JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF SETTLEMENT AND REGIONAL DEVELOPMENT
THE REPUBLIC OF INDONESIA

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

FINAL REPORT

COMPONENT A:
WEST FLOODWAY / GARANG RIVER IMPROVEMENT

VOLUME V CONSTRUCTION PLANNING

AUGUST 2000

CTI ENGINEERING INTERNATIONAL CO., LTD.
IN ASSOCIATION WITH
PACIFIC CONSULTANTS INTERNATIONAL
AND
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CONSTITUTION OF THE REPORT

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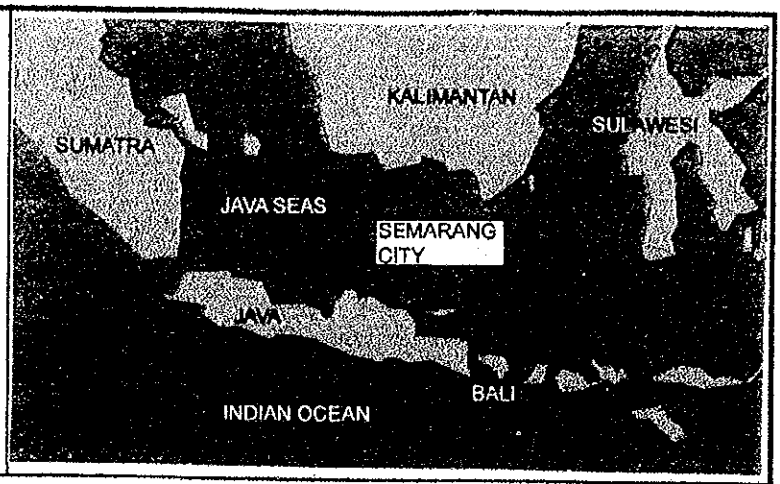
GENERAL MAP



SCALE
0 10 20 30 40 50 km

JAVA SEA

SEMARANG CITY

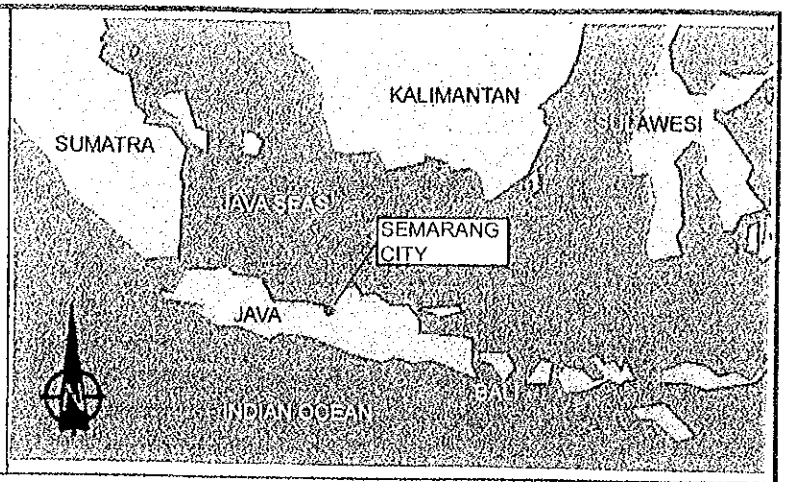
WEST FLOODWAY

GARANG RIVER

GARANG RIVER BASIN

INDIAN OCEAN

GENERAL MAP



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JAVA SEA

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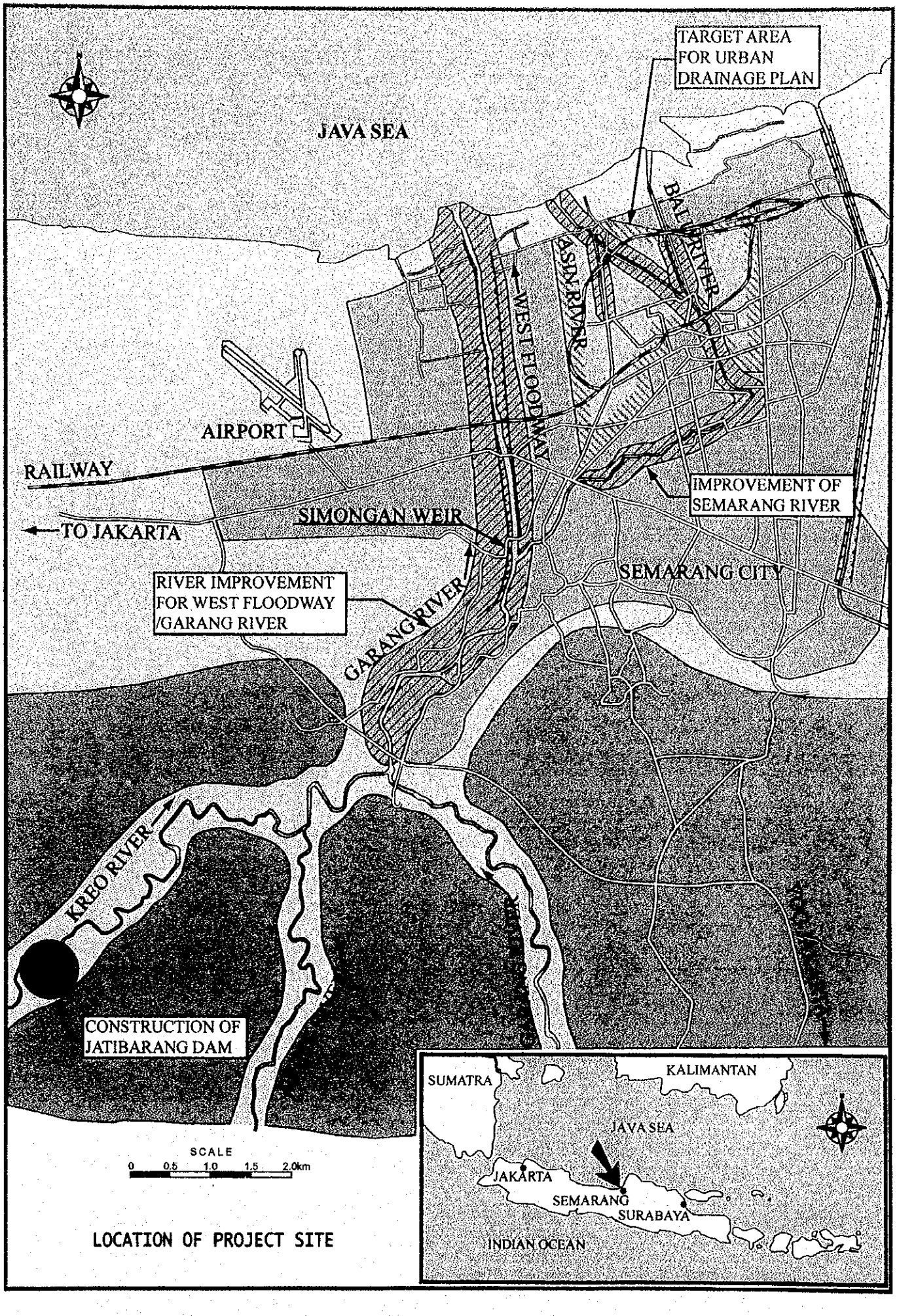
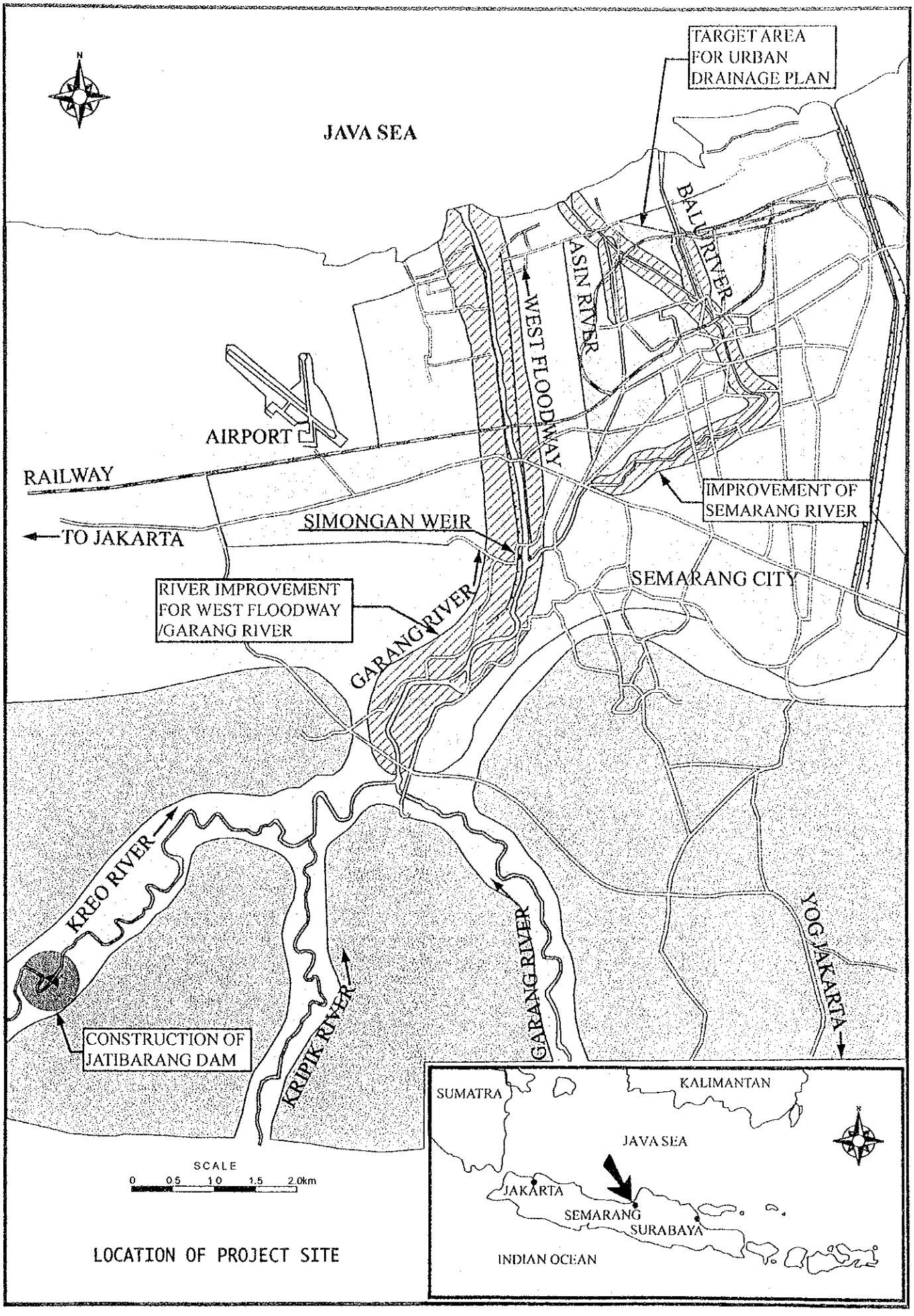


LOCATION OF PROJECT SITE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VOLUME V CONSTRUCTION PLANNING

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CHAPTER 1 OUTLINE OF CONSTRUCTION WORKS

1.1 Summary of Construction Works

Improvement of West Floodway / Garang River including reconstruction of Simongang Weir are conducted for the stretch of 9.761 km from the river mouth to the confluence of Garang River and Kreo River. The main work items and work volumes are summarized as below.

Work Item	West Floodway Improvement	Garang River Improvement	Reconstruction of Simongan Weir	Total
Length of Objective Stretch	5,436 m	3,907 m	418 m	9,761 m
Coffering		160 m	120 m	280 m
Dredging and Excavation	857,400 m^3	395,100 m^3	61,200 m^3	1,313,700 m^3
Dike Embankment	57,200 m^3	10,400 m^3	14,200 m^3	81,800 m^3
Raising of Existing Floodwall	4,970 m	160 m		5,130 m
Revetment Works	4,000 m	2,500 m	490 m	6,990 m
Foundation Works PC Pile L=12.0m Conc.Sheet Pile L=5.0m			 680 pcs 3,880 m	 680 pcs 3,880 m
Concrete Works	5,800 m^3	6,300 m^3	11,700 m^3	23,800 m^3
Water Gate 18.5m x 3.7m 5.5m x 3.7m			 3 gates 2 gates	 3 gates 2 gates
Simongan Weir Intake Structures			2 places	2 places
Control Office			11 nos.	11 nos.
Maintenance Bridge			1 lump Sum	1 lump Sum
Raising of Existing Railway Bridge	1 lump Sum			1 lump Sum
Ground Sill		2 places		2 places

1.2 Possible Spoil Bank Areas

The total volume of the excavated and demolished material from the improvement works of West Floodway / Garang River including relocation of Simongang Weir is estimated at 1,313,700 m^3.

The possible spoil bank areas near the construction site were surveyed in the previous stage and land reclamation areas along the coast was proposed as spoil bank areas. The features of the proposed spoil bank areas are summarized as shown in the table below and Fig. 1.2.1.

Area No	Schedule of reclamation	Area (ha)	Volume of reclamation (m^3)
1	1999 ~ 2003	150	6,800,000
2	1997 ~ 2000	200	3,000,000
3	2003 ~ 2008	-	2,800,000
4	2001 ~	-	1,000,000
5	1999 ~	-	4,000,000
6	~ 2008	-	-
7	~ 2003	-	-
8	~ 2003	-	-
Total			17,600,000

Among the possible spoil bank areas shown in the above table, Area No.1 is considered suitable spoil bank in terms of hauling distance and available schedule.

1.3 Procurement of Construction Material and Equipment

The construction material and equipment can be procured from Semarang City, Indonesia and overseas countries as shown in the table below.

Item	Domestic		Other Countries
	Semarang	Indonesia	
Construction Equipment	○	○	○
Construction Material			
• Cobble stone, Gravel	○	–	–
• Ready Mixed Concrete	○	–	–
• Reinforcing Bar	○	○	–
• Steel Material	–	–	○
• Steel Sheet Pile	–	–	○
• Concrete Product	○	○	–
Water Gate and Hoist	–	–	○

Note : ○ : Available
– : Not available

1.4 Construction Road

Main roads along West Floodway / Garang River in Semarang City will be mainly used for construction purpose. For construction works of West Floodway between North Ring Road and Simongan Weir, the right bank flood plain is also used. For construction works of Garang River, public roads along the both river banks of Garang River are also used.

CHAPTER 2 CONSTRUCTION METHOD OF WEST FLOODWAY/GARANG RIVER IMPROVEMENT

2.1 Temporary Construction Road and Bridge

2.1.1 River Mouth～North Ring Road

Bypass drainage channel excavation and dike embankment works, channel excavation works and revetment works are carried out in this area.

It is difficult to approach the channel and dike embankment works area from landsite, because there are many ponds and small channels at the right bank side. Therefore, temporary construction road will be constructed at the inside of new dike and used for the channel and dike embankment and revetment works.

Before construction of the temporary construction road, the alignment of existing drainage channel will be changed to the river (refer to Fig. 2.1.1). The corrugated pipe is installed in the crossing part of the temporary construction road over the drainage channel. After completion of above works and the diversion of drainage channel, this corrugated pipe is removed and the place is backfilled by good soil materal.

2.1.2 North Ring Road～National Road Bridge

Channel excavation works, Raising and reinforcement of existing floodwall, Revetment works, River Amenity and Maintenance Facilities works, and Raising of Railway and Railway Bridge are carried out in this area.

A temporary construction road will be constructed near North Ring Road at right bank from the crest of dike to floodplain, temporary construction road is constructed at left bank near WF-39 from the crest of dike to floodplain also.

2.1.3 National Road Bridge～Simongan Weir

Channel excavation works and revetment works are main works in this area. Temporary construction roads will be constructed at both sides of near upstream side of National Road Bridge.

2.1.4 PDAM Water Intake

There is groin and revetment works at the downstream of PDAM Water Intake, so a temporary construction road will be constructed at the downstream side of working area from right bank crest.

2.1.5 Ground Sill (Hydraulic Drop) ~ WF.130

Revetment and groin works are closely associated with Ground Sill (with Hydraulic Drop) construction works, so temporary construction roads will be connected to the flood plain from existing banks.

2.1.6 WF.130~WF.160

Groin, revetment and floodwall construction works are carried out in this area. At WF.135R, WF.145R, WF.133L and WF.147L, temporary construction roads will be constructed at both sides of the floodplain.

2.1.7 WF.160~WF.184

Revetment, earth dike embankment, raising of existing road and ground sill works are carried out in this area. A temporary construction road will be constructed at right bank. At left bank, an existing road will be used for construction purpose after widening and gentling of gradient of the existing road. Summary of the temporary construction roads is shown in Table 2.1.1.

2.2 Channel Excavation and Dike Embankment Works

2.2.1 Coffering and Dewatering

(1) River Mouth~North Ring Road

Existing drainage channel on the right bank will be drained through corrugated pipe. Coffering that made by earth fill type will be constructed to protect working area of embankment for dike (refer to Fig. 2.1.1), and some numbers of submersible pumps are used for dewatering to keep inside the coffering dry condition.

(2) Other construction area

Principally, single sheet pile type of temporary coffering and submersible pumps with flexible hose for dewatering will be applied for the works in the low water channel.

2.2.2 Channel Excavation and Dredging for West Floodway/Garang River

Channel excavation for West Floodway/Garang River consists of two items, which are "Excavation below Water Level" and " Excavation above Water Level".

Some excavated material with required quality that meets the specification can be used for embankment material of earth dike and filling material of earth filling. Excavated material above water level will meet the specification and in principle, the qualified excavated material is transported directly to embankment and filling areas which are located at the same working place. Excavated material which cannot be used for dike embankment and filling will be hauled to spoil bank areas.

- Excavation above Water Level

Excavation and loading is done by backhoes and dump trucks are used for hauling excavated material to embankment area and a spoil bank located about 4.5 km away. And giant breaker is applied to excavate of soft rock, which is estimated in low percentage at downstream side of the confluence with Kreo River.

The capacity of the equipment are as below.

- Backhoe : 0.35 m^3
- Dump Truck : 10 t
- Bulldozer : 15 t
- Giant Breaker : 600 kg～800 kg

- Excavation below Water Level and Dredging

In this area two kind of excavation method will be used.

(a) Excavation below Water Level

Excavation and loading are done by backhoe from floodplain and dump trucks are used for hauling excavated material to a spoil bank. Giant

breaker is applied to excavate soft rock. The capacity of the equipment are as below.

- Backhoe : 0.35 m³
- Dump Truck : 10 t
- Giant Breaker : 600 kg～800 kg

(b) Dredging

In the stretch between the river mouth and North Ring Road, dredger is used for dredging river bed material and loading. Hauling of dredged material to a spoil bank is done by a combination of barge and tugboat. The capacity of main equipment are as below.

- Clamshell Grabbing : 1.0 m³
- Pontoon (for clamshell) : 200 t
- Barge (for hauling) : 100 m³
- Tugboat : 15 t

Summary of the work volume of excavation, embankment and filling and material to be spoiled are shown in Table 2.2.1.

2.2.3 Earth Dike Embankment West Floodway/Garang River

Earth dike embankment works are executed for the areas at the river mouth and the confluence with Kreo River. The typical cross section of earth dikes are shown in Fig. 2.2.1.

(1) River Mouth (Right bank)

If excavated material meet the specification for embankment material, the excavated material will be hauled to construction area directly.

Spreading and compaction works are done by bulldozer. Bulldozer spreads transported material with the thickness of 30 cm and compacts with 4 times of pass keeping specified moisture content. After completion of embankment final slope shaping will be done by backhoe.

The capacity and number of the equipment are as below.

- Bulldozer : 21 t x 1 unit
- Backhoe : 0.35 m³ x 1 unit

- Dump Truck : 10 t x 2 units

(2) Confluence with Kreo River (Right bank)

The same method described in (a) will be applied for the dike embankment works and raising of existing road works that is located about 80 m upstream side from the dike embankment area.

However, considering the work quantity, 15t-bulldozer is applied for spreading and compaction works.

The capacity and number of the equipment are as below.

- Bulldozer : 15 t x 1 unit
- Backhoe : 0.35 m^3 x 1 unit
- Dump Truck : 10 t x 2 units

2.3 Raising of Existing Floodwall

Raising works are done by connecting new reinforced concrete wall with the existing ones. Connecting surface of existing wall is chipped carefully, deformed bars are inserted in drilling holes with non-shrinkage mortar and concrete placing work will be carried out directly by agitator truck with chute and vibrator. The concrete should be vibrated to prevent honeycomb and to improve the appearance of the exposed surface.

Some block joints, which have a difference, after chipping of transition area joint material will be embedded at specified location to prevent water seepage, followed by careful concrete placing and curing works.

Typical section of raising of existing floodwall is shown in Fig. 2.3.1.

The capacity and number of the equipment are as below.

- Bulldozer : 15 t x 1 unit
- Backhoe : 0.35 m^3 x 1 unit
- Backhoe : 0.20 m^3 x 2 units
- Truck with Crane : 4 t x 1 unit

2.4 Protection Works for Riverbank and Riverbed

2.4.1 Coffering and Dewatering

The following type of Revetments and Groin are provided for the protection of river banks and dike slopes, and the type of coffering is also related to the type of Revetment (refer to Fig. 2.4.1) and Groin (refer to Fig.2.4.2).

Type of Revetment	Standard Slope	Application
Wet Stone Masonry	Vertical to 1:0.5	River bank, Dike slope Height of 3 m to 7 m
Wet Stone Pitching	1:1.5 or gentler	
Stone Facing (Riprap)	1:2.0 or gentler	Height of up to 3 m
Precast Concrete Block	Horizontal	
PC Sheet-pile Wall	Vertical	Water front structures Height : 3 m to 4 m
PC Sheet-pile Wall with Tie Rod	Vertical	Water front structures Height: 4 m to 8 m
Leaning Wall (Mass concrete type)		
Gabion Mattress/Cylinder	1:1.0 or gentler	Transition of channel

A single steel sheet pile and earthfill type of coffering which has 100 m of unit length is applied. Standard section of coffering types are shown in Fig. 2.4.3.

2.4.2 Bank Protection Works

In general, bank protection works will be carried out in accordance with the following construction procedure.

After closing the construction area by coffering and completion of access road, excavation until bottom elevation of base concrete is carried out by backhoe and log pile driving is done by backhoe also.

Some types of revetment have concrete sheet piles, and these concrete sheet piles are driven by vibratary pile driver, base concrete, backfill gravel and wet stone masonry work is followed..

The capacity and number of the equipment are as below.

- Backhoe : 0.35 m^3 x 2 units
- Truck with Crane : 4 t x 1 unit
- Vibratary Pile Driver : 30 kW x 1 unit

2.5 Ground Sill

2.5.1 Coffering and Dewatering

Ground Sill with head and without head are proposed at about 1.0 km and 3.3 km upstream side from existing Simongan Weir. During dray season the water level of the upstream of the Weir is to be kept at about EL.5.200 m, so coffering at Ground Sill with head receives large water pressure during construction period. But the coffering at Ground Sill without head will not be influenced this water level.

(1) Coffering for Ground Sill with Head

The 2-stage construction method is carried out and double steel sheet pile type is applied for coffering in this area, because the width of the ground sill becomes 40 m and maximum water head becomes more than 4.70 m. Submersible pumps are used for dewatering. Construction procedure and typical cross section of coffering (double steel sheet pile) method are shown in Fig. 2.5.1.

(2) Coffering for Ground Sill without head

In this construction area water level is not so high and there are some boulders and rocks at the site near the confluence with Kreo River, so earthfill type coffering and submersible pumps for dewatering are used. The 2-stage construction method is employed. Construction procedure and typical cross section of coffering (earthfill) is shown in Fig. 2.5.2.

2.5.2 Construction of Ground Sill with Head (WF.124)

Ground Sill with Head is located about 1,050m upstream from Simongan Weir. After the access road to the site reached to the downstream side of the riverbed at the elevation about EL. 1.80 m, foundation excavation work will be commenced. After the foundation excavation and hauling excavated material to spoil bank areas, replacement work by selected material and concrete sheet pile driving work follows.

Base slab concrete of apron and sidewall concrete will be placed by concrete pump and backfill, backfill gravel and wet stone masonry works follows.

The capacity and number of the equipment are as below.

- Bulldozer : 15 t x 1 unit
- Backhoe : 0.35 m^3 x 1 unit

- Dump Truck	:	10 t	x	3 units
- Vibratary Pile Driver	:	30 kW	x	1 unit
- Clamshell Bucket	:	0.60 m³	x	1 unit
- Crawler Crane	:	40 t	x	1 unit
- Truck with Crane	:	4 t	x	1 unit
- Concrete Mixer	:	1.5 m³	x	3 units

2.5.3 Construction of Ground Sill without Head (WF.172+30)

Ground Sill without Head is located about 3,400 m upstream from Simongan Weir. After the access road to the site reached to the riverbed at the elevation of about EL. 5.30 m, foundation excavation work using by bulldozer, backhoe and if necessary giant breaker will be commenced.

Wet stone masonry works of the ground sill, backfill, gabion mattress, backfill gravel and wet stone masonry works of sidewall follows.

The capacity and number of the equipment are as below.

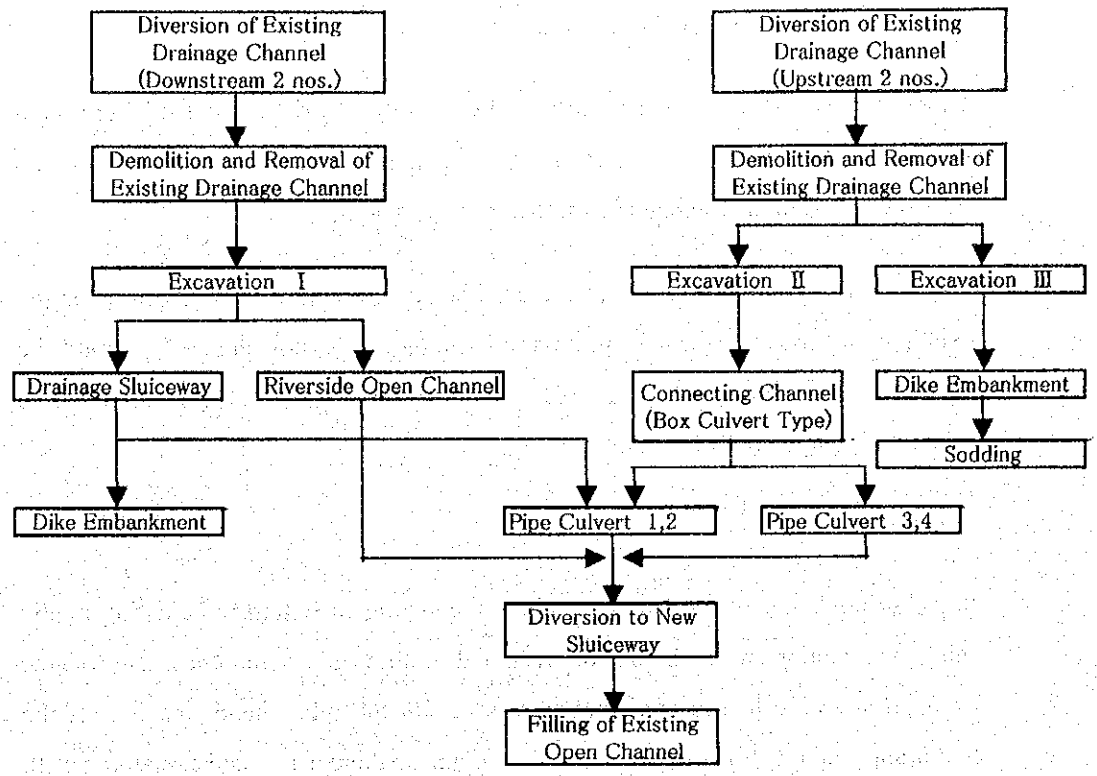
- Bulldozer	:	15 t	x	1 unit
- Backhoe	:	0.35 m³	x	1 unit
- Dump Truck	:	10 t	x	3 units
- Giant Breaker	:	600 kg ~ 800 kg	x	1 unit
- Backhoe	:	0.60 m³	x	1 unit
- Truck with Crane	:	4 t	x	1 unit

2.6 Drainage Sluiceway at WF.172R+15m

A drainage sluice for two drainage channels on the right river bank at WF.172 is constructed. The drainage sluiceway mainly consists of such structures as connecting channel, river side open channel, dike embankment and a box culvert.

Temporary drainage from existing channels will be done by submersible pumps during construction period. Since the most structures have long length and short width, backhoe is useful for excavation and loading works. Concrete placing for main box culvert will be done by concrete pump, and other structure's concrete placing work will be done directly by agitator truck with chute.

Construction procedure of the drainage sluiceway is shown below.



The capacity and number of the main equipment are as below.

- Bulldozer	:	15 t	x 1 unit
- Backhoe	:	0.35 m³	x 1 unit
- Vibratary Pile Driver	:	30 kW	x 1 unit
- Dump Truck	:	10 t	x 4 units
- Truck with Crane	:	4 t	x 1 unit
- Giant Breaker	:	600 kg ~ 800 kg	x 1 unit

2.7 Raising of the Existing Railway Bridge

The railway bridge is located at the point of 3.6 km upstream from the river mouth and is to be raised about 60 cm to have a clearance of 1.0 m above the design high water level, because the present clearance of about 47 cm is too small.

Location of the new bridge shall be the same as the existing bridge but be shifted to the Cirebon side by 5.0 m in order to decrease the traffic jam at the Semarang side during construction period. The construction method was decided by comparative study in the previous report as follows.

"The existing superstructure will be raised by jacks and the existing superstructures are used, while the new substructure will be

reconstructed beside the existing one."

Therefore, the raising of the existing railway bridge works consist of three main works as the raising and shifting of superstructures, reconstruction of the substructures and the raising of approach railway tracks.

The period of raising up works of the existing superstructure of truss bridge on the existing substructures which foundation condition is not grasped, should be shortened. Considering these matters procedure of main works and construction time schedule is shown in Table 2.7.1 and Fig. 2.7.1.

Abutment

Since an abutment of the Cirebon side is reconstructed within the existing public road, a retaining wall should be installed before the commencement of the excavation and structure construction works. On the other hand, the one of the Semarang side is reconstructed in the flood plain, so there is no need a retaining wall. Concrete placing works are continued until the same elevation of the existing one, and the remaining (a part of wall concrete and parapet) is commenced again after completion of the raising work of the superstructure.

Pier

After completion of the coffering, piling and retaining wall work , excavation and concrete work for pier will be carried out. But concrete placing works for beam portion are executed after completion of the raising of the existing superstructure in order not to avoid the existing rail elevation. Coffering is needed again at the time for the removal of the existing piers after the completion of bridge shifting works.

Bridge and track

After completion of the concrete placing of piers and abutments until the same elevation of the existing substructures, raising works of bridge and tracks are carried out step by step. Considering the total raising height of 60 cm and existing railway tracks conditions, 15 cm raising in one time is applied as the stepped raising height in this project.

Raising of the approach tracks are carried out during the free time of train at first and after completion of the one step of the raising of the approach tracks, raising works of superstructure is followed using the no operation time of train.

A shifting works of 3-spaned bridge are carried out at one time during no operation time after preparation of the temporary girders at both abutments. Demolition of existing piers and abutments, removal works of temporary girders and other supporting facilities follows and arrangement of the rail alignment within the project area is carried out finally.