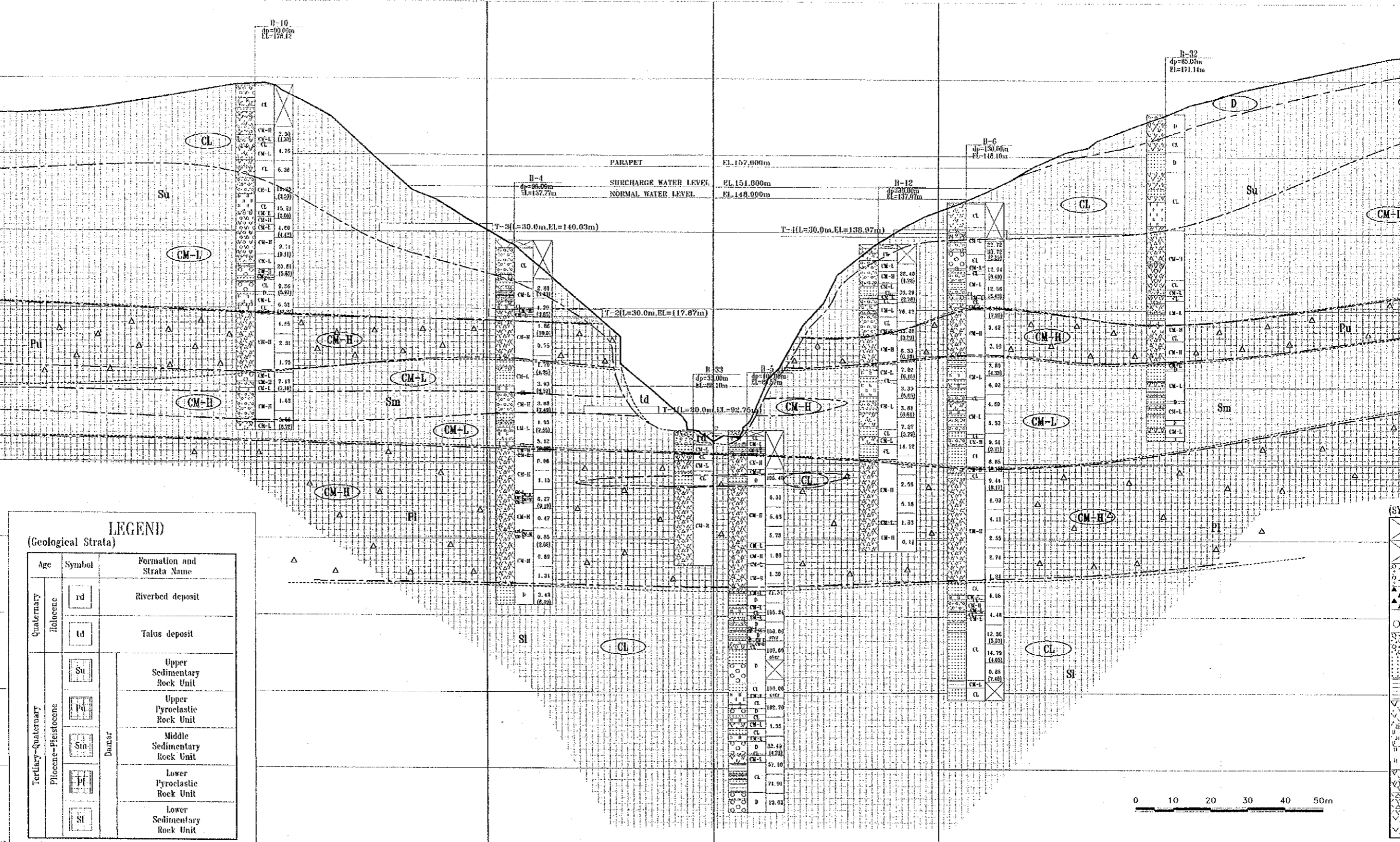
- BOUNDARY OF GEOLOGICAL UNIT AND STRATUM
- (LOCATION OF BORE HOLES AND ADITS AT THE PHASE I INVESTIGATION)
- ⊙ : BORE HOLE (NUMBER, TOTAL DEPTH)
- ▬ : ADIT (NUMBER, TOTAL LENGTH)
- (LOCATION OF BORING HOLES AND TEST PITS AT THE PHASE 2 INVESTIGATION)
- ⊙ : BORE HOLE (NUMBER, TOTAL DEPTH)
- ⊗ : TEST PIT (NUMBER)

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
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Fig. 5.1.1  
 GEOLOGICAL MAP AT DAMSITE

El.(m)

200  
199  
160  
140  
120  
100  
80  
60  
40  
20  
0  
-20



**LEGEND**  
(Geological Strata)

Age	Symbol	Formation and Strata Name
Quaternary	rd	Riverbed deposit
	td	Talus deposit
Tertiary-Quaternary Pliocene-Pleistocene	Su	Upper Sedimentary Rock Unit
	Pu	Upper Pyroclastic Rock Unit
	Sm	Middle Sedimentary Rock Unit
	Pl	Lower Pyroclastic Rock Unit
	Sl	Lower Sedimentary Rock Unit

(Note)

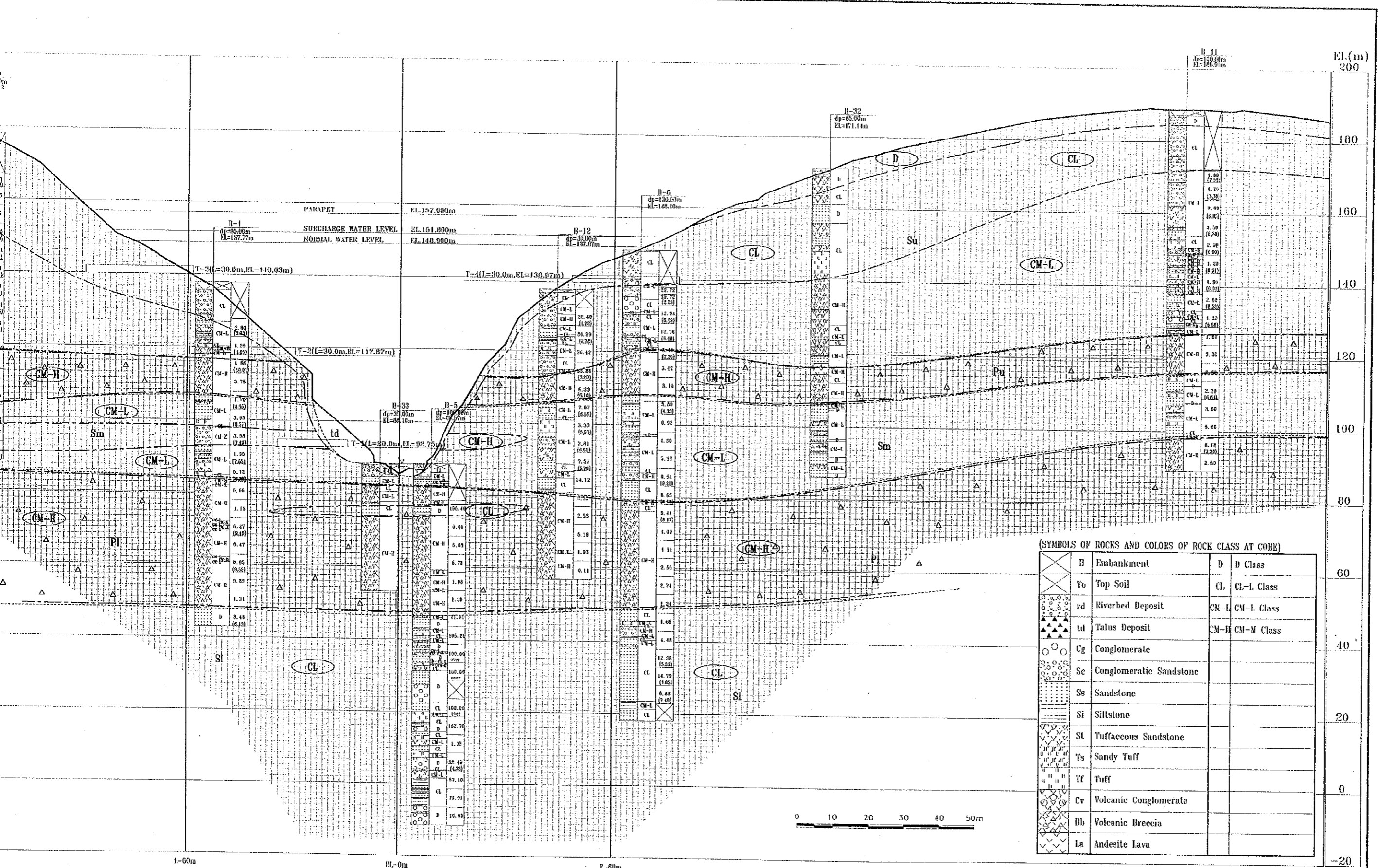
--- Boundary of Geological Unit  
--- Boundary of Rock Class



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5



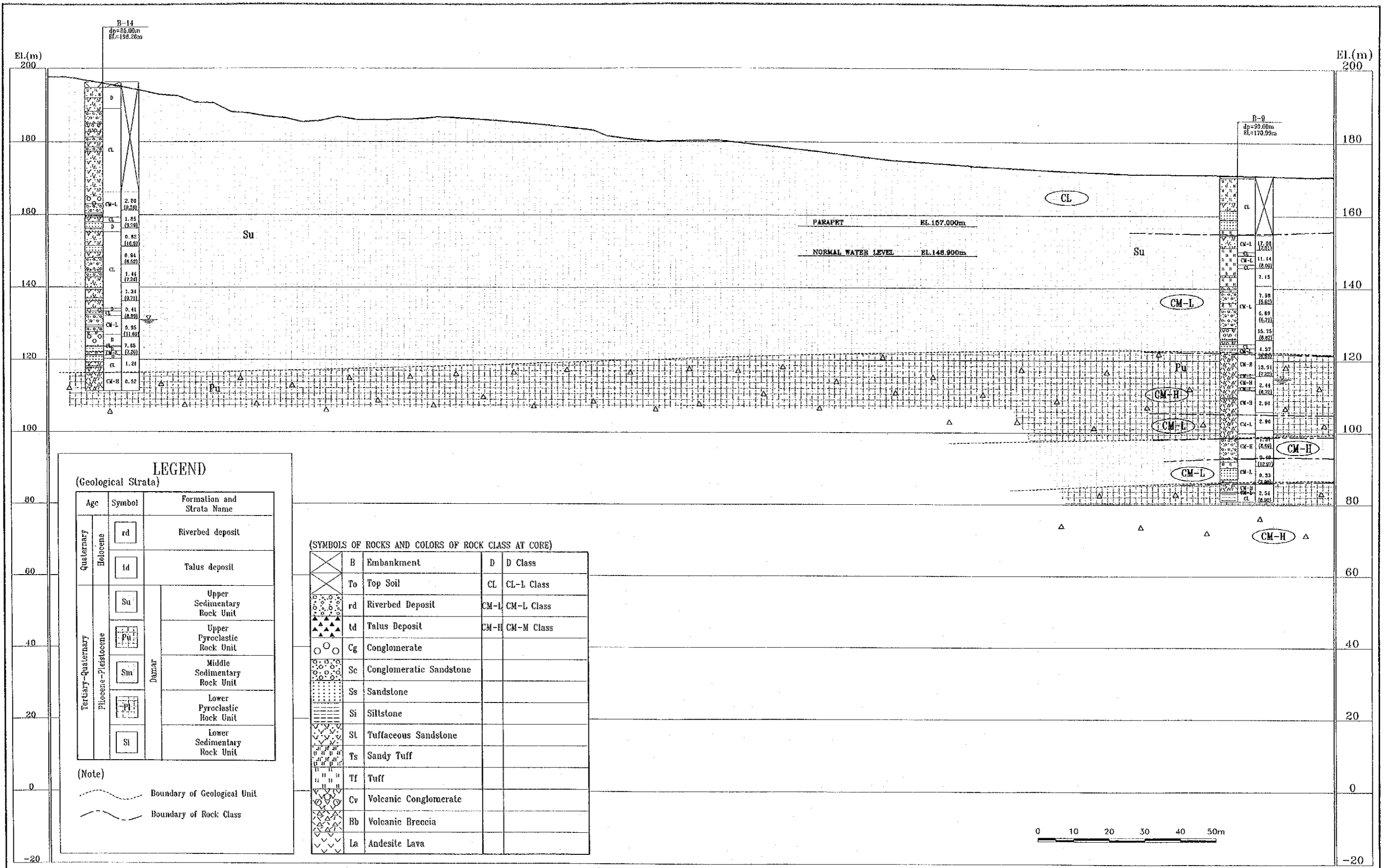


(SYMBOLS OF ROCKS AND COLORS OF ROCK CLASS AT CORE)

	B Embankment		D D Class
	To Top Soil		CL CL-L Class
	rd Riverbed Deposit		CM-L CM-I Class
	td Talus Deposit		CM-H CM-M Class
	Cg Conglomerate		
	Sc Conglomeratic Sandstone		
	Ss Sandstone		
	Si Siltstone		
	St Tuffaceous Sandstone		
	Ts Sandy Tuff		
	Tf Tuff		
	Cv Volcanic Conglomerate		
	Bb Volcanic Breccia		
	La Andesite Lava		

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
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Fig. 5.1.2 (1/2)  
 GEOLOGICAL PROFILE ALONG DAM AXIS



**LEGEND**  
(Geological Strata)

Age	Symbol	Formation and Strata Name
Quaternary Holocene	rd	Riverbed deposit
	td	Talus deposit
Tertiary-Quaternary Pliocene-Pleistocene	Su	Upper Sedimentary Rock Unit
	Pu	Upper Pyroclastic Rock Unit
	Sm	Middle Sedimentary Rock Unit
	Pl	Lower Pyroclastic Rock Unit
	Sl	Lower Sedimentary Rock Unit

(Note)  
 Boundary of Geological Unit  
 Boundary of Rock Class

(SYMBOLS OF ROCKS AND COLORS OF ROCK CLASS AT CORE)

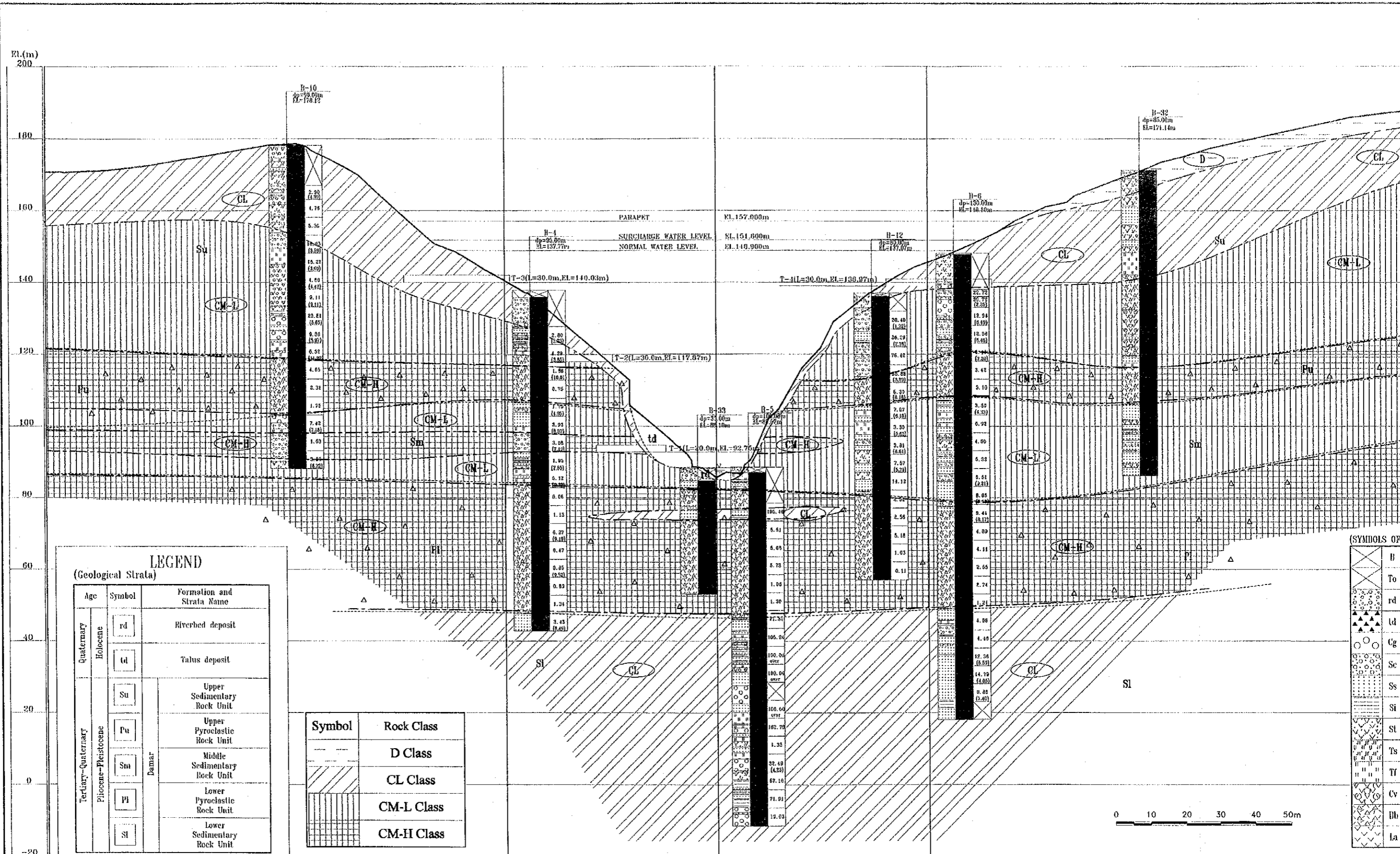
	B	Embankment	D	D Class
	To	Top Soil	CL	CL-L Class
	rd	Riverbed Deposit	CM-L	CM-L Class
	td	Talus Deposit	CM-H	CM-M Class
	Cg	Conglomerate		
	Sc	Conglomeratic Sandstone		
	Ss	Sandstone		
	Si	Siltstone		
	Sl	Tuffaceous Sandstone		
	Ts	Sandy Tuff		
	Tf	Tuff		
	Cv	Volcanic Conglomerate		
	Bb	Volcanic Breccia		
	La	Andesite Lava		



L-130m

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.1.2 (2/2)  
 GEOLOGICAL PROFILE ALONG DAM AXIS (LEFT BANK RIDGE)



**LEGEND**  
(Geological Strata)

Age	Symbol	Formation and Strata Name
Quaternary Holocene	rd	Riverbed deposit
	td	Talus deposit
Tertiary-Quaternary Pliocene-Pleistocene	Su	Upper Sedimentary Rock Unit
	Pu	Upper Pyroclastic Rock Unit
	Sm	Middle Sedimentary Rock Unit
	Pl	Lower Pyroclastic Rock Unit
	Sl	Lower Sedimentary Rock Unit

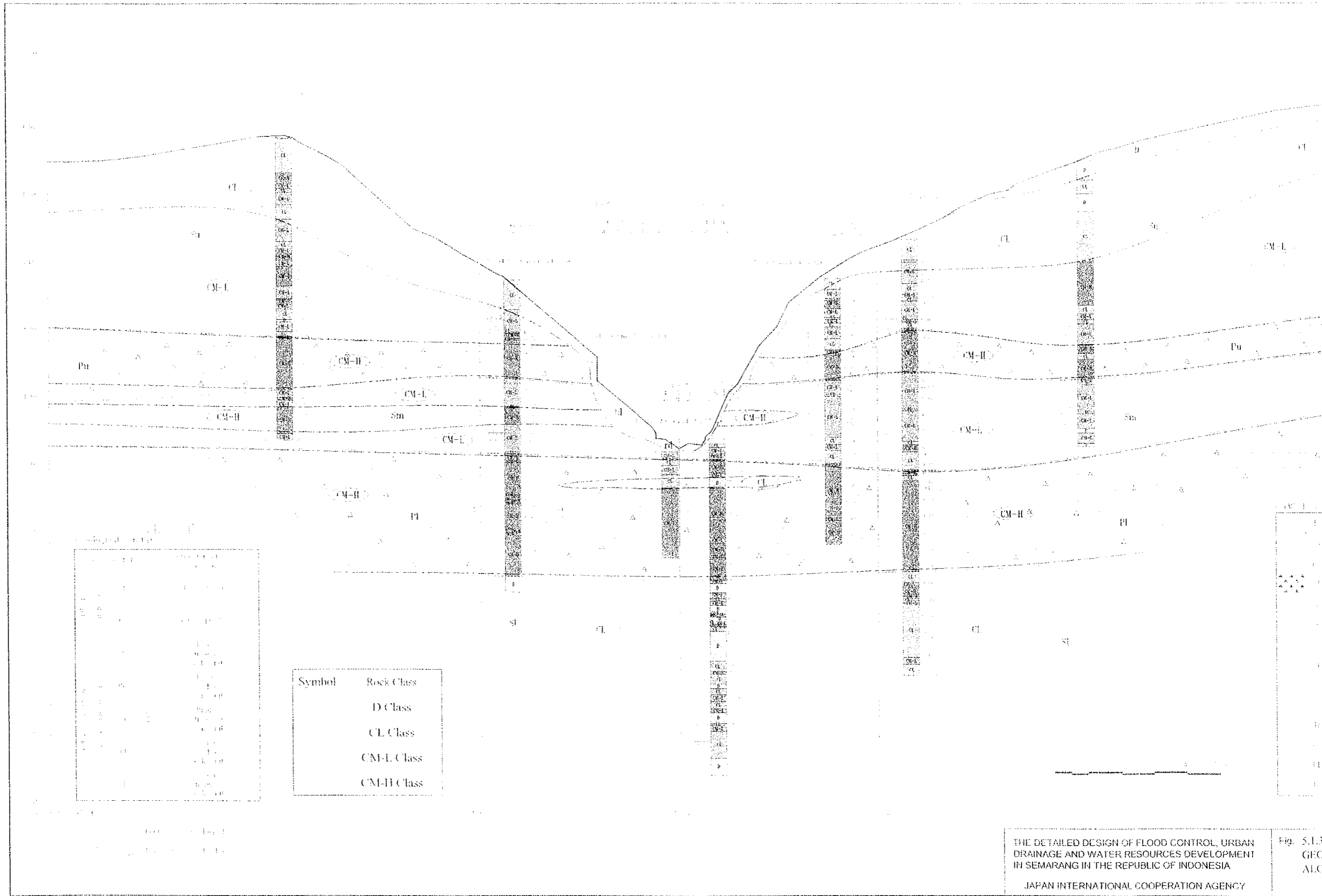
Symbol	Rock Class
(Diagonal lines)	D Class
(Horizontal lines)	CL Class
(Vertical lines)	CM-L Class
(Grid pattern)	CM-H Class

(Note)

- Boundary of Geological Unit
- Boundary of Rock Class

(SYMBOLS OF I)

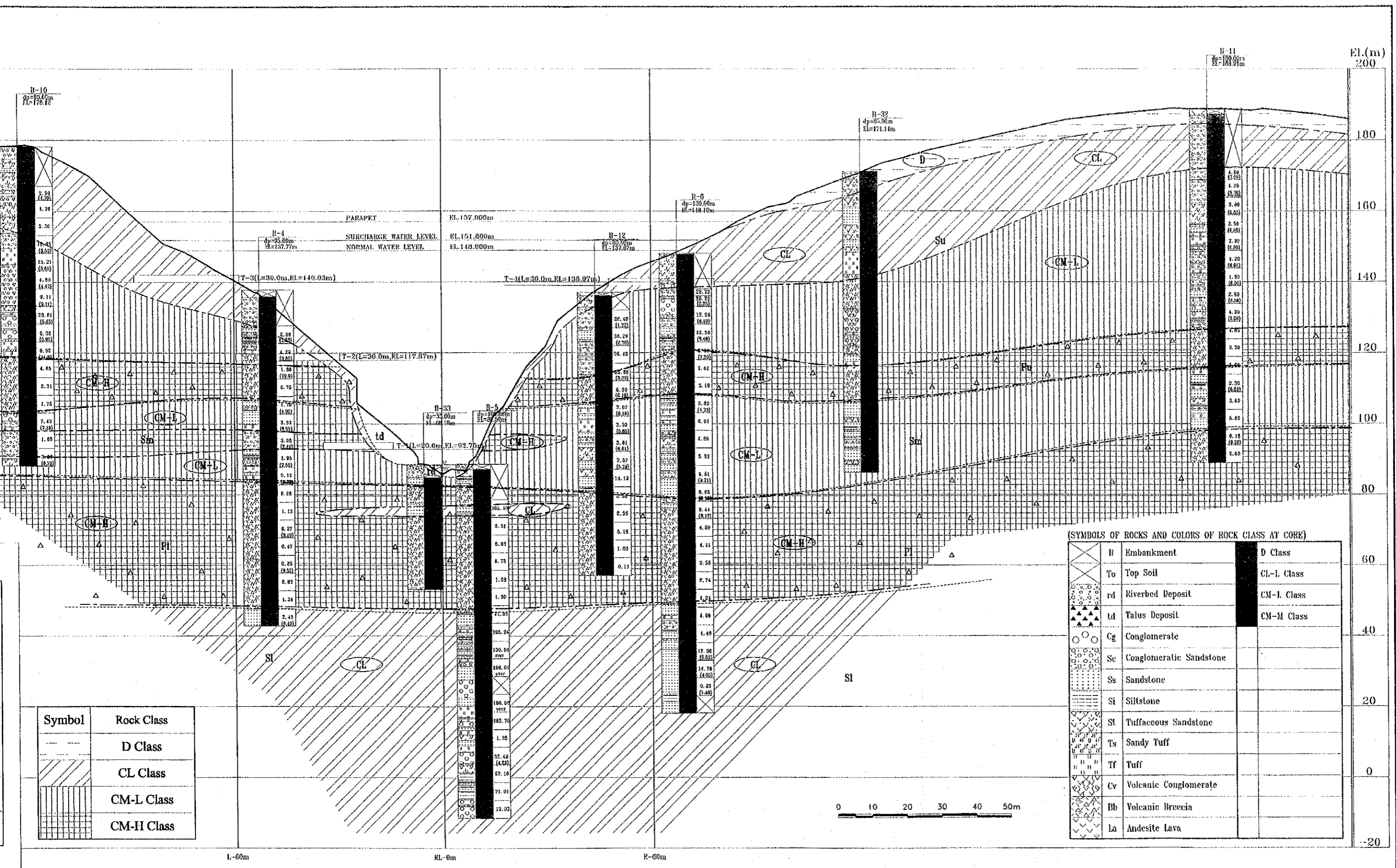
(Symbol)	B
(Symbol)	To
(Symbol)	rd
(Symbol)	td
(Symbol)	Cg
(Symbol)	Sc
(Symbol)	Ss
(Symbol)	Si
(Symbol)	St
(Symbol)	Ts
(Symbol)	Tf
(Symbol)	Cv
(Symbol)	Lh
(Symbol)	La



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
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Fig. 5.1.3  
 GEOLOGICAL CROSS SECTION





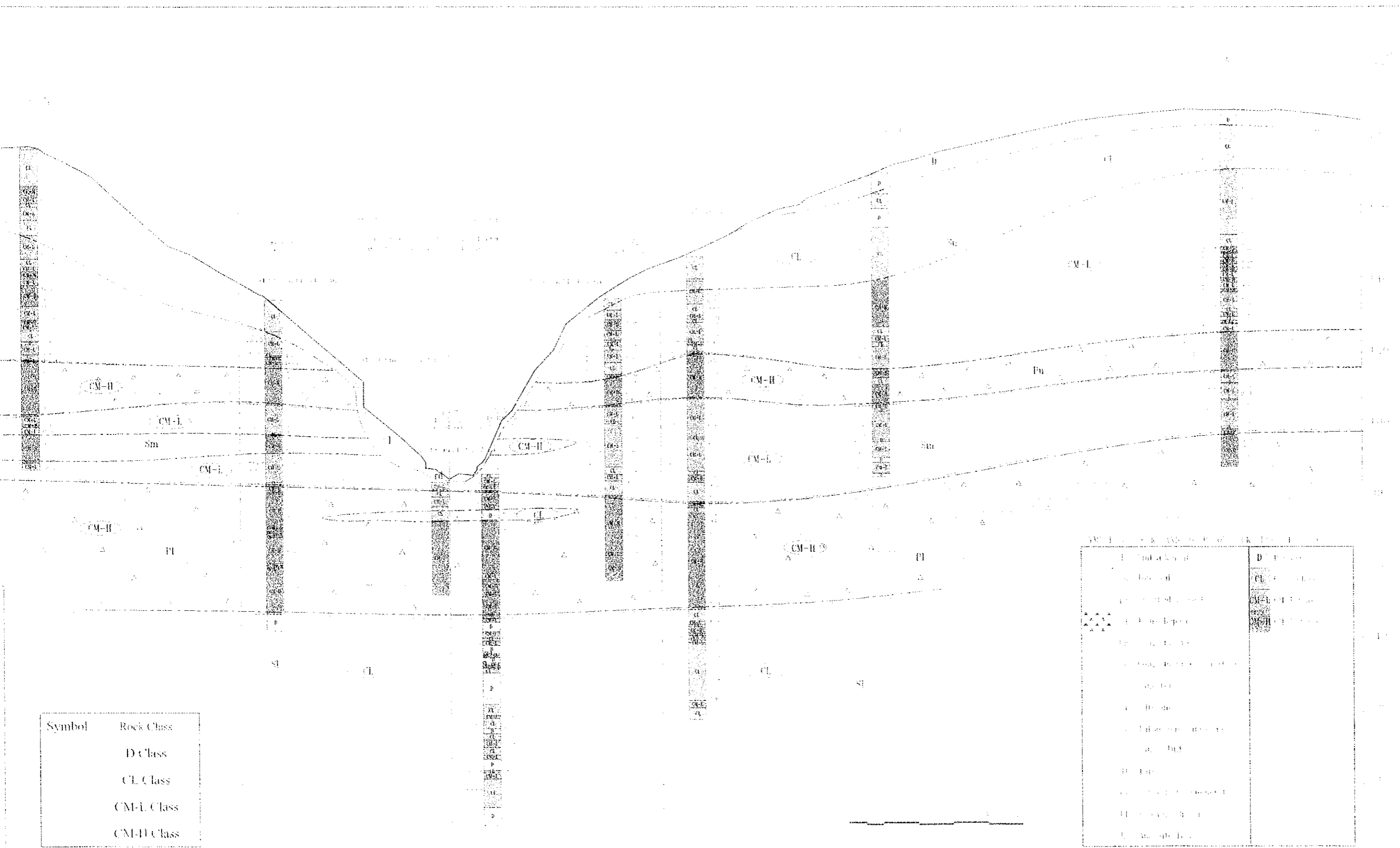
Symbol	Rock Class
[Hatched pattern]	D Class
[Diagonal lines]	CL Class
[Vertical lines]	CM-L Class
[Grid pattern]	CM-H Class

SYMBOLS OF ROCKS AND COLORS OF ROCK CLASS AT CORE			
[Cross-hatch]	B Embankment	[Black]	D Class
[Dotted]	To Top Soil	[Light Grey]	CL-L Class
[Stippled]	rd Riverbed Deposit	[Medium Grey]	CM-L Class
[Triangle pattern]	td Talus Deposit	[Dark Grey]	CM-M Class
[Circle pattern]	Cg Conglomerate		
[Square pattern]	Sc Conglomeratic Sandstone		
[Horizontal lines]	Ss Sandstone		
[Vertical lines]	Si Siltstone		
[Diagonal cross-hatch]	St Tuffaceous Sandstone		
[Vertical lines with dots]	Ts Sandy Tuff		
[Horizontal lines with dots]	Tf Tuff		
[Vertical lines with dots]	Cv Volcanic Conglomerate		
[Diagonal lines with dots]	Bb Volcanic Breccia		
[Vertical lines with dots]	La Andesite Lava		

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.13 GEOLOGICAL PROFILE FOR ROCK CLASSIFICATION ALONG DAM AXIS





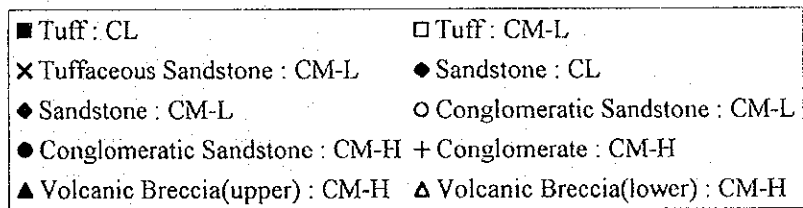
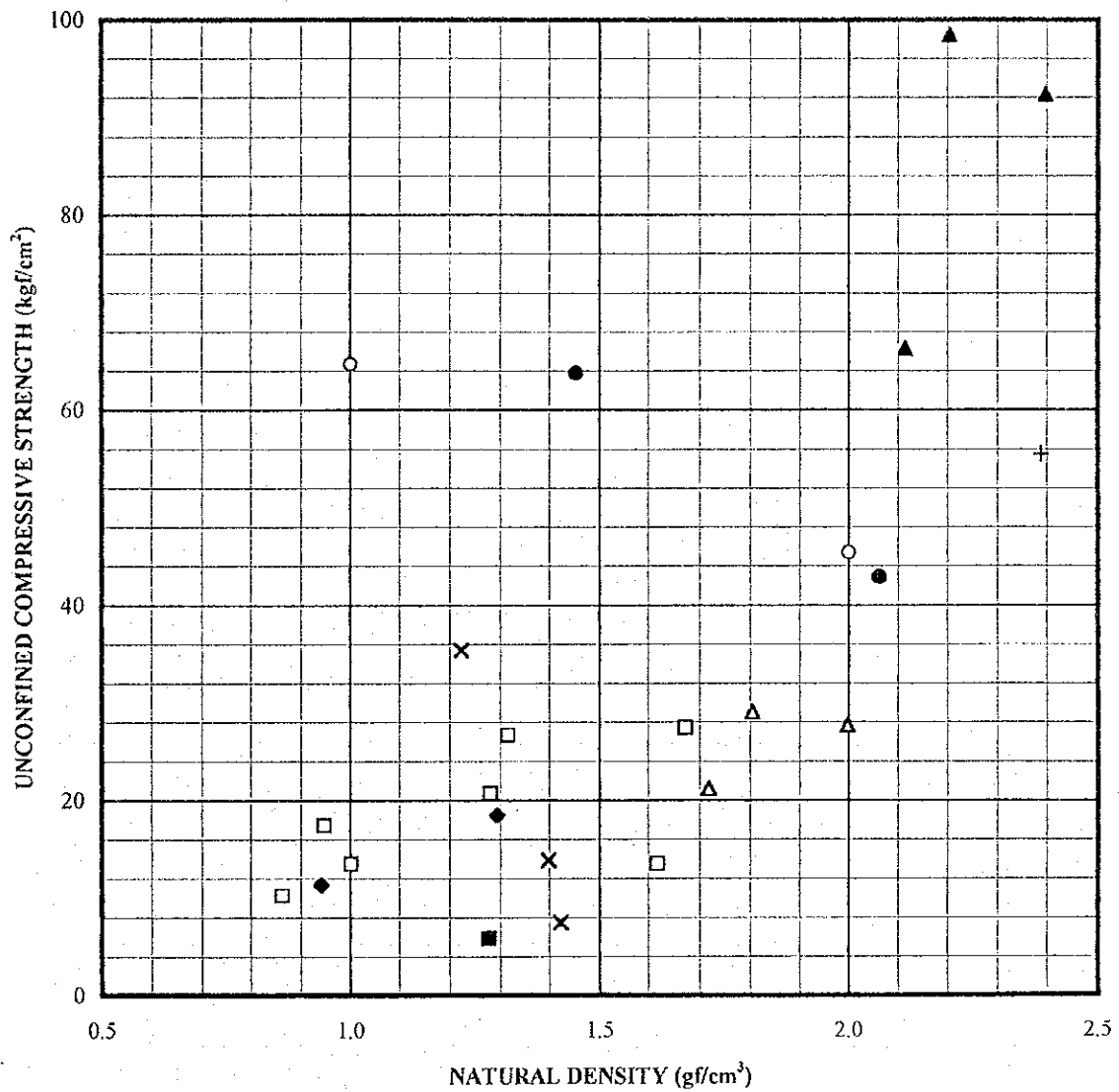
Symbol	Rock Class
(Hatched pattern)	D Class
(Dotted pattern)	CL Class
(Stippled pattern)	CM-I Class
(Cross-hatched pattern)	CM-II Class

Symbol	Rock Class
(Hatched pattern)	D Class
(Dotted pattern)	CL Class
(Stippled pattern)	CM-I Class
(Cross-hatched pattern)	CM-II Class

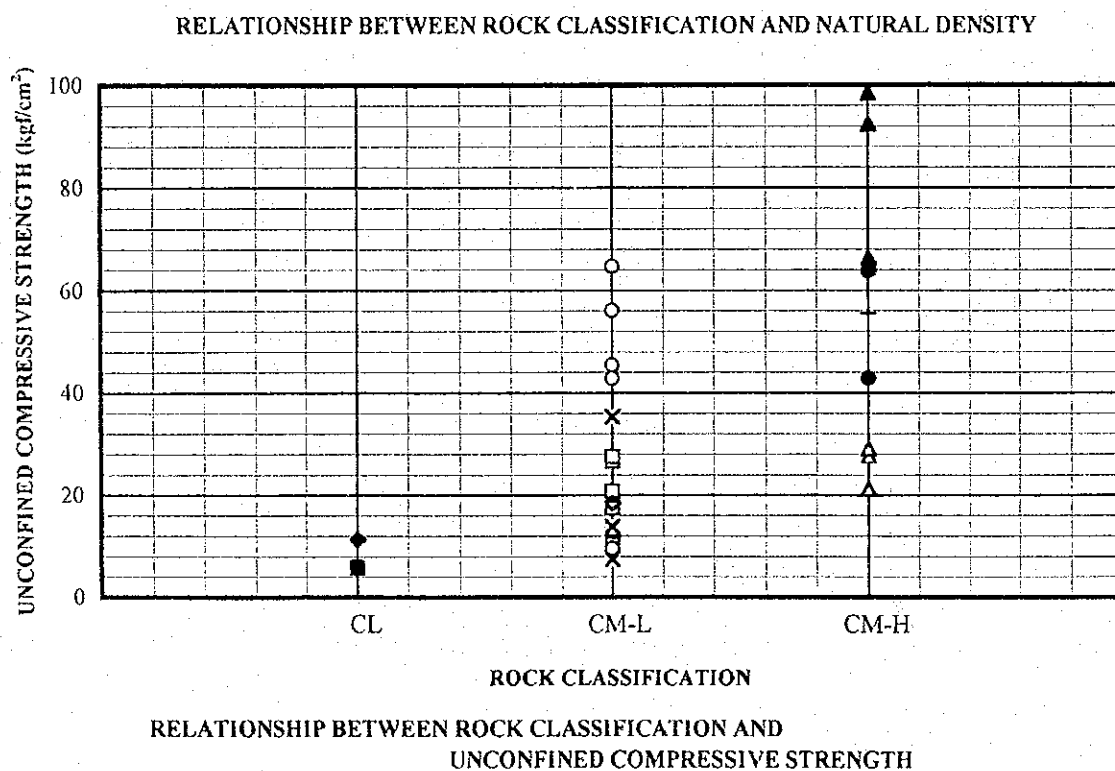
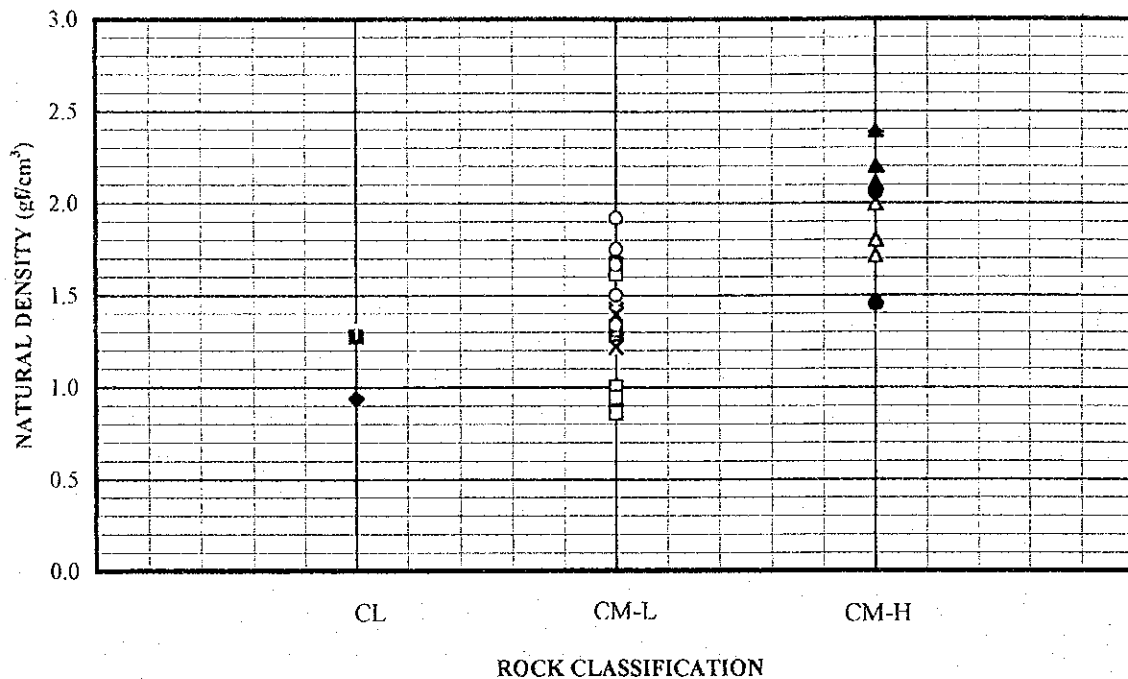
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
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Fig. 5.1.3  
 GEOLOGICAL PROFILE FOR ROCK CLASSIFICATION ALONG DAM AXIS



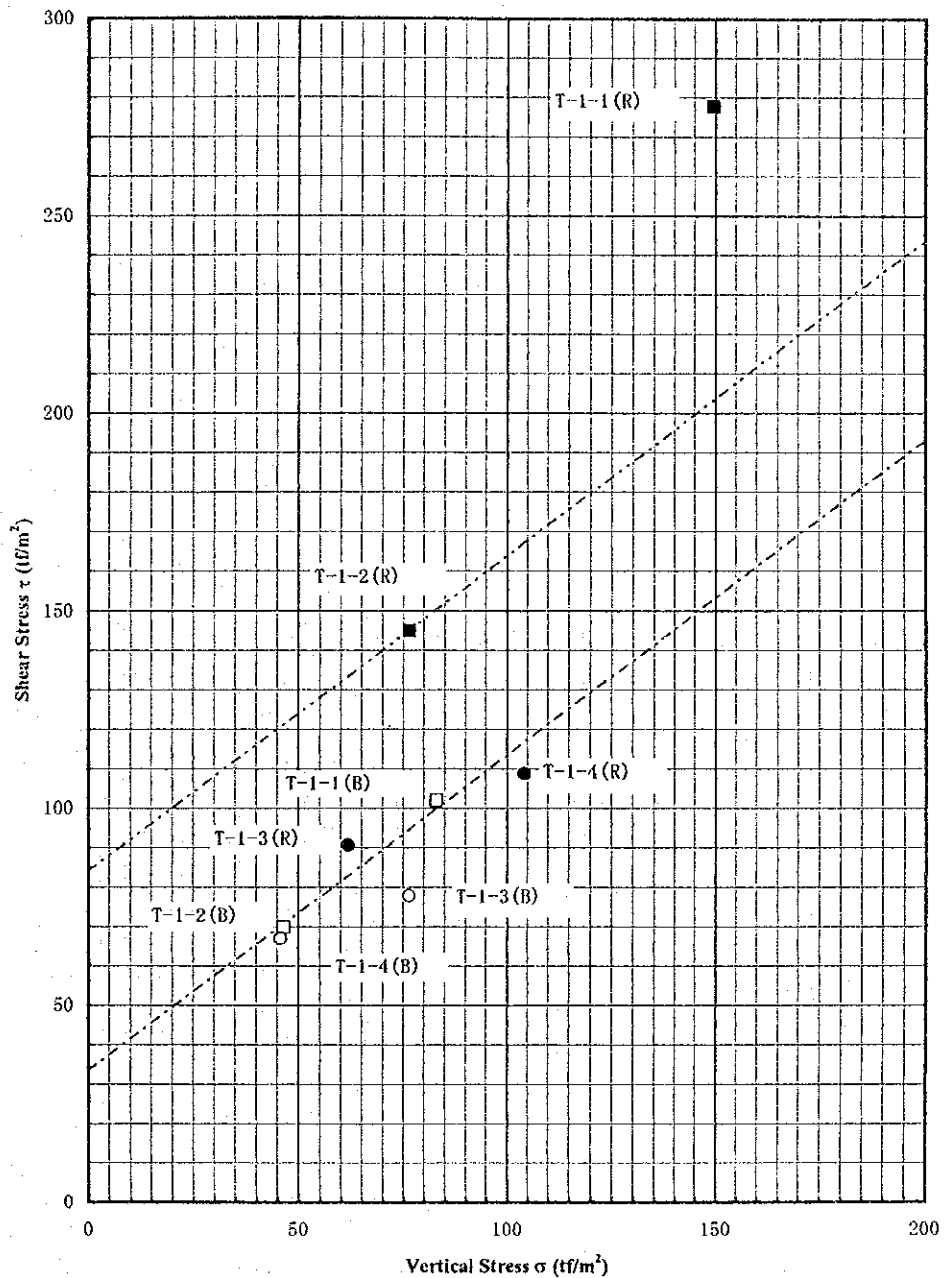






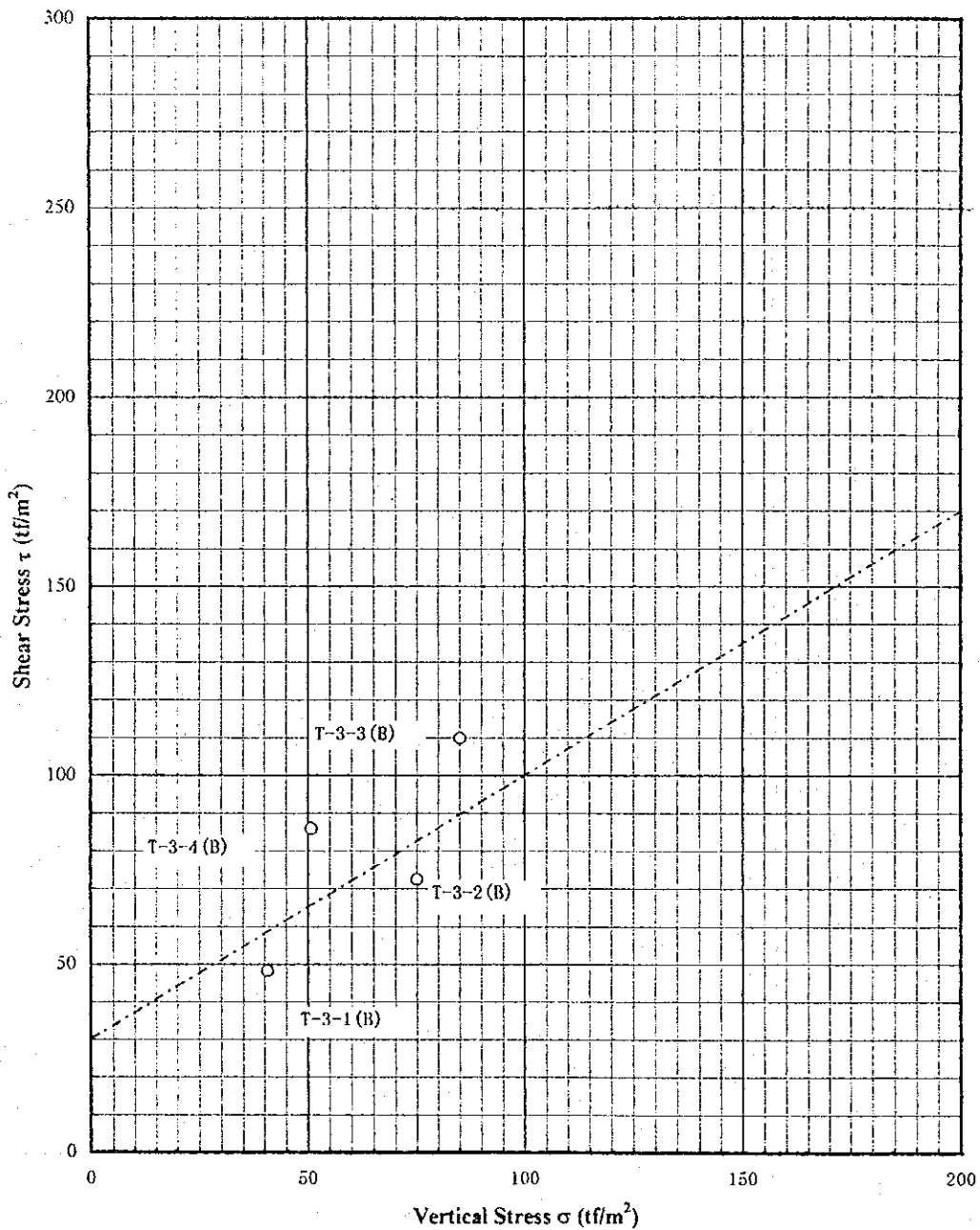
- Tuff : CL
- ◆ Sandstone : CL
- Conglomeratic Sandstone : CM-H
- ▲ Volcanic Breccia(lower) : CM-H
- Tuff : CM-L
- ◇ Sandstone : CM-L
- + Conglomerate : CM-H
- × Tuffaceous Sandstone : CM-L
- Conglomeratic Sandstone : CM-L
- ▲ Volcanic Breccia(upper) : CM-H

Fig. 5.1.5  
RELATIONSHIP BETWEEN ROCK CLASSIFICATION AND OTHER PROPERTIES OF BORING CORE SAMPLES FROM FOUNDATION ROCK



R : Rock Shear Test  
B : Block Shear Test

- Conglomeratic Sandstone:Rock Shear Test
- Sandstone:Rock Shear Test
- Conglomeratic Sandstone:Block Shear Test
- Sandstone:Block Shear Test
- - - CM-L:  $\tau = \tau_0(33t/m^2) + \sigma \cdot f(0.8)$
- - - CM-H:  $\tau = \tau_0(85t/m^2) + \sigma \cdot f(0.8)$



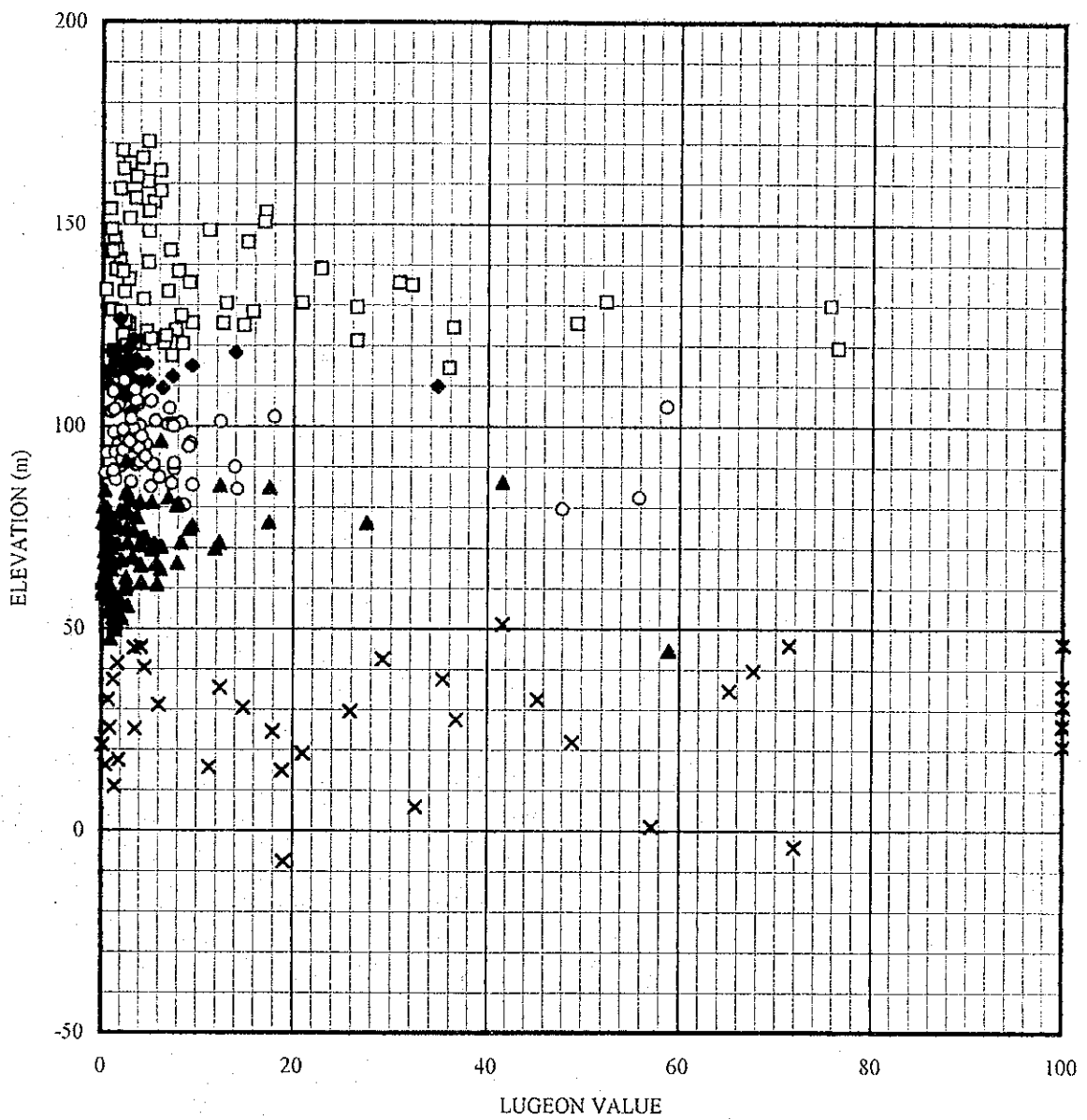
○ Tuffaceous Sandstone:Block Shear Test  
 ---- CL-L:  $\tau = \tau_0(30t/m^2) + \sigma \cdot f(0.7)$

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

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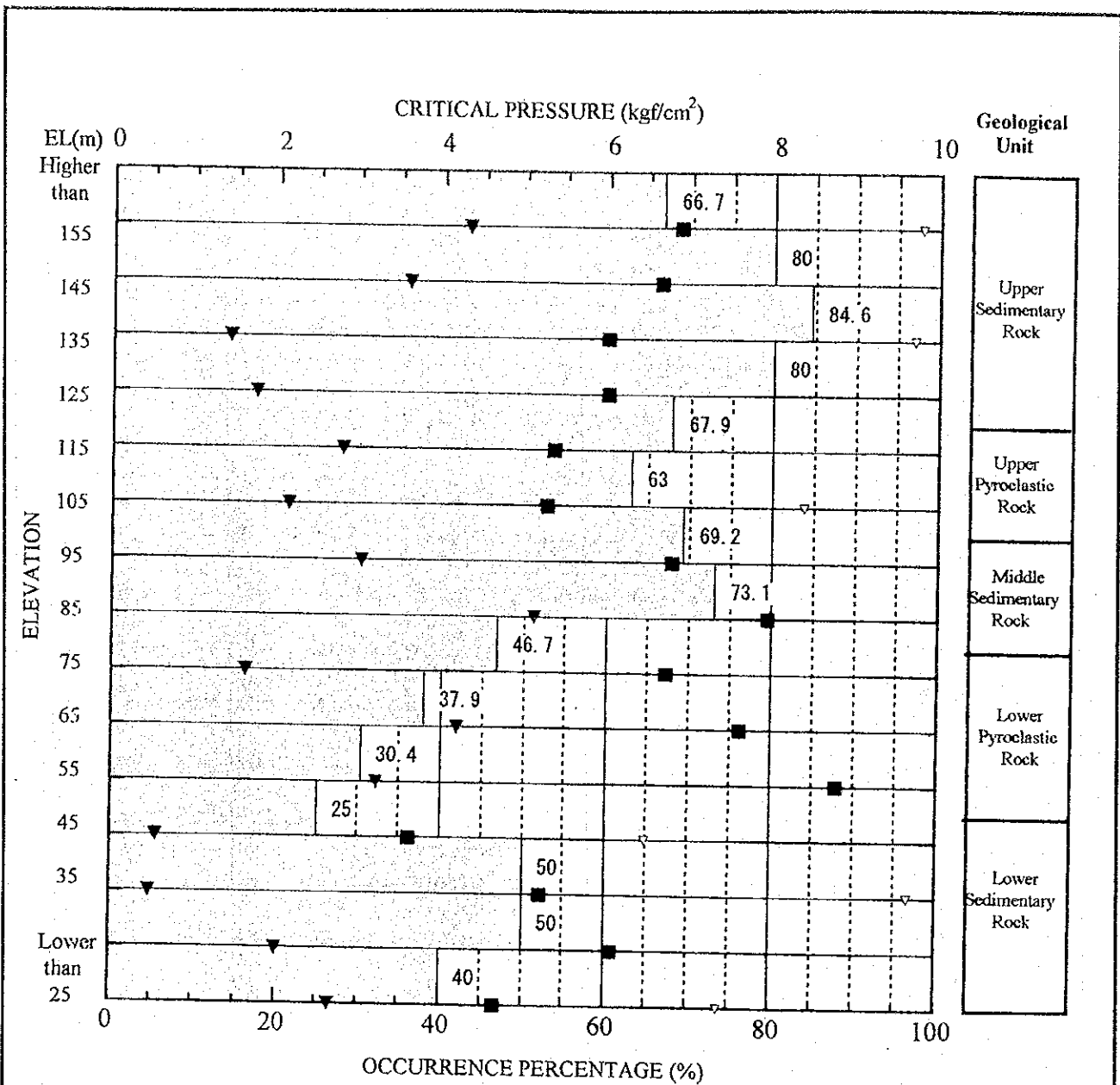
Fig. 5.1.7  
 IN-SITU SHEARING TEST RESULT OF CL CLASS AT DAMSITE





□ Upper Sedimentary Rock    ◆ Upper Pyroclastic Rock    ○ Middle Sedimentary Rock  
 ▲ Lower Sedimentary Rock    × Lower Pyroclastic Rock

Note : Elevation of each point shows middle point of each test section.

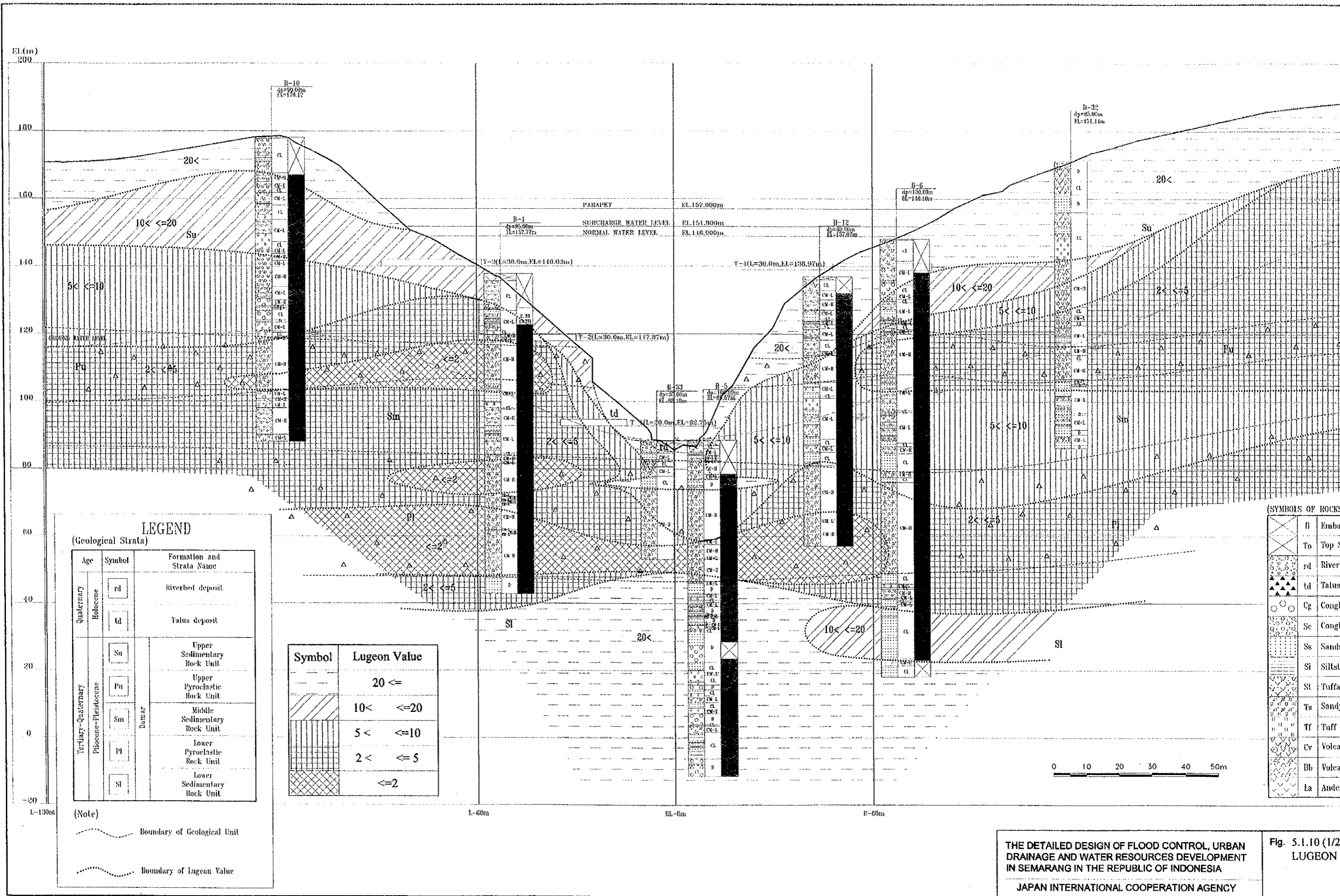


▽ Maximum Critical Pressure  
 ▼ Minimum Critical Pressure  
 ■ Average Critical Pressure

Note : Figures show percentage of occurrence frequency of critical points







**LEGEND**  
(Geological Strata)

Age	Symbol	Formation and Strata Name
Quaternary Holocene	rd	Riverbed deposit
	td	Talus deposit
Tertiary-Quaternary Pliocene-Pleistocene	Su	Upper Sedimentary Rock Unit
	Pu	Upper Pyroclastic Rock Unit
	Sm	Middle Sedimentary Rock Unit
	Pl	Lower Pyroclastic Rock Unit
	Sl	Lower Sedimentary Rock Unit

(Note)

- Boundary of Geological Unit
- Boundary of Lugeon Value

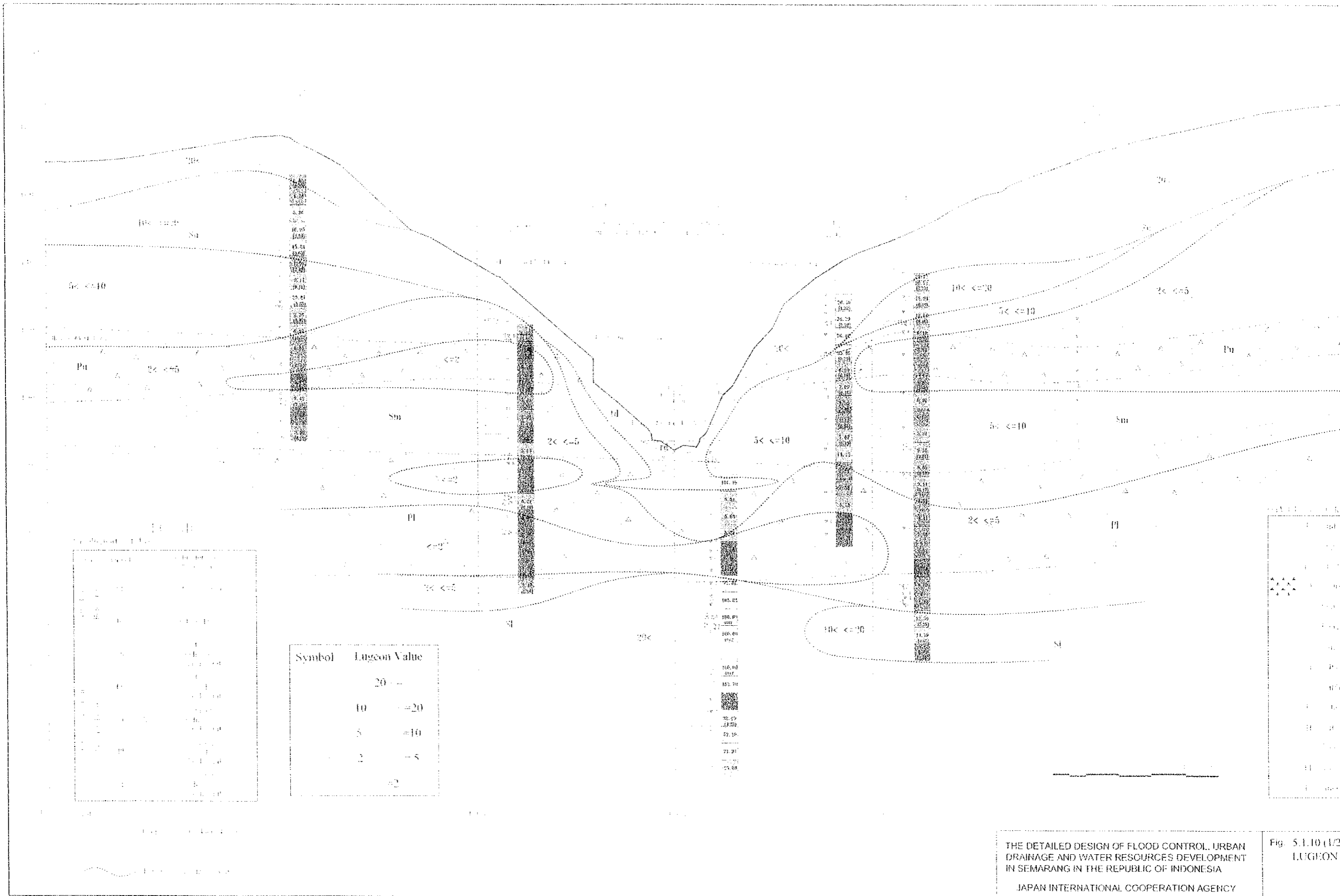
Symbol	Lugeon Value
(Horizontal dashed line)	20 <=
(Diagonal hatching)	10 < <= 20
(Vertical hatching)	5 < <= 10
(Cross-hatching)	2 < <= 5
(Stippled)	<= 2

(SYMBOLS OF ROCKS)

(Cross-hatched)	B	Embar
(Horizontal dashed)	To	Top S
(Diagonal hatching)	rd	Riverb
(Vertical hatching)	td	Talus
(Stippled)	Cg	Congl
(Diagonal hatching)	Sc	Congl
(Vertical hatching)	Ss	Sands
(Horizontal dashed)	Sl	Siltst
(Cross-hatched)	Sl	Tuffac
(Stippled)	Ts	Sandy
(Vertical hatching)	Tf	Tuff
(Diagonal hatching)	Cv	Volcan
(Cross-hatched)	Bb	Volcan
(Stippled)	La	Andes

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
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Fig. 5.1.10 (1/2)  
LUGEBON M



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA  
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Fig. 5.1.10 (1/2)  
 LUGEON