

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

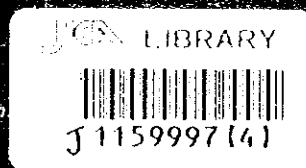
MINISTRY OF SETTLEMENT AND REGIONAL DEVELOPMENT
THE REPUBLIC OF INDONESIA

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

FINAL REPORT

COMPONENT C:
URBAN DRAINAGE SYSTEM IMPROVEMENT

VOLUME: VI DATA BOOK



AUGUST 2000

CTI ENGINEERING INTERNATIONAL CO., LTD.

IN ASSOCIATION WITH

PACIFIC CONSULTANTS INTERNATIONAL

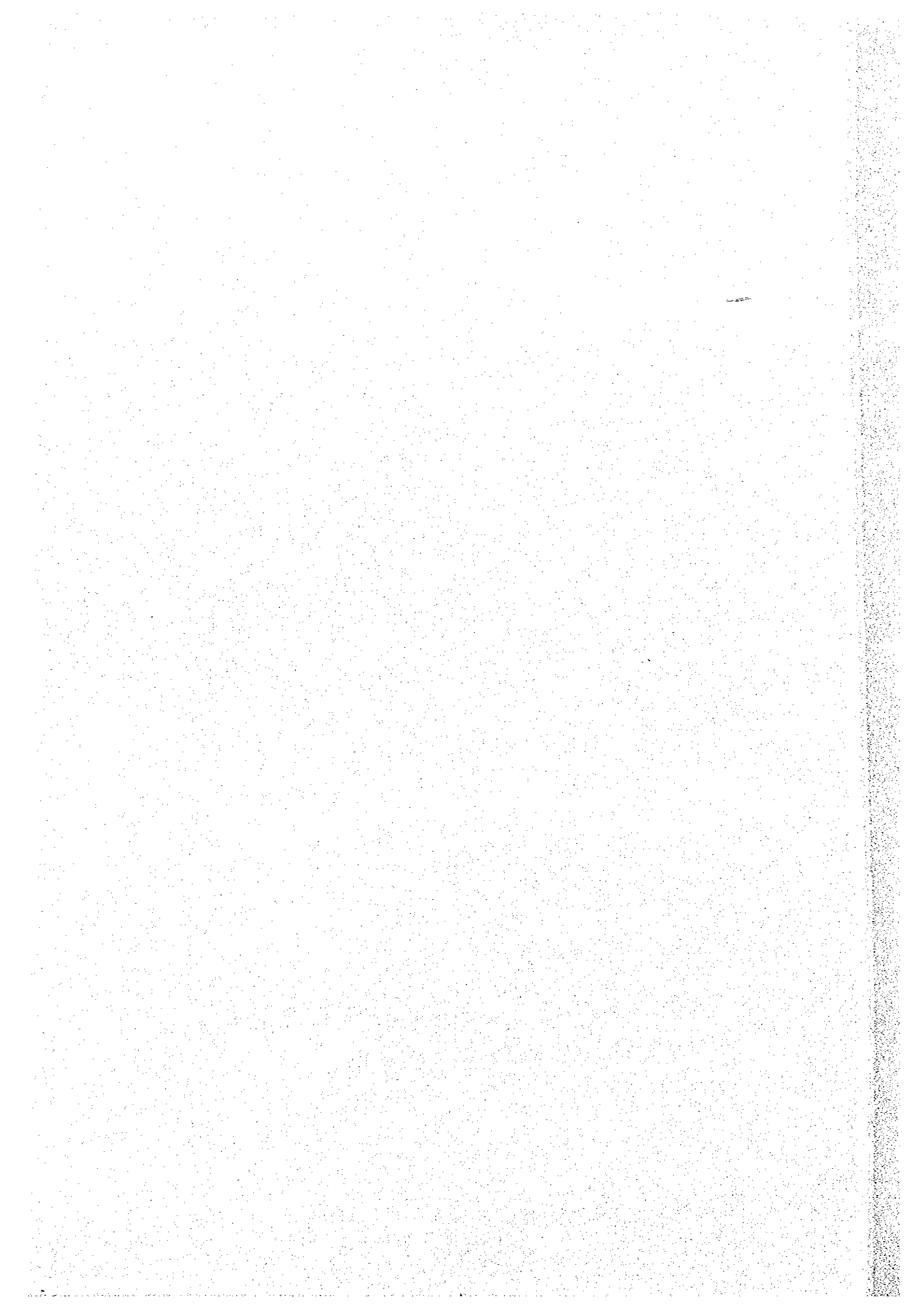
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CONSTITUTION OF THE REPORT

1. SUMMARY
2. COMPONENT A : WEST FLOODWAY/GARANG RIVER IMPROVEMENT

VOLUME I	MAIN REPORT
VOLUME II	DESIGN CRITERIA
VOLUME III	DESIGN NOTES
VOLUME IV	WORK QUANTITY CALCULATION
VOLUME V	CONSTRUCTION PLANNING
VOLUME VI	COST ESTIMATE
VOLUME VII	DATA BOOK

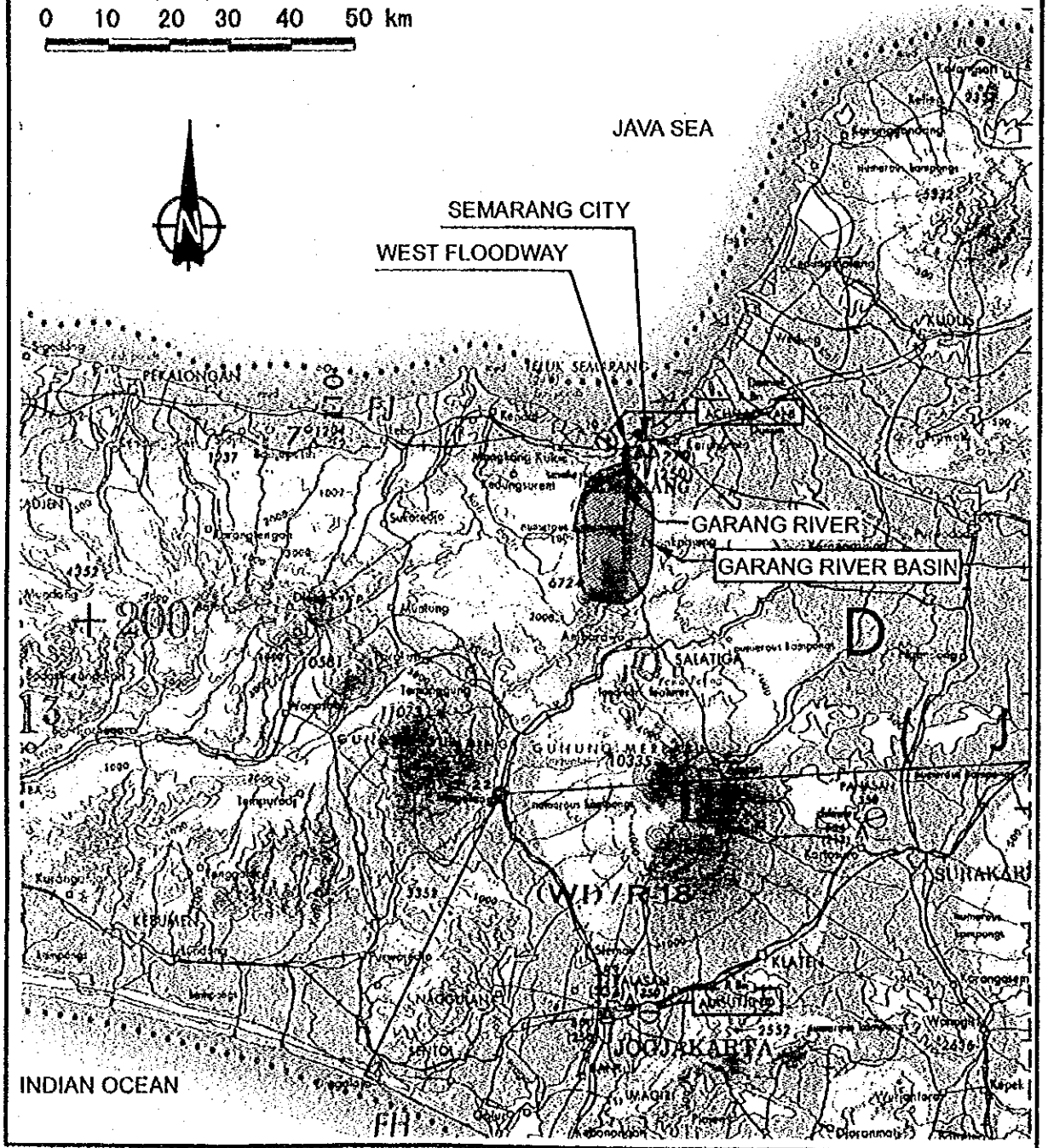
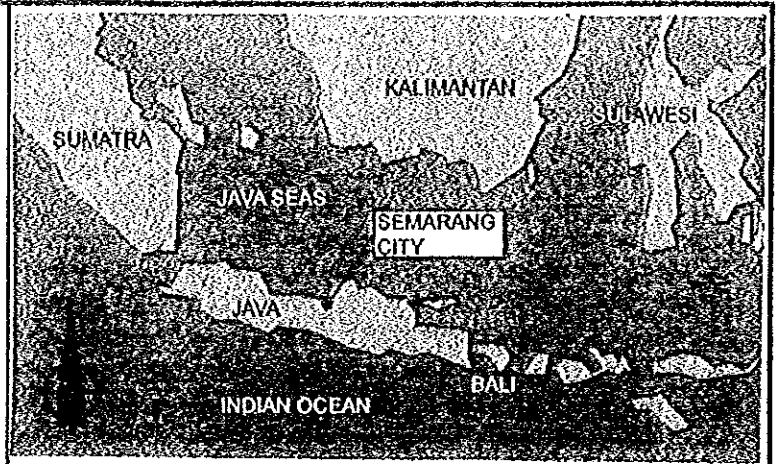
3. COMPONENT B : JATIBARANG MULTIPURPOSE DAM CONSTRUCTION

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VOLUME III	DESIGN NOTES
VOLUME IV	WORK QUANTITY CALCULATION
VOLUME V	CONSTRUCTION PLANNING
VOLUME VI	COST ESTIMATE
VOLUME VII	DATA BOOK
VOLUME VIII	ANNEX

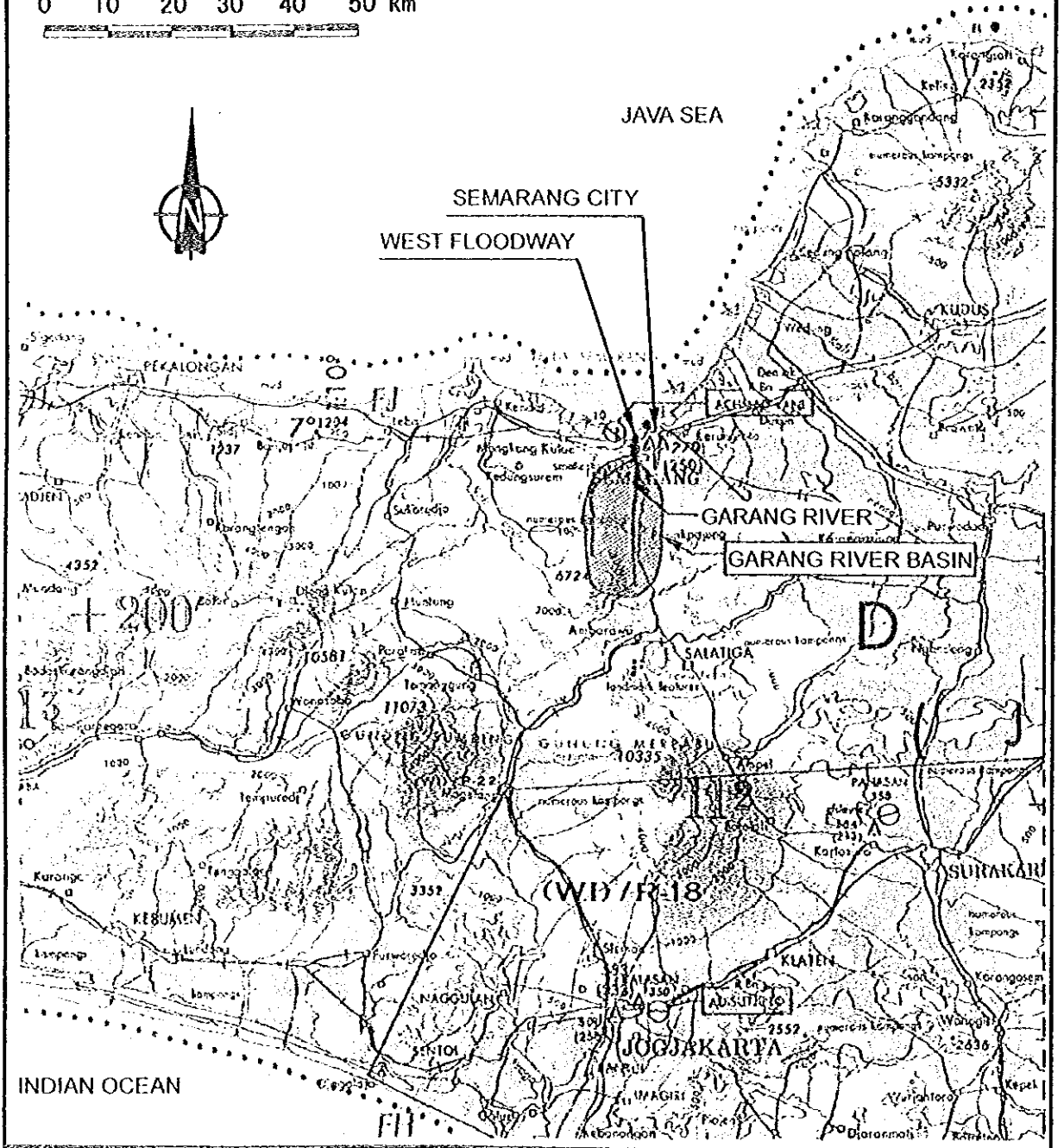
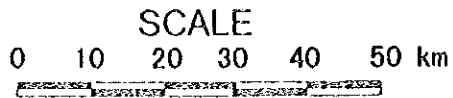
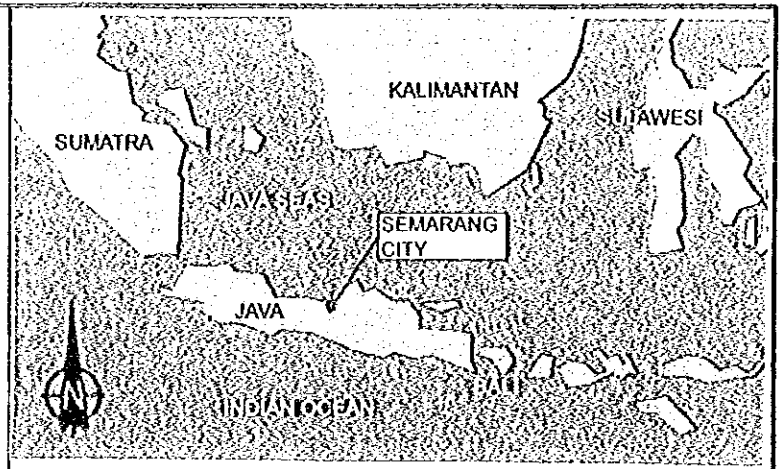
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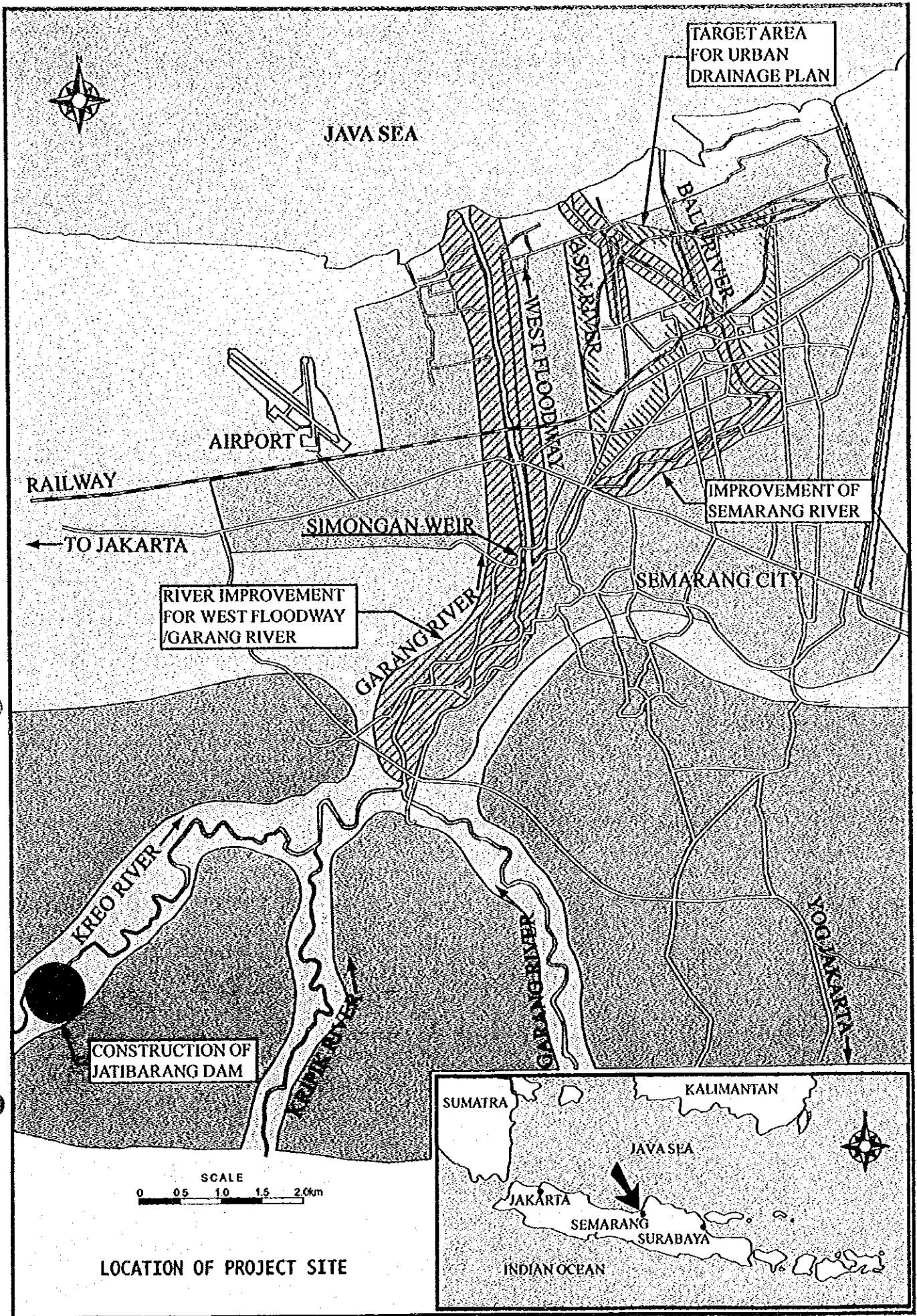
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VOLUME VI	DATA BOOK

GENERAL MAP



GENERAL MAP





TARGET AREA FOR URBAN DRAINAGE PLAN

JAVA SEA



AIRPORT

RAILWAY

← TO JAKARTA

SIMONGAN WEIR

RIVER IMPROVEMENT FOR WEST FLOODWAY / GARANG RIVER

IMPROVEMENT OF SEMARANG RIVER

SEMARANG CITY

GARANG RIVER

KREO RIVER

CONSTRUCTION OF JATIBARANG DAM

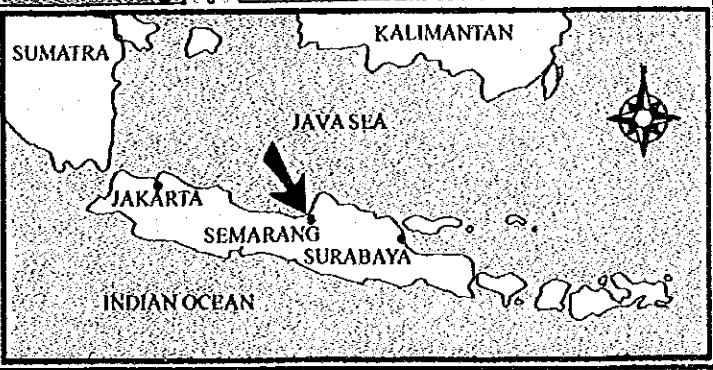
SUKOHARJO RIVER

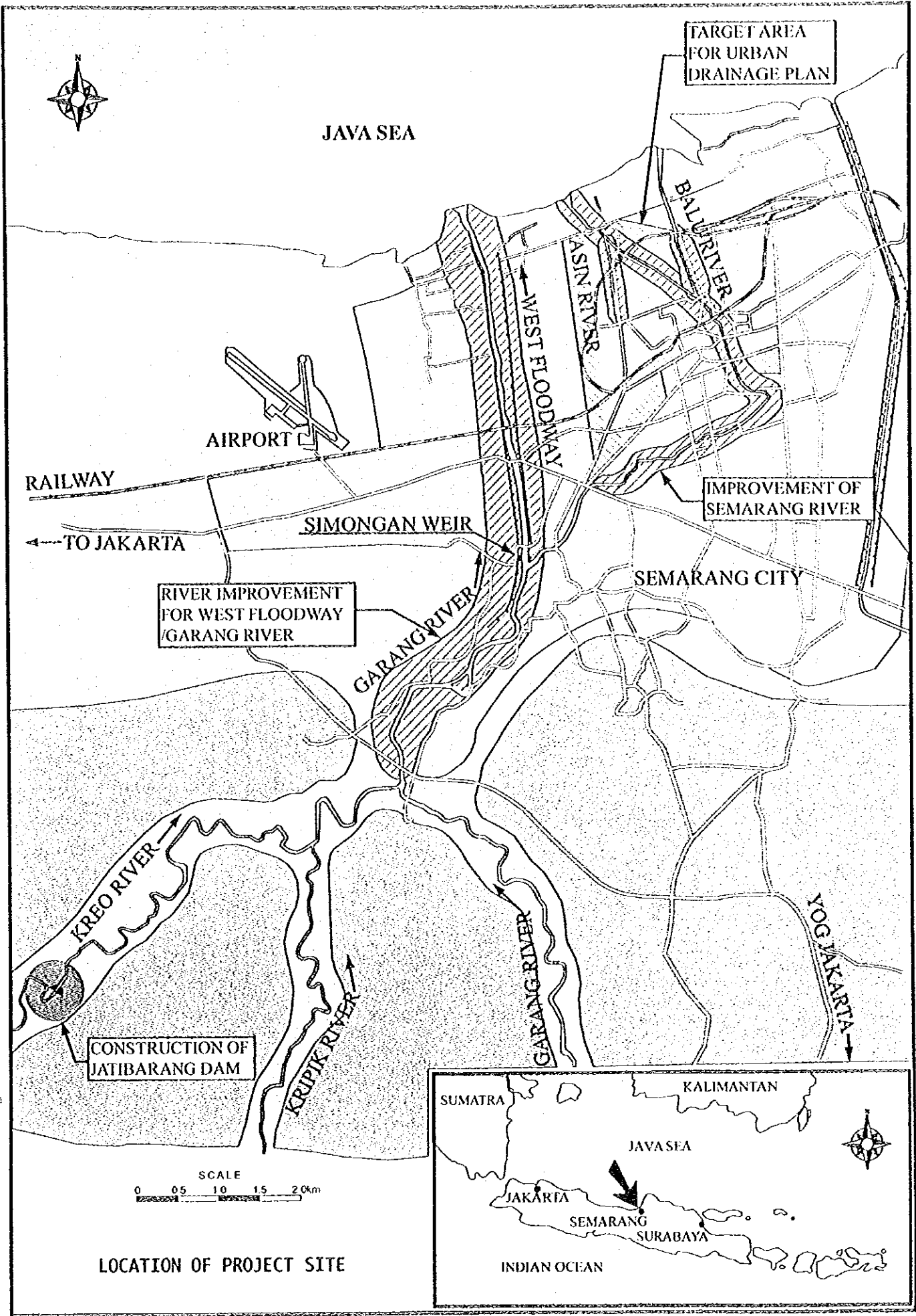
GARANG RIVER

TO JAKARTA

SCALE
0 0.5 1.0 1.5 2.0km

LOCATION OF PROJECT SITE





VOLUME VI DATA BOOK

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GENERAL MAP

LOCATION OF PROJECT SITE

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TERMS AND ABBREVIATIONS

1. INDONESIAN GOVERNMENT AGENCIES AND ORGANIZATIONS

GOI	:	Government of Indonesia
BAPPENAS	:	Badan Perencanaan Pembangunan Nasional (National Development Planning Board)
BAPPEDA	:	Badan Perencanaan Pembangunan Daerah (Provincial Development Planning Board)
BINAMARGA	:	Directorate General of Road and Bridge, Ministry of Public Works
BAPEDAL	:	Badan Pengendalian Dampak Lingkungan (Environmental Impact Assessment Board)
BPN	:	Badan Pertanahan Nasional (National Land Agency)
BPP	:	Balai Penyuluhan Pertanian (Agricultural Extension Center)
DPU	:	Departemen Pekerjaan Umum (Ministry of Public Works)
DGWRD	:	Directorate General of Water Resources Development, Ministry of Public Works
DGCK	:	Directorate General of Cipta Karya (Housing, Building and Urban Development, Ministry of Public Works)
DGRD	:	Directorate General of Research and Development, Ministry of Public Works)
DOR	:	Directorate of Rivers
DPUP	:	Dinas Pekerjaan Umum Propinsi (Provincial Public Works Services)
IHE	:	Institute of Hydraulic Engineering (Bandung)
PJKA	:	Perusahaan Jawatan Kereta Api (Railway Company, Old Name)
PERUMKA	:	Perusahaan Umum Kereta Api (Indonesian Railway Public Corporation, New Name)
PDAM	:	Perusahaan Daerah Air Minum (Water Works Company)
PMG	:	Pusat Meteorologi dan Geofisika (Center of Meteorology and Geophysics)
PLN	:	Perusahaan Listrik Negara (State Electricity Corporation)
P3SA	:	Proyek Pengembangan dan Penyelidikan Sumber-Sumber Air (Water Resources Development and Investigation Project)

2. JAPANESE GOVERNMENT / INTERNATIONAL ORGANIZATIONS

GOJ	:	Government of Japan
JICA	:	Japan International Cooperation Agency
MOC	:	Ministry of Construction, Japan

JEM	:	Japan Electric Machine Industry
ADB	:	Asian Development Bank
IBRD	:	International Bank for Reconstruction and Development (World Bank)
UNDP	:	United Nations Development Program
WMO	:	World Meteorological Organization
ASTM	:	American Society for Testing and Materials
ASME	:	American Society of Mechanical Engineer
USASI	:	United States of America Standards
IEC	:	International Electrotechnical Committee
NEMA	:	National Electrical Manufacturers Association

3. MEASUREMENT UNITS

(Length)

mm	:	millimeter(s)
cm	:	centimeter(s)
m	:	meter(s)
km	:	kilometer(s)

(Weight)

g, gr	:	gram(s)
kg	:	kilogram(s)
t, ton	:	tonnage (s)

(Area)

mm ²	:	square millimeter(s)
cm ²	:	square centimeter(s)
m ²	:	square meter(s)
km ²	:	square kilometer(s)
ha(has)	:	hectare(s)

(Time)

sec., s	:	second(s)
min	:	minute(s)
h (hrs)	:	hour(s)
d (dys)	:	day(s)
y, yr(yrs)	:	year(s)

(Volume)

cm ³	:	cubic centimeter(s)
m ³	:	cubic meter(s)

(Discharge)

l, ltr	:	liter(s)
EL., El.	:	Elevation

(Combined Units)

Speed/Velocity

cm/sec, cm/s	:	centimeter per second
m/sec, m/s	:	meter per second
km/hr, km/h	:	kilometer per hour

Stress

kgf/cm ²	:	kilogram per square centimeter
tf/m ²	:	ton per square meter
N/mm ²	:	newton per square millimeter

Mpa : mega pascal

Discharge

ltr/sec, l/s : liter per second

m³/sec, m³/s : cubic meter per second

m³/yr, m³/y : cubic meter per year

(Note : Other combined units may be constructed similarly as above)

Electricity

MW : megawatt

GW : gegawatt

MWh : megawatt hour

GWh : gegawatt hour

kV : kilovolt

4. MONETARY TERMS

¥ : Japanese Yen

US\$: United States Dollar

Rp. : Indonesian Rupiah

5. INDONESIAN TERMS

JKT : Jakarta

Jawa : Java

Propinsi : Province

Kabupaten, Kab. : District (Regency)

Kotamadya, Kodya : Municipality

Kecamatan, Kec. : Sub-District

Desa : Village (Rural Area)

Kampung, Kp. : Village (Rural Area)

Kelurahan : Village (Urban Area)

Kali, Sungai : River

Gunung : Mountain

Rawa : Swamp

Danau : Lake

Laut : Sea

PT. : Incorporated or Limited

PPT : Panitia Pembebasan Tanah (Land Acquisition Committee)

KOMPUS : Komisi Pusat (Central Committee for Environmental Impact Assessment)

KA-ANDAL : Terms of Reference of Environmental Impact Statement

ANDAL : Environmental Impact Statement

RKL	:	Environmental Management Plan
RPL	:	Environmental Monitoring Plan
AMDAL	:	Environmental Impact Assessment
BPPM2	:	Semarang Port Bench Mark
SPB	:	Semarang Peil Baru (New Semarang Level)
TTG	:	Tanda Tinggi Geodesi (National Bench Mark)

6. OTHERS

JRATUNSELUNA PROJECT : Water Resources Development Projects for Jragung, Tuntang, Serang, Lusi and Juwana Rivers

SSUDP	:	Semarang and Surakarta Urban Development Program
UIDP	:	Integrated Urban Infrastructures Development Program
SWL	:	Surcharge Water Level
DFWL	:	Design Flood Water Level
PMP	:	Probable Maximum Precipitation
PMF	:	Probable Maximum Flood
EIRR	:	Economic Internal Rate of Return
JIS	:	Japanese Industrial Standard
USASI	:	United States of America Standards
SWR	:	Shadow Wage Rate
CIF	:	Cost, Insurance and Freight
VAT	:	Value Added Tax.

CHAPTER 1 PHOTOGRAMMETRIC MAPPING AND TOPOGRAPHIC SURVEY

1.1 Aerial Photography and Mapping

1.1.1 Aerial Photography

Aerial photography at a scale of 1:8,000 and covering approximately 64 line kilometer in total was started after obtaining permission from the Central Survey and Mapping ABRI (PUSSURTA ABRI).

The results of the aerial photography are as follows:

Total No. of Films	1 Roll
Total Flight Runs	12 Runs
Total Exposures	156 Photos
Overlap and Side Lap	55% and 35%

The aerial photographs were taken by using Semarang Airport as a base, and processing of film and printing of aerial photos were done in Jakarta. The aerial photos were developed for mapping after checking navigation routes.

1.1.2 Uncontrolled Mosaic

Using aerial photographs that are newly taken at a scale 1:8,000 in 1997, uncontrolled mosaic photo at a scale of 1:10,000 was established for the area of 35 km² in total.

1.1.3 Photo Control Point Survey

Photo control point survey was conducted by Global Positioning System (GPS), and spirit leveling started from the photo control points and bench marks (BMs) for the above-mentioned photogrammetry and the existing national control points and Tanda Tinggi Geodesi (TTGs).

(1) Control Point Survey

The control point survey by GPS was executed to determine the X and Y coordinates of a minimum two (2) existing control points to be used for the photogrammetric mapping, cross section survey, longitudinal profile and topographic survey. Final

results of all photo control points by GPS are shown in Table 1.1.1.

(2) Datum Coordinates

The Indonesian Government changed the surveying datum in 1997 from the Indonesian Datum 1974 (ID74) ellipsoid to the World Geodetic System in 1984 (WGS 84).

Two (2) existing GPS stations having the new Indonesian Datum, namely N1.0259 and N.0004, which were established by Badan Koodinasi Survey Dan Pemetaan National (Bakosurtanal) in 1994, were chosen and applied as the X and Y geographical coordinates datum for this study by the JICA Study Team.

(3) GPS Observation

At least four (4) satellites were simultaneously observed for one hour for all the control points. In general, the base line lengths were planned between two (2) to five (5) kilometers.

(4) Post-processing

The post-processing was done using GPS survey software to obtain the best independent baseline solutions for all the GPS sessions. With the existing two stations (N1.0259, N.0004) fixed as the planimetric control on the modified WGS ellipsoid and the same stations serving as the vertical control for mean sea level height, the whole GPS network was constrained and adjusted by the GPS surveying software.

(5) Accuracy of GPS Survey

Accuracy of trigonometric closures for coordinates and height were checked to be less than 10 PPM (10/1,000,000) between the control points.

1.1.4 LEVELING

Minor order leveling was executed to obtain the heights of control points necessary for the topographic survey, cross section survey and longitudinal profile survey.

Leveling survey was conducted by means of closed loops and double runs, and temporary bench marks were established at every 2 km interval on the leveling routes. Also temporary bench marks were established at 49 points in Semarang City. And a total distance of the leveling survey was approximately 105 km.

The leveling works are described below:

(1) Datum Height

Government bench marks obtained from the Mean Sea Level of Indonesia as established by Bakosurtanal are applied for the leveling survey.

(2) Checking of Government Bench Marks

Before starting leveling survey, heights of three government bench marks namely TTG446, TTG447 and TTG449 were checked by the local contractor.

Leveling Loops	Distance	Misclosure
TTG449 to TTG447	4.601 km	14 mm
TTG447 to TTG446	5.095 km	-201 mm

From the above, it was judged by the JICA Study Team that TTG446 shall be ignored because TTG446 had ground subsidence about 20 cm from 1983.

The JICA Study Team decided to use TTG447 as the bench mark for topographic survey, river cross section survey and longitudinal profile survey in this project.

(3) Accuracy of Leveling

Any misclosure of leveling does not exceed $20\sqrt{S}$ between bench marks and/or control points (S: a single distance between bench marks in kilometer). And Standard division was 3.80 mm/km.

1.1.5 Field Verification

Using two (2) times enlarged aerial photographs, the keys for interpretation required for plotting and cartography was done by verifying them in the field. The work quantity was 35 km² for mapping with the scale of 1:2,000 and 1 km² for mapping with the scale of 1:1,000.

1.1.6 Aerial Triangulation

The implication and purpose of Aerial Triangulation work are to obtain the coordinates (X, Y, Z) of the aerial photo points necessary for the orientation process of each stereo model on the plotting instrument for the purpose of topographic map on the scale of 1:2,000 and 1:1,000 applying coordinates (X, Y, Z) of ground control points resulting from field measurement (GPS and leveling).

(1) Aerial Triangulation and Block Adjustment

The sequence of works to be carried out is as follows:

(a) Quantity

119 models of aerial triangulation work was carried out, and the quantity of models for each flight run was as follows:

Run Number	Number of Photo	Number of Model
Run 1(Semarang Area)	10 PCs	9 Models
Run 2(Semarang Area)	14 PCs	13 Models
Run 3(Semarang Area)	13 PCs	12 Models
Run 4(Semarang Area)	13 PCs	12 Models
Run 5(Semarang Area)	13 PCs	12 Models
Run 6(Semarang Area)	11 PCs	10 Models
Run 7(Semarang Area)	18 PCs	17 Models
Run 8(Semarang Area)	19 PCs	16 Models
Run 9(Semarang Area)	17 PCs	6 Models
Run 11(Ungaran Area)	9 PCs	6 Models
Run 12(Ungaran Area)	9 PCs	6 Models
Total	146 PCs	119 Models

(b) Data Collection

All necessary data such as flight index, control point coordinate and calibration of the aerial photographic camera were collected.

(c) Planning

Preparation of aerial triangulation was carried out as follows:

Selection of the Aerial Photos

Total sheets of aerial photos for Ungaran Area : 12 models

Total sheets of the aerial photos for Semarang Area : 107 models.

Control Point Selection

Total control points were 22, consisting of 5 horizontal and 17 vertical control points for aerial triangulation processing at Ungaran area.

Total control points of 74, consisting of 21 horizontal and 53 vertical control points for aerial triangulation processing at Semarang area.

(d) Preparation

The preparation stages were carried out as follows:

Point selection and numbering

Pass points and tie points were selected within the triple overlap area with the circle notation on the index model.

Numbering system for aerial triangulation

Ex. Model number : 80111

Where:

8011 : First two digits show the number of flight run as shown and last two digits show the number of aero photographs.

1 : Tie point number

The horizontal and vertical control points were annotated on the index models as a square, and vertical control points were annotated as triangle.

The point selection and numbering were carried out on the 1:2,000 and 1: 1,000 scale of aerial photographs by using mirror stereoscope.

(e) Point Transfer

The selected and control points on the diapositive film were marked and then transferred to adjacent diapositive film by using Wild PUG-4 instrument. This process was carried out until the last photo.

(f) Index Model

The index model on 1:50,000 scale, where all point numbers were plotted showing the relationship between each point, was produced.

(g) Measurement of Coordinates

Photo coordinates were observed and measured by using an analytical stereoplotter Leica SD-2000. All points including fiducial marks were measured.

(h) Adjustment

The final step of the aerial triangulation is the block adjustment using PATM-GPS software.

(i) Result

Block adjustment of Ungaran Area

Sigma Naught in the model system is as below.

Sigma naught for horizontal block = 21.064 micron

Sigma naught for vertical block = 14.773 micron

Weight root mean square values and check value of residual of Photogrammetric observations.

Model Points	RMS. (meter) Terrain system	RMS. (micron) Model system	CHV VXY/Z Model system
OBS X/Y	0.090	11.216	47.586
OBS z	0.063	7.888	23.664
Projection center	RMS. (meter) Terrain system	RMS. (micron) Model system	CHV VXY/Z Model system
OBS X/Y	0.120	14.975	65.532
OBS z	0.094	11.750	73.658

Block adjustment of Semarang Area

Sigma Naught in the model system, is as below.

Sigma naught for horizontal block = 18.890 micron

Sigma naught for vertical block = 20.353 micron

Weight root mean square values and check value of residual of Photogrammetric observations.

Model Points	RMS. (meter) Terrain system	RMS. (micron) Model system	CHV VXY/Z Model system
OBS X/Y	0.094	12.118	51.411
OBS z	0.080	10.273	30.820
Projection center	RMS. (meter) Terrain system	RMS. (micron) Model system	CHV VXY/Z Model system
OBS X/Y	0.254	32.718	138.809
OBS z	0.130	13.292	39.875

(j) Equipment

The equipment used in Aerial Triangulation is as follows:

Stereoscope	2 units
Point transfer Wild PUG-4	1 unit
Analytical Stereoplotter Leica SD-2000	1 unit
Computer	1 unit
PATM-GPS Software	1 unit

1.1.7 Plotting and Editing

The implication and purpose of stereo plotting and editing work are drawing details and contour lines using aerial photo diapositives, which are placed on the plate holders of the stereo plotter instrument.

The sequences of the plotting and editing works are as follows:

(1) Data collection

All the following necessary data were collected and prepared for stereo plotting.

- Model index of aerial triangulation
- Print out of aerial triangulation adjustment
- Vertical control points and description on two (2) times enlarged aerial photographs
- Field identification on two(2) times enlarged aerial photographs

(2) Planning

Preparation of stereo plotting was carried out as follows:

(a) Control sheets

Total control sheets of the stereo plotting topographic map are:

- 48 sheets for 1:2,000 scale of Semarang topographic map (including 4 sheets of sounding survey result);
- 4 sheets for 1:2,000 scale of Ungaran topographic map; and
- 26 sheets for 1:1,000 scale of channel topographic map

(b) Models

Total models of stereo plotting are:

- 52 models for 1:2,000 scale of Semarang topographic map
- 4 models for 1:2,000 scale of Ungaran topographic map
- 12 models for 1:1,000 scale of channel topographic map

(c) Preparation of Control Sheets

Control sheets were produced by block adjustment result of aerial triangulation on polyester base material.

(d) Plotting

Plotting manuscript at the scale of 1:2,000 and 1:1,000 were produced from aerial photos at the scale of 1:8,000 by using second order precision plotter.

The sequences of the stereo plotting works are as follows:

- Inner Orientation;
- Relative Orientation;
- Absolute Orientation; and
- Plotting of details, spot height, vegetation boundary and contour lines.

Contour intervals for intermediate contour line are 1 m both maps with the scale of 1:2,000, and 1:1,000.

Editing works was carried out on the plotting manuscript by compiling result of field identification, such as symbol annotation etc.

(e) Result

The final manuscript was used for the fair drawing work and the number of sheets plotting manuscript are as below.

- 48 sheets plotting manuscript at scale of 1:2,000 for Semarang area (including 4 sheets of sounding survey result)
- 4 sheets plotting manuscript at scale of 1:2,000 for Ugaran area
- 26 sheets plotting manuscript at scale of 1:1,000 for channel area

(f) Equipment

The equipment used for plotting and editing are:

Computer	2 units
Roland Plotter	1 unit
Stereo Plotter, Wild A-8	2 units
Plotter Wild AG-1	1 unit
Stereo Plotter, Leica SD-2000	1 unit
Drafting Table	3 units

1.1.8 Fair Drawing

The implication and purpose of fair drawing work are drawing details using symbols and contour lines with tracing method from the plotting manuscript and other additional data and information.

The sequence of the fair drawing were carried out as follows:

(1) Data Collection

All necessary data were collected and prepared for fair drawing such as:

- Plotting manuscript
- Vertical control points and description on two (2) times enlarged aerial photographs
- Field identification results on two (2) times enlarged aerial photographs

(2) Planning

Preparation for fair drawing were carried out as follows:

(a) Drawing sheets

Total sheets of fair drawing are 78 sheets, consisting of 48 sheets of Semarang map (including 4 sheets of sounding survey result) and 4 sheets of Ungaran map at the scale of 1:2,000; 26 sheets of map at scale of 1:1,000.

(b) Legend and Symbol

Legend, symbols and annotation used for the map are shown in Table 1.1.2.

(3) Preparation

The preparations were carried out as follows:

(a) Drawing sheets

Drawing sheets were made using computer PC on polyester base. The sheet's size is A1 (60 cm ~ 85 cm). Numbering system is as follows:

Sheet number 45-12

Where:

45 = Total sheets

12 = Sheet number

(4) Fair drawing

Fair drawing was carried out with tracing method using drafting pen and black ink from plotting manuscript at scale of 1:2,000 and 1:1,000.

Fair drawing works are as follows:

- Drawing details
- Spot heights and contour lines
- Symbols and annotations, on the map symbols must be matched to legend
- Vegetation boundary

Contour interval for intermediate contour lines are 1 m for map at scale of 1:2,000 and 1 m for map at scale of 1:1,000.

(5) Results

The final results of the fair drawing are:

- 48 sheets of topographic map at scale of 1:2,000 for Semarang area,
- 4 sheets of topographic map at scale of 1:2,000 for Ugarang area,
- 26 sheets of topographic map at scale of 1:1,000 for Channel area,
- 48 sheets duplicate at scale of 1:2,000 for Semarang area,

- 4 sheets duplicate at scale of 1:2,000 for Ugarang area, and
- 26 sheets duplicate at scale of 1:1,000 for channel area.

The equipment used for the fair drawing works are:

- Computer : 2 units
- Roland plotter : 1 unit
- Drafting table : 9 units
- Drafting tools : 9 units

1.2 Ground Survey

1.2.1 River Longitudinal Profile and Cross-Section Survey

(1) Installation of Kilometer Post

Prior to the commencement of the river longitudinal profile survey, kilometer posts of wooden pegs were installed on the right and left banks of West Floodway, Garang, Semarang, Asin and Baru rivers. When the location of a kilometer post is very close to such structures as bridges, water intake and water pipes, kilometer posts were shifted to the center line of these structures. The position of a kilometer post was decided by traverse method in the field. All coordinates data are as shown in Table 1.1.3.

(2) Longitudinal Profile Survey

The river longitudinal profile survey (the profile survey) by direct leveling was executed to obtain heights of kilometer posts for the river cross section survey and to prepare longitudinal profile sections. Leveling routes were formed by closed loops and double-runs. A total distance of the leveling survey covering West Floodway, Garang, Semarang, Asin and Baru rivers was 41 km.

The datum height was applied for the longitudinal profile survey including river cross section survey and auxiliary leveling. The heights of TTGs bench marks are applied to the kilometer posts by direct leveling.

All results of heights of kilometer posts by the profile survey, the deepest height of the river cross section survey, names of bridge and others were edited by Auto CAD system.. The longitudinal profile sections at a horizontal scale of 1:2,000, 1:1,000 and

vertical scale of 1:100 were prepared on the draft plotting paper sheets using the longitudinal profile data. Final longitudinal profile data as shown in Table 1.1.4.

(3) River Cross Section Survey

Heights and distance of slope changing points, roads, channels, etc. along the cross section lines were measured by using a Total Station System, levels and Electric Distance Meter (EDM).

Water levels and depths of the rivers were measured using a survey rod, and the distance of these measured simultaneously. The bridges, irrigation intakes and water pipes of all rivers were also measured. A total number of cross sections surveyed are approximately 814.

(4) Checking of Longitudinal Profile

(a) The check results of differences in height closure between the kilometer posts did not exceed $20\sqrt{S}$ (S: length of single run in kilometer) as specified in the Technical Specifications.

(b) Checking of River Cross Sections

At the same kilometer posts checked above, river cross section lines were measured. The check results of height of these cross section line points did not exceed ± 50 mm and distance errors between the cross section line points are less than 1/300 as specified in the Technical Specifications.

Longitudinal profile and cross-section were surveyed along Semarang, Asin, and Baru rivers.

Semarang River

Work Item	Volume	Drawing		Remarks
		No. of Sheets	Scale	
Longitudinal Profile	8.650 km	9	H=1/1,000 V=1/100	Sheet Size: A1
Cross-Section Survey	303 sections	88	H=1/200 V=1/100	Sheet Size: A1

Asin River

Work Item	Volume	Drawing		Remarks
		No. of Sheets	Scale	
Longitudinal Profile	1.318 km	2	H=1/1,000 V=1/100	Sheet Size: A1
Cross-Section Survey	70 sections	19	H=1/200 V=1/100	Sheet Size: A1

Baru River

Work Item	Volume	Drawing		Remarks
		No. of Sheets	Scale	
Longitudinal Profile	1.498 km	2	H=1/1,000 V=1/100	Sheet Size: A1
Cross-Section Survey	78 sections	20	H=1/200 V=1/100	Sheet Size: A1

East Bandarharjo

Work Item	Volume	Drawing		Remarks
		No. of Sheets	Scale	
Longitudinal Profile	0.792 km	1	H=1/1,000 V=1/100	Sheet Size: A1
Cross-Section Survey	17 sections	2	H=1/200 V=1/200	Sheet Size: A1

West Bandarharjo

Work Item	Volume	Drawing		Remarks
		No. of Sheets	Scale	
Longitudinal Profile	1.423 km	1	H=1/500 V=1/100	Sheet Size: A1
Cross-Section Survey	73 sections	8	H=1/200 V=1/200	Sheet Size: A1

1.3 Topographic Survey

Topographic survey was carried out for Asin Pumping Station, West and East Bandarharjo Pumping Station, West and East Bandarharjo Drainage area, a bridge across Semarang River and a water gate at Baru River.

The work quantities carried out are as follows:

(a) Scale 1:200

Asin Pumping Station	9.0 ha
West Bandarharjo Pumping Station	6.0 ha
East Bandarharjo Pumping Station	3.0 ha
Bridge (Semarang River)	0.5 ha
Water gate (Baru River)	1.0 ha

(b) Scale 1:500

West Bandarharjo Drainage Area	2.8 ha
East Bandarharjo Drainage Area	3.2 ha

1.4 Sounding Survey

(1) Location and Quantity

The location is shown in Fig.6.4.14. The work quantities are 3 km², consisting of 16 survey lines and 1 km per line.

(2) Setting of Base Survey Line

Base survey line was established along the coastline for 3 km eastward from the mouth of West Floodway by GPS, traversing and spirit leveling. All control monuments were set at 200 m interval along the base survey line.

Misclosure of leveling does not exceed $20\sqrt{S}$ between bench mark and control points (S: a single distance in kilometer between control points).

(3) Measuring Interval of Survey Line

From the control point, water depth of each line 1 km offshore were measured at 30 m interval. Water surface was also measured.

(4) Equipment

Echo sounder and survey rod for water depth measurement, GPS and Total Station Surveying System for positioning were used.

(5) Chart Drawing

Charts were interpolated in the 1:2,000 scale topographic map.

1.5 Land Subsidence

During this study period, leveling measurements were conducted between TTGs and 49 permanent bench marks established in the Study.

The survey result is shown in Fig.6.4.15.

No subsidence was found in the western part of the study area. However in the eastern port of the city and study area, considerable subsidence was found with a maximum measure of -0.972 m observed.

The amount of annual subsidence in future can easily be checked by re-examining these points at regular intervals.

CHAPTER 2 GEOLOGICAL AND SOIL MECHANICAL INVESTIGATION

2.1 Boring and Soil Mechanical Test

(1) Core Drilling

(a) Purpose

The purpose of core drilling is to obtain the subsurface geology of the drilling area, i.e. soil type, thickness, sequence, physical condition, etc.

During the drilling, Standard Penetration Tests (SPT) are executed in order to gain the soil property.

(b) Method

Core drilling is performed according to "Hydraulic feed rotary drilling" method, mounted appropriately on a platform. Single tube core barrels and tungsten bit are used in order to gain good quality of core samples.

The core samples are sequentially arranged in core boxes from top to bottom, representing soil types and layer distribution.

SPT are performed by dropping a 63.5 kg hammer from a height of 75 cm. The numbers of drop to penetrate 45 cm deep are noted, and the drops for the last 30 cm is taken as N value.

(c) Scope of Work

27 bore holes, with total length of 535 m were drilled. SPT were performed at every 1.0 metre depth with the total test number is 501.

The detailed specification of each boreholes is available in Table below.

No	Hole	Depth (m)	SPT	Undisturbed Samples
1	DB-1	30	27	3
2	DB-2	30	27	3
3	DB-3	30	27	3
4	DB-4	30	27	3
5	DB-5	30	27	3
6	DB-6	30	27	3
7	DB-7	30	27	3
8	DB-8	30	27	3
9	DB-9	30	27	3
10	DB-10	20	20	-
11	DB-11	10	10	-
12	DB-12	10	10	-
13	DB-13	20	20	-
14	DB-14	10	10	-
15	DB-15	10	10	-
16	DB-16	30	30	-
17	DB-17	10	10	-
18	DB-18	10	10	-
19	DB-19	10	10	-
20	DB-20	10	10	-
21	DB-21	10	10	-
22	DB-22	10	10	-
23	DB-23	10	10	-
24	DB-24	10	10	-
25	DB-25	10	10	-
26	DB-26	35	31	3
27	DB-27	30	27	3
	TOTAL	535	501	33

(d) Result

The core drilling results at each bore hole, including information about the soil type, thickness of layers, physical condition, N values, etc. are tabulated in Table 2.1.1.

(2) Laboratory Test

(a) Purpose

The laboratory test is subjected to determine the physical and mechanical properties of soil sample.

(b) Method

The laboratory test for soil sample followed the standard method of ASTM tabulated below:

Item	Standard Method
Soil Samples	
Gradation Analysis	ASTM D422
Moisture Content	ASTM D4959
Specific Gravity	ASTM D854
Liquid and Plastic Limits	ASTM D431
Density	USBR 5370
One dimensional consolidation	ASTM D2435
Triaxial compression UU	ASTM D2850

(c) Result

The results of laboratory tests are presented in detail in Table 2.1.2.

2.2 Geological Condition and Soil Properties

(1) Semarang River

The soil profile along Semarang River was figured out from the result of the core drilling at the boreholes DB-4 to DB-6, DB-10 to DB-21, and DB-27.

In general, the upper parts of the boreholes were dominated by Riverbed Deposit (Rd), embankment (B) and or very soft Clay (Ac), while the lower parts are Hard Clay layer (Dc).

- Riverbed Deposit (Rd) consists of clay and is very soft. It was found at all boreholes, from the surface up to 3.0 m deep.
- Embankment (B) consists of clay, silt, sand, gravel, and sometimes masonry was found in the lower part. The average N value of this layer is nearly 1. The thickness of embankment is about 1 m.
- Very soft Clay (Ac) was found beneath the Embankment (B) in general and or Riverbed Deposit (Rd), consisting of clay and sandy clay, very soft to soft with N values ranging 0 to 20 with average less than 10. The thickness of this layer is estimated at more than 24 m. This layer locally contains a lense of 1.7 m of coarse grain Sand (As) and Original Clay (Ao).
- Hard Clay layer (Dc) is dark brown and the surface part is characterized by oxidation containing coral limestone. This layer lies beneath the very soft Clay layer (Ac). It ranges 20 m from the ground surface to the bottom of the holes.

- The N value of this layer is more than 50 in general.

(2) Asin River

The soil profile along Asin River is reflected from the result of core drilling at the boreholes DB-1, DB-2, DB-22, and DB-23.

In general, the upper part of the boreholes was dominated by Embankment (B) and very soft Clay (Ac), while the lower part is hard Clay layer (Dc), containing 3 m thick of Coarse grain Sand (Ds) lense at the bore hole DB-1.

- Embankment (B) consists of clay, silt, sand and gravel. The thickness of embankment is about 1 m.
- Very soft Clay (Ac) was found beneath the Embankment (B) in general, consisting of clay and sandy clay, very soft to soft with N value ranging 0 to 8. The thickness of this layer is estimated as 20 m.
- Hard Clay layer (Dc) is dark brown. The surface part is characterized by oxidation, containing coral limestone. The N value of this layer is in general more than 50.

(3) Baru River

The soil profile along Baru River was figured out from the results of core drillings DB-7, DB-8, DB-9, DB-24, DB-25 and DB-26.

In general, the upper part of the boreholes was dominated by Embankment (B) or Riverbed Deposit (Rd) and very soft Clay (Ac), while the lower part is Hard Clay layer (Dc), containing 1.5 m lense of coarse grain Sand (Ds) at the borehole DB-9.

- Riverbed deposit (Rd) consists of sand and clay and it is very soft. It was found at the borehole DB-24 at 1.8 m deep from the ground surface.
- Embankment (B) consists of clay, silt, sand, gravel in the upper part and masonry in the lower part. The average N value of this layer is 5 and more than 50 for the upper and lower part, respectively. The thickness of embankment is about 2 m to 7 m.
- Very soft Clay (Ac) in general was found beneath the Embankment (B) and or Riverbed Deposit (Rd), consisting of clay and sandy clay, very soft to soft with N value of 0 to 10 and average value of 6. The thickness of this layer is estimated as 17 m. This layer contains a lense of 1.7 m thick of coarse grain Sand.

- Hard Clay (Dc) is dark brown and the surface part is characterized by oxidation, containing coral limestone and 1.4 m lense of coarse grained Sand (Ds). This layer lies beneath the very soft Clay layer (Ac), from 22 m deep to the bottom of the holes. The N value of this layer is in general more than 50.

(4) Conclusion

- The project area geologically belongs to Damar Formation and alluvium deposit.
- Alluvium deposit is sedimented as river, lake, swamp, or coastal deposits. Each type of deposit is physically and mechanically varied.

TABLES

TABLE 1.1.1 (1/2) FINAL RESULT OF CONTROL POINTS(1/2)

DATUM : WGS84
 PROJECTION : U.T.M
 ZONE : 49
 SEMI-MAJOR AXIS : 6,378,137.0000
 MINI-MINOR AXIS : 6,356,752.3143
 FLATTERING : 298.2572236
 SCALE FACTOR : 0.9996000
 LATITUDE OF ORIGIN : 0° 0' 0" 0000
 LONGITUDE OF ORIGIN : 111° 0' 0" 0000E

STATION	NORTHING	EASTING	LATITUDE	LONGITUDE	EVEVATION	REMARKS
N.0004	7° 4' 7.0809" S	110° 28' 55.8562" E	9,218,632.118	442,814.138		
N1.0259 (JP-7)	6° 59' 1.5641" S	110° 24' 34.2824" E	9,228,004.682	434,777.817	4.362	
JP-1	6° 56' 51.3269" S	110° 25' 6.6671" E	9,232,005.355	435,766.570	0.922	
JP-2	6° 56' 28.9296" S	110° 26' 41.9642" E	9,232,696.655	438,690.025	1.015	
JP-3	6° 56' 47.2163" S	110° 23' 32.0770" E	9,232,127.943	432,863.829	0.926	
JP-4	6° 57' 46.8455" S	110° 25' 59.3975" E	9,230,302.408	437,386.684	0.744	
JP-5	6° 58' 38.3085" S	110° 26' 54.6029" E	9,228,724.049	439,082.490	2.999	
JP-6	6° 58' 26.1345" S	110° 23' 40.1529" E	9,229,090.579	433,115.536	0.986	
JP-8	6° 59' 9.3077" S	110° 25' 43.6724" E	9,227,769.509	436,907.230	2.864	
JP-9	6° 59' 46.0844" S	110° 23' 22.6932" E	9,226,634.706	432,582.979	33.702	
JP-10	7° 0' 19.0705" S	110° 26' 56.3074" E	9,225,629.835	439,138.413	7.980	
JP-11	7° 0' 18.8807" S	110° 25' 40.3323" E	9,225,633.799	436,807.342	14.416	
JP-12	7° 0' 22.1649" S	110° 24' 30.8753" E	9,225,529.384	434,676.387	86.673	
JP-13	7° 0' 44.3283" S	110° 22' 14.3173" E	9,224,843.319	430,487.408	60.949	

TABLE 1.1.1 (2/2) FINAL RESULT OF CONTROL POINTS(2/2)

STATION	NORTHING	EASTING	LATITUDE	LONGITUDE	EVEAVATION	REMARKS
JP-14	7' 1' 23.1271" S	110° 23' 19.3198" E	9 223.654.479	432.483.354	34.648	
JP-15	7' 1' 32.2396" S	110° 22' 16.3307" E	9 223.372.085	430.551.770	80.953	
JP-16	7' 1' 37.6491" S	110° 20' 54.4400" E	9 223.302.528	428.038.896	184.599	
JP-17	7' 3' 1.1278" S	110° 21' 33.5130" E	9 220.640.610	429.241.206	204.198	
JP-18	7' 3' 1.4915" S	110° 19' 36.6186" E	9 220.624.394	425.654.959	219.344	
JP-19	7' 3' 34.4587" S	110° 20' 54.294" E	9 219.613.256	426.540.306	218.583	
JP-20	7' 4' 15.2827" S	110° 20' 28.5683" E	9 218.360.582	427.251.956	212.435	
BM-13	6' 57' 52.1123" S	110° 24' 38.5192" E	9 230.137.634	434.905.154	0.349	

TABLE 1.1.2 (1/3) MAP SYMBOLS (1/3)
















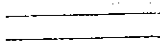





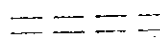

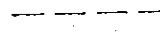

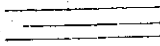



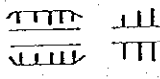

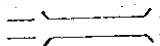

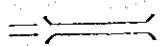
	Triangulation point		Market
	GPS point		Transformer house
	Bench Mark TTG		Bank
	Minor order levelling		Gas station
	Spot elevation		Telephone office
	Minor order BM		Government office
	House/Building		Hotel
	Factory		Main road
	Public hall		Road > 2m
	Public station		Road 1-2m
	Mosque		Road under construction
	Church		Footpath
	Temple		Median strips
	Hospital		Road and strips
	Fire station		Cutting and Embankment
	Post office		Iron and concrete bridge
	School		Wooden bridge

TABLE 1.1.2 (2/3) MAP SYMBOLS (2/3)

	Foot bridge bamboo bridge		Cultivation land boundary
	Culvert		Rice field
	Rail way		Farm/Cultivated
	Railway bridge		Sugar cane
	Station		Palm plantation
	Intersecting railway		Rubber plantation
	Water/Oil pipe		Teak plantation
	Water/Oil tank		Coffee plantation
	Automatic waterlevel gauge		Cacao plantation
	Electricity power		Orchard
	Wall hedge/Fence		Other plantation
	Monument		Bush
	Moslem graves		Grass field
	Christian cemetery		Trees/Forest
	Chinese graves		Dead trees
	Buddha graves		Bore land
	Vegetation boundary		Bamboo copse

TABLE 1.1.2 (3/3) MAP SYMBOLS (3/3)

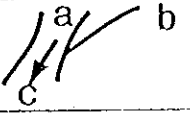

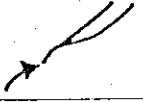

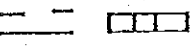
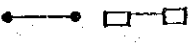

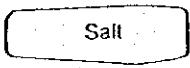
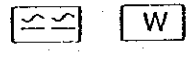
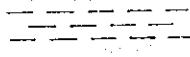

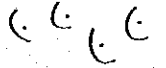
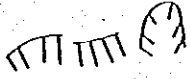
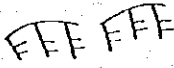


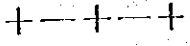
	River(a), rivulet(b) direction(c)	+ · + · + · +	Kecamatan boundary
	Channel		
	Water fall		
	Small/large weirment		
	Small/large wair		
	Small/large watergate		
	Sand(a), shore line(b)		
	Saltarn		
	Fish pond/Pond, Lake		
	Swamp		
	Depresion		
	Rocs		
	Preclpice, Land slide		
	Cliff		
	Contour		
	Storages		
	Kabupaten boundary		

TABLE 1.1.3 (1/11) COORDINATES OF CROSS SECTION POINT
(SEMARANG RIVER)

SEMARANG River (1/7)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
SML-0	9231990.906	434391.309	0.189	SMR-0	9232021.922	434513.780	0.619
SML-1	9231957.081	434397.736	0.065	SMR-1	9231992.745	434520.589	1.043
SML-2	9231934.618	434407.143	-0.040	SMR-2	9231963.636	434527.795	0.775
SML-3	9231908.831	434438.626	0.472	SMR-3	9231934.393	434534.581	0.738
SML-4	9231868.036	434458.275	0.436	SMR-4	9231906.043	434544.603	0.890
SML-5	9231851.997	434473.771	0.985	SMR-5	9231883.152	434551.348	0.813
SML-6	9231832.522	434485.053	1.062	SMR-6	9231854.019	434558.322	1.012
SML-7	9231808.089	434484.619	0.489	SMR-7	9231824.513	434562.822	1.308
SML-8	9231783.763	434503.683	0.165	SMR-8	9231795.282	434569.542	1.338
SML-9	9231746.687	434504.371	0.377	SMR-9	9231766.031	434576.273	1.613
SML-10	9231725.021	434512.362	1.304	SMR-10	9231732.929	434569.675	0.571
SML-11	9231691.292	434523.065	0.933	SMR-11	9231707.526	434590.044	1.695
SML-12	9231658.786	434528.856	0.420	SMR-12	9231678.523	434597.769	1.688
SML-13	9231631.027	434536.868	0.403	SMR-13	9231649.500	434605.427	1.816
SML-14	9231604.749	434548.062	0.652	SMR-14	9231616.910	434598.111	1.372
SML-15	9231577.850	434552.779	0.761	SMR-15	9231587.407	434602.997	1.398
SML-16	9231548.401	434559.831	0.722	SMR-16	9231557.896	434608.480	1.034
SML-17	9231515.162	434569.483	0.619	SMR-17	9231529.326	434617.641	1.123
SML-18	9231482.355	434580.770	0.684	SMR-18	9231501.122	434627.972	1.532
SML-19	9231452.550	434593.191	0.565	SMR-19	9231474.087	434640.809	1.818
SML-20	9231426.379	434603.674	0.475	SMR-20	9231447.139	434654.089	1.853
SML-21	9231402.645	434615.976	0.620	SMR-21	9231420.086	434666.913	1.885
SML-21+23	9231385.132	434613.822	2.249	SMR-21+23	9231399.698	434681.629	2.419
SML-22	9231373.580	434632.014		SMR-22	9231392.775	434680.497	
SML-23	9231344.514	434648.052	1.456	SMR-23	9231365.463	434694.080	0.096
SML-24	9231314.750	434665.708	0.787	SMR-24	9231339.477	434709.014	-0.038
SML-25	9231284.986	434684.967	1.128	SMR-25	9231314.110	434725.097	-0.007
SML-26	9231259.585	434705.689	1.084	SMR-26	9231290.933	434744.126	-0.143
SML-27	9231236.804	434724.652	0.805	SMR-27	9231267.960	434763.409	-0.106
SML-28	9231215.136	434744.707	1.029	SMR-28	9231244.570	434782.130	-0.057
SML-29	9231193.162	434765.900	1.146	SMR-29	9231221.294	434801.137	-0.073
SML-30	9231172.615	434784.882	1.386	SMR-30	9231196.299	434817.849	0.112
SML-31	9231150.515	434797.551	0.796	SMR-31	9231173.103	434836.911	0.191
SML-31+8	9231128.079	434799.928	0.864	SMR-31+8	9231166.694	434842.564	0.225
SML-32	9231127.773	434823.933	0.273	SMR-32	9231149.805	434855.576	0.362
SML-33	9231103.429	434843.113	0.221	SMR-33	9231125.501	434872.983	0.203
SML-34	9231079.474	434862.800	0.293	SMR-34	9231102.111	434891.714	0.146
SML-35	9231046.754	434897.947	0.213	SMR-35	9231082.947	434914.915	0.269
SML-36	9231030.495	434927.661	0.243	SMR-36	9231069.717	434940.572	0.069
SML-37	9231022.686	434962.280	-0.025	SMR-37	9231059.380	434968.962	0.182
SML-38	9231018.365	434992.509	0.326	SMR-38	9231055.528	434998.848	0.083
SML-39	9231013.521	435020.950	0.185	SMR-39	9231050.055	435028.361	0.079
SML-40	9231009.007	435048.892	0.215	SMR-40	9231042.832	435057.323	0.183
SML-41	9231004.310	435075.731	0.208	SMR-41	9231038.373	435087.674	-0.047
SML-42	9230995.508	435097.183	0.154	SMR-42	9231027.261	435115.382	0.218
SML-43	9230980.950	435117.372	0.238	SMR-43	9231009.768	435139.762	0.262
SML-44	9230963.158	435132.054	0.160	SMR-44	9230987.752	435160.104	0.229
SML-45	9230942.105	435145.358	0.180	SMR-45	9230962.776	435176.694	0.281

**TABLE 1.1.3 (2/11) COORDINATES OF CROSS SECTION POINT
(SEMARANG RIVER)**

SEMARANG River (2/7)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
SML-46	9230917.715	435160.666	0.337	SMR-46	9230937.345	435192.602	0.256
SML-47	9230891.418	435173.457	0.049	SMR-47	9230911.735	435208.196	0.254
SML-48	9230864.513	435191.707	0.115	SMR-48	9230886.519	435224.429	0.270
SML-49	9230838.394	435209.193	0.030	SMR-49	9230861.838	435241.508	0.320
SML-50	9230814.120	435228.466	0.185	SMR-50	9230840.222	435262.680	0.298
SML-51	9230786.029	435245.314	0.123	SMR-51	9230813.272	435276.675	0.247
SML-52	9230763.951	435264.772	0.240	SMR-52	9230789.293	435294.733	0.318
SML-53	9230741.061	435285.590	0.242	SMR-53	9230765.834	435313.519	0.282
SML-53+17	9230725.246	435303.009	0.576	SMR-53+17	9230755.372	435327.738	0.283
SML-54	9230716.557	435315.016	0.303	SMR-54	9230746.564	435336.310	0.215
SML-55	9230699.884	435343.161	0.153	SMR-55	9230731.002	435362.002	0.205
SML-56	9230685.785	435371.370	0.307	SMR-56	9230717.061	435388.553	0.248
SML-57	9230672.614	435409.431	0.162	SMR-57	9230706.646	435416.690	0.315
SML-58	9230671.343	435453.818	0.161	SMR-58	9230708.157	435446.746	0.379
SML-59	9230683.760	435479.751	0.195	SMR-59	9230718.285	435475.534	0.399
SML-60	9230689.278	435502.471	0.371	SMR-60	9230729.544	435505.521	0.434
SML-61	9230683.623	435523.573	0.126	SMR-61	9230717.187	435533.562	0.344
SML-62	9230673.502	435540.509	0.116	SMR-62	9230705.002	435561.017	0.384
SML-63	9230657.241	435563.097	0.318	SMR-63	9230687.640	435585.513	0.429
SML-64	9230642.924	435582.380	0.353	SMR-64	9230669.040	435609.103	0.623
SML-65	9230624.271	435591.643	0.123	SMR-65	9230643.257	435624.512	0.538
SML-66	9230604.328	435602.190	0.309	SMR-66	9230614.776	435633.715	0.391
SML-67	9230573.110	435612.480	0.188	SMR-67	9230586.568	435643.902	0.472
SML-68	9230541.266	435628.714	0.284	SMR-68	9230559.965	435657.754	0.455
SML-69	9230510.965	435652.899	0.290	SMR-69	9230535.782	435675.514	0.380
SML-69+14	9230502.748	435661.801	0.385	SMR-69+14	9230528.277	435687.055	0.268
SML-70	9230492.374	435673.811	0.349	SMR-70	9230513.946	435695.944	0.246
SML-71	9230470.778	435697.687	0.413	SMR-71	9230493.248	435717.753	0.141
SML-72	9230450.640	435715.508	0.363	SMR-72	9230472.253	435739.220	0.255
SML-73	9230425.398	435736.483	0.486	SMR-73	9230451.199	435760.765	0.266
SML-74	9230401.380	435760.528	0.120	SMR-74	9230435.484	435786.501	0.187
SML-75	9230385.515	435790.930	0.390	SMR-75	9230416.908	435810.285	0.184
SML-76	9230368.491	435822.103	0.434	SMR-76	9230402.341	435836.660	0.149
SML-77	9230358.387	435852.046	0.556	SMR-77	9230390.512	435864.202	0.117
SML-78	9230346.629	435875.225	0.581	SMR-78	9230380.924	435892.659	0.270
SML-79	9230333.067	435897.468	0.598	SMR-79	9230367.127	435919.342	0.185
SML-80	9230322.322	435926.579	0.777	SMR-80	9230350.797	435944.250	0.470
SML-81	9230302.840	435949.028	0.600	SMR-81	9230336.750	435971.055	0.355
SML-82	9230287.938	435969.381	0.622	SMR-82	9230319.768	435995.743	0.320
SML-83	9230270.839	435991.285	0.692	SMR-83	9230299.202	436017.596	0.331
SML-84	9230252.127	436013.403	0.319	SMR-84	9230279.170	436039.990	0.342
SML-85	9230233.042	436035.850	0.333	SMR-85	9230258.978	436062.152	0.205
SML-86	9230212.470	436056.487	0.513	SMR-86	9230238.185	436083.828	0.272
SML-87	9230191.487	436079.744	0.351	SMR-87	9230216.311	436104.623	0.287
SML-88	9230169.205	436109.642	0.368	SMR-88	9230197.262	436127.800	0.443
SML-89	9230151.930	436146.303	0.481	SMR-89	9230187.266	436156.113	0.488
SML-90	9230151.674	436179.376	0.914	SMR-90	9230190.877	436186.384	0.500
SML-	9230147.854	436189.958	0.939	SMR-	9230188.355	436197.249	0.834

TABLE 1.1.3 (3/11) COORDINATES OF CROSS SECTION POINT
(SEMARANG RIVER)

SEMARANG River (3/7)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
90+11				90+11			
SML-91	9230139.354	436198.710	0.600	SMR-91	9230182.316	436214.334	0.849
SML-92	9230130.104	436209.451	0.689	SMR-92	9230164.414	436239.818	0.603
SML-93	9230120.251	436215.890	0.529	SMR-93	9230137.186	436252.364	0.145
SML-94	9230095.877	436212.180	0.309	SMR-94	9230108.262	436260.720	0.157
SML-95	9230074.270	436233.985	0.130	SMR-95	9230078.712	436265.959	0.186
SML-96	9230054.087	436226.520	0.405	SMR-96	9230048.921	436265.830	0.114
SML-97	9230029.531	436221.601	0.590	SMR-97	9230019.809	436259.017	0.037
SML-98	9230004.119	436220.068	0.395	SMR-98	9229992.346	436247.076	0.050
SML-99	9229974.250	436210.976	0.223	SMR-99	9229964.704	436235.467	0.075
SML-100	9229947.305	436203.807	0.253	SMR-100	9229936.999	436223.946	0.172
SML-101	9229920.287	436187.392	0.209	SMR-101	9229910.643	436209.618	0.164
SML-102	9229891.151	436175.221	0.388	SMR-102	9229882.739	436198.441	0.561
SML-103	9229856.773	436164.172	0.113	SMR-103	9229853.803	436190.155	0.660
SML-104	9229820.585	436161.078	0.071	SMR-104	9229823.841	436189.271	0.683
SML-105	9229779.189	436187.829	0.172	SMR-105	9229796.613	436201.698	0.568
SML-106	9229757.801	436218.728	0.538	SMR-106	9229783.163	436228.517	0.624
SML-106+13	9229762.064	436217.091	0.722	SMR-106+13	9229779.148	436240.711	0.778
SML-107	9229747.027	436252.472	0.526	SMR-107	9229775.320	436257.586	0.719
SML-108	9229747.961	436287.256	0.165	SMR-108	9229774.500	436287.610	0.664
SML-109	9229745.372	436311.350	0.136	SMR-109	9229770.495	436317.375	0.586
SML-110	9229739.313	436337.607	0.486	SMR-110	9229763.692	436346.672	0.684
SML-111	9229725.871	436365.366	0.499	SMR-111	9229750.187	436373.940	0.445
SML-112	9229715.803	436393.017	0.466	SMR-112	9229739.709	436402.140	0.378
SML-113	9229708.362	436422.629	0.723	SMR-113	9229729.492	436430.359	0.533
SML-114	9229696.079	436441.058	0.560	SMR-114	9229715.343	436456.759	0.823
SML-115	9229680.837	436461.771	0.954	SMR-115	9229694.098	436478.017	0.928
SML-115+14	9229669.963	436468.381	1.621	SMR-115+14	9229683.898	436487.774	1.686
SML-116	9229657.828	436479.091	1.281	SMR-116	9229670.489	436497.983	1.477
SML-116+8	9229651.091	436485.786		SMR-116+8	9229662.031	436503.142	
SML-117	9229631.733	436495.184	0.861	SMR-117	9229645.458	436514.217	0.893
SML-118	9229610.431	436513.973	0.548	SMR-118	9229622.783	436533.836	0.553
SML-119	9229587.145	436526.451	0.571	SMR-119	9229596.559	436548.722	0.630
SML-120	9229564.699	436535.307	0.537	SMR-120	9229569.544	436561.384	0.772
SML-121	9229539.374	436538.060	0.676	SMR-121	9229539.244	436563.026	0.829
SML-121+3	9229536.783	436537.709		SMR-121+3	9229537.198	436556.391	1.028
SML-122	9229509.509	436535.962	0.715	SMR-122	9229510.262	436561.219	0.847
SML-123	9229479.677	436534.524	0.996	SMR-123	9229480.335	436560.438	0.905
SML-124	9229449.847	436532.258	1.670	SMR-124	9229450.353	436559.697	1.058
SML-125	9229419.836	436531.658	1.483	SMR-125	9229420.285	436559.079	1.110
SML-126	9229389.944	436529.056	1.284	SMR-126	9229390.336	436558.912	1.076
SML-126+17	9229373.109	436527.640	1.607	SMR-126+17	9229373.240	436551.228	1.596
SML-127	9229355.520	436531.433	1.124	SMR-127	9229360.281	436552.926	1.129
SML-128	9229324.065	436542.403	1.078	SMR-128	9229331.820	436562.402	0.768
SML-129	9229291.540	436568.391	0.596	SMR-129	9229308.202	436580.836	0.690

TABLE 1.1.3 (4/11) COORDINATES OF CROSS SECTION POINT
(SEMARANG RIVER)

SEMARANG River (4/7)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
SML-130	9229272.575	436596.168	0.663	SMR-130	9229291.277	436605.715	0.619
SML-131	9229256.374	436619.309	0.621	SMR-131	9229275.728	436631.317	0.637
SML-132	9229241.784	436639.607	0.689	SMR-132	9229257.600	436655.057	0.653
SML-133	9229221.498	436656.183	0.733	SMR-133	9229234.304	436673.882	0.632
SML-134	9229198.095	436672.628	1.099	SMR-134	9229209.692	436691.007	0.739
SML-135	9229176.378	436679.499	1.214	SMR-135	9229181.281	436700.485	0.917
SML-136	9229147.143	436684.747	0.847	SMR-136	9229152.013	436706.926	0.999
SML-137	9229117.189	436691.136	1.384	SMR-137	9229122.754	436713.445	1.131
SML-137+14	9229103.846	436697.609	1.070	SMR-137+14	9229109.887	436718.358	1.278
SML-138	9229084.648	436709.000	1.003	SMR-138	9229095.774	436726.464	1.139
SML-139	9229057.895	436729.762	0.982	SMR-139	9229072.294	436745.240	1.174
SML-140	9229035.153	436756.469	1.026	SMR-140	9229052.496	436767.796	1.187
SML-141	9229020.040	436789.783	1.076	SMR-141	9229039.958	436794.997	1.223
SML-142	9229016.827	436825.525	1.232	SMR-142	9229036.558	436824.754	1.362
SML-142+25	9229016.835	436849.515		SMR-142+25	9229037.452	436849.719	
SML-143	9229015.675	436856.015	1.896	SMR-143	9229037.390	436856.536	1.796
SML-144	9229017.425	436884.428	1.486	SMR-144	9229038.781	436884.682	1.220
SML-145	9229015.959	436909.626	1.861	SMR-145	9229034.770	436913.258	1.337
SML-146	9229010.878	436940.345	1.690	SMR-146	9229030.749	436943.777	1.290
SML-147	9229002.011	436967.253	1.624	SMR-147	9229024.936	436973.194	1.287
SML-148	9228992.437	436987.047	1.560	SMR-148	9229010.592	436999.557	1.400
SML-149	9228979.103	437009.787	1.553	SMR-149	9228993.816	437024.441	1.394
SML-150	9228965.593	437018.363	1.492	SMR-150	9228967.193	437037.069	1.493
SML-151	9228940.882	437014.981	1.609	SMR-151	9228937.560	437035.791	1.515
SML-152	9228916.895	437007.311	1.616	SMR-152	9228909.012	437026.840	1.615
SML-153	9228892.030	436994.459	1.660	SMR-153	9228882.509	437012.774	1.712
SML-154	9228873.462	436980.028	1.667	SMR-154	9228858.318	436995.549	1.609
SML-155	9228859.933	436958.593	1.603	SMR-155	9228841.831	436969.588	1.616
SML-156	9228838.552	436933.264	1.587	SMR-156	9228823.621	436945.791	1.651
SML-156+17	9228826.113	436919.618	2.183	SMR-156+17	9228811.471	436933.647	1.820
SML-157	9228818.661	436911.495	1.638	SMR-157	9228803.369	436923.736	1.709
SML-158	9228797.330	436888.285	1.550	SMR-158	9228783.118	436901.600	1.790
SML-159	9228775.558	436867.956	1.567	SMR-159	9228762.281	436879.909	1.793
SML-160	9228753.601	436846.474	1.647	SMR-160	9228740.903	436858.765	1.785
SML-161	9228727.443	436825.364	2.386	SMR-161	9228717.709	436834.962	2.426
SML-162	9228705.021	436804.996	2.070	SMR-162	9228695.845	436814.285	1.986
SML-163	9228685.328	436784.213	2.079	SMR-163	9228674.580	436793.286	1.916
SML-164	9228666.856	436761.292	2.087	SMR-164	9228655.498	436770.191	2.038
SML-165	9228649.087	436738.379	2.089	SMR-165	9228637.062	436746.540	2.111
SML-166	9228635.493	436716.196	2.042	SMR-166	9228621.864	436720.692	2.289
SML-167	9228624.561	436686.817	2.156	SMR-167	9228611.417	436692.552	2.178
SML-168	9228610.930	436659.424	2.346	SMR-168	9228598.842	436665.333	2.539
SML-168+7	9228607.253	436653.496		SMR-168+7	9228594.803	436659.547	
SML-169	9228593.554	436633.578	1.951	SMR-169	9228582.886	436639.975	2.055
SML-170	9228577.918	436608.199	1.984	SMR-170	9228565.614	436615.230	2.052
SML-171	9228564.369	436582.986	1.896	SMR-171	9228551.383	436588.651	2.085

TABLE 1.1.3 (5/11) COORDINATES OF CROSS SECTION POINT
(SEMARANG RIVER)

SEMARANG River (5/7)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
SML-172	9228555.795	436556.980	1.971	SMR-172	9228542.691	436561.978	2.122
SML-173	9228551.184	436528.152	2.043	SMR-173	9228537.161	436529.975	2.158
SML-174	9228538.960	436492.285	2.089	SMR-174	9228529.432	436502.925	2.172
SML-175	9228507.559	436477.798	2.221	SMR-175	9228503.078	436491.202	2.319
SML-176	9228476.358	436472.422	2.333	SMR-176	9228473.810	436486.355	2.324
SML-177	9228453.729	436464.463	2.417	SMR-177	9228444.318	436475.281	2.342
SML-178	9228440.502	436444.805	2.356	SMR-178	9228426.835	436449.560	2.364
SML-179	9228436.284	436419.456	2.376	SMR-179	9228422.179	436418.985	2.356
SML-180	9228445.138	436402.787	2.398	SMR-180	9228435.626	436392.422	2.392
SML-181	9228467.851	436386.521	2.364	SMR-181	9228459.707	436375.065	2.252
SML-182	9228492.941	436367.708	2.359	SMR-182	9228483.925	436356.956	2.286
SML-183	9228516.299	436343.006	2.862	SMR-183	9228504.863	436337.263	2.909
SML-184	9228528.036	436314.392	2.440	SMR-184	9228514.790	436308.960	2.437
SML-185	9228538.699	436286.240	2.319	SMR-185	9228525.587	436281.073	2.392
SML-186	9228547.724	436255.977	2.389	SMR-186	9228533.598	436252.029	2.353
SML-187	9228527.470	436217.590	2.398	SMR-187	9228523.492	436231.810	2.460
SML-188	9228495.244	436214.440	2.355	SMR-188	9228493.962	436228.744	2.506
SML-189	9228465.645	436210.092	2.420	SMR-189	9228463.983	436228.306	2.460
SML-190	9228436.492	436209.679	2.311	SMR-190	9228434.024	436223.757	2.543
SML-191	9228417.831	436200.785	2.303	SMR-191	9228405.484	436209.335	2.483
SML-192	9228407.310	436175.540	2.258	SMR-192	9228393.667	436180.111	2.323
SML-193	9228398.288	436148.785	2.298	SMR-193	9228384.326	436153.026	2.371
SML-194	9228389.041	436118.725	2.357	SMR-194	9228375.661	436123.479	2.353
SML-195	9228378.219	436091.374	2.584	SMR-195	9228366.122	436094.945	2.448
SML-195+17	9228373.206	436075.390	3.062	SMR-195+17	9228362.830	436077.588	2.998
SML-196	9228368.897	436062.644	1.456	SMR-196	9228357.382	436065.996	2.667
SML-197	9228360.941	436033.655	2.324	SMR-197	9228350.711	436036.444	2.467
SML-198	9228352.305	436005.503	2.339	SMR-198	9228342.286	436008.652	2.386
SML-199	9228343.340	435976.707	2.441	SMR-199	9228332.966	435980.080	2.371
SML-200	9228331.189	435948.427	2.502	SMR-200	9228322.470	435952.758	2.379
SML-201	9228313.727	435922.896	2.286	SMR-201	9228305.417	435928.759	2.392
SML-202	9228297.095	435897.954	2.223	SMR-202	9228288.740	435903.614	2.286
SML-203	9228280.707	435872.194	2.320	SMR-203	9228270.856	435878.378	2.304
SML-204	9228265.127	435847.967	2.488	SMR-204	9228255.504	435852.629	2.419
SML-205	9228253.006	435821.032	2.499	SMR-205	9228243.422	435825.155	2.475
SML-206	9228242.460	435797.819	2.561	SMR-206	9228232.198	435801.919	2.423
SML-207	9228231.952	435768.491	2.435	SMR-207	9228221.797	435770.604	2.423
SML-208	9228224.782	435739.031	2.542	SMR-208	9228214.326	435741.609	2.393
SML-209	9228217.281	435709.743	2.453	SMR-209	9228207.377	435712.424	2.449
SML-210	9228209.381	435680.498	2.428	SMR-210	9228199.655	435683.434	2.427
SML-211	9228202.978	435659.737	2.407	SMR-211	9228195.047	435660.068	2.439
SML-212	9228196.271	435629.687	2.455	SMR-212	9228187.179	435631.088	2.528
SML-213	9228191.409	435599.882	2.546	SMR-213	9228181.310	435601.750	2.554
SML-214	9228185.494	435570.930	2.574	SMR-214	9228175.205	435572.345	2.600
SML-215	9228178.132	435540.039	2.612	SMR-215	9228167.949	435542.803	2.666
SML-215+22	9228171.181	435517.881	2.728	SMR-215+22	9228162.255	435521.301	2.599
SML-216	9228169.116	435510.938	2.754	SMR-216	9228159.940	435514.020	2.606
SML-217	9228157.623	435481.786	2.837	SMR-217	9228148.061	435486.520	2.531

TABLE 1.1.3 (6/11) COORDINATES OF CROSS SECTION POINT
(SEMARANG RIVER)

SEMARANG River (6/7)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
SML-218	9228144.698	435454.780	2.774	SMR-218	9228135.508	435459.347	2.554
SML-219	9228129.418	435427.749	2.783	SMR-219	9228121.043	435433.014	2.672
SML-220	9228112.402	435402.084	2.747	SMR-220	9228104.334	435407.753	2.774
SML-221	9228093.528	435377.368	2.702	SMR-221	9228085.475	435384.485	2.735
SML-222	9228073.718	435355.062	2.675	SMR-222	9228066.030	435361.838	2.939
SML-223	9228051.720	435332.465	2.830	SMR-223	9228044.325	435340.330	3.291
SML-224	9228030.095	435312.728	2.906	SMR-224	9228022.207	435321.294	3.462
SML-225	9228009.295	435292.751	2.890	SMR-225	9228000.809	435300.381	3.441
SML-225+10	9228001.691	435285.820	3.506	SMR-225+10	9227995.468	435291.592	3.531
SML-226	9227988.166	435271.362	2.848	SMR-226	9227981.278	435277.814	3.006
SML-227	9227966.769	435249.537	2.850	SMR-227	9227959.674	435257.122	2.924
SML-228	9227945.281	435228.978	2.938	SMR-228	9227938.119	435236.454	2.961
SML-229	9227927.794	435208.062	2.992	SMR-229	9227919.851	435212.825	3.020
SML-230	9227923.901	435182.652	3.048	SMR-230	9227909.978	435184.658	3.038
SML-231	9227916.102	435154.444	3.106	SMR-231	9227907.184	435154.960	3.037
SML-232	9227916.941	435125.340	3.171	SMR-232	9227906.080	435124.941	3.023
SML-233	9227919.021	435096.818	3.081	SMR-233	9227909.467	435095.170	3.058
SML-234	9227924.169	435067.982	3.130	SMR-234	9227914.959	435065.742	3.094
SML-235	9227930.654	435038.947	3.106	SMR-235	9227921.277	435036.496	3.097
SML-235+24	9227936.231	435015.157	3.281	SMR-235+24	9227925.552	435012.602	3.473
SML-236	9227935.787	435007.346	3.186	SMR-236	9227926.534	435006.927	3.183
SML-237	9227935.171	434976.835	3.261	SMR-237	9227925.301	434977.047	3.289
SML-238	9227932.388	434946.191	3.335	SMR-238	9227922.580	434947.230	3.358
SML-239	9227928.474	434916.773	3.321	SMR-239	9227918.596	434917.550	3.432
SML-240	9227928.699	434886.853	3.511	SMR-240	9227911.470	434888.861	3.525
SML-241	9227919.322	434857.892	3.716	SMR-241	9227911.496	434858.712	3.512
SML-241+13	9227916.946	434843.687	4.116	SMR-241+13	9227910.069	434845.472	4.113
SML-242				SMR-242			
SML-242+20	9227875.655	434802.482	4.566	SMR-242+20	9227868.294	434813.118	4.984
SML-243	9227851.327	434783.348	4.978	SMR-243	9227842.839	434797.177	5.027
SML-244	9227803.484	434755.389	4.831	SMR-244	9227801.267	434771.643	4.827
SML-245	9227765.424	434732.457	4.712	SMR-245	9227760.933	434740.625	4.572
SML-245+28	9227739.638	434720.127	4.847	SMR-245+28	9227732.495	434733.279	4.906
SML-246	9227720.016	434710.227	4.649	SMR-246	9227712.299	434724.310	5.186
SML-247	9227675.868	434686.790	4.823	SMR-247	9227668.818	434699.984	4.523
SML-248	9227631.634	434663.541	4.925	SMR-248	9227624.335	434677.451	6.783
SML-248+17	9227616.356	434655.388	4.666	SMR-248+17	9227610.547	434670.583	4.962
SML-249	9227586.285	434646.545	4.937	SMR-249	9227581.527	434667.860	4.873
SML-249+24	9227563.113	434640.329	4.857	SMR-249+24	9227557.934	434664.255	4.672
SML-250	9227539.317	434634.111	5.018	SMR-250	9227533.226	434661.757	4.264
SML-250+27	9227515.016	434622.216	4.837	SMR-250+27	9227495.154	434651.517	5.051
SML-251	9227497.025	434610.775	4.933	SMR-251	9227481.575	434636.039	4.457

**TABLE 1.1.3 (7/11) COORDINATES OF CROSS SECTION POINT
(SEMARANG RIVER)**

SEMARANG River (7/7)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
SML-251+21	9227478.641	434600.600	5.040	SMR-251+21	9227463.288	434622.816	5.007
SML-252	9227446.703	434580.762	5.244	SMR-252	9227429.477	434606.146	4.354
SML-252+42	9227410.210	434560.056	5.210	SMR-252+42	9227396.647	434589.380	5.068
SML-253	9227400.693	434554.411	5.491	SMR-253	9227384.616	434581.161	4.353
SML-253+36	9227369.262	434536.994	5.523	SMR-253+36	9227350.381	434553.254	5.077
SML-254	9227358.935	434531.287	5.767	SMR-254	9227346.940	434550.513	4.379
SML-255	9227313.711	434504.426	5.961	SMR-255	9227303.256	434525.004	4.621
SML-256	9227270.920	434479.815	6.066	SMR-256	9227252.201	434522.780	5.319
SML-256+16	9227256.804	434472.099	5.882	SMR-256+16	9227242.091	434510.719	5.762
SML-256+24	9227250.403	434467.462	6.318	SMR-256+24	9227231.263	434513.154	
SML-257	9227222.513	434452.336	6.573	SMR-257	9227198.360	434488.304	6.452
SML-258	9227177.515	434427.686	6.896	SMR-258	9227150.840	434448.921	6.969
SML-258+28	9227150.158	434414.376	7.066	SMR-258+28	9227136.329	434416.009	7.142
SML-259	9227146.388	434396.056	5.736	SMR-259	9227135.112	434395.120	6.503
SML-260	9227149.556	434345.654	5.521	SMR-260	9227140.975	434345.410	5.681
SML-261	9227152.143	434297.011	6.580	SMR-261	9227142.195	434296.031	6.420
SML-261+30	9227157.949	434265.732	5.856	SMR-261+30	9227142.055	434265.808	5.937
SML-261+37	9227158.415	434258.103		SMR-261+37	9227142.332	434258.790	5.927
SML-262	9227153.503	434245.910	5.212	SMR-262	9227142.731	434246.201	5.771
SML-262+41	9227156.796	434205.145		SMR-262+41	9227141.119	434205.098	5.501
SML-263	9227123.153	434197.671	5.416	SMR-263	9227121.487	434209.745	5.802
SML-264	9227073.913	434194.081	5.629	SMR-264	9227075.096	434205.366	6.712
SML-265	9227025.879	434195.369	5.300	SMR-265	9227020.900	434203.948	5.396
SML-266	9226983.700	434168.395	5.376	SMR-266	9226973.826	434177.226	5.544
SML-267	9226965.064	434123.349	5.644	SMR-267	9226952.837	434124.965	5.898
SML-268	9226960.768	434073.850	5.890	SMR-268	9226944.799	434074.281	5.882
SML-268+21	9226965.267	434052.897	9.861	SMR-268+21	9226934.109	434052.522	9.660
SML-269	9226960.681	434034.423	8.521	SMR-269	9226940.491	434033.981	8.602

TABLE 1.1.3 (8/11) COORDINATES OF CROSS SECTION POINT (ASIN)

ASIN River (1/2)

ASILBP	9231128.081	434799.670	0.890	ASIRBP	9231128.661	434822.982	0.097
ASIL1	9231108.308	434802.422	0.778	ASIR1	9231111.905	434826.336	0.192
ASIL2	9231088.478	434805.102	0.761	ASIR2	9231090.378	434828.058	0.263
ASIL3	9231068.660	434807.802	0.784	ASIR3	9231071.777	434830.437	0.307
ASIL4	9231048.997	434810.223	0.780	ASIR4	9231050.667	434832.465	0.311
ASIL5	9231029.254	434812.898	0.765	ASIR5	9231031.470	434834.317	0.308
ASIL6	9231009.499	434815.450	0.742	ASIR6	9231012.171	434836.705	0.251
ASIL7	9230989.617	434817.875	0.760	ASIR7	9230992.955	434840.639	0.249
ASIL8	9230969.739	434820.356	0.679	ASIR8	9230972.877	434843.865	0.890
ASIL9	9230950.065	434823.025	0.702	ASIR9	9230953.685	434847.627	1.279
ASIL10	9230930.282	434825.331	0.834	ASIR10	9230933.516	434849.204	1.439
ASIL11	9230910.371	434827.724	0.828	ASIR11	9230912.904	434852.491	1.290
ASIL12	9230890.510	434830.047	0.739	ASIR12	9230893.262	434854.931	1.250
ASIL13	9230870.602	434832.297	0.753	ASIR13	9230873.034	434857.306	1.207
ASIL14	9230850.708	434834.590	0.849	ASIR14	9230853.602	434859.472	1.176
ASIL15	9230830.845	434837.006	0.838	ASIR15	9230833.557	434861.843	1.200
ASIL16	9230811.004	434839.374	0.784	ASIR16	9230813.618	434864.275	1.179
ASIL17	9230791.196	434841.439	0.972	ASIR17	9230794.393	434866.566	1.020
ASIL18	9230771.449	434843.972	0.838	ASIR18	9230774.128	434868.889	0.993
ASIL19	9230751.361	434845.350	0.606	ASIR19	9230753.420	434870.054	0.620
ASIL20	9230731.486	434847.348	0.979	ASIR20	9230732.853	434868.030	0.881
ASIL21	9230711.503	434849.722	0.981	ASIR21	9230712.769	434871.526	0.511
ASIL22	9230691.698	434852.624	0.752	ASIR22	9230694.547	434875.099	0.550
ASIL23	9230671.856	434854.804	0.783	ASIR23	9230673.864	434875.779	0.526
ASIL24	9230651.886	434856.817	1.053	ASIR24	9230654.140	434877.535	0.526
ASIL25	9230632.023	434859.235	0.991	ASIR25	9230634.039	434879.880	0.621
ASIL26	9230612.066	434861.173	0.972	ASIR26	9230614.272	434881.965	0.560
ASIL27	9230592.228	434863.445	0.834	ASIR27	9230594.035	434884.191	0.549
ASIL28	9230572.369	434865.882	0.771	ASIR28	9230574.914	434886.598	0.544
ASIL29	9230552.441	434867.954	0.761	ASIR29	9230555.022	434888.446	0.518
ASIL30	9230532.742	434870.387	0.776	ASIR30	9230535.088	434889.245	0.863
ASIL31	9230513.037	434874.200	0.194	ASIR31	9230515.175	434894.086	0.560
ASIL32	9230492.966	434874.361	0.879	ASIR32	9230494.896	434896.110	0.574
ASIL33	9230473.100	434876.461	0.931	ASIR33	9230475.036	434897.332	0.548
ASIL34	9230453.261	434878.491	0.825	ASIR34	9230455.453	434899.535	0.571
ASIL35	9230433.372	434880.646	0.676	ASIR35	9230435.741	434901.500	0.572
ASIL36	9230413.476	434882.858	0.621	ASIR36	9230415.347	434903.677	0.560
ASIL37	9230393.609	434885.065	0.627	ASIR37	9230394.866	434906.005	0.556
ASIL38	9230373.757	434887.352	0.646	ASIR38	9230375.678	434907.940	0.517
ASIL39	9230353.850	434889.566	0.650	ASIR39	9230356.036	434910.160	0.519
ASIL40	9230333.885	434891.785	0.758	ASIR40	9230336.101	434911.501	0.786
ASIL40+14	9230320.030	434896.487	0.265	ASIR40+14	9230321.170	434908.457	0.426
ASIL41	9230314.125	434892.921	0.090	ASIR41	9230316.036	434914.896	0.633
ASIL42	9230294.679	434897.800	0.251	ASIR42	9230296.966	434918.980	0.656
ASIL43	9230274.782	434899.049	0.512	ASIR43	9230277.170	434920.343	0.546
ASIL44	9230254.908	434901.347	0.480	ASIR44	9230257.583	434923.322	0.560
ASIL45	9230235.021	434903.194	0.525	ASIR45	9230237.521	434926.051	0.572
ASIL46	9230214.812	434904.877	0.547	ASIR46	9230217.636	434928.594	0.507
ASIL47	9230194.997	434907.649	0.424	ASIR47	9230197.772	434930.778	0.474
ASIL48	9230175.080	434909.715	0.382	ASIR48	9230177.357	434933.252	0.500
ASIL49	9230155.080	434911.480	0.355	ASIR49	9230157.380	434935.785	0.564
ASIL49+13	9230141.679	434910.677	0.121	ASIR49+13	9230144.380	434937.303	0.448
ASIL50	9230135.207	434912.927	0.232	ASIR50	9230138.033	434936.975	0.449
ASIL51	9230115.331	434916.874	0.526	ASIR51	9230118.471	434940.384	0.523
ASIL52	9230095.576	434919.646	0.337	ASIR52	9230097.645	434943.092	0.580
ASIL53	9230075.473	434921.971	0.434	ASIR53	9230078.182	434945.369	0.568
ASIL54	9230055.533	434924.506	0.344	ASIR54	9230058.194	434947.871	0.605
ASIL55	9230035.790	434926.916	0.234	ASIR55	9230038.699	434950.141	0.616
ASIL56	9230015.793	434928.960	0.361	ASIR56	9230018.760	434952.505	0.616

TABLE 1.1.3 (9/11) COORDINATES OF CROSS SECTION POINT (ASIN)

ASIN River (2/2)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
ASIL57	9229995.991	434931.796	0.470	ASIR57	9229998.685	434954.983	0.766
ASIL58	9229976.793	434934.652	0.474	ASIR58	9229978.714	434945.743	0.395
ASIL58+5	9229972.292	434945.315	0.400	ASIL58+5	9229971.623	434937.509	0.537
ASIL59	9229956.374	434933.594	0.367	ASIR59	9229955.491	434942.660	-0.013
ASIL60	9229936.123	434931.563	0.326	ASIR60	9229935.235	434939.914	0.248
ASIL61	9229916.335	434929.046	0.317	ASIR61	9229915.191	434937.458	0.274
ASIL62	9229896.556	434926.466	0.322	ASIR62	9229895.238	434935.229	0.264
ASIL63A	9229876.558	434922.250	0.329	ASIR63A	9229875.361	434928.504	
ASIL64A	9229860.638	434918.768	0.518	ASIR64A	9229858.417	434923.856	0.486

TABLE 1.1.3 (10/11) COORDINATES OF CROSS SECTION POINT (BARU RIVER)

BARU River (1/2)

BALBP	9231595.810	435753.664	0.872	BARBP	9231597.431	435837.088	0.872
BAL01	9231579.885	435766.163	0.203	BAR01	9231577.496	435836.040	0.861
BAL02	9231558.363	435766.196	0.161	BAR02	9231557.441	435838.037	1.052
BAL03	9231537.100	435772.050	0.375	BAR03	9231537.370	435837.447	1.054
BAL04	9231517.798	435777.765	0.194	BAR04	9231517.333	435836.926	1.116
BAL05	9231494.535	435784.730	0.191	BAR05	9231497.438	435836.838	0.920
BAL06	9231479.025	435789.421	0.190	BAR06	9231477.407	435835.661	0.893
BAL07	9231445.112	435800.791	0.170	BAR07	9231457.822	435839.733	0.908
BAL08	9231427.323	435805.913	0.160	BAR08	9231438.704	435845.604	0.902
BAL09	9231406.273	435812.099	0.158	BAR09	9231419.654	435851.789	0.920
BAL10	9231384.408	435806.811	0.386	BAR10	9231403.830	435868.101	1.206
BAL11	9231369.855	435825.026	0.199	BAR11	9231381.556	435863.872	0.925
BAL12	9231351.946	435836.920	0.232	BAR12	9231360.549	435864.315	0.863
BAL13	9231331.499	435843.449	0.151	BAR13	9231341.476	435870.305	0.822
BAL14	9231313.817	435848.888	0.149	BAR14	9231322.387	435876.274	0.814
BAL15	9231297.610	435853.939	0.125	BAR15	9231303.309	435882.244	0.827
BAL16	9231275.694	435860.829	0.191	BAR16	9231284.199	435888.159	0.823
BAL17	9231256.599	435866.955	0.130	BAR17	9231265.126	435894.094	0.809
BAL18	9231238.004	435872.750	0.177	BAR18	9231246.052	435900.080	0.804
BAL19	9231218.938	435878.612	0.143	BAR19	9231226.947	435905.985	0.815
BAL20	9231196.816	435874.573	0.319	BAR20	9231213.064	435927.742	1.258
BAL21	9231180.933	435890.929	0.139	BAR21	9231188.785	435917.956	0.811
BAL22	9231160.346	435897.440	0.106	BAR22	9231169.731	435923.991	0.838
BAL23	9231142.750	435902.886	0.092	BAR23	9231150.649	435929.952	0.821
BAL24	9231122.966	435908.884	0.113	BAR24	9231131.575	435935.921	0.833
BAL25	9231106.233	435914.194	0.118	BAR25	9231112.458	435941.799	0.840
BAL26	9231084.486	435920.697	0.101	BAR26	9231093.397	435947.808	0.810
BAL27	9231065.606	435926.871	0.073	BAR27	9231074.313	435953.756	0.820
BAL28	9231045.173	435930.425	0.856	BAR28	9231055.441	435960.306	0.945
BAL29	9231027.205	435935.981	1.887	BAR29	9231036.820	435967.204	1.757
BAL29+8	9231018.881	435938.550	2.046	BAR29+8	9231029.263	435970.111	1.957
BAL30	9231008.556	435944.385	0.314	BAR30	9231015.861	435970.127	-0.028
BAL31	9230993.301	435945.445	-0.077	BAR31	9230997.107	435976.845	-0.021
BAL32	9230979.808	435954.284	-0.118	BAR32	9230978.040	435982.708	-0.084
BAL32+11	9230978.968	435945.696	2.876	BAR32+11	9230965.281	435998.914	2.786
BAL33	9230953.325	435956.913	-0.046	BAR33	9230955.743	435993.533	-0.159
BAL34	9230927.232	435965.010	0.220	BAR34	9230937.623	436001.804	0.421
BAL35	9230907.149	435971.575	0.204	BAR35	9230918.590	436007.752	0.273
BAL36	9230888.591	435977.489	0.357	BAR36	9230899.498	436013.554	0.228
BAL37	9230868.231	435981.290	-0.165	BAR37	9230880.460	436019.599	0.143
BAL38	9230848.977	435986.616	-0.137	BAR38	9230861.354	436025.389	0.115
BAL39	9230825.223	435976.413	-0.017	BAR39	9230842.314	436031.369	0.101
BAL40	9230807.027	435982.704	-0.031	BAR40	9230822.803	436036.422	0.215
BAL41	9230787.604	435987.730	0.033	BAR41	9230804.196	436043.252	0.044
BAL42	9230764.242	435985.562	0.097	BAR42	9230785.100	436049.168	0.059
BAL43	9230748.267	436000.398	0.130	BAR43	9230767.629	436059.835	0.073
BAL44	9230732.380	436016.438	0.389	BAR44	9230748.751	436066.867	-0.070
BAL45	9230713.750	436029.863	0.311	BAR45	9230728.109	436068.313	0.172
BAL46	9230694.419	436032.017	0.016	BAR46	9230709.009	436074.166	0.180
BAL47	9230672.345	436029.032	0.264	BAR47	9230690.088	436080.474	0.386
BAL48	9230654.711	436035.235	0.097	BAR48	9230670.763	436085.251	0.366
BAL49	9230634.970	436040.055	0.692	BAR49	9230651.970	436091.904	0.295
BAL50	9230620.460	436060.160	-0.080	BAR50	9230633.149	436098.828	0.352
BAL51	9230598.441	436052.132	0.330	BAR51	9230614.285	436104.937	0.415
BAL52	9230584.788	436074.630	-0.090	BAR52	9230595.114	436110.429	0.661
BAL53	9230565.256	436084.657	-0.104	BAR53	9230576.093	436116.066	0.232
BAL54	9230543.431	436084.547	-0.231	BAR54	9230557.004	436121.593	0.265
BAL55	9230523.878	436091.712	-0.144	BAR55	9230535.887	436129.177	0.510

TABLE 3.1.3 (11/11) COORDINATES OF CROSS SECTION POINT (BARU RIVER)

BARU River (2/2)

NAME	NORTHING	EASTING	ELEVATION	NAME	NORTHING	EASTING	ELEVATION
BAL56	9230502.441	436083.036	0.124	BAR56	9230518.051	436130.308	0.636
BAL57	9230485.444	436088.422	0.226	BAR57	9230499.577	436137.810	0.572
BAL58	9230470.587	436106.864	0.010	BAR58	9230480.418	436143.211	0.421
BAL59	9230448.172	436104.928	0.381	BAR59	9230461.219	436148.395	0.241
BAL60	9230432.453	436127.059	0.152	BAR60	9230441.533	436152.749	0.242
BAL61	9230414.418	436132.768	0.388	BAR61	9230422.904	436159.263	0.393
BAL62	9230395.210	436139.850	0.173	BAR62	9230404.676	436168.073	0.338
BAL63	9230376.341	436144.531	0.128	BAR63	9230385.511	436173.601	0.277
BAL64	9230357.568	436149.571	0.060	BAR64	9230366.640	436179.745	0.271
BAL65	9230338.748	436156.130	0.105	BAR65	9230347.456	436185.112	0.244
BAL66	9230317.373	436164.035	0.151	BAR66	9230328.439	436191.413	0.229
BAL67	9230299.875	436169.718	0.046	BAR67	9230309.566	436197.863	0.297
BAL68	9230281.918	436175.272	0.130	BAR68	9230290.591	436204.087	0.338
BAL69	9230262.264	436181.188	0.200	BAR69	9230271.519	436210.129	0.370
BAL70	9230240.942	436186.993	0.162	BAR70	9230248.472	436211.525	0.219
BAL70+13	9230228.200	436190.314	0.695	BAR70+13	9230236.262	436215.439	0.778
BAL71	9230220.781	436194.242	0.603	BAR71	9230229.487	436216.764	0.470
BAL72	9230207.764	436211.975	0.124	BAR72	9230209.905	436218.157	0.205
BAL73	9230188.932	436220.033	0.858	BAR73	9230191.458	436226.745	0.583
BALEP	9230183.139	436220.935	0.664	BAREP	9230180.132	436235.069	0.619