

FIGURES



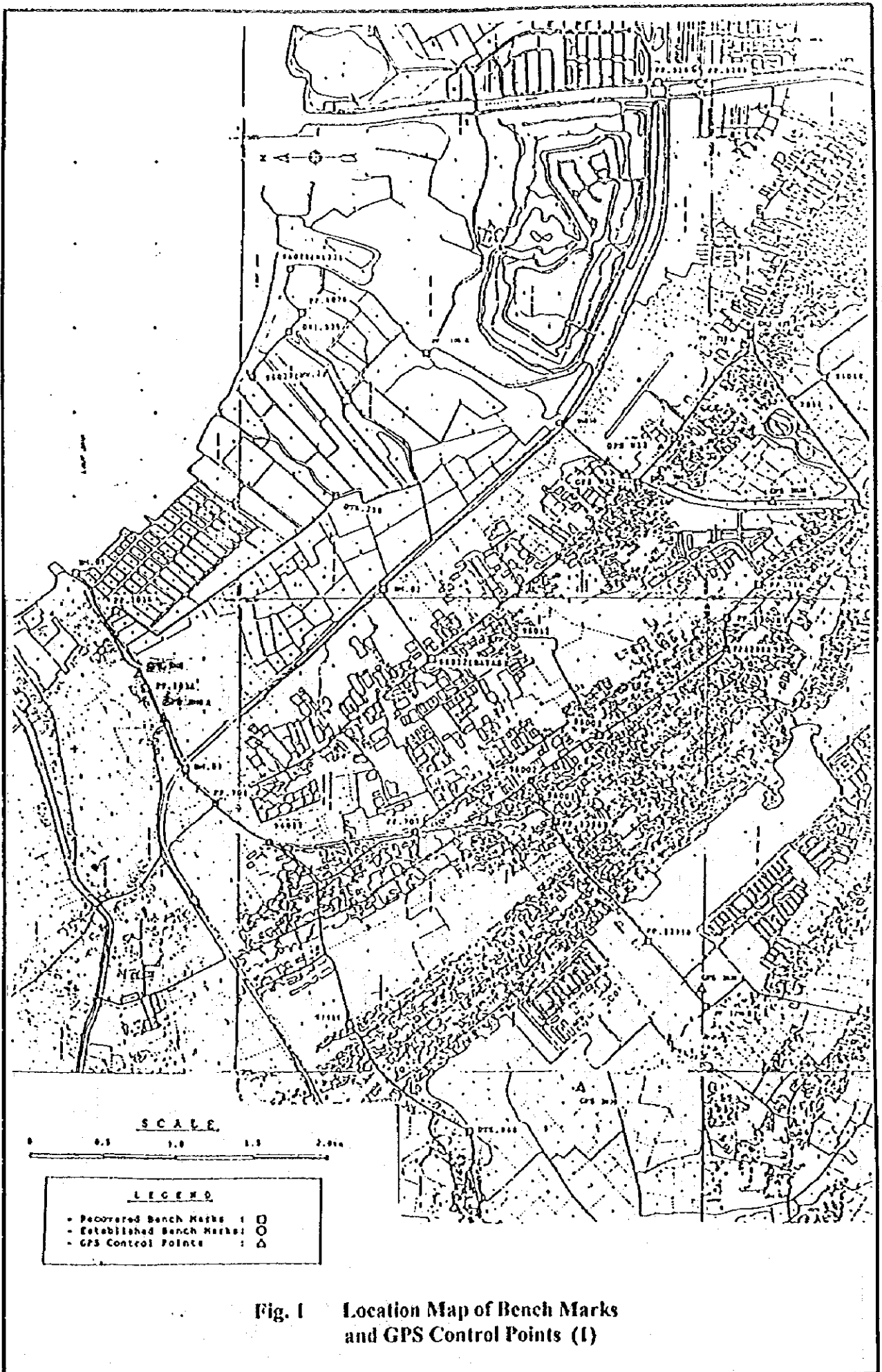






Fig. 3 Location Map of Bench Marks and GPS Control Points (3)

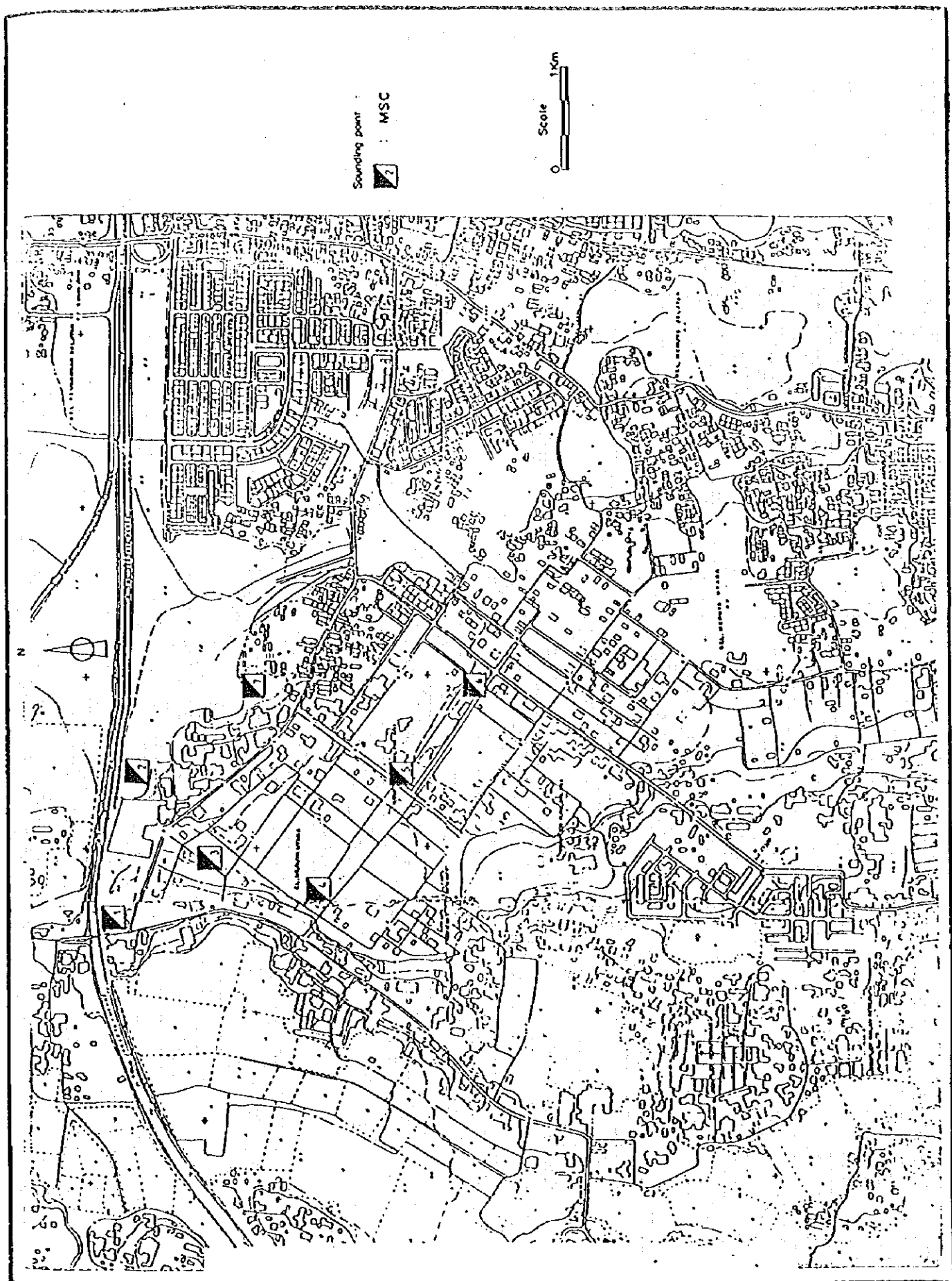


Fig. 5 Location Maps of Dutch Cone Sounding
in Cengkareng West and Meruya Areas

Fig. 6 Drill Log, Hole No. A - 1

Project		JAKARTA URBAN DRAINAGE				Depth: 35.4		Elevation: 0.37 m							
		Site : Tanjung River				Drilled: YALIA		Drilling rig : KOEN OE 2L							
Depth (m)	Elevation (m)	Soil type or Formation	Date	Column Section	DESCRIPTION	USBR	Recovery (%)	GWC (m)	N ₆₀ value	Number of Blows					
			From: 20 OCT 1995 to: 25 OCT 1996							10	20	30	40		
1		EARTH FILL			Silty CLAY, dark brown, soft		80							1	
2	1.6						70		4						2
3		CLAY			Silty and sandy CLAY, brown to greenish grey, red spots, soft, moist, medium plastic, rock fragments and shell fragments		90		4					3	
4	3.7						90		2						4
5		SAND & CLAY					100	1.43	4					5	
6						SAND, dark grey-brown, very silty, fine to medium, sticky, contains roots of plants and shell fragments, becomes black at 5 m depth, soft		100		4					6
7							100		2						7
8	8.3						100		2						8
9						SAND & CLAY, gradual change of color to green, low plastic, very fine, with shells and organic material, medium dense		100		2					9
10	10.3						100		15						10
11	11.0	Cemented SANDS			Coarse SAND, silty, well distributed grain size, some cemented portion, aspect of disintegrated rock, black		100		17					11	
12						High plastic CLAY, greenish with inclusions of coarse sand, derived from disintegrated rock, contains organic material (dark coals), some shell fragments, very stiff.		100	2.56	19					12
13		CLAY			- from 11.6 m to 12 m nodules of CaCO ₃ and iron concretions, 1.5 cm Ø		100		32					13	
14						- from 14 m to 14.5 m fine brown sand, silty, passes into green clay		100		27					14
15	15.0					- 14.5 m to 15 m green, plastic clay		100		34					15
16							100		36						16
17		SAND & SILT			Alternation of light green-brown silty fine SAND and SILT, contains thin levels of organic material, dense.		100		42					17	
18						- 15.5 m to 16.45 m green, plastic clay		100	2.25	29					18
19						- 18.45 m to 19.8 m color becomes dark and the sediment contains more clay		100		35					19
20	20.4						100		29						20
21	21.4	CLAY			Black, fat high plastic CLAY.		100		34					21	
22						- 21m to 21.4 m passage from clay to greenish, silty sand		100		30					22
23		SAND & CLAY			Brown-green intercalations of silty, fine SAND and CLAY sand is dense and the clay is hard.		100		35					23	
24						21.4 m to 22 m silty fine sand or silt		100		32					24
25						22 m to 22.7 m fine to medium sand, with hard rock fragments, 3 cm Ø		100		30					25
26						22.7 m to 24.4 m silty green clay, low plastic		100		30					26
27	27.0					24.4 m to 25 m silty fine sand with brown zones (iron) and small pebbles of white rock		100		33					27
28						25 m to 27 m sand derived from disintegrated rock, fine to coarse, silty		100		35					28
29		CLAY			Greenish brown CLAY, hard brown, colored by iron oxide		97		37					29	
30	30.0					From 20 to 30 m		100		40					30
31						From 30 to 35 m		100	1.85	41					31
32						Predominantly CLAY, brown, high plastic, very stiff to hard thin levels or pockets of brown fine to medium sand, irregularly intercalated		100		31					32
33								100		35					33
34								100		42					34
35	35.0							100							35

Fig. 7 Drill Log, Hole No. B - 1

Project		JAKARTA URBAN DRAINAGE				Depth: 35M		Elevation: 0.45M					
Depth (m)	Elevation (m)	Soil type or Formation	Site : Tanjungan River		DESCRIPTION	Drilled: YALIA		Drill rig : Y50 - 1					
			Date	from: 30 OCT 1996 to: 4 NOV 1996		USBR	Recovery (%)	GWL (m)	N ₁ value	Number of Blows			
			Column Section							10	20	30	40
1	0.9	Earth Fill			Red SOIL with black zones of organic material, sandy, silty and clayey soil	70							
2		SAND			SAND, gray-black with yellow veins, fine to medium, very loose to loosely in some portion, wet, contains many shell fragments, white, which break down easily, fragments of wood fibers, up to 12 cm and some gravel 1-2 cm Ø, sub-angular to rounded	70		2					
3						100		16					
4						100		5					
5	4.45					100		3					
6		SILT			Clayey SILT, gray, soft consistency, slightly plastic, contains shells and black organic material, traces of fine to medium sand	100		2					
7						100		4					
8						100		2					
9						100		3					
10	9.5	CLAY			Predominantly CLAY, green-yellow and white, product of rock weathering, medium to high plastic, very stiff, contains hard fragments and pebbles 3-5 mm Ø, iron concretions, brown or yellow and carbonaceous rock	100	25	10					
11						97		21					
12						97		26					
13						95		21					
14	14.5	SILT			SILT, compact, yellow to green brown and red, plastic, very stiff, contains fine sand	100		25					
15						95		28					
16						100							
17	17.0					100							
18		CLAY & SILT			Alternation of SAND and CLAY, the sand is fine, silty or clayey, brown, medium dense contains organic material (leaf), the clay is high plastic, green, very stiff	100		24					
19						95		31					
20	19.45					100							
21	20.0					100							
22	20.2	CLAY & SILT			SANDSTONE, medium grained, dark brown, recovered as core fragments coated by silt Medium SAND and SILT, brown, contains iron concretions, very dense Silty CLAY green or grey, passing to light grey, low to medium plastic, very stiff, slightly carbonaceous, from 21 to 22.2 m it passes progressively into dark grey soil	100	36	25					
23						100		21					
24	22.2					100		23					
25						100		20					
26		CLAY			CLAY and SILT 22.2-24 m fat, high plastic clay, dark grey, contains small pebbles of white, hard material and iron concretions 24-24.4 m sandy-silty grey clay with shell fragments 24.4-27.4 m alternation of sandy and silty clay, green, with brown zones (weathered iron oxide), low plastic and green clay, predominant from 25 m, highly plastic, very stiff, contains thin levels of organic material (grass) and 1 cm Ø iron concretions 27.4-28 m brown-grey clay, high plastic, very stiff, contains small pebbles 28-29 brown grey sandy clay, sand is derived from disintegrated carbonate rock and concentrated in pockets	100		25					
27						100		23					
28						100		20					
29						100		27					
30	29.0	SAND			Silty SAND, fine, brown, non plastic, dense, contains iron crusts, responsible for the brown color and plastic clay pockets	100	85	28	38				
31						100		46					
32						100		26					
33						100		26					
34		CLAY			CLAY, pure or silty, brown green with thin levels of hematite (iron oxide) 10-10.45 m silty, sandy clay, hard 10.45-13 m pure clay, very stiff 13-14.45 m silty clay, very stiff 14.45-15 m pure, dark grey clay, very stiff	100		23					
35						100		31					
36	35.0					100							

Fig. 8 Drill Log, Hole No. B - 2

Project		JAKARTA URBAN DRAINAGE				Depth: 30 M		Elevation: 2.25 M					
						Drilled: TATANG		Drilling rig: Y50-01					
Depth (m)	Elevation (m)	Soil type or Formation	Site : Cengkong Timur		DESCRIPTION	USBR	Recovery (%)	GWL (m)	N value	Number of Blows			
			Date	Column Section						10	20	30	40
1	0.9	Earth Fill	XXXX		CLAY silty sandy, organic, dark grey		100						
2		SAND	/		SAND, loose, fine to coarse, includes dark green clay pockets.	SM	100		8				
3	2.4				from 0.9-2.0 m dark brown		100		11				
4					from 2.0-2.4 m yellow-brown, silty		100						
5	4.45	CLAY	-		SAND, loose to medium dense, brown-grey, very fine, contains shell fragments	CH	100		13				
6					CLAY, stiff, pure or silty, medium plastic, contains shells and traces of organic material		100		8				
7	6.4	SAND	/			SM	100		10				
8	7.0				SAND, fine, gray, silty		100		12				
9		CLAY	-		Sandy CLAY, stiff to very stiff, iron oxide inclusions, with sand from desintegrated rock	CH	100		17				
10					- 7-8 m gray-green, with red zones, colored by iron oxide		100		17				
11	9.0	SAND & CLAY	-		- 8-9 m green-brown, low plastic, very sandy	SC / CL	100						
12					SAND, mainly derived from weathered/ desintegrated rock, CLAY in the lower levels		100						
13					- 9-10.55 m gradual passage from clay to sand, low plastic material, calcareous, sand is coarse, white		100		24				
14					- 10.55-11 m fine, clean, brown sand		100		26				
15					- 11-11.4 m brown-green coarse sand (from weathered rock)		100		22				
16					- 11.4-12 m silty, brown-green, fine sand		100		39				
17					- 12-13 m brown, fine, clean or silty, with black zones, colored by iron		100						
18					- 13-15 m clay, light brown, low plastic, intercalated with thin levels of clean sand, becomes gradually clayey at the bottom, hard		100						
19	13.35						100		36				
20		Cemented SAND	-		SAND/SANDSTONE	SM	100		39				
21					- 15-16 m partly consolidated sand- or siltstone, brown-grey, hard		100						
22					- 16-18 m, brown green silt, sand and clay, low plastic, rich in iron oxide		100		50/21			150	
23					- 10-19.7 m sand coarse to fine, brown, partly consolidated and recovered as hard, sandstone fragments		100		46				
24	20.0	SILT & CLAY	-		- 19.7-20 m light-brown silty sand, medium dense	CH	100		22				
25					SILT and CLAY		100		30				
26					- 20-21 m light brown-grey silt, non plastic		100		22				
27		CLAY	-		- 21-22 m fat, high plastic gray-green clay	CH	100		23				
28	23.0				- 22-23 m silty, light colored clay		100		31				
29					CLAY, fat, high plastic, hard with sand pockets from desintegrated rock.		100						
30					- 23-27.5 m dark-grey, sandy, brown zones colored by iron oxide, white calcareous pebbles and coarse sand		100		32				
31					- 27.5-29 m reddish green, very rich in iron oxide, silty.		100		42				
32					- 29-30 m brown green clay intercalated with silt		100		36				
33							100		35				
34							100						
35	30.0						100						

Fig. 9 Drill Log, Hole No. C - 1

Project		JAKARTA URBAN DRAINAGE				Depth: 20 M		Elevation: 2.19 M							
Depth (m)	Elevation (m)	Soil type or Formation	Site : Cengkaring Timur		DESCRIPTION	USBR	Recovery (%)	CMT (m)	N-value	Number of Blows					
			Date	From: 20 OCT 1996 to: 22 OCT 1996						10	20	30	40		
1	0.9	129	EARTH FILL		SAND and silty CLAY, reddish brown, soft, moist, with round pebbles		90								
2			CLAY		CLAY, dark grey, medium consistency, little silt, medium plasticity, traces of brown, organic material		100		5						
3	2.8	0.61						100		7					
4	3.5	1.31				Silty CLAY, brownish grey, moist, medium consistency, medium plastic, sand pockets, sand derived from weathered rock		100		8					
5			CLAY				100		12						
6						CLAY, light grey, stiff to very stiff, medium plastic, sandy and silty portions are irregularly distributed and low plastic		82		18					
7	6.8	4.61						98		30					
8	7.8	5.61				Sandy CLAY, green to dark grey, very stiff, contains sandy portions, yellow, fine grained, derived from weathered rock		100							
9			Cemented SANDS		Partially cemented SANDs, aspect of a weathered sandstone, fine to medium grained, very dense, greenish-grey:		90						150		
10						- 7.8-9.2 m sharp, thin rock fragments in sandy silt, sticky (drilling sludge)		100					150		
11						- 9.2-11 m black, thin fragments of fine sandstone		95					150		
12						- 11-12 m predominantly green sandy silt with angular rock fragments		98					150		
13	13.0	10.81				- 12-13 m only rock fragments, few cm thick, black, RQD 10%		96					150		
14								100		36					
15			CLAY				100		25				150		
16						Predominantly CLAY, fat, high plastic, green, very stiff, irregularly distributed zones of fine sand, olive-green, resulting from weathering of rock.		82		5			150		
17						19-19.6 m gradual passage to grey clay		100		30					
18								100		30					
19								100		15					
20	19.6	17.41				CLAY, pure fat, dark grey, stiff	CH	97							
21	20.0	17.81													
22															
23															
24															
25															
26															
27															
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Fig. 10 Drill Log, Hole No. D - 1







Project		JAKARTA URBAN DRAINAGE				Depth: 20 M		Elevation: 0.45 m					
Depth (m)	Elevation (m)	Soil type or Formation	Site : Cengkareng Timur		DESCRIPTION	USBR	Recovery (%)	GWL (m)	N-value	Number of Blows			
			Date	From: 28 OCT 1996 To: 28 OCT 1996						10	20	30	40
1		CLAY		Silty CLAY, light brown and black, soft, moist, low plastic, contains organic material, becomes light grey from 1.7 m and it contains small crystals of gypsum and trash	CL	60							1
2	2.0					100	4					2	
3		SILT & SAND		Sandy SILT or silty SAND, grey-brown or green, contains coarse sand from disintegrated rock and small fragments of coal, from 4 m coarse, silty sand, loose	SM / SA	100							3
4						100	4					4	
5	6.0					100						5	
6						100						6	
7		CLAY		Predominantly CLAY, greenish, low plastic - 3.6-6 m silty, sandy clay, medium - 6-6.4 m silty sand - 6.4-7 m green silty clay - 7-7.4 clayey silt - 7.4-8.2 clay, silt and sand mixture with wood fragments, 5 cm long, low plastic, stiff	CH	100	5						7
8	8.2					100	13					8	
9	8.6					100	13					9	
10	9.55					100	21					10	
11		SAND & GRAVEL		CLAY, sandy and silty, grey-green, moist, hard, low plastic, sand is fine to coarse, derived from disintegrated rock SILT or fine SAND, partially cemented, brown SAND and GRAVEL, well graded, clean, medium grain size predominates, grains of quartz, rock frag. and gypsum, gravel is 1-2 cm Ø, small pebbles, sub-angular or core fragments till 4 cm thick of consolidated sandstone, probably an irregularly consolidated deposit. - from 14.5 predominantly fine sand, clean or silty, yellow-green with iron concretions	SM - SG	100	24						11
12						100							12
13						100							13
14						100							14
15						100	36						15
16	16.5					100							16
17						100							17
18	18.0					100							18
19	18.3	MARL		MARL, greenish-white calcareous, very hard		100							19
20	20.0	SAND		Black or dark green SAND, fine, partly consolidated and recovered as sandstone fragments	SM	100							20
21													21
22													22
23													23
24													24
25													25
26													26
27													27
28													28
29													29
30													30
31													31
32													32
33													33
34													34
35													35

Fig. 11 Drill Log, Hole No. O - 1

Project		JAKARTA URBAN DRAINAGE				Depth: 25 M		Elevation: 4.33 M								
		Site : Cengkering Boro				Drilled: TATANG		Drilling : YSO-1								
Depth (m)	Elevation (m)	Soil type or Formation	Date	Column Section	DESCRIPTION	USBR	Recovery (%)	CWL (m)	Ni-value	Number of Blows						
			From: 26 OCT 1996 to: 28 OCT 1996							10	20	30	50			
1		Earth Fill	From: 26 OCT 1996 to: 28 OCT 1996		SILT, gravelly and sandy, brown		100						11			
2							100		24						2	
3	3.0						100		15							3
4		CLAY			CLAY, silty, grey-brown, moist, low plastic with lenses of fine sand, very stiff		100		25					4		
5	4.5							100							5	
6						CLAY, brown-reddish or black, highly plastic, very stiff, very rich in organic material (roots, peat, coal), moist, weathered rock fragments in the lower part	CH	100		19					6	
7								100		19					7	
8	7.7							100		26						8
9						CLAY, silty or sandy, green-grey, very stiff, medium plastic, moist, derived from disintegrated rock		100		30						9
10								100								10
11	10.3	Cemented SANDS			Partially cemented SANDS, rock or soil, fine to medium grained, sand is silty, medium dense, grey	SM	100		30					11		
12	11.45	CLAY					100		40				12			
13				Sandy CLAY, grey to greenish-grey, very stiff, high plastic, contains weathered rock fragments	CH	100		46						13		
14	13.9					100								14		
15		Cemented SANDS			Gravelly SAND, grey-green, very dense, fine to medium grained, poorly graded, looks like weathered sandstone, contains silty levels	SM	100							15		
16	15.7	SILT					100		32				16			
17				Clayey and sandy SILT, brown-yellow, with traces of iron	MS	100		26						17		
18	17.7					100		32						18		
19		CLAY			Silty CLAY grey to greenish grey, moist, high plastic, very stiff, becomes reddish from 18.2 m because of the iron oxide, close to 20 m it contains small pebbles of calcareous rock		100		34				19			
20	20.0						100		32					20		
21						CH	100		27					21		
22					Sandy CLAY, predominantly, white, stiff or very stiff, contains carbonate		100		16					22		
23	22.9				Cemented fine SANDSTONE or SILTSTONE, very hard, dark grey, underlain by MAREL		100								23	
24	23.4						100		38						24	
25	25.0				Silty CLAY grey to brownish grey, moist very stiff, similar to residual soil	CH	100									25
26													26			
27													27			
28													28			
29													29			
30													30			
31													31			
32													32			
33													33			
34													34			
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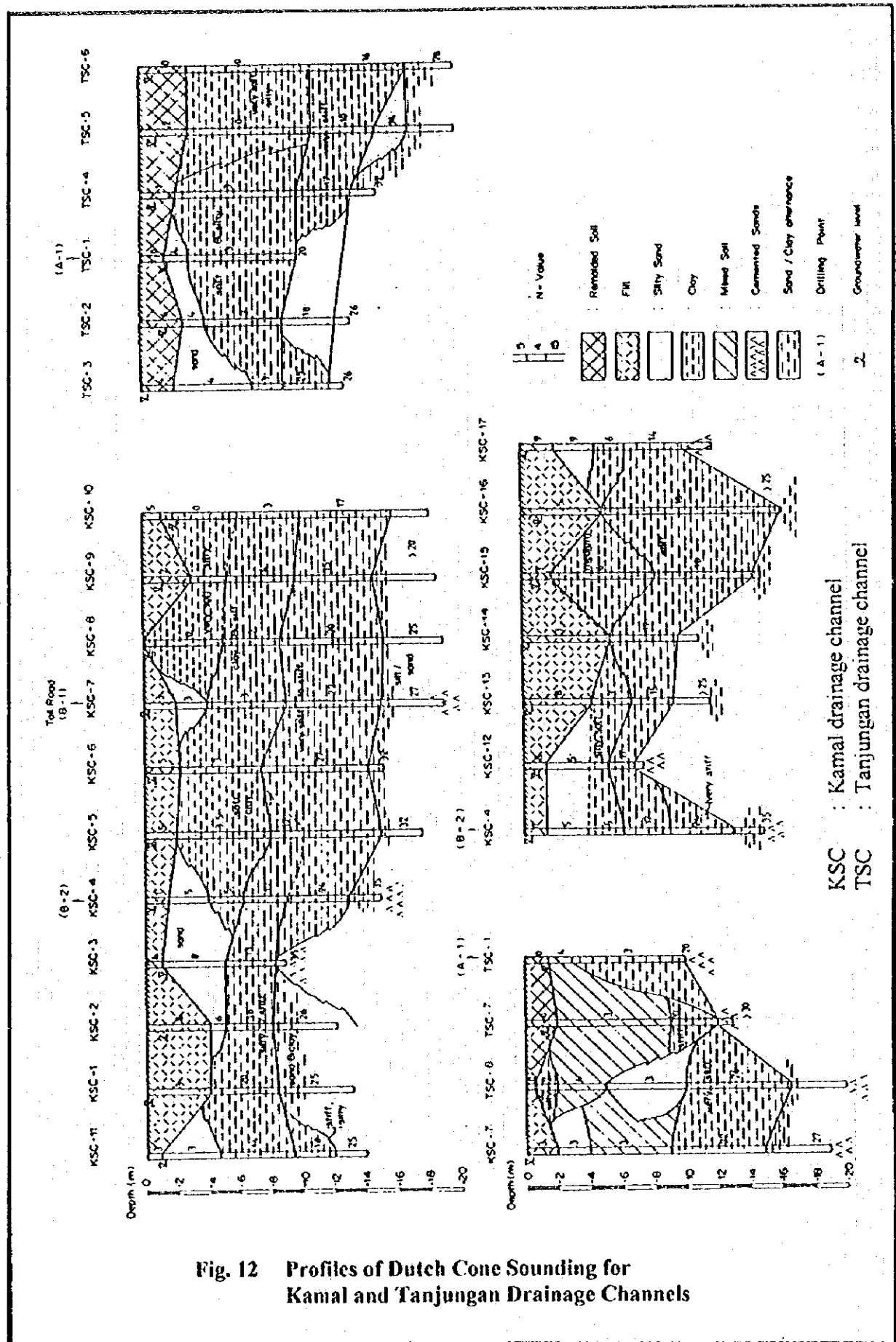


Fig. 12 Profiles of Dutch Cone Sounding for Kamal and Tanjung Drainage Channels

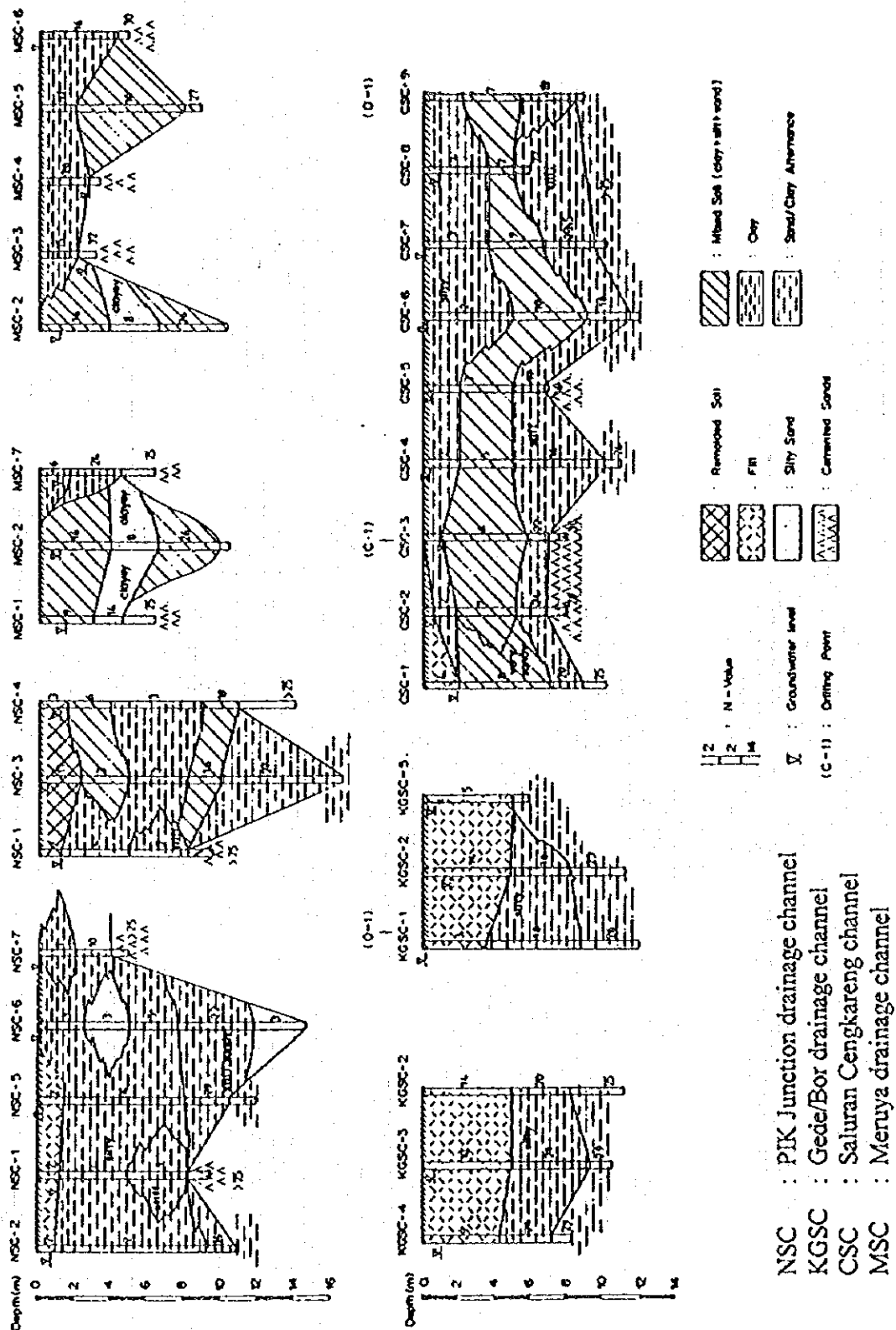


Fig. 13 Profiles of Dutch Cone Soundings for PIK Junction (New Channel), Gede/Bor, Saluran Cengkareng and Meruya Drainage Channels

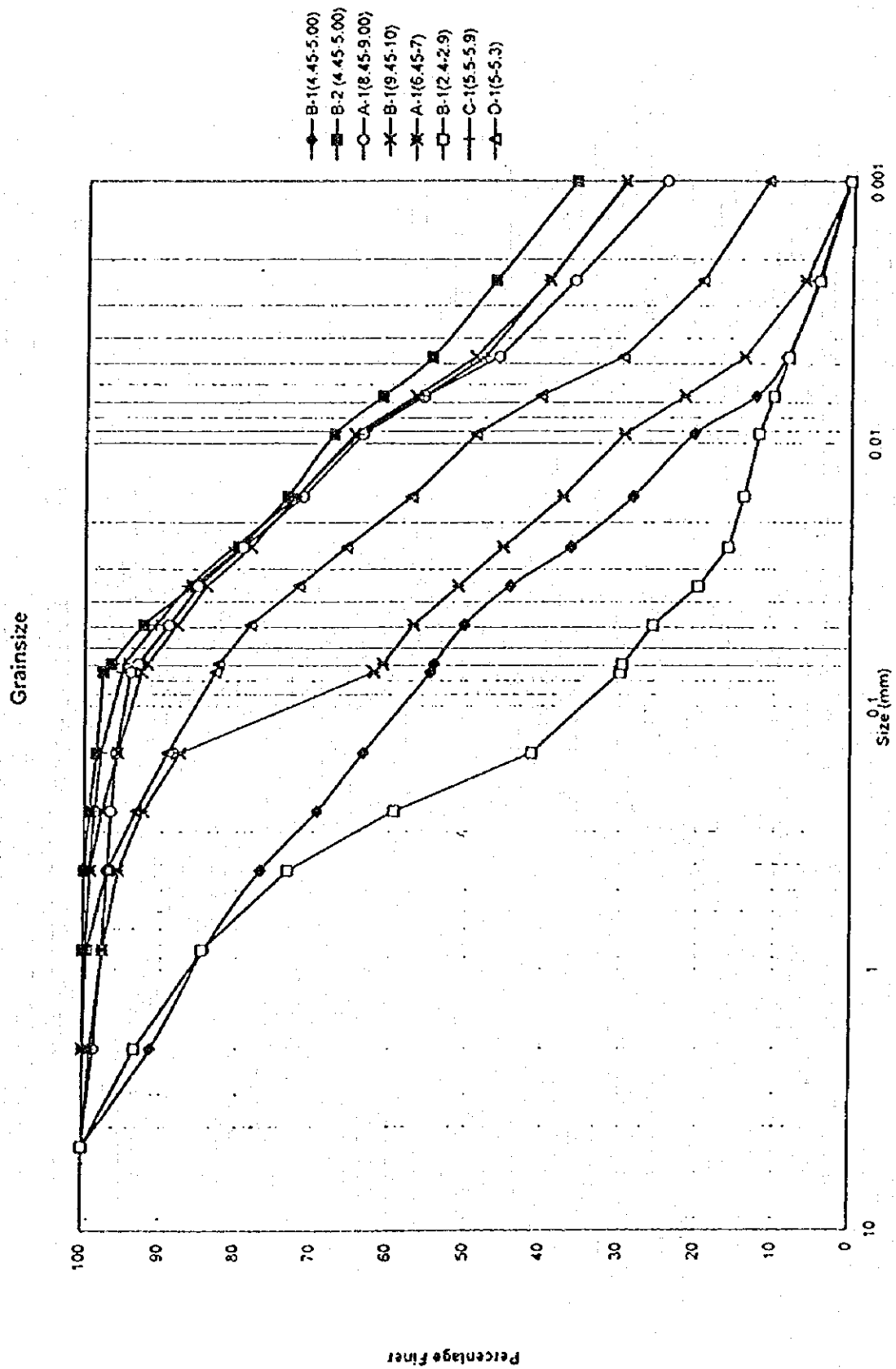
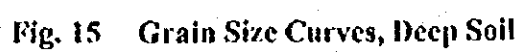


Fig. 14 Grain Size Curves, Shallow Soil



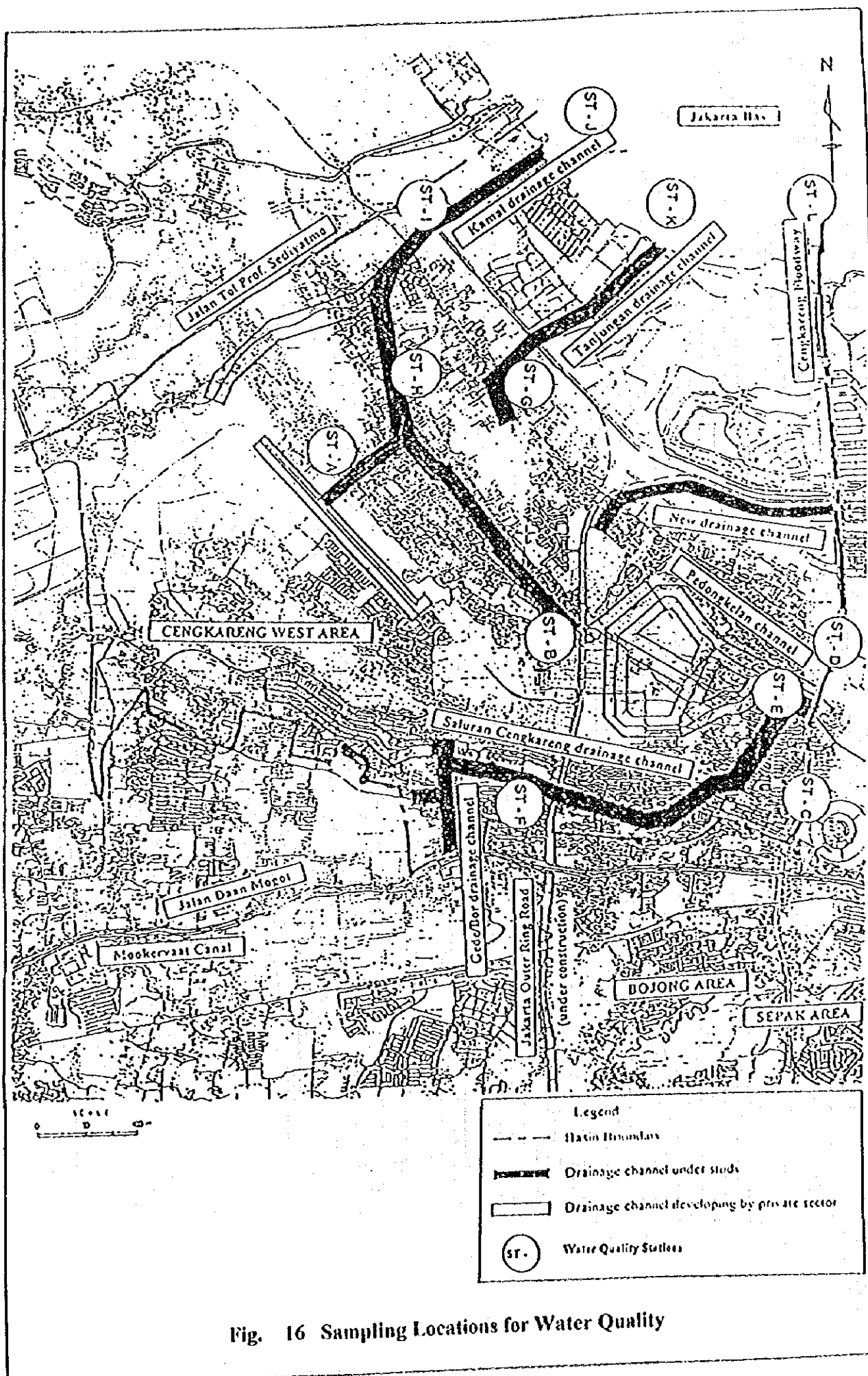


Fig. 16 Sampling Locations for Water Quality

PART II - TECHNICAL SPECIFICATIONS

VOLUME III PART II

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1. TEMPORARY WORKS : COFFERING WORKS, CARE OF WATER AND DEWATERING WORKS

1.1 General

The works under this Chapter consist of but not limited to :

- The required coffering works, care of water and dewatering works during the construction of drainage channel works including new channel, levee embankment, foundations of bridges and other drainage structures such as parapet walls, revetments, concrete stairs, sluiceways, drainage connection canals and cross drains, etc., relocation of drainage pipes and relocation and construction of approach roads,
- Stream diversion of the existing drainage channels and local drain ditches which flow into the channels in the areas covered by this Project and other miscellaneous diversion works,
- The required temporary road works such as detours and service roads, stagings and temporary bridges, etc., and
- The removal and demolishing of the existing structures as directed by the Engineer.

These works shall be performed in the manner as specified hereinafter or as directed by the Engineer.

The Contractor shall furnish all labour, tools, equipment, spares and materials required for construction, operation and maintenance of the temporary cofferings, diversions, care of water, dewatering and water disposal from the Works including temporary roads, stagings and bridges, removal and demolishing of the existing structures shown on the approved construction drawings or as directed by the Engineer.

After these temporary facilities have achieved their purpose, the same shall, with the approval of the Engineer, be removed from the places or leveled to give a sightly appearance as there were and shall, if considered necessary, be left at the places during the period of Operation and Maintenance unless otherwise directed by the Engineer.

No interruption or interference or injurious contamination with natural water flow and drains shall,

without the approval of the Engineer, be made by such works as coffering, diverting, caring of water, dewatering and water disposal from the Works which shall be operated by the Contractor during the specified period.

Other Temporary Works such as concrete plant, water supply system, electric power supply system, telecommunication system, buildings including the Contractor's site office and the Engineer's site office, etc., shall conform to the requirements stipulated in Chapter G8 in Vol. III, Part I - General Specifications.

1.2 Construction Plans and Detailed Drawings

The Contractor shall prepare in accordance with the provisions of Sub-clauses G4.2 in Vol. III, Part I - General Specifications, the construction plans and detailed drawings on the coffering, diverting, caring of water, dewatering and water disposal from the Works and shall submit to the Engineer for his approval at least thirty (30) days before the commencement of the Works.

The plan may be placed in operation upon approval, but the approval shall not relieve the Contractor from full responsibility for the adequacy of the care and diversion works.

The Contractor shall be totally responsible for furnishing labour, equipment and materials needed in regard to the diversion and care of the water during the period such diversion and care is necessary. The works pertaining to the diversion and care of the water shall be performed in accordance with the Contractor's plan and all applicable specifications, drawings, procedures, safety programmes, etc.

Some physical data which are presented in the tables in Chapter G2 in Vol. III, Part I - General Specifications, are only for general information to be used by the Contractor in regard to work volume and timing of his construction operations.

The Employer will, however, not be responsible for any deductions, conclusions or interpretations which may be made by the Contractor from this information and for any damage and delay of the Works attributed to the Contractor's design and drawings which may have been reviewed and approved by the Engineer.

The diversion arrangements are designed to safely pass the floods during the construction period. The Contractor shall fully prepare his water control and handling plan against occurrence of the floods and shall assume the responsibility for the stability of the cofferings and other structures up

to the water levels anticipated.

1.3 Temporary Coffering Works

1.3.1 Coffering works

The works under this Clause shall consist of supply of all labour, materials, and equipment and the performance of all works in respect to the coffering works for the construction of all the drainage structures, bridges and revetments, etc. covered under this Contract. The coffering works shall be designed in detail by the Contractor. Not less than thirty (30) days before commencement of any part of the coffering works, the Contractor shall submit to the Engineer detailed construction drawings, construction programme and method for his approval. The coffering for bridge foundations shall be carried out in the dry season.

Notwithstanding the approval of his plans by the Engineer, the Contractor shall remain fully responsible for a proper design, construction, maintenance and removal of the cofferings.

Coffering works shall be executed in accordance with the provisions in Chapter 2, Earthwork, of these Technical Specifications and in such a manner as shown on the approved construction drawings or as directed by the Engineer.

1.3.2 Steel sheet piling for coffering works

Where the steel sheet piles may be used for the coffering works, the furnishing and installation of all steel sheet piles including all beams, tie-rods with turnbuckles, ring joints, nuts and washers shall conform to the following :

(1) Material requirements

The Contractor shall submit the mill certificates of all the material for the Engineer's approval. Materials used for steel sheet piling shall conform to the requirements of the following applicable standards or approved equivalent standard :

Steel sheet piles	:	JIS A5528 SY295 or SNI 005-87-A
Walling materials,	:	JIS G 3102 or SNI 0722-89-A for material and channel steel, and
H-beam	:	JIS G 3192 or SNI 2295-88 for dimension

The steel sheet piles supplied shall be of U-shaped type, YSPF, W = 400 mm.

(2) Construction method

The Contractor shall not construct cofferdam or other obstacles totally stopping the stream water in the drainage channels in the Project area during construction.

Prior to driving the sheet piles, the Contractor shall provide and construct the access or temporary staging for piling equipment to the required alignment and properly set out and establish the centre of each pile position in accordance with the approved construction drawings or as directed by the Engineer.

The steel sheet piles shall be driven with a suitable equipment and in a manner as specified in Chapter 4, Piling Work, of these Technical Specifications. During driving sheet piles, the Contractor shall take the following records under supervision of the Engineer : tip depth of pile, number of blows per ten (10) cm for the last fifty (50) cm penetration and per fifty (50) cm for the last two (2) m penetration, accumulated number of blows and drop height of ram.

Walling and struts of steel sheet piles shall be made in such a manner as shown on the approved construction drawings or as directed by the Engineer on each row of piles.

1.4 Temporary Diversion Works

During the construction of sluiceways, drainage connection channels and relocation of drainage pipes and the likes, if necessary, the Contractor shall construct the temporary diversion channel not to damage the function of the existing drainage channels and pipes.

The temporary diversion channel as well as method of execution of the work shall be designed in detail by the Contractor and submitted to the Engineer for his approval. The diversion method shall be designed in such a way that none of the works are interrupted. The Contractor shall ensure that all diverted water shall be disposed without causing any damage or interference to the properties and operation of the Works.

The temporary diversion channel shall be maintained for the period directed by the Engineer. After the completion of the work for which it was constructed and under the direction of the Engineer, the temporary channel shall be backfilled with materials approved by the Engineer,

compacted and trimmed to the satisfaction of the Engineer.

The Contractor shall remain fully responsible for a proper design, construction, maintenance and removal of the temporary diversion channel and approval of his plans as well as method of execution of diversion channel by the Engineer shall in no way relieve the Contractor of his responsibility.

1.5 Dewatering During Construction

1.5.1 General

All excavated areas in open-air shall be drained-off. The required drainage facilities will consist of pits, trenches, pump sumps, pumps, pipe lines, generators and all auxiliary equipment and materials required for a safe and continuous operation of the dewatering system.

The Contractor shall furnish, install, maintain and operate all pumping and other equipment or methods which may be required for dewatering the various parts of the Works on the surface, in open-cut excavations and for keeping the foundation and other parts of the work free from water as necessary for constructing each part of the Works, and as may be required after any part of the Works is completed for such things as inspection, safety, installation by others or for any reason determined to be necessary by the Engineer.

The Contractor shall design temporary drainage facilities required for construction sites including for emergency in such a way that water originated from any source can be drained. The Contractor shall submit general design drawings, working procedures and time schedule to the Engineer for approval at least thirty (30) days prior to commencement of any works under this Clause. These documents shall state the quantity, type, capacity, arrangement and location of the required equipment. The Contractor shall submit, if so desired by the Engineer, detailed calculations carried out for arriving at the proposed dewatering system.

If the excavation should extend below the water table, the water table shall be lowered in advance of the excavation. The dewatering shall be accomplished in a manner that will maintain the stability of the slopes and the bottom of open-cut excavation, and will result in all construction operations being performed in the dry, where "in the dry" means that the construction operation will not be performed in an appreciable amount of free, running or standing water.

The Contractor shall pump all water from and shall keep the working areas free of water while

excavating, preparing foundations, placing embankment materials, backfilling, pouring concrete or as may otherwise be required for completing the Works. The Contractor shall be responsible for and shall repair at his own expense any damage to foundations, excavated slopes, structures or any other parts of the Works caused by water including flooding.

1.5.2 Construction method

The Contractor shall supply all labour, materials, equipment and installations for the temporary drainage facilities. The Contractor shall carry out all the works necessary for the construction and installation required for connecting, diverting and evacuating by free-flow or by pumping of all the water encountered.

If the Engineer judges that the temporary drainage facilities are not enough, he may order the Contractor to provide additional facilities.

The Contractor shall maintain and regularly clean all dewatering equipment and accessories during the construction time on all construction works and shall remain fully responsible for proper disposal of water at all times.

1.5.3 Starting and duration of water drainage

The duration of water drainage will be determined according to the construction time schedule.

Pump operation shall not be removed or altered in any way without the written permission of the Engineer. The pumps and water drainage facilities shall be kept in proper working conditions without extra payment, until the Engineer notifies the time of removal.

The removal shall be made in a manner that will have a slightly appearance and will not interfere with the operation or usefulness of the Works. In such case, the removal and disposal of the structures including incidental repairs and adjustments of remaining structures shall be performed by the Contractor at no extra cost to the Employer.

1.6 Temporary Road and Bridge Works

1.6.1 General

The Contractor shall furnish, maintain, and remove on completion of the works for which they are

required, all temporary road works such as detours and service roads, stagings and temporary crossings or bridges over streams or unstable ground, and he shall make them suitable in every respect for carrying all Construction Plant and Equipment required for the Works, for providing access and traffic for himself or others, or for any other purposes.

Such temporary roads and bridges shall be constructed to the satisfaction of the Engineer, but the Contractor shall nevertheless be responsible for any damage done to or caused by such temporary road works.

1.6.2 Construction requirements

Before constructing temporary roads, the Contractor shall make all necessary arrangements, if required, with the public authorities or landowners concerned, for the use of the land and he shall obtain the approval of the Engineer. Such approval will not, however, relieve the Contractor of his responsibility. Upon completion of the Works, the Contractor shall clean up and restore the land to the satisfaction of the Engineer or the landowner concerned.

Where, in the opinion of the Engineer, a detour is not feasible or a sufficient area is not obtained for detour, construction shall be undertaken only over half of the full width and shall be permitted under the approval of the related authorities. The length of such half-width construction shall be kept as short as possible.

Stagings and temporary bridges shall be designed for D-Loading (Muatan-D) specified in Indonesian Standard, provided that allowable stress of fifty (50) percent can be increased for temporary load and force during construction.

1.7 Removal and Demolishing of Existing Structures

Prior to the execution of construction of the new channels, levee, revetments and the new sluiceways and bridges as well as extension of the existing sluiceways, etc., the Contractor, where directed, shall remove or demolish the existing structures such as channel revetment, culverts, bridges, levees, parapet walls and other related structures stated in the Bill of Quantities in the respective items of work or as directed by the Engineer excluding the following facilities :

- (1) Water supply pipe line under PDAM,
- (2) Electrical cable, pole, transmission and supply line under P.T. PLN,
- (3) Telephone cable under P.T. TELKOM,

- (4) Public utilities,
- (5) Private utilities, and
- (6) Existing irrigation facilities, if any, under DGWRD.

The Contractor shall submit the construction drawings, removal and demolishing plan, and time schedule to any public authority, company or person belonging to, controlling or concerning the above mentioned existing facilities, and negotiate with them in respect of various matters which may occur in the execution of the removal and demolishing works. The Contractor shall confirm in writing to the Engineer that he has obtained the consent of the concerned authority before taking up such demolition and removal. The Contractor shall fully indemnify the Employer against any claim, action, expense, loss, damage or injury incurred in this respect.

1.8 Measurement and Payment

1.8.1 Temporary coffering works, care of water including dewatering

The payment for temporary coffering works, care of water including dewatering stated in the respective items of works in the Bill of Quantities will be made at the lump sum prices tendered therefor which shall include the full compensation for the cost of construction, maintenance, removal of coffering work, furnishing materials, labour and equipment for coffering work including care of water and dewatering during construction and channel diversion works, if any. But those which are not itemized in the Bill of Quantities shall be deemed to be included in the cost of the respective works for which the coffering works is required.

Payment for the lump sum price shall be made upon the basis as follows:

- (i) Eighty (80) percent of the lump sum price will be paid after completion of dry up in the coffering works duly certified by the Engineer,
- (ii) The remaining twenty (20) percent of the lump sum price will be paid after completion of removal of the coffering works and the site restored to the original state duly certified by the Engineer.

No separate payment will be made for control and removal of water from the various foundations, all types of excavation and when placing embankment or backfill material during construction. All cost incurred from the works for control and removal of water shall be deemed to be included in the appropriate unit or lump sum prices for the respective work items for excavation, backfilling,

embankment, etc. tendered therefor in the Bill of Quantities.

1.8.2 Temporary road and bridge works

The payment for temporary road and bridge works will be made at the lump sum price tendered for Item No. 0/01 in the Bill of Quantities which shall include the full compensation for the cost of construction, maintenance and removal of temporary roads, stagings and bridges including furnishing materials, labour and equipment.

Payment for the lump sum price will be made upon the basis as follows :

- (i) Eighty (80) percent of the lump sum price will be paid after completion of the temporary roads, stagings and/or bridges duly certified by the Engineer,
- (ii) The remaining twenty (20) percent will be paid after completion of removal of the structures above and site restored to original state duly certified by the Engineer.

1.8.3 Removal and demolishing of existing structures

The payment for removal and demolishing of the existing structures stated in the respective items of works in the Bill of Quantities will be made at the lump sum prices tendered therefor in accordance with the Drawings, Specifications and/or as directed by the Engineer and duly certified by the Engineer in the Bi-Monthly Statement of Account.

The lump sum price shall include the full compensation for furnishing all the equipment and labour for removal and demolishing of the existing structures including any incidental works such as preparation and negotiation with the owners, authorities, etc. in accordance with the Specifications.



2. EARTHWORK

2.1 General

This Chapter covers earthwork consisting of the following, but not limited to :

- (1) Site Clearing, Grubbing and Stripping
- (2) Demolishing of Existing Structures
- (3) Excavation
- (4) Excavation in Drainage Channel
- (5) Excavation for Structures
- (6) Bench Cut Excavation for Existing Levee
- (7) Excavation for Connection Canal
- (8) Earthfill
- (9) Earthfill for Levee Embankment
- (10) Earthfill for Inspection Road Embankment
- (11) Dumpfill (Not Applicable)
- (12) Backfill
- (13) Filling-up of Abandoned Drains with Compacted Materials, if any
- (14) Filling-up by Random Materials
- (15) Soil Disposal
- (16) Sodding
- (17) Gravel Metalling
- (18) Borrow Areas, if any

The Contractor shall prepare his plans, detailed working drawings and sequence of construction and submit to the Engineer for his review and approval at least thirty (30) days prior to such works being taken up as provided in Sub-clause G3.2 of Vol. III, Part I - General Specifications.

If the Engineer decides the excavated material is suitable for use in embankment and other works, it shall be stockpiled in appropriate areas for later use or hauled to and directly placed in permanent construction, as determined by the Engineer. Stockpiled material shall be smoothed to the lines and grades as directed by the Engineer.

Generally speaking, the unit prices for material excavated from the various construction sties shall include the cost of hauling it to and disposing it at designated spoil bank(s). Suitable material

excavated from the borrow area for use in constructing the levee embankment will be considered basically as embankment material and shall be priced as such.

2.1.1 Character of strata

The Contractor shall satisfy himself of the character of all earth works and ascertain for himself the character of the strata and materials to be excavated or filled.

The Contractor shall also satisfy himself as to the general conditions and circumstances at the site of the works, the obstructions thereon and therein, the form of any channel bed and banks, the flow of water in the drainage channels, the surface of the ground, the possible subsidence of soft ground and poor materials, likelihood of shrinkage and sliding of materials and possibility of floods.

The Contractor shall quote the unit prices in the Bill of Quantities according to his own view of the above, as no allowance will afterwards be made beyond the unit prices tendered in the Bill of Quantities which shall be inclusive of all the above mentioned circumstances.

The Contractor shall also take the risk of having in the excavations, slipping clay, running sand and gravel, subsoil and drainage water, springs, stones, trees, brushwood, timber and debris, obstructions of any kind and material of whatever nature may be encountered : and the unit prices in the Bill of Quantities shall cover these and all other contingencies.

2.1.2 Earthworks to lines, levels and grades

Whole of the earthworks for several parts of the Works shall be carried out to the dimensions and levels as shown on the Drawings, or to such other dimensions and levels as may be ordered by the Engineer. Dimensions, which are based on or related to ground levels, shall be referred to the Engineer before commencing earthworks at any location.

For the purpose of these Specifications, the term ground or channel bed level shall refer to the ground or the channel bed surface before the start of earthwork.

The Contractor shall be completely and solely responsible for setting out the position of the various structures on the ground and establishing an adequate number of bench marks and reference points. The topographical data shown on the Drawings are indicative only and the Contractor shall have to carry out any checking required and make any extra topographical survey which may be necessary. Should the Contractor find any discrepancy between the original surveys

and the new surveys he shall, therefor, inform the Engineer in writing. In such case, the Contractor shall carry out the survey in the presence of the Engineer, and the results obtained at that time shall be used in measurement of the Works.

2.2 Site Clearing, Grubbing and Stripping

2.2.1 Scope of work

When the removal of certain trees and shrubs may be required during the Contractor's operations, the Contractor shall remove such trees and shrubs after seeking prior approval of the Engineer. All trees and shrubs to remain in place shall be protected from damage. Where clearing is required, as in the right-of-way width, and borrow area outside the right-of-way, all combustible materials from clearing operations shall be burned or removed from the work sites or otherwise disposed of as directed by the Engineer.

All materials to be burned shall be piled neatly. Piling for burning shall be done in such a manner and in such locations as to cause the least fire risk. All burning shall be so thorough that the cleared materials are reduced to ashes. The Contractor shall at all times take special precautions to prevent fire from spreading to areas beyond the limits of the cleared areas and shall have available at all times, suitable equipment and supplies for use in preventing and fighting fires in accordance with the provisions of Clause G7.6 of Vol. III, Part I - General Specifications.

Grubbing will consist of the removal of the stumps, jungle growth, brush and rubbish from the work areas to be occupied by permanent structures, roads and canals and from the surface of borrow areas, stockpile sites and elsewhere as directed by the Engineer.

Stripping shall include removal of top soil and perishable or unsuitable material including the existing buildings, foundations, fences, structures and retaining walls, if any, which obstruct the Works. Stripping shall remove all such materials from the ground surface of foundations of the permanent structures, stock piles, borrow areas and sub-grades of the inspection roads, etc., as shown on the Drawings or otherwise directed by the Engineer. The stripping shall be made by a suitable manner employing equipment or tools and as directed by the Engineer. Transportation and disposal of the stripped material to the designated places shall be subject to the direction of the Engineer.

All timber cleared in the area, if marketable, shall remain the property of the Employer. The holes caused by removing the roots shall be backfilled with approved material and compacted in

accordance with the requirements for fill at the level concerned.

Before the commencement of site clearing, grubbing and stripping work, the Contractor shall carry out a survey in the presence of the Engineer or his authorized representative to precisely define the area and to set out the original ground lines within which the Work is to be executed and shall submit his drawings to the Engineer for approval.

2.2.2 Measurement and payment

Measurement, for payment, of site clearing, grubbing and stripping work will be made on the basis of the total designated surface area in square metres as determined by the original ground lines and design lines shown on the Drawings or as directed by the Engineer. The original ground lines shall be established by the Contractor by carrying out survey in the presence of the Engineer's Representative and submitted to the Engineer for his verification and approval prior to the execution of any site clearing, grubbing and stripping work.

Regardless of the quantities actually cleared, grubbed or stripped, measurement for payment shall be made to the prescribed lines, grades and levels and no payment shall be made for such work executed by the Contractor which is beyond the prescribed lines unless the same has been directed by the Engineer in writing.

Payment for site clearing, grubbing and stripping work shall be made at the unit price stated in the relevant items to the area in square metres as prescribed above and so certified by the Engineer in the Bi-Monthly Statement of Account. The unit price shall include all costs of equipment, tools, materials and manpower required to complete the works in all respects and subsequently to demobilize the same as directed by the Engineer.

2.3 Demolishing of Existing Structures

2.3.1 Scope of work

Demolishing works, inclusive of demolishing, chipping, hauling and disposing of the existing works, shall be made to the following structures, but not limited to:

- (1) Levee embankment
- (2) Parapet wall
- (3) Drainage channel revetment

- (4) Sluiceways
- (5) Extension of existing sluiceways, if any
- (6) Drainage connection canal and cross drains
- (7) Relocation of irrigation canal, discharge pipe and distribution line, if any.

The Work shall also include the salvaging of designated materials and backfilling of the resulting trenches, holes, areas and depressions.

Before demolishing, the Contractor shall carry out a survey in the presence of the Engineer's Representative to measure the dimensions of the existing structure and submit the survey result to the Engineer for his verification and approval prior to execution of such demolishing.

The demolishing works shall be carried out carefully on the existing masonry parapet wall, revetments and concrete structures by chipping employing suitable hand tools in order to prevent any injuries and damage to the properties and materials neighbouring outside the working site. All costs incurred from such damage due to the Contractor's failure or negligence shall be borne by him. The damages to masonry, parapet wall, revetments and concrete shall be made good as satisfactory and acceptable to the owners at the Contractor's expense. The demolished material shall be disposed-off by the Contractor to the designated dumping yards or as directed by the Engineer.

Basements and cavities left by such removals shall be filled and compacted with acceptable material to the level of surrounding ground.

All designated salvageable material shall be removed, without unnecessary damage, in sections or pieces which may be readily transported by the Contractor and stored on specified places in the Project area as directed by the Engineer. All material recovered from demolition shall remain the property of the Employer, if marketable,

2.3.2 Measurement and payment

Measurement including demolishing, chipping, hauling and disposing of the existing structures will be made on the basis of the volume in cubic metres of the material demolished to the lines, grades and levels as shown on the Drawings duly certified by the Engineer.

Payment to the Contractor shall be made at the unit price per cubic metre stated in the Bill of Quantities to the volume as prescribed above and so certified by the Engineer on the Bi-Monthly

Statement of Account.

The unit price stated for the relevant items in the Bill of Quantities shall include all costs incurred from demolishing, chipping, hauling, salvaging and disposing including equipment, tools, materials, manpower, loading, unloading, transport, disposal and subsequent demobilization of the same as directed by the Engineer.

2.4 Excavation

2.4.1 Scope of work

The Contractor shall carry out all excavations other than dredging in whatever material may be encountered in accordance with these Specifications, Drawings or as directed by the Engineer. The Contractor shall provide and operate the equipment for all the necessary excavating, lifting, hauling and transport to deal with every kind of material. The whole of the excavation for the several works is to be carried out to such widths, lengths, depths and profiles as shown on the Drawings, or to such other dimensions as may be ordered by the Engineer in writing.

The Contractor may carry out the excavation by any method he considers most suitable subject to stipulations hereinafter or hereinbefore contained and approval of his proposed method by the Engineer.

All excavations are to be finished to the lines, levels and profiles shown on the Drawings or as directed by the Engineer. Except in so far as specifically provided, over excavation of the works beyond the dimensions shown on the Drawings shall be filled with selected material as ordered by the Engineer.

Where necessary the sides of all excavations shall be properly shored up and supported with struttings and plankings, and the sides shall be close sheeted where necessary to prevent the entry of running sand, mud, etc.

When any excavation has been carried out and trimmed, the Engineer shall be informed accordingly so that he may inspect the completed excavation. No excavation shall be filled-in or covered with concrete until it has been inspected by the Engineer and the Contractor has been authorized to proceed further with the work. Survey points, bench marks, boundary stones and other fixtures, if any, shall not be removed without the written approval of the Engineer. Such fixtures, if removed, shall be restored in their original condition and as directed by the Engineer at

no extra cost to the Employer.

During the progress of the work, the Engineer may find it necessary or desirable to vary the slopes, grades or the dimensions of the excavations from those specified herein and the Contractor shall not be entitled to any additional allowance above the unit prices tendered in the Bill of Quantities for excavation by reason of such changes. Any other open-cut excavation, performed at the option of the Contractor such as to secure access to the required work, for disposal of material excavated, or for any other purpose, shall be kept within the limits approved by the Engineer and shall be at the expense of the Contractor with no costs being charged to the Employer.

Following works shall not be measured and paid separately and the cost hereof shall be deemed to be included in the unit prices of various excavation items in the Bill of Quantities :

- (1) Excavation either in the dry or in water and any dewatering which may be necessary.
- (2) Excavation through any material to any depth unless stated otherwise in the Bill of Quantities.
- (3) Trimming and, where necessary, benching the excavation to the correct profiles, lines and levels and compacting to receive concrete or other construction materials.
- (4) Selecting excavated material proven to be unsuitable or suitable for use as embankment material and setting aside suitable excavated materials.
- (5) Transporting excavated materials to spoil dumps or stock piles except as designated in the respective excavation work items in the Bill of Quantities including any special measures taken for such transportation due to existing access conditions.
- (6) Removal of wooden groynes, if any, that might interfere with excavation profiles and subsequent re-driving of the same as directed by the Engineer.
- (7) Any additional topographical survey required for completion of the Works including establishing secondary survey points.

2.4.2 Excavation beyond true line

If from any cause whatsoever excavations other than for concrete work are carried out beyond their true line and level other than at the direction of the Engineer, the Contractor shall at his own cost

make good to the required line and level with the approved material and in such a manner as the Engineer may direct.

If from any cause whatsoever excavation for concrete works are carried out beyond their true line and level other than at the direction of the Engineer, the Contractor shall at his own cost fill in to the required line and level with concrete similar in grade to that intended to be used in the true concrete work unless otherwise directed.

2.4.3 Unsuitable materials

Fill materials excavated from the drainage channels and drainage ditches which, in the opinion of the Engineer, cannot be compacted to the specific density as provided for in Sub-clause 2.9.2. hereinafter after breaking up, wetting or drying, shall be classified as "unsuitable materials". Unsuitable materials shall not be included in the embankment and shall be disposed of as specified in Sub-clause 2.15.1 hereof.

2.4.4 Transportation of excavated materials

The transportation of excavated materials to fill site or disposal of excess or unsuitable materials shall be carried out in accordance with the approved schedule of earthwork operation by the Engineer. The Contractor shall transport materials by the most appropriate route between excavation and dumping or the route directed by the Engineer. No separate payment shall be made for transportation of earth material up to and beyond the distance specified in the excavation, of which the cost shall be included in the unit prices of appropriate excavation items.

2.4.5 Measurement and payment

Measurement, for payment, of each kind of material of excavation will be made on the basis of the volume in cubic metres as a solid mass prior to excavation as determined from the original ground lines and design lines as shown on the Drawings or as directed by the Engineer. The original ground lines shall be surveyed in the presence of the Engineer or his authorized representative and submitted to the Engineer for verification and approval prior to the start of excavation.

Regardless of the quantities actually excavated, measurement for payment shall be made to the prescribed lines, levels and grades and no payment shall be made for excavation or removal of materials by the Contractor which is beyond the prescribed lines unless such excavation or removal has been directed by the Engineer in writing.

Payment for the various items of excavation shall be made at the unit price to the sum calculated for the volume in cubic metre as prescribed above and so certified by the Engineer in the Bi-Monthly Statement of Account. The unit prices stated in the relevant items in the Bill of Quantities shall include all costs incurred from all equipment, tools, materials and manpower required to complete the works in all respects and subsequent demolition of the same.

All costs incurred by the Contractor from the correction or restoration of the works during the course of excavation of such works shall be borne by the Contractor and no claim for extra costs shall be considered by the Employer.

2.5 Excavation in Drainage Channel

2.5.1 Scope of work

The work covered under this Clause shall mean the excavation in a drainage channel, which is not be executed by means of a dredger.

It is scheduled that the soil excavated in the original ground of the drainage channel is used for levee embankment as practically as possible. The Contractor shall survey the borrow area in the channel, if designated, and submit his excavation programme along with drawings showing the location and extent of borrow areas, excavation lines, grades, levels and other dimensions and requirements for approval of the Engineer.

The area in which the excavation is carried out shall be site-cleared and surface-stripped in accordance with Clause 2.2 hereinbefore. After the surface soil is stripped, the soil material to be used for the levee embankment shall be excavated to the lines and grades as shown on the Drawings or as directed by the Engineer. Excavation shall be carried out in strict conformity to the requirements provided for in Clause 2.4 hereinbefore.

Excavation in the drainage channel shall generally be carried on from the downstream reaches to the upstream reaches to avoid flooding due to the occurrence of unexpected high water, and also carried on from the center of channel to the levee side to ensure the easy access for obtaining the fill material for levee embankment.

During the execution of excavation in the drainage channel, the Contractor shall fill up depressions located on the route of hauling the excavated materials. Where earth material from excavation

must necessarily be transported to the fill sites or stock piles with different haul distances, the cost of excavation shall include the transportation of fill material up to the distance designated in the relevant excavation items in the Bill of Quantities. No transport for distance greater than the above distance shall be separately measured and paid.

The excavated soil extracted from the drainage channel shall not be disposed of to the drainage channel, even if dredging is being executed downstream of the excavation. All excavated materials shall be placed in the designated stockpiles or disposal area alongside the levee separately depending on the suitability for its reuse as embankment material.

Special caution shall be given throughout the execution period for prompt removal of the construction equipment to safe places when there is an unexpected high water stage.

2.5.2 Tolerances

The excavated surface shall be finished to the lines and grades as shown on the Drawings or to other lines and grades as may be ordered by the Engineer. The dimensions of the cross-section on the completion of excavation in the drainage channel shall conform to the following tolerances :

Works	Tolerance from Designated Point
Excavated surface (except structure sites) and filling surface in depressions	-10 cm to + 10 cm in depth measured perpendicular to the surface
Excavated bed width of channel	zero to + 50 cm

2.5.3 Measurement and payment

Measurement and payment for the relevant items of works in the Bill of Quantities will be made in accordance with Sub-clause 2.4.5 hereinbefore. The unit prices stated in the Bill of Quantities shall include all costs incurred from equipment, tools, materials, fuels, electric power and manpower employed for the excavation, hauling and disposing to the stockpiles and/or fill sites.

All cost incurred from filling up depressions in the drainage channel located on the route of hauling the excavated materials shall be borne by the Contractor. No claims for such extra costs

shall be considered by the Employer.

2.6 Excavation for Structures

2.6.1 Scope of work

Excavation for structures shall include excavation of all soil, sand, gravel and boulder if any, stockpiling of soil fit for reuse and dumping of soil unfit for reuse to the designated places.

Excavation for structures shall be carried out in a safe manner and to the lines and levels shown on the Drawings or to such lines and levels as approved by the Engineer.

The base and side slopes of excavation against which concrete is to be placed shall be finished accurately to the dimensions shown on the Drawings or prescribed by the Engineer, and the surfaces so prepared shall be moistened with water and tamped or rolled with suitable tools or equipment for the purpose of securing firm foundations. If at any point the natural foundation material is disturbed during the excavation process or otherwise, it shall be compacted in place, or it shall be removed and replaced with suitable earth materials or concrete as directed by the Engineer at the expense of the Contractor.

When the foundation material is soft or otherwise unsuitable in the opinion of the Engineer, the Contractor shall remove the unsuitable materials to the dimensions as directed by the Engineer and fill in to the required lines and levels with approved material in a manner acceptable to the Engineer.

Trench excavation for concrete pipe, cross drains, drain pits and side drain ditches for the permanent roads shall be performed by the use of hand tools and/or approved mechanical equipment, in such a manner as to prevent shattering of the sides and bottom of the excavation.

2.6.2 Measurement and payment

Measurement and payment for the relevant items of work in the Bill of Quantities shall be made in accordance with Sub-clause 2.4.5 hereinbefore.

2.7 Bench Cut Excavation for Existing Levee, if any

2.7.1 Scope of work

Bench cut for the existing levee shall be made along the slope of the existing levee in order to ensure proper bond between the existing levee and the new levee to be constructed over it.

Bench cut excavation shall be made to the lines and grades as shown on the Drawings and as directed by the Engineer in such a manner as not to cause any cracks on the excavated surface of the existing levee. If cracks or other damages are caused, they shall be restored to the full satisfaction of the Engineer and all costs incurred from such restoration shall be borne by the Contractor.

After bench cut excavation, no bush, roots, sods or any other perishable or unsuitable materials shall be placed or left remaining on the bench cut excavated surfaces.

2.7.2 Measurement and payment

Measurement for bench cut for the existing levee will be made to the area in square metres in accordance with the lines, grades, dimensions and other requirements shown on the Drawings and/or area as prescribed above and so certified by the Engineer in the Bi-Monthly Statement of Account.

The unit prices stated in the relevant items in the Bill of Quantities shall include all costs of materials, equipment, tools and manpower required for excavation, loading, transporting, disposing of excavated materials as directed and all other items necessary for completion of the works.

2.8 Excavation for Connection Canal, if required

2.8.1 Scope of work

Excavation in the connection canal, if required, shall generally be carried out in accordance with Clause 2.4 hereof, and the work is to be executed in such a manner as to ensure that the side slopes, as shown on the Drawings, are not in any way endangered by under-cutting.

Soil excavated from the connection canal shall be placed temporarily alongside excavation sites at

designated places depending on the suitability of its reuse as fill material.

The transportation of fill material and disposal of unsuitable materials extracted from the connection canal shall be made in accordance with the respective provisions stipulated in Sub-clauses 2.4.4 and 2.15.1 hereof.

2.8.2 Measurement and payment

Measurement and payment for the relevant items of work in the Bill of Quantities shall be made in accordance with Sub-clause 2.4.5 hereinbefore. All costs incurred by the Contractor in complying with the requirements of the Sub-clause 2.8.1 shall be included in the respective unit prices stated in the relevant items in the Bill of Quantities. No claims for such extra costs shall be considered by the Employer.

2.9 Earthfill

2.9.1 Scope of work

Earthfill shall include procurement, loading and transportation of materials, unloading of materials, moisture control, placing, spreading, compaction and all other necessary works for construction of the embankments for levee and inspection roads and fillings in other parts of the works with suitable materials obtained from channel excavation and/or designated borrow areas.

Earthfill shall be preferably constructed during the dry season or during the periods of relatively low precipitation.

All embankments shall be constructed to the lines and levels shown on the Drawings or established by the Engineer. The materials for earthfill shall not contain any stump, brush, weed, root, turf, clod and other organic material that may decay. Clod of clay or other materials shall be broken apart and no accumulation at the foot of the side slopes of embankment will be permitted. The Contractor shall make due allowance for consolidation and settlement whether compaction is specified or not, such that the levels, widths and the dimensions of the finished surfaces at the end of the Defects Liability Period shall not be less than the levels and dimensions shown on the Drawings. This may be achieved by the Contractor by increasing the height of the levee by five (5) percent of the height prescribed on the Drawings. This arbitrary percentage increase in the levee height is only for the Contractor's guidance and the Employer shall in no way be responsible for any deductions or conclusions drawn from the same by the Contractor. The required increase in

height of the levee shall be governed by the prevailing site conditions and construction method and equipment deployed by the Contractor and the cost of all such allowances shall be deemed to be included in the unit prices of the earthfill.

2.9.2 Placing and compaction of material

Prior to the commencement of earthfilling, the Contractor shall carry out under the direct supervision and to the satisfaction of the Engineer a series of field tests to determine the optimum conditions of compaction and the minimum number of passes of each type of equipment required to compact to the specified dry density hereinafter for each type of fill material. The cost of carrying out such tests shall be deemed to be included in the respective unit prices for earthfills in the Bill of Quantities.

No fill material shall be placed when, in the opinion of the Engineer, satisfactory work cannot be done on account of heavy rain or other adverse conditions.

Material shall be spread in layers not exceeding thirty (30) cm in thickness before compaction, which shall be subject to the Engineer's determination upon the results of trial embankment tests.

The material obtaining and placing operations shall be such that the materials when compacted shall be blended sufficiently to secure the required dry density and sufficient impermeability and stability of the compacted fill. Moisture content of the embankment materials prior to and during compaction shall be maintained uniformly throughout each layer of the materials. If the surface of any layer of embankment is too dry or smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and/or scarified in an approved manner to provide a satisfactory bonding surface.

Fill material for levee embankment shall be compacted by means of approved compacting equipment to a density specified in Sub-clause 2.10.5 hereinafter.

The earthfill for other parts of the Works shall be carried out with the approved materials and compacting equipment, and the fill material shall be compacted to a density as directed by the Engineer.

In so far as practicable as determined by the Engineer, moistening of the material shall be performed at the site of stockpiles or borrow areas. Moistening shall be supplemented by sprinkling at the time of compaction, if necessary, and approved by the Engineer. If the moisture

content is beyond the suitable range, the operation shall not proceed except with the specific approval of the Engineer, until the material has been wetted or allowed to dry out within the required range of the moisture content. No adjustment in price shall be made on account of any delays occasioned thereby.

When the material has been conditioned as hereinabove specified and the surface has been scarified in an approved manner to bond subsequent layer, the new layer shall be compacted by the approved compacting equipment as the nature of the soil dictates to achieve at least the prescribed degree of compaction.

At the end of each day, or whenever operations are suspended by any reason, the surface shall be left smooth and slightly crowned to shed water.

2.9.3 Preparation of surface under embankment

No materials shall be placed on any portion of embankment foundations until such foundation has been cleared, stripped, suitably prepared and has been approved by the Engineer for placing fill. Test areas, trenches and cavities made by the removal of unsound foundation materials or for the inspection of sub-surface foundation shall be filled with selected materials.

Foundation material which does not have such density in an undisturbed condition as prescribed for the fill material shall be moistened and compacted by means of compaction equipment or shall be removed and refilled or shall be treated in a manner as directed by the Engineer.

The foundation surface under all embankments shall be scarified in an approved manner to provide a satisfactory bonding surface. This scarified foundation surface upon which compacted fill will be placed shall be moisture-conditioned immediately prior to placing of fill upon the surface to the same conditions as specified for compacted fill. If the placing of fill has been suspended, the surface of the fill shall be prepared as crowned shape before fill placing operations are resumed.

2.9.4 Fill adjacent to structures

Fill material adjacent to the structures shall be placed in such a manner as will ensure that they can be compacted without damage to the structures. Compaction adjacent to all structures shall be carried out by hand or by suitable hand operated equipment.

Unless otherwise specified, no fill material shall be placed and no compaction shall be permitted adjacent to concrete for fourteen (14) days after the placing of the concrete.

Compaction of backfilling material placed above buried concrete, however, shall not be permitted to be carried out with vibrating except with the prior approval of the Engineer.

2.9.5 Trial embankment

(1) General

The Contractor shall demonstrate to the Engineer the performance of equipment for controlling moisture, placing, spreading and compacting of the material by constructing a trial embankment.

(2) Scope of trial embankment

Trial embankment shall be carried out on the specified materials such as Types A, B and C stated under Sub-clause 2.10.1 for evaluating :

- The levee construction methods proposed by the Contractor,
- The effects of layer thickness,
- The effects of roller passing and compacting, and
- Other items deemed necessary by the Engineer.

(3) Schedule

The Contractor shall submit a schedule of trial embankment including laboratory tests to the Engineer for his approval at least two (2) months before the commencement of levee work.

In the schedule, the trial embankment including laboratory tests shall be scheduled to be finished at least five (5) days before the commencement of works.

(4) Required quantities of materials

The quantities of materials to be provided for trial embankment shall be as follows; or as directed by the Engineer :

- Type A : Two thousand (2,000) m³
- Type B : Two thousand (2,000) m³
- Type C : As directed by the Engineer

(5) Equipment

All equipment necessary for trial embankment shall be furnished by the Contractor. Unless otherwise approved by the Engineer, the compacting equipment shall be tamping roller type of ten (10) to twenty (20) ton class.

(6) Moisture control

Prior to the start of placing and spreading works, moisture content of trial embankment materials shall be adjusted to four (4) to five (5) percent dry side of natural moisture content or as directed by the Engineer.

(7) Field and laboratory tests

Field tests shall be carried out near the embankment site in the Project area. The conditions of tests are as follows unless otherwise directed by the Engineer.

- Spreading thickness : 20 cm and 30 cm for each material
- Passage of roller : 2, 4, 6 and 8 times
- Field density tests : 24 points
- Laboratory tests : 2 cases each for each material
(Physical and compaction)

2.9.6 Moisture content adjustment

The moisture content of earthfill materials, prior to and during compaction, shall be distributed uniformly throughout each layer of material. As far as practicable, the material shall be brought to the proper moisture content in the excavation areas to ensure adequate compaction effect. Supplementary watering or drying may be carried out on the embankment, and such wetted or dried soil shall be thoroughly mixed to attain uniform moisture content distribution before compaction.

When each layer of material has been conditioned to have a moisture content in the required range, it shall be compacted by use of an approved compacting equipment as may be necessary to attain the specified compaction .

2.9.7 Soil tests

Tests on earth materials for use as embankment as well as on the compacted levee shall be performed by the Contractor at his expense by use of his laboratory and laboratory equipment, or by use of the existing laboratory approved by the Engineer, to determine and control the soil characteristics, suitability, moisture content, dry density/ moisture content relation, etc. All test results in the form of a report shall be prepared by the Contractor and approved by the Engineer. The tests performed by the Contractor prior to commencement of the earthwork, and every time when the soil characteristic changes, shall include the following :

- (a) Compaction test
- (b) Particle size distribution test
- (c) Specific gravity test
- (d) Moisture content test
- (e) Dry density test
- (f) Plastic limit test
- (g) Triaxial shear test

The results shall be submitted to the Engineer for his approval.

The field moisture content and field dry density tests of the compacted earthfill will be made for each layer and every two thousand (2,000) m³. The Contractor shall prepare the soil test programme according to the earthfill placement and operation schedule and shall submit it to the Engineer for approval.

Should test results prove that changes in the embankment material are necessary in order to obtain the prescribed compacted fill, these changes or obtaining of suitable material shall be at the Contractor's expense.

2.9.8 Finishing

Finishing of crest surface and slopes of the embankment shall meet the formation height and gradient as shown on the Drawings or as determined by the Engineer and tolerances allowable for

finishing shall be specified as follows :

- Variation in formation height measured at any point on the crest shall not be lower than the formation height (design levee crest).
- Gradient of both the embankment slopes shall not be steeper than the specified gradient and unevenness of the embankment slope shall not exceed ten (10) cm inwards and ten (10) cm outwards.

2.9.9 Measurement and payment

Measurement for earthfill will be made on the basis of the volume in cubic metres of each material placed and compacted within the lines, grades and dimensions of the design section as shown on the Drawings or as directed by the Engineer.

Unless otherwise approved by the Engineer in writing, no payment shall be made to the Contractor for material placed outside the limits of levee shown on the Drawings. The volume of extra embankment shall not be taken into account for measurement and payment.

All costs incurred from the embankment shall include obtaining, loading and transportation of fill material from borrow areas or stockpiles, preparation of surface under the embankment, unloading of the fill material at site and placing, moisture control, compaction and finishing including all equipment, tools, materials, manpower necessary for completion of the works and subsequent withdrawal of the same.

Payment for the works shall be made at the unit prices per cubic metre stated in the respective work items in the Bill of Quantities to the sum calculated by the volume in cubic metre as prescribed above and duly certified by the Engineer on the Bi-Monthly Statement of Account.

The trial embankment including field and laboratory tests shall be made under the supervision of the Engineer and the cost incurred for the same shall be included in respective unit prices stated in the Bill of Quantities.

All costs incurred by the Contractor in complying with the requirements of this Clause including, scarifying of foundation surface before placement of earthfill, changes in the embankment construction method due to variations of fill material, etc. shall be deemed to be included in the respective unit prices stated in the relevant items in the Bill of Quantities and no claim for such

extra costs shall be considered by the Employer.

2.10 Earthfill for Levee Embankment

2.10.1 Scope of work

The Specifications of this Clause cover the construction of levee embankment to be newly constructed as well as heightening of the existing levee. The Contractor shall construct these levee embankments to the lines, grades and dimensions as shown on the Drawings, as directed by the Engineer and in accordance with these Specifications.

Based upon the material characteristics, levee material has been classified into Types A, B and C for this Project as shown in the table below :

Classification of Embankment Material

Type	Description of Levee Material
A	Material obtained in the drainage channel
B	Locally available material covered with Type C material
C	Material obtained from designated borrow areas

Two types of levee embankment are proposed, viz, homogeneous type comprising of only Type A material and zoning type comprising of both Type B and Type C materials.

2.10.2 Setting-out

The Contractor shall entirely be responsible for accurate setting-out of the works including staking of alignment of levee and reference pegs based on the information supplied on the Drawings and the instructions given by the Engineer in accordance with Chapter G5, Vol. III, Part I - General Specifications. The costs to conform to the requirements of this Clause shall be included in the unit price of the earthfill of levee embankment stated in the Bill of Quantities.

2.10.3 Site clearing and stripping of topsoil

The areas to be occupied by levee embankments including the slopes of existing levee to be heightened shall be cleared and stripped in accordance with Clause 2.2 hereof. All vegetation, tree stumps, organic materials and other obstructions shall be removed from the right-of-way area. Fences, buildings and structures designated for removal shall be disposed of or re-erected as directed by the Engineer. All cleared materials shall be disposed off in accordance with Clause 2.15 hereof.

2.10.4 Preparation of surface under levee embankment

Foundation on which levee embankments are to be placed shall be prepared generally in accordance with Sub-clause 2.9.3 hereof, and no materials shall be placed on any portion at the foundations until such foundation has been approved by the Engineer for placing fill. Test areas, trenches and cavities made for removal of unsound foundation materials or for inspection of sub-surface foundation materials shall be filled with selected material and properly compacted.

The slopes of the existing levee to be heightened, on which the fill materials are placed, shall be bench-cut with the dimension of thirty (30) cm in vertical and of more than sixty (60) cm in horizontal lengths, to prevent sliding of new filled materials.

2.10.5 Placing and compaction of materials

Material to be used for levee embankment shall generally conform to the requirements of Sub-clauses 2.9.1 and 2.9.5 hereof.

Material for levee embankment shall be obtained from adjacent drainage channel excavation materials or from the designated borrow areas or as approved by the Engineer. Fill materials obtained from the above shall be placed and compacted in accordance with the following specifications :

- (1) Fill material shall be placed in layers not exceeding thirty (30) cm in thickness before compaction as specified under Sub-clause 2.9.2 hereinbefore. Each layer shall be spread out approximately fifty (50) cm beyond the design lines shown on the Drawings so that the portion of embankment near the side slopes is properly and sufficiently compacted. The levee portion thus provided beyond the design lines shall be subsequently removed and trimmed to the lines and grades as shown on the Drawings or as directed by the Engineer.

All costs incurred from said works shall be deemed to be included in the unit price for earthfill stated in the Bill of Quantities and no extra payment for the same shall be made to the Contractor.

- (2) Compaction shall be carried out by means of approved compacting equipment such as tamping roller of ten (10) to twenty (20) ton class so as to obtain a dry density of not less than ninety (90) percent of the maximum dry density for types A and B materials, and ninety three (93) percent for type C material, measured at the wet side of the optimum moisture content.
- (3) The number of passes required for the compacting equipment shall be determined based upon the test results of trial embankment stipulated under Sub-clause 2.9.5 hereinbefore.

Except in so far as approved by the Engineer, however, the subsequent filling made on the embankment constructed shall not be permitted until adequate foundation conditions are achieved.

During the execution of the work, the Contractor shall take care of the embankment completed at each stage. The Contractor shall not be relieved for this work from any obligation and responsibility under the Contract up to the issuance of the Certificate of Satisfaction. The cost of earthfill for levee embankment of this Clause shall include the allowance for such care of the works.

2.10.6 Finish to embankments

The Contractor may elect to construct the embankment over-size and finally trim back to the designed section but no specific payment shall be made for this operation and cost thereof shall be included in the unit price for earthfill of levee embankment.

The finished surfaces of the top crown and side slopes of the levee embankment shall present an even and neat appearance. Sod facing shall be placed thereon in accordance with Clause 2.16 provided hereunder.

2.10.7 Tolerances in embankment dimensions

Unless otherwise specified, no point on the surface of the completed levee embankment shall be more than the under-mentioned distance from the designated surface. Should the levee embankment be formed beyond the specified allowances at the time of the Certification of

Completion provided for in Clauses 48 (1) and 48 (2) of Vol. II - General and Special Conditions of Contract, the Contractor shall establish the specified or such other section as the Engineer may direct without additional payment.

The Contractor shall make due allowance for consolidation and settlement of embankment, such that the levels, widths and dimensions of the finished surface at the end of the Defects Liability Period shall not be less than the levels, widths and dimensions shown on the Drawings. The cost of all such allowances shall be included in the unit price of levee embankment.

All tolerances shall be within the limits specified in the table given below :

Tolerances for Levee Embankment

Description (Designated Point)	Tolerance from
Surface levels (Centre of levee)	- 5 cm
Top width of embankment	- 10 cm
Deformation perpendicular to slope	- 10 cm

2.10.8 Measurement and payment

Measurement and payment for both types of levee embankment will be made on the basis of volume in cubic metres of each material placed and compacted within the lines, grades and dimensions of the design section as shown on the Drawings or as directed by the Engineer. Such measurements shall further, be based upon the ground surface obtained after stripping and the design section shown on the Drawings and the method approved by the Engineer.

Payments for Items of levee embankment for the two types of levee shall be made at the respective unit prices per cubic metre stated in the Bill of Quantities. These unit prices shall include the cost incurred from all plants and equipment, tools, fuel and electric power, materials and manpower required for completion of levee embankment work including preparation of surface under embankment, spreading and compaction of embankment material, finish to the embankment, allowance for consolidation and settlement of levee embankment, etc. Payment for the levee embankment shall be made to the actual volume of fill materials in cubic metre as determined and certified by the Engineer in the Bi-Monthly Statement of Account.

No separate payment shall be made for preparation of surface under embankment, and stockpiles, spreading and compaction of the fill material, finish to the embankment and allowance for consolidation and settlement of levee material up to the Certificate of Satisfaction and no such claim shall be considered by the Employer.

2.11 Earthfill for Road Embankment

2.11.1 Scope of work

The Specifications of this Clause cover the construction of the road embankment including approach ramps. The work comprises obtaining, loading and transporting material from borrows areas or stockpiles, unloading fill material at site, the supply of all manpower, materials and Construction Plant and Equipment, and the performance of all earthworks for the road embankment in accordance with the Drawings or direction of the Engineer.

The Contractor shall be entirely responsible for setting-out the alignment of the road embankment. After setting-out the alignment, the site clearing and stripping shall be made in accordance with the requirements provided for in Clause 2.2 hereinbefore. The earthfill shall conform to the requirements of Clause 2.9 hereinbefore.

The works of the road embankment shall be performed in parallel with the progress of bridge and levee embankment to be constructed alongside them.

2.11.2 Measurement and payment

Measurement and payment for the relevant items of work stated in the Bill of Quantities will be made in accordance with Sub-clause 2.9.9 hereinbefore.

All costs incurred by the Contractor in complying with the requirements of Sub-clause 2.11.1 hereof shall be included in the respective unit prices stated in the Bill of Quantities. No claims for such extra costs shall be considered by the Employer.

2.12 Backfill

2.12.1 Scope of work

Backfill shall be carried out on the front and the side of outlying structure and elsewhere as shown

on the Drawings or as directed by the Engineer, with approved materials complying with the Specifications for earthfill provided for in Clause 2.9 hereinbefore. For the backfill to be provided around the sluiceways, the elevation of original ground lines which form part of the levee, materials and all other related works shall conform to the applicable requirements of Clause 2.10 hereinbefore. The backfill shall be compacted after placing fill material in continuous horizontal layers not more than thirty (30) cm in height. Unless otherwise specified, placing and compaction of any backfilling materials shall conform to the applicable requirements of Sub-clause 2.9.2 hereinbefore.

Prior to the commencement of placing backfill material adjacent to structures, the place shall be cleaned of all remaining forms for concrete and other temporary works. Compaction shall be made in such a manner as will ensure that filling material can satisfactorily be compacted without damage to the structures by means of the approved equipment. The backfilling material shall be watered or allowed to dry in order to maintain or achieve the prescribed moisture content for compaction. The cost of such watering or drying out shall be covered by the unit prices for backfill stated in the Bill of Quantities.

Unless otherwise provided for in the Specifications or directed by the Engineer, backfill materials shall be placed and compacted at least fourteen (14) days after the placing of concrete.

2.12.2 Free draining backfill

Free draining backfill shall be placed to the lines and dimensions as shown on the Drawings or as directed by the Engineer.

The materials to be used for free draining backfill shall be selected pervious material which is well graded with a maximum rock size of fifteen (15) cm and shall not contain more than five (5) percent, by mass, of material passing a 0.074 mm mesh sieve as stipulated in JIS Z-8801 or approved equivalent. Fragments larger than fifteen (15) cm may be used if approved by the Engineer, provided that such fragments shall be evenly distributed in the backfill.

The material shall be handled and placed in such a manner as to prevent segregation. The method of placing free draining backfill shall be subject to approval by the Engineer. Free draining backfill shall be placed wet in approximately horizontal layers not more than thirty (30) cm before compaction and thoroughly compacted by an approved method to sixty (60) percent of relative density or to the satisfaction of the Engineer.

2.12.3 Random backfill

Random backfill shall be placed to the line and dimensions as shown on the Drawings or as directed by the Engineer. The materials to be used for random backfill shall be all classes of disposed or excavated materials available at all in-place. The quality of such materials shall be approved by the Engineer and shall be free from any organic matter or other objectionable material such as large clods of stones, boulder, etc.

The material shall be handled and placed in such manner as to achieve favorable compaction and density. The method of handling, placing, moisture controlling and compacting random backfill shall be subject to the approval of the Engineer.

2.12.4 Measurement and payment

Measurement and payment for the relevant items of work in the Bill of Quantities will be made in accordance with Sub-clause 2.9.9 hereinbefore.

All costs incurred by the Contractor in complying with the requirements of Sub-clause 2.12.1 hereof shall be included in the respective unit prices stated in the Bill of Quantities and no claims for such extra costs shall be considered by the Employer.

2.13 Filling-up of Abandoned Drainage Channel with Compacted Material, if any

2.13.1 Scope of work

For new channel construction work, abandoned portion of the canal shall be filled-up with approved materials and compacted to the lines, levels and grades as shown on the Drawings or as directed by the Engineer. Such filling with compaction shall be carried out under the levee foundation as shown on the Drawings or as directed by the Engineer.

Material for the filling-up shall comply with the requirements of earthfill provided for under Clause 2.9 hereinbefore and it shall be placed and compacted to the same degree as the levee embankment.

2.13.2 Measurement and payment

Measurement and payment for Items of filling-up of the abandoned drainage channel in the Bill of

Quantities will be made in accordance with Sub-clause 2.9.9 hereinbefore.

All costs incurred by the Contractor in complying with the requirements of Sub-clause 2.13.1 hereof shall be included in the respective unit prices stated in the Bill of Quantities and no claims for such extra costs shall be considered by the Employer.

2.14 Filling-up by Random Materials

2.14.1 Scope of work

Space created between the compacted fill placed under the levee as prescribed in Sub-clause 2.13.1 hereinabove shall be filled-up by random material as shown on the Drawings or as directed by the Engineer.

Material for the random fill shall be obtained from the excavated drainage channel and which in the opinion of the Engineer is not suitable for levee construction. If sufficient material is not available for the random fill, the same shall be obtained from borrow areas located nearest to the site or as directed by the Engineer.

Random fill shall be dumped in the designated space shown on the Drawings or as directed by the Engineer by means of tipper trucks or any other earth moving or dumping equipment such as bulldozers. Care shall be taken not to damage the compacted backfill, levee or any other structure during the course of dumping of the material. Dumped material shall be spread by means of bulldozers so as to give a sightly appearance.

2.14.2 Measurement and payment

Measurement for the filling-up by random material will be made to the volume in cubic metres of the fill material placed at the designated locations shown on the Drawings and duly certified by the Engineer.

Payment shall be made in accordance with Sub-clause 2.9.9 hereinbefore, at the unit price stated in the Bill of Quantities so certified by the Engineer in the Bi-Monthly Statement of Account. All costs incurred by the Contractor including equipment, tools, materials and labours required for completing the works shall be included in the unit price stated in the Bill of Quantities and no claims for such extra costs shall be considered by the Employer.

2.15 Soil Disposal

2.15.1 Scope of work

Excavated material from the work selected by the Engineer for reuse is to be placed directly in its final position or stockpiled on the Site as directed by the Engineer.

Soil unfit for reuse or surplus excavated materials shall be disposed of in the designated disposal areas located at Teluknaga area in Tangerang region as shown on the Drawings or other places as directed by the Engineer. The Contractor shall trim and regulate the spoil tips to profiles of the designated heights and levels approved by the Engineer. The Contractor shall also maintain without interruption the flow of water courses affected by such spoil tips and he shall observe any arrangement concerning the site, arising between the Engineer and the persons or authorities concerned.

Location changes, or additions, to the disposal area for the Contractor's own convenience shall be made at the Contractor's expense subject to approval of the Engineer.

The Contractor shall submit proposals to the Engineer for approval for disposing of materials at any area other than previously approved areas and for the protection of these materials from erosion, at least thirty (30) calendar days prior to the commencement of hauling material to the area.

2.15.2 Measurement and payment

Cost incurred by the Contractor in complying with the requirements of this Clause shall be deemed to be included in the unit prices of respective excavation work items stated in the Bill of Quantities and no extra payment for the same shall be considered by the Employer.

2.16 Sodding

2.16.1 Scope of work

To protect the slope susceptible to damages by rainfall or stream water, sod facing shall be provided as shown on the Drawings or as directed by the Engineer. Sod squares used for the slope protection shall be fresh, dense and well rooted and the length of any of the cut sod piece shall not be shorter than twenty (20) cm.

The work consists of preparing, cutting, hauling and placing of topsoil and sod squares, and maintaining the slopes in order that the grass grows normally and uniformly.

The Engineer will inspect and approve topsoil and sod source. It is necessary that sod and topsoil are not separated from each other during cutting and hauling. The transplant of sod shall be done within twenty four (24) hours after its cutting and it can be stored only if the Engineer approves it. Storing and hauling of sod shall be done in such a way that two sod surfaces or two earth surfaces shall be always in contact. If sod squares prior to cutting are dry, they shall be sufficiently watered. Neither sod squares of poor quality and in bad condition nor sod squares containing weeds or unsuitable grass shall be accepted.

All areas to be covered with sod shall be fine graded to a uniform surface and shall be loosened to a depth of three (3) cm below surface. Sod squares shall be placed next to each other. After placing them, they shall be compacted in order to avoid the creation of voids which may cause the loosening of sod due to rainfall. After compaction, gaps between sod squares shall be filled with sod and topsoil of good quality.

The Contractor shall be responsible for maintenance and cleaning of the sod faced areas until sod reaches a normal and uniform growth, and thereafter, until a Certificate of the Satisfaction of the whole Works is issued by the Engineer. The Contractor shall replace, at his own cost, any damaged area where sod has dried up or has not rooted to slope surface, which contains undesirable plants, or which has an irregular or unattractive appearance in the Engineer's opinion.

2.16.2 Measurement and payment

Measurement for payment will be made on the placed area in square metres to the lines, grades and dimensions as shown on the Drawings or as directed by the Engineer.

Payment shall be made at the unit price per square metre stated in the Bill of Quantity. The unit price shall include the cost of all equipment, material and manpower including supplying, cutting, transporting, planting the sod and maintaining it up to the issue of Certificate of Satisfaction. Payment shall be made to the area measured as prescribed above and certified by the Engineer in the Bi-Monthly Statement of Account.

2.17 Gravel Metalling, if any

2.17.1 Scope of work

All the road and levee ramps shall be surfaced with gravel with a minimum compacted thickness of twenty (20) cm placed over a ten (10) cm thick sand bedding.

Material used for road surfacing shall be crushed aggregates having appropriate gradation as metalling material duly approved by the Engineer. The material shall be free from lumps or balls of clay, organic matter, objectionable coatings or other foreign matters.

The surfacing material shall be free from flat and elongated particles, and generally, particles of the material shall be spherical or cubical in shape. The maximum size of the material shall be forty (40) mm, and the material shall be graded down to zero. The quality and gradings of the material shall be subject to the approval of the Engineer.

The gravel surfacing when thoroughly compacted, shall conform to the grades and dimensions shown on the Drawings or otherwise established by the Engineer. Depositing and spreading the material shall commence at the point farthest from the point of loading and shall progress continuously without breaks, except as otherwise directed.

Rolling of the material shall be performed under the direction of the Engineer with road rollers which shall be subject to the approval of the Engineer.

2.17.2 Measurement and payment

Measurement of gravel surfacing for roads, ramps and other areas will be made by cubic metres of gravel surfacing materials placed and compacted in accordance with the Drawings and these Specifications or as directed by the Engineer.

Payment shall be made at the unit price per cubic metre stated in the Bill of Quantities. The unit price shall include the cost of obtaining the material, processing if necessary, loading, transporting, unloading, placing, compacting and all incidentals thereto for completing the work. Payment shall be made to the volume of material as prescribed above and as determined and certified by the Engineer in the Bi-Monthly Statement of Account.

2.18 Borrow Areas

2.18.1 Scope of work

All materials required for the levee embankment construction, all kinds of backfill including filling-up of the depressed land and earthfill for the road which are not available from the drainage channel excavations or not suitable for permanent construction under these Specifications, shall be obtained from the designated or approved borrow areas located at Serpong in Tangerang region, about 20 km far from the Project site. The location of the borrow areas are shown on the Drawings of Volume IV of the Tender Documents. The earthfill material may be purchased from the licensed suppliers.

With the exception of earthfill material intended to be purchased by the Contractor from the said suppliers, the materials shall be obtained from suitable borrow areas approved by the Engineer.

The Tenderers and the Contractor must assume all responsibility for quality concerning the nature, moisture content, and texture of material, the percentages of oversize materials, the total yield of suitable materials, the difficulties of making excavations, of breaking down or removing the oversize materials, of obtaining a satisfactory moisture content, and obtaining a uniform mixture of materials.

Some borrow areas will be open for inspection and the Tenderers should inspect the borrow areas and examine the test pits during the Site visit. The Tenderers are urged to sample and test material from borrow areas prior to submitting his Tender.

The type of equipment used and the Contractor's operations in the excavation of materials in borrow areas shall be such as will produce the required uniformity of mixture of each of the types of the materials at the borrow areas.

The location and extent of all borrow areas shall be proposed by the Contractor who shall submit his excavation programme along with necessary drawings prepared on the basis of his surveys and the Engineer reserves the right to change the limits of the borrow areas in order to obtain the most suitable material, to minimize stripping, or for other reasons.

To avoid the formation of pools in the borrow areas during the excavation operations, after the excavation operations are completed, drainage ditches from the borrow areas to the nearest outlets shall be excavated by the Contractor where, in the opinion of the Engineer such drainage ditches

are necessary.

2.18.2 Roads, buildings and utility lines in borrow areas, if any

Roads, buildings, and other utility services in the Project area, if any, shall be relocated by others or by the Contractor as directed by the Engineer. Prior to the relocation of the road, the Contractor shall not excavate materials within twenty (20) m of the centreline of the road. The Contractor shall conduct his operations in such a manner as to permit continuous use of the road and to provide safety to the public until such time as the road has been relocated. The Contractor shall permit access as necessary to others for the purpose of relocation of this road.

The buildings located in the borrow areas will be disposed of by others. Prior to disposal of the buildings, they shall be protected from damage from the Contractor's operations. The Contractor shall permit access as necessary to others for the purpose of disposal of these buildings.

Power lines, pipelines, telephone lines, etc, traversing the borrow areas, if any, and as shown on the Drawings will be relocated by others or by the Contractor as directed by the Engineer. Prior to relocation of the utility lines, the Contractor shall not excavate material within twenty (20) m of the centreline of any pipe, power, or telephone lines. The Contractor shall conduct his operations in a manner to prevent any interference with or damage to the utility lines and to permit access as necessary to others for the purpose of relocation of these utility lines.

2.18.3 Moisture and drainage, if any

The moisture content of the earthfill material prior to and during compaction shall be in accordance with Sub-clause 2.9.6 hereinbefore. As far as practicable, the material shall be conditioned in the borrow areas before excavation. If required, moisture shall be introduced into the borrow areas for the earthfill material by irrigation at least seven (7) days in advance of excavation operations. When moisture is introduced into the borrow areas for earthfill material prior to excavation, care shall be exercised to moisten the material uniformly to produce the required moisture content during compaction, avoiding both excessive runoff and accumulation of water in depressions. The Contractor is cautioned to control carefully the application of water and check on the depth and amount of water penetration during application so as to avoid over-irrigation.

If at any location in the borrow areas for earthfill material, before or during excavation operations, there is excessive moisture, as determined by the Engineer, steps shall be taken to reduce the

moisture by selective excavation to secure the drier materials, by excavating and placing in temporary stockpiles material containing excessive moisture, by excavating drainage ditches, by allowing adequate additional time for curing or drying, or by any other approved means.

Borrow areas for sand material, if any, will not require preconditioning by irrigation but may require preconditioning by draining and lowering the water level below the elevation of the borrow excavation. (Preconditioning by draining may be accomplished by any approved method, including lowering the water level in the borrow area prior to excavation or stockpiling). If, after excavation, sandfill material has a moisture content greater than that required for placement and compaction in embankment, the material shall not be placed on the embankment, but shall be placed temporarily in stockpiles and allowed to drain or dry until the moisture content is reduced sufficiently to permit it to be placed in the embankment.

In any event, the Contractor will be required to excavate sufficient suitable material in portions of the borrow areas to complete the work under these Specifications, regardless of whether overly wet conditions encountered are due to ground water, precipitation, difficulty of draining, or any other reason. To minimize operations with overly wet material, the Contractor will be permitted to utilize portions of the borrow areas which contain dry material and which have been designated as suitable borrow areas to the greatest extent practicable consistent with obtaining suitable material.

The Contractor shall not be entitled to additional payment beyond the unit prices stated in the Bill of Quantities on account of the requirements for excavating drainage ditches; for allowing additional time for curing or drying; for stockpiling and re-handling excavated materials which have been deposited temporarily in stockpiles; delays or increased costs due to stockpiling; poor trafficability in the borrow area, the haul roads, or the embankment; reduced efficiency of the equipment that the Contractor elects to use; or on account of any other operations or difficulties caused by overly wet materials.

No additional payment beyond the unit prices stated in the Bill of Quantities shall be made because of variation in the proportion between wet and dry material which is required to be excavated in order to obtain adequate suitable material.

2.18.4 Stripping and waste, if any

Borrow areas shall be cleared and stripped as provided in Clause 2.2 hereinbefore. Borrow areas may be designated by the Engineer as the work progresses, and stripping operations shall be limited only to designated and approved borrow areas. The Contractor shall carefully strip the

designated borrow areas of boulders, topsoil, sod, loam, and other matter which is unsuited for the purposes for which the borrow area is to be excavated. The Contractor shall maintain the stripped surfaces free of vegetation until excavation operations in the borrow area are completed and the Contractor shall be entitled to no additional allowance beyond the unit prices stated in the Bill of Quantities because of this requirement. Materials from stripping which are suitable for topsoil shall be selected during stripping operations, temporarily stockpiled adjacent to borrow areas, if necessary, and spread on the suitable portions of the borrow areas as directed by the Engineer.

If materials unsuitable or not required for permanent construction purpose are found in any borrow areas, such materials shall be left in place or excavated and wasted, as directed by the Engineer. Where excavation of such material is directed, payment for such excavation and disposal of unsuitable or excess materials shall be included in the unit price per cubic metre stated in the Bill of Quantities for excavation.

2.18.5 Excavation and transportation

The Contractor shall excavate all parts of the borrow areas based upon the approved excavation plan.

The earthfill materials delivered on the embankment site shall be equivalent to a mixture of materials obtained from an approximately uniform cutting from the full height of the designated face of the borrow excavation. Shallow cuts will be permitted in the borrow areas if unstratified materials with uniform moisture content are encountered. The Contractor shall load, transport and unload the materials to the embankment sites designated by the Engineer.

The Contractor shall be entitled to no additional payment beyond the unit prices stated in the Bill of Quantities on account of the designation by the Engineer of various portions of the borrow areas from which materials are to be obtained, on account of the depths of cut which are required to be made, or on account of the zone or location on embankment where materials are hauled.

2.18.6 Measurement and payment

No separate payment shall be made for obtaining, loading and transportation of fill material from the borrow areas and these costs shall be included in earthfill or embankment works. Payment will be made in accordance with Sub-clause 2.9.9 hereinbefore.

All costs incurred by the Contractor in complying with the requirements of Clause 2.18 hereof

shall be included in the respective unit prices for earthfill or embankment works in the Bill of Quantities. No claims for such extra costs shall be considered by the Employer.

