THE PREPARATORY SURVEY
FOR
UPPER CITARUM BASIN TRIBUTARIES
FLOOD MANAGEMENT PROJECT
IN
INDONESIA

FINAL REPORT

SUMMARY

OCTOBER 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.

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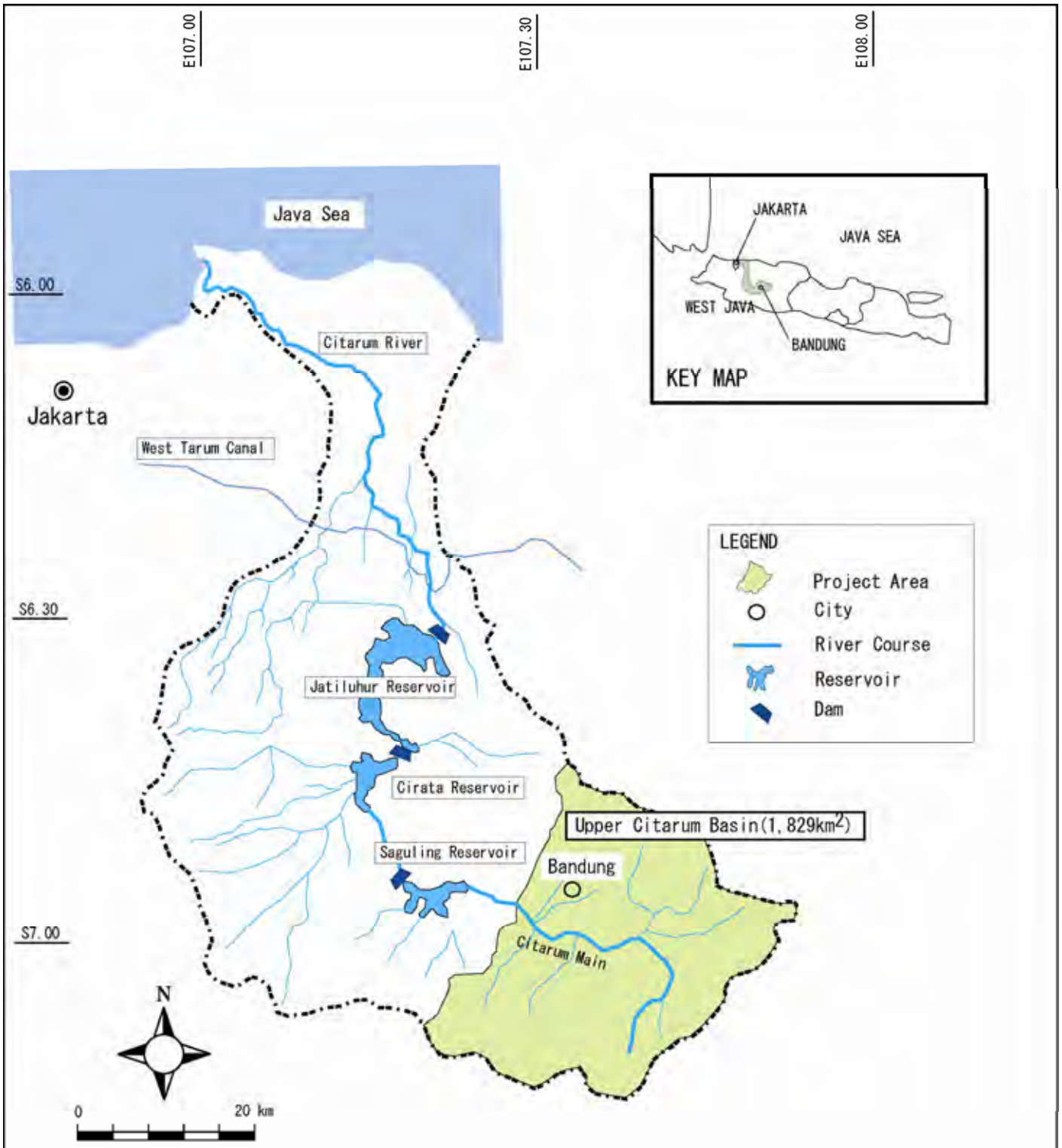
Foreign Currency Exchange Rates Applied in the Study

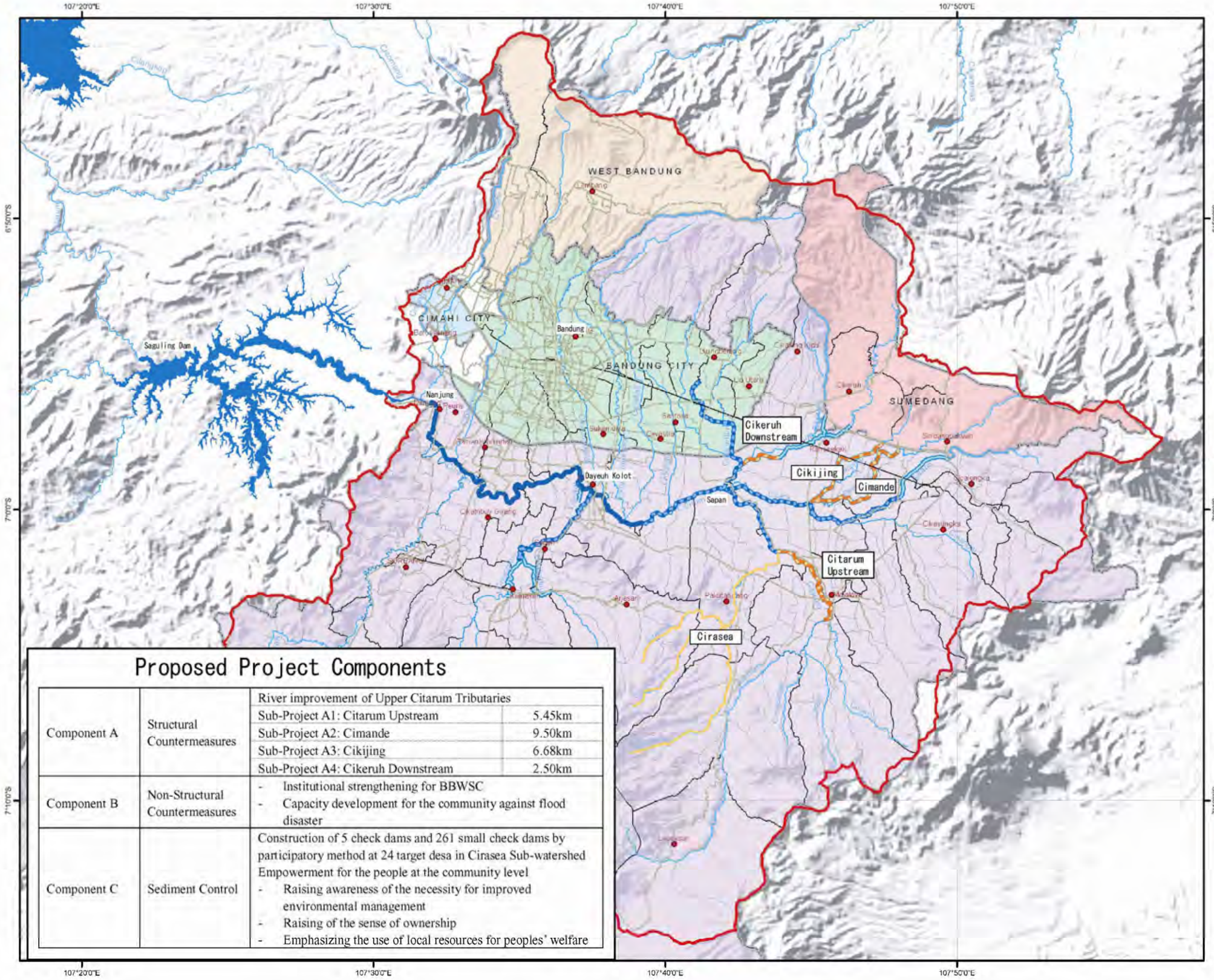
Currency	Exchange Rate/USD
Rupiah (IDR)	9017.00
Japanese Yen (JPY)	90.9

(Monthly Averaged Rate as of April, 2010)



LOCATION OF PROJECT AREA

Project Map



N

1:220,000

0 1 2 4 6 8 km

Legend

- City
- Main Road
- Rail Way
- River
- Lake/Reservoir
- Upper Citarum River Basin Boundary
- Kabupaten/Kota Boundary
- Kecamatan Boundary
- Desa Boundary

River Improvement Works by Japanese ODA Loan Projects

- Stage (I) (IP-405, 1994-1999)
- Stage (II) (IP-497, 1999-2007)
- Proposed Stage (III) based on 2007 D/D
- Proposed ODA Loan Project by Surver(2010)

Proposed Project Components

Component A	Structural Countermeasures	River improvement of Upper Citarum Tributaries	
		Sub-Project A1: Citarum Upstream	5.45km
		Sub-Project A2: Cimande	9.50km
		Sub-Project A3: Cikijing	6.68km
		Sub-Project A4: Cikeruh Downstream	2.50km
Component B	Non-Structural Countermeasures	- Institutional strengthening for BBWSC - Capacity development for the community against flood disaster	
Component C	Sediment Control	Construction of 5 check dams and 261 small check dams by participatory method at 24 target desa in Cirasea Sub-watershed Empowerment for the people at the community level - Raising awareness of the necessity for improved environmental management - Raising of the sense of ownership - Emphasizing the use of local resources for peoples' welfare	

Data Source : UCBFM,ICWRMIP,ADB(2010)

JICA Japan International Cooperation Agency

The Preparatory Survey for Citarum Upper Basin Tributaries Flood Management Project

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ABBREVIATIONS AND GLOSSARIES

Terms	English
1D	One dimensional
2D	Two dimensional
2007 D/D	Review of Flood Control Plan And Detailed Design Preparation Under Upper Citarum Basin Urgent Flood Control Project (II) (JBIC Loan No. IP-497), 2007
6 Cis RBT	River Basin territory covering Cidanau, Ciujung, Cidurian + Ciliwung, Cisadane + Citarum
ADB	Asian Development Bank
AMDAL	Environmental Impact Assessment
ANDAL	Environmental Report
APBN	State Annual Budget
BAKOSURTANAL	National Coordination Agency for Survey & Mapping (Badan Koordinasi Survei dan Pemetaan)
BAPPEDA	Regional body for planning and development (Badan Perencanaan Pembangunan Daerah)
BAPPENAS	National Development Planning Agency (Badan Perencanaan Pembangunan Nasional)
BBWSC	Balai Besar Wilayah Sungai Citarum
BMKG	Agency of Meteorology, Climatology and Geophysics (Badan Meteorologi Klimatologi dan Geofisika)
BNPB	National Disaster Management Agency (Badan Nasional Penanggulangan Bencana)
BPBD	Regional Disaster Management Agency (Badan Penanggulangan Bencana Daerah)
BPLHD	Regional Environmental Agency
BPN	National Land Board
COD	Chemical Oxygen Demand
D/D	Detailed Design
DEM	Digital Elevation Model
DEPHUT	Department of Forestry (Departemen Kehutanan)
DGWR	Directorate General for Water Resources at MPW
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EPA	Environmental Protection Agency
EWS	Early Warning System
F/S	Feasibility Study
GDP	Gross Domestic Products
GIS	Geographic Information System
GOI	Government of Indonesia
GOJ	Government of Japan
GPS	Global Positioning System
GRDP	Gross Regional Domestic Products
ICB	International Competitive Bidding
ICWRMIP	Integrated Citarum WRM Investment Program
IDR	Indonesian Rupiah
ITB	Bandung Institute Of Technology (Institut Teknologi Bandung)
IWRM	Integrated Water Resources Management
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
LARAP	Land Acquisition and Resettlement Action Plan
LMD	Village Consultative Committee (Lembaga Mushawarah Desa)
LPC	Land Procurement Committee
LRP	Livelihood Restoration Program
LRSC	Land Rehabilitation and Soil Conservation
M/D	Minutes of Discussion
MOHA	Ministry of Home Affairs
MPW	Ministry of Public Works (PU=Departemen Pekerjaan Umum)
NGO	Nongovernmental Organization
NJOP	Selling Value of Taxed Object
ODA	Official Development Assistance
PAP	Project Affected Person
PCMU	Project Coordination and Management Unit
PIU	Project Implementation Unit
PJTII	National Corporation for Basin Management (for Citarum)
PLN	Electricity Public Cooperation (Perusahaan Listrik Negara)
PM	Project Manager
PMU	Project Management Unit
PP	Government Regulation (Peraturan Pemerintah)
PSDA	Water Resources Management (Pengelolaan Sumber Daya Air)

Terms	English
PU	Department of Public Works (Departemen Pekerjaan Umum)
PUSAIR	Research Center for Water Resources (Puslitbang Sumber Daya Air)
RBO	River Basin Organization
RBT	River Basin Territory (Willayah Sungai, WS)
RCMU	Road Map Coordination Management Unit
RENSTRA	Strategic Plan (Rencana Strategis)
RKL	Environmental Management Plan
ROW	Right Of Way
RPJMN	Medium-Term Development Plan (Rencana Pembangunan Jangka Menengah Nasional)
RPJPN	Long Term Development Plan
RPL	Environmental Monitoring Plan
SAPROF	Special Assistance for Project Formation
SATKORLAK PB	Provincial Coordination Unit for Disaster Management (Satuan Koordinasi Pelaksana Penanggulangan Bencana)
SATLAK PB	District Coordination Units for Disaster Management (Satuan Pelaksana Penanggulangan Bencana)
SCF	Standard Conversion Factor
SMS	Short Message Service
SOBEK	1D2D Hydraulic Modeling Framework of Deltares – Delft Hydraulics
SRTM	Shuttle Rader Topography Mission
SS	Suspended Solid
TA	Technical Assistance
TCLP	Toxicity Characteristic Learning Procedure
TDA - US Embassy	Trade and Development Agency
TOR	Terms of Reference
UCBFM	Upper Citarum Basin Flood Management project
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPLDP	Upland Plantation and Land Development Project
USLE	Universal Soil Loss Equation
WB	World Bank
WISMP	Water Resources and Irrigation Sector Management program
WRM	Water Resources Management
WTC	West Tarum Canal

CHAPTER 1 INTRODUCTION

1.1. Background of the Survey

Flooding in Indonesia is considered to be a major disaster risk and the number of floods has been increasing yearly. Flooding causes not only direct physical damage but also indirect economic and social damage, such as the stagnation of economic activities. This causes an increase in the number of poor, thus adversely affecting sustainable economic development in Indonesia. Sustainable river basin management including flood control is crucial to the social and economic development of the country.

The Government of Indonesia (GOI) considers the Citarum River Basin to be the most strategic river basin in the country and has determined to adopt a concerted approach to improving land and water management in the area. It has requested ADB's help in developing and funding a long-term Integrated Water Resources Management (IWRM) Investment Program guided by a strategic Roadmap.

The Upper Citarum River Basin located in the Bandung region of West Java province, has incurred frequent floods for many years. These floods have caused enormous damage, especially to economic sectors such as the agricultural and textile industries.

JICA has been supporting the mitigation of flood damage in the Upper Citarum River Basin since the 1980s. Between 1987 and 1988, an overall flood control plan, the Master Plan (M/P), was formulated for the Upper Citarum River Basin with technical cooperation from JICA. Subsequently, "Upper Citarum Basin Urgent Flood Control Project Stage (I) & (II)" were implemented from 1994 to 2007. Due to the Stage (I) & (II) projects, flooding has been decreasing along the Citarum main river to a considerable extent, however, countermeasures for flood management along the upper tributaries is still not sufficient.

Further, the river flow capacity of the Citarum main river, which was improved by the implementation of Stage (I) and Stage (II), has been considerably decreasing due to an excessive amount of sediment runoff from upstream mountainous regions since effective countermeasures could not be carried out. In fact, GOI carried out the "Upland Plantation and Land Development Project at Citarik Sub-Watershed" with financial assistance from JICA (1995-2006) for the reduction of the sediment runoff from the mountainous regions. However, no similar projects have been implemented after the project of IP-455. In addition, the river excavation works along the main Citarum River could not be implemented as the original O&M activity of GOI. As a result, the river flow capacity along the Citarum main river has been decreasing considerably due to sedimentation, which increases flood risk or causes recurrent flood disasters in the area.

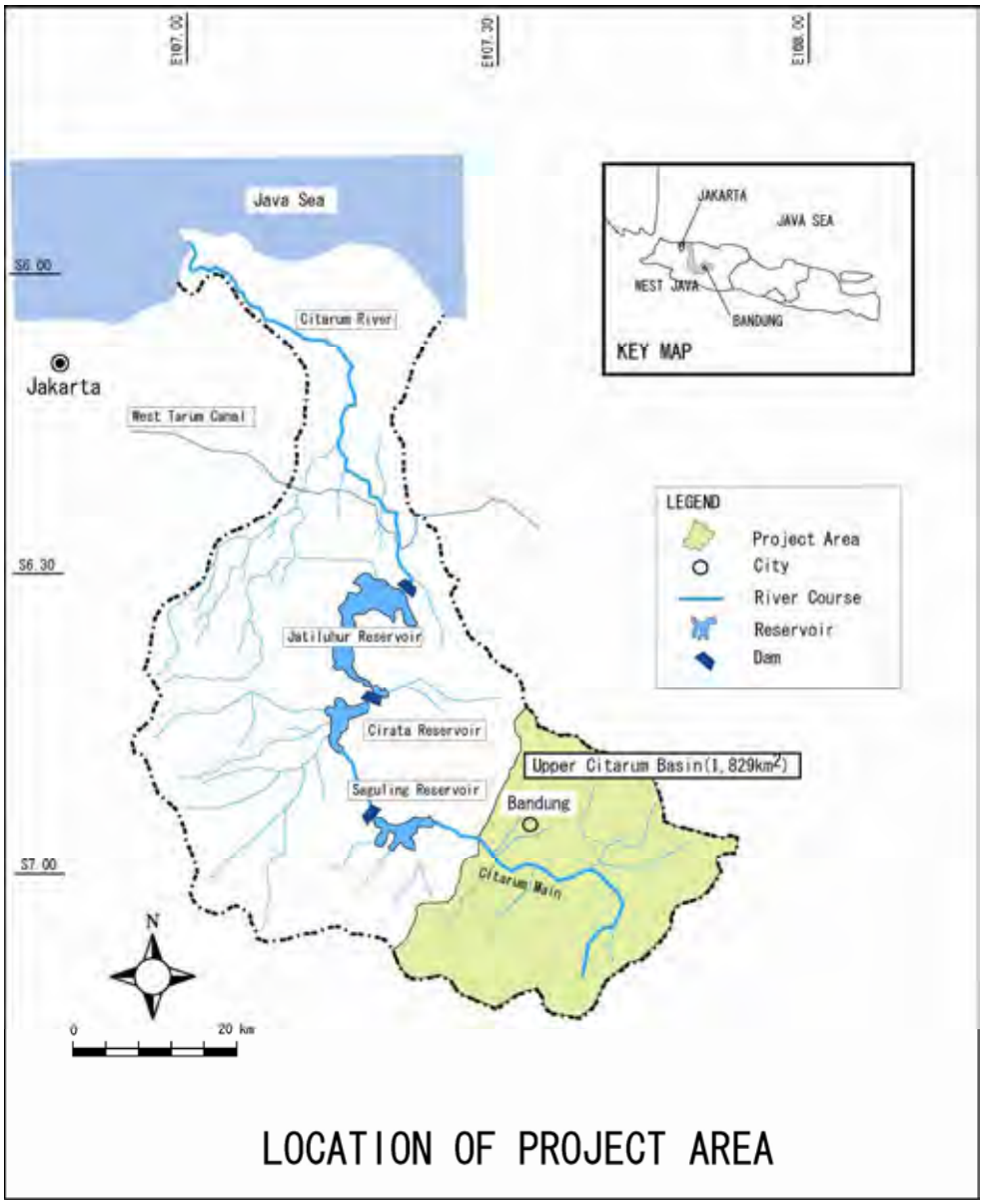
Under the above circumstances, JICA had discussions on the Scope of Work of JICA Preparatory Survey for the Upper Citarum River Basin Tributaries Flood Management Project with officials of the Ministry of Public Works of Indonesia in December, 2009, aiming at formulation of a future ODA loan project. In view of the recent flood disasters along the upper tributaries, GOI pre-requested ODA Loan Assistance to GOJ (Government of Japan) for river improvement works of the tributaries in the Upper Citarum River Basin as an urgent prioritized project on 30th of June, 2010.

1.2. Objectives of the Survey

The Survey is aimed at formulating a future Official Development Assistance (ODA) loan project to minimize flood damage occurrence along the upper tributaries of the Citarum River. In addition, associated technical assistance for improving water-related environmental management in the area are to be proposed based on the results of the Survey.

1.3. Survey Area

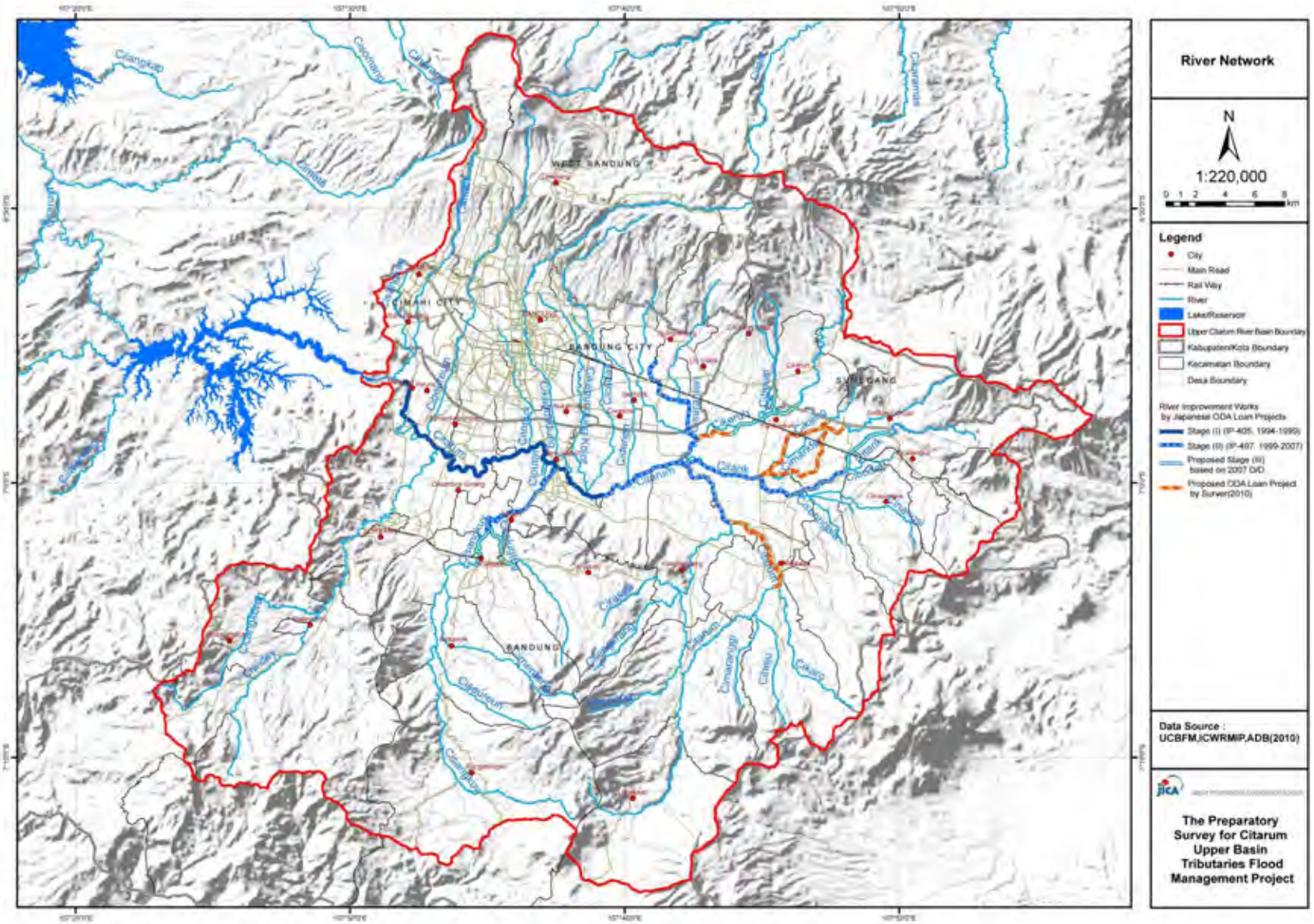
The survey area (1,829km^2) covers the Upper Citarum River Basin in West Java Province as shown in the location maps below (Figure 1.3.1.1).



Source: Based on a pamphlet "UPPER CITARUM BASIN URGENT FLOOD CONTROL PROJECT" published by BBWSC

Figure 1.3.1.1 Location Map of Upper Citarum River Basin

Figure 1.3.1.2 on the next page shows the river network map in the Upper Citarum River Basin (Refer to Appendix).



Source: JICA Survey Team (Data Source: 2007 D/D and UCBFM, ICWRMIP, ADB)

Figure 1.3.1.2 River Network Map in Upper Citarum River Basin (Refer to Appendix for Original Map)

1.4. Scope and Schedule of the Survey

The Survey is to be carried out based on the "Minutes of Discussion" agreed between the GOI and JICA in December 2009. The scope of the Survey is shown in Table 1.4.0.1 below. Refer to Annex at the end of this report for the Minutes of Discussion (M/D).

Table 1.4.0.1 Survey Schedule

(1)	**Review of the background and necessity of the Project**
1)	Review RPJM2010-2014, Regional Development Plan and relevant policy
2)	Review recent flood damage (Number of affected people, economic loss, damaged area)
3)	Analyze bottlenecks for the implementation of the Project (Water quality and land subsidence, etc.)
(2)	**Review of the Feasibility of the Project**
1)	Propose selection criteria for the sub-projects
2)	Implementation of runoff and flood analysis including collection of meteorological and hydrological data utilizing flood models (Impact assessment in the case with/without the Project)
3)	Review existing detailed designs and propose essential structural measures for controlling water discharge volume to the downstream basin
4)	Conduct basic designs of structural measures for possible new target tributaries, prepare the schedule, and calculate cost estimates based on the results of the runoff analysis
5)	Identify the locations of needed land space to be acquired and the number of inhabitants to be relocated due to the proposed development
6)	Conduct sampling surveys to determine the presence of heavy metals and propose countermeasures as necessary
7)	Formulate key non-structural measures (including capacity strengthening of the community in response to the occurrence of frequent floods)
8)	Make a preliminary determination of the scope of the Project based on information of flood damage within a reasonable loan amount
(3)	**Identify other issues of concerns and propose necessary countermeasures for identified concerns (for possible JICA assistance in coordination with concerned stakeholders considering the Project referred to above and taking the Roadmap into account)**
(4)	**Evaluation of the Project Implementation and O&M Framework**
(5)	**Evaluation of the Benefits of the Project (EIRR, Operation and Benefit Indicators)**
(6)	**Assessment of the Environmental and Social Considerations**
1)	Review the preparation process of AMDAL and LARAP in accordance with JBIC Guidelines for confirmation of environmental and social issues (April 2002) (hereinafter called as "JBIC Guidelines")
2)	Review the results of actual implementation of AMDAL and LARAP for Stage (I) and Stage (II) projects, and analyze issues of major concern (including necessary countermeasures)
3)	Support the Indonesian side in preparing the LARAP framework for each sub-project should a large-scale involuntary resettlement and/or land acquisition be required
4)	Review the EIA report, and if necessary, support the Indonesian side in conducting additional surveys, if needed
5)	Support the Indonesian side in preparing the environmental checklist and monitoring forms in accordance with the JBIC Guidelines

Source: JICA Survey Team

The survey period is 8 months from March 2010 to October 2010 as shown in the table hereunder.

Table 1.4.0.2 Survey Schedule

Year	2010							
Month	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
	1	2	3	4	5	6	7	8
Work in Indonesia		1st work in Indonesia			2nd work in Indonesia			3rd work in Indonesia
Work in Japan	1st work in Japan			2nd work in Japan			3rd work in Japan	4th work in Japan
Report	△ ICR			△ IR			△ DFR	△ FR

ICR: Inception Report IR: Interim Report DFR: Draft Final Report FR: Final Report

Source: JICA Survey Team

CHAPTER 2 POSITION AND NECESSITY OF THE PROJECT

2.1. Current Status of Development Plans in Indonesia

In Indonesia, development plans at the national level consist of the National Long-Term Development Plan (RPJPN: 20 years) and the National Medium-Term Development Plan (RPJMN: 5 years). The implementation period for the RPJPN covers the years from 2005 to 2025. The period for the first RPJMN (RPJMN I) covered the years 2005 to 2009, while the second RPJMN (RPJMN II) covers 2010 to 2014. The RPJMN I stated that countermeasures, for mitigation of flood damage that were included as water resource management, were considered as an important strategic program. The RPJMN II also places mitigation of flood risk as one of the most important goals of the national program due to climate change. In addition to the national plans above, both the national government (*e.g.* departments, agencies, *etc.*) and local government (*e.g.* provinces, districts, cities, *etc.*) are to establish their development plans in line with the national plans.

(1) National Long-Term Development Plan (RPJPN 2005-2025)

The objective of the RPJPN 2005-2025 is set for "providing direction and also as reference for all elements of the nation (*e.g.* government, society, the business community, *etc.*), in realizing the national ideals and goals in accordance with the vision, mission, and direction of development that have been commonly agreed so that the entire endeavors carried out by the stakeholders in development are synergic, coordinated, and mutually supporting in one pattern of perception and one pattern of behavior". In this RPJPN, the issues are pointed out in terms of water resources management, water quality, water demand, sewage systems, water pollution, sedimentation, insufficient infrastructure, and insufficient water supply for irrigation and disaster management. The necessity of the measures for those issues is also mentioned in the RPJPN.

(2) National Medium-Term Development Plan (RPJMN 2010-2014)

The second RPJMN (2010-2014) aims at greater consolidation of the reform of Indonesia in all fields by emphasizing endeavors for increasing the quality of human resources, including the promotion of advancement in science and technology and the strengthening of economic competitiveness. Reduction of flood disasters is one of the main focuses in the plan as well as water quality, water demand, IWRM, information management, improvement of irrigation system, *etc.*

(3) Ministerial Strategic Plan in terms of Water Resources (RENSTRA)

RPJMN is the National Medium-Term Development Plan covering a period of 5 years, while RENSTRA is a 5-year ministerial strategic plan for relevant agencies. DGWR, MPW prepared RENSTRA related to the water resources sector based on RPJMN and Water Resources Law (No.7/2004). Likewise the RPJMN, reduction of flood disasters is one of the main activities in the plan.

(4) Regional Medium-Term Development Plans (West Java Province, Kabupaten Bandung and Kota Bandung)

At the regional level, all local governments must prepare long, medium and annual term plans (RPJPD, RPJMD and RKPD) in accordance with the national level plans. The provincial agency for water

resources (Dinas PSDA) also formulated their five-year plan (RENSTRA 2008-2013), which covers both structural and non-structural measures. Kota Bandung has also formulated the program activities in terms of water resources in RPJMD 2009-2013, while Kabupaten Bandung has a program for the development and management of water resources in the RPJMD 2005-2010 of Kabupaten Bandung. Likewise the RPJMN, reduction of flood disasters is one of the main activities in the plan.

2.2. Current Status of Related JICA Projects

2.2.1. JICA Projects in the Field of Water Resources

The GOJ has stated its policy on the Assistance Plan for Indonesia since November 2004 to provide support for improvement of the living environment, including disaster measures, for the realization of “a fair and democratic social framework”. JICA has implemented a number of projects related to the field of integrated water resources management in terms of “Development Study”, “ODA Loan Project”, “Technical Assistance”, “Grant Aid”, *etc.* for many years. In recent years, the following projects, shown in Table 2.2.1.1, have been implemented or are under planning.

Table 2.2.1.1 Recent JICA Projects Related to Water Resources

Name of Project	Scheme	Status	Present Situation and future plan	Schedule					Cate-gory	
				2009	2010	2011	2012	2013	Comprehensive Disaster Management	Integrated Water Resources Management
9 tributaries for Citarum river Improvement Project	LA	Pre-requested						~2017		x
Urban Flood Control System Improvement in Selected Cities	LA	On going					~2014.5			x
Project on Capacity Development for RBOs Practical Water Resources Management and Technology	TA	On going								x
The Institutional Revitalization Project for Flood Management in JABODETABEK	TA	Finished							x	x
Capacity Development Project for Comprehensive Flood Control in JABODETABEK	TA	Requested							x	x
Renovation of Pluit Drainage Pumping Station	GA	On going								x
Water Resources Policy Adviser	EXP	On going								x
Water Resources Existing Facilities Rehabilitation and Capacity Improvement Project	LA	On going								x
Integrated Water Resources and Flood Management Project for Semarang	LA	On going					~2015.7		x	x
Contermeasure for Sediment in Wonogiri Multipurpose Dam Reservoir (1)	LA	On going								x
Lower Solo River Improvement Project (2)	LA	On going					~2015.7			x
Urgent Disaster Reduction Project for Mt. Merapi / Progo River Basin and Mt. Bawakaraeng	LA	On going					~2014.7		x	x
The Study on Disaster Management in Indonesia	DS	Finished							x	x
Capacity Development Project for Disaster Risk Management	TA	Proposed							x	x
Disaster Recovery and Management Sector Program Loan	LA	Under monitoring	Additional actions will be incooperated into CCPL.						x	x
Tsunami Early Warning Advisor	EXP	Adopted	under selecting						x	x

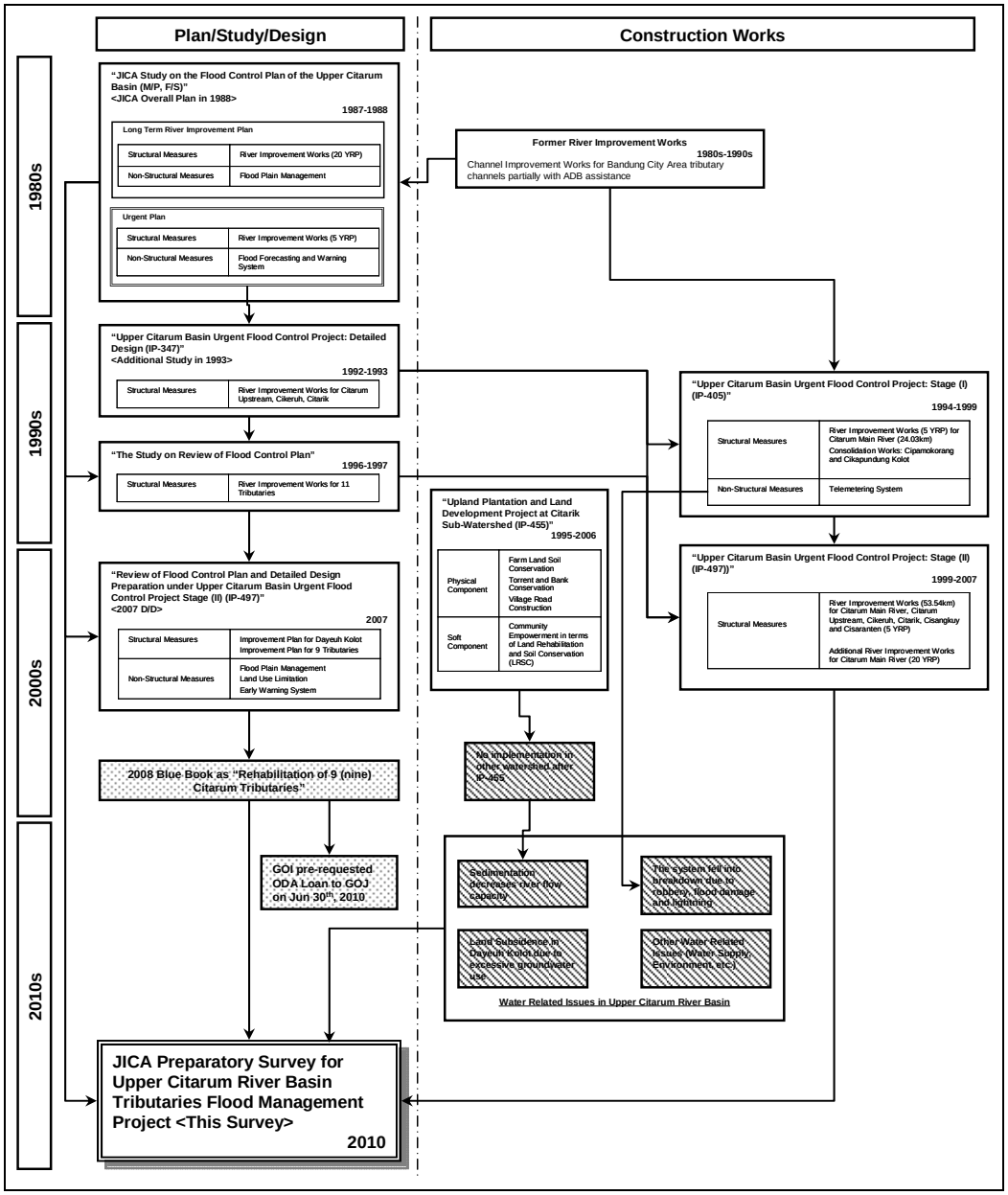
Source: JICA Preparatory Study on Disaster Management Program for Indonesia (2010) (Revised by JICA Survey Team)

2.2.2. JICA Assistances in the Upper Citarum River Basin

JICA has been supporting the mitigation of flood damage in the Upper Citarum River Basin since the 1980s. Refer to Figure 2.2.2.1 indicating the related studies and projects in the Upper Citarum River Basin. Between 1987 and 1988, an overall flood control plan, the Master Plan (M/P), was formulated for the Upper Citarum River Basin. It included a Feasibility Study (F/S) for the Urgent Flood Control Plan

and was implemented with technical cooperation from JICA. Subsequently, from 1992 to 1993, GOI carried out the Detailed Design (D/D) for the Urgent Flood Control Plan with financial assistance from JICA (IP-347, 1992-1993). On the basis of the D/D, the construction works were implemented from 1994 to 2007. The implementation was divided into two stages: Stage (I) (IP-405, 1994-1999) and Stage (II) (IP-497, 1999-2007). Due to the Stage (I) & (II) projects, floods have been decreasing along the Citarum main river to a considerable extent.

During Stage (II), GOI prepared the "Final Engineering Report for Review of Flood Control Plan and Detailed Design Preparation" in 2007 (Hereinafter, to be referred to as "2007 D/D") for the preparation of Stage (III), which consists of river improvement works of the upper tributaries for the completion of the Urgent Flood Control Plan.



Source: JICA Survey Team based on JICA Study on the Flood Control Plan of the Upper Citarum Basin (1988) and 2007 D/D Report

Figure 2.2.2.1 Related Studies and Projects in the Upper Citarum River Basin

2.3. Current Status of Major Donors

The Asian Development Bank (ADB), World Bank, Islamic Development Bank, Fonds D'etude Et D'aide Au Secteur Prive (FASEP), United Nations Educational Scientific and Cultural Organization (UNESCO) and the Trade and Development Agency (TDA - US Embassy) are donors presently working in the Citarum River Basin.

Table 2.3.1.1 Foreign Funding Projects in the Citarum River Basin

Donors	Project	Loan
Asian Development Bank (ADB)	Integrated Citarum Water Resources Management Investment Program (ICWRMIP) (Project-1) Technical Assistance	Loans: USD 20 M (2500-INO) USD 30 M (2501-INO SF) Grant: USD 3.75 M (GEF Grant) USD 8.0 M (ADB Grant) USD 2.55 M (ADB Grant for CCAM)
	Infrastructure Resources Sector Development Project –IRSDP	USD 2 M Loan No. 2264-INO Dutch Government Grant No. 0064 -INO.
World Bank	Water Resources and Irrigation Sector Management Program (WISMP - APL2) - Rehabilitation of Jatihulur Irrigation Canals	USD 25 M (IBRD Loan no 4711-IND) USD 45 M (IDA Credit no: 3807-IND) Grant: USD 14 M (Grant TF No: 052124)
	Dam operational improvement and safety (DOISP)	US $ 50 M (loan nr: 7669-ID)
Islamic Development Bank	The Construction of Transfer Water Inter Basin (Cibatarua-Cilaki Project)	USD 75 M IDB Loan: USD 63.75 M GOI: USD 11.25 M
Fonds D'etude Et D'aide Au Secteur Prive (FASEP)	Design of Jakarta Raw Water Transmission Improvement Project for the Rehabilitation of the Raw Water Transmission of the West Tarum Canal between Bekasi and Cawang	-
Trade and Development Agency (TDA - US Embassy)	Feasibility Study for Wastewater Treatment Technology and Service Options for the Upper Citarum River Basin	Cost of the study: USD 796,000
UNESCO	SWITCH in Asia Programme (Dara Ulim and Mahmud oxbows)	-

Source: ROADMAP FOR A BETTER FUTURE National Steering Committee for Water Resources - Citarum Roadmap Coordination Meeting Jakarta, April 12th 2010 Deputy Minister for Infrastructure Affairs, State Ministry of National Development Planning CITARUM

2.4. Necessity of the Project

The whole Citarum River Basin, which is located east of DKI Jakarta, has an area of 6,614km^2. It is the biggest basin and has the longest river in West Java Province. There are three dams in the basin: Saguling dam (982 million m^3), Cirata dam (2,165 million m^3) and Jatiluhur dam (3,000 million m^3) used for electric power generation and water supply (Domestic, Industrial and Agricultural) especially for DKI Jakarta.

The Upper Citarum River Basin is located in the Bandung region of West Java Province. It is one of the most important regions in Indonesia since it is one of the centers of the textile and agriculture industries. According to the BPS (Badan Pusat Statistik), the total GRDP of the Bandung region (Kabupaten Bandung and Kota Bandung) is listed third after DKI Jakarta and Surabaya.

Flood control or management included in IWRM is one of the key policies as described in RPJPN, RPJMN and RENSTRA. Also, reduction of flood disasters is one of the main activities at local government level such as West Java Province, Kabupaten Bandung, Kota Bandung, *etc*.

The Project is aimed at contributing to the completion of the Urgent Flood Control Plan, the development of the Indonesian economy and industries through the mitigation of flood damage by river improvement and enhancement of flooding prevention capacity for target residents along tributaries of the Upper Citarum River Basin where serious flood damage has been occurring. Included in the Project is a series of Non-Structural Countermeasures comprised of Institutional Strengthening for BBWSC, Capacity Development for Community against Flood Disaster, and Sediment Control.

The Project is considered significant in terms of the socio-economic development of the Indonesian economy.

CHAPTER 3 CURRENT CONDITIONS OF THE UPPER CITARUM RIVER BASIN

3.1. Geology

3.1.1. Topographical Condition

Bandung is the capital of West Java province, Indonesia. Topographically, it is surrounded by Late Tertiary and Quaternary volcanic terrain up to 2,400 m high and forms an intramontane basin known as the Bandung Basin. The basin, which is a highland plateau at approximately 650 to 700 m above sea level, lies in the catchment area of the Upper Citarum River. The Upper Citarum River, which is the survey area, rises from the surrounding mountains of the Bandung Basin and flows from south to east. It then feeds into the Java Sea through the Saguling Reservoir. The tributary rivers of the Upper Citarum River are fed by the high slopes of the surrounding mountains. The Bandung Basin was a lake 50,000 to 16,000 years ago and became a flatland due to an abundance of sediment from the surrounding mountains.

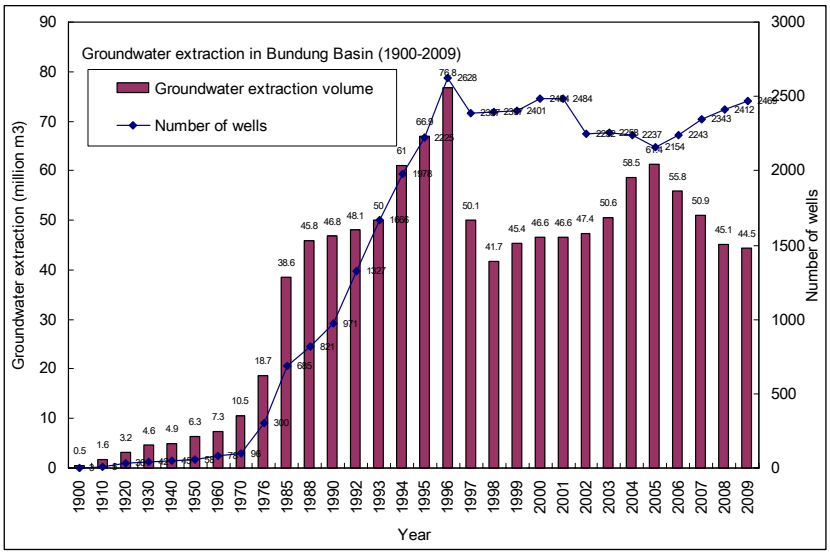
3.1.2. Geological Condition

The Basin is dominated by various Quaternary volcanic rocks consisting of andesitic to dacitic lava, breccia, agglomerate, tuff, lahar, and intrusive rocks. The western flanks of the basin consist of old Tertiary sediment comprising of sandstone, clay stone, and limestone, while the younger alluvium and fluvial sediment of reworked volcanic deposits are widespread in the center of the basin.

3.1.3. Groundwater Extraction and Land Subsidence Phenomena

(1) Groundwater Extraction

The use of groundwater resources in the Bandung Basin has been rapidly increasing due to industrial activities since the 1980s.



Source: West Java Province Office of Energy and Mineral Resources, 2010

Figure 3.1.3.1 Registered Groundwater Extraction in Greater Bandung (1900-2009) from the Deep Aquifer (40-250m) below the Surface

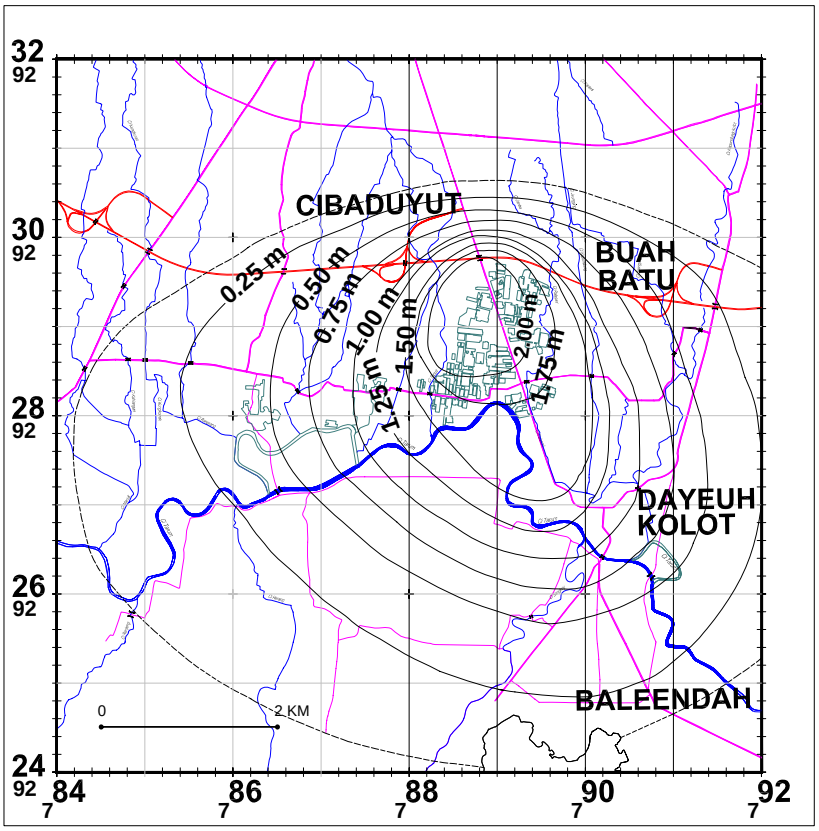
The registered number of deep wells and water extraction volume in the Bandung Basin as of December 2009 is shown in Figure 3.1.3.1. According to this latest data, extraction is 44.5 million cubic meters and the number of wells is 2,400. Although extraction is decreasing, the number of wells has recently been increasing. The Dayeuh Kolot area is one of the industrial development areas and has 119 factory units. The main user of groundwater is the textile industry, which consists of 100 factories.

(2) Groundwater Level

Increased groundwater extraction has led to a rapid sinking of water tables on the plain, which in turn causes land subsidence. During the 1980s, the average annual drop in water tables in the basin was one (1) meter, while in the most heavily extracted areas, annual drops up to 2.5 meters were recorded.

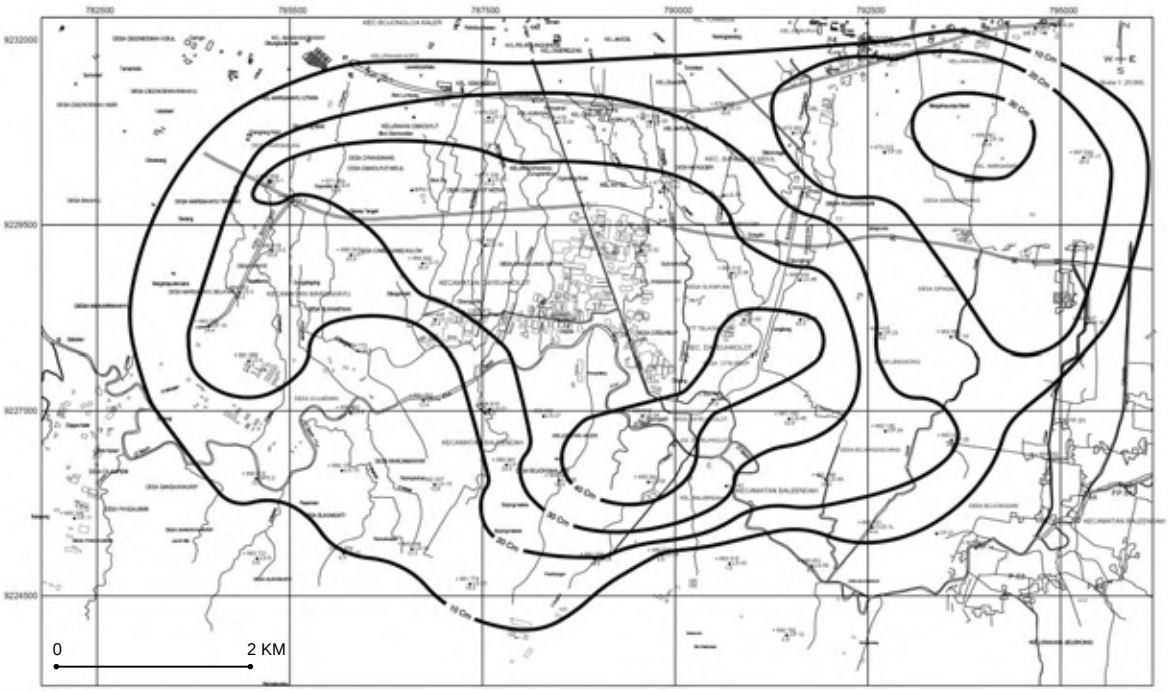
(3) Land Subsidence Phenomena

Theoretically, excessive groundwater extraction will lead to a decrease in the groundwater level, which in turn will cause land subsidence. Since 2006, the Citarum Flood Control Project has established a monitoring system for land subsidence in the Dayeuh Kolot area comprised of 55 points with gridiron. The progression of land subsidence from 1996 until 2006 and the land subsidence rate in May 2010 (for the past 3.5 years) are shown in Figure 3.1.3.2 and Figure 3.1.3.3, respectively. As shown in Figure 3.1.3.3, land subsidence is continuing, resulting in a total of more than 40 cm/3.5 years. A rate of 12 cm/year has been measured in the Dayeuh Kolot area.



Source: 2007 D/D

Figure 3.1.3.2 Progress of Land Subsidence from 1996 until 2006



Source: JICA Survey Team

Figure 3.1.3.3 Land Subsidence Rate from Nov. 2006 until May 2010

3.2. Socio-Economic Features

3.2.1. Administration

The survey area of 1,829 km² is located within the 4,800 km² area of the five administrative districts of Kota Bandung, Kota Cimahi, Kabupaten Bandung, Kabupaten West Bandung, and Kabupaten Sumedang in West Java Province. Most of the survey area is concentrated in Kota Bandung, Kabupaten Bandung, and Kota Cimahi.

3.2.2. Population

The total population of the five administrative districts in 2008 was 8.7 million inhabitants. In particular, Kabupaten Bandung and Kota Bandung are two of the most populated districts in West Java Province. In the four years since 2005, the population growth of each district has slightly increased by 2%, according to statistics of West Java Province (2008).

Table 3.2.2.1 Population in Five Administrative Districts of the Survey Area

Administrative District	Administrative Area (km^2)	Population				Population Density in 2008
		2005	2006	2007	2008	
Kota Bandung	167.29	2,315,895	2,340,624	2,364,312	2,390,120	14,287
Kab. Bandung	1762.39	4,263,934	4,399,128	3,038,038	3,116,056	1,768
Kab. West Bandung	1305.77	-	-	1,493,225	1,531,072	1,173
Kab. Sumedang	1522.2	1,067,361	1,089,889	1,112,336	1,134,288	745
Kota. Cimahi	40.2	493,698	506,250	518,985	532,114	13,237
Total	4797.85	8,140,888	8,335,891	8,526,896	8,703,650	-

Note: Bandung Barat Regency was established in December 2006, and used to be a part of Kabupaten Bandung.
Source: Statistics of West Java Province (BPS Jawa Barat) 2008

3.2.3. Land Use

According to the land use map of the survey area (1,829 km²) from the National Coordination Agency for Surveys and Mapping (BAKOSURTANAL, 2008), built-up areas are mainly concentrated in Kota Bandung, and paddy fields mainly occupy the central north of Kabupaten Bandung. Dry field and plantation areas are spread across Kota Cimahi and Kabupaten Bandung. There are large areas of forest in the south of Kabupaten Bandung.

Table 3.2.3.1 Land Use of the Survey Area

Category	Area (km²)	Ratio
Built-up Area	367	20.0%
Paddy Field	496	27.1%
Forest	497	27.2%
Water Surface	9	0.5%
Dry Field & Plantation, etc.	461	25.2%
Total	1,829	100%

Source: BAKOSURTANAL, 2008

3.2.4. Gross Regional Domestic Product (GRDP)

The Gross Regional Domestic Product (GRDP) of West Java was 602,420 billion Indonesian rupiah in 2008, corresponding to 12% of the total GDP of Indonesia. The total GRDP of the five administrative districts was responsible for 22% of the total GRDP of West Java, totaling 133,961 billion Indonesian rupiah.

Table 3.2.4.1 GRDP of Five Administrative Districts (Current Market Price)

Industry	Kota Bandung	Kab. Bandung	Kab. West Bandung	Kab. Sumedang	Kota Cimahi	Five Administrative Districts	%
Agricultural, Livestock, Forestry & Fisheries	153,030	2,728,755	1,579,761	2,984,417	16,346	7,462,309	5.57
Mining & Quarrying	0	468,303	58,121	14,600	0	541,024	0.4
Manufacturing Industries	15,548,704	23,275,745	6,624,524	2,399,351	6,406,371	54,254,695	40.5
Electricity, Gas & Water Supply	1,363,364	642,658	919,660	273,611	357,246	3,556,539	2.65
Construction	2,604,004	648,394	361,715	222,446	764,118	4,600,677	3.43
Trade, Hotel & Restaurant	24,211,804	6,005,197	2,634,504	2,676,178	2,048,127	37,575,810	28.05
Transportation & Communication	7,071,588	1,783,920	951,601	448,048	189,601	10,444,758	7.8
Finance, Real Estate & Business Services	3,956,663	792,877	369,958	434,493	236,809	5,790,800	4.32
Services	5,532,326	1,936,315	720,563	847,794	697,669	9,734,667	7.27
Total	60,441,483	38,282,164	14,220,407	10,300,938	10,716,287	133,961,279	100

Source: Jawa Barat in Figures 2009, BPS Jawa Barat, PDRB Kabupaten/Kota di Jawa Barat 2006-2008, BPS Jawa Barat

3.3. Present Condition of Rivers/Facilities

3.3.1. River Flow Capacity after Stage (I) and (II)

1) Citarum main river

In Stage (I) (1994-1999), Citarum main river from Nanjung to Leuwi Nutag (L = 24.0km) was improved with the following design conditions:

- Design Discharge: 280 – 530m³/s (5-year flood frequency)
- Riverbed slope: 1/5,500

Later, in Package VIII and IX of Stage (II) (2007), Citarum mainstream's riverbed from Nanjung to Citepus Village (L=20.2 km) was lowered to allow for 20-year flow capacity with the following design conditions:

- Design Discharge: 510 – 650m³/s (20-year flood frequency)
- Riverbed slope: 1/5,500

In Package I of Stage (II) (2003), Citarum mainstream from Leuwi Nutug to Sapan (L = 6.7km) was improved with the following design conditions:

- Design Discharge: 260 – 280m³/s (5-year flood frequency)
- Riverbed slope: 1/5,500

2) Citarum Upstream

In Package III of Stage (II) (2006), Citarum upstream from Sapan to Kantren (L = 5.7km) was improved with the following design conditions:

- Design Discharge: 110m³/s (5-year flood frequency)
- Riverbed slope: 1/2,050

3) Citarik Upstream

In Packages IV (2006) and V (2007), Citarik upstream from Sapan to Cisunggala (L = 6.48km) and Cisunggala to Bojong Gempol (L = 6.08km) were improved with the following design conditions:

- Design Discharge: 80 to 65, 65 to 40m³/s (5-year flood frequency)
- Riverbed slope: 1/4,300 to 1/3,300, 1/3,300 to 1/1,300

4) Cikeruh

In Package I (2006), Cikeruh River from Sapan to Ranca Kemuning (L = 4.75km) was improved with the following design conditions:

- Design Discharge: 80m³/s (5-year flood frequency)
- Riverbed slope: 1/7,500

5) Cisangkuy

In Package II (2003), Cisangkuy from confluence with Citarum to Rancaenggang (L = 6.67km) was improved with the following design conditions:

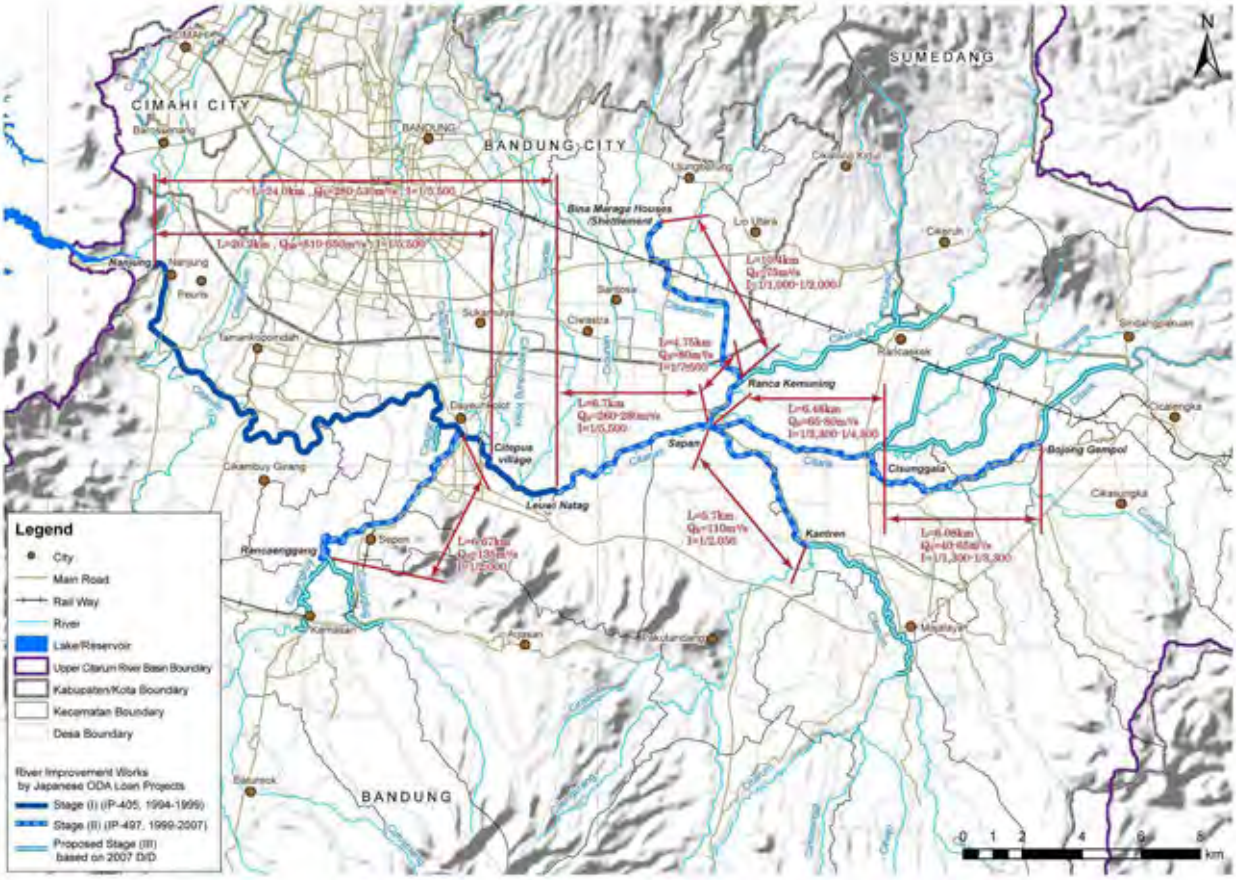
- Design Discharge: 135m³/s (5-year flood frequency)
- Riverbed slope: 1/2,000

6) Cisaranten

In Package IV and V (2007), Cisaranten from confluence with Cikeruh to Bina Marga Houses / Settlement (L = 10.4km) was improved with the following design conditions:

- Design Discharge: 75m³/s (5-year flood frequency)

- Riverbed slope: 1/2000 to 1/1000



Source: JICA Survey Team based on the previous projects and studies

Figure 3.3.1.1 Present River Conditions of Stage (I) & (II) Segments

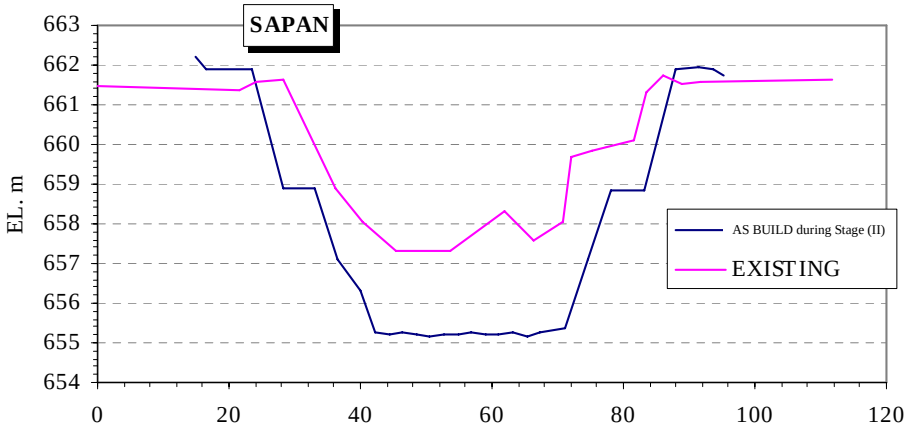
3.3.2. Sediment Deposition in the River

Because of both cultivation in steep terrain without terraces and forest collapse, the sediment yield in the Upper Citarum Basin is very high. In addition to soil erosion of steep sloped mountainous areas in the Upper Citarum Basin, human activities along the river channel have accelerated sedimentation in the river downstream, even at the segments that were improved in Stage (I) and (II).

Additionally, although banned, the river berm, which was formed in accordance with the design, is being used for planting vegetables, cassava or corn. After the corn is harvested, the remaining stalks trap rubbish, especially plastic waste, causing the subsequent capture of sediment. Similarly, when planting vegetables, grooves are built on the banks and the vegetables are grown on the high part. In the rainy season, these grooves are filled with sediment. So every year the height of the berm increases and eventually it will reach the same height as the inspection road.

Furthermore, in the dry season, the Citarum river discharge is very low, influencing the condition of the tributaries. Farmers who need water will stem the river traditionally using bamboo to raise the water level so it is easily pumped into the paddy fields. Farmers do not demolish the weirs in the rainy season because of their need the next dry season. According to the farmers, a little boost in the stem surface water will not cause flooding. But the resulting dam causes sedimentation and every year the river is normalized, it will become shallower. In some places, the farmers have dug up inspection roads to pass a pipe to drain water from the river to the paddy fields.

Figure 3.3.2.1 shows the cross-sectional difference between "As Build during Stage (II)" in 2007 and "Existing" conditions in 2010 at Sapan. Over 2m of sedimentation and riverbed rising is shown. Based on these cross-sectional data, hydraulic parameters, cross section area, wetted perimeter and the hydraulic radius can be calculated with Existing and As Build cases (Refer to Table 3.3.2.1). The ratio of cross section area and discharge between the cases are 54% and 40%, respectively. This shows that sedimentation has caused a serious decrease in the flow capacity.



Source: BBWSC for As Build condition, PUSAIR for the Existing condition

Figure 3.3.2.1 Cross sections compared between As -Build and Existing at Sapan

Table 3.3.2.1 Hydraulic Parameters at Sapan based on the Cross Section Profiles (related to Figure 3.3.2.1)

Item	unit	Existing	As Build	Ratio
Cross Section Area	m^2	172	317	54%
Wetted Perimeter	m	60	68	88%
Hydraulic Radius	m	2.9	4.7	62%

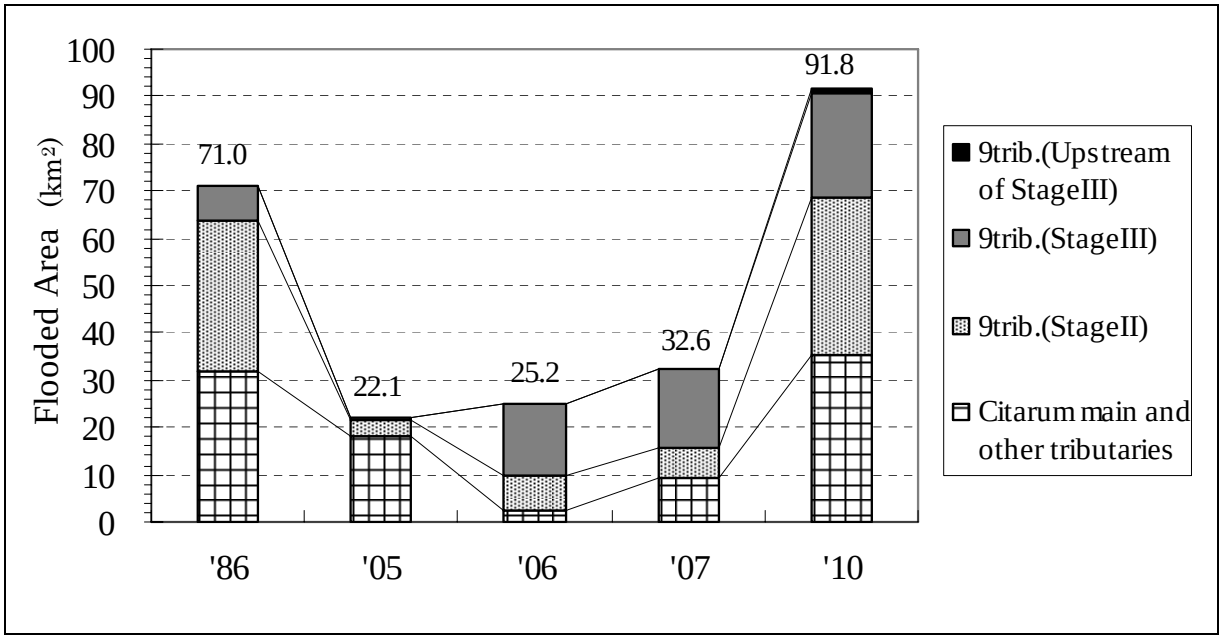
Source: JICA Survey Team

3.3.3. Flood and Inundation Areas / Flood Disaster Records

Serious floods have occurred frequently in the Upper Citarum River Basin. Damage conditions of the recent floods are shown in Figure 3.3.3.1 and Table 3.3.3.1. Inundation areas of recent major floods (1986, 2005, 2006, 2007, and 2010) are illustrated in Figure 3.3.3.2 to 3.3.3.6.

The effects of river improvement have been exposed by the floods after 2005. As shown in Figure 3.3.3.1 to 3.3.3.6, the inundated area spread along the Citarum main river by the flood in the March 1986. However, during the floods in 2006 and 2007, the inundated area was limited to Dayeuh Kolot at Citarum main river while the unimproved section of the tributaries, which are located upstream of the improved section In the 1986 flood, the inundated area appeared widely along the Citarum main river, resulting from overtopping of the Citarum main river. Subsequently, due to river improvement of the Citarum main and its major tributaries such as Citarik and Cisangkuy during the Stage (I) & (II) Projects, flooding has been decreasing considerably along the Citarum main river. However, flood damage still occurs along the upper tributaries that have not been improved, and around the Dayeuh Kolot area where land subsidence has been recorded.

The 2010 flood caused serious damage in a wide area upstream of Dayeuh Kolot in February and March. The peak discharge at Nanjung was evaluated to be over a 10-year return period, which is far beyond the channel capacity for Q5 (5-year return period discharge).



Source: JICA Survey Team based on 2007 D/D

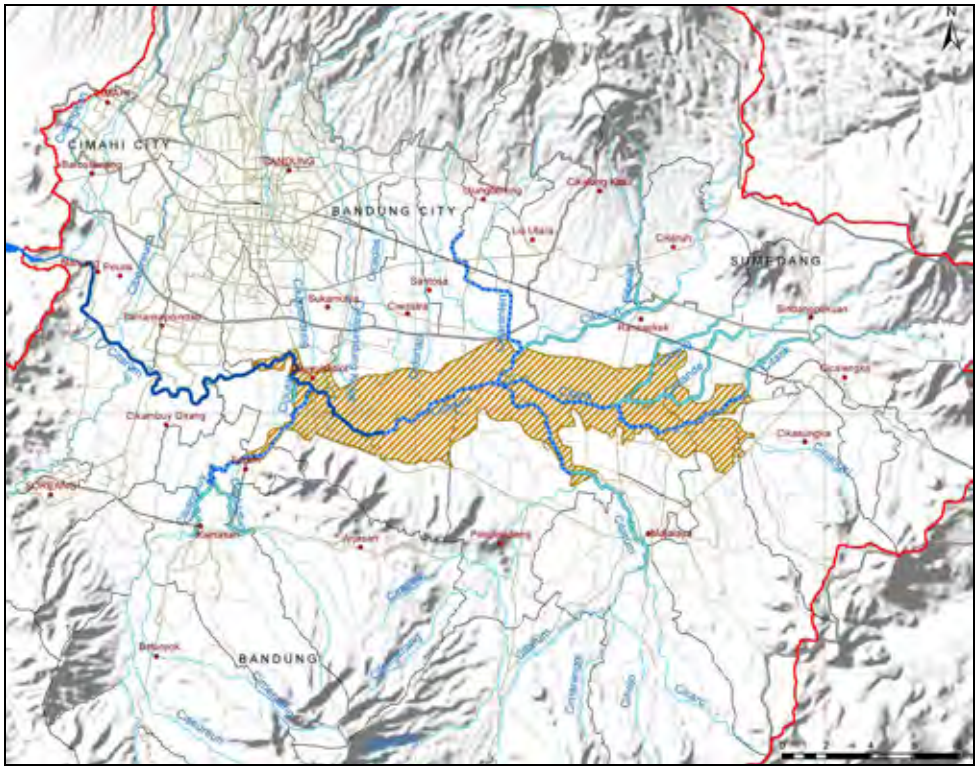
Figure 3.3.3.1 Flooded Area of Recent Major Floods

Table 3.3.3.1 Population in Flood Area and Damage Amount at Stage (III) Segments

Tributaries	Catchment area	Improvement length	Population in flooded area					Damage amount				
			'86	'05	'06	'07	'10	'86	'05	'06	'07	'10
Unit	km2	m	1000 person					Rp. Billion				
Citarum Upstream	229.7	5,450	10.4	0.0	111.3	140.8	69.0	164	0	1,782	2,274	1,096
Citarik Upstream	97.4	4,820	0.0	0.0	24.4	29.7	40.3	0	0	417	476	706
Cimande	41.2	9,510	6.0	0.0	8.8	6.6	37.1	101	0	144	111	627
Cikijing	20.8	6,680	14.3	0.0	50.2	58.1	31.5	229	0	839	954	545
Cikeruh	77.7	7,650	0.0	1.6	70.2	55.8	47.4	0	28	1,114	881	760
Cibeusi	10.7	1,360	0.0	0.0	12.3	0.1	0.8	0	0	199	1	12
Cisangkuy Upstream	241.0	3,730	0.0	0.0	33.9	7.3	15.8	0	0	556	113	271
Citalugtug	39.5	4,010	0.0	0.0	41.1	9.5	12.8	0	0	834	210	244
Ciputat	0.8	660	5.7	5.2	0.0	5.8	6.2	88	80	0	89	95
Total	**758.9**	**43,870**	**36.5**	**6.8**	**352.1**	**313.6**	**260.9**	**582**	**107**	**5,885**	**5,110**	**4,357**

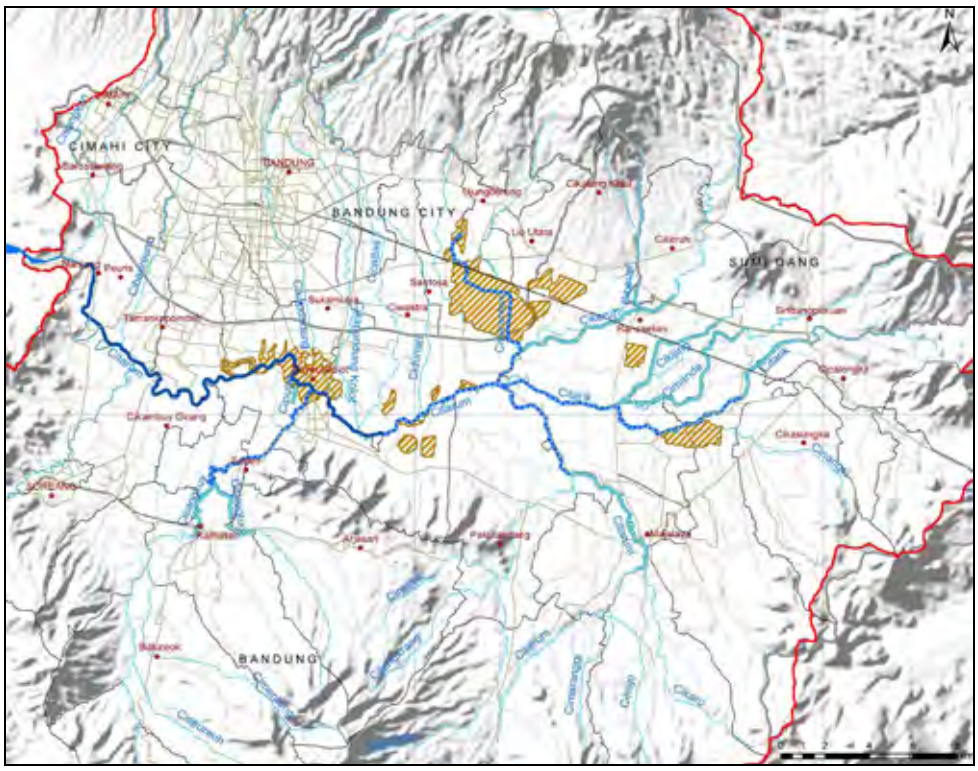
Note: calculation method of population in flooded and damage amount is as follows:
- Population in flooded area is calculated by multiplying the number of households by 5.0, the average population per household. The number of households is calculated by dividing the settlement area in the flooded area by 59.45m^2, the average area per household.
- Damage amount is damage total of house, housing assets, paddy fields, industries, industry stock, social facilities and roads. Each damage amount is calculated by multiplying the unit price and flooded area (or number, length) of related land use.

Source: JICA Survey Team based on 2007 D/D



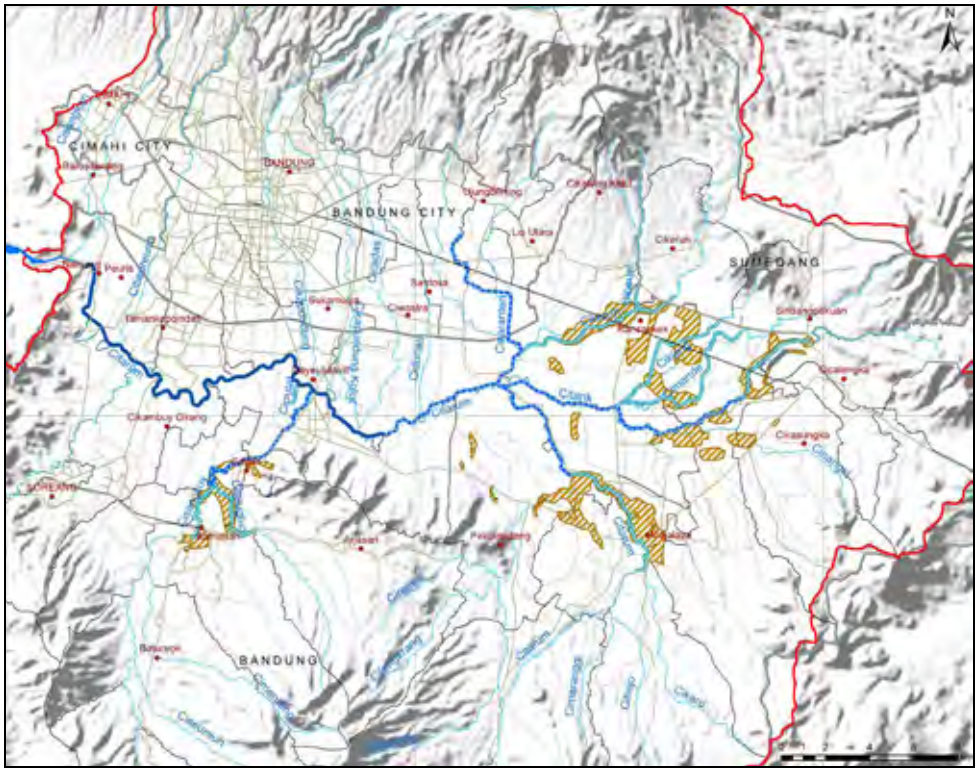
Source: JICA Survey Team based on 2007 D/D or various sources

Figure 3.3.3.2 Inundation Area of 1986 Flood



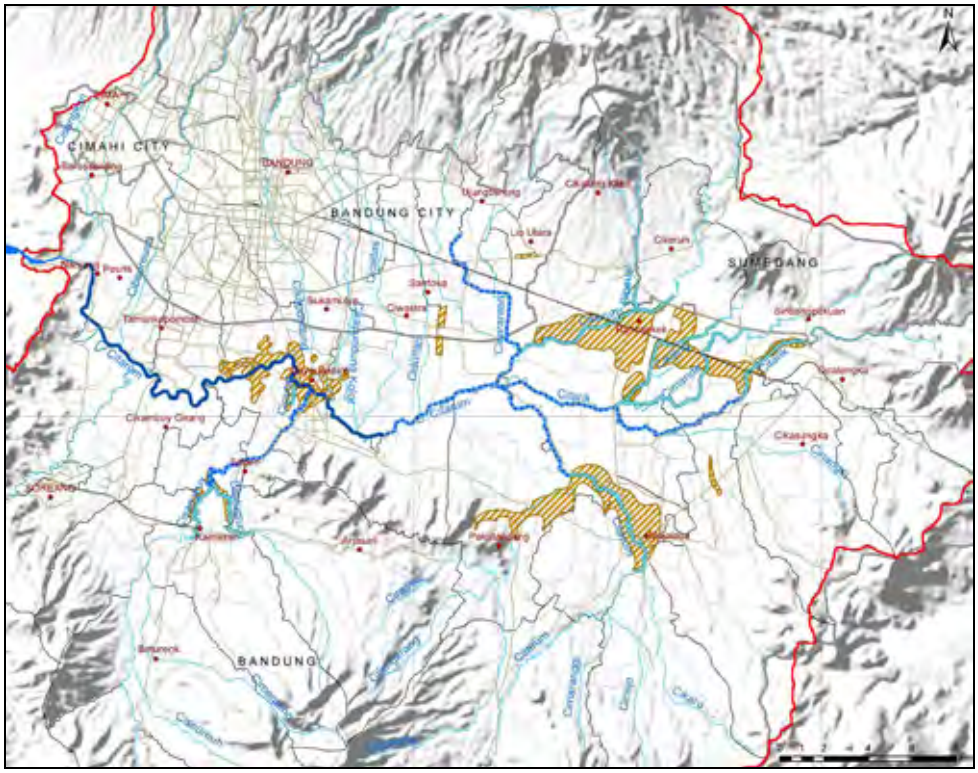
Source: JICA Survey Team based on 2007 D/D or various sources

Figure 3.3.3.3 Inundation Area of 2005 Flood



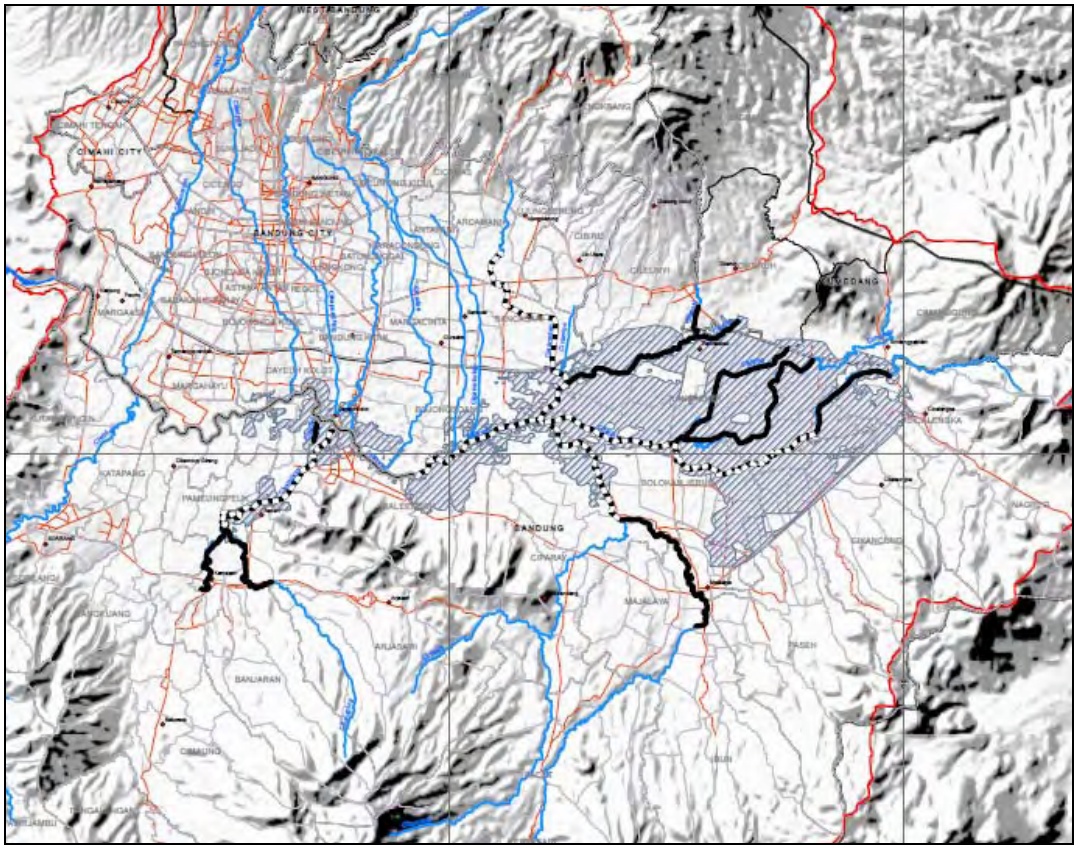
Source: JICA Survey Team based on 2007 D/D or various sources

Figure 3.3.3.4 Inundation Area of 2006 Flood



Source: JICA Survey Team based on 2007 D/D or various sources

Figure 3.3.3.5 Inundation Area of 2007 Flood



Source: UCBFM, ICWRMIP, ADB (2010)

Figure 3.3.3.6 Inundation Area of 2010 Flood

3.3.4. Sediment Contamination and Water Quality Survey

Since 2006, heavy metal contained sediment in the Upper Citarum River Basin has been a problem. In this Project, a huge volume of dredging sediment will be generated through river dredging. To avoid an adverse environmental effect, it is important to adopt an appropriate sediment disposal method.

A heavy metal survey of river water and sediment of the Upper Citarum River Basin was conducted to understand the existing heavy metal contamination conditions and to determine an appropriate disposal method.

1) Heavy metal survey

Sediment content test

The major heavy metals in the sediment are Ba, Cr, Cu, Pb, Sn and Zn. Table 3.3.4.1 shows a summary of heavy metal content in the sediment. In this table, the maximum value and minimum value of each measurement item is shown. In this survey, Kep-04/BAPEDAL/09/1995 and US limit value are used as a reference to assess sediment quality.

Table 3.3.4.1 Summary of Heavy Metal Content in Sediment

Item (mg/kg)	Max	Min*	Indonesian regulation**	US Pollutant limits***
Arsenic (As)	25.4	1.8	300	75
Barium (Ba)	4184.8	81.6	---	---
Cadmium (Cd)	335.9	7.6	50	85
Chromium (Cr)	2344.6	21.0	2500	3000
Copper (Cu)	3003.1	38.8	1000	4300
Cobalt (Co)	242.6	13.4	500	---
Lead (Pb)	1668.5	61.2	3000	840
Mercury (Hg)	0.0008	0.00008	20	57
Molybdenum (Mo)	205.0	0.03	400	57
Nickel (Ni)	724.1	11.8	1000	420
Tin (Sn)	2245.9	0.03	500	---
Selenium (Se)	166.9	0.03	100	100
Silver (Ag)	5.7	1.3	---	---
Zinc (Zn)	3915.3	210.7	5000	7500
Cyanide (CN)	4.1	1.4	---	---
Fluoride (F)	206.1	67.1	---	---

* N.D. is expected
** Kep-04/BAPEDAL/09/1995, Procedures and requirements for the dumping the processing result, requirements of the former processing location, and former location of B3 waste dumping site, Head of Bapedal Decree No.4/1995.
*** Pollutant limits for the land application of sewage sludge (Ceiling concentrations, Table 1 of 40 CFR 503,13)
Source: JICA Survey Team

In the results of the survey, the concentrations of Cd, Cu, Sn and Se exceeded the Column A value. Therefore, after assessment of heavy metal content, sediment is dumped into a specific dumping site with a double impermeable liner. Moreover, Cd, Pb and Se exceeded US limit value for land application.

Sediment leaching test

Table 3.3.4.2 shows a summary of the leaching test. The results show that the leaching concentration of heavy metal is lower than the Indonesian standard and U.S. EPA regulatory level. From these results, the sediment of the Upper Citarum River Basin is interpreted as non-hazardous waste.

Table 3.3.4.2 Summary of Heavy Metal Leaching Test

Item (mg/L)	Max	Min	Indonesian standard* (B3 waste dumping)	US EPA Regulatory level (Waste leachate)
Arsenic (As)	0.054	0.006	5	5
Barium (Ba)	4.294	0.294	100	100
Cadmium (Cd)	0.076	0.001	1	1
Chromium (Cr)	0.552	0.017	5	5
Copper (Cu)	6.152	0.001	10	-
Lead (Pb)	0.942	0.053	5	5
Mercury (Hg)	0.00062	0.00042	0.2	0.2
Selenium (Se)	0.144	0.005	1	1
Silver (Ag)	0.008	0.001	5	5
Zinc (Zn)	5.435	0.033	50	-

* Kep-04/BAPEDAL/09/1995, Procedures and requirements for the dumping the processing result, requirements of the former processing location, and former location of B3 waste dumping
Source: JICA Survey Team

2) Water quality survey

Physical-chemical items

The BOD_5 ranged from 18.4mg/L to 132.2mg/L, and the CODcr ranged from 36.9mg/L to 368.6mg/L. This result shows that water quality of the Upper Citarum River Basin is categorized as Criteria III or IV.

Table 3.3.4.3 Summary of Physical-chemical Items

Item	Unit	Max	Min	Indonesian standard criteria			
				I	II	III	IV
pH	-	7.8	6.6	6-9	6 - 9	6 - 9	5 - 9
Water Temp. *	^{o}C	32.8	31.4	∓3	∓3	∓3	∓5
SS	mg/L	340	2	50	50	400	400
DS	mg/L	3800	54	1000	1000	1000	2000
T-P	mg/L	0.7	0.01***	0.2	0.2	1	5
BOD_5	mg/L	132.2	18.4	2	3	6	12
CODcr	mg/L	368.6	36.9	10	25	50	100
NH_4-N	mg/L	1.4	0.1	0.5	(-)**	(-)**	(-)**
T-N	mg/L	2.0	0.1	0.06	0.06	0.06	(-)**

I For drinking water, and / or for other purposes that require similar quality
II For water tourism facilities, cultivation of freshwater fish, livestock, irrigation, and / or other purposes that require similar quality
III For cultivation of freshwater fish, livestock, irrigation, and / or other purposes that require similar quality
IV For watering plants and / or other purposes that require similar quality

* Water temperature deviation from the natural condition
** (-) means that for that class, this parameter is not required
*** T-P of Cikeruh, Citaric3, Citaric2 and Cimande 2 was N.D.
Source: JICA Survey Team

When this water quality is compared with Japanese standards, the water quality of the Upper Citarum River Basin is assessed as being E class (Industry water class 3 and conservation of environment). The NH_4-N concentration ranged from 0.08mg/L to 1.42mg/L.

In comparison with water quality criteria for aquatic biodiversity of Japan, water quality for aquatic biodiversity in the Upper Citarum River Basin is assessed as being from “Poor” to “Very good”. T-N and T-P were compared with the eutrophication indices of Japan. T-N of most sampling points exceeded 0.15mg/L. Therefore, eutrophication of the Upper Citarum River Basin is expected.

Heavy metal in River Water

Major heavy metals in the Upper Citarum River Basin are Ba, Cr, Cu, Pb, Sn and Zn. Notably, Cr, Cu, Pb and Zn were detected at all the sampling points.

In Japan, the standard value for Zn is determined according to the level required for protection of the habitat of aquatic life (See Appendix IV, Table Zinc (Zn) Standard Value to Protect Aquatic Life (Japanese standard)). For fish and their habitat, 0.03mg/L of Zinc is accepted as the limitation value. However, the Zn concentration of the Upper Citarum River Basin was 0.07 to 12.4mg/L. Therefore, the water environment of the Upper Citarum River Basin is expected to be hostile for the habitation of aquatic life.

CHAPTER 4 REVIEW OF EXISTING DETAILED DESIGN FOR THE 9 TRIBUTARIES

4.1. Detailed Design in 2007 (2007 D/D)

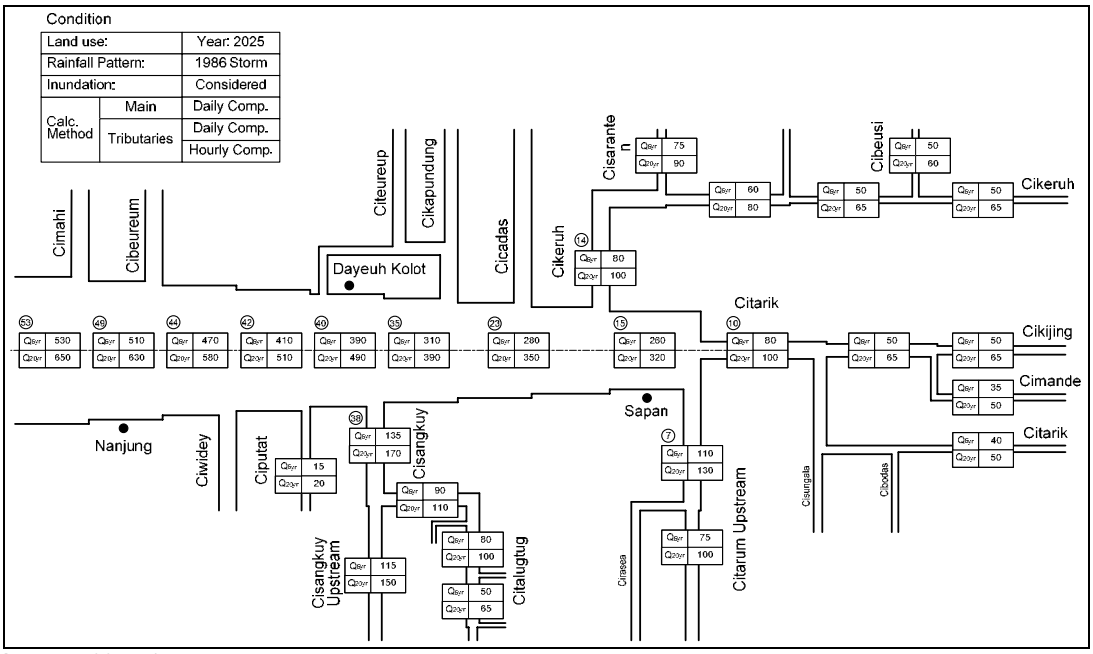
The tributaries that reported suffering from serious flood damage in recent years are shown in Table 4.1.1.1. These 9 tributaries were selected to be improved during Stage (III) of the Project in 2007 D/D. In Table 4.1.1.1, the design discharges of the tributaries accommodating 5-year return period floods are also indicated.

Table 4.1.1.1 Subjective Tributaries for Detailed Design in 2007

Stream	Targeted River	Location	Distance	Design Discharge
1. Citarum Upstream	Citarum Upstream	Kantren to Majalaya	L = 8.0 km	75 m^3/s
2. Cisangkuy	Cisangkuy	Rancaenggang to Kamasan	L = 7.0 km	115 m^3/s
	Citalugtug	Waas to Cileutik	L = 5.0 km	90 m^3/s
3. Citarik	Citarik Upstream	Bojong Gempol to Panenjoan	L = 6.0 km	40 m^3/s
4. Cimande	Cikijing	Tanggeung to Cikijing village	L = 8.0 km	50 m^3/s
	Cimande	Langensari to Rancapanjang	L = 8.0 km	35 m^3/s
5. Cikeruh	Cikeruh	Ranca Kamuning to Sirna Galih	L = 10.0 km	50 m^3/s
	Cibeusi	Buah Dua to Sindang Sari	L = 2.5 km	50 m^3/s
6. Ciputat	Ciputat	Bojongasih to Kulalet Hilir	L = 1.2 km	15 m^3/s

Source: 2007 D/D

Design discharge for the rivers was estimated based on the urgent flood control plan, and thus 5-year return period discharge was the basis of the estimation. Rational formula method was applied for estimation of the discharges using rainfall intensity formula (Bandung meteorological observatory).



Source: 2007 D/D

Figure 4.1.1.1 Discharge Distribution for Proposed River Improvement Works in 2007 D/D

The proposed construction works by 2007 D/D including Cikapundung diversion channel consisted of 1) excavation, 2) dredging, 3) bank protection, 4) groundsill & drop, 5) culvert & sluice, 6) re-construction of bridges and 6) irrigation facility. The main components of the construction works are shown below.

Table 4.1.1.2 Proposed construction works by 2007 D/D for Stage (III)

River Name	Improved Distance	1. Bank Protection	2. Groundsill & Drop	3. Culvert & Sluice	4. Bridge			5. Irrigation Weir
					Road	Pedestrian	I/M Road	
1. Citarum Mainstream	20,260	0	0	0	0	0	0	0
2. Citarum Up.	5,450	4,760	2	29	0	4	0	0
3. Citarik	4,820	2,460	2	30	0	6	1	1
4. Cimande	9,580	1,775	6	35	3	3	1	1
5. Cikijing	6,680	1,745	5	22	3	4	0	1
6. Cikeruh	7,650	10,170	3	32	5	9	2	2
7. Cibeusi	1,360	2,665	7	8	1	0	0	0
8. Cisangkuy Up.	3,730	2,070	1	27	0	4	0	0
9. Citalugtug	4,050	6,240	4	29	1	9	1	0
10. Ciputat	660	240	1	5	1	2	0	0
11. Cikapundung DC	715	1,430	2	0	1	0	1	0
Total	64,955	33,555	33	217	15	41	6	5

出典: 2007 D/D

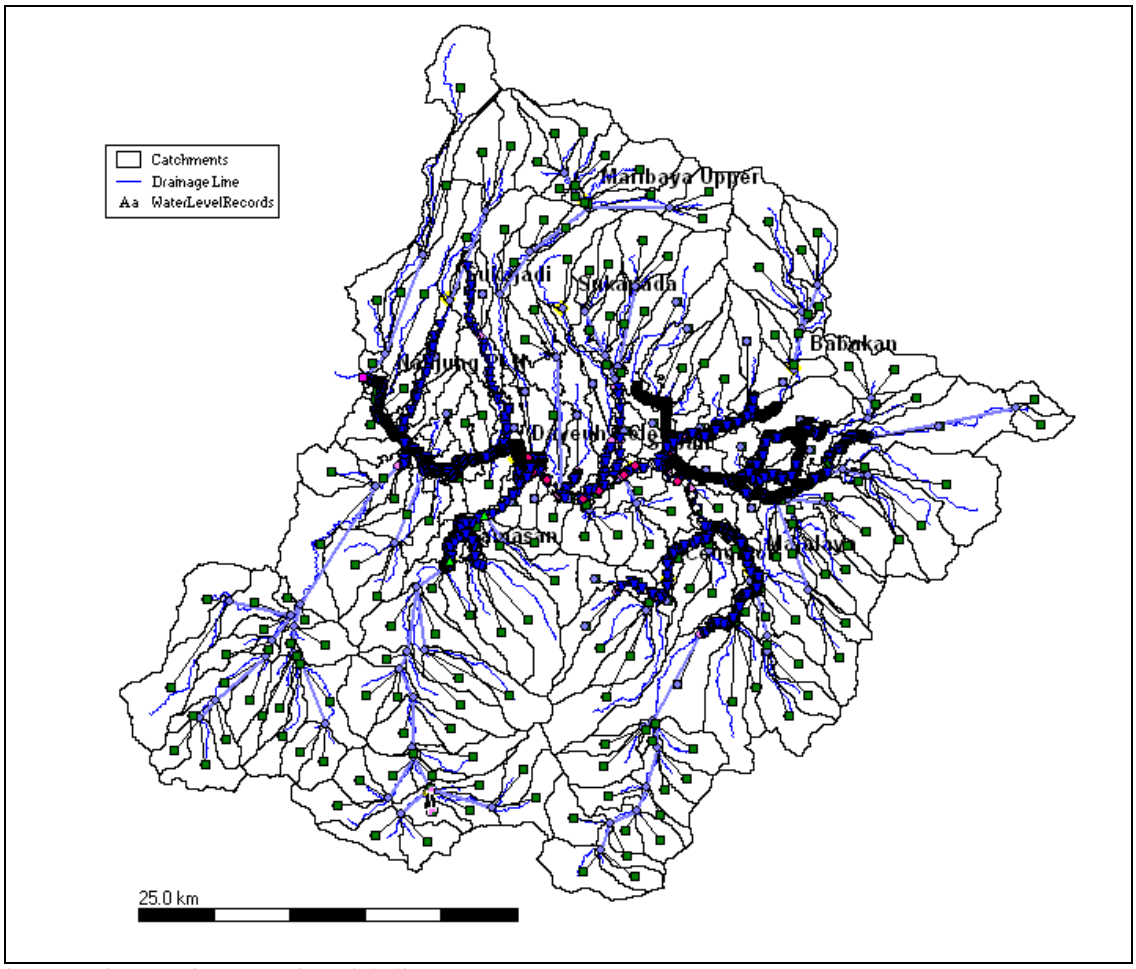
4.2. Hydrology and Hydraulic Analysis by SOBEK

4.2.1. Outline of SOBEK Model

The SOBEK mathematical model developed by Deltares, Delft Hydraulics was used to simulate the river network of the Citarum river and its tributaries. This software has been utilized in an ADB assistance project (UCBFM, ICWRMIP) including the Upper Citarum River Basin. The utilization of this software was required for the Survey since the both results from the Survey and the UCBFM team should be consistent each other. SOBEK is an integrated software package for river, urban or rural management used for a comprehensive overview of waterway systems. SOBEK-Rural, used for modeling irrigation systems, drainage systems, natural streams in lowlands and hilly areas, was applied to set-up the river model network. It incorporates three modules: RR rainfall-runoff model, 1D and 1D2D hydraulic models.

The basin has been divided into 258 sub-catchments and river network is represented by a large number of cross sections and hydraulic infrastructures such as bridges, weirs etc. as explained above. In 1D model, storage nodes are connected to the channel at approximately 1000m intervals. In 1D2D model, storage nodes were replaced by DEM with topographic data. The upstream boundary conditions to the hydrodynamic model are the linked run-off discharges of sub-catchments through

rainfall-runoff process. The downstream boundary condition is the fixed water level at the stable rocky downstream station, Nanjung. The schematic view of the model is given in Figure 4.2.1.1.



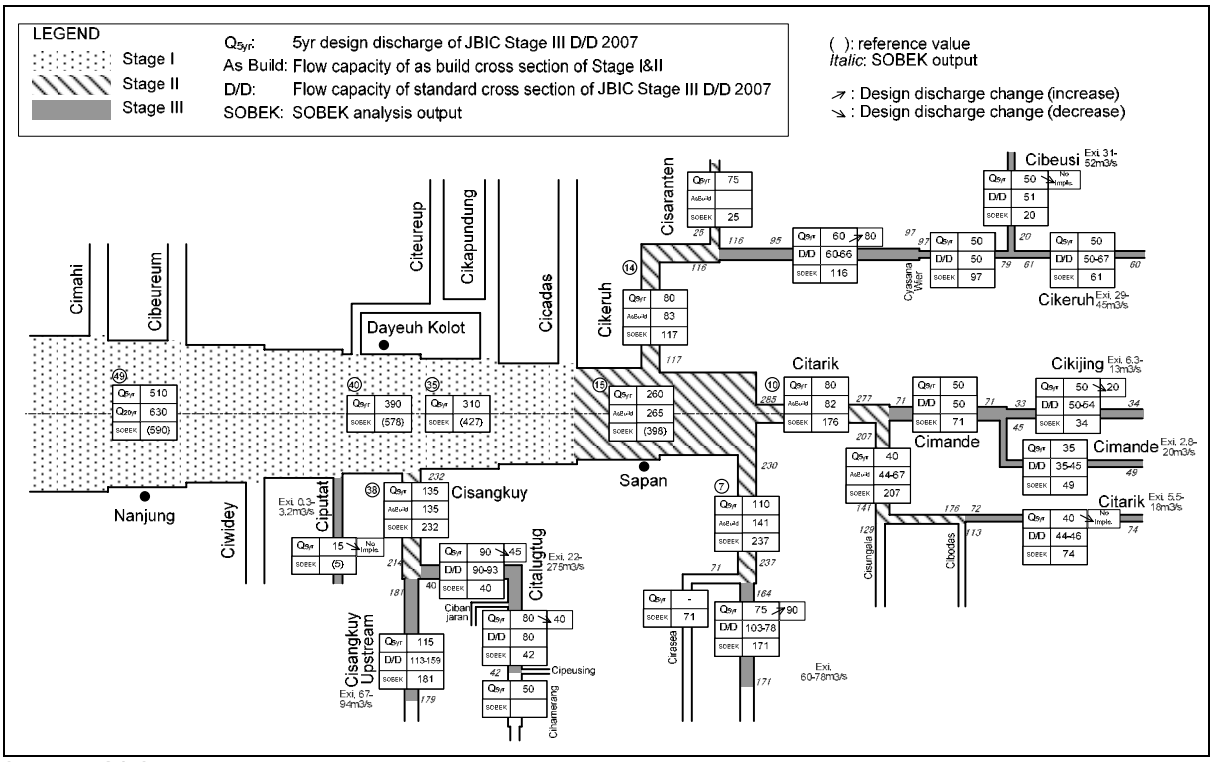
Source: UCBFM, ICWRMIP, ADB (2010)

Figure 4.2.1.1 Schematization of SOBEK Model

4.3. Modification of 2007 D/D

(1) SOBEK analysis output

The SOBEK outputs are arranged in Figure 4.3.1.1. In this figure, besides the peak discharges of SOBEK outputs at typical points (gray and small figures), 5-year return period design discharges and flow capacities of standard cross sections of “As Build”, which are calculated by Slice Method of Manning’s Formula, at the improved segments of Stage (I) and (II) are presented. 5-year return period design discharges and flow capacities of standard cross sections of 2007 detailed design at the Stage (III) segments of 9 tributaries are also presented. 9 tributaries’ design discharges were reviewed and decided based on these SOBEK outputs.



Source: JICA Survey Team

Figure 4.3.1.1 Discharge Distribution Comparison between 2007D/D and SOBEK Output

(2) Deliberation of discharge of tributaries

The 9 tributaries to be improved have been deliberated and have been decided basically following the 2007 D/D as shown in Table 4.3.1.1 and Figure 4.3.1.2. The improved river segments will accommodate approximately a 5-year return period flood or less (the flow capacity of each tributary is determined by SOBEK analysis output and downstream flow capacity). 6 tributaries: Citarum Upstream, Cimande, Cikijing, Cikeruh, Citalugtug, Cisangkuy were assessed to be appropriate for improvement works from a flood control point of view. The Citarik Upstream, Cibeusi and Ciputat were determined to be not so urgent for improvement from the following technical point of view.

Citarik Upstream: After Stage (II), the improved segment of Citarik (downstream of Stage (III) segment) has a flow capacity of 40-80m^3/s and flow increase caused by Stage (III) segment improvement will procure the flood at Stage (II) segment. The improvement design should be done together with the design of other left tributaries such as the Cibotas along the Citarik upstream.

Cibeusi: In its current condition, it can accommodate a 5-year return period flood. River improvement can be done as an excess flood countermeasure in the future.

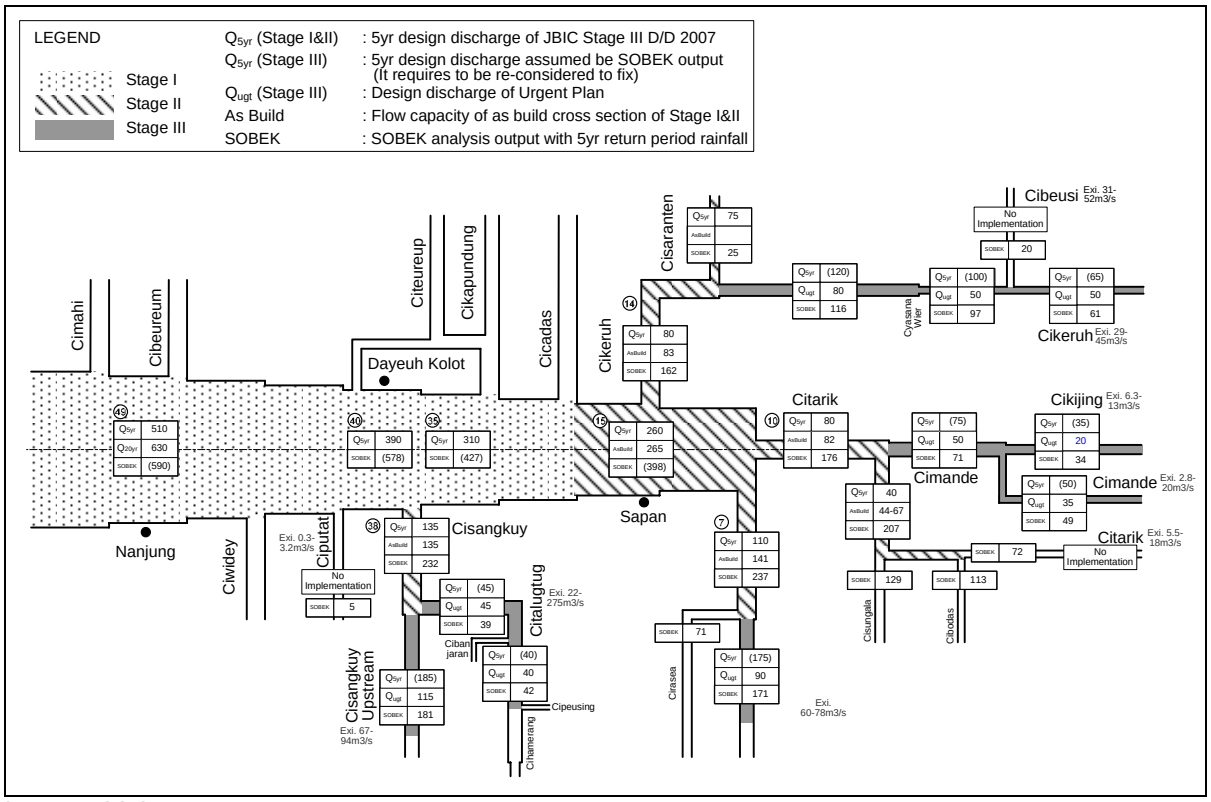
Ciputat: This reach can be affected by the backwater of the Citarum main. River improvement can be huge scale with a floodgate and a pump station at the confluence of the Citarum mainstream while the affected area is small.

Table 4.3.1.1 Modified Design Discharge

Tributaries	Design Discharge of 2007D/D	Modified design discharge
Citarum Upstream	75 m^3/s	90 m^3/s
Citarik upstream	40 m^3/s	-
Cimande	50－35 m^3/s	50－35 m^3/s
Cikijing	50 m^3/s	20 m^3/s
Cibeusi	50 m^3/s	-
Cikeruh	60－50 m^3/s	90－50 m^3/s
Citalugtug	90－80 m^3/s	45－40 m^3/s
Cisangkuy	115 m^3/s	115 m^3/s
Ciputat	15 m^3/s	-

Red: design discharge change (increase compared to 2007 D/D), Blue: design discharge change (decrease compared to 2007 D/D)

Source: JICA Survey Team and 2007 D/D



Source: JICA Survey Team

Figure 4.3.1.2 Design Discharge Distribution

(3) Modification of Standard Cross Sections and Longitudinal Profile

Based on the change of the design discharges and the above basic concepts, standard cross sections were modified as shown in Table 4.3.1.2. As for Cikijing and Citalugtug, as water depth and riverbed elevation are changed, longitudinal profiles were also modified. The standard cross sections and longitudinal profile of the 6 tributaries to be improved are presented in Appendix.

Table 4.3.1.2 Modification of Standard Cross Sections

River	Standard XS Type	Segment		Former Design Discharge	New Design Discharge	River Width			Bottom Width			Water Depth		
						Former	Modified	Ratio	Former	Modified	Ratio	Former	Modified	Ratio
		From	To	m3/s	m3/s	m	m	-	m	m	-	m	m	-
Citarum Upstream	Type I	0.000	0.367	75	**90**	24.5	24.5		6.5	6.5		4.00	4.00	
	Type II	0.367	2.389			24.5	24.5		8.5	8.5		3.50	3.50	
	Type III	2.389	3.839			22.5	22.5		6.5	6.5		3.50	3.50	
	Type IV	3.839	5.547			13.0	**14.5**	1.12	9.0	**10.5**	1.17	3.50	3.50	
Cimande	Type I	0.035	1.190	50	50	24.0	24.0		6.0	6.0		4.00	4.00	
	Type II	1.270	6.522	35	35	19.2	19.2		4.0	4.0		3.30	3.30	
	Type III-V 1/1500	6.668	7.988			18.0	18.0		4.0	4.0		3.00	3.00	
	Type III-V 1/1000	7.988	9.537			18.0	18.0		4.0	4.0		3.00	3.00	
Cikijing	Type I	0.000	1.516	50	*20*	24.0	*18.5*	*0.77*	6.0	*4.5*	*0.75*	4.00	*3.00*	*0.75*
	Type II	1.516	3.131			22.0	*17.0*	*0.77*	4.0	*3.0*	*0.75*	4.00	*3.00*	*0.75*
	Type III&IV	3.131	6.679			20.0	*15.0*	*0.75*	4.0	*3.0*	*0.75*	3.50	*2.50*	*0.71*
Cikeruh	Type I	0.375	1.315	60	**80**	23.8	**27.8**	1.17	6.0	**10.0**	1.67	3.95	3.95	
	Type II	1.315	3.016			21.5	**25.0**	1.16	5.5	**9.0**	1.64	3.50	3.50	
	Type III Lower	3.016	4.046			19.5	**21.5**	1.10	3.5	**5.5**	1.57	3.50	3.50	
	Type IV Lower	4.046	5.223			11.2	**14.0**	1.25	7.2	**10.0**	1.39	3.50	3.50	
	Type III Upper	5.223	5.549			19.5	**21.5**	1.10	3.5	**5.5**	1.57	3.50	3.50	
	Type IV Upper	5.549	5.997			11.2	**14.0**	1.25	7.2	**10.0**	1.39	3.50	3.50	
	Type V 1/800	5.997	7.634	50	50	10.7	10.7		7.0	7.0		3.20	3.20	
	Type V 1/450	5.997	7.634			10.7	10.7		7.0	7.0		3.20	3.20	
	Type VI	7.634	8.398			9.1	9.1		5.5	5.5		3.10	3.10	
Cisangkuy Upstream	Type I	6.650	7.187	115	115	29.0	29.0		7.0	7.0		5.00	5.00	
	Type II	7.187	11.064			24.5	24.5		4.5	4.5		4.50	4.50	
Citalugtug	Type I	0.000	1.398	90	*45*	24.7	*20.0*	*0.81*	6.7	*6.0*	*0.90*	4.00	*3.00*	*0.75*
	Type II	1.398	2.226			15.7	*13.0*	*0.83*	6.7	*6.0*	*0.90*	4.00	*3.00*	*0.75*
	Type III 1/750	2.226	2.637			15.5	*12.5*	*0.81*	6.5	*5.5*	*0.85*	4.00	*3.00*	*0.75*
	Type III 1/700	2.637	3.219			15.5	*12.5*	*0.81*	6.5	*5.5*	*0.85*	4.00	*3.00*	*0.75*
	Type IV	3.219	4.049	80	*40*	11.0	*8.5*	*0.77*	6.5	*5.0*	*0.77*	4.00	*3.00*	*0.75*

Bold: Design discharge increased, *Italic* : Design discharge decreased
Dot cell: Cross Section Changed
Dark cell: Cross Section Changed

Source: JICA Survey Team

(4) Required Land Acquisition Area and House Relocation

For the 6 tributaries to be improved, the required land acquisition area and the number of houses to be relocated were calculated. The required land acquisition area is defined as areas within the Right of Way (ROW) excluding the river channel. After the extents of ROW based on the standard design cross-section drawing were superimposed over the land use data, the land use within ROW is allocated with GIS. Google Earth satellite images were primarily used to estimate the number of houses within the ROW. The breakdown of the required land acquisition area (112 ha) and the number of houses to be relocated (369) is presented in Table 4.3.1.3 for the targeted river channels.

Table 4.3.1.3 Required Land Acquisition Area and Number of Houses to be Relocated

Tributaries	Land Acquisition Area				House Relocation
	Agricultural Land	Residential Area	Idle Space	Total	
Unit	ha				house
Citarum Upstream	9.5	1.9	1.2	12.5	34
Cimande	26.7	4.1	0.7	31.5	16
Cikijing	18.6	2.6	0.0	21.2	40
Cikeruh	12.2	11.3	0.0	23.5	190
Cisangkuy Upstream	12.6	1.9	0.0	14.5	25
Citalugtug	6.0	4.7	0.0	10.6	64
Total(6tiributaries)	85.6	26.4	1.9	113.9	369

Source: JICA Survey Team

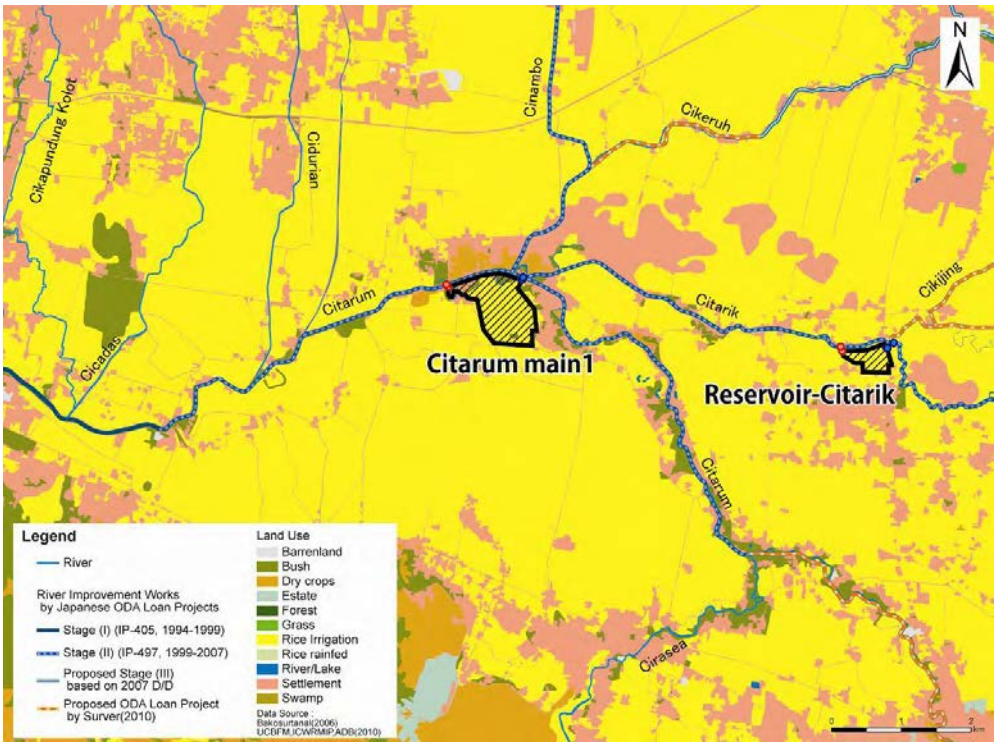
4.4. Impact Assessment for Downstream Reach

The increase of discharge at the Citarum downstream due to the improvement of the 6 tributaries would cause the negative impacts in the Citarum mainstream. Since serious land subsidence, which can be seen in Dayeuh Kolot, has occurred along the Citarum main river, the negative impacts can result in a substantial increase in inundation damage. As a result of the assessment, Cisangkuy river improvement works may cause serious negative impacts on Dayeuh Kolot. Citarum Upstream and Citalugtug may also cause negative impacts, which are relatively small. The remaining three tributaries (Cimande, Cikijing, and Cikeruh) don’t contribute to serious impacts on Dayeuh Kolot.

4.5. Retarding Reservoirs

As presented, a considerable increase in peak discharge in the Citarum main river is anticipated in areas such as Dayeuh Kolot due to the improvement of the 6 tributaries (Figure 4.5.1.1). Therefore, to mitigate the increase of peak discharge, placing reservoirs at Citarik and Citarum at Sapan was considered.

Firstly, 4 candidate reservoirs along the Citarik, Citarum mainstream, Reservoir-Citarik and Reservoir-Citarum Main 1-3 were nominated. The candidate locations of these reservoirs were to be located in paddy fields to avoid the massive relocation of houses. As a result of the hydraulic simulation analysis with SOBEK model, placing reservoirs at Citarik at the confluence of Cimande and Citarum at Sapan have been proven to be effective.

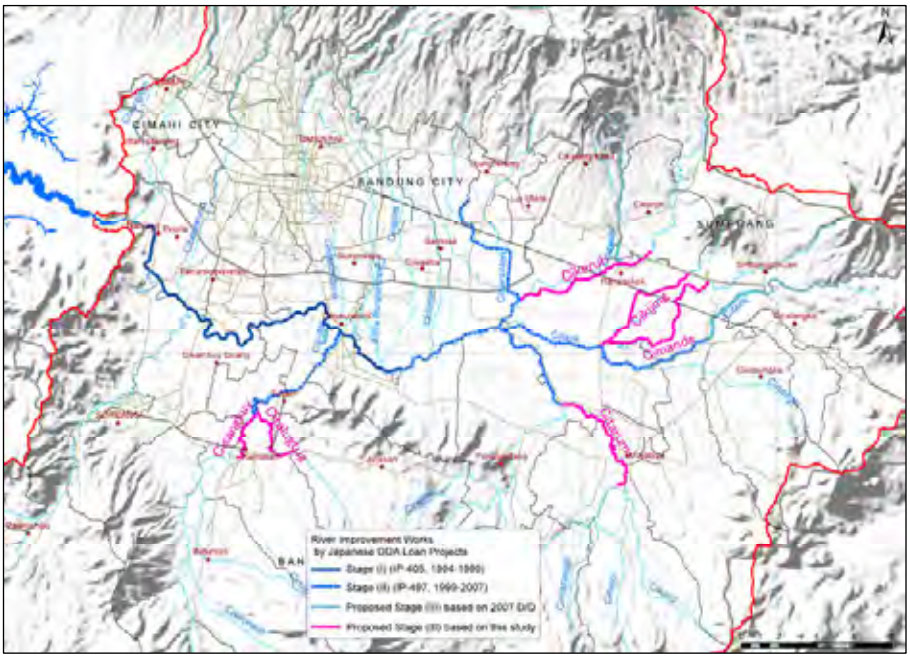


Source: JICA Survey Team

Figure 4.5.1.1 Location of the Retarding Reservoirs (Citarum Main 1 and Citarik)

4.6. Definitive Design for the 9 Tributaries

The 6 tributaries to be improved have been decided as shown in Table 4.6.1.1 and Figure 4.6.1.1. These decisions basically follow the 2007 D/D. The improved river segments will accommodate approximately a 5-year return period flood or less. Figure 4.6.1.2 shows the design discharge distribution of each tributary. The Citarik Upstream, Cibeusi and Ciputat were determined to be inappropriate for improvement from a technical point of view.



Source: JICA Survey Team

Figure 4.6.1.1 Location of the Retarding Reservoirs (Citarum Main 1 and Citarik)

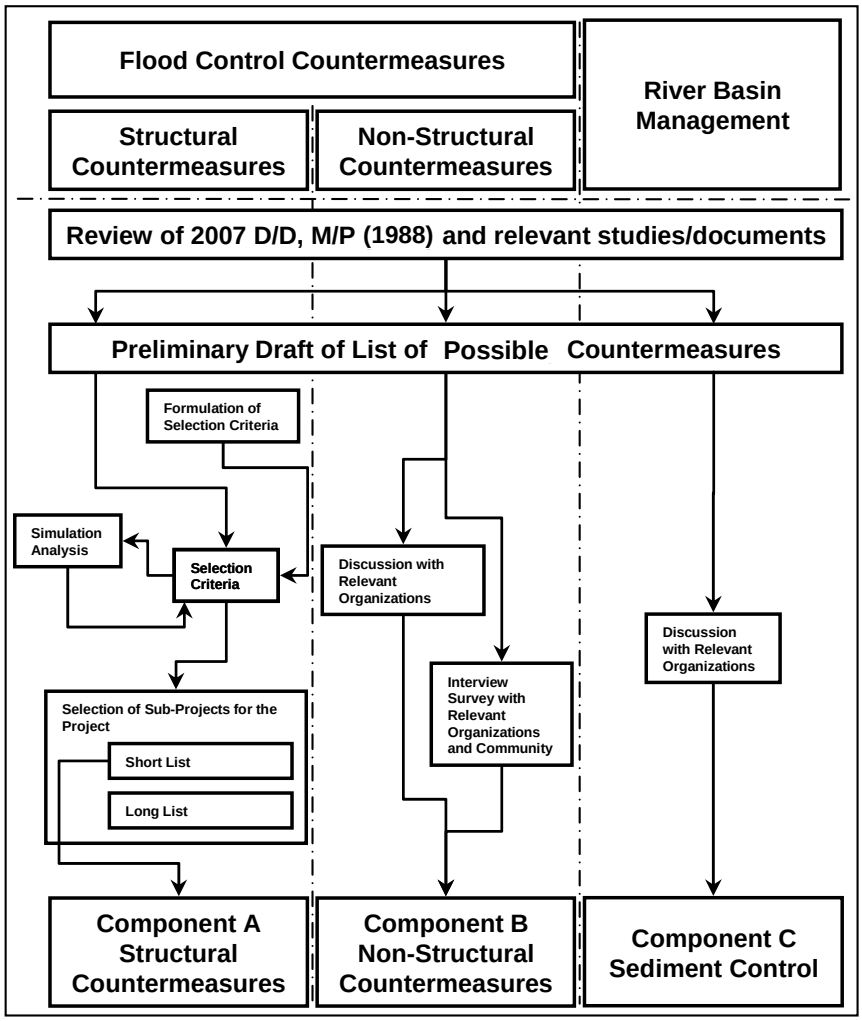
CHAPTER 5 DELIBERATION OF THE PROJECT COMPONENTS

5.1. Objectives of the Project

JICA has been supporting the mitigation of flood damage in the Upper Citarum River Basin since the 1980s, especially through the implementations of "Upper Citarum Basin Urgent Flood Control Project (I) & (II)". The Project is aimed at contributing to the completion of the Urgent Flood Control Plan, continued from the Stages (I) & (II). Included in the Project is a series of Non-Structural Countermeasures comprised of Institutional Strengthening for BBWSC, Capacity Development for Community against Flood Disaster, and Sediment Control. The Project is therefore considered significant in terms of the economic development of the Indonesian economy.

5.2. Process of Deliberation of the Project Components

The Project comprises of three components: 1) Structural Countermeasures, 2) Non-Structural Countermeasures and 3) River Basin Management (Sediment Control). Figure 5.2.1.1 shows a brief representation of the procedure for deliberation of the project components.



Source: JICA Survey Team

Figure 5.2.1.1 Process of Deliberation of the Project Components

5.3. Structural Countermeasures

5.3.1. Draft of Possible Countermeasures

Based on the review of the relevant study reports/documents (*e.g.* 2007 D/D, M/P in 1998, *etc.*), a draft of the candidate sub-projects and possible countermeasures was created (refer to Table 5.3.1.1).

Table 5.3.1.1 Draft of Candidate Sub-Projects for Structural Countermeasures

Candidate Sub-Project or Countermeasures for Flood Control Countermeasures (Structural Countermeasures)				
Structural Countermeasures	Upper Tributaries	River Improvement Works	9 Tributaries	Citarum Upstream
				Citarik Upstream
				Cimande
				Cikijing
				Cikeruh
				Cibeusi
				Cisangkuy Upstream
				Citalugtug
				Ciputat
			Other Tributaries	Cirasea
				Cisunngala
				Cibodas
				Cicadas
				Cidurian
				Cikapundung
				Citepus
				Cikapundung Kolot
	Citarum Main	Dredging Works for the Completed Sections during Stage (I) and (II)		
		Retarding Reservoir	Citarum Main -1	
			Citarum Main -2	
			Citarum Main -3	
			Citarik -1 (after the confl. of Cimande)	
			Oxbow	
		Installation of Flood Walls nearby Dayeuh Kolot		
		Construction of Dyke nearby Dayeuh Kolot		
		Diversion Channel		

Source: JICA Survey Team

5.3.2. Formulation of Selection Criteria

The following selection criteria were formulated in order to select prioritized sub-projects in terms of structural countermeasures. Refer to Table 5.3.3.1 for the definitions.

1) Flood Damage Potential
2) Flood Control Effect
3) Impact on Dayeuh Kolot
4) Houses to be relocated (Social Impact)
5) Acquisition of Agricultural Land (Social Impact)
6) Direct Cost
7) Existence of Detailed Survey Data

5.3.3. Selection of Prioritized Sub-Projects (Short List) and Long List

Table 5.3.3.1 shows the results of the selection of prioritized sub-projects (Short List), Long List and the others at the end of this chapter.

(1) Long List

In this sub-section, the reasons for selection or exclusion of sub-projects from the possible countermeasures for the Long List are explained. The Long List consists of a series of candidate sub-projects included in the Project.

Some of the candidate sub-projects were excluded from the Long List. “Dredging Works for the Completed Sections during Stage (I) and (II)” cannot be included in the Long List (or excluded from the Project), since the dredging works for the completed sections during Stage (I) and (II) along the Citarum main river should be implemented as the ordinal O & M activity of GOI. “Installation of Flood Walls nearby Dayeuh Kolot” was also excluded from the Project, because it requires excessive costs in the aspect of the construction and operation & maintenance. Increasing the height of the flood wall will be required repeatedly depending on the extent of continuous land subsidence, which also increases the risk of potential flood damage in case of collapse of the wall. “Construction of Dyke nearby Dayeuh Kolot” was also excluded from the Project due to similar reasons. This also requires a large amount of resettlement. “Diversion Channel” was also excluded considering the excessive cost and resettlement. The utilization of oxbows along the Citarum main river as retarding reservoirs is not feasible from a technical point of view, since the oxbows have a limited effect in terms of flood control when there is excessive flood discharge.

Among the possible countermeasures, the countermeasures which satisfy the following features were excluded to result into the Long List.

- the ordinal O & M activity of GOI
- excessive costs in the aspect of the construction and operation & maintenance
- limited effect in terms of flood control

(2) Short List (Prioritized Sub-Projects)

In this sub-section, the reasons for selection of the Short List sub-projects taken from the Long List (or exclusion from the Short List) are explained. The Short List consists of a series of sub-projects with higher priority considering the selection criteria from the Long List. The short listed sub-projects are expected to be implemented during the Project. Any sub-project in the Short List can be interchanged with any sub-project on the Long List and vice versa under certain conditions. Refer to Chapter 10 for details.

The sub-projects of river improvement works for the other upper tributaries cannot be included in the Short List, since necessary survey results and drawings do not exist. Surveying is necessary prior to design analysis.

The sub-projects for retarding reservoirs along the Citarum main river also cannot be included in the Short List considering the significant social impact (Large-sized Resettlement).

As mentioned in Chapter 4, the 9 tributaries river improvement works were reviewed and deliberated from a technical viewpoint. As a result, the 6 tributaries (Citarum Upstream, Cimande, Cikijing, Cikeruh, Cisangkuy Upstream and Citalugtug) have been selected. Additionally, the Citarik Upstream, Cibeusi and Ciputat were excluded from the Short List.

From the remaining sub-projects for the 6 tributaries (Citarum Upstream, Cimande, Cikijing, Cikeruh, Cisangkuy Upstream and Citalugtug), the prioritized sub-projects were carefully examined and selected. Table 5.3.3.2 shows the indicators for "Flood Damage Potential", "Flood Control Effect", "Impact on Dayeuh Kolot", "Social Impact (Houses to be relocated)", and "Direct Cost" as a part of the selection criteria.

From the viewpoint of "Flood Damage Potential", the Citarum Upstream, Cikijing and Cikeruh show a higher potential value, which means higher priority compared to the other three tributaries. The indicator "Flood Control Effect" indicates that a greater positive impact is expected from improvement works for Cimande, Cikijing and Cikeruh. Citalugtug was excluded from the Short List, since the flood control effect is much lower than the others. From the viewpoint of "Impact on Dayeuh Kolot" due to river improvement of the upper tributaries, Cisangkuy results in the most negative impact on Dayeuh Kolot and thus Cisangkuy was dropped from the Short List.

On the basis of the indicators of "Flood Damage Potential"," Flood Control Effect" and "Impact on Dayeuh Kolot", Citarum Upstream, Cimande, Cikijing, Cikeruh can be recommended.

However, it is necessary to consider the social impact due to river improvement. Taking the social impact into account, Cikeruh improvement is implemented to the downstream segment: 2.5km.

Table 5.3.3.2 Selection of Prioritized Sub-Projects (Short List) <Extraction from Table 5.3.3.1>

Tributary	Short List	Length	Flood damage Potential	Flood control effect	Impact on DK	Direct cost	Social impact
							Houses to be relocated
		m	Rp. Billion	Rp. Billion	-	Rp. Billion	house
Citarum Upstream	○	5,450	1,063	112	0.21	44.8	34
Cimande	○	9,510	196	1,147	Slight	44.5	16
Cikijing	○	6,680	513	563	Slight	44.0	40
Cikeruh(up to 2.5km)	○	2,500	557	626	Slight	21.9	34
Cikeruh(upstream)	-	5,150				77.7	156
Cisangkuy Upstream	-	3,730	188	82	1.67	40.3	25
Citalugtug	-	4,010	258	65	0.24	51.5	64

Source: JICA Survey Team

5.3.4. Replacement of Sub-Projects

As stated above, the Component A (Structural Countermeasures) is composed of 4 sub-projects as the results of selection of prioritized known as the Short Listed projects to be supposed to be implemented during the Project period. Any sub-project in the Short List can be interchanged with sub-projects on the Long List and vice versa under certain condition. The sub-project can be re-analyzed and proposed by GOI, if it satisfies the selection criteria as well as the conditions stated hereunder.

5.4. Non-Structural Countermeasures

5.4.1. Draft of Possible Countermeasures

Compared to the progress of structural countermeasures in the Upper Citarum River Basin, there has been less progress in terms of non-structural countermeasures. It is indispensable to carry out non-structural countermeasures along with structural measures. Based on a review of the relevant study reports/documents (*e.g*. 2007 D/D, M/P in 1998, *etc*.), a draft of candidate sub-projects or countermeasures from the possible countermeasures was created (refer to Table 5.4.1.1).

Table 5.4.1.1 Draft of Candidate Sub-Projects for Non-Structural Countermeasures

Candidate Sub-Project or Countermeasures as Flood Control Countermeasures (Non-Structural Countermeasures)			
Non-Structural Measures	Floodplain Management	Preparation and delivery of Flood Hazard Map	
		Community Disaster Prevention Activity	Flood fighting activity
			Emergency Supply Goods Storage
			Education in School
			Evacuation Drill, etc.
		Institutional Strengthening	Rehabilitation of the System installed in Stage (II)
			Technical support and advise for the existing system and the future system of Indonesian side
			Land use regulation for flood-prone area
			Flood-proofing structure
	Runoff Storage and Infiltration Measures	Urban Area	On-site storage
			Infiltration Pavement
			Retention Area
		Upstream Recharge Area	Preservation of Forest
			Land use regulation

Source: JICA Survey Team

5.4.2. Profile of Activity for Non-Structural Countermeasures

The activities for Component B were selected through discussions with the relevant organizations of GOI (*i.e*. BBWSC, DGWR, BAPPENAS, *etc*.) and the Survey Team. Interview surveys were also carried out for the governmental agencies or individuals (*e.g*. BBWSC, Kabupaten Bandung, residents, *etc*.) in order to formulate the activities. Table 5.4.2.1 and 5.4.2.2 show the profiles of activities for non-structural countermeasures.

Table 5.4.2.1 Profile of Activity for Non-Structural Countermeasures (Institutional Strengthening for BBWSC)

Implementation Agency	Balai Besar Wilayah Sungai Citarum: BBWSC
Activity	1) Institutional Strengthening for Early Warning System (EWS) ・Strengthening of the existing Automated Water Level System (AWLS) for Early Warning ・Strengthening of Information Network System connecting Upper, Middle and Lower areas in the Citarum River Basin ・Strengthening Early Warning Communication System (PUSAIR, Kab., Kota, BPBD, Community) ・Data Storage and Data Accumulation for Reliable Early Warning System, *etc.* 2) Strengthening for Operation & Maintenance (O&M) ・Regular Monitoring for River Structure ・Regular Dredging as ordinal O&M activity, *etc.*

Source: JICA Survey Team

Table 5.4.2.2 Profile of Activity for Non-Structural Countermeasures (Capacity Development for Community against Flood Disaster)

Implementation Agency	BBWSC in associated with Community (Desa), Kab. Bandung and PUSAIR
Purpose	Coping Capacity against Flood Disaster will be strengthened or developed at community level.
Activity	1) Application of Flood Hazard Mapping prepared by ADB project 2) Reinforcement of Desa activity (LMD) through BBWSC supports (Temporary Flood Walls, Sand bags, Commodities, etc.) 3) Community discussion forum 4) Prevention education in school, Evacuation Drills, etc.
Outputs	The following capacity will be raised through the activities. 1) Establishment of Information flow network involving communities 2) Enhancement of Flood fighting capacity, evacuation, etc.

Source: JICA Survey Team

5.5. River Basin Management

5.5.1. Draft of Possible Countermeasures

Many issues related to flood disaster have occurred such as: i) Land subsidence, ii) Heavy metal contamination, iii) Excessive sediment runoff and deposition, iv) a decrease in water quality of the river and reservoir, v) Waste disposal to river, etc. due to population increase, urbanization, and the increasing tempo of economic and social activities in the basin. Such issues cannot be dealt with by only flood control. The draft of the possible countermeasures was created (refer to Table 5.5.1.1).

Table 5.5.1.1 Draft of Candidate Sub-Projects for River Basin Management

Candidate Sub-Project or Countermeasures as Flood Control Countermeasures (River Basin Management)				
River Basin Management	Sediment Discharge Control	Cirasea Sub-Watershed (11,500ha)	Sediment Discharge Control (Communities' participation)	Check Dam
				Small Check Dam
				Gully Plug
				Bank Conservation Works
				Farmland and Forest Land Conservation
				Establishment of Terrace
			Rain Water Runoff Control	Absorbing Well
			Supporting Activities	Road Construction & Improvement
				Irrigation System
				Water Supply
			Soft Measures	Environmental Enlighten
				Natural Resources Management
				Group Management
				Land Use Management
				Self-reliance
		Citarik Sub-watershed		
		Cikapundung Sub-watershed		
		Ciwidey Sub-watershed		
		Cisangkuy Sub-watershed		
	Measure for Old-channel	Measure for Garbage	Environment Improvement and People's education	
		Filling up		
	Measure for Land Subsidence	Control of Abstraction		
		Alternative Water Sources		
		Improvement of recycle of industry water usage		
		Relocation of Factory		
	Water Quality	Domestic Measure	Sewerage System	
			Septic Tank	
		Industrial Measure	Control of Effluent	
			Monitoring of Effluent	
			Effluent Treatment Facility	
		Non-point source	Agricultural measure to protect environment	
			Rainwater Storage	
	Measure for	People's education		
		Improvement of Garbage collection system		

Source: JICA Survey Team

5.5.2. Profile of Activity for River Basin Management

The activities for River Basin Management were selected through the discussions with the relevant organizations of GOI (*i.e*. BBWSC, DGWR, BAPPENAS, *etc*.). The name of this component was titled "Component C for Sediment Control" through the discussion.

Table 5.5.2.1 Profile of Activity for Sediment Control as Component C

Construction of 5 check dams and 261 small check dams by participatory method at 24 target desa in Cirasea Sub-watershed Empowerment for the people at the community level - Raising awareness of the necessity for improved environmental management - Raising of the sense of ownership - Emphasizing the use of local resources for peoples' welfare

Source: JICA Survey Team

Table 5.3.3.1 Long List and Selection Results of the Sub-Projects (Structural Countermeasures)

Candidate Sub-Project or Countermeasures as Flood Control Countermeasures (Structural Countermeasures)					Dimension	Possible Counter-measures	Classification of Sub-Project (Countermeasure): Next ODA Loan: Long List	Next ODA Loan: Short List	Next ODA Loan: Excluded from Short List	Others: Counter-measures by GOI	Others: Others	Selection Criteria: Flood Damage Potential (B. Rp.)	Flood Control Effect (B. Rp.)	Impact on DK (-)	Social Impact: Houses to be relocated (house)	Social Impact: Acquisi-tion of Agri-cultural Land (ha)	Direct Cost (B. Rp.)	Existence of Detailed Survey Data	Remarks
						*1	*2	*3	*4	*5	*6	*7	*8	*9	*10	*11	*12	*13	
Structural Countermeasures	Upper Tributaries	River Improvement Works	9 Tributaries	Citarum Upstream	L=5,450m	○	○	○				1,063.3	112	0.21	34	9.5	44.8	○	-
				Citarik Upstream	L=4,820m	○	○		○			320.0	−	Slight	-	-	Middle	○	As mentioned in Chapter 4, the sub-project for Citarik river was exluded from the Short List. Then, the indicators for "Flood Control Effect" and "Social Impact (Houses to be relocated, Acquisition of Agricultural Land)" were not estimated.
				Cimande	L=9,510m	○	○	○				196.4	1,147	Slight	16	26.7	44.5	○	-
				Cikijing	L=6,680m	○	○	○				513.4	563	Slight	40	18.6	44.0	○	-
				Cikeruh (downstream)	L=2,500m	○	○	○				556.6	626	Slight	34	6.9	21.9	○	-
				Cikeruh (upstream)	L=5,150m	○	○		○						156	5.3	77.7		-
				Cibeusi	L=1,360m	○	○		○			42.4	-	Slight	-	-	Middle	○	As mentioned in Chapter 4, the sub-project for Citarik river was exluded from the Short List. Then, the indicators for "Flood Control Effect" and "Social Impact (Houses to be relocated, Acquisition of Agricultural Land)" were not estimated.
				Cisangkuy Upstream	L=3,730m	○	○		○			188.1	82	1.67	25	12.6	40.3	○	-
				Citalugtug	L=4,010m	○	○		○			257.6	65	0.24	64	6.0	51.5	○	-
				Ciputat	L=660m	○	○		○			70.3	-	None	-	-	Middle	○	As mentioned in Chapter 4, the sub-project for Citarik river was exluded from the Short List. Then, the indicators for "Flood Control Effect" and "Social Impact (Houses to be relocated, Acquisition of Agricultural Land)" were not estimated.
			Other Tributaries	Cirasea	-	○	○		○			-	-	-	-	-	-	△	GOI has implemented the excavation works for 1km section in 2009. However, the survey needs to be implemented before the design since the existing survey map shows a limited part. Surveying is necessary prior to design analysis. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK,
				Cisunngala	-	○	○		○			-	-	-	-	-	-	×	There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK, Social Impact and Direct Cost) were not estimated.
				Cibodas	-	○	○		○			-	-	-	-	-	-	×	There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK, Social Impact and Direct Cost) were not estimated.
				Cicadas	-	○	○		○			-	-	-	-	-	-	×	There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK, Social Impact and Direct Cost) were not estimated.
				Cidurian	-	○	○		○			-	-	-	-	-	-	×	There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK, Social Impact and Direct Cost) were not estimated.
				Cikapundung	-	○	○		○			-	-	-	-	-	-	×	There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK, Social Impact and Direct Cost) were not estimated.
				Citepus	-	○	○		○			-	-	-	-	-	-	×	There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK, Social Impact and Direct Cost) were not estimated.
				Cikapundung Kolot	-	○	○		○			-	-	-	-	-	-	×	There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis. The indicators (Flood Damage Potentilal, Flood Control Effect, Impact on DK, Social Impact and Direct Cost) were not estimated.
	Citarum Main	Dredging Works for the Completed Sections during Stage (I) and (II)			-	○				○		-	○	-	Not Large	Not Large	Middle	○	The river excavation works for the main Citarum river should be implemented as the original O&M activity of GOI.
		Retarding Reservoir		Citarum Main -1	A=2,054,000m^2	○	○		○			-	○	None	Not Large	Large	115	×	This plan cannot be implemented urgently (or short term) considering the social impact, etc.
				Citarum Main -2	A=5,906,000m^2	○	○		○			-	○	None	Not Large	Large	328	×	This plan cannot be implemented urgently (or short term) considering the social impact, etc.
				Citarum Main -3	A=4,238,000m^2	○	○		○			-	○	None	Not Large	Large	237	×	This plan cannot be implemented urgently (or short term) considering the social impact, etc.
				Citarik -1 (after the confl. of Cimande)	A=175,000m^2	○	○		○			-	○	None	Not Large	Large	56	×	This plan cannot be implemented urgently (or short term) considering the social impact, etc.
				Oxbow	A=43,193m^2	○					○	-	×	None	Not Large	Large	Small	×	Oxbows have few positive effect in terms of flood control considering limited volume.
		Installation of Flood Walls nearby Dayeuh Kolot			-	○					○	-	○	-	Not Large	Not Large	Large	×	In the aspect of the construction cost and the operation & maintenance, this plan cannot be implemented urgently (or short term) due to its high cost, etc.
		Construction of Dyke nearby Dayeuh Kolot			-	○					○	-	○	-	Large	Large	Large	×	In the aspect of the construction cost and the operation & maintenance, this plan cannot be implemented as urgently (or short term) due to its high cost. The plan cannot be implemented considering the social impact.
		Diversion Channel			-	○					○	-	○	-	Large	Large	Large	×	This plan cannot be implemented urgently (or short term) considering the social impact, etc.

Source: JICA Survey Team

Note:

*1: Possible Countermeasures
- Possible Countermeasures in the Upper Citarum River Basin for reducing flood damages without regard to Term Classification (Short, Middle and Long)

*2: Long List
- A series of Candidate Sub-Projects for the Next ODA Loan Project
- The following countermeasures are excluded from "Possible Countermeasures":
  - Countermeasures to be improved by GOI as ordinal O&M activity
  - Countermeasures not included as sub-project for JICA Yen Loan considering a) Required budget is too large, b) Advanced Tech., Cost, Institution are necessary for O&M, etc.
  - Countermeasures not to be expected from the technical view point of flood control effect

*3: Short List
- Sub-projects selected as higher priority considering the Selection Criteria from Long List.

*4: Excluded from Short List
- A series of Sub-Projects which are lower priority. This type of Sub-Project can be implemented (short-listed) under certain conditions.

*5: Countermeasures implemented by GOI
- The countermeasure which is supposed to be implemented by GOI, thus excluded from the next ODA loan project.

*6: Others
- The countermeasure which is not expected to be implemented as urgent or prioritized measures.

*7: Flood Damage Potential (unit: billion rupiah)
- This indicates the flood damage potential based on the total amount of property in the flood areas of the 1986, 2005, 2006, 2007 and 2010 floods.
  "-": Not estimated

*8: Flood Control Effect (unit: billion rupiah)
- This indicator shows the potential flood damage reduction amount due to the river improvement works for a 5-year return period flood.
  ○: Potential flood damage reduction can be expected due to the construction works.
  ×: Salient flood damage reduction cannot be expected.
  "-": Not estimated

*9: Impact on DK
- This indicator shows the potential discharge impact on Dayeuh Kolot due to improvement works of each tributary or construction of river facility.
- The ratio between increased discharge due to tributary improvement works and downstream river storage capacity
  None: No impact on Dayeuh Kolot due to improvement works
  Slight: Very small impact on Dayeuh Kolot due to improvement works
  Less than 1.0: Increased discharge due to tributary improvement works will not cause serious impact on Dayeuh Kolot.
  More than 1.0: Increased discharge due to tributary improvement works is expected to cause serious impact on Dayeuh Kolot.
  "-": Not estimated

10*: Social Consideration in terms of Resettlement
- An assessment on the possibility of large resettlement was carried out for each sub-project.
- The expected number of relocated houses were counted for the sub-projects for the tributaries (Citarum Upstream, Cimande, Cikijing, Cikeruh, Cisangkuy Upstream, Citalugtug).
- The other sub-projects were also assessed following to the indicator as below:
  Large: Large-sized resettlement is expected.
  Not Large: Large-sized resettlement is not expected.
  "-": Not estimated

11*: Social Consideration in terms of Acquisition of Paddy fields, etc.
- An assessment on the possibility of large acquisition was carried out for each sub-project.
- The expected area of acquisition of Agricultural land were estimated for the sub-projects for the tributaries (Citarum Upstream, Cimande, Cikijing, Cikeruh, Cisangkuy Upstream, Citalugtug).
  Large: Large-sized acquisition is expected.
  Not Large: Large-sized acquisition is not expected.
  "-": Not estimated

12*: Direct Cost (unit: billion rupiah)
- The direct costs were estimated for the tributaries (Citarum Upstream, Cimande, Cikijing, Cikeruh, Cisangkuy Upstream, Citalugtug) including improvement works and excavation works.
- The direct costs for the retarding reservoirs (Citarum Main -1, Citarum Main -2, Citarum Main -3 and Citarik -1) along the Citarum main river were roughly estimated.
- Except for the estimated direct cost for tributaries and retarding reservoirs, the cost was assessed with the three conceptual classifications (Large, Middle and Small) based on the past practices and experiences.
  Large: >1,000 billion Rp.
  Middle: between 10 billion Rp. and 1,000 billion Rp.
  Small: <10 billion Rp.
  "-": Not estimated
- The cost should be estimated more accurately during the detailed design stage.

13*: Existence of Detailed Survey Data
  ○: There exist detailed survey results and drawings. Thus, it is possible to proceed to design analysis based on the results and drawings.
  △: There exist detailed survey results and drawings, but insufficient for design analysis. Surveying is necessary prior to design analysis.
  ×: There doesn't exist survey results and drawings. Surveying is necessary prior to design analysis.

CHAPTER 6 THE PROPOSED PROJECT

6.1. Project Components

The Project is composed of three components: 1) Component A: Structural Countermeasures, 2) Component B: Non-Structural Countermeasures and 3) Component C: Sediment Control.

Table 6.1.0.1 Components of Proposed Project by the Survey

Component A	Structural Countermeasures	River improvement of Upper Citarum Tributaries	
		Sub-Project A1: Citarum Upstream	5.45 km
		Sub-Project A2: Cimande	9.50 km
		Sub-Project A3: Cikijing	6.68 km
		Sub-Project A4: Cikeruh Downstream	2.50 km
Component B	Non-Structural Countermeasures	- Institutional strengthening for BBWSC - Capacity development for the community against flood disaster	

Component C	Sediment Control	- Construction of 5 check dams and 261 small check dams by participatory method at 24 target desa in Cirasea Sub-watershed
		- Empowerment for the people at the community level
		  - Raising awareness of the necessity for improved environmental management
		  - Raising of the sense of ownership
		  - Emphasizing the use of local resources for peoples' welfare
		  - Strengthening institutions at the village level for community-based watershed management	

Source: JICA Survey Team

6.1.1. Component A: Structural Countermeasures

(1) Objectives

Component A (Structural countermeasures) is aimed at contributing to the completion of the Urgent Flood Control Plan through river improvement works for the upper tributaries: Citarum upstream, Cimande, Cikijing and Cikeruh downstream.

(2) Implementation Area

The locations of Citarum upstream (Kantren - Majalaya: 5.45km), Cimande (Langensari - Rancapanjang: 9.58km), Cikijing (Tanggeung - Cikijing village: 6.68km) and Cikeruh downstream (Ranca Kamuning - Ranca Bango village: 2.50km) are shown in Figure 6.3.1.1. Refer to the Appendix or the Annex attached at the end of this report for the plan view, longitudinal profiles and standard cross-sections.

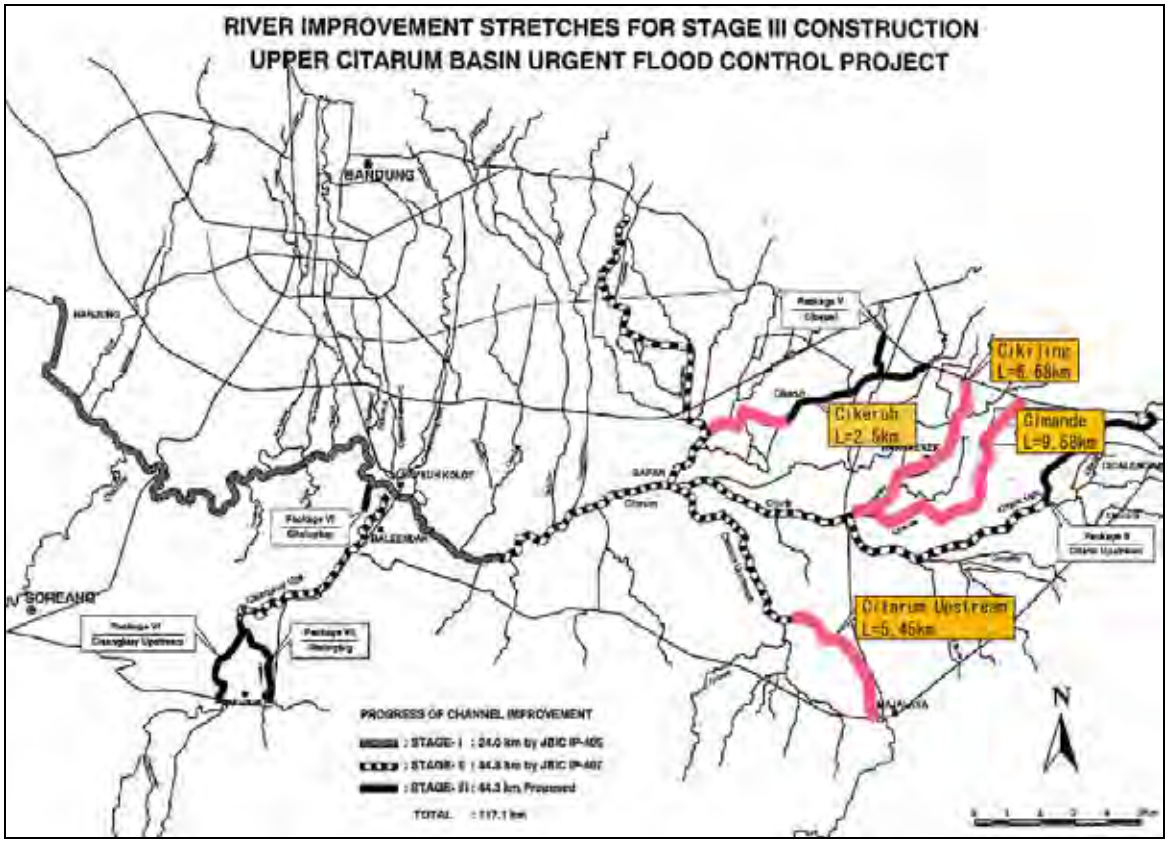
(3) River Improvement Works

The river improvement works primarily involve channel normalization through channel excavation and bank slope protection, resulting in compensation works such as the replacement of bridges, irrigation weirs, culverts/sluice ways and groundsill. The profile of the construction works is briefly indicated in Table 6.1.1.2.

Table 6.1.1.1 Proposed Construction Works

River Name	Improved Distance	1. Bank Protection	2. Groundsill & Drop	3. Culvert & Sluice	4. Bridge			5. Irrigation Weir
					Road	Pedestrian	I/M Road	
Citarum Upstream	5,450	4,887	2	30	0	4	0	0
Cimande	9,510	2,162	6	36	3	3	1	1
Cikijing	6,680	1,720	4	26	3	4	0	1
Cikeruh Downstream	2,490	824	1	13	0	4	1	1
Total	24,130	9,593	13	105	6	15	2	3

Source: JICA Survey Team



Source: JICA Survey Team based on a map in a pamphlet published by BBWSC.

Figure 6.1.1.1 Location of Selected 4 Tributaries

6.1.2. Component B: Non-Structural Countermeasures

(1) Objective

In addition to structural countermeasures such as channel improvement and retarding reservoirs, non-structural countermeasures should be implemented to ease the flood damage along the Citarum mainstream and other tributaries.

(2) Sub-components of non-structural countermeasures

The following sub-components are proposed for the Project.

- Institutional Strengthening for BBWSC
- Capacity Development for Community against Flood Disaster

(3) Institutional Strengthening for BBWSC

(3)-1) Institutional Strengthening for Early Warning System (EWS)

Through interview surveys with BBWSC and a review of the relevant documents (*e.g.* 2007 D/D, *etc.*), the Early Warning System, which was installed during Stage (I) project, has malfunctioned because of accidents (*e.g.* struck by lighting, *etc.*), burglary, obsolete software systems, poor operation & maintenance, *etc.* It is necessary to review the current situation in detail and provide further analysis and discussions with BBWSC in order to establish a reliable and practical EWS for disseminating smooth and accurate early warning to the public. During the Project implementation period, BBWSC will be assisted by the EWS sub-component of Component B activity. Currently, the four items stated below are expected to be the main activities:

- Strengthening of the existing Automated Water Level System (AWLS) for Early Warning
- Strengthening of Information Network System connecting Upper, Middle and Lower sections in the Citarum River Basin
- Strengthening the Early Warning Communication System (PUSAIR, Kab., Kota, BPBD, Community)
- Storing and Accumulating Data for Reliable Early Warning System, etc.

(3)-2) Strengthening for Operation & Maintenance (O&M)

During the Project implementation period, BBWSC will be assisted by the O & M sub-component of Component B activity. Currently, the two items stated below are expected to be the main activities:

- Regular Monitoring for River Structure
- Regular Dredging as ordinal O&M activity, etc.

1) Regular Monitoring for River Structure

It is a principal activity of BBWSC to carry out regular monitoring for river structures in order to maintain the functionality of the river network in the Upper Citarum River Basin. Based on an interview survey with BBWSC, insufficient budget allocated to BBWSC impedes their regular monitoring properly. The risk of malfunctioning of the river network (*e.g.* flood protection, water use and environmental management, *etc.*) will increase if proper continuous O & M activities are not carried out. BBWSC will be effectively assisted through technical assistance and advice for activities such as a river reconnaissance survey for the Citarum River and its major tributaries.

2) Regular Dredging as ordinal O&M activity, etc.

As indicated in Figure 6.3.2.2, sedimentation caused serious a reduction in the flow capacity at the segment improved in Stages (I) and (II). Such river dredging works for the main Citarum River should be implemented as the ordinal O & M activity of GOI or BBWSC. The necessary technical assistance and advice will be provided during the Project.

(4) Capacity Development for Community against Flood Disaster

During the Project period, the communities (*e.g.* desa, *etc.*), which will be selected, are to be assisted by a sub-component of Component B. Currently, the four items stated below are expected to be the main activities:

- Reinforcement of desa activity (LMD) through BBWSC supports (Temporary Flood Walls, Sand bags, Commodities, etc.)
- Community discussion forums
- Prevention education in school, Evacuation Drills, etc.
- Application of Flood Hazard Mapping prepared by ADB project

6.1.3. Component C: Sediment Control

(1) Objectives

The objective of this component is to minimize the negative effects on the river caused by sediment discharge. By construction of sediment control facilities in streams, sediment discharge to the river will be controlled.

(2) Scope of the Component

In order to minimize the negative effects of sediment discharge, check dams and small check dams will be constructed through communities' participation. In addition to this construction, the following empowerment of communities will be carried out with the help of NGO.

1) Raising awareness of the necessity for improved environmental management
2) Raising of the sense of ownership (to develop communities' sense of belonging for local natural resources)
3) Emphasizing the use of local resources for peoples' welfare
4) Strengthening institutions at the village level for community-based watershed management

(3) Implementation Area

The Cirasea Sub-watershed, is located in the upper reaches of the Citarum River, and consists of 55 desa in 7 kecamatan. The proposed Project area is extended to 24 desa in 5 kecamatan in the Cirasea Sub-watershed, which has been designated as critical land with high soil loss.

(4) Sediment Control Facilities

Considering the difficulties of land acquisition due to land ownership, the number of check dam constructions was limited. Therefore, instead of large check dams, multistage small check dam systems were introduced. 5 check dams and 261 small check dams are planned in 24 desas.

6.2. Consulting Services

6.2.1. Objective of Consulting Services

Consulting services are required for implementation of the rehabilitation of the Upper Citarum River. The objectives of the consulting services are to facilitate the implementation of the Project by assisting the Balai Busar Wilayah Sungai Citarum (BBWSC), Directorate General of Water Resources, Ministry of Public Works in review of detailed design, bidding, supervision of tributaries improvement construction works, Flood Plain Management, and Sediment Control. The services comprise of engineering and construction technical supervision and advisory instructions. The services will be performed at the field site and will be done in close cooperation with related agencies.

6.2.2. Scope of Services

The Consultant is responsible for carrying out the entire project components as outlined below on behalf of and in collaboration with DGWR and BBWSC. The Consultants will consult with other concerned agencies and/or institutions in order to reach a common ground for the implementation of the activities at every stage of the Project.

The scope of the consulting services is itemized as follows:

(1) Component A: Structural Countermeasures

1) Review of the existing study and detailed design
2) Review of pre-qualification and bid documents
3) Assistance with bidding and contracting
4) Assistance with construction supervision
5) Monitoring for environmental protection
6) Monitoring for land acquisition and resettlement
7) Transfer of knowledge to counterpart personnel

8) Reporting.

(2) Component B: Non-Structural Countermeasures

1) Institutional Strengthening for BBWSC
   - Institutional Strengthening for Early Warning System (EWS)
   - Strengthening for Operation & Maintenance (O&M)

2) Capacity Development for Community against Flood Disaster
   - Application of Flood Hazard Mapping prepared by ADB project
   - Reinforcement of desa activity (LMD) through BBWSC supports (temporary flood walls, sand bags, commodities, etc.)
   - Community discussion forums
   - Prevention education in schools, Evacuation Drills, etc.

(3) Component C: Sediment Control

1) Detailed Design
2) Assistance with Project dissemination in desa
3) Assistance with local project planning and financing
4) Assistance with yearly review of participatory LRSC activities
5) Supervision of participatory LRSC activities
6) Supervision of NGO activities

(4) Feasibility Study of Dayeuh Kolot and its surroundings

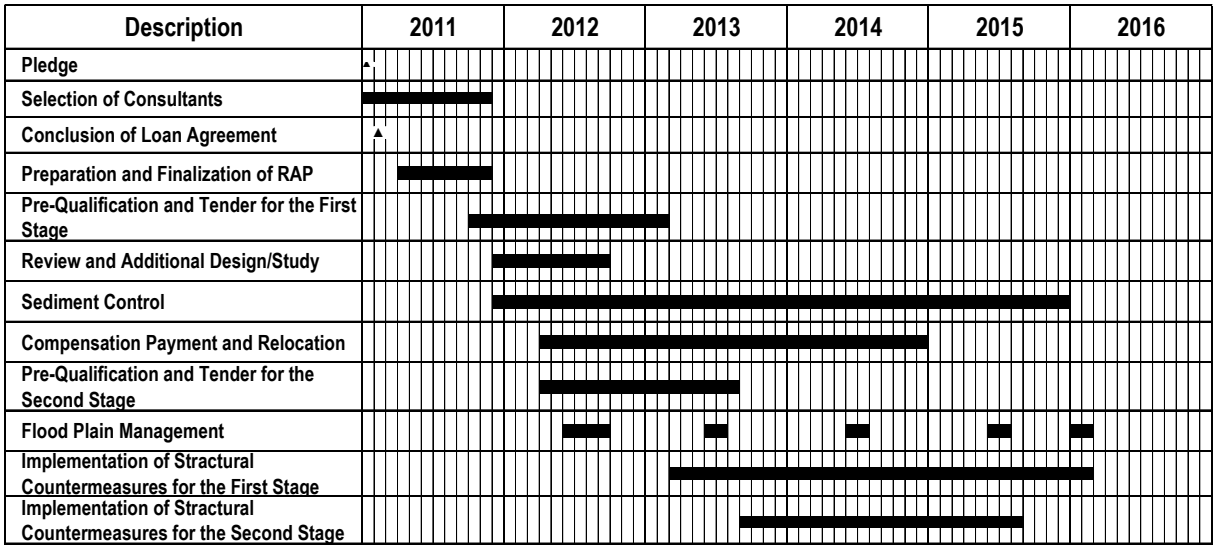
Regarding the Feasibility Study for Flood Damage Mitigation Measure for the DK right bank area, the following activities will be carried out.

1) To review the existing study for DK flooding issues.
2) To conduct topographical survey (river cross section including floodplain for Cicapundung, Cicapundung Kolot and Citeureup Basins)
3) To study the flooding mechanism including interview survey to local people, hydrological data collection and evaluation of existing river capacity.
4) To set-up and calibration of hydrology and hydraulic model
5) To study alternatives for flood mitigation measures
6) To study the economic evaluation for main alternatives
7) To prepare definitive plan for Flood Damage Mitigation Measure for DK right bank area

6.3. Implementation Schedule

During the preparation stage of the project implementation, Selection of consultants, Preparation and Finalization of RAP and Pre-qualification of contractors for Phase 1 is carried out. Implementation period of this project are expected to be approximately 51 months from the beginning of Consulting services in December 2011until the end of the river improvement work of Phase 2 in February 2016.

The tentative schedule of the Project is shown in Figure 6.3.0.1 below



Source: JICA Survey Team

Figure 6.3.0.1 The Tentative Schedule of the Project

CHAPTER 7 PROJECT COST

7.1 Basic Conditions for Cost Estimate

7.1.1 General

The followings are the basic conditions for the Project cost estimate.

(1) The Project consists of three components as described below:

Table 7.1.1.1 Three Components of the Project

Component A	Structural Countermeasures	River improvement of Upper Citarum Tributaries	
		Sub-Project A1: Citarum Upstream	5.45 km
		Sub-Project A2: Cimande	9.50 km
		Sub-Project A3: Cikijing	6.68 km
		Sub-Project A4: Cikeruh Downstream	2.50 km
Component B	Non-Structural Countermeasures	- Institutional strengthening for BBWSC - Capacity development for the community against flood disaster	

Component C	Sediment Control	- Construction of 5 check dams and 261 small check dams by participatory method at 24 target desa in Cirasea Sub-watershed
		- Empowerment for the people at the community level
		  - Raising awareness of the necessity for improved environmental management
		  - Raising of the sense of ownership
		  - Emphasizing the use of local resources for peoples' welfare
		  - Strengthening institutions at the village level for community-based watershed management	

Source: JICA Survey Team

(2) The funds required for the construction works will be financed by a foreign loan.

(3) The funds required for the construction and procurement of goods for each component will be financed 100% by a JICA ODA loan.

(4) The funds required for land acquisition and compensation will be financed by the local budget.

(5) The implementation of river improvement construction works (Component A) will be done by using a full contracting system through International Competitive Bidding (ICB) with pre-qualified contractors from eligible source countries including Indonesia.

(6) The contract of Component A will be calculated on a unit price basis excluding the mobilization/demobilization and preparatory works.

(7) The construction works of Sediment Control (Component C) will be done through community participation method.

(8) The project will take 51 months from the start-up of the Consulting Services to the completion of the construction of river improvement works excluding a defect liability period of 12 months.

The project will be supervised and administrated by Balai Busar Wilaya Sungai Citarum with assistance of the Consultant.

7.1.2 Unit Price, Exchange Rate, Price Escalation and Physical Contingency

(1) Labor wages and material costs are based on "Keputusan Gubernur Jawa Barat September 2009 (Standar Biyaya Belanja Daerah Pemerintah Provinsi Jawa Barat Tahun Anggaran 2010)" and "Analisa Haruga Satuan Pekerjaan Kabupaten Bandung October 2009".

(2) The exchange rate of currencies is US $1.00 = Yen 90.90. Accordingly, the rates Rp. 1 = Yen 0.0101 and US $1.00 = Rp. 9017 are applied.

(3) The cost is classified into foreign and local currency components.

(4) An annual price escalation of 1.8% and 7.9% are applied to the foreign currency portion (F/C) and the local currency portion (L/C) respectively.

(5) A physical contingency of 5% of the total cost of base cost and price escalation is counted.

7.1.3 Composition of Project Cost

The Project cost consists of the direct construction cost (base cost), price contingency, physical contingency, consulting service cost, land acquisition and compensation cost, government administration cost and value added tax (VAT).

(1) Direct Construction Cost (Base Cost)

The direct construction cost for the contract of Component A consists of the cost for preparatory works, main civil works and miscellaneous expenses. The direct construction costs are estimated by adopting the unit cost basis multiplied by the corresponding work quantity.

1) Material cost

All the unit prices include transition fees to the project site. These prices are counted into the local currency component.

2) Labor cost

The labor cost was calculated with the local currency component. The rates of labor wages include all the laborers' fringe benefits such as vacation and sick leave, insurance charges, medical care, living allowance, etc.

Regarding Component C, the rates of wages exclude all fringe benefits due to the participatory method.

3) Equipment cost

The equipment cost consists of the depreciation cost, repair cost and administration cost, which are calculated using the Indonesian standard economical life and repair rate. With regard to the operation cost of equipment, the cost of the operator, petroleum, oil, lubricant and consumables, they are counted into each unit cost.

4) Contractor's indirect cost

The contractor's expenses are counted in every unit cost proportionally. An estimated 10% of the direct cost will be used to cover the following expenses:

a) Field administration and supervision
b) Corporate overhead and profit
c) Assistance and back support from head office
d) Material handling
e) Insurance
f) Bond and taxes
g) Other incidentals

Regarding Component C, the contractor's expenses are excluded due to the community participatory method.

(2) Cost for Land Acquisition and Compensation

The cost is estimated in local currency based on the required area and unit cost estimated for each parcel of land and housing.

(3) Administration Cost

The cost is estimated at 5% of the total direct construction cost of Components A, B and C.

(4) Consulting Services

The cost for Consulting Services is estimated on a man-month basis with the direct cost according to the proposed assignment schedule.

(5) Contingencies

1) Physical Contingency: estimated at 5% of the direct cost.

2) Price Contingency: estimated at 7.9% per annum for local currency and 1.8% per annum for foreign currency, as price escalation.

(6) Government Tax

Value added tax (VAT) is estimated at 10% of the sum of the total cost, in terms of the equivalent in Indonesian Rupiah (IDR).

The detailed cost for structural countermeasures is shown in Table 7.1.3.1.

(7) Land Acquisition and Compensation

Estimating the amount of Land Acquisition and Compensation for the project, unit costs in 2007DD was employed.

Table 7.1.3.1 Structural Countermeasures Cost

(Unit : Rp. Million)

Name of River and Channel	Citarum Upstream	Cimande	Cikijing	Cikeruh	Total
Improvement Length (m)	**5,450**	**9,510**	**6,680**	**2,500**	**24,140**
L/S	705	752	574	235	2,266
Channel	7,816	14,904	9,328	4,493	36,541
Revetment	17,601	9,089	8,398	4,476	39,563
Groundsill	901	3,104	1,444	645	6,094
Drop	0	0	0	0	0
Culvert	5,170	5,359	4,477	0	15,006
Weir	0	1,244	1,268	2,104	4,616
I/M Road	5,873	10,077	6,842	2,668	25,461
Bridge	2,733	8,194	3,889	4,017	18,832
Dumping with Geote	4,033	5,184	7,822	3,309	20,348
Total	**44,832**	**57,906**	**44,043**	**21,947**	**168,727**

Source: JICA Survey Team

The cost for non-structural measures is assumed to be 5,000 million Rp. for purchasing some necessary equipment, machines and goods (*i.e.* materials for Flood Fighting, *etc.*) in this report. The details will be discussed in the course of the discussion forum among the related stakeholders on the non-structural countermeasures.

The cost for sediment control is estimated to be 17,608 million Rp. This cost includes the construction cost for 261 small check dams and 5 check dams, 14,935 and 2,673 million Rp., respectively.

The detailed costs of small check dams and check dams for sediment control are shown in Table 7.1.3.2 and 7.1.3.3.

Table 7.1.3.2 Small Check Dam Cost for Sediment Control

Kind of Works	Quantity	Unit	Unit Cost (Rp)	Total Cost (Rp)
1. Preparation				752,185
2. Land Cutting and drainage	18	m2	21,285	383,130
3. Gabion Construction	72.3	m3	574,405	41,529,463
4. Dam Apron Construction	12	m3	610,587	7,327,044
5. Reinforcing	120	Kg	8,243	989,160
6. Foreman	20	man-day	52,000	1,040,000
Sub -Total				52,020,982
4. Miscellaneous Expenses (10%)		LS		5,202,098
Total				57,223,080
Rounded	1	Unit		57,223,000
Total Cost for Small Check Dam	261	Unit	57,223,000	14,935,203,000

Note: Standard size of DPN (based on Citarik data) ; Lemgth of Crest-9.5m, hight of Dam-3.5m

Table 7.1.3.3 Check Dam Cost for Sediment Control

Kind of Works	Quantity	Unit	Unit Cost (Rp)	Total Cost (Rp)
1. Road Construction (Temporary Road 500 m)				43,524,422
2. Preparation				38,589,952
3. Dam body Construction				
3.1 Land Cutting and drainage	160	m3	21,285	3,405,600
3.2 Cutting, Filling and penetration	3,755	m3	22,940	86,139,700
3.3 Construction of Water-proof layer	344	m3	278,827	95,846,863
3.4 Form	90	m2	31,820	2,863,803
3.5 Grass Planting	500	m2	7,110	3,554,969
Sub Total				191,810,935
4. Construction of drainage and Water Gate				
4.1 Land Cutting and drainage	116	m3	21,285	2,469,060
4.2 Water gate construction	1	set		6,000,000
4.3 Wet Stone masonry 1:3	53	m3	484,315	25,562,146
4.4 Floor Cement 1:4	19	m2	34,528	665,697
4.5 Mortar Pluging	45	m2	30,067	1,347,906
4.6 Concrete pipe	15	m	1,464,438	21,966,563
4.7 Land Filling	50	m3	7,353	367,650
Sub Total				58,379,021
5. Construction of Spill Way				
5.1 Land Cutting and drainage	500	m3	21,285	10,642,500
5.2 Wet Stone masonry 1:3	151	m3	484,315	73,228,428
5.3 Floor Cement 1:4	181	m2	34,528	6,249,545
5.4 Mortar Pluging	341	m2	30,067	10,246,851
5.5 Spill way Bridge construction(jembatan spill wa	7	m	501,438	3,309,488
Sub Total				103,676,812
6.Dray Masonry				
6.1 Rip rap	179	m3	177,153	31,705,072
6.2 Drinage	102	m3	179,048	18,209,131
Sub Total				49,914,203
Total	1	Unit		485,895,345
7. Miscellaneous Expenses		LS		48,590,000
Rounded	1	Unit		534,485,000
Total cost for Check Dam	5	Unit	534,485,000	2,672,425,000

Note: Standard size of Check dam (based on Citarik data) ; Lemgth of Crest-54m, hight of Dam-8m, Legth of Spill way=80m

7.2 Fund Requirement

7.2.1 Required Funds

The required funds for execution of the Project was estimated at 451,982 million IDR (Indonesian Rupiah) consisting of an eligible portion (loan portion) of 349,685 million IDR + 251 million JPY equivalent to 3,783 million JPY, and a non-eligible portion (local currency Indonesian portion) of 102,297 million IDR (including VAT). A summary of the required funds is shown in Table 7.2.1.1.

Table 7.2.1.1 Required Funds

Unit: million

Eligible Portion (JICA Loan Portion)				
Component		Foreign Currency (Japanese Yen)	Local Currency (Indonesian Rupiah)	Total in Japanese Yen
Component A Structural Counter-measures	Sub-Project A1 : Citarum Upstream River	0	44,832	453
	Sub-Project A2 : Cimande River	0	57,906	585
	Sub-Project A3 : Cikijing River	0	44,043	445
	Sub-Project A4 : Cikeruh River (Downstream)	0	21,947	222
	Sub-Total		168,728	1,704
Component B	Non-Structural Countermeasures	0	5,000	51
Component C	Sediment Control (IDG - I)		7,669	77
	Sediment Control (IDG - II)		6,123	62
	Sediment Control (IDG - III)		3,816	39
	Sub-Total		17,608	178
Direct Construction Cost (Base Cost)		**0**	**191,336**	**1,933**
Price escalation		0	89,823	907
Physical contingency		0	14,058	142
Total of Direct Construction Cost			**295,217**	**2,982**
Consulting services		251	54,468	801
Price escalation		0	0	0
Physical contingency		0	0	0
Total of Consulting services		**251**	**54,468**	**801**
Total of JICA Loan Portion		**251**	**349,685**	**3,783**
Non Eligible Portion (Local Portion)				
Land Acquisition		0	32,123	
Price escalation		0	11,799	
Physical contingency		0	2,196	
Administration cost		0	18,727	
VAT		0	37,452	
Total of Local Portion			**102,297**	
Total Fund Required		**251**	**451,982**	**4,816**

Source: JICA Survey Team

7.2.2 Annual Fund Requirement

The annual fund requirement with price escalation is shown in Table 7.2.2.1 on page 7-8.

7.2.3 Loan Application

Financial assistance is required to implement the Project. The JICA ODA Loan is applicable to eligible structural and non-structural countermeasures, sediment control and consultant services. The amount of the loan is proposed at 3,783 million JPY (374,532 million IDR).

7.2.4 Consulting Services

Consulting services by foreign and local consultants will be required to assist with the implementation of the Project in review of design and construction supervision. The cost estimated for these consulting services is 801 million JPY consisting of 54,468 million IDR for the local currency portion and 251 million JPY for the foreign currency portion excluding price escalation and physical contingencies, as shown in Table 7.2.4.1.

Table 7.2.4.1 Consulting Services Cost

unit: Million

ITEM	AMOUNT		Amount in
	JPY	IDR	JPY
I. Remuneration			
1. Professional A	235		235
2. Professional B	0	28,100	284
3. Sub-Professional	0	1,930	19
4. Office Supporting Staff	0	1,224	12
SUB TOTAL REMUNERATION	235	31,254	315
II. Reimbursable Cost			
1. Mobilization/Demobilization	16	253	19
2. Miscellaneous Travel Expenses	0	118	1
3. Subsistence Allowance	0	2,817	28
4. Local Transportation Costs	0	3,604	36
5. Office rent/ accomodation/ clerical assistance	0	464	5
6. NGO Services		12,830	130
SUB TOTAL REIMBURSABLE COST	16	20,086	219
III. Miscellaneous Expenses			
1. Communication Costs	0	550	6
2. Drafting, Reproduction of Reports	0	267	3
3. Equipment/Furniture: Computers, etc.	0	843	9
4. Software	0	1,468	15
SUB TOTAL MISCELLANEOUS EXP	0	3,128	33
TOTAL	251	54,468	801

Source: JICA Survey Team

Table 7.2.2.1 Annual Fund Requirement

Base Year For Cost Estimation:	Sep. 2009		FC & Total:	million JPY
Exchange Rates	Rupiah = yen 0.0101		LC:	million Rupiah
PriceEscaration:	FC: 1.80%	LC: 7.90%		
Physical Contingency	5%			
Physical Contingency for Consultant	0%			

Item		Total			2011			2012			2013			2014			2015			2016		
		FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
A. ELIGIBLE PORTION																						
I)	Procurement / Construction	**0**	**295,216**	**2,982**	**0**	**0**	**0**	**0**	**2,198**	**22**	**0**	**71,775**	**725**	**0**	**126,603**	**1,279**	**0**	**87,397**	**883**	**0**	**7,242**	**73**
	Component A - Sub Project A1 : Citarum Upstream River Improvement Works	0	44,832	453	0	0	0	0	0	0	0	18,680	189	0	22,416	226	0	3,736	38	0	0	0
	Component A - Sub Project A2 : Cimande River Improvement Works	0	57,906	585	0	0	0	0	0	0	0	16,085	162	0	19,302	195	0	19,302	195	0	3,217	32
	Component A - Sub Project A3 : Cikijing River Improvement Works	0	44,043	445	0	0	0	0	0	0	0	7,340	74	0	22,021	222	0	14,681	148	0	0	0
	Component A - Sub Project A4 : Cikeruh (Downstream) River Improvement Works	0	21,947	222	0	0	0	0	0	0	0	3,658	37	0	10,973	111	0	7,316	74	0	0	0
	Component B: Non-Structural Countermeasures	0	5,000	51	0	0	0	0	1,667	17	0	833	8	0	833	8	0	833	8	0	833	8
	Component C: Sediment Control (IDG - I)	0	7,669	77	0	0	0	0	0	0	0	3,835	39	0	3,835	39	0	0	0	0	0	0
	Component C: Sediment Control(IDG - II)	0	6,123	62	0	0	0	0	0	0	0	0	0	0	3,061	31	0	3,061	31	0	0	0
	Component C: Sediment Control(IDG - III)	0	3,816	39	0	0	0	0	0	0	0	0	0	0	0	0	0	3,816	39	0	0	0
	Base cost for JICA financing	0	191,335	1,932	0	0	0	0	1,667	17	0	50,431	509	0	82,442	833	0	52,745	533	0	4,050	41
	Price escalation	0	89,823	907	0	0	0	0	427	4	0	17,926	181	0	38,133	385	0	30,491	308	0	2,846	29
	Physical contingency	0	14,058	142	0	0	0	0	105	1	0	3,418	35	0	6,029	61	0	4,162	42	0	345	3
II)	Consulting services	251	54,468	801	13	419	17	73	11,113	185	69	11,117	181	48	16,273	212	40	13,344	175	9	2,202	31
	Base cost	251	54,468	801	13	419	17	73	11,113	185	69	11,117	181	48	16,273	212	40	13,344	175	9	2,202	31
	Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (I +II)		251	349,684	3,783	13	419	17	73	13,311	207	69	82,893	906	48	142,876	1,491	40	100,741	1,058	9	9,444	104
B. NON ELIGIBLE PORTION																						
a	Land Acquisition	0	46,119	466	0	0	0	0	11,559	117	0	16,623	168	0	17,937	181	0	0	0	0	0	0
	Base cost	0	32,123	324	0		0	0	8,763	89	0	11,680	118	0	11,680	118	0		0	0		0
	Price escalation	0	11,799	119	0	0	0	0	2,245	23	0	4,152	42	0	5,402	55	0	0	0	0	0	0
	Physical contingency	0	2,196	22	0	0	0	0	550	6	0	792	8	0	854	9	0	0	0	0	0	0
b	Administration cost	0	18,727	189	0	83	1	0	1,026	10	0	4,484	45	0	7,381	75	0	5,237	53	0	515	5
c	VAT	0	37,453	378	0	166	2	0	2,052	21	0	8,968	91	0	14,762	149	0	10,474	106	0	1,030	10
Total (a+b+c)		0	102,298	1,033	0	248	3	0	14,637	148	0	30,076	304	0	40,080	405	0	15,712	159	0	1,545	16
TOTAL (A+B)		251	451,983	4,816	13	667	19	73	27,948	355	69	112,969	1,210	48	182,956	1,896	40	116,453	1,217	9	10,989	120

Source: JICA Survey Team

CHAPTER 8 INVOLUNTARY RESETTLEMENT

8.1. General

JICA clearly indicates the basic principle on involuntary Resettlement in the JBIC guidelines for Confirmation of Environmental and Social Considerations (April 2002) that, "*People to be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by the project proponents in timely manner*". Therefore, the JICA requests borrowers to submit a Land Acquisition and Resettlement Action Plan (LARAP) for development projects that contain large-scale involuntary resettlement prior to JICA appraisals of the projects.

8.2. Involuntary Resettlement of GOI

8.2.1. Legal Framework and Procedures

(1) Indonesian Regulations

The Indonesian regulations on land procurement for infrastructure projects, which have been provided by the central government of the Republic of Indonesia, are as follows:

1) President Regulation No. 36/2005 on Land Procurement for Implementation of Public Interest
2) President Regulation No. 65/2006 on Amendment of President Regulation No. 36/2005
3) Head of National Land Board (BPN) Regulation No. 3/2007 on Guidelines for Implementation of President Regulation No. 36/2005 on Land Procurement for Implementation of Public Interest as amended by President Regulation No. 65/2006.

(2) Responsible Agency and Procedures

The Land Procurement Committee (LPC) and Land Price Appraisal Team conduct land procurement for public facilities construction. The Land Procurement Committee will be established based on the request by the Project Implementer. The assets to be compensated are a) land rights, b) buildings, c) crops / plants and other objects built on the land. The form of compensation for the assets affected by the Project are a) cash, and/or b) replacement land, and/or c) resettlement, and/or d) combination of two or more forms of compensation as referred to in a), b) and c) and other forms which are agreed on or approved by the related parties.

Land price appraisal is conducted based on the Taxed-Object Selling Value (NJOP) or real value by taking into consideration the *NJOP* price of the current year, as well as other factors.

The appraisal of buildings and plantation prices is done by the related government staff of the district government that are responsible for buildings and farming/landscaping by referring to the price standard, set by laws and regulations.

8.2.2. Experiences on Involuntary Resettlement

The Project Implementer for the Project, BBWSC, has experience in land acquisition through the project implementation of Stages (I) and (II) of the "Upper Citarum Basin Urgent Flood Control

Project" under Japanese ODA loan. The total compensation provided for the Stage (I) Project was Rp. 12,302,407,477-. Compensation payments were made in several phases and were completed over a 5-year period (1993-1997). The total compensation cost provided for the Stage (II) Project was Rp 163,552,128,569-. Compensation payments were made in several phases and were completed over a 12-year period (1996-2007). Note that the submission of an LARAP for both Projects was not required by the Japanese Government.

8.2.3. Comparative Analysis with International Practices on Involuntary Resettlement

The "*Japan Bank for International Cooperation Guidelines for Confirmation of Environmental and Social Considerations* (April 2002)" has been applied to the Project since the Indonesian government submitted the official request for the Project to Japanese Government prior to 1st July 2010. In order to assist BBWSC to prepare the framework of LARAP (FLARAP), a comparative analysis between Indonesian Regulations and international practices including JBIC on involuntary resettlement was conducted.

There are some gaps between the Indonesian regulations and international practice on Involuntary Resettlement. For example, the Indonesian regulations do not stipulate the preparation of an LARAP.

8.3. Assistance on the Preparation of FLARAP

8.3.1. General

For this Project under Japanese ODA Loan, the Indonesian Government is requested to submit the FLARAP to confirm consistency with JICA's basic policies on involuntary resettlement. The LARAP will be prepared based on the FLARAP after determination of the sub-projects for the smooth implementation of the Project.

JICA requests borrowers to prepare an FLARAP that is consistent with the basic policy on involuntary resettlement mentioned in the JBIC Guidelines referring to the Operational Policy 4.12 of the World Bank.

8.3.2. Review on the RAP Framework prepared for the ICWRMIP

It is essential that the FLARAP for the Project will be prepared in the form of closing the gaps between Indonesian regulations and JBIC Guidelines (WB OP 4.12) with "mutually acceptable mechanisms".

The Integrated Citarum Water Resources Management Investment Program (ICWRMIP), which had the target area in the Citarum River Basin commenced in February 2005 and was funded by ADB. The program successfully prepared an RAP framework based on "mutually acceptable mechanisms" closing the gaps between Indonesian regulations and ADB's resettlement policies.

In order to examine if the framework is applicable to this Project, the RAP Framework prepared for the ICWRMIP was reviewed for the following reasons:

- Both projects have same target area, the Citarum River Basin, and they will be

implemented by same project proponent, i.e., BBWSC.

- The projects have been supported by international donors (ADB and JICA)

(1) Livelihood

In the RAP Framework, the Livelihood Restoration Program (LRP), which is the Project Resettlement Policy for the ICWRMIP, was specifically proposed to close the gap between the ADB's policies and existing Indonesian regulations on involuntary resettlement.

The Livelihood Restoration Program is divided into two components: (i) special program and (ii) general program.

The special program under the LRP has allocated an estimated amount to cover any gaps in local government regulations on providing for affected structures, crops and trees, required during relocation. It should be noted that these are estimates of only the actual impacts, costs and levels of assistance will be determined during RAP updating (to be conducted from October 2010).

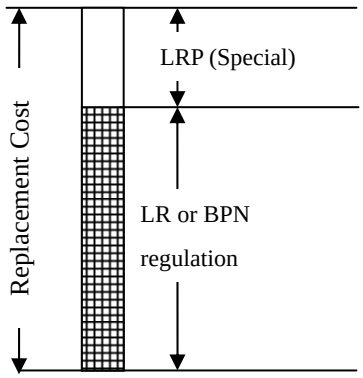
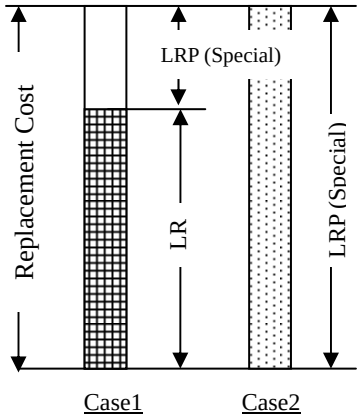
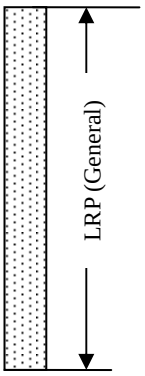
In the general program of the LRP, the Project will also provide suitable livelihood activities under the LRP for the severely affected and vulnerable AHs. The program will be based and designed according to the results of needs assessment to be carried out by the local organization with the AHs during the updating of the RP. In deciding on an appropriate livelihood activities, the following factors will be taken into account: (i) the nature of loss and/or situation of the AH; (ii) preference of the AH, (iii) level of preparedness of the AH to participate in the livelihood activity, and (iv) economic viability of the livelihood activity.

The BBWSC will engage the services of a local NGO or any organization that has expertise in social development and training. Participating AHs will also receive transition subsistence allowance in form of a program for a maximum of 6 months sufficient to provide the minimum basic needs for a household of 5 members. This is also based on the assumption that it will take a maximum of 6 months in order for these AHs to start earning income from the program. It should be noted that the local organization or NGO will review and adjust the program if necessary depending on the final design of the livelihood activities as per consultation with AHs.

The basic compensation policies applied in the RAP Framework are shown in Table 8.3.2.1.

- In the case that there are local regulations available regarding compensation APs will be entitled to compensation as stipulated in the existing local government regulation available at the time of implementation.
- In the case that there is no local regulations available regarding compensation, APs will be entitled to replacement cost as described in the entitlement matrix.
- Any gaps in the local regulation on providing replacement cost compensation will be fulfill in the form of a special program of the Livelihood Restoration Program (LRP).
- "Assistance for restoration on livelihood and living standard" and "Paying attention to vulnerable groups" will be considered in the form of a general program of the Livelihood Restoration Program (LRP).
- Allowances defined in the entitlement matrix may be provided as cash or in kind or alternatively may be provided in the form the LRP (community empowerment program).

Table 8.3.2.1 Basic Compensation Policies Applied in the RAP

Compensation Items	Official Dweller	Squatter
Land	The compensation cost for land will be determined based on the BPN regulation/bupati or mayoral decree with several considerations such as land transaction results in the last 6 months, NJOP, and market price (Sumedang District experience). Note that the cost will be examined in the process of RAP reparation.	None
Property (Crops, Building)		
Assistance for Restoration on Livelihood and Living Standard	 The eligibility groups and the amount for LRP (General) will be identified in the RAP Updating.	
Paying attention to vulnerable groups		

- LR: Local Regulation on compensation
- BPN regulation: Compensation cost based on Indonesian Regulation decided by BPN
- LRP (Special): Special Program for Livelihood Restoration Program
- LRP (General): General Program for Livelihood Restoration Program
- Case1: Local Regulation available
- Case2: Local Regulation not available

Source: JICA UCBTFMP Preparatory Survey Team through interview to RAP consultant for the ICWRMIP

(2) Summary of the RAP for the Rehabilitation of West Tarum Canal (WTC)

The RAP for the Rehabilitation of West Tarum Canal, which is one of the sub-projects of ICWRMIP, was developed and approved by ADB in August 2008. The summary of the RAP is as follows:

- The number Project Affected Persons (PAPs) is 892 (all squatters).
- The WTC didn't require any land acquisition because the project ROW was inside government land. Therefore, the compensation for the project is only for buildings, crops

and trees etc.

- The Land Procurement Committee（LPC）was established and the Replacement cost survey (RCS) was conducted through coordination with a "Resettlement working Group（RWG)" under the LPC.
- The field surveys (census, Inventory of Loss, and replacement cost survey) necessary for preparation of the RAP commenced in September 2006. At the same time, public meetings were conducted at district levels. After the update of the draft of the RAP, it was finalized in August 2008 and officially approved by ADB.
- Updating on the approved draft of the RAP will be conducted from October 2010 to August 2011.

(3) Comparative analysis on the Requirements of WB (OP 4.12) and ADB Policies for Involuntary Resettlement

A comparative analysis on the requirements of WB (OP 4.12) and ADB Policies for involuntary resettlement was conducted to examine the appropriateness in applying the Project Resettlement Policies with Livelihood Restoration Program of the ICWRMIP to the Project. Given that both policies request preparation of a resettlement plan and compensation based on replacement cost etc., it was determined that there are no differences in the resettlement policies of both parties.

8.3.3. Conclusion (The Policies for the FLARAP for the Project)

The JICA Preparatory Survey Team concluded that the preparation of the FLARAP for the Project following the basic policies of the RAP Framework for ICWRMIP is considered as appropriate for the following reasons:

- Both ICWRMIP and the Project are located in the same river basin and have similar project components.
- There are no remarkable differences between the requirements of WB OP 4.12 and ADB policies on involuntary resettlement.
- The Project Resettlement Policy with the Livelihood Restoration Program (LRP) is appropriate as "mutually acceptable mechanisms" to close the gap between JICA's policies (WB OP 4.12) and existing Indonesian regulations on involuntary resettlement.

The draft the FLARAP for the Project was prepared based on the principles of the RAP Framework of ICWRMIP by the JICA Preparatory Survey Team. The draft of the FLARAP was agreed on in the meeting with DGWR including BBWSC on 11th August.

8.3.4. Brief Profile of the FLARAP

(1) Project description

According to the Preparatory survey for the Upper Citarum Basin Tributaries Flood Management Project, the expected area of land required for acquisition and the number of affected houses is summarized as shown in Table 8.3.4.1.

Table 8.3.4.1 Land Acquisition area and Number of House Relocation for the Project

Tributaries	Land Acquisition Area				House Relocation
	Agricultural Land	Residential Area	Idle Space	Total	
Unit	ha				house
Citarum Upstream	9.5	1.9	1.2	12.5	34
Citarik Upstream	12.7	0.5	0.0	13.2	16
Cimande	26.7	4.1	0.7	31.5	16
Cikijing	18.6	2.6	0.0	21.2	40
Cikeruh	12.2	11.3	0.0	23.5	190
Cikeruh (up to 2.5km)	6.9	2.7	0.0	9.6	34
Cibeusi	0.1	3.0	0.0	3.1	46
Cisangkuy Upstream	12.6	1.9	0.0	14.5	25
Citalugtug	6.0	4.7	0.0	10.6	64
Ciputat	2.7	0.1	0.0	2.8	4
Total	101.1	30.1	1.9	133.1	469

Note: Citarik Upstream, Cibeusi and Ciputat are indicated based on 2007 D/D.
Source: JICA Survey Team

(2) Objectives

The FLARAP for the Project has been prepared to support the implementing agency (BBWSC) in setting out strategies to mitigate adverse effects and to maintain living standards of those affected by land acquisition and any other resettlement effects. The LARAP for each sub-project will be prepared based on the FLARAP after determination of the sub-projects for the Project.

8.4. Recommendations

(1) Approval on the FLARAP

The Indonesian regulations do not stipulate an approval procedure for the FLARAP. The BBWSC will submit the draft FLARAP to the Ministry of Public Works through DGWR. Then, the approved draft FLARAP will be submitted to JICA. The BBWSC should obtain approval on the draft FLARAP from the related local governments before submission to DGWR.

(2) LARAP Preparation

The LARAP for the sub-projects will be prepared by BBWSC based on the policies described in the FLARAP.

(3) Monitoring on the LARAP Updating for ICWRMIP funded by ADB

The Involuntary Resettlement Policies applied in the draft FLARAP for the Project basically follows those of ICWRMIP. The LARAP for the “Rehabilitation of West Citarum Canal (ICWRMIP)” will be updated during October 2010 to August 2011. The updating of the RAP should be monitored carefully because the Livelihood Restoration Program for closing the gaps between Indonesian regulations and ADB’s resettlement policies will be completed during the updating process.

CHAPTER 9 ENVIRONMENTAL CONSIDERATION AND ENVIRONMENTAL PROTECTION

9.1. Review of Relevant Laws, Regulations and AMDAL Procedure

9.1.1. Relevant Laws and Regulations

The relevant laws and regulations for EIA process (AMDAL) in Indonesia are shown in the table below (Table 9.1.1.1), while the environmental quality standards and related regulations/guidelines concerning AMDAL are indicated in Table 9.1.1.2.

Table 9.1.1.1 Laws and Regulations in Relation to EIA Process (AMDAL) in Indonesia

Title of Law/Regulation	Profile
Protection and Management of the Environment, Law of the Republic of Indonesia, No.32/2009.	This law describes the basic principles of environmental protection and management in Indonesia.
Regarding analysis of Environmental Impacts, Government Regulation, No.27/1999.	This regulation describes the details of AMDAL. Purpose, scope and procedure of AMDAL are defined in this regulation.
Head of Environmental Impact Control Agency, Decree regarding Public Participation and Information Sharing on Process of Environment Impact Analysis, No.8/2000.	This regulation describes public participation and information sharing in the AMDAL process.
Guideline for the Preparation of RKL (Environmental management plan) and RPL (Environmental monitoring plan), Decree of the State Minister of the Environment, No.45/2005.	This degree describes the details of RKL and RPL. Purpose, scope and contents of RKL and RPL are defined in this regulation
Type of Business and/or Activities that Require AMDAL, State Minister of Environment Regulation Environmental, No.11/2006.	This regulation defines the type and scale of business for which AMDAL is required.
Guidelines for the Implementation of Environmental Management Efforts and Environmental Monitoring Efforts, Environmental Decree, No.86/2002.	This guideline describes environmental management and monitoring activities that do not require AMDAL in Regulation No.11/2006.

Source: JICA Survey Team

Table 9.1.1.2 Quality Standards, Regulations and Guidelines Concerning AMDAL

Category	Title of Law/Regulation
Ambient Air Quality and Noise	1) Air pollution control, Government regulation, No.41/1999. 2) Noise level standard, Decree of the State Ministry of Environment, No.48/1996.
Water Quality	1) Water quality management and controlling water pollution, Government regulation, No.82/2001. 2) Water resources, Law No.7/2004
Waste Control	1) Kep-04/BAPEDAL/09/1995, Procedures and requirements for dumping processing waste, requirements of the former processing location, and former location of hazardous waste (B3 waste) dumping site, Head of Bapedal Decree No.4/1995. 2) Management of hazardous waste and toxic materials, Government regulation No.18/1999. 3) Amendment to Government regulation No.18/1999 about the management of hazardous and toxic waste, Government regulation No.85/1999.
River Management	River bank demarcation line, River usage area, River coverage area and Former river, Minister of Public Work Regulation, No. 63/ 1993.
Work Place Safety	Implementation of Occupational Health and Safety (K3) for Construction site, Ministry of Public works, 2009.

Source: JICA Survey Team

The following explains the abbreviations of the terms regarding EIA in Regulation No.27/1999.

- AMDAL: Process of environment impact assessment
- ANDAL: Assessment of the important impacts from planned business and/or activities
- KA-ANDAL: TOR of ANDAL
- RKL: An effort to manage important environmental impacts, which are caused by planned business and/or activities
- RPL: An effort to monitor the environmental components that are affected by important impacts from planned business and/or activities.

9.1.2. Legal Framework of AMDAL

Decree No.11/2006 defines the sectors or projects which require AMDAL. There are 13 types of business and/or activities that require AMDAL. In this decree, the activity including river improvement works is classified as "public works sector". Generally, the following criteria (Table 9.1.2.1) are applied to decide on AMDAL implementation.

Table 9.1.2.1 Criteria for AMDAL Implementation

Classification	Criterion
a. Big/Metropolitan city	
- Length, or	≥ 5 km
- Dredging Volume	≥ 500,000 m^3
b. Middle sized city	
- Length, or	≥ 10 km
- Dredging Volume	≥ 500,000 m^3
c. Village	
- Length, or	≥ 15 km
- Dredging Volume	≥ 500,000 m^3

Source: Type of Business and/or Activities that Require AMDAL, State Minister of Environment Regulation Environmental, No.11/2006.

9.1.3. AMDAL Procedure

Basically, AMDAL procedure consists of the following 7 steps (Regulation No.27/1999).

Step1: Announcement of planned activities (30 days)

Step2: Preparation of TOR (KA-ANDAL) by Project owner

Step3: Evaluation / approval of TOR by AMDAL committee (Max. 75 days)

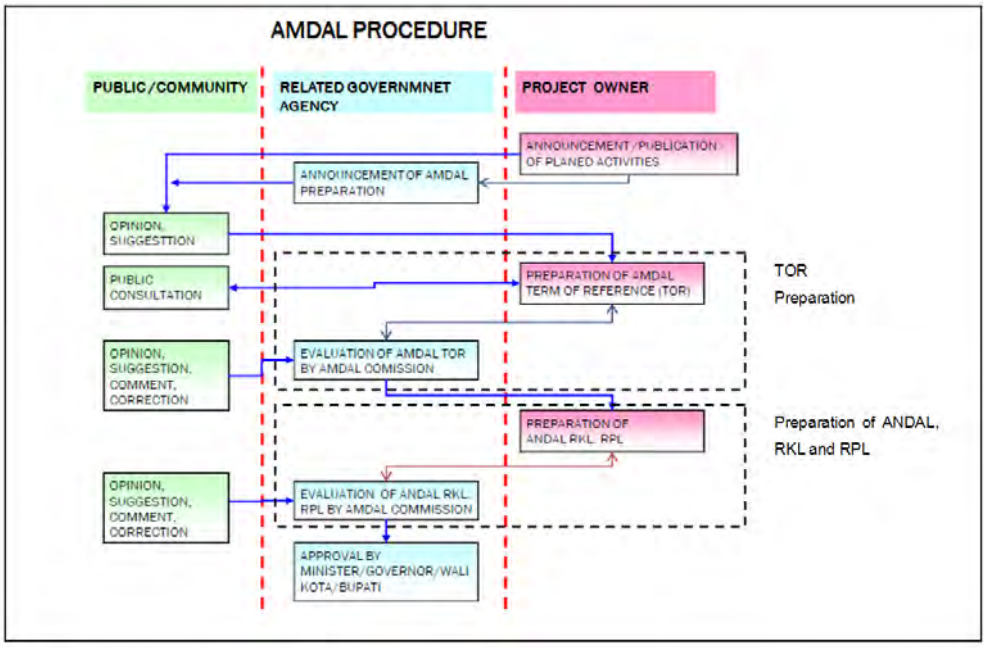
Step4: Preparation of ANDAL, RKL and RPL by Project owner

Step5: Evaluation of ANDAL, RKL and RPL by AMDAL committee (Max. 75 days)

Step6: Approval of ANDAL, RKL and RPL

Step7: Project approval

This AMDAL procedure is illustrated in Figure 9.1.3.1.



Source: JICA Survey Team based Degree No.27/1999

Figure 9.1.3.1 AMDAL Procedure

9.2. Review of AMDAL Process of Previous Upper Citarum Basin Urgent Flood Control Project

9.2.1. Review of AMDAL process for Upper Citarum Basin Urgent Flood Control Project

(1) Stage (I)

In 1993, AMDAL for Stage (I) was implemented in accordance with standard procedure (See Figure 9.1.3.1). In this procedure, EIA documents (ANDAL, RKL and RPL) for Stage (I) were prepared, and public involvement (stake holder meeting) and assessment by AMDAL committee were implemented. Finally, AMDAL was authorized by BPLHD prior to the project implementation.

(2) Stage (II)

In Stage (II), the standard AMDAL procedure (Figure 9.1.3.1) was not implemented. In lieu of this, a "Supplemental AMDAL document" was prepared (1999). Stage (II) was treated as an expansion project of Stage (I). Therefore, the AMDAL document of Stage (I) was reviewed, and a supplemental document for Stage (II) was developed. This supplemental AMDAL document was added to the Stage (I) AMDAL document.

(3) 2007 D/D

During 2007 D/D preparation, AMDAL was also prepared, which includes the river improvement works for the 9 tributaries. Similar to the process for Stage (II), a "Supplemental AMDAL document" was prepared for 2007 D/D, since river improvement work in 2007 D/D could be treated as an expansion project of Stage (I). Even though the AMDAL document was prepared, the AMDAL document was not submitted and thus not authorized by BPLHD.

9.2.2. AMDAL Preparation Process for the Proposed Project

(1) Position of AMDAL Preparation Process for the Proposed Project

For the preparation of AMDAL process including authorization, discussions have been held among BBWSC, BPLHD and the Indonesian Ministry of Environment. As a result of these discussions, the Proposed Project can be regarded as an expansion project of Stage (I) and it was confirmed that the supplementary report of Stage (I) prepared during 2007 D/D is still valid. Additionally, the revision of 2007 D/D can be accepted as AMDAL preparation process for the Proposed Project.

(2) Time Schedule for AMDAL Preparation Process for the Proposed Project

Upon discussion with BBWSC, the time schedule for the AMDAL preparation process was made for EIA (AMDAL) authorization. The time schedule of AMDAL process is shown below (Table 9.2.2.1). The supplemental report was to be submitted in the middle of September, 2010, and it was expected to be authorized by BPLHD by the middle of October, 2010.

Table 9.2.2.1 Time Schedule of AMDAL Approval

No.	Activity	July	August				September					October			
		5	1	2	3	4	1	2	3	4	5	1	2	3	4
1	**Data Collection**														
1.1	Demography														
1.2	Environmental / Physical Condition														
2	**Preparation / Revision of RKL and RKL**														
2.1	Updating Scope of Work														
2.2	Evaluation of Impact														
2.3	Design of Sediment Handling Method														
2.4	Environmental Management Plan (RKL)														
2.5	Environmental Monitoring Plan (RPL)														
3	**Approval**														
3.1	Submission to BPLHD														
3.2	AMDAL commission meeting														
3.3	Revision and Improvement														
3.4	Approval														

Source: JICA Survey Team

9.3. Preparation of AMDAL for the Proposed Project Based on 2007 D/D AMDAL Report

AMDAL document 2007 was reviewed through comparison with "JICA's Environmental checklist".

The following issues with consideration of the JICA environmental guidelines are described for the assistance of AMDAL preparation by BBWSC.

- Renewal of Environmental Data
- Review of Water Quality Monitoring Plan
- Work Place Safety Management
- Waste Management
- Sediment Survey before Construction
- Disposal Procedure for Dredged Sediment

(1) Renewal of Environmental Data

Environmental data in ANDAL is important information and will provide baseline data through environmental monitoring during and after construction. The existing environmental data in the

project area was collected before 2007. These environmental data may be different from the current environmental conditions because of changes in human activity. Therefore, additional environmental data collection and analysis is necessary to understand the current environmental status.

(2) Review of Water Quality Monitoring Plan

Water quality monitoring and aquatic life (plankton and benthos) monitoring was proposed in the 2007 D/D AMDAL report.

For both water quality and aquatic life monitoring, monitoring of the pre-construction period and during construction (until all construction activity is finished) is desirable because monitoring in the pre-construction period is necessary to obtain baseline data.

In Indonesia, a monitoring frequency of 2 times/year (every 6 months) is usually used. However, for water quality monitoring, 4 times/year (every 3 months) is desirable in order to respond to any increase in water contamination from the construction area.

On the contrary, the monitoring frequency for aquatic life monitoring can be 2 times/year (every 6 months) because the fluctuation of the aquatic community is slower than the change of water quality.

(3) Work Place Safety Management

Work place safety is not described in the 2007 D/D AMDAL report. According to the JICA environmental guidelines (2010), consideration of the work environment (occupational safety) is necessary. Indonesia has guidelines for workplace safety (Keselamatan dan Keselahatan Kerja). According to these guidelines, adequate work place safety measures should be established in construction areas. These measures are to be implemented by the contractor. To give the responsibility to the contractor, a written contract should be delivered to the contractor. Regarding workplace safety, the following measures are possible:

- Establishment of safety management structure
- Installation of sign boards to warn workers
- Periodical safety patrol

(4) Waste Management

Construction activity generates many kinds of waste (construction waste, domestic waste, *etc.*). In Bandung, both construction waste and domestic waste are collected by public or private collection companies. Reusable waste (*e.g.* electrical waste, wood waste, *etc.*) is recycled by a recycling company, and the remaining waste is dumped in a waste dumping site. In order to facilitate the recovery and reuse of construction waste and to prevent the spread of waste, the following items should be included as the responsibilities of the contractor:

- Separate collection of waste. In order to facilitate reuse, reusable waste (electric, metal glass, plastic) and non-reusable waste (wood, paper, garbage) will be separated.
- Storage of waste to prevent unauthorized dumping around the construction area.

(5) Sediment Survey before Construction

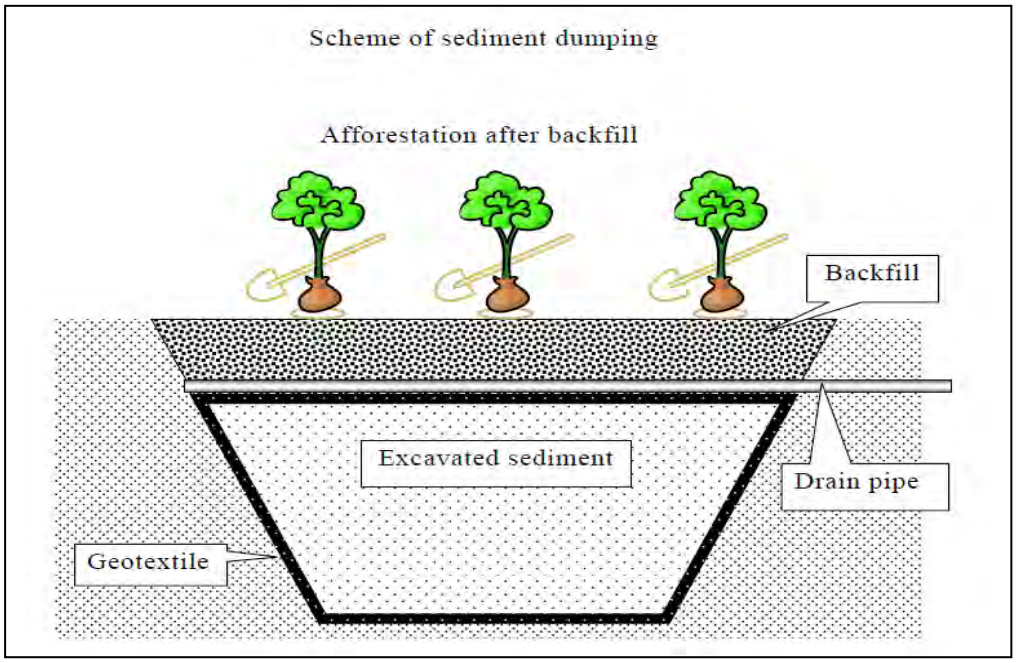
The existing conditions of heavy metal contamination in sediment were surveyed by the Survey Team. From the result of the leaching test, the tested heavy metals didn't exceed the Indonesian standards for TCLP test (Kep-04/BAPEDAL/09/1995). However, to confirm the condition of heavy metal contamination and to obtain the exact amount of sediment volume to be dumped, an additional sediment survey (*i.e.* TCLP test) should be carried out before the construction of river improvement works or excavation works of the Project.

(6) Disposal Procedure for Derdged Sediment

For the assessment process of soil and sediment, the process was proposed by JICA Survey Team based on the discussion with BPLHD. This assessment process should be done before construction starts, while a detailed assessment plan should be considered in D/D stage.

Since there are no standards or criteria for derdged sediment treatment in Indonesia, a criterion for B3 waste dumping (Kep 04/BAPEDAL/09/1995) is applied to the assessment process.

In the proposed dumping procedure, the geo-textile layer is installed as an alternative to a soil-sealing layer to prevent water leakage and sediment particle leakage. Near the Bandung area, there is no efficient dumping site with enough volume to accommodate the dredged sediment from the upper tributaries to be improved during the Project except for a number of oxbows along the Citarum main river. As described above, a few oxbows were used as dumping sites for dredging sediment. There are a number of oxbows, which may be able to be available for dredged sediment during the implementation of the Project. The utilization of oxbows for dumping the dredged sediment is also suggested based on the discussion with BPLHD. The schema of oxbow dumping is indicated in Figure 9.3.0.1.



Source: JICA Survey Team

Figure 9.3.0.1 Scheme of Sediment Dumping in Oxbow

CHAPTER 10 IMPLEMENTATION PROGRAM

10.1. Implementation Schedule

10.1.1. Implementation Period

During the preparation stage of the project implementation, Selection of consultants, Preparation and Finalization of RAP and Pre-qualification of contractors for Phase 1 is carried out. Implementation period of this project are expected to be approximately 51 months from the beginning of Consulting services in December 2011until the end of the river improvement work of Phase 2 in February 2016.

The tentative schedule of the Project is shown in Table 10.1.1.1below.

Table 10.1.1.1 The Tentative Schedule of the Project

Activities		Period	
1.	Pledge	Jan-2011	
2.	Selection of Consultants	Jan-2011 - Nov-2011	11 months
3.	Conclusion of Loan Agreement	Feb-2011	
4.	Preparation and Finalization of RAP	Apr-2011 - Nov-2011	8 months
5.	Pre-Qualification and Tender for the First Stage	Oct-2011 - Feb-2013	17 months
6.	Review and Additional Design/Study	Dec-2011 - Sep-2012	10 months
7.	Sediment Control	Dec-2011 - Dec-2015	49 months
8.	Compensation Payment and Relocation	Mar-2012 - Dec-2014	34 months
9.	Pre-Qualification and Tender for the Second Stage	Apr-2012 - Sep-2013	17 months
10.	Flood Plain Management	Jun-2012 - Feb-2016	45 months
11.	Structural Countermeasures for the First Stage	Mar-2013 - Feb-2016	36 months
12.	Structural Countermeasures for the Second Stage	Sep-2013 - Aug-2015	24 months

Source: JICA Survey Team

10.2. Construction Schedule

10.2.1. Basic Considerations

The following are the basic considerations required for making the schedule of construction.

(1) The execution of construction works will be made by using a full contracting system through International Competitive Bidding (ICB) with pre-qualified contractors from eligible source countries including Indonesia.

(2) Tender will start after review of the detailed design and will take at least 17 months.

(3) The construction will start at least one year after compensation payment and relocation.

10.2.2. Construction Schedule

(1) Structural Countermeasures and Non-Structural Countermeasures

The construction works for structural countermeasures consist of the following 4 sub-projects and will be implemented in 2 phases:

- First phase works: Cimande Sub-project (9.51km)
- Second phase works: Citarum Upstream Sub-project (5.45km)

Cikijing River Sub-project (6.68km)
Cikeruh Downstream Sub-project (2.5km)

Non-Structural Countermeasures will start just after the review of the design. During the first year, an activity plan or activity schedule will be formulated. Technical assistance and advice will be given through Consulting Services regularly once a year .

(2) Sediment Control

The implementation is divided into four stages as stated below:

1) Planning and Design Stage
2) Dissemination Stage
3) Local Planning and Financing Stage
4) Implementation Stage

All construction works of check dams and small check dams shall be carried out and completed during this phase. The construction period is extended over five (5) years. Target communities shall be empowered through participating as a primary body in project implementation.

The entire project implementation schedule is shown in Figure 10.2.2.1.

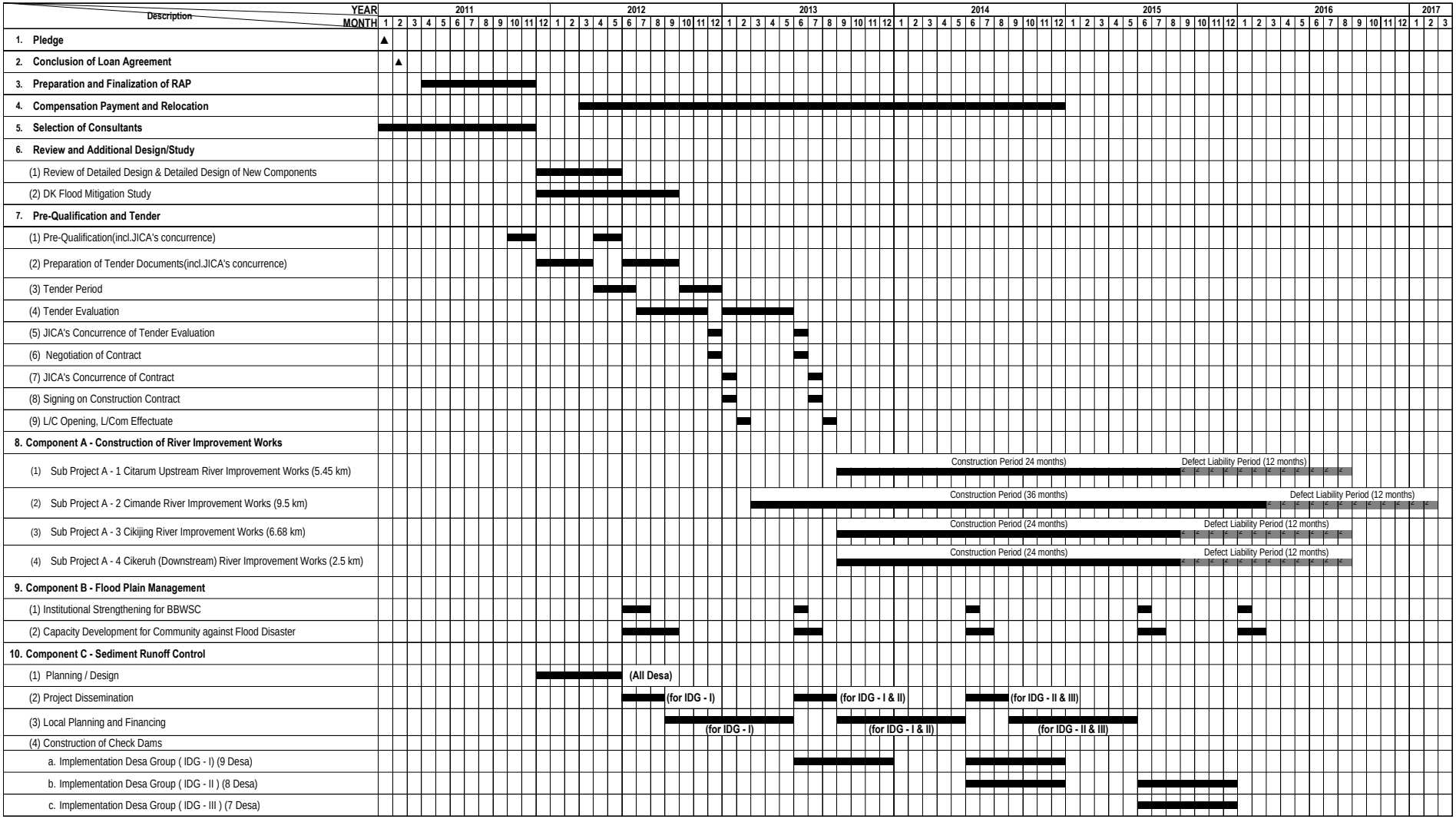
10.3. Procurement Method

10.3.1. Contractor/Supplier

Goods and Services shall be procured in accordance with the "Guidelines for Procurement under Japanese ODA Loans", dated March 2009, and valid and relevant laws and regulations of the Government of Indonesia as long as these laws and regulations are not in contradiction with JICA Guidelines.

10.3.2. Consulting Services

The consultant shall be selected by a Short List Method in accordance with the "Guidelines for Employment of Consultants under Japanese ODA Loans", dated March 2009, and valid and relevant laws and regulations of the Government of Indonesia as long as these laws and regulations are not in contradiction with JICA Guidelines JICA Guidelines. The consultant will be selected in 1 (one) package through short listing, in accordance with the said guidelines.



Source: JICA Survey Team

Figure 10.2.2.1 Tentative Implementation Schedule

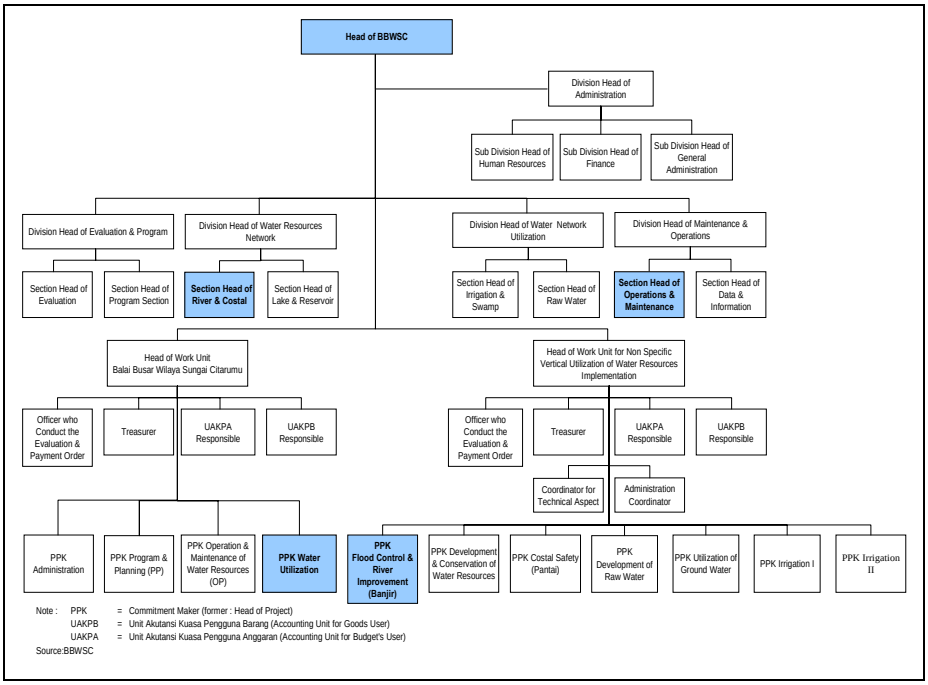
10.4. Implementation Organizations

The Balai Busar Wilayah Sungai Citarum (BBWSC) is one of the 11 BBWS and has an original function of operation and maintenance of the Citarum River Basin and a new function for integrated water resources management in the basin.

Regarding the current project implementation, the executing agency of the Project is the Directorate General of Water Resources (DGWR), Ministry of Public Works (MPW). DGWR entrusts BBWSC to manage and operate the Project with assistance of the Directorate of Bina Program and the Directorate of Rivers, Lakes and Dams at the central level.

No Project Management Unit (PMU) and Project Implementation Unit (PIU) will be established in this project due to the project location being within a single basin and jurisdiction. The head of BBWSC will have the initiative to organize existing sections and human resources in the BBWSC.

The existing organization of BBWSC in accordance with Regulation of the MPW: 23/PTR/M/2008 is shown in Figure 10.4.1.1 below.



Source: JICA Survey Team based on the organization chart provided by BBWSC

Figure 10.4.1.1 Existing Organization of BBWSC

(1) Structural Countermeasures

Regarding the implementation of structural countermeasures, the River & Coastal section and PPK of Flood Control & River Improvement will be in charge of construction supervision. At present, PPK of Flood Control has only 2 field managers and 4 supervisors. The addition of personnel has been proposed to BBWSC.

(2) Non-Structural Countermeasures

1) Institutional Strengthening for Early BBWSC

The Operation and Maintenance section will be in charge. At present the EWS is under the management of Operation and Maintenance section. Substantial costs are required to repair and renew the damaged EWS. This system will be operated by trained personnel. The EWS will provide the data required by each division.

2) Capacity Development for Community against Flood Disasters

This sub-component is comprised of four activities: 1) Reinforcement of Desa activity (LMD) through BBWSC supports, 2) Community discussion forum, 3) Prevention education in school, Evacuation Drills, 4) Application of flood hazard mapping prepared by ADB project, *etc.*

Each activity will be organized as indicated in the table below (Table 10.4.1.1).

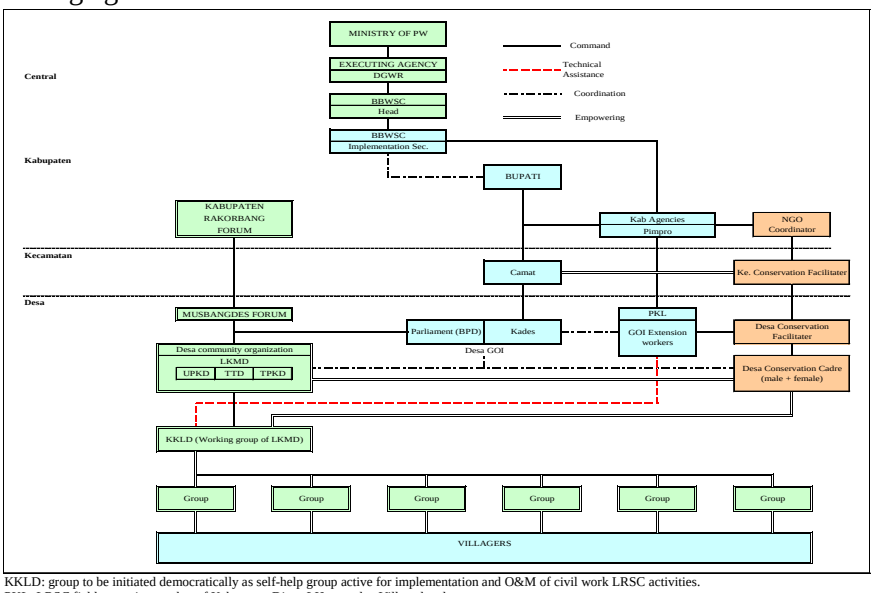
Table 10.4.1.1 Implementation Organization for Capacity Development for Community

Activity	Implementation Organization
Reinforcement of Desa activity (LMD) through BBWSC supports	PPK of Water Utilization with support the LMD in supplying materials required during floods
Community discussion forum	PPK of Water Utilization will participate in discussions with regard to the Citarum River and its tributaries
Prevention education in school, Evacuation Drills, etc.	In this case, the PPK of Water Utilization will participate in community empowerment when handling issues such as flood mitigation and evacuation of residents.
Application of flood hazard mapping prepared by ADB projects	BBWSC will work with concerned agencies (PUSAIR, Province, Kabupaten, Kota) on the socialization of flood maps

Source: JICA Survey Team

(3) Sediment Control

A community based bottom-up system will be adopted in this Component C. Due to the participatory implementation and bottom-up concept, utilization of human resource of Kabupaten Dinas will be effective for smooth implementation of this component. In this case, an institutional arrangement between Central, BBWSC, and Kabupaten will be mandatory. Assuming that BBWSC is responsible for the implementation of the component by endorsing all the field implementation to Kabupaten DINAS concerned, the following Implementation Organization in Figure 10.4.1.2 may be proposed and discussed among agencies concerned.



KKLD: group to be initiated democratically as self-help group active for implementation and O&M of civil work LRSC activities.
PKL: LRSC field extension worker of Kabupaten Dinas LH posted at Village level.
DCF: Village conservation facilitator posted at Village level for working under KCF and to be responsible to train DCC.
DCC: male and female Village conservation cadres selected from and by the local Village community (Musbangdes Forum), working under DCF.

Source: JICA Survey Team

Figure 10.4.1.2 Implementation Organizations Chart

CHAPTER 11 ECONOMIC EVALUATIONS

11.1. Methodology

The economic evaluation for the Project is done by calculating the estimated Project cost and the flood control benefit. The economic evaluation calculations are used to determine the Economic Internal Rate of Return (EIRR), Net Present Value (NPV) and Benefit-Cost ratio (B/C).

11.2. Economic Costs

For the economic evaluation, financial costs are converted to economic costs by deducting the tax and subsidies portions, and applying a standard conversion factor (SCF) to the portion of non-trade goods. For this Project, a value of 0.9 has been applied to the local portion of costs in order to adjust the price.

11.3. Hydraulic Analysis for Estimation of Economic Benefits

Hydraulic analysis was carried out using SOBEK 1D and 1D2D model simulations for the Upper Citarum River Basin. The 1D2D Model represents the river network and the topography of the surrounding flood plain incorporated by Digital Elevation Method (DEM). Model simulations were done under the existing condition “without Project’ and proposed design “with Project”. The proposed design “with Project” consists of improvement of the four tributaries (Citarum Upstream, Cimande, Cikijing and Cikeruh Downstream). 1D2D model simulations were conducted for 2, 5, 10, 20 and 50-year return period flood conditions and respective flood extents and inundation depths were marked. In order to evaluate the economic benefit, a comparison study was done based on “with Project” and “without Project” simulation results.

11.4. Economic Benefits

Benefits of the flood control Project are defined as the reduction of flood damage costs derived from the economic difference between the “with Project” and “without Project” scenarios. The “with Project” scenario covers the situation where flood control is implemented, and the “without Project” scenario covers the situation where no flood control takes place. Benefits are analyzed both quantitatively and qualitatively. The economic benefits are shown below in Table 11.4.1.1.

11.5. Economic Evaluations for the Proposed Flood Control Project

(1) Basic Assumption

The Economic Internal Rate of Return (EIRR), Net Present Value (NPV) and Benefit-Cost ratio (B/C) are calculated based on the economic benefits, the construction costs, and operation and maintenance costs (O&M costs). The following basic assumptions were made:

1) Project life is 30 years after completion of the construction works.
2) Discount rate is 10%.
3) Price for exchange rate is IDR 1.0 = JPY 0.0101

(2) Construction Costs

The financial costs of the Project are converted to economic costs. The price contingency portion is excluded from the economic construction costs.

The financial and economic costs of construction for the Project are shown below in Table 11.5.1.1.

(3) Operation and Maintenance Costs

According to BBWSC, the annual operation and maintenance cost is Rp. 100 million/km. Dredging is assumed to be implemented every three years. Therefore, the annual operation and maintenance cost is expected to be Rp. 800 million.

(4) Cost Benefit Analysis

All the three indicators of the economic evaluations for the Project ensure economic feasibility of the proposed Project: 10.3% EIRR (higher than the discount rate 10%), 1.04 B/C Ratio (one or above), and a sufficiently positive NPV.

Table 11.4.1.1 Economic Benefits of Project

(Unit : Rp. Million)

Without Project	2-year	5-year	10-year	20-year	50-year	Annual Average
Houses	256,820	400,807	544,338	802,511	1,186,175	209,403
Building	137,089	211,314	283,604	419,609	606,841	109,983
Household Assets	119,732	189,493	260,734	382,902	579,334	99,419
Paddy	5,270	9,193	12,442	16,198	20,944	4,524
Industry	74,389	113,497	136,140	160,449	266,021	54,477
Building	5,441	8,099	9,492	11,170	18,635	3,874
Depreciable Assets	56,681	86,810	104,497	123,177	204,007	41,689
Inventory Stock	5,010	7,795	9,510	11,387	19,361	3,770
Business Operations	7,258	10,793	12,641	14,715	24,018	5,144
Social-Infrastructure	5,418	9,557	13,352	19,000	29,101	4,922
Building	2,902	4,968	6,997	9,911	14,978	2,575
Assets	2,516	4,588	6,355	9,089	14,123	2,347
Road	71,910	112,226	152,415	224,703	332,129	58,633
Total	413,808	645,279	858,686	1,222,860	1,834,370	331,958
Total Annual Average Damage						**331,958**

(Unit : Rp. Million)

With Project	2-year	5-year	10-year	20-year	50-year	Annual Average
Houses	214,782	355,533	509,252	775,306	1,149,041	189,766
Building	116,644	189,475	266,427	405,960	590,043	100,463
Household Assets	98,138	166,057	242,825	369,346	558,998	89,303
Paddy	4,213	8,121	11,481	15,241	19,884	4,025
Industry	40,843	69,659	109,785	145,072	287,834	38,412
Building	3,011	5,054	7,868	10,425	20,600	2,779
Depreciable Assets	31,237	53,303	84,090	111,101	221,088	29,413
Inventory Stock	2,889	4,817	7,520	10,092	20,387	2,670
Business Operations	3,705	6,485	10,308	13,453	25,758	3,550
Social-Infrastructure	4,906	9,248	12,962	18,291	26,646	4,689
Building	2,640	4,874	6,767	9,542	13,807	2,467
Assets	2,266	4,373	6,195	8,749	12,839	2,222
Road	60,139	99,549	142,591	217,086	321,731	53,134
Sub-total (Direct Damage)	324,882	542,110	786,071	1,170,996	1,805,135	290,027
Total Annual Average Damage						**290,027**

Expected Annual Benefit of Project = 41,932

Note: Expected Annual Benefit = Total Annual Average Damage (without) – Total Annual Average Damage (with)

Source: JICA Survey Team

Table 11.5.1.1 Project Costs

(Unit: Million)

Cost Item	Financial Cost			Economic Cost		
	F/C Yen	L/C Rp.	Total Equiv. Rp.	F/C Yen	L/C Rp.	Total Equiv. Rp.
1. Construction Cost	0	191,335	191,335	0	172,202	172,202
1.1 Component A	0	168,727	168,727	0	151,855	151,855
1.2 Component B	0	5,000	5,000	0	4,500	4,500
1.3 Component C	0	17,608	17,608	0	15,847	15,847
2 Consulting Service Cost	251	54,468	79,314	251	49,022	73,868
3 Land Acquisition and House Compensation Cost	0	50,850	50,850	0	45,765	45,765
3.1 Land Acquisition	0	32,123	32,123	0	28,911	28,911
3.2 Administration	0	18,727	18,727	0	16,854	16,854
4 Contingencies	0	117,876	117,876	0	14,629	14,629
4.1 Physical Contingency	0	16,254	16,254	0	14,629	14,629
4.2 Price Contingency	0	101,622	101,622	0	0	0
Total	**251**	**414,529**	**439,375**	**251**	**281,616**	**306,463**

Source: JICA Survey Team

Table 11.5.1.2 Evaluation Results of the Project

Indicator	Result
EIRR	10.3%
B/C (at discount rate of 10%)	1.04
NPV (Rp.billion, at discount rate of 10%)	10.17

Source: JICA Survey Team

11.6. Operation and Effect Indicators

The definitions of operation and effect indicators are as follows:

1) Operation indicator: An indicator to quantitatively measure the operational status of a project.

2) Effect indicator: An indicator to quantitatively measure the effects generated by a project.

In order to evaluate the achievements of the Project quantitatively, the benchmarks of operation and effect indicators are set up based on the current available data. Balai Besar Wilayah Sungai Citarum (BBWSC) is in charge of selecting and reviewing the available data for operation and effect indicators as given in the following table proposed by the Survey Team.

Table 11.6.1.1 Operation and Effect Indicators (Proposal)

Operation and Effect Indicators (Proposal)
Max. Discharge at Nanjung (unit: m^3/s)
Max. Flood Area (unit: ha)
The number of damaged buildings (houses, stores, factories, offices, etc.)
Return Period of Rainfall Amount (1-day, 2-day, 3-day, 4-day, 5-day) in the Upper Citarum Basin (1,771km^2) (unit: Return Period Year)

Source: JICA Survey Team

In a discussion with BBWSC and the Survey Team, BBWSC confirmed that data is available for the following indicators: maximum discharge at Nanjung (unit: m^3/s), maximum flood area (unit: ha), and the number of damaged buildings with necessary budget and mobilization. However, regarding the return period of rainfall amount (unit: return period year), it is difficult to collect rainfall data due to the shortage of available data and the current status of BBWSC. Therefore, only the three former indicators will be applied to the Project.

CHAPTER 12 CONCLUSION

The Preparatory Survey for Upper Citarum Basin Tributaries Flood Management Project was conducted for the proposition and formulation of a future ODA loan project funded by JICA in order to reduce or minimize flood damage occurrence in the Upper Citarum River Basin. Based on the results of the Survey, the following conclusions have been drawn:

The Upper Citarum River Basin, which is located in the Bandung region of West Java Province, has the important role of supplying water for DKI Jakarta. The Upper Citarum River Basin also plays an important role for socio-economic activity, since the total GRDP of the Bandung region (Kabupaten Bandung and Kota Bandung) is the third largest after DKI Jakarta and Surabaya. It is necessary to implement flood countermeasures continuously in order to reduce or minimize flood damage occurrence in the Upper Citarum River Basin.

The following components of the Project (Sector Loan) were proposed by the Survey as indicated in Table 12.0.0.1.

Table 12.0.0.1 Components of Proposed Project by the Survey

Component A	Structural Countermeasures	River improvement of Upper Citarum Tributaries	
		Sub-Project A1: Citarum Upstream	5.45 km
		Sub-Project A2: Cimande	9.50 km
		Sub-Project A3: Cikijing	6.68 km
		Sub-Project A4: Cikeruh Downstream	2.50 km
Component B	Non-Structural Countermeasures	- Institutional strengthening for BBWSC - Capacity development for the community against flood disaster	

Component C	Sediment Control	- Construction of 5 check dams and 261 small check dams by participatory method at 24 target desa in Cirasea Sub-watershed
		- Empowerment for the people at the community level
		  - Raising awareness of the necessity for improved environmental management
		  - Raising of the sense of ownership
		  - Emphasizing the use of local resources for peoples' welfare
		  - Strengthening institutions at the village level for community-based watershed management	

Source: JICA Survey Team

Component A (Structural Countermeasures) is composed of 4 sub-projects (Citarum Upstream, Cimande, Cikijing and Cikeruh Downstream) chosen for river improvement works for the upper tributaries of the Citarum River as so-called Short Listed sub-projects to consider the flood effect to the Dayeuh Kolot, project scale and environmental-social issues. Flood damage in the area of those upper tributaries will be reduced by implementation of river improvement works. Component B (Non-Structural Countermeasures) will be implemented, aiming for institutional strengthening of BBWSC in terms of EWS, O&M and capacity development at the community level. The total number of 266 Sabo dams distributed in 24 villages (desa) in the Cirasea Sub-watershed of the Upper Citarum River Basin will be constructed with community participation through the activities of Component C (Sediment Runoff Control).

The Project components were assessed as reasonable and proper in view of technical aspects as well as economic evaluations and socio-environmental considerations. Early implementation of the proposed Project is recommended.

Annex I: Minutes of Discussion on Scope of Work of the Survey (December 8th, 2009)

MINUTES OF DISCUSSION
ON
SCOPE OF WORK
OF
JICA PREPARATORY SURVEY
FOR
UPPER CITARUM RIVER BASIN TRIBUTARIES FLOOD MANAGEMENT PROJECT
BETWEEN
MINISTRY OF PUBLIC WORKS
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

DATE: December 8 , 2009
PLACE: Jakarta, Indonesia

1. Japan International Cooperation Agency (hereinafter referred to as "JICA") had discussions on the Scope of Work of JICA Preparatory Survey for the Upper Citarum River Basin Tributaries Flood Management Project (hereinafter referred to as "the Project") with officials of the Ministry of Public Works (hereinafter referred to as "MPW").

2. JICA Mission and MPW hereby agreed upon the Scope of Work of the Preparatory Survey for the Project as per Annex-1, subject to the approval by the competent higher authorities of both sides. It should be noted that implementation of the Survey does not imply any decision or commitment by JICA to extend its loan for the Project at this stage.

For JICA

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Annex-1

DRAFT IMPLEMENTATION PROGRAM
ON
JICA PREPARATORY SURVEY
FOR
UPPER CITARUM RIVER BASIN TRIBUTARIES FLOOD MANAGEMENT PROJECT

1. Background

(1) In Indonesia, flooding is considered as a major disaster risk and the number of flooding has been increasing year after year. Flooding causes not only direct physical damage but also indirect economic and social damage, such as the stagnation of economic activities and an increase in the number of poor, which has an adverse affect on sustainable economic development in Indonesia.

(2) The Government of Indonesia stipulates in the Midterm National Development Plan (RPJM 2004-2009) that the mitigation of flood damage under Integrated Water Resources Management is an important strategy program for the acceleration of construction and improvement of flood mitigation infrastructures centering on densely populated areas and major industrial areas, and disaster mitigation activities with public participation, and balance between non-structural and structural measures.

(3) Upper Citarum river basin located in the south of Bandung city, capital of West Java Province, had hit frequent floods for many years and caused enormous damage to especially economic activities such as agriculture sector and textile industry in this area. Although due to GOI' s continuous effort for flood management and JICA' s supports towards it from 1980s, flooding along Citarum main river has been reduced, countermeasures for flood management along upper tributaries has not been sufficient.

(4) Currently, it is reported that Citarum River is caused by pollution from untreated waste water, solid waste from factories and houses in and around Bandung City and also by the poor management of the upper watershed including the forest area control. This tendency in the upper basin of Citarum river has numerous negative impacts on the functions of water resources facilities on water for domestic purpose not only for Bandung area but also the Jakarta Metropolitan area such as declining electric generation, degrading fish farming in the reservoirs, and possibly even reducing human health.

2. Purpose of the Survey

The Survey aims to formulate a future ODA loan project which intends to minimize flood damage along upper tributaries of Citarum River. In addition, necessary technical assistance for improving water-related environmental management in this area may be proposed through the Survey.

3. Outline of the Proposed Project to be surveyed

(1) Subject of the Survey

Upper Citarum River Basin Tributaries Flood Management Project

(2) Scope of the Project

The project is designed as a "sector loan project" which has collection of sub-projects aiming to minimize flood damage along upper tributaries of Citarum River. The candidate sub-project will be selected based on the selection criteria which will be set through the Survey. Although selected sub-projects should be more urgent and effective than other sub-projects, depending on the changes of the situation, candidate sub-project can be changed in the course of the project implementation.

In this project, following components will be implemented.

1) Civil works (Channel improvement, embankment, retarding reservoir, etc.)
2) Consulting services (detailed design, bidding support, construction monitoring, environmental management, land acquisition monitoring, supporting of Flood Disaster Preparedness Enhancement, etc.)

(3) Executing Agency

Ministry of Public Works

4. Terms of Reference of the Preparatory Survey

(1) Review of the background and necessity of the Project

(1-1) Review RPJM2010-2014, Long-term Development Plan (2005-2025) and Mid-term Development Plan (2008-2013) of West Jawa Province, and relevant policy

(1-2) Review recent Flood Damage (Number of affected people, economic loss, damaged area)

(1-3) Analyze bottlenecks on implementation of the Project (Water quality, sedimentation and land subsidence, etc.)

(2) Review of the Feasibility of the Project

(2-1) Propose selection criteria for sub-project

(2-2) Collect and review of metrological, hydrological, hydraulic, morphological and land subsidence data

(2-3) Implement runoff and flood analysis utilizing Upper Citarum Basin Flood Management Model (Impact assessment in the case with / without the Project)

(2-4) Review existing detail design and propose necessary additional structural measures for controlling discharge volume to downstream basin

(2-5) Conduct basic design of structural measures for possible new target tributaries, and propose schedule, cost estimation based on the result of runoff analysis

(2-6) Identify the necessary land acquisition space and the number of resettlement

(2-7) Conduct sampling survey on the contamination of toxic substance including heavy metals, and propose its necessary countermeasures

(2-8) Propose basic design of non-structural measures (Capacity strengthening of the community so as to respond to frequent flood)

(2-9) Propose Pre-Selection of scope of the Project based on the information of flood damage within a predictable Loan amount registered in Blue Book

(3) Point out other concerns and propose necessary countermeasures for identified concerns (Any possibility of JICA's additional assistance coordinating with related stakeholders is proposed aside from the Project taking the Road Map into account)

(4) Assessment of the Project Implementation and O&M Framework

(5) Assessment of the Effect and Benefit of the Project (EIRR, Operation and Effect Indicator)

(6) Assessment of the Environmental and Social Considerations

(6-1) Review the preparation process of AMDAL and LARAP in accordance with JBIC Guidelines for confirmation of environmental and social considerations (April 2002) (hereinafter mentioned as "JBIC Guidelines")

(6-2) Review the result of actual implementation of AMDAL and LARAP in the phase1 and phase2 project, and analyze the issues (including necessary countermeasures).

(6-3) Support Indonesian side to prepare LARAP framework on each sub-project if the sub-project have a large scale involuntary resettlement and/or land acquisition

(6-4) Review EIA report, and if necessary, support Indonesian side to conduct

additional survey.

(6-5) Support Indonesian side to prepare the environmental checklist and monitoring form in accordance with the JBIC Guidelines.

5. Implementation Framework of the Preparatory Survey

(1) Preparatory Survey Team

JICA will select and dispatch a Preparatory Survey team to carry out the services. The team will include the following experts.

- Hydrologist
- Geologist
- Geotechnical engineer
- River Basin Plan Specialist
- Flood Control Engineer
- Design and cost estimate engineer
- Hydraulic Engineer
- Economics and Finance Specialist
- Environmental Specialist
- Social Environmental Specialist
- Stakeholder Coordinator

The Preparatory Survey team may engage local consultants, NGOs, and/or other supporting staffs.

(2) Implementation Schedule

The Survey will be conducted in accordance with the tentative schedule shown below. The schedule is tentative and may be modified if and when such modification becomes necessary during the course of the Survey and is mutually agreed upon by both sides.

Dec. 2009- Jan 2010	-	Discussion and confirmation of the Preparatory Survey Implementation Program
	-	Selection of consultants by JICA
Feb. 2010	-	Mobilization of the Preparatory Survey team, commencement of the Survey, submission of Inception Report
May. 2010	-	Submission of Progress Report
Aug. 2010	-	Submission of Draft Final Report
Oct. 2010	-	Submission of Final Report

(3) Reports

The Preparatory Survey team will prepare and present the following reports.

Inception Report	:	10 copies in English (8 to GOI and 2 to JICA), 2CD-R
Progress Report	:	10 copies in English (8 to GOI and 2 to JICA), 2CD-R
Draft Final Report	:	10 copies in English (8 to GOI and 2 to JICA), 2CD-R
Final Report	:	10 copies in English (8 to GOI and 2 to JICA), 2CD-R 3 copies in Japanese: (all copies to JICA)
Final Report (Summary)	:	10 copies in English (8 to GOI and 2 to JICA), 2CD-R 3 copies in Japanese: (all copies to JICA)

(4) Monitoring

The Preparatory Survey team's work will be subject to periodic review by JICA. JICA staff will attend meetings between the Preparatory Survey team and Executing Agency and/or other organizations involved during the implementation of the Preparatory Survey if necessary.

6. Undertakings by Executing Agency and other organizations involved

The executing agencies and other relevant organizations will undertake to provide the following in order to assist the implementation of the Preparatory Survey services on schedule, through close coordination with the authorities of GOI:

(1) To provide security-related information as well as measures to ensure the safety of the survey team upon request

(2) To provide information as well as support in obtaining medical service

(3) To furnish the Preparatory Survey team with all available and relevant data, information and documents requested by the team

(4) To assign counterpart personnel

(5) To provide the team with appropriate office space, office equipment and secretarial services

(6) To provide the Survey Team with credentials or identification card

(7) To provide assistance for issuance of entry permits necessary for the Preparatory Survey team members to conduct field survey

(8) To ensure close coordination and information sharing with relevant authorities and organizations regarding the contents and progress of the Survey

(9) To assist the team in customs clearance, exempt from any duties with respect to equipment, instruments, tools and other articles to be brought into and out of Indonesia in connection with the implementation of the services

(10) To assist the team to obtain other privileges and benefits if necessary

7. Others

The nature of the services to be rendered by the Preparatory Survey team shall be exclusively advisory, with all decisions as to whether to accept or implement any recommendation(s) made or instruction(s) given in the course of the implementation of the services shall be the responsibility of GOI and other agencies involved.

The GOI through relevant agencies shall take, with their own responsibility, all the necessary measures for the utilization of the recommendations and outcomes of the Preparatory Survey in the JICA financed projects.

(end)

Annex-2

MAIN POINTS DISCUSSED

The JICA Mission and MPW discussed and agreed on the following points.

I. Project Type

The JICA Mission and MPW agreed that the project is designed as a sector loan, and new target tributaries other than 9 tributaries can be candidate sub-projects under the Project based on the selection criteria set in the Survey in terms of urgency, priority and efficiency as mentioned in Annex-1. In addition, the JICA Mission and MPW confirmed that possible bottlenecks including contamination of heavy metal and toxic substance in river bed and necessary land acquisition and resettlements should be considered carefully in sub-project selection process.

II. Review the Detailed Design of 9 tributaries

The JICA Mission and MPW agreed that the detail design of 9 tributaries river improvement, which was completed in 2007 by MPW, should be reviewed considering the impact to the downstream area, especially, Dayeuh Kolot.

III. Flood Model

The JICA Mission and MPW agreed that MPW provides the basic data of Upper Citarum Basin Flood Management Model Framework which is under developing by PusAir to the Survey Team. In close coordination with PusAir, the Survey Team will study the flood management plan of Upper Citarum River Basin.

IV. Relevant Problem

The JICA Mission and MPW confirmed that Citarum River has more challenges to be tackled than flooding. In order to promote integrated water resources management in Citarum River, the Survey may propose possible additional assistance not only for flood management but also water quality improvement, heavy metal in river bed and land subsidence and so on.

V. Executing agency of the Survey

The JICA Mission and MPW confirmed that the executing agency of the Survey is MPW represented by BBWSC who work together with the Survey Team.

In addition, the JICA Mission and MPW confirmed that the Survey should be

conducted coordinating relevant stakeholders including BAPPENAS and regional governments in Indonesian in order to make necessary consensus for the progress of the Survey.

VI. Environmental and social consideration studies and procedures

MPW will undertake necessary studies for environmental and social consideration, such as environmental impact assessment, in accordance with the laws and regulations in force in Indonesia as well as JBIC guidelines for confirmation of environmental and social considerations (April 2002) if the projects whose finance will be requested to GOJ.

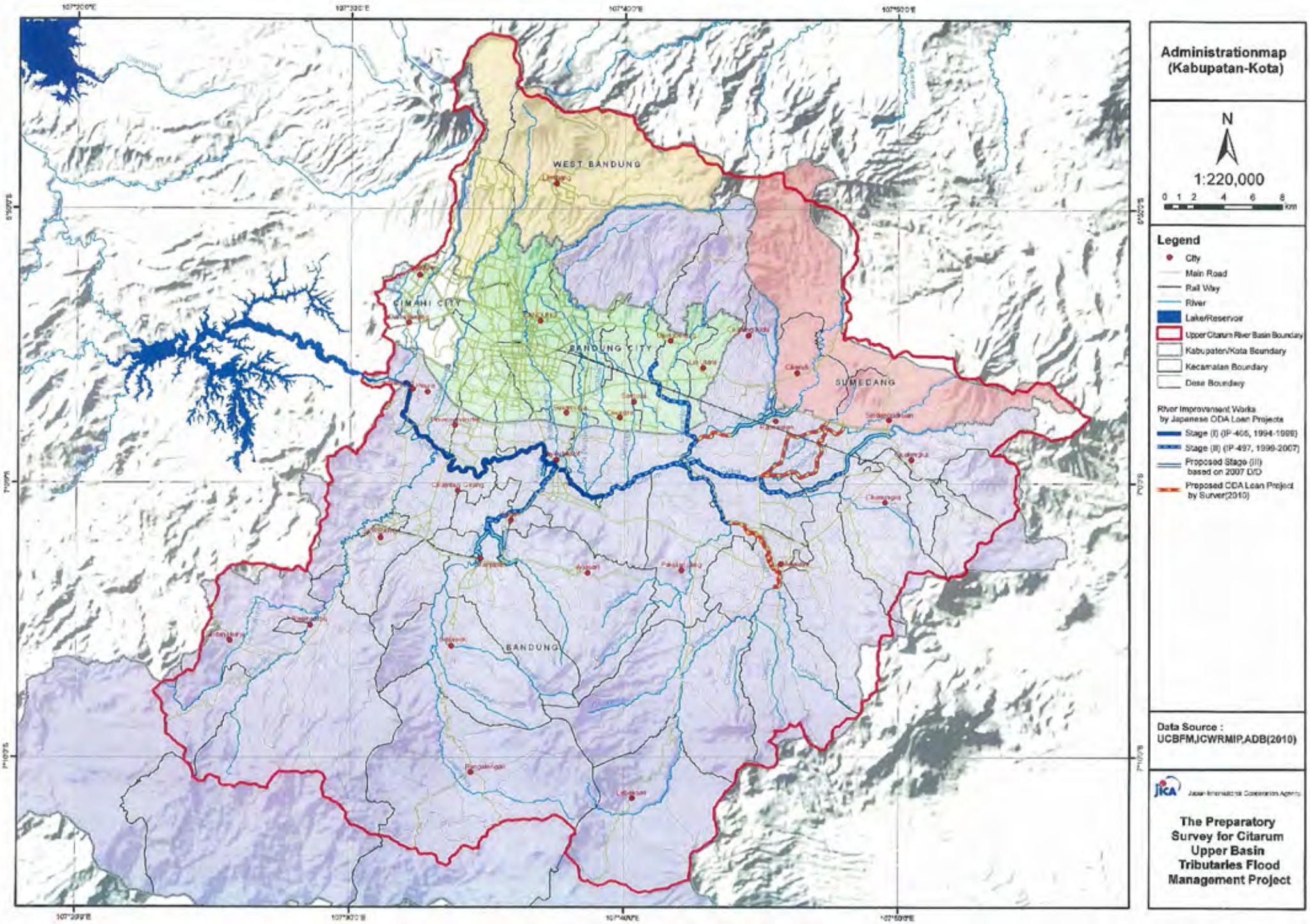
Regarding the social consideration, in the case of having large amount of resettlement and/or land acquisition, LARAP framework is requested to be prepared and submitted to JICA prior to its actual project examination. Therefore MPW will conduct necessary examination throughout the Survey. Also, MPW will review the EIA report and conduct additional examination if necessary. The Survey Team will provide necessary technical support to MPW throughout the studies. EIA report is required to be approved in accordance with AMDAL procedure prior to the submission to JICA.

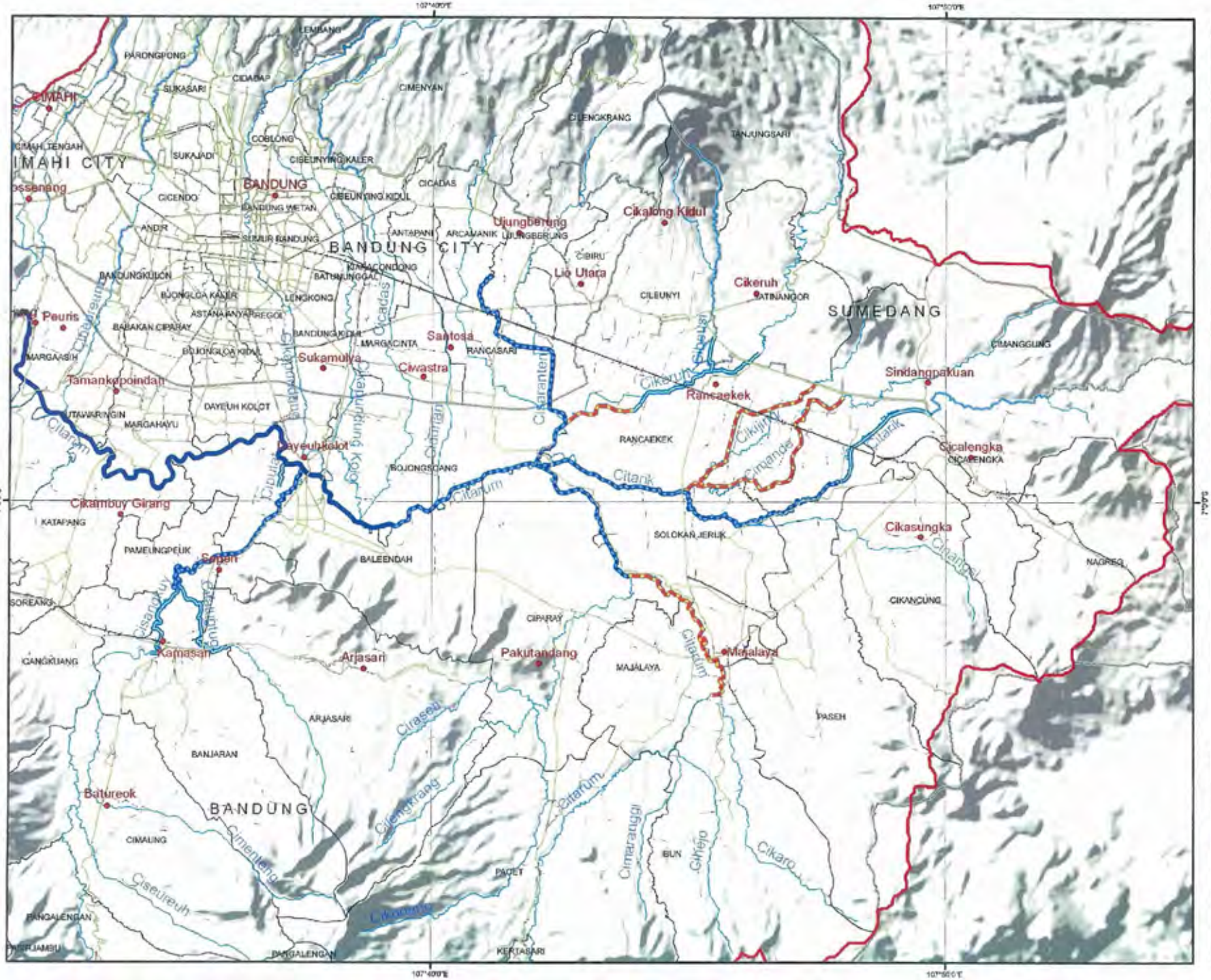
VII. Disclosure of the final report of the Survey

MPW and the JICA Mission agreed that the final report of the Survey will be disclosed to the public except information related to tender, which may be included in the results of the feasibility study, such as cost estimates.

Annex II: Referential Figures

List of Referential Figures


Administrationmap
(Kabupatan-Kota)
N
1:220,000
0 1 2 4 6 8 km
Legend
City
Main Road
Rail Way
River
Lake/Reservoir
Upper Citarum River Basin Boundary
Kabupaten/Kota Boundary
Kecamatan Boundary
Desa Boundary
River Improvement Works
by Japanese ODA Loan Projects
Stage (I) (IP-466, 1994-1998)
Stage (II) (IP-497, 1999-2007)
Proposed Stage (III)
based on 2007 D/D
Proposed ODA Loan Project
by Survey(2010)
Data Source :
UCBFM,ICWRMIP,ADB(2010)
JICA
Japan International Cooperation Agency
The Preparatory
Survey for Citarum
Upper Basin
Tributaries Flood
Management Project
WEST BANDUNG
CIMAHI CITY
BANDUNG CITY
SUMEDANG
BANDUNG

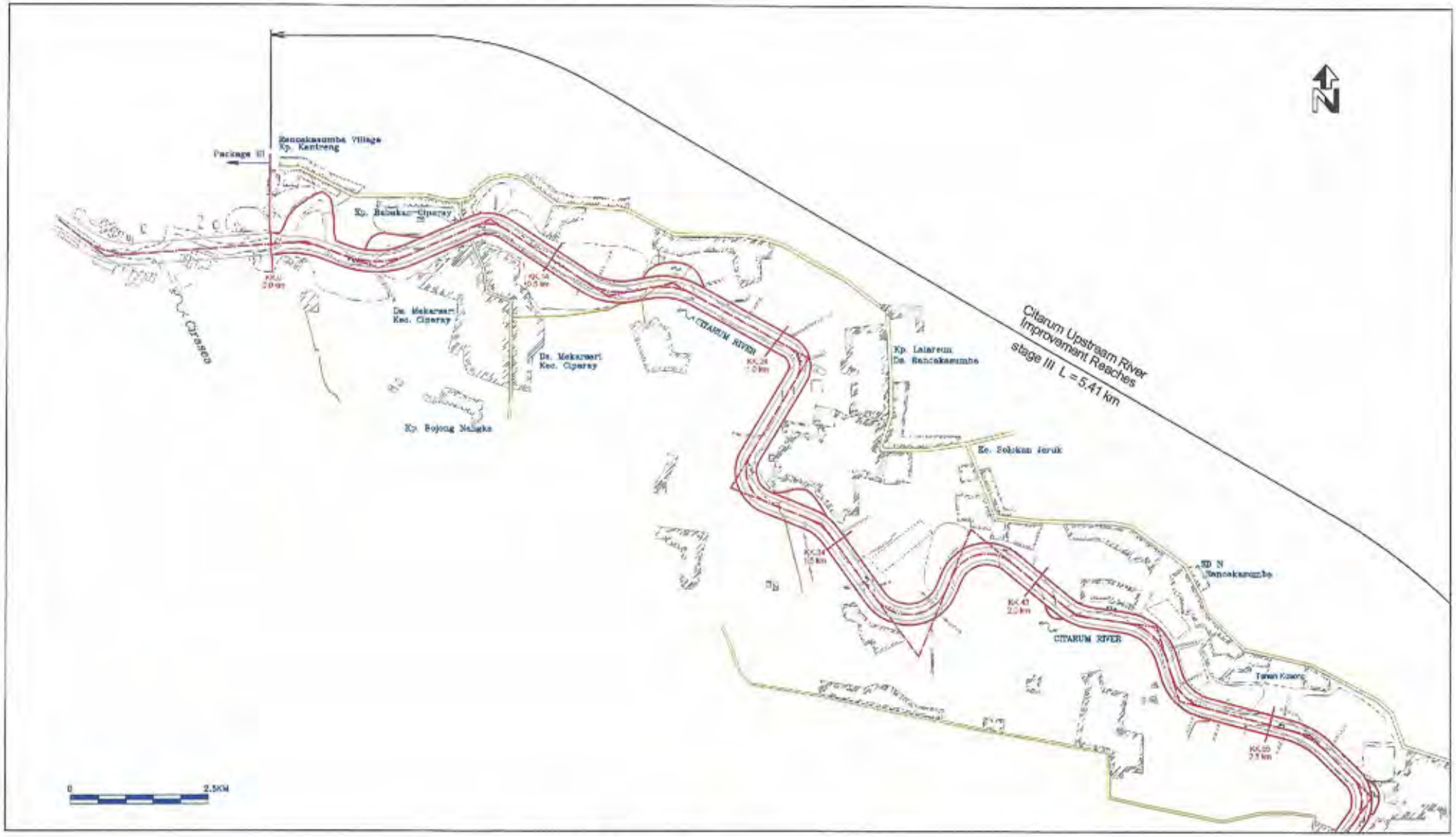


Administration Map
(Flood Prone Area)

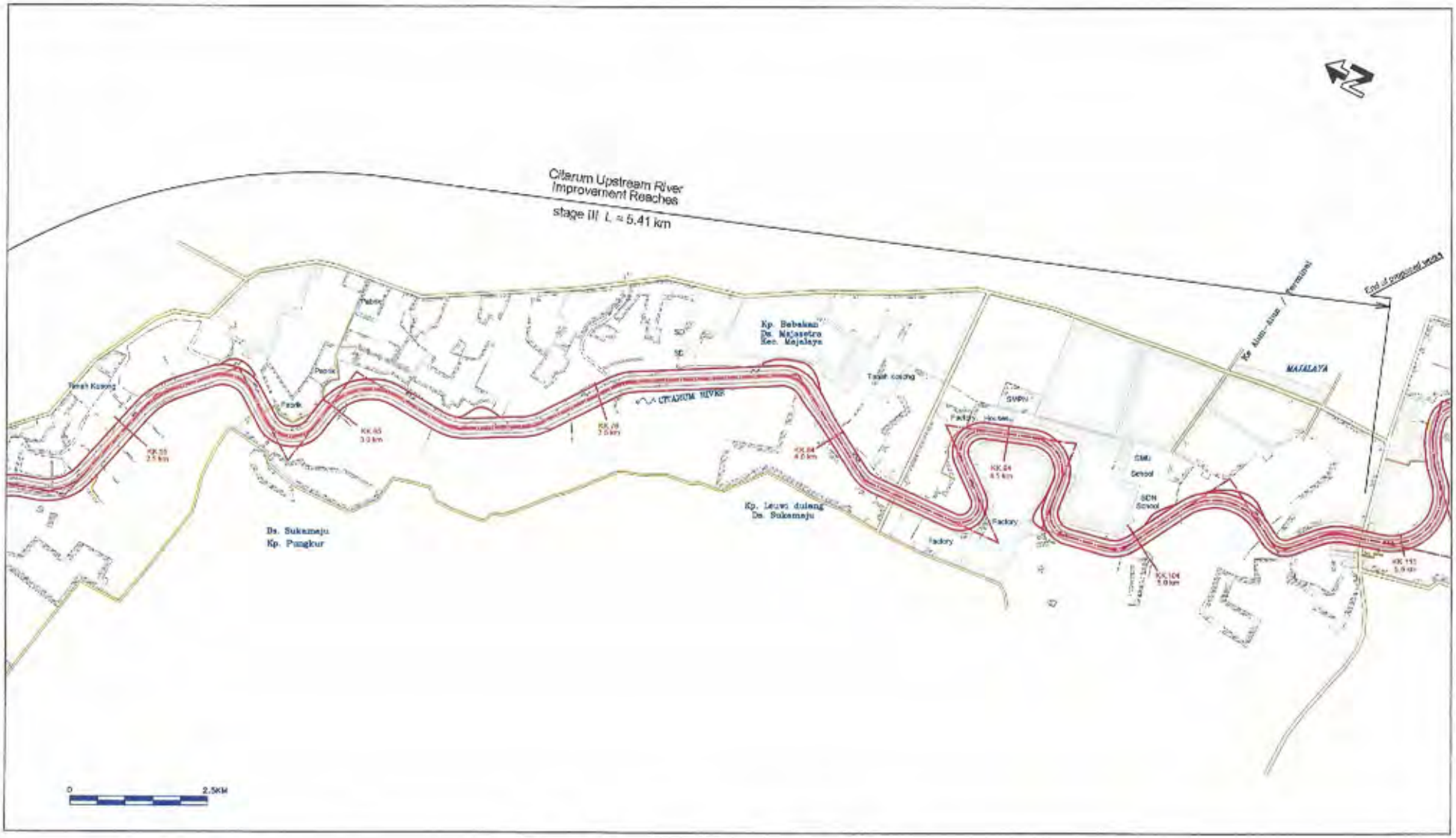
Data Source :
UCBFM,ICWRMIP,ADB(2010)

JICA Japan International Cooperation Agency

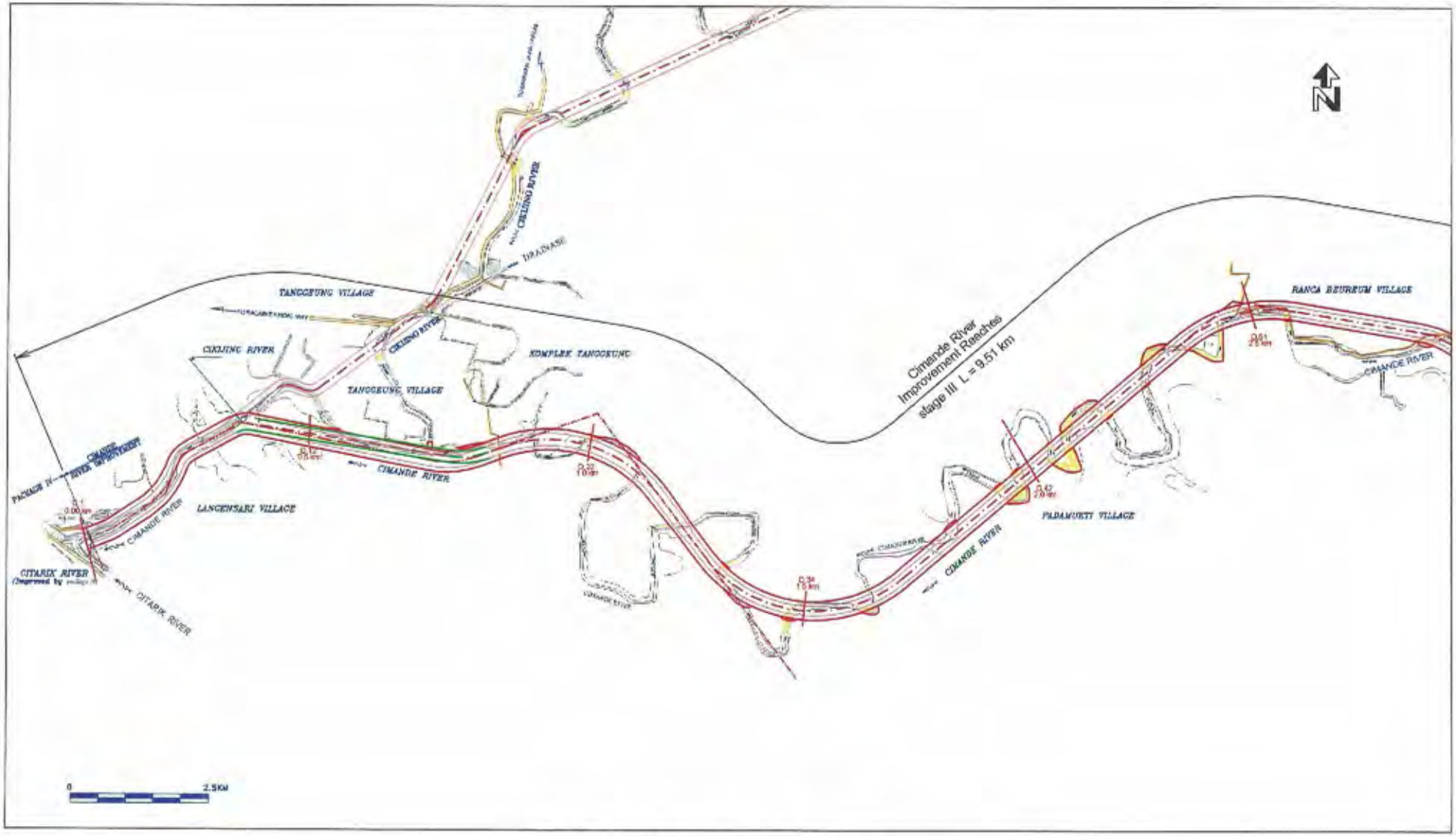
The Preparatory Survey for Citarum Upper Basin Tributaries Flood Management Project



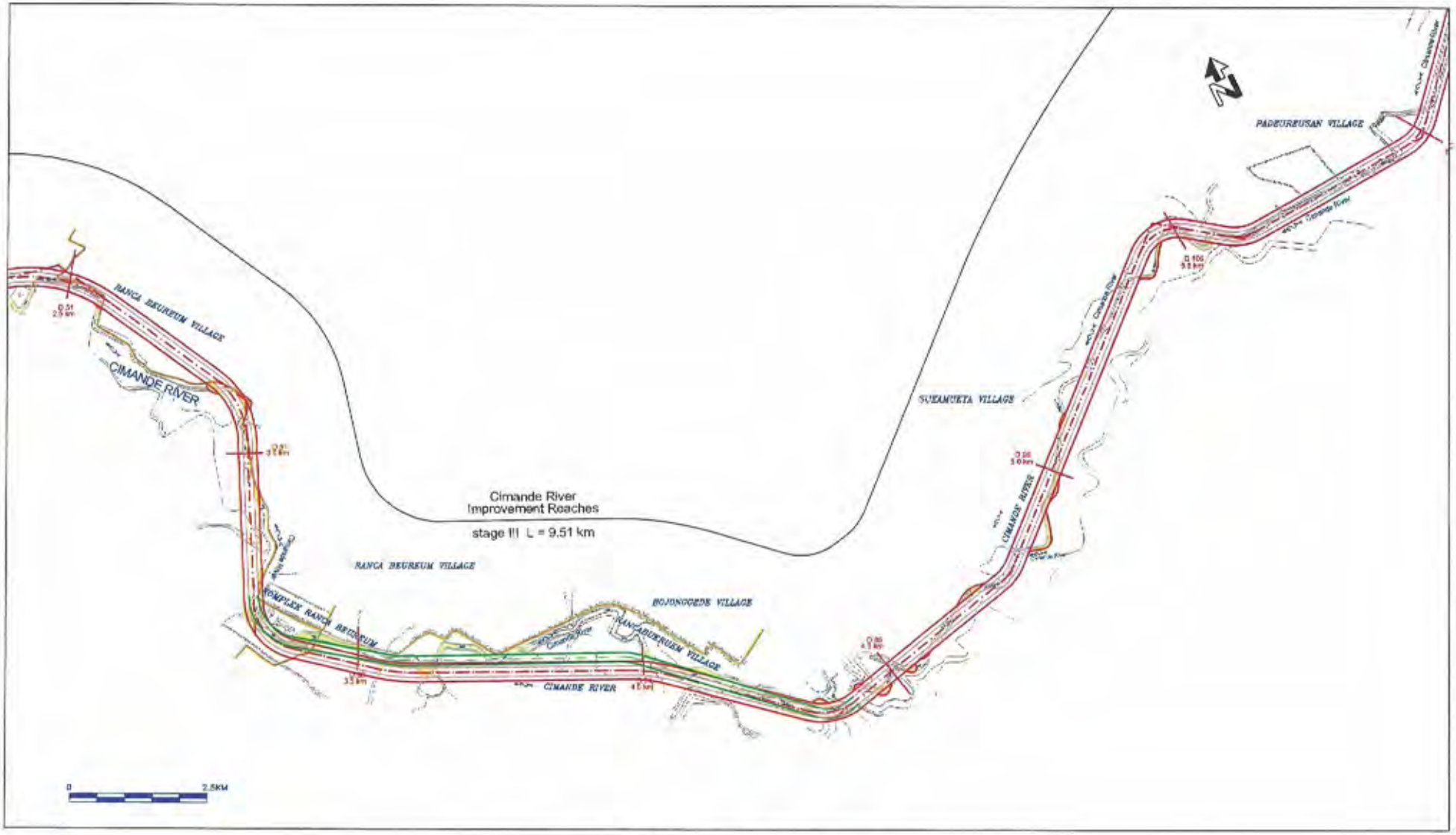
Plan of Citarum Upstream River (1/2)



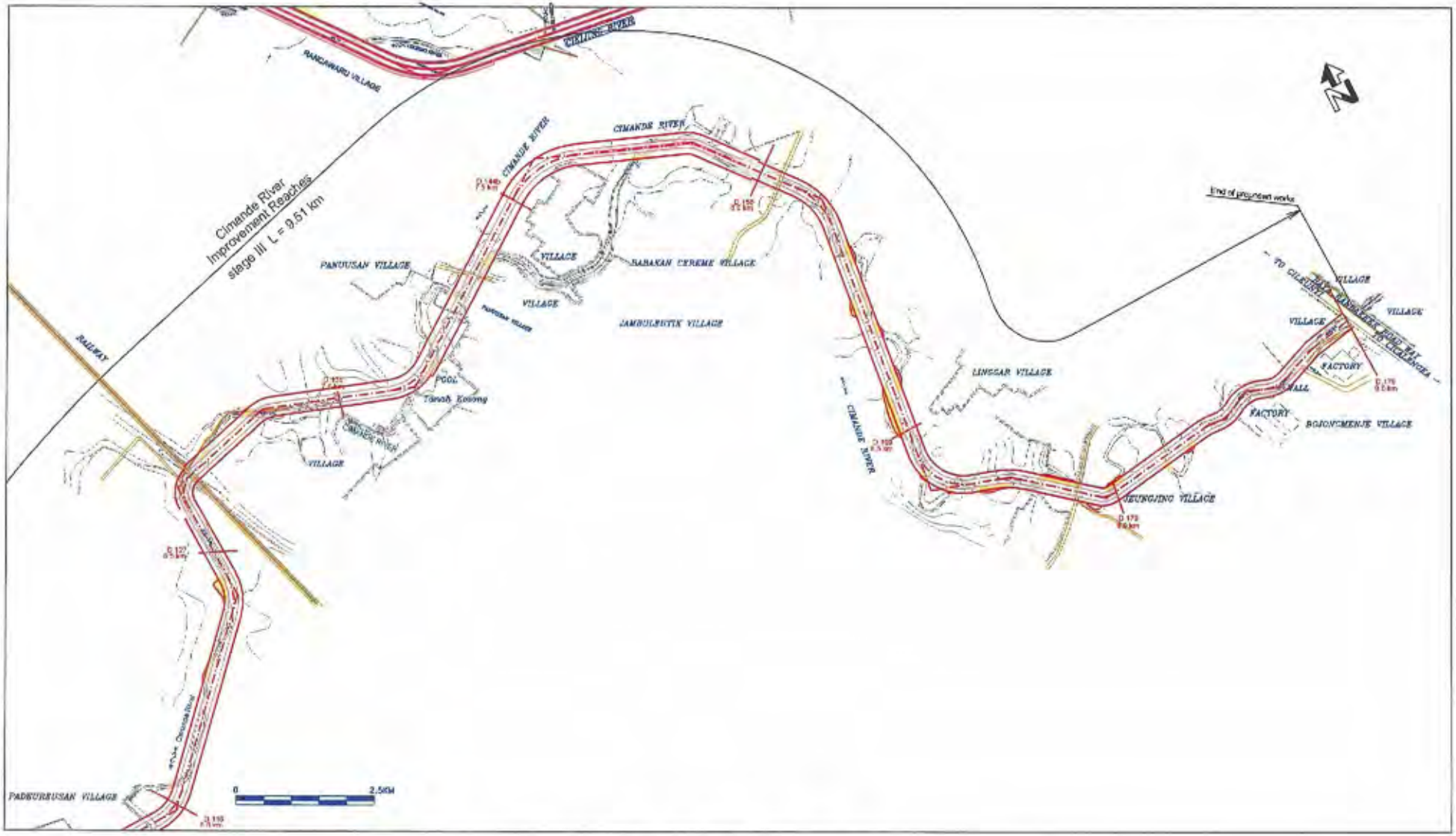
Plan of Citarum Upstream River (2/2)



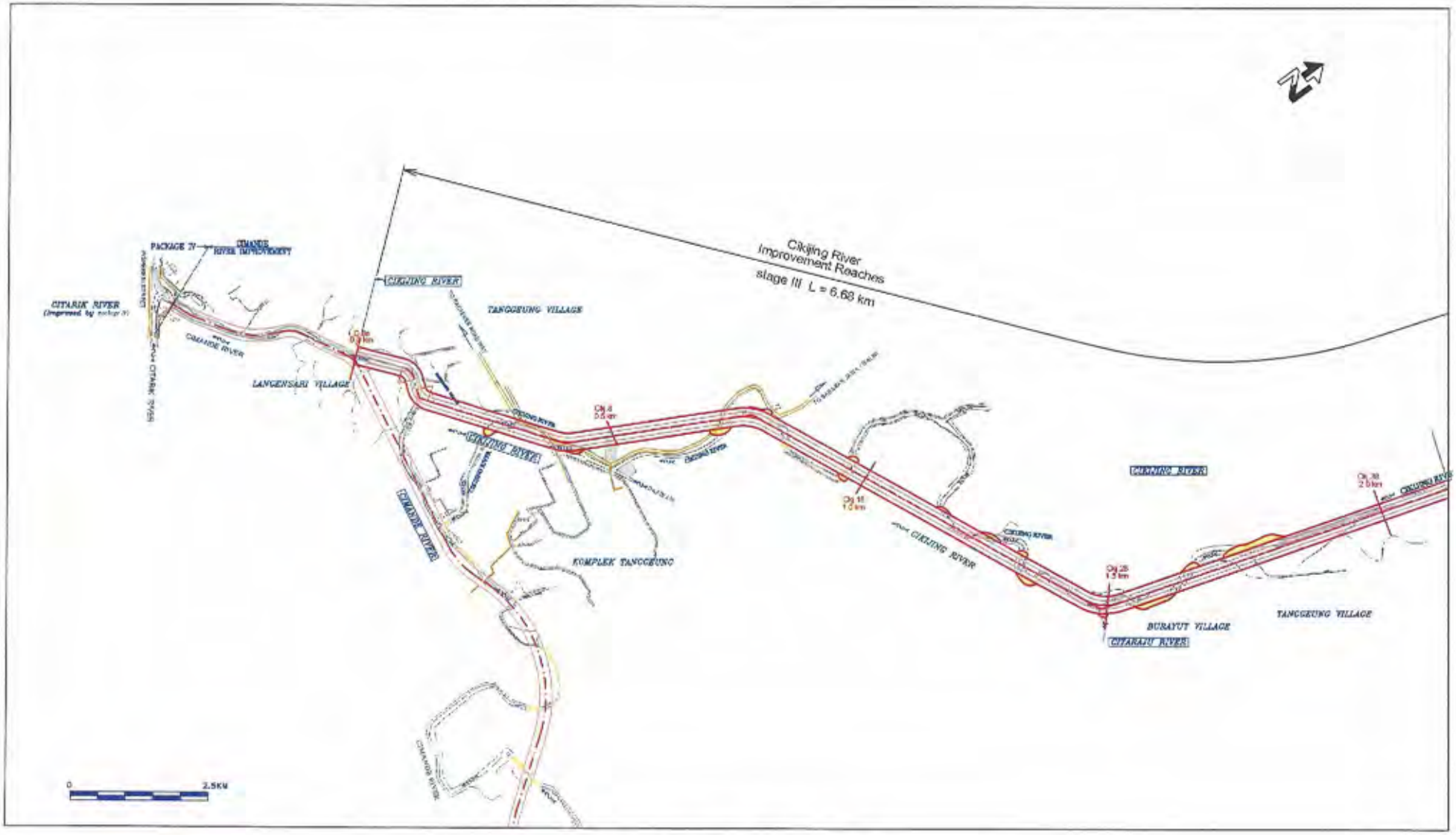
Plan of Cimande River (1/3)



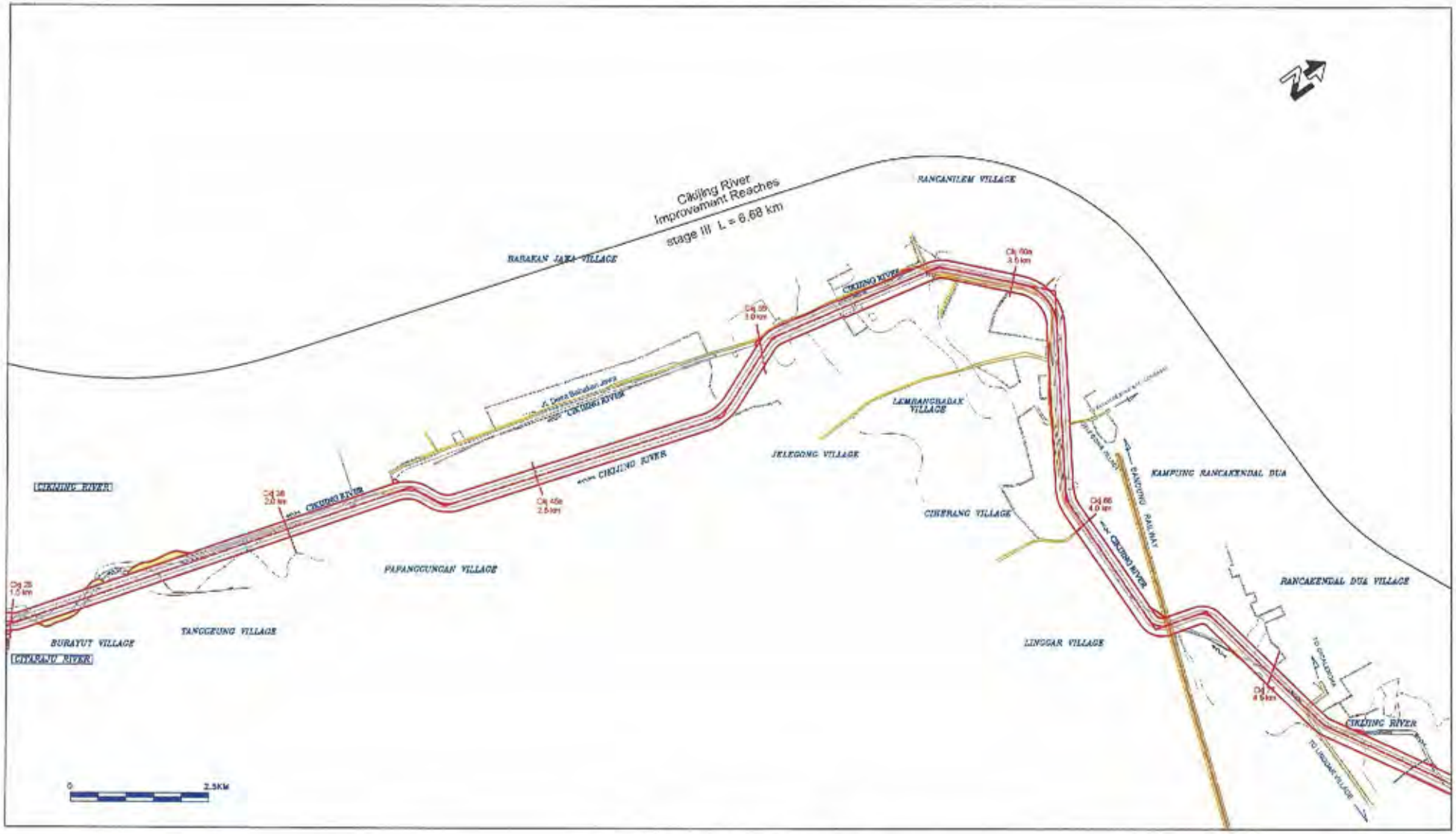
Plan of Cimande River (2/3)



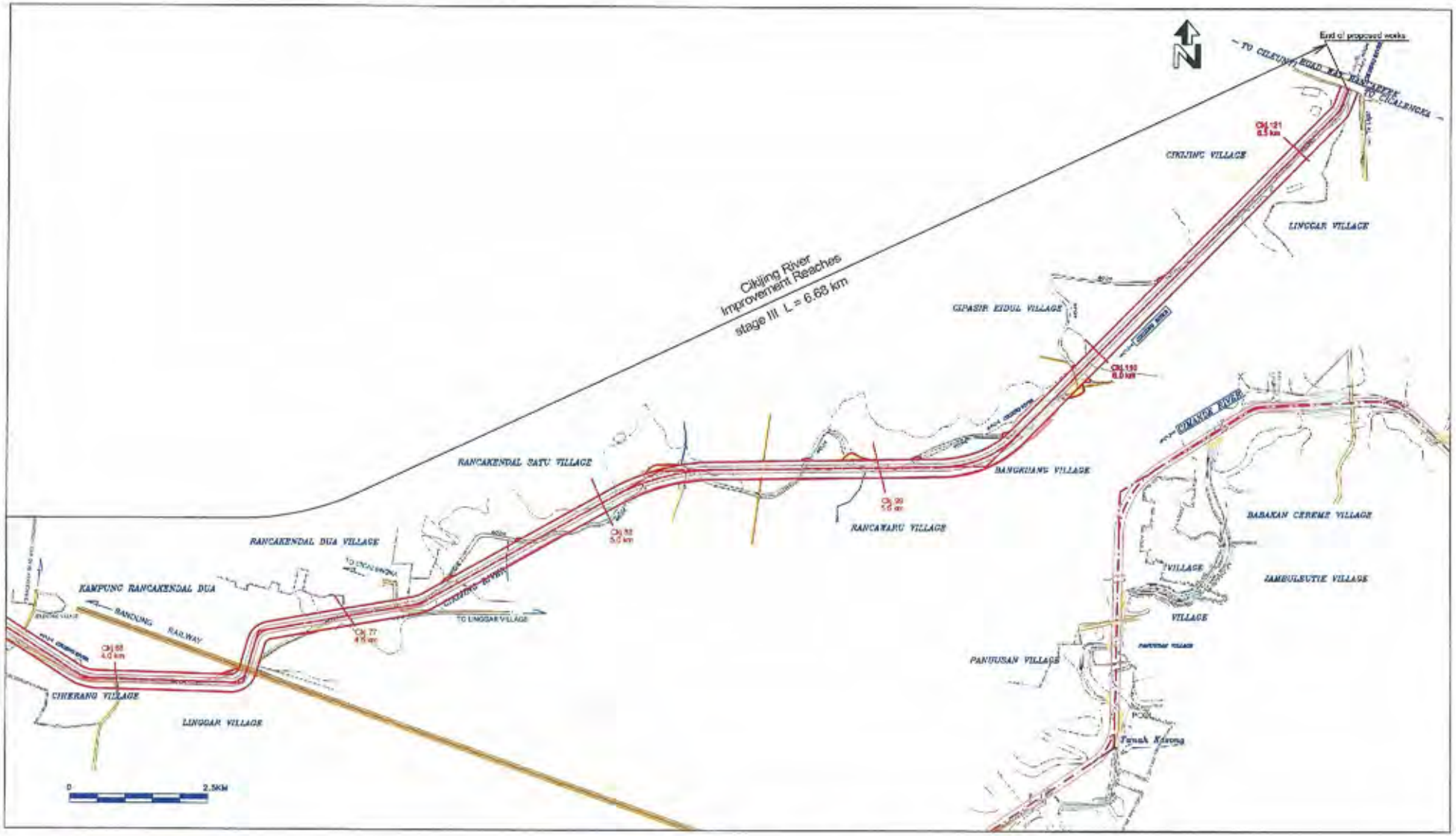
Plan of Cimande River (3/3)



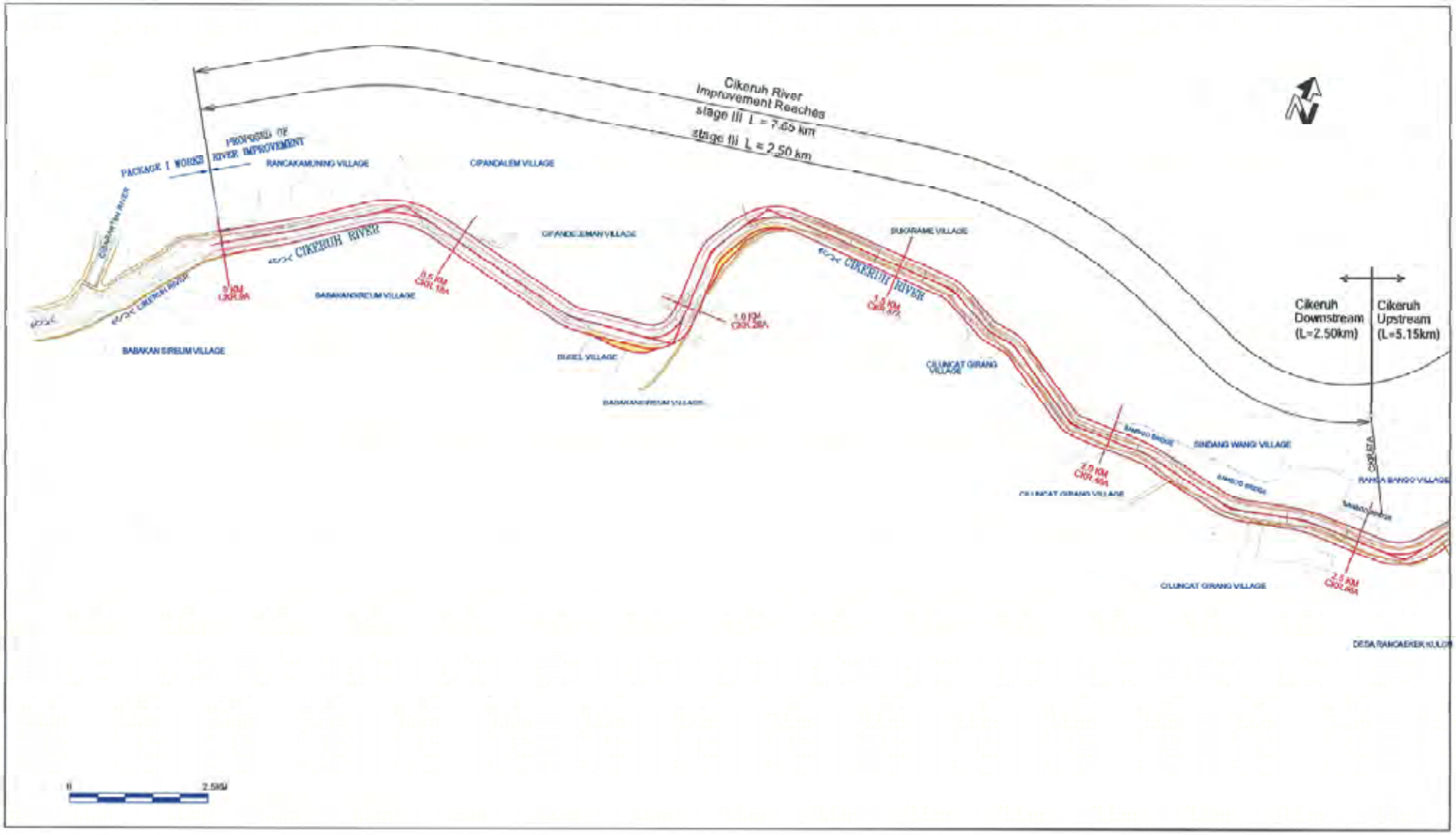
Plan of Cikijing River (1/3)



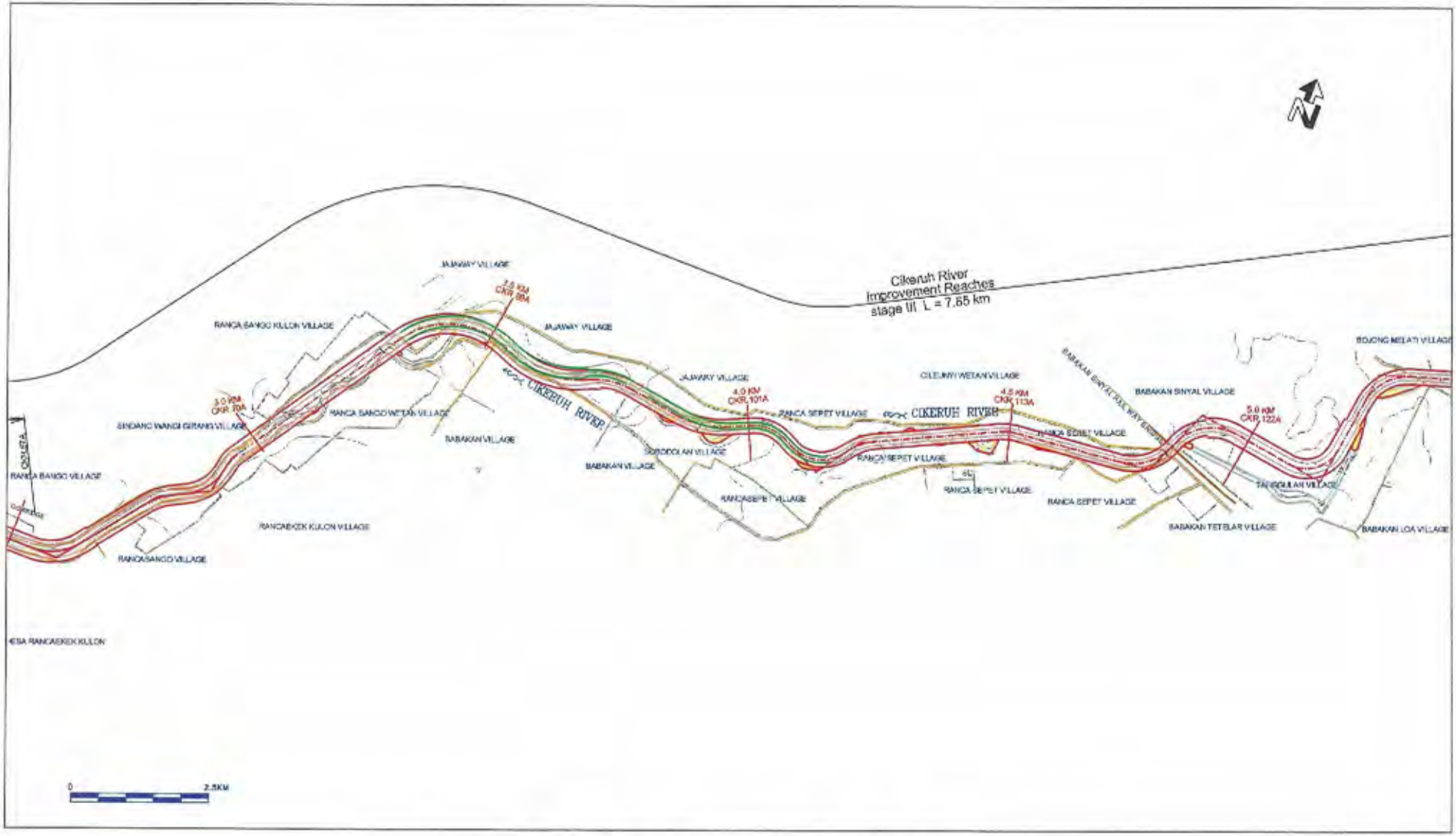
Plan of Cikijing River (2/3)



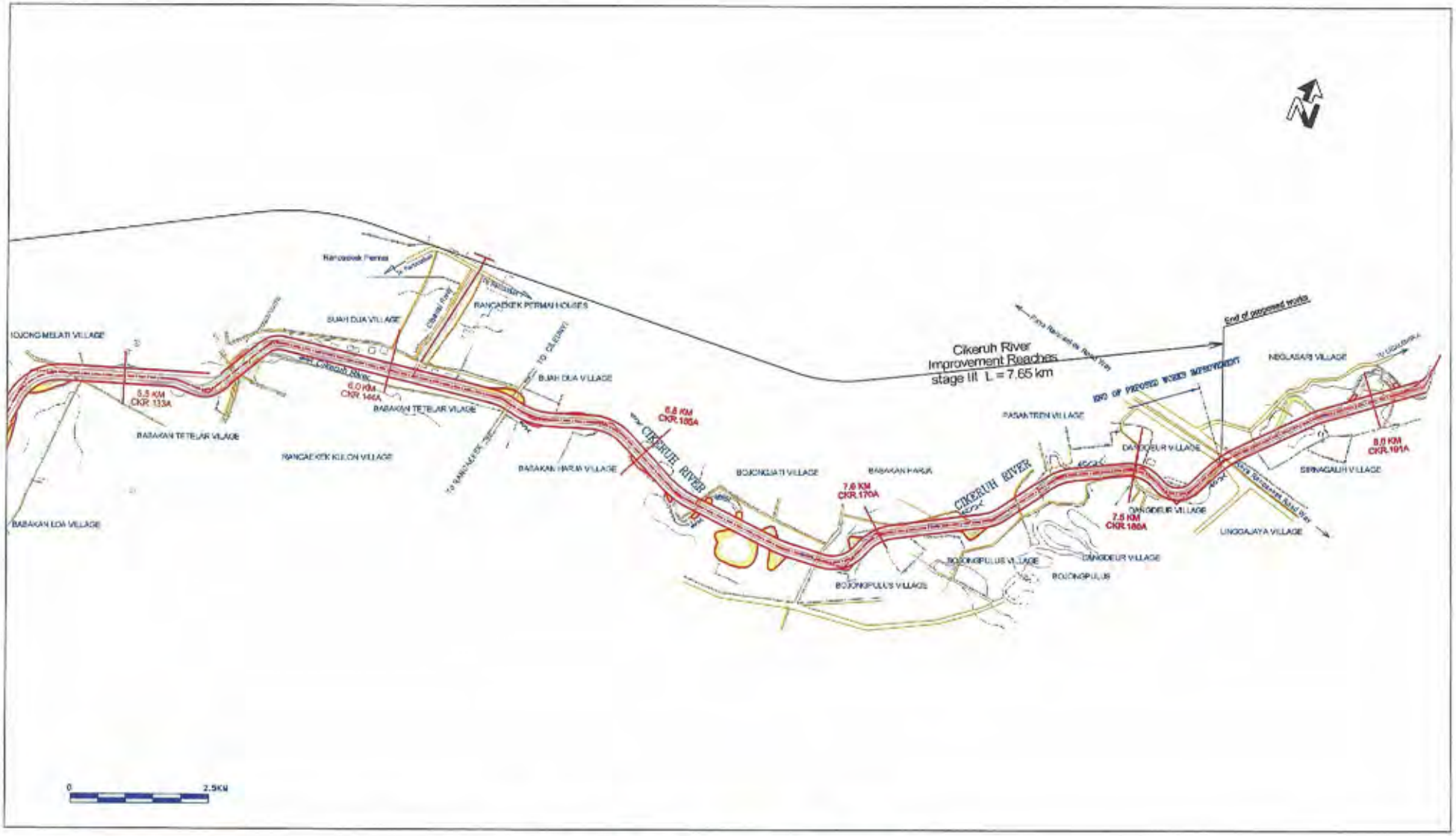
Plan of Cikijing River (3/3)



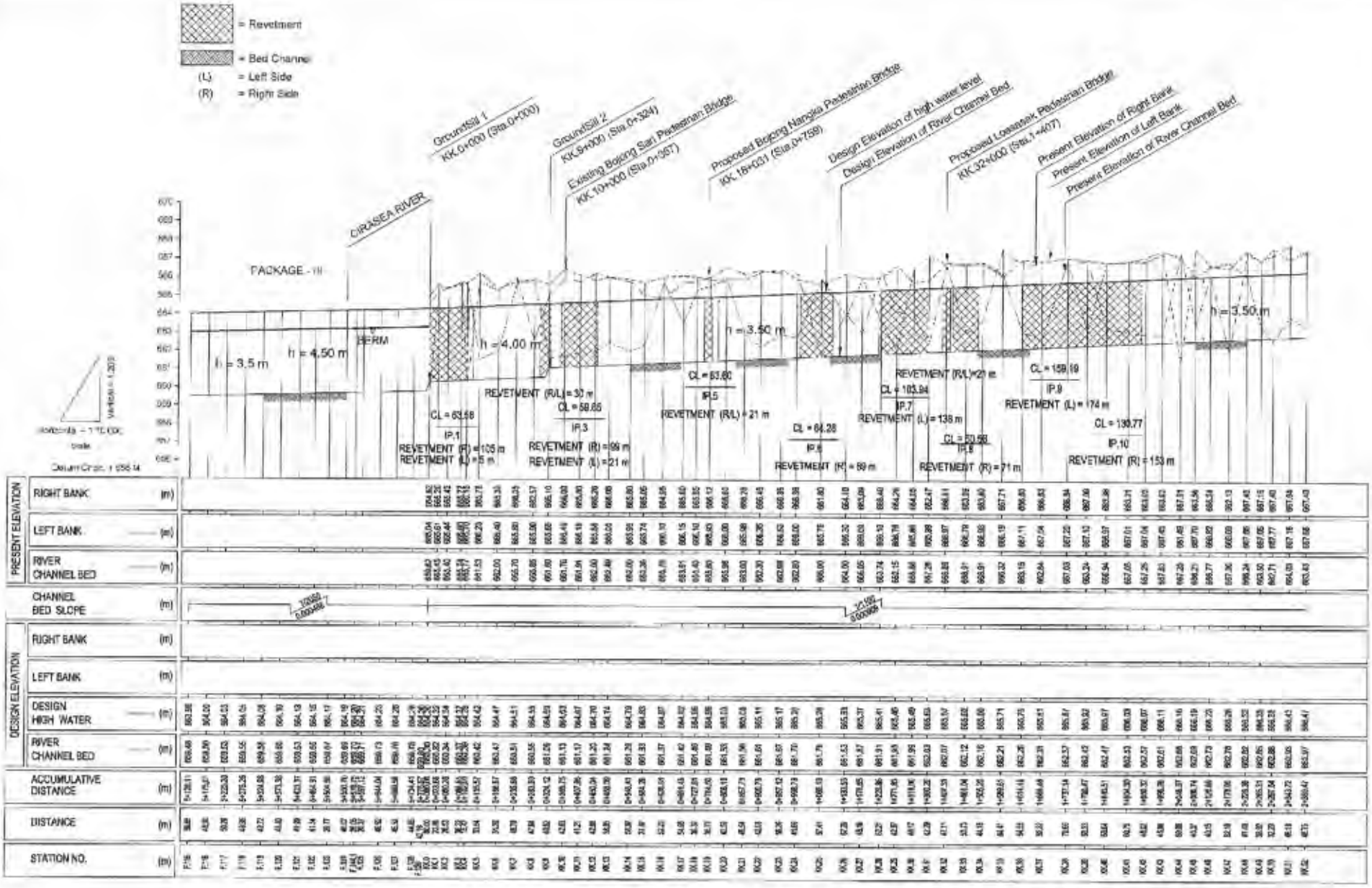
Plan of Cikeruh Upstream River (1/3)



Plan of Cikeruh Upstream River (2/3)



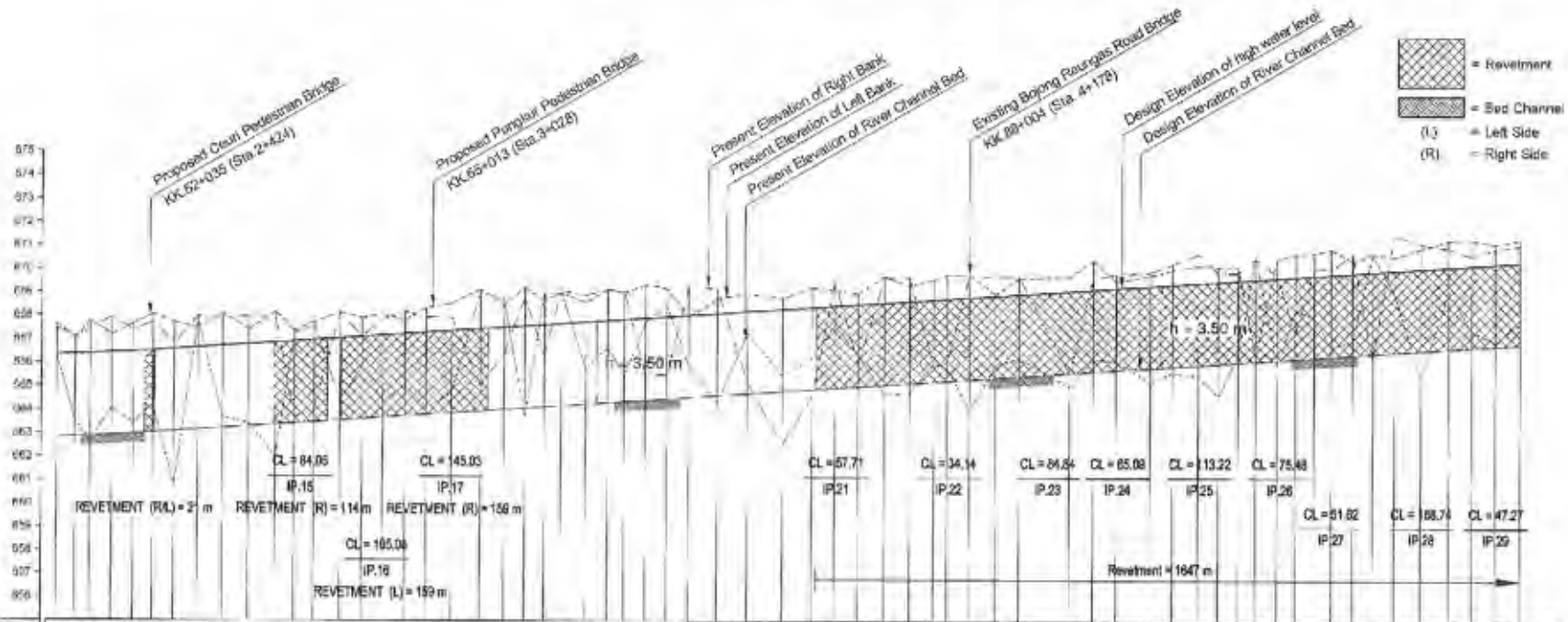
Plan of Cikeruh Upstream River (3/3)



SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CITARUM UPSTREAM RIVER (1/3)

DRAWING NO.
P00-010PF001

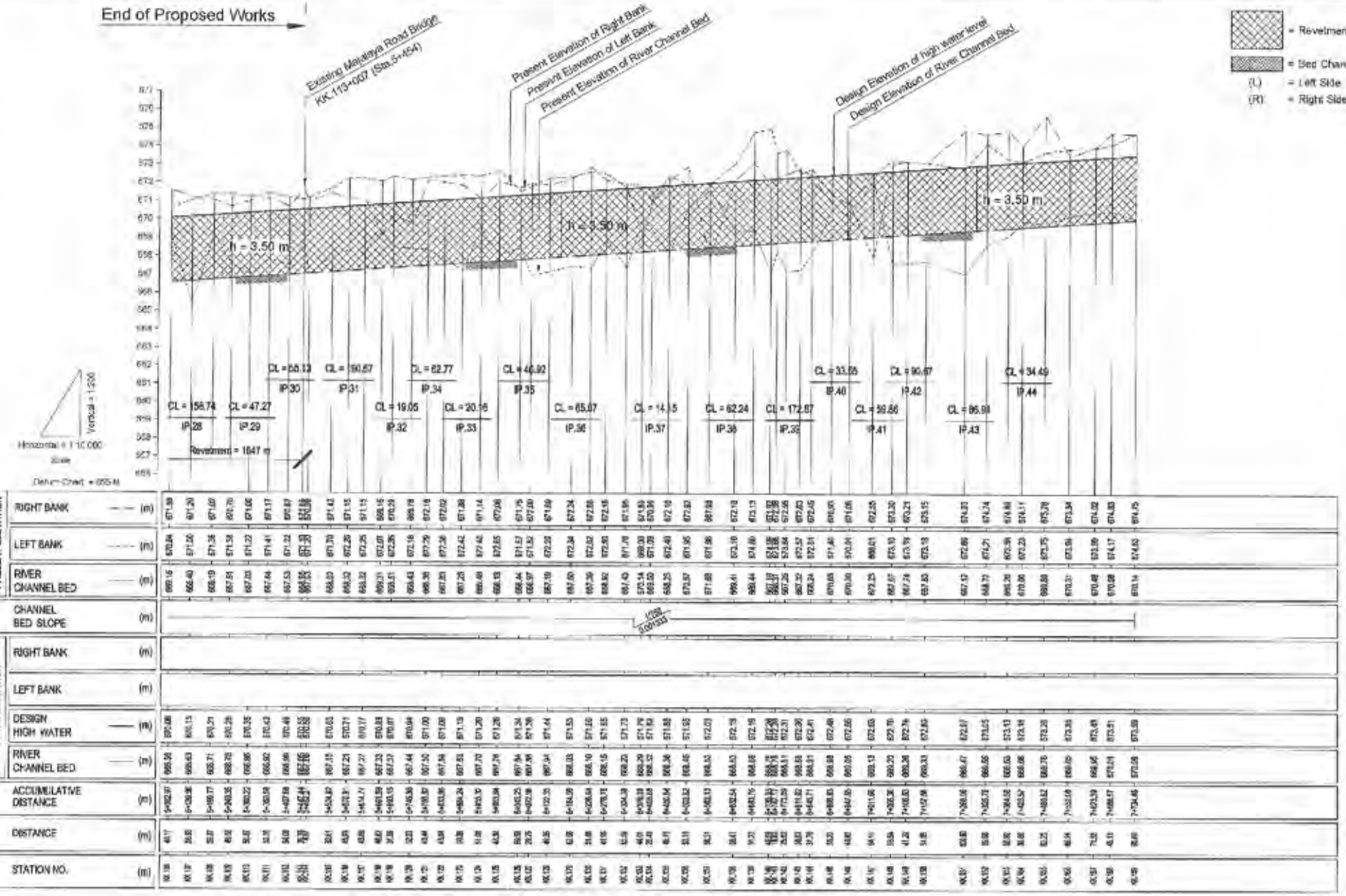


PRESENT ELEVATION	RIGHT BANK	(m)
	LEFT BANK	(m)
	RIVER CHANNEL BED	(m)
CHANNEL BED SLOPE		(m)
DESIGN ELEVATION	RIGHT BANK	(m)
	LEFT BANK	(m)
	DESIGN HIGH WATER	(m)
	RIVER CHANNEL BED	(m)
ACCUMULATIVE DISTANCE		(m)
DISTANCE		(m)
STATION NO.		(m)

SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CITARUM UPSTREAM RIVER (2/3)

DRAWING NO.
F00-01OPF002



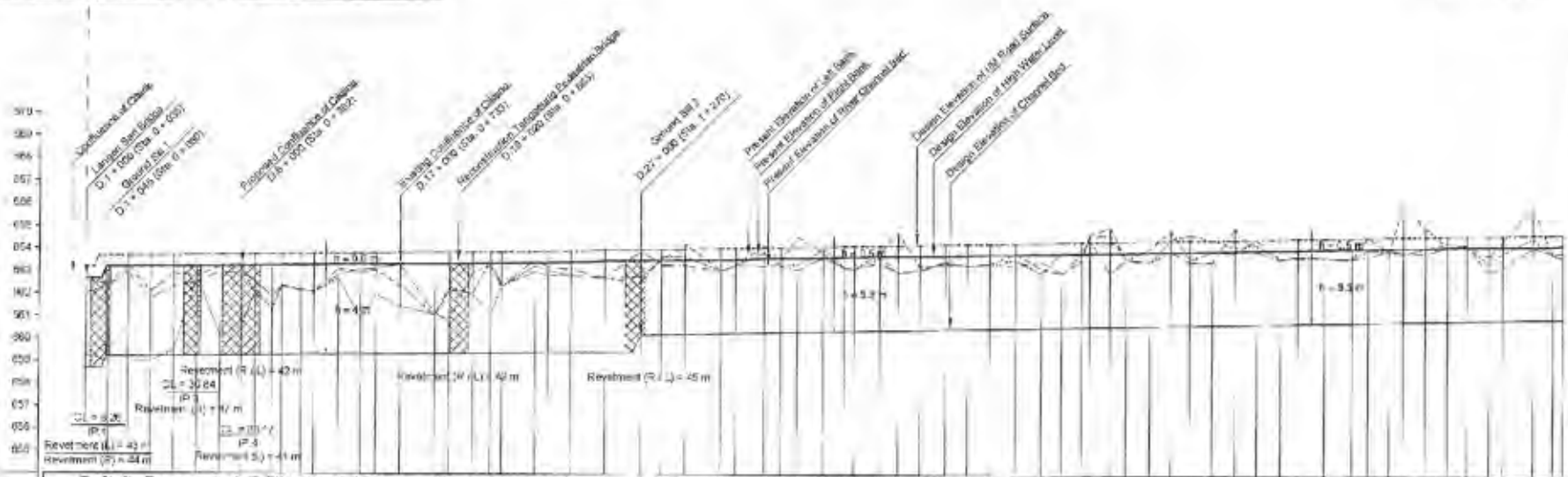
SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CITARUM UPSTREAM RIVER (3/3)

DRAWING NO.
P00-01DF003

PACKAGE V WORKS | PROPOSED IMPROVEMENT WORKS

= Revetment
= Bed Channel
(L) = Left Side
(R) = Right Side

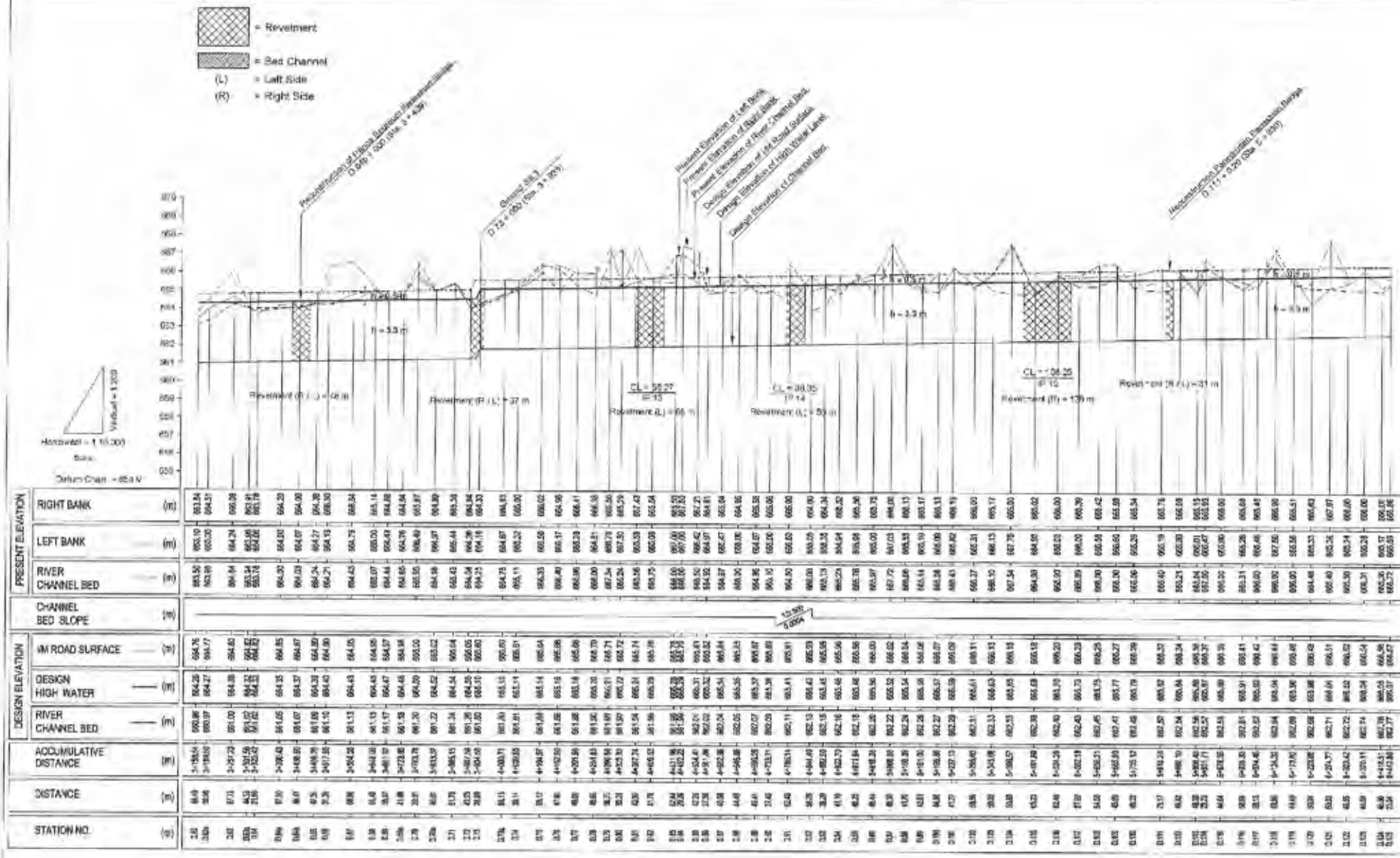


PRESENT ELEVATION	RIGHT BANK	(m)
	LEFT BANK	(m)
	RIVER CHANNEL BED	(m)
	CHANNEL BED SLOPE	(m)
DESIGN ELEVATION	IM ROAD SURFACE	(m)
	DESIGN HIGH WATER	(m)
	RIVER CHANNEL BED	(m)
	ACCUMULATIVE DISTANCE	(m)
	DISTANCE	(m)
	STATION NO.	(m)

SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIMANDE RIVER (1/3)

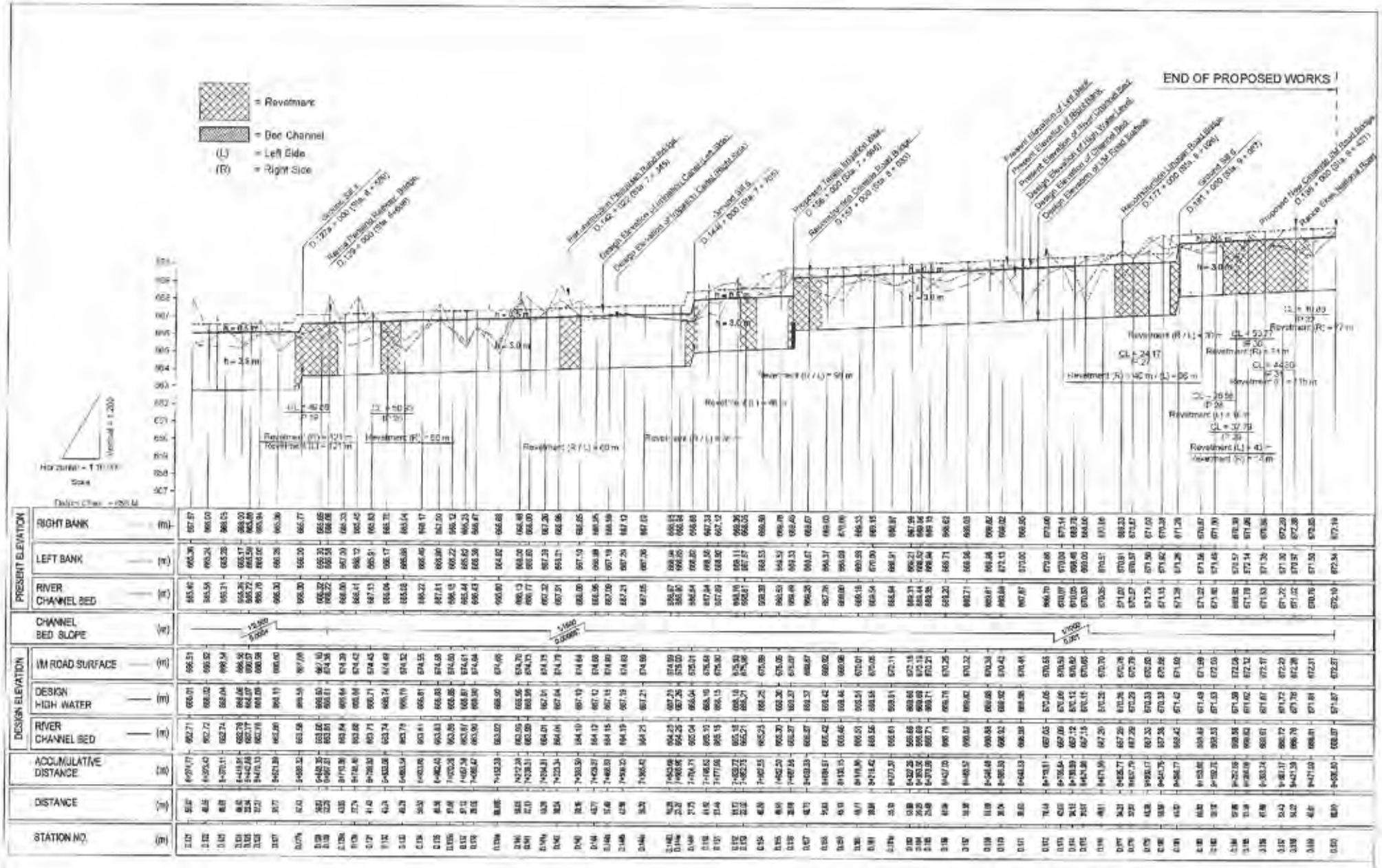
DRAWING NO.
PDO-050PFD01



SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIMANDE RIVER (2/3)

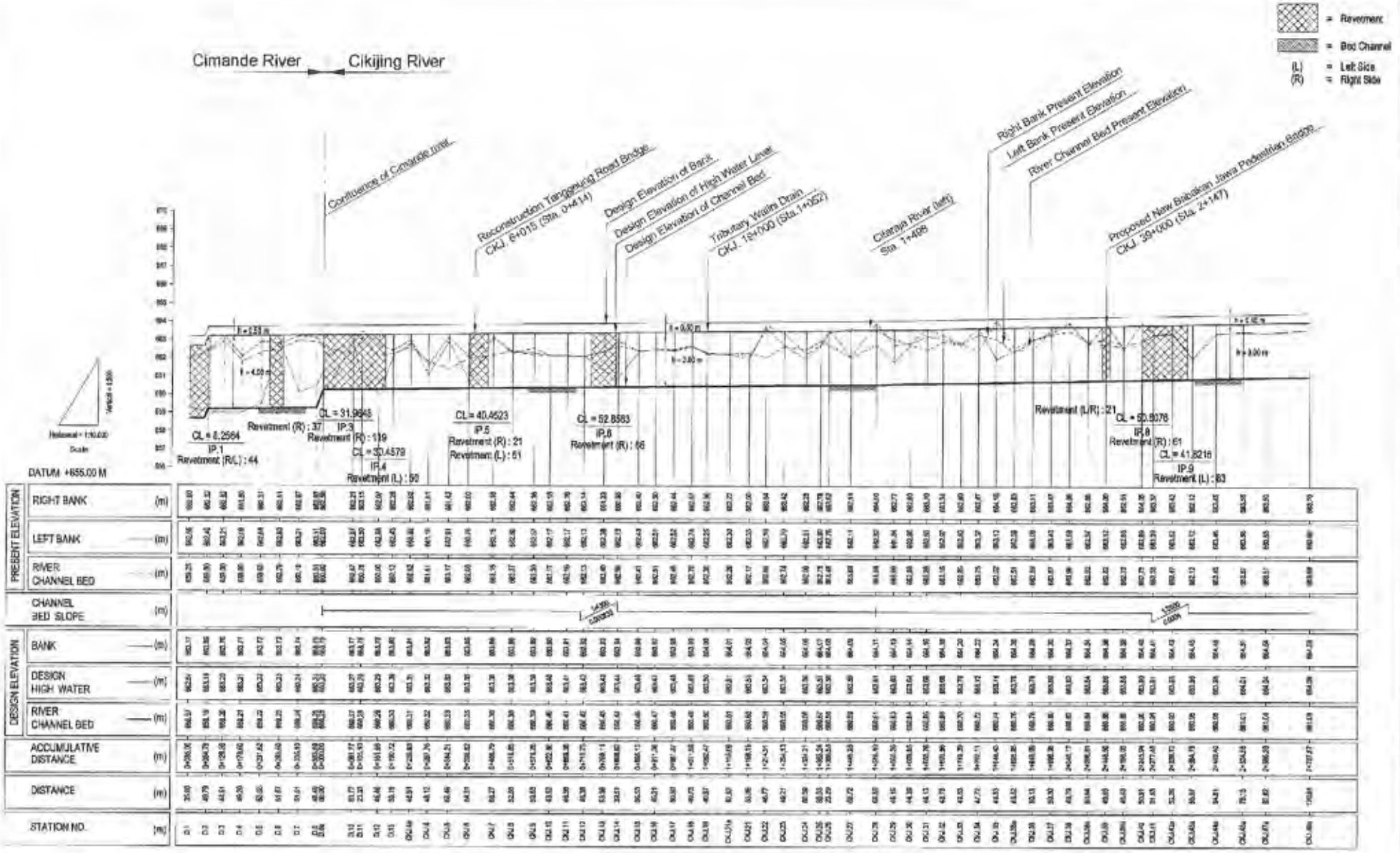
DRAWING NO.
PGC-03CRP002



SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIMANDE RIVER (3/3)

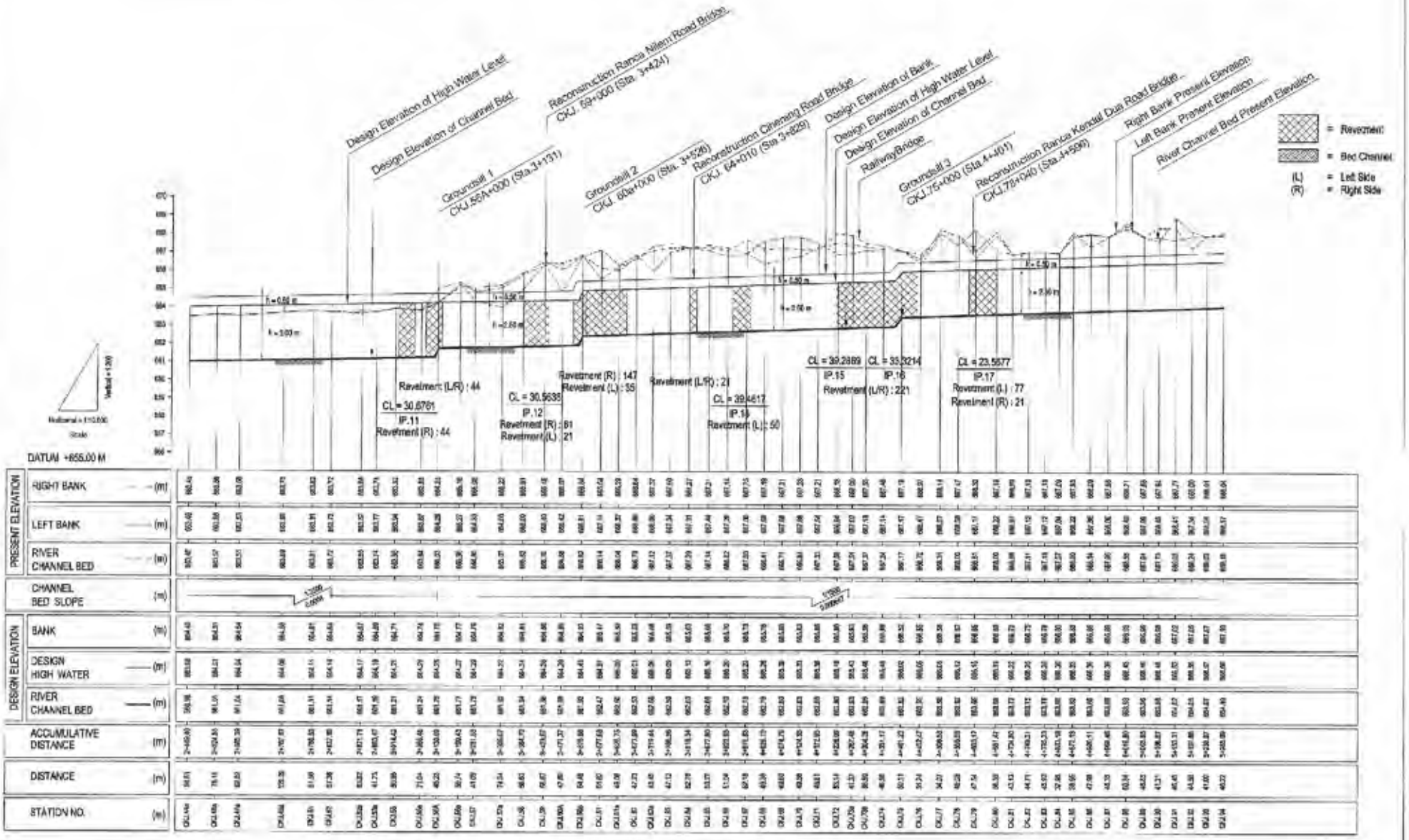
DRAWING NO.
P00-03CPF003



SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIKIJING RIVER (1/3)

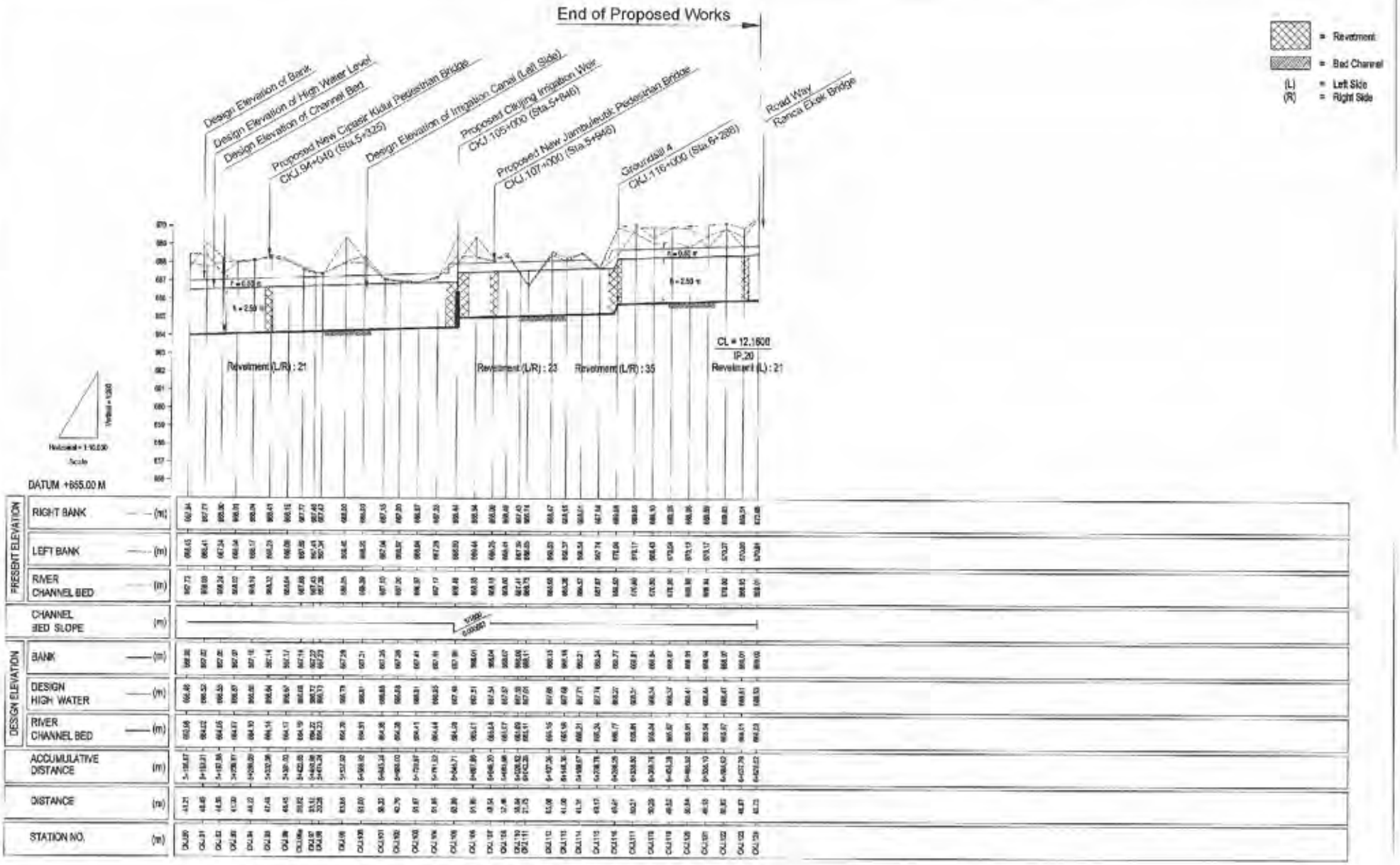
DRAWING NO.
F00-040PF001



SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIKIJING RIVER (2/3)

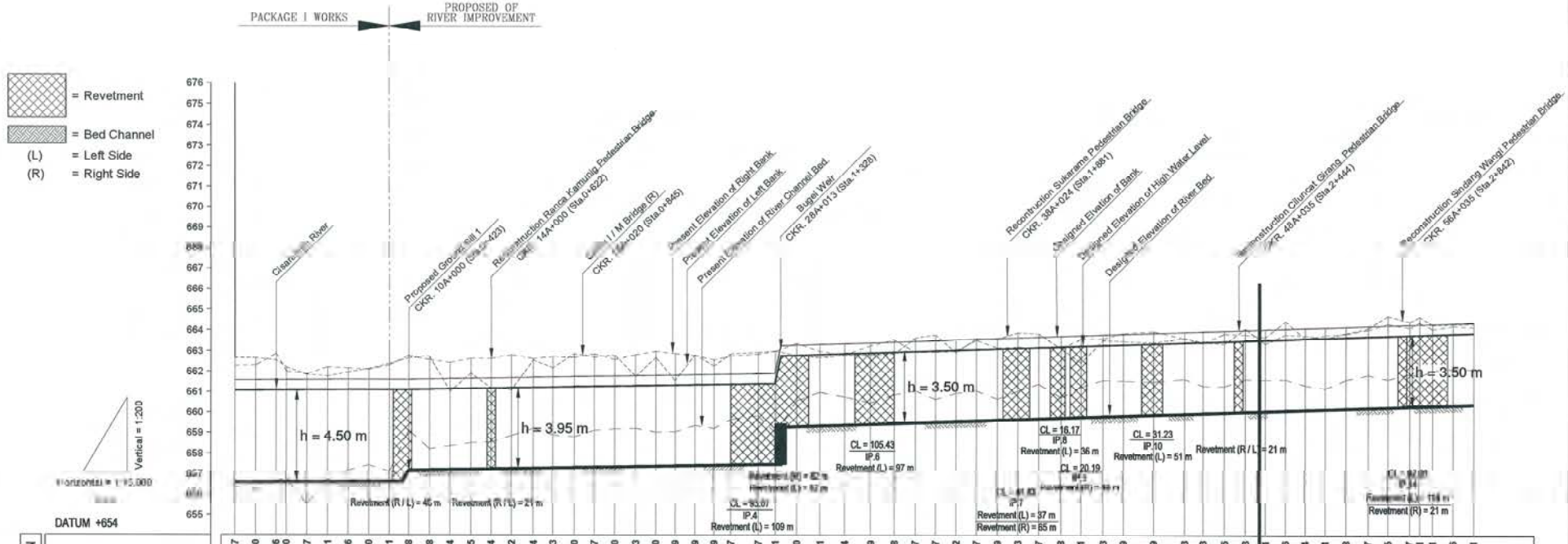
DRAWING NO.
P00-04CPF002



SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIKIJING RIVER (3/3)

DRAWING NO.
P00-040PF033



PRESENT ELEVATION	RIGHT BANK (m)	662.27	662.30	662.86	662.00	661.87	662.21	662.16	662.10	662.31	662.78	662.58	662.44	662.65	662.64	662.82	662.64
	LEFT BANK (m)	662.67	662.66	662.55	662.20	661.85	661.77	661.96	662.13	662.38	662.67	662.74	661.03	661.91	661.19	661.10	662.56
	RIVER CHANNEL BED (m)	656.37	656.14	656.63	656.74	655.53	656.67	657.16	657.43	657.10	659.12	658.22	658.36	658.52	658.55	658.86	659.21
DESIGN CHANNEL BED SLOPE					1/7500 0.00013												
DESIGN ELEVATION	RIGHT BANK (m)	661.57	661.57	661.58	661.58	661.59	661.60	661.61	661.61	661.61	661.61	661.62	661.64	661.66	661.68	661.69	661.71
	LEFT BANK (m)	661.57	661.57	661.58	661.58	661.59	661.60	661.61	661.61	661.61	661.61	661.62	661.64	661.66	661.68	661.69	661.71
	HIGH WATER LEVEL (m)	661.07	661.07	661.08	661.08	661.09	661.10	661.10	661.11	661.11	661.11	661.12	661.14	661.16	661.18	661.19	661.21
	CHANNEL BED (m)	656.57	656.57	656.58	656.58	656.59	656.60	656.60	656.61	656.61	657.16	657.17	657.19	657.21	657.23	657.24	657.26
CUMULATIVE DISTANCE (m)		0+000.00	0+050.08	0+100.10	0+125.11	0+175.09	0+225.04	0+275.12	0+325.26	0+375.25	0+422.79	0+473.00	0+522.07	0+572.83	0+622.27	0+671.27	0+724.70
DISTANCE (m)		0.00	50.08	50.02	25.01	49.98	49.95	50.08	50.14	49.98	47.54	50.21	50.21	50.76	49.44	49.08	53.43
STATION NO.		CKR.1	CKR.2	CKR.3	CKR.4	CKR.5	CKR.6	CKR.7	CKR.8	CKR.8A	CKR.10A	CKR.11A	CKR.12A	CKR.13A	CKR.14A	CKR.15A	CKR.16A

PRESENT ELEVATION	RIGHT BANK (m)	662.73	662.70	662.87	662.60	662.83	663.00	662.89	662.79	662.59	662.77	662.87	663.01	663.40	663.01	662.84	663.29
	LEFT BANK (m)	662.19	662.88	662.71	662.82	661.78	662.69	661.57	662.83	662.29	662.88	662.96	663.02	662.81	662.71	662.80	662.84
	RIVER CHANNEL BED (m)	658.89	658.81	659.13	659.19	659.23	659.04	659.06	659.37	659.23	659.66	659.85	659.01	660.59	661.01	660.78	660.48
DESIGN CHANNEL BED SLOPE				1/2800 0.00036													
DESIGN ELEVATION	RIGHT BANK (m)	661.73	661.75	661.77	661.78	661.80	661.82	661.84	661.85	661.87	661.89	661.91	661.92	663.31	663.35	663.39	663.43
	LEFT BANK (m)	661.73	661.75	661.77	661.78	661.80	661.82	661.84	661.85	661.87	661.89	661.91	661.92	663.31	663.35	663.39	663.43
	HIGH WATER LEVEL (m)	661.23	661.25	661.27	661.28	661.30	661.32	661.34	661.35	661.37	661.39	661.41	661.42	662.81	662.85	662.89	662.93
	CHANNEL BED (m)	657.28	657.30	657.32	657.33	657.35	657.37	657.39	657.40	657.42	657.44	657.46	657.47	659.31	659.35	659.39	659.43
CUMULATIVE DISTANCE (m)		0+772.52	0+824.73	0+873.42	0+923.07	0+973.69	1+023.56	1+070.45	1+118.80	1+165.37	1+205.97	1+272.85	1+314.69	1+367.00	1+423.59	1+483.61	1+546.98
DISTANCE (m)		47.82	52.38	48.68	49.68	50.62	49.87	46.88	48.35	46.57	40.60	66.88	41.84	52.31	56.59	60.02	63.37
STATION NO.		CKR.17A	CKR.18A	CKR.19A	CKR.20A	CKR.21A	CKR.22A	CKR.23A	CKR.24A	CKR.25A	CKR.26A	CKR.27A	CKR.28A	CKR.29A	CKR.30A	CKR.31A	CKR.32A

PRESENT ELEVATION	RIGHT BANK (m)	663.58	662.97	662.97	663.02	663.57	663.19	663.23	663.17	663.18	663.61	663.63	663.89	663.99	663.63	663.43	663.86
	LEFT BANK (m)	662.90	663.67	663.81	662.97	663.64	663.61	663.92	663.87	663.17	662.47	663.56	663.52	663.46	663.66	663.48	663.39
	RIVER CHANNEL BED (m)	660.89	661.08	660.67	660.96	661.08	660.68	661.07	661.41	660.76	661.27	661.61	661.57	661.53	661.66	661.32	661.30
DESIGN CHANNEL BED SLOPE													1/1500 0.0006				
DESIGN ELEVATION	RIGHT BANK (m)	663.47	663.50	663.53	663.57	663.60	663.64	663.67	663.70	663.74	663.77	663.81	663.84	663.89	663.94	663.97	664.00
	LEFT BANK (m)	663.47	663.50	663.53	663.57	663.60	663.64	663.67	663.70	663.74	663.77	663.81	663.84	663.89	663.94	663.97	664.00
	HIGH WATER LEVEL (m)	662.97	663.00	663.03	663.07	663.10	663.14	663.17	663.20	663.24	663.27	663.31	663.34	663.39	663.44	663.47	663.50
	CHANNEL BED (m)	659.47	659.50	659.53	659.57	659.60	659.64	659.67	659.70	659.74	659.77	659.81	659.84	659.89	659.94	659.97	660.00
CUMULATIVE DISTANCE (m)		1+604.64	1+656.29	1+705.36	1+755.33	1+804.86	1+856.51	1+906.06	1+957.12	2+011.52	2+059.88	2+113.86	2+163.50	2+236.87	2+312.77	2+357.16	2+409.31
DISTANCE (m)		57.68	51.65	49.07	49.97	49.53	51.65	49.55	51.06	54.40	48.36	53.98	49.64	73.37	75.89	44.39	52.15
STATION NO.		CKR.33A	CKR.34A	CKR.35A	CKR.36A	CKR.37A	CKR.38A	CKR.39A	CKR.40A	CKR.41A	CKR.42A	CKR.43A	CKR.44A	CKR.45A	CKR.46A	CKR.47A	CKR.48A

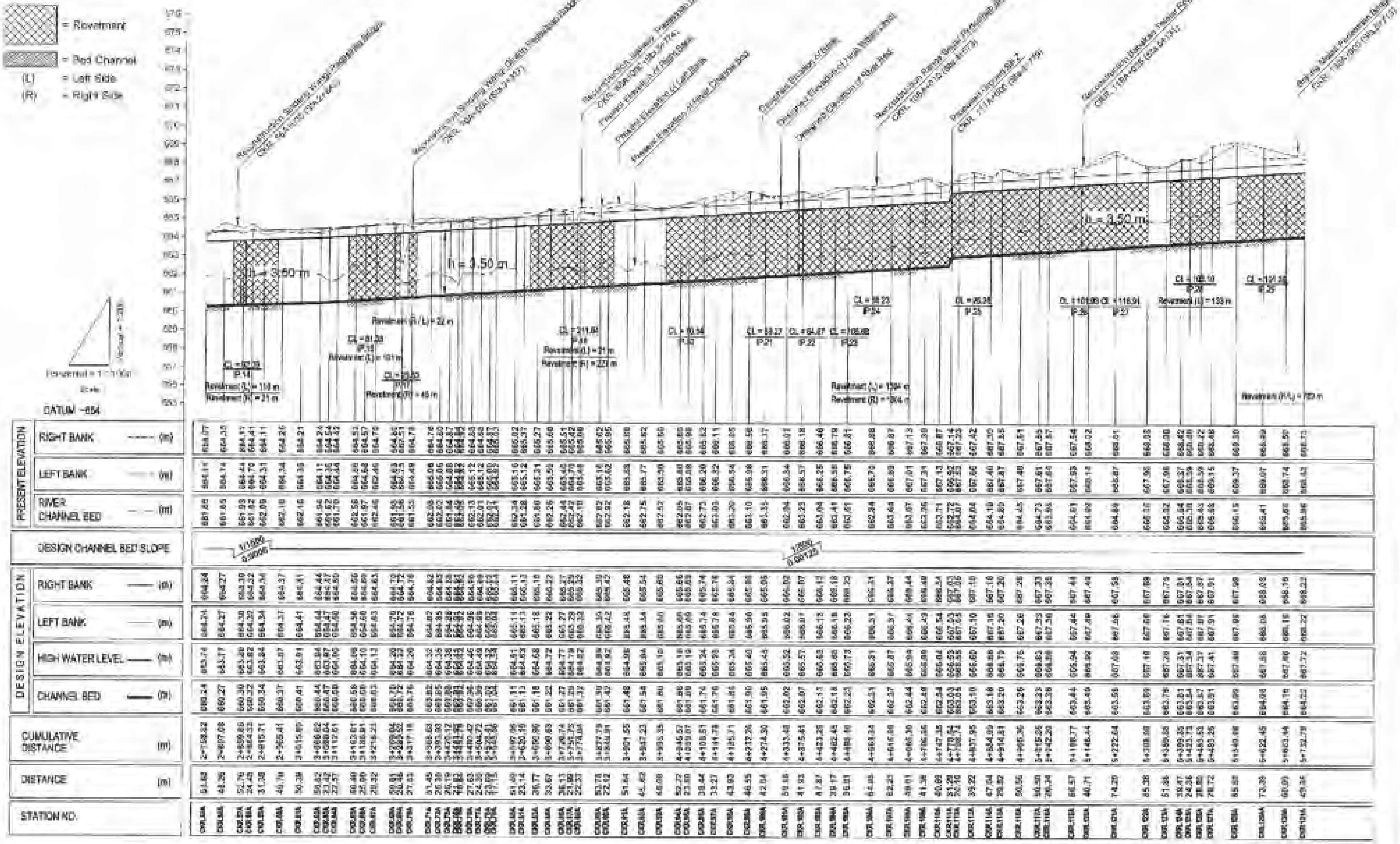
PRESENT ELEVATION	RIGHT BANK (m)	663.83	663.71	664.46	663.64	663.81	663.88	664.07	664.35	664.17	664.41	664.11	664.26	664.21
	LEFT BANK (m)	664.11	663.40	663.83	663.79	663.66	663.90	664.14	664.74	664.44	664.70	664.31	664.34	664.36
	RIVER CHANNEL BED (m)	661.65	661.62	661.64	661.35	661.19	661.63	661.86	661.65	661.93	661.82	662.09	662.18	662.15
DESIGN CHANNEL BED SLOPE														
DESIGN ELEVATION	RIGHT BANK (m)	664.04	664.07	664.10	664.14	664.17	664.20	664.24	664.27	664.30	664.32	664.34	664.37	664.41
	LEFT BANK (m)	664.04	664.07	664.10	664.14	664.17	664.20	664.24	664.27	664.30	664.32	664.34	664.37	664.41
	HIGH WATER LEVEL (m)	663.54	663.57	663.60	663.64	663.67	663.70	663.74	663.77	663.80	663.82	663.84	663.87	663.91
	CHANNEL BED (m)	660.04	660.07	660.10	660.14	660.17	660.20	660.24	660.27	660.30	660.32	660.34	660.37	660.41
CUMULATIVE DISTANCE (m)		2+460.44	2+508.72	2+558.34	2+605.86	2+654.08	2+705.14	2+758.82	2+807.08	2+859.85	2+884.33	2+915.71	2+965.41	3+015.80
DISTANCE (m)		51.13	48.28	49.62	47.52	48.22	51.06	53.68	48.26	52.77	24.48	31.38	49.70	50.39
STATION NO.		CKR.49A	CKR.50A	CKR.51A	CKR.52A	CKR.53A	CKR.54A	CKR.55A	CKR.56A	CKR.57A	CKR.58A	CKR.59A	CKR.60A	CKR.61A

Cikeruh Downstream (L=2.50km) ← → Cikeruh Upstream (L=5.15km)

SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIKERUH RIVER (1/3)

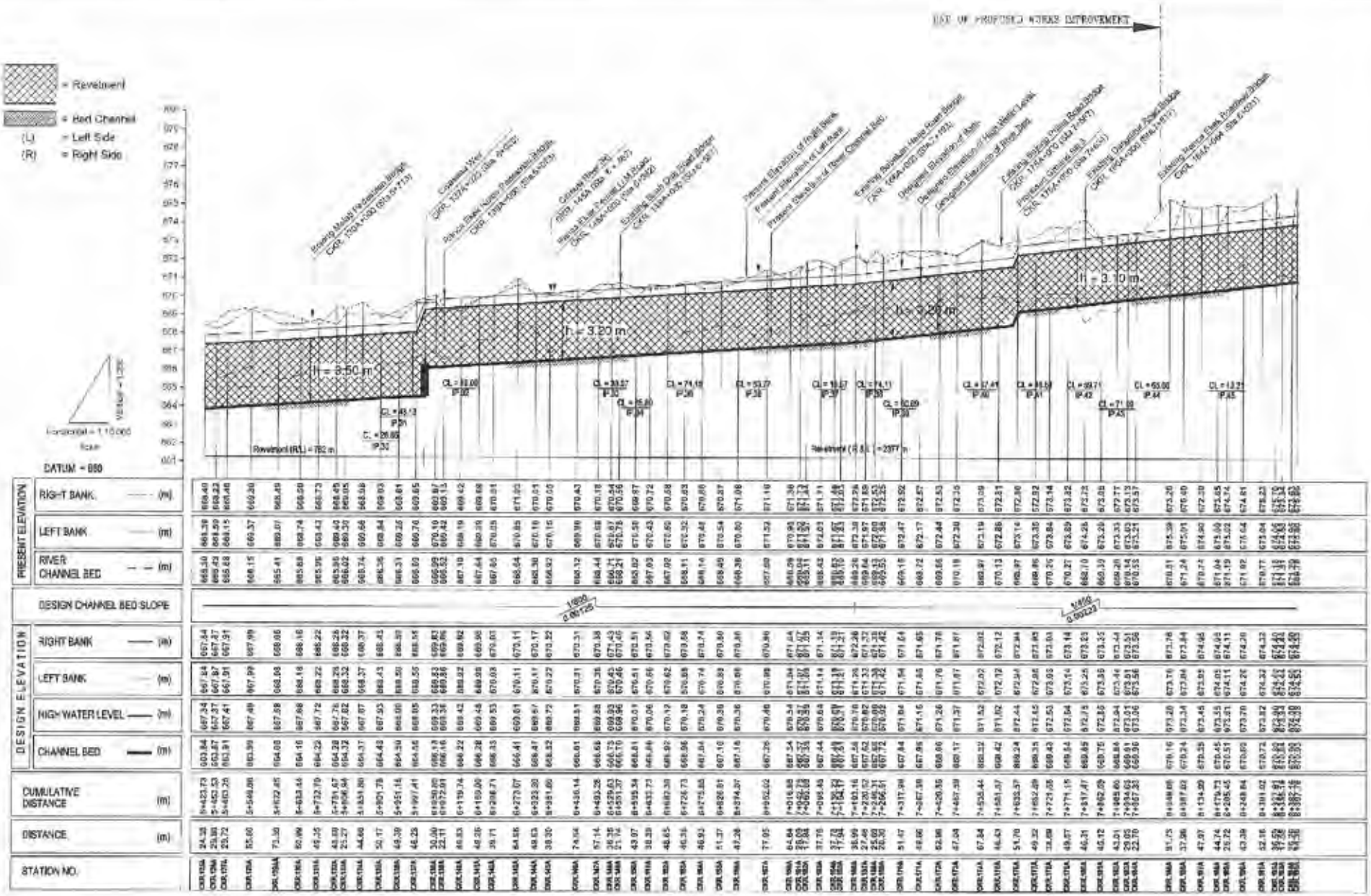
DRAWING NO.
POD-050P7001



SCALE V 1 : 200
SCALE H 1 : 10000

LONGITUDINAL PROFILE OF CIKERUH RIVER (2/3)

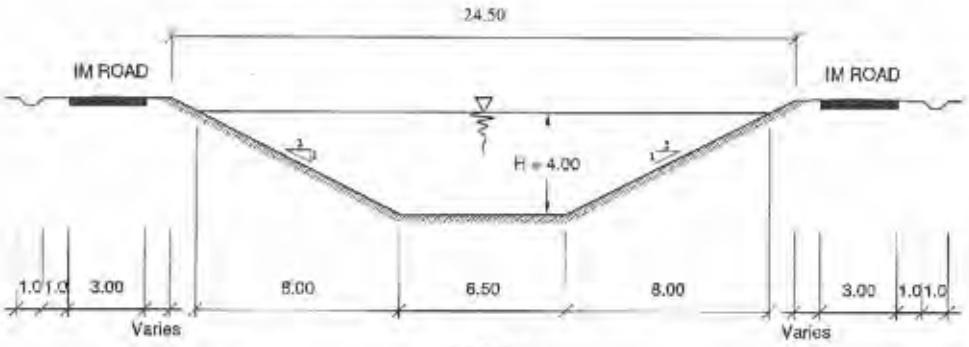
DRAWING NO.
F09-050PF002



SCALE V 1 : 200
SCALE H 1 : 10000

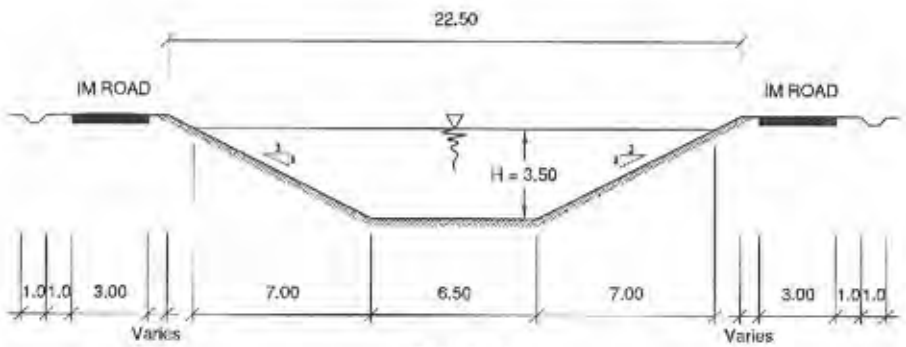
LONGITUDINAL PROFILE OF CIKERUH RIVER (3/3)

DRAWING NO.
P00-C00PF003



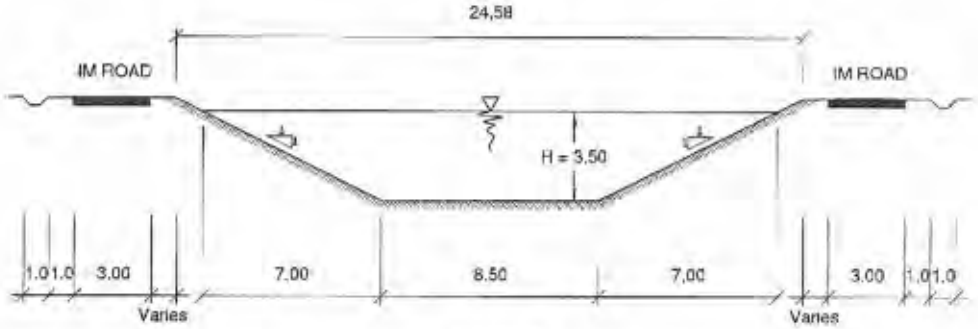
TYPE I

FROM : KK.0 - KK.10
STA. 0 + 000 - STA. 0 + 367



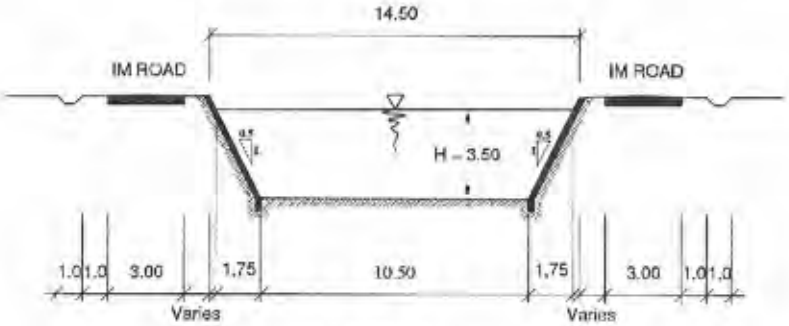
TYPE III

FROM : KK.52 - KK.83
STA.2 + 369 - STA.3 + 839



TYPE II

FROM : KK.10 - KK.52
STA. 0 + 367 - STA.2 + 369



TYPE IV

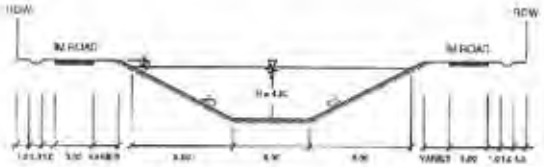
FROM : KK.84 - KK.159
STA.3 + 839 - STA.7 + 734

SCALE 1 : 200

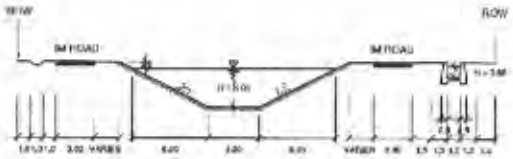
0 2 4 6 8 10 M

STANDARD CROSS SECTION OF CITARUM UPSTREAM RIVER

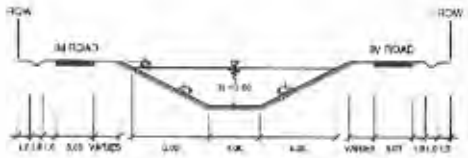
DRAWING NO.
PCO-01055001



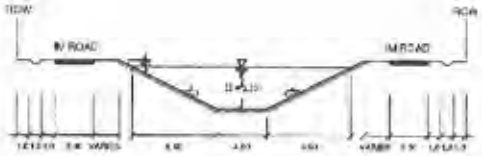
TYPE I
FROM : D.1 - D.23a
STA. 0 + 035 - STA.1+190



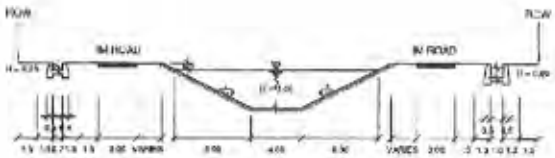
TYPE III
FROM : D.129 - D.138a
STA. 6 + 668 - STA. 7 + 153



TYPE V
FROM : D.127a - D.190
STA. 6 + 589 - STA. 9 + 537



TYPE II
FROM : D.27 - D.127
STA. 1 + 270 - STA. 6 + 522



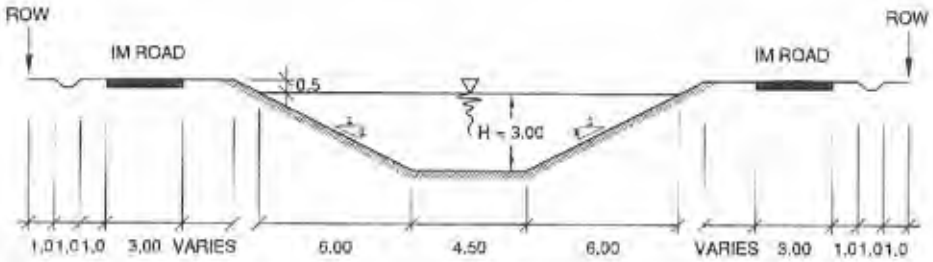
TYPE IV
FROM : D.1.38a - D.156
STA. 7+153 - STA. 7 + 988

SCALE 1 :400

0 4 8 12 16 20 M

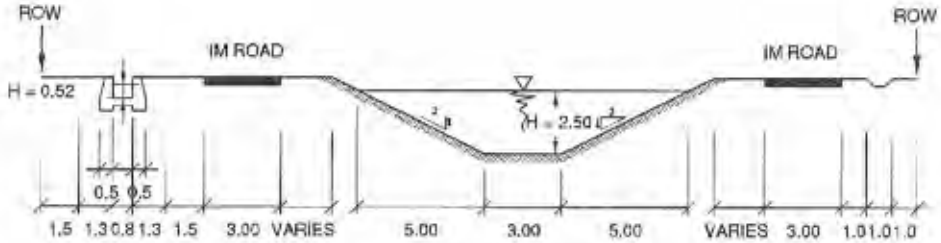
STANDARD CROSS SECTION OF CIMANDE RIVER

DRAWING NO.
P00-03OSS001



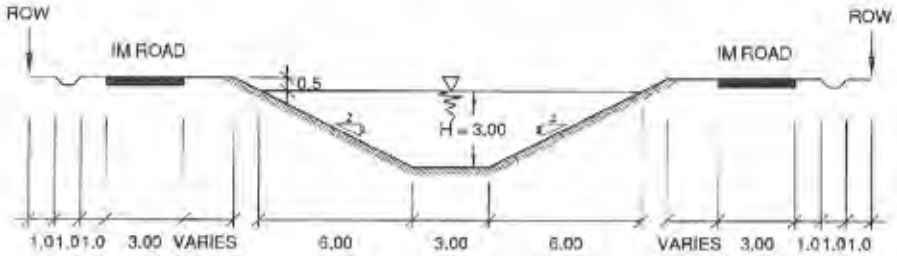
TYPE I

CKJ.1 - CKJ.28
STA.0+0.00 - STA.1+516



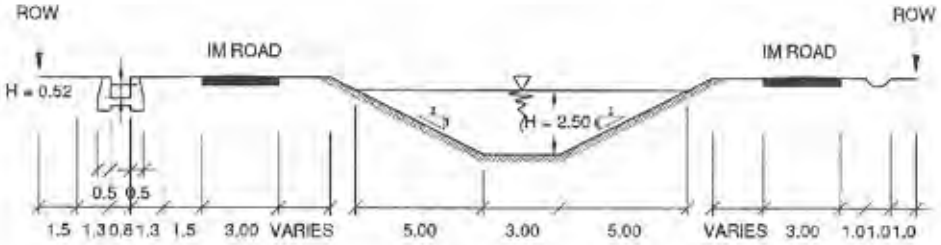
TYPE III

CKJ.85 - CKJ.106
STA.4+872 - STA.5+898



TYPE II

CKJ.28 - CKJ.56a
STA.1+516 - STA.3+131



TYPE IV

CKJ.56a - CKJ.124
STA.3+131 - STA.6+879

SCALE 1 : 200

0 2 4 6 8 10 M

STANDARD CROSS SECTION OF CIKIJING RIVER

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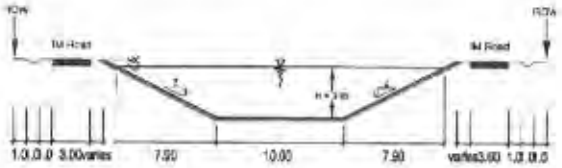
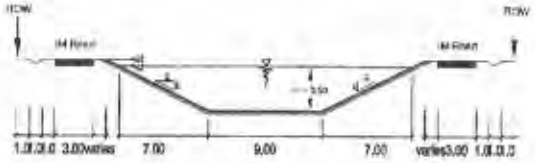
PDD-04CSS001



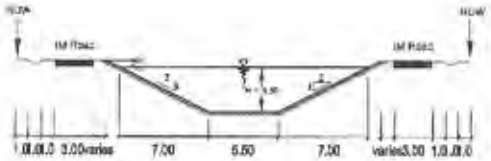
TYPE I

FROM : CKR.0A - CKR.28A
STA.0+375 - STA.1+315



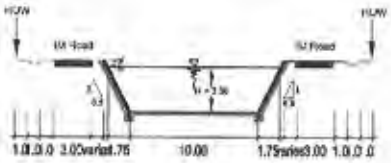
TYPE II

FROM : CKR.28A - CKR.60A
STA.1+315 - STA.3+016



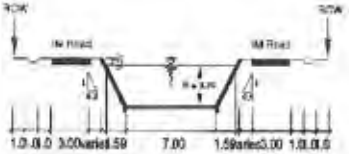
TYPE III

FROM : CKR. 60A - CKR. 94A
STA. 3 + 016 - STA. 4 + 046
FROM : CKR. 121A - CKR. 128A
STA. 5 + 222 - STA. 5 + 549



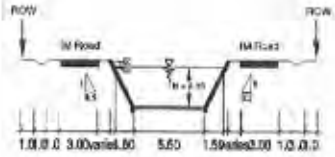
TYPE IV

FROM : CKR. 94A - CKR. 121A
STA. 4 + 046 - STA. 5 + 223
FROM : CKR. 128A - CKR. 137A
STA. 5 + 549 - STA. 5 + 997



TYPE V

FROM : CKR. 137A - CKR. 176A
STA. 5 + 997 - STA. 7 + 634



TYPE VI

FROM : CKR. 176A - CKR. 195A
STA. 7 + 634 - STA. 8 + 398

SCALE 1 :400

0 4 8 12 16 20 M

STANDARD CROSS SECTION OF CIKERUH RIVER

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F00-05055001