No.

THE STUDY ON
CAPACITY DEVELOPMENT FOR JENEBERANG RIVER BASIN MANAGEMENT
IN
THE REPUBLIC OF INDONESIA

FINAL REPORT

VOLUME IV-1
DATA BOOK 1 - GUIDELINES AND MANUALS

March 2005

Japan International Cooperation Agency

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Composition of Final Report

Volume I	**Executive Summary**
Volume II	**Main Report**
Volume III-1	**Supporting Report 1**
Volume III-2	**Supporting Report 2**
Volume IV-1	**Data Book 1-Guidelines and Manuals**
Volume IV-2	**Data Book 2-Data**

Cost Estimate : October 2004 Price

Exchange Rate: **IDR 1,000 = JPY 11.92 = USD 0.1094**
JPY 100 = IDR 8,387 = USD 0.9174
USD 1 = JPT 109.0 = IDR 9,142
(Bank Indonesia, October 2004 average TT selling rate)

ABBREVIATIONS (1/5)

ABBREVIATION	BAHASA INDONESIA	ENGLISH
ADB	Bank Pembangunan Asia	Asian Development Bank
Amdal	Analisa Mengenai Dampak Lingkungan	Environmental Impact Assessment (EIA)
Andal	Analisa Dampak Lingkungan	Environmental Impact Analysis
APBD	Anggaran Pendapatan dan Belanja Daerah	Regional Government Revenue and Expenditure Budget (Province/Regency Budget)
APBN	Anggaran Pendapatan dan Belanja Negara	Central Government Revenue and Expenditure Budget (National Budget)
ASA	Air dan Sumber-sumber Air	Water and Water Resources
ASGL	Sistem Akuntasi Buku Besar	Accounting System General Ledger
Askes	Asuransi Kesehatan	Health Insurance
AWLR	Alat Pencatat Tinggi Muka Air Otomatis	Automatic Water Lever Recorder
Bakornas PB	Badan Kordinasi Nasional-Penanggulangan Bencana	National Coordination Board for Disaster Managemenet
Balai PSDA	Unit Pelakasana Teknis Dinas Balai Pengelolaan	Provincial River Basin Management Unit
Bapedal	Badan Pengendalian Dampak Lingkungan	Environmental Impact Management Agency
Bappeda	Badan Perencanaan Pembangunan Daerah	Regional Development Planning Agency
Bapedalda	Badan Pengendalian Dampak Lingkungan Daerah	Provincial Environmental Impact Agency
Bappenas	Badan Perencanaan Pembangunan Nasional	National Development Planning Agency
Bili-Bili HEPP	Pembangkit Listrik Tenaga Air Bili-bili	Bili-Bili Hydro Electric Power Plant
BKPMM	Badan Kerjasama Pengembangan Metropolitan Mamminasata	Mamminasata Metropolitan Development Cooperation Board
BLK	Balai Latihan Kerja	Government Work Training Office
BMG	Badan Meterologi dan Geofisika	Meterology and Geophysics Agency
BOD	Kandungan Oksigen dari Bahan Biologi dan Kimia	Biological Oxygen Demand
BOD	Direksi	Board of Directors
BODD	Surat Keputusan Direksi	Board of Directors Decree
BPDAS	Balai Pengelolaan Daerah Aliran Sungai	Watershed Management Office (under National Ministry of Forestry; formerly Land Rehabilitation and Soil Conservation Office, Balai RLKT)
BPK	Badan Pemeriksa Keuangan	Government Audit Agency
BPKP	Badan Pemeriksa Keuangan dan Pembangunan	Finance and Development Control Agency
BPP	Balai Penyuluhan Pertanian	Agricultural Extension Office
BPTH	Balai Pembenihan Tanaman Hutan	Forest Tree Seedling Office
BPS	Biro Pusat Statistik	Central Bureau of Statistics
BUMD	Badan Usaha Milik Daerah	Regional Government-owned Corporation
BUMN	Badan Usaha Milik Nasional	State-owned Corporation
BWRM	Pengelolaan Sumber Daya Air DAS	Basin Water Resources Management
CDP	Rencana Pengembangan Kapasitas	Capacity Development Plan
CDMP	Rencana Pengelolaan dan Pengembangan Menyeluruh	Comprehensive Development and Management Plan
CEPI	Kerjasama Program Lingkungan di Indonesia -	Collaborative Environmental Program in Indonesia
CES/PPLH-UNHAS	Pusat Penelitian Lingkungan Hidup - Universitas HasanuddinPusat Studi Lingkungan - Universitas Hasanuddin (PSL-UNHAS)	Center of Environmental Studies-Hasanuddin University
CG	Pemerintah Pusat	Central Government
CP	Periode Penagihan	Collection Periods
COD	Kandungan Oksigen dari Bahan Kimia	Chemical Oxygen Demand
CSSP	Standar Kompetensi Posisi Struktural	Competence Standard for Structural Position
DAK	Dana Alokasi Khusus	Special Allocations Fund
Danrem	Komandan Resort Militer	Commander of Regional Military Administrative Unit
DASK	Dokumen Anggaran Satuan Kerja	Work Unit Budget Document
DAU	Dana Alokasi Umum	General Allocations Fund
DFWL	Muka Air Banjir Rencana	Design Flood Water Level
DG	Direktorat Jenderal	Directorate General
DGWR	Direktorat Jenderal Sumber Daya Air	Directorate General of Water Resources
DIK	Daftar Isian Kegiatan	Activities Implementation Plan
DIP	Daftar Isian Proyek	Project Implementation Plan
DIP	Daftar Isian Proyek	Project Budget Allocation
DO	Oksigen Terlarut	Dissolved Oxygen
DOMC	Direktorat Kota Metropolitan	Directorate of Metropolitan City
DPR	Dewan Perwakilan Rakyat	House of Representatives
DPRD	Dewan Perwakilan Rakyat Daerah	Regional House of Representatives

ABBREVIATIONS (2/5)

ABBREVIATION	BAHASA INDONESIA	ENGLISH
DPSDA	Dinas Pengelolaan Sumber Daya Air	Provincial Water Resources Services (PWRS)
DPS	Daerah Pengaliran Sungai	Watershed
DWRS	Dinas PSDA Kabupaten	District Water Resources Services
EC	Komisi Eropa	Europian Commission
FAO	Organisasi Pertanian dan Pangan PBB	United Nations Food and Agriculture Organization
FFWS	Sistem Peringatan dan Peramalan Banjir	Flood Forecasting and Warning System
FIK-ORNOP/LSM	Forum Informasi Komunikasi-Organisasi Non Profit/ Lembaga Swadaya Masyarakat	Communication & Information Forum - Non-Profit Organizations/Non-Governmental Organizations
FMISP	Proyek Sistem Irigasi Dikelola Petani	Farmer Managed Irrigation System Project
FRAP	Perencanaan Pemulihan Keuangan	Financial Recovery Action Plan
F/S	Studi Kelayakan	Feasibility Study
FY	Tahun Anggaran	Fiscal Year
GBHN	Garis Garis Besar Haluan Negara	Broad Outlines of the Nation's Direction
GDP	Produk Domestik Bruto	Gross Domestic Product
GIS	Sistem Informasi Geografik	Geographic Information System
GMTDC	PT. Gowa Makassar Tourism Development (GMTD)	Gowa Makassar Tourism Development Corporation
GNRHL	Gerakan Nasional Rehabilitasi Hutan dan Lahan	National Campaign for Land and Forest Rehabilitation
GOI	Pemerintahan Republik Indonesia	Government of Indonesia
GR	Peraturan Pemerintah (PP)	Government Regulation (GR)
GRDP	Produk Domestik Bruto Daerah	Gross Regional Domestic Product
GWUA	Perkumpulan Pemakai Air Tanah	Ground Water Users Association
HEPP	Pembangkit Listrik Tenaga Air	Hydro Electric Power Plant
HO	Kantor Pusat	Head Office
HR	Sumber Daya Manusia	Human Resources
HRA	Administrasi Sumber Daya Manusia	Human Resources Administration
HRD	Pengembangan Sumber Daya Manusia	Human Resources Development
HRM	Pengelolaan Sumber Daya Manusia	Human Resource Management
HWL	Tinggi Muka Air	High Water Level
IKMN	Inventarisasi Kekayaan Milik Negara	National Treasury Inventory System
ORARI	Organisasi Radio Amatir Indonesia	Indonesian Amateur Radio Organization
IMT	Penyerahan Pengelolaan Irigasi	Irrigation Management Transfer
Inpres	Instruksi Presiden	Presidential Instruction
Inhutani	PT. Industri Kehutanan dan Pertanian	Government-owned Forestry and Agricultural Industry Company
IOMP	Kebijakan Pengoperasian dan Pemeliharaan Irigasi	Irrigation O&M Policy
IP3A	Induk P3A	Main Water Users Association (at primary irrigation system level)
IPAIR	Iuran Pelayanan Air Irigasi	Irrigation Service Fee (ISF)
IPABP	Iuran Penggunaan Air Bawah Permukaan	Underground Water Use Fee
IPAP	Iuran Penggunaan Air Permukaan	Surface Water Use Fee
IPLC	Iuran Pembuangan Limbah Cair	Liquid Waste Disposal Fee
IPEP	Iuran Pembiayaan Eksplotasi dan Pemeliharaan	Fee for Financing Exploitation and Maintenance
IR	Komponen dari Kajian Khusus WATSAL yg bertujuan untuk peningkatan pengelolaan irigasi	A component of WATSAL Special Study aiming at improvement of irrigation management
ISF	Iuran Pelayanan Air Irigasi (IPAIR)	Irrigation Service Fee
ISO	Pengoperasian Standar International	International Standard Operation
IWIRIP	Proyek Pelaksanaan Pembaharuan Irigasi & Sumber Daya Air Indonesia	Indonesian Water Resources & Irrigation Reform Implementation Project
IWRM	Pengelolaan Sumber Daya Air Terpadu	Integrated Water Resources Management
Jamsostek	Jaminan Sosial Tenaga Kerja	Labor Social Insurance
JBIC	Bank Jepang untuk Kerjasama Internasional	Japan Bank for International Cooperation
JBIC-SAPS	Bank Jepang untuk Kerjasama Internasional - Bantuan Khusus untuk Keberlanjutan Proyek	Japan Bank for International Cooperation - Special Assistance for Project Sustainability
JDESs	Uraian Tugas dan Persyaratan Pegawai	Job Descriptions and Employee Specifications
JICA	Badan Kerjasama Internasional Jepang	Japan International Cooperation Agency
JIWMP	Proyek Pengembangan Irigasi dan Pengelolaan Sumber Daya Air di Jawa	Java Irrigation Improvement and Water Resources Management Project
JRB	Wilayah Sungai Jeneberang	Jeneberang River Basin
JSUIT	Tim Investigasi Khusus JICA Sabo	JICA Sabo Urgent Investigation Team
Kapolda	Kepala Polisi Daerah	Head of the Provincial Police

ABBREVIATIONS (3/5)

ABBREVIATION	BAHASA INDONESIA	ENGLISH
Kapolwil	Kepala Polisi Wilayah	Head of the Regional Police
Kepmen	Keputusan Menteri	Ministerial Decree
Keppres	Keputusan Presiden	Presidential Decree
KIMA	Kawasan Industri Makassar	Makassar Industrial Zone
Kimpraswil	Departemen Pemukiman dan Prasarana Wilayah	Ministry of Settlement and Regional Infrastructure
KPH	Kelompok Pengaman Hutan	Forest Protector Group
KPSA	Kelompok Pelestari Sumber Daya Alam	Natural Resources Conservation Group
KSM	Kelompok Sosial Masyarakat	Social Community Group
KT	Kelompok Tani	Farmer's Group
KTH	Kelompok Tani Hutan	Forest Farmers Group
KTP	Kelompok Tani Penghijauan	Reforestation Farmers Group
KUD	Koperasi Unit Desa	Village Unit Cooperatives
LAN	Lembaga Administrasi Negara	State Administration Institute
LHP	Laporan Hasil Penelitian	Report on Research Result
LKMD	Lembaga Ketahanan Masyarakat Desa	Village Social Activities Group
LWL	Muka Air Rendah	Low Water Level
MCM	Juta m3	Million Cubic Meter
M&E	Pemantauan & Evaluasi	Monitoring & Evaluation
Menko-Ekuin	Menteri Koordinator Ekonomi, Keuangan dan Industri	Coordinating Minister for Economy, Finance and Industry
Meneg LH	Menteri Negrara Lingkungan Hidup	State Minister of Environment
MoHA	Departemen Dalam Negeri	Ministry of Home Affairs
MEI	Laporan Monitoring, Evaluasi dan Implementasi	Monitoring, Evaluation and Implementations
MENR	Departemen Energi dan Sumber Daya Alam	Ministry of Energy and Natural Resources
MoA	Departemen Pertanian	Ministry of Agriculture
MoF	Departemen Keuangan	Ministry of Finance
MoU	Nota Kesepakatan	Memorandum of Understanding
MPW	Departemen Pekerjaan Umum	Ministry of Public Works
MSOE	Departemen BUMN	Ministry of Stated-Owned Enterprises
MSRI	Departemen Permukiman dan Prasarana Wilayah (Kimpraswil)	Ministry of Settlement and Regional Infrastructure
NDF	Dana Pembangunan Nasional	National Development Fund
N-1	Suatu komponen WATSAL Studi Khusus tentang peningkatan kerangka kelembagaan nasional	A component of WATSAL Special Study aiming at improvement of national institutional framework
N-2	Suatu komponen WATSAL Studi Khusus tentang peningkatan pengelolaan wilayah sungai	A component of WATSAL Special Study aiming at improvement of river basin management
N-3	Suatu komponen Watsal Studi Khusus mengenai pengelolaan kualitas air	A component of WATSAL Special Study aiming at water quality management
NGO	Lembaga Swadaya Masyarakat (LSM)	Non-Government Organization
NTU	Satuan Turbiditas Nephlometrik	Nephlometric Turbidity Unit
NWL	Muka Air Normal	Normal Water Level
NWRC	Dewan Sumber Daya Air Nasional	National Water Resources Council
NWRP	Kebijakan Sumber Daya Air Nasional	National Water Resources Policy
O&M	Operasi & Pemeliharaan (O&P)	Operation & Maintenance
OECD	Organisasi Kerjasama Ekonomi & Pembangunan	Organization for Economic Co-operation & Development
OECF	Pendanaan Kerjasama Ekonomi Luar Negeri Jepang	Overseas Economic Cooperation Fund of Japan
OJT Training	Pelatihan Kerja di Tempat	On the Job Training
P.T.	Perseroan Terbatas	Limited Liabilities Corporation
PAB	Penyediaan Air Baku	Raw Water Supply (RWS)
PABJ	Penyediaan Air Baku Jeneberang	Jeneberang Raw Water Supply
PAD	Pendapatan Asli Daerah	Regional Government Revenue
Pangdam	Panglima Daerah Militer	Territorial Military Commander
PBB	Pajak Bumi dan Bangunan	Land and Building Tax
PBPP	Pengendalian Banjir dan Pengamanan Pantai	Flood Control and Coastal Protection
PCM	Manajemen Siklus Proyek	Project Cycle Management
PDAM	Perusahaan Daerah Air Minum	Regional Drinking Water Supply Company
PDM	Matriks Disain Proyek	Project Design Matrix
Perda	Peraturan Daerah	Regional Regulation (RR)
Permen	Peraturan Menteri	Ministerial Regulation
Perum	Perusahaan Umum	Public Corporation

ABBREVIATIONS (4/5)

ABBREVIATION	BAHASA INDONESIA	ENGLISH
Persero	Perusahaan Perseroan	Copartnership / Shareholding Corporation
PGPNS	Peraturan Gaji Pegawai Negeri Sipil	Government Employee Salary Rule
PHU	Unit Hydrologi Propinsi	Provincial Hydrology Unit
PIPWSJ	Proyek Induk Pengembangan Wilayah Sungai Jeneberang	Jeneberang River Basin Development Project (JRBDP)
PIRASS	Proyek Irigasi dan Rawa Andalan Sulawesi Selatan	South Sulawesi Major Swamp and Irrigation Project
PISP	Proyek Irigasi Partisipatif	Participatory Irrigation Sector Project
PJT	Perum Jasa Tirta	Jasa Tirta Public Corporation
PKK	Pendidikan Keterampilan Keluarga	Skills Training for Housewifes
PKPI	Pembaharuan Kebijakan Pengelolaan Irigasi	Irrigation Management Policy Reform (IMPR)
PKPT	Program Kerja Pengawasan Tahunan	Work Program for Annual Inspection (Audit)
PLN	Perusahaan Listrik Negara	State Electricity Company
PLTA	Pembangkit Listrik Tenaga Air	Hydro Electric Power Plant
PNS	Pegawai Negeri Sipil	Government Employees
PO	Rencana Pengoperasian	Plan of Operation
POJ	Perum Otorita Jatiluhur	Jatiluhur Authority Public Corporation
Pokja	Kelompok Kerja	Working Group
POWAA	Pola Operasi Waduk & Alokasi Air	Semiannual Water Allocation Plan
PP	Perencanaan Partisipatif	Participatory Plan
PPAP	Pajak Pengambilan Air Permukaan	Surface Water Use Tax
PPABP	Pajak Pengambilan Air Bawah Permukaan	Underground Water Use Tax
PPh	Pajak Penghasilan	Income Tax
PPL	Penyuluh Pertanian Lapangan	Field Extension Workers
PPSA	Pengembangan dan Pengelolaan Sumber Air	Water Resources Development and Management
PPSAJ	Pengembangan & Pengelolaan Sumber Air Jeneberang	Jeneberang Water Resources Development and Management
PTPA	Panitia Tata Pengaturan Air	Provincial Water Resources Coordination Committee(PWRC)
PPTPA	Panitia Pelaksana Tata Pengaturan Air	River Basin Water Resources Coordination Committee (RBWRC)
PRA	Identifikasi Desa secara Partisipatif	Participatory Rural Appraisal
Prokasih	Program Kali Bersih	Clean River Campaign Program
Propeda	Program Pembangunan Daerah	Regional Development Program
Propenas	Program Pembangunan Nasional	National Development Program
PSB	Petunjuk Siaga Bajir	Flood Alert Manual
PSO	Kewajiban Pelayanan Umum (KPU)	Public Service Obligation
PSP	Partisipasi Pihak Swasta	Private Sector Participation
PUKK	Pembinaan Usaha Kecil dan Koperasi	Small Business and Cooperative Guidance
PWRC	Panitia Pelaksana Tata Pengaturan Air (PPTA)	Provincial Water Resource Coordination Committee
QMS	Sistem Pengelolaan Mutu	Quality Management System
RBPC	Badan (Perum) Pengelola Wilayah Sungai	River Basin Public Corporation
RBM	Pengelolaan Wilayah Sungai	River Basin Management
RBMC	Korporasi Pengelola Wilayah Sungai	River Basin Management Corporation
RBWRC	Panitia Pelaksana Tata Pengaturan Air (PPTPA)	River Basin Water Resources Coordination Committee
RD	Rapat Direksi	Board of Director's Meeting
Repetada	Rencana Pembangunan Tahunan Daerah	Regional Annual Development Plan
RC	Kurva Dasar Pengoperasian Waduk	Reservoir Operation Curve
RJP	Rencana Jangka Panjang	Long Term Plan
Renstra	Rencana Strategis	Strategic Plan
RIM	Pengelolaan Prasarana Wilayah	River Infrastructure Management
RKAP	Rencana Kerja Anggaran Perusahaan	Corporate Work Plan Budget
RKM	Rapat Koordinasi Manajemen	Management Coordination Meeting
RKOP	Rencana Kerja Operasional Perusahaan	Corporate Work Plan Operations
RKU	Rapat Koordinasi Unit	Unit Coordination Meeting
RLKT	Rehabilitasi Lahan dan Konservasi Tanah	Land Rehabilitation and Soil Conservation
RMCD	Proyek Pengembangan Kapasitas Pemantauan Daerah	Regional Monitoring Capcity Development Project
ROE	Laba atas Modal Sendiri	Return on Equity
ROI	Laba atas Investasi	Return on Investment
RPH	Polisi Hutan	Forest Ranger Resort
RTM-P	Rapat Tinjauan Managemen - Pusat	Central Management Evaluation Meeting

ABBREVIATIONS (5/5)

ABBREVIATION	BAHASA INDONESIA	ENGLISH
RTM-U	Rapat Tinjauan Management - Unit	Unit Management Evaluation Meeting
RWL	Muka Air Waduk	Reservoir Water Level
RWTM	Pipa Transmisi Utama Air Baku	Raw Water Transmission Main
Satlak-PB	Satuan Pelaksana-Penanggulangan Bencana	Implementation Unit for Disaster Management (District Level)
Satkorlak	Satuan Coordinator Pelaksana	Implementation Coordination Unit (Province Level)
SDA	Sumber Daya Air	Water Resources
SEC	Komisi Pertukaran Sekuriti	Security Exchange Commission
SKI	Surat Ketetapan Iuran	Fee Enactment
SMEs	Usaha Kecil Menengah (UKM)	Small and Medium Size Enterprises
SMSOE	Menteri Negara BUMN	State Minister of State-Owned Enterprises
SOE	Badan Usaha Milik Negara (BUMN)	State-Owned Enterprises
SP3AP	Surat Penetapan Pengambilan dan Penggunanan Air Permukaan	Surface Water Abstraction and Utilization Enactment
SPI	Satuan Pengawas Internal	Internal Control Unit
SPK	Surat Perjanjian Kerja	Work Agreement Letter
SPTP	Surat Perintah Tugas Pemeriksaan	Inspection Letter
SS	South Sulawesi	Sulawesi Selatan
SS	Padatan Tersuspensi	Suspended Solid
SuSENas	Survey Sosial Ekonomi Nasional	National Socio-Economic Survey
SWL	Muka Air Tambahan	Surcharge Water Level
SWOT Analysis	Analisa Kekuatan, Kelemahan, Peluang dan Ancaman	Strength, Weakness, Opportunity and Threat Analysis
SWS	Satuan Wilayah Sungai	River Basin Unit
TA	Bantuan Tekhnis	Technical Assistance
TATO	Perputaran Total Aset	Total Asset Turn Over
T-C	Total Bakteri Coli	Total Coliforms
TDS	Total Padatan Terlarut	Total Dissolved Solid
TET	Tim Evaluasi Tarif	Tariff Evaluation Team
TIU	Unit Pelaksana Teknis	Technical Implementation Unit
TNA	Pelatihan Analisa Kebutuhan	Training Needs Analysis
TSS	Total Padatan Tersuspensi	Total Suspended Solid
ToR	Kerangka Acuan	Term of Reference
UFW	Air yang hilang	Unaccounted-for Water
UKL/UPL	Upaya Kelola Lingkungan / Upaya Pemantau Lingkungan	Environmental Management Effort / Environmental Monitoring Effort
UNWB	Unit Usaha Non-Air	Non-Water Business Unit
UPTD/Balai PSDA	Unit Pelaksana Teknis Daerah/Balai PSDA	Local Technical Implementation Unit/Balai PSDA
WATSAL	Penyesuaian Pinjaman Sektor Sumber Daya Air	Water Resources Sector Adjustment Loan
WATSAP	Program Penyesuaian Sektor Air	Water Sector Adjustment Programme
WB	Bank Dunia	World Bank
WiD	Wanita dalam Pembangunan	Women in Development
WISMP	Proyek Pengelolaan Sektor Irigasi dan Sumber Air	Water Resources and Irrigation Sector Management Program
WMO	Badan Meteorologi Dunia	World Meteorogical Organization (WMO)
WPM	Pemantauan Pencemaran Air	Water Pollution Monitoring
WQM	Pemantauan Kualitas Air	Water Quality Monitoring
WRM	Pengelolaan Sumber Daya Air (PSDA)	Water Resource Management
WS	Wilayah Sungai	River Basin (RB)
WTP	Instalasi Pengelolaan Air (IPA)	Water Treatment Plant
WUA	Perkumpulan Petani Pemakai Air (P3A)	Water User Association
WUAF	Gabungan Perkumpulan Petani Pemakai Air (GP3A)	Water User Association Federation
WUR	Hak Guna Air	Water Use Right

Part I

GUIDELINES AND MANUALS FOR RIVER INFRASTRUCTURE OPERATION AND MAINTENANCE

GUIDELINES AND MANUALS – PART I

RIVER INFRASTRUCTURE OPERATION AND MAINTENANCE

Table of Contents

Chapter 1

Definition of River Management Area

1.1 Boundaries of River Management Area

1.1.1 Cross-section Extent of River Management Area

"Government Regulation No. 35/1991" and "Provincial Regulation of Government of South Sulawesi No.5/1999" prescribes the following terms related to the river management area by the river administrator.

Legal Terms to Specify River and Its Adjacent River Corridor

English Term	Indonesian Term	Definition
River Borderline	Garis Sempadan Sungai	Outward bound of jurisdiction of the river administrator.
River Utilization Area	Daerah Manfaat Sungai	The area including: - **Water Body**: Whole extent of river, lake, and dam reservoir; - **River Corridor**: A certain extent of land along the water body, which has been acquired by the river administrator for the sake of river basin management; and - **River Retention Area**: A certain extent of land, which has been acquired by the river administrator for the specific purpose of flood control.
River Control Area	Daerah Penguasaan Sungai	The area including: - **River Corridor**: A certain extent of land along the water body, which is important for river management but has not been acquired by the river administrator; - **River Retention Area**: A certain extent of land, which is retained as the future flood control work but has not been acquired by the river administrator. - **Flood Plain**: The potential flood inundation area in a certain scale of flood*.

* A probable flood of 50-year return period was applied in south Sulawesi Province

Among the above terms, the "Flood Plain" under the "River Control Area" is hardly defined due to difficulties in estimating the extent of the potential extent flood inundation area. Moreover the "Flood Plain" in Jeneberang river basin would extends over a substantial part of Makassar City, whereby it is virtually difficult to demarcate the administrative authorities of the local government and the river administrator. It is further noted that there does not exist any "River Retention Area" under both of River Utilization Area and River Control Area.

From the above viewpoints, the river management area for Public Corporation covers the Water Body and the River Corridor both for the River Utilization Area and River Control Area. The border of River Corridor (i.e., the cross-sectional borders of the river management) is defined in accordance with the above Government and Provincial Regulations as listed below (refer to Figure 1.1):

Borderline of River Corridor

Type of Water Body	Borderline of River Corridor
River with dike in urban area	3m from edge of dike
River with dike in non-urban area	5m from edge of the dike
Major river (A>500km2) without dike in non-urban area	100m from the river bank
Minor river (A<500km2) without dike in non-urban area	50m from the river bank
Bili-Bili dam reservoir	The land around the reservoir, the ground level of which is between NWL (EL. 95.5m) and SWL (EL.101.6m)

The Public Corporation should monitor and control any excessive use and exploitation of water and land within the above border of river management area including: illegal and/or excessive (i) water abstraction from the river, (ii) land use in the river corridor, (iii) sand-mining, (iv) construction and/or renovation in river corridor and (v) effluent into the river. At the same time, the Public Corporation has a responsibility to preserve the environment of the river area through the periodical patrol, inspection and maintenance works.

1.1.2 Longitudinal Extent of River Management Area

JRBDP is the present principal river administrator for Jeneberang River, and its authority is likely to prevail over the whole river systems, although there does not exist a clear definition on the administrative boundary between JRBDP and other possible administrative entities such as Balai PSDA and local governments at Kabupaten level. Moreover, it is virtually difficult for the Public Corporation to administrate the whole river systems due to the limited manpower and budgetary constrain. From these points of view, Public Corporation would initially administrate the following mainstream and tributaries of Jeneberang River and their associated river corridors and river structures (refer to Figures 1.2 and 1.3):

Longitudinal Extent of

River	Stretch	Length	Classification*	Remarks
Mainstream (1)	From river mouth to Sungguminasa Bridge	9.60	A	1st order River
Mainstream (2)	From Sungguminasa Bridge to Mt. Bawakaraeng	75.90	B	1st order River
Long Storage	From river mouth to confluence with the mainstream	4.50	A	2nd order River (old channel of Jeneberang River
Jenelata River	Between the confluences with the mainstream and Binanga Kamplala	38.45	B	2nd order River (the largest tributary)
Binanga Tokka	From the confluence with the mainstream to Sapakeke Village	24.26	B	3rd order Ricer (tributary of Jenelata River)
Salo Malino	From the confluence with mainstream to Sabo Dam No.6	18.67	B	2nd order River
Kausis	From the confluence with mainstream to Sabo Dam No.8	18.91	B	2nd order River
Total		190.29		

*: Classification of River A = The land of the river corridor has been acquired by the river administrator.
Classification of River B = The land of the river corridor has not been acquired by the river administrator.

1.1.3 Extent of Authority of Public Corporation for Watershed Management

The Public Corporation would possess the direct authority on the aforesaid river management area. However, the Public Corporation hardly prevails the management of the watershed other than the river administration area, and the principal function of the watershed management should be delegated to the organizations relevant to forest management and soil conservation as represented by the Watershed Management Center (Balai Pengelolaan Daerah Aliran Sungai). The function of the Public Corporation would be oriented to just collaboration with those organizations.

1.2 Development of Inventory of River Stretches and River Corridors in River Administrative Area

In order to facilitate the management of the river management area, the Public Corporation should develop the inventory of the river stretches/water body (such as lake and dam reservoir) and river corridors in the river management area. The inventory should be made by the following unit of river stretches/corridors:

- An approximately uniform morphology for a river and river corridor of about 500m in longitudinal length;
- A shorter length of river and river corridor displaying a particular problems, if exist, such as severe bank erosion; and
- A shorter length of river containing a particular river structure of interest such as a rubber dam and a groundsill.

The following information should be recorded into the inventory list. Among the information, the land use in the river corridor as of 2000 has been developed in this Study based on the aero-photograph maps as shown in Tables 1.1 to 1.2.

(1) Classification of River Corridor:

The following classification should be made:

- A unique identity number (ID) should be assigned to each of entities (i.e., each reach of river corridor, section of levee and structure);
- Date of inspection;
- Name of river basin;
- Code number and name of river;
- Type of river corridor (to be classified into four types, namely without-levee on left and right bank, with-levee on left and right banks, with-levee only on left bank and, with-levee along right levee);
- Name of adjacent village, if any (useful to identify the location);
- List of all structures, which are under jurisdiction of river administrator, contained in the river corridor; and

- Definition of the upstream and downstream of river corridor (recorded as GPS coordinates, channel length from a standard point (such as river mouth).

(2) Land Use States of River Corridor

The following land use sates in the river corridor should be inventoried and updated.

- Photographic record number;
- Land ownership;
- Land use with evaluation whether or not the land use results in a significant obstruction of flood flows;
- Type and densities of vegetation together with evaluation whether or not the vegetation results in a significant obstruction of flood flows; and
- Sand mining activity, if any, together with evaluation on whether or not the activity could cause danger to the levee.

Chapter 2

Classification of O&M Works of River Infrastructures

2.1 Definition of River Infrastructures under Administration of Public Corporation

The following existing river infrastructures should be subject to administration by Public Corporation (refer to Table 2.1):

(1) Riparian Structures along Lower Jeneberang River

There exist a variety of riparian structures along the river channel improvement section of about 9.5km in length from river mouth to Sungguminasa. The structures are such as river dikes of about 21km in total for both of right and left bank, revetment of 8,786km, one rubber dam, two groundsills, 43 groynes and 11 drainage sluices (refer to sections 3.4 to 3.7).

(2) Bili-Bili Multipurpose Dam

The Dam is located about 34 km upstream from the river mouth having a catchment area of 384.4 km^2. The dam body is the rockfill type with central core with the dam height of 73 m and composed of the main dam (dam volume = 2,760,000 m^3), the left wing dam (dam volume =1,470,000 m^3) and the right wing dam (1,060,000 m^3). The effective storage capacity of the dam reservoir is 346 million m^3, which is divided into 41 million m^3 for flood control of the downstream of Jeneberang River and, 305 million m^3 as the water sources for irrigation and municipal water and river maintenance flow in the lower reaches of the Jeneberang River. As the incidental facilities for Bili-Bili Dam, the following telemetry hydrological gauging stations were constructed. Moreover, the hydropower plant is now being constructed at the tail end of Bili-Bili Dam with the target completion year of 2005.

- Telemetry hydrological gauging stations: There exist three rainfall gauging stations, four rainfall/water level gauging stations, and three water level gauging stations to monitor both of the flood and drought conditions in Jeneberang river basin. The real-time information of water level and rainfall gauged by the stations is transmitted to the " Dam Control Station" at the dam site and the "Monitoring Station" in Makassar. Based on the information, the Dam Control Station undertakes the reservoir operation both for flood and water supply management. The Monitoring Station issues the flood warning as required.
- Hydropower plant: The plant generates the power by utilize of discharged released from the dam for the downstream irrigation and municipal water requirement. Two units of vertical shaft Kaplan type turbines are equipped. The rated capacity and annual energy output of the project will be 20.0 MW and 77 GWh, respectively.

(3) Rubber Dam

An inflatable rubber dam with a width of 210 m and a height of 2.0 m dam is located about 3.65 km upstream of the river mouth. The principal function of the rubber dam is to prevent the salinity water from intruding into Jeneberang River, and at the same time, to stabilize the riverbed fluctuations.

(4) Long Storage

There exits an old channel called "Long Storage" at the right-bank side of the Jeneberang River having a channel length of about 4km and an effective storage capacity of 1.6 million m^3. The Long Storage is connected with the mainstream of Jeneberang River by an inlet gate to store the water diverted from the Jeneberang River through the inlet gate. The water stores in the Long Storage is used as the water supply source for municipal water demand in Makassar City, and to dilute the water in the primary drainage channels in Makassar City.

(5) Diversion Weirs for Irrigation System

As a part of Bili-Bili Irrigation Project, three diversion weirs namely, Bili-Bili, Bissua and Kampili are now being constructed and/or renovated along the middle reaches of the Jeneberang River between Sungguminasa Bridge to Bili-Bili dam site. The weirs are scheduled to complete by the end of 2004, and upon completion of them, Bili-Bili Multipurpose dam is to supply the water for the following irrigation use:

Intake Discharge through Intake Weirs of Bili-Bili Irrigation

Name of Weir	Intake Discharge (Annual Maximum)	Irrigation Area
Bili-Bili	4.7 m^3/s	2,360 ha
Bissua	25.0 m^3/s	10,758 ha
Kampili	17.5 m^3/s	10,545 ha

(6) Sand Pocket Dams and Sabo Dams

There exist five sand pocket dams and two sabo dams in the upper reaches of Bili-Bili Dam[1]. These sand pocket and sabo dams aim at trapping the sediment runoff so as to reduce the sediment inflow into the reservoir of Bili-Bili dam, and at the same time prevent against the local disaster by sediment runoff. The sediment trapped in the sand pocket dams was further expected as the source for sand mining.

(7) Raw Water Transmission Main (RWTM)

A single pipeline of about 17 km in length was constructed to transmit raw water of 3.3 m^3/s by gravity from Bili-Bili dam reservoir to the existing water treatment plant operated by PDAM at Somba Opu.

[1] Of the three sabo dams constructed in total, the sabo dam No.4 was seriously damaged and abandoned.

2.2 Development of Inventory of River Infrastructures

In order to achieve the effective inspection and maintenance, inventory of all major river infrastructures in Jeneberang river basin should be developed and updated in the following manners:

(1) A unique identity number (ID) should be assigned to each of entities (i.e., each reach of river corridor, section of levee and structure).
(2) Name and number of each entity;
(3) Location of the entity and name of river, where the entity is located;
(4) Structural size, type and quantities of the river infrastructures.

All river infrastructures in the river management area should be inventoried, however, detailed assessment should be made for those as specified in the foregoing subsection 2.1, which have a direct river function. The structures not to be provided with the detailed assessment in the inventory list are the bridges, the intakes for municipal water supply, the urban drainage facilities, the facilities for hydropower generation and others, which are supposed not to be under administration of the Public Corporation.

2.3 Classification of O&M Works

2.3.1 Classification of Inspection Works

Inspection of river infrastructures aims at detecting deterioration in function of facilities including fatigue/decrepitude of structures and mechanical troubles, and should apply the following measures: (a) visual inspection, (b) inspection by touch and sense of hearing on the facilities and (c) operation test and measurement by simple tools and (d) overhaul.

Inspection works should be classified into the following three categories:

(1) Annual Routine Inspection should be made by visual inspection with a certain time throughout a year. The objectives of inspection are outward appearance and cleanliness.
(2) Annual Periodical Inspection should be made at intermittent intervals throughout a year in accordance with a schedule programmed beforehand.
(3) Overhaul should be made with a certain interval of years to detect and repair the mechanical facilities in accordance with a schedule programmed beforehand.
(4) Temporary Inspection should be made immediately after occurrence of disaster such as extensive scale of flood, landslide, volcanic eruption and earthquake, which cause the abnormal conditions of river channels and river infrastructures. The objective items of the Temporary Inspection should include those for the Routine and Annual Inspection, and be determined in accordance with the scale and characters of the disaster.

2.3.2 Classification of Maintenance Works

The Maintenance aims at detecting and rehabilitating deterioration in function of facilities including fatigue/decrepitude of facilities and mechanical troubles. The works are broadly classified into the following three categories:

(1) Preventive Maintenance: This aims at keeping the originally designed function of the river infrastructure through the following three kinds of activities.
- Routine Maintenance, which includes all repetitive activities to be performed throughout a year such as lubrication of mechanical facilities, removal of weed/garbage, and removal of sediment deposit,
- Periodical Maintenance, which includes all activities such as overhaul of mechanical facilities and re-painting of substantial part of metal parts to be performed at intermittent intervals in accordance with a schedule programmed beforehand, and
- Small Repair Work, which includes works necessary for restoration of a facility such as repair of small cracks, holes or detachment on structures and replacement of damaged facilities.

(2) Corrective Maintenance: This aims at more substantial repair/replacement works than the Preventive Maintenance to restore a facility, which has considerably reduced its function originally designed due to over-period of durability service and/or destructive damages. The ongoing rehabilitation works for the under-mentioned damaged Rubber Dam, Groundsill No.2 and Sand Pocket dam No.4 are as enumerated as the typical cases of the Corrective Maintenance. It is herein preliminarily proposed that the repair works with more than about Rp. 500 million should be classified as the Corrective Maintenance, while those of less than Rp. 500 million are as the small repair.

(3) Emergency Maintenance: This is executed against the imminent failures of infrastructures by extensive scales of disasters such as flood, landslide and earthquake.

2.3.3 Classification of Operation Works

A variety of mechanical facilities such as gates and valves attached to the river infrastructures require the operation works, and they will be broadly divided into three groups: (1) the facilities which require the daily operation throughout a year, (2) the facilities, the daily operation works of which are biased to either a rainy season or dry season, (3) the facilities, which require the operation on the ado-hoc basis. The representative facilities, which belong to each of the three groups are as enumerated below:

(1) ***Facilities, which require the daily operation throughout a year***: The typical facilities are those for water distribution as enumerated below:
- Control Gate of Bili-Bili Dam;
- Dam Control and Monitoring System (DCMS) of Bili-Bili Dam including telemetry gauging system;

- Intake Gate of Raw Water Transmission Main;
- Intake Gate and Sluice Gate attached to three irrigation weirs of Bili-Bili, Bissua and Kampili; and
- Intake Gate of Long Storage.

(2) Facilities, which require seasonally deferent operation during a rainy season and a dry season: The following facilities are enumerated to be typical of this group:

- Regular Gate of Bili-Bili Dam, which is operated for the sake of flood control during a rainy season;
- Drainage Gates along the downstream of Jeneberang River, which are operated to drain the rainfall from the hinterland area into the river during a rainy season;
- Rubber Dam, which continues to be inflated during most time of a dry season, but need the daily frequent operation of inflating/deflating of the rubber gate during a rainy season in order to check the salinity intrusion into the river channel;
- Flush Gate of Long Storage, which need the rather frequent operation during a dry season in order to dilute the stagnant water of the drainage channels of Jongaya, Sinrijala and Panampu in Makassar City; and
- Tidal Gate of Long Storage, which require the rather frequent operation during a rainy season in order to keep the water level of Long Storage less than Surcharge Water Level (SWL).

(3) ***Facilities, which require operation on ad-hoc basis:*** The following facilities are seldom operated only for the sake of the emergency and/or backup maintenance in case of trouble of the relevant facilities and/or structures:

- Butterfly valves, sluice valves and air valves attached to Raw Water Transmission main, which are operated for inspection on pipe leakage or repair/replacement of damaged pipes;
- Bulkhead Gate of Bili-Bili Dam, which is operated, only when it is required to inspect and/or repair the penstock (inlet/outlet pipe) placed under the main dam body;
- Guard Gate of Bili-Bili Dam, which is operated, only when it is required to inspect and/or repair the Control Gate placed below the Guard gate.

2.4 Work Procedures for O&M of River Infrastructures

2.4.1 Formation for Execution of Maintenance Works

As described above, the maintenance works would be classified into the preventive maintenance, the corrective maintenance and the emergency maintenance. Among others, the preventive maintenance should be the major scope of the Public Corporation in due consideration of the following conditions:

(1) The preventive maintenance could be performed based on the annual definite and consistent program. On the other hand, most of the corrective and emergency maintenance

works are required on the ah-hock basis, and therefore, it is virtually difficult to formulate the annual maintenance program for them in advance.

(2) Both of the corrective and emergency maintenance is oriented to replacement of the structures/facilities, which have the over-period of durability service and /or destructive damages by the extensive scales of natural disasters. Such replacement is deemed to fall into responsibility the possessor of the river infrastructures/facilities (i.e., JRBDP)) but not that of the Public Corporation as the executer of O&M of the assets.

(3) Both of the corrective and emergency maintenance require the huge implementation cost within a short period, and the budgetary arrangement for them is deemed to be far beyond of the capacity of Public Corporation. Instead, the corrective and maintenance would need to be implemented as the national project.

It is further presumed that the major part of preventive maintenance works would be hardly implemented on the force account base of the Public Corporation because of difficulties in effective use of heavy equipment and machines for the objective maintenance works. It is commercially better to spend the budget for maintenance directly to actual implementation by contracts. From these viewpoints, the routine and periodic maintenance work and a part of small repair works other than inspection works should be executed by the contract based on the following measures as recommended by "Guideline Manual for River Infrastructure Maintenance (RIM) by SMEC in 1997:

(1) Direct appointment of small Class C2 contractors with contract values up to Rp. 50 million using highly standardized contracts, and

(2) Award of large proportion of the work to large contractors of more than one year based on "period contract", where the unit prices are tendered for and fixed, and there is flexibility in directing actual work items and quantities during the course of the contract.

The small repair work should be executed based on the sketch drawing of the area, and the standard typical drawing together with brief work instruction and technical specification but without detailed design. It is desirable, whenever possible, to implement the works by labor-intensive means using local labor.

The required standard preventive maintenance works are as listed in the following Table, and the details of the works are described in the following Chapters:

Proposed Work Items for Preventive Maintenance

Work item	Objective Facility	Time interval of Work	Standard Annual Work Volume
Removal of garbage in river corridor	– River corridor in management area of Public Corporation	As required	The whole extent of river corridor
Removal of garbage twining around riparian structures	– Riparian structures such as groyne, groundsill, drainage sluice gate along river channel – Trash boom in Bili-Bili dam reservoir – Regular and control gates of Bili-Bili Dam – Intake and outlet gates of Long Storage – Intake and sluice gates of irrigation weirs	As required	As required
Removal of sediment deposit	– Sediment sand trap of irrigation weir – Sand pocket dams and sabo dams	As required	10% of sediment trapping capacity
Removal of water hyacinth	– Water surface of Long Storage	Once a year	About 5% of the water surface
Removal of grass in river corridor	– River corridor in management area of Public Corporation – Green belt around dam reservoir	Once a year 4times a year	Entire area of river corridor
Small repair for earth dike	– Earth dike	As required	About 0.5% of the entire surface
Small repair for structures other than earth dike	– Revetment of all river structures – Foundation works of all riparian structures	As required	About 0.1% of the entire surface
Land slide protection work	– River management area of Public Corporation around Bili-Bili dam reservoir	As required	As required
Lubrication of mechanical facilities	– All mechanical facilities	As required	As required
Small-scale re-painting for detachment of metal parts	– All mechanical facilities	As required	As required
Test and repair of pipe leakage	– Raw Water Transmission Main	Once a year	1% of the whole pipes
Supply of spare parts to the electric facilities	– Telemetry gauging equipment attached to Bili-Bili dam control office – Monitoring and control system at Bili-Bili dam control office – Control devices for Rubber dam	Once a year	As required
Supply of consumables to the electric facilities	– All mechanical facilities	As required	As required
Overhaul of mechanical facilities	– All gate facilities – Valves of RWTM – Control device for Rubber Dam	Once for 2 years	Whole mechanical parts
Greasing of whole movable part of mechanical facilities	– All movable parts of mechanical facilities	Once for 3 years	Whole mechanical part
Cross-sectional river channel survey	– River channel along mainstream of about 70.6km in length from river mouth to Daraha Bridge.	Once year	With an interval of 500 to 1000m
Echo-sounding survey for Bili-Bili dam reservoir	– Bili-Bili dam reservoir	Once a year	Whole reservoir area

2.4.2 Formation for Execution of Operation Works

The operation of the gates, rubber dam and other relevant facilities could cause the significant effect on the flood control and the water distribution in Jeneberang river basin. Accordingly, major part of operation works should be executed on the force account base by the staffs of Public Corporation.

Exceptional cases would be, however, given to the operation works for the drainage gates along the downstream of Jeneberang River and the inlet/outlet gates of the Long Storage. These gates are scattered along the along the downstream river stretch of 9.5 km in length, and their operation works are required on the ad-hoc bases as described above. Accordingly, it is virtually difficult for the Public Corporation to assign its limited permanent staffs for operation of the gates. Due to these backgrounds, the Public Corporation should entrust the operation of these

gates to the local residents on the premises that the operation should be made through instruction and supervision of the Public Corporation.

2.4.3 Procedures for Formulation and Execution of Annual O&M Program

The Public Corporation should undertake the following formulate and execution of the annual O&M Program on the premises of the above formation of execution of the O&M works:

(1) Formulation of Annual O&M Program

- To estimate and propose the necessary O&M works together with the necessary O&M cost to be executed by each of the Sub-divisions;
- To determine the entire scope of the O&M works taking the available fund, and the priorities of maintenance works as listed below into account;

  First Priority

  - Maintenance of water supply structures, which are directly related to the water supply service;
  - Water resources infrastructures, which have the direct relation with the customer's interest;
  - Rehabilitation of critical damages of flood control structures, which leads to the disastrous flood damage;
  - Removal of the critical sediment deposit in the reservoir and river, which would seriously affect the hydropower generation; and
  - Emergency rehabilitation works, which are endorsed by the Board of Director.

  Second Priority

  - Lubrication of the mechanical facilities;
  - Rehabilitation of minor damages of flood control facilities, which would not still lead to the disastrous flood damage; and
  - Maintenance of water resources infrastructures and water supply facilities, which would not directly support the water supply services.

  Third Priority

  - All maintenance works other than the above first and second priority works;

- To formulate the draft of O&M program, which includes the implementation/disbursement schedule and procurement/execution methods for the O&M works;
- To verify and approve the draft of the maintenance program; and
- To input the O&M program into the entire work and budgetary plan of the Public Corporation.

(2) Execution of O&M Works

- To execute the O&M works through either the force-account base or the contract base in accordance with the O&M program;
- To submit the field inspection report to the Head of Programme Subsection every month, and execute the follow-up action for the immediate/emergency repair, as required; and
- To submit the monthly and annual reports for O&M works to the Head of Operations Directors.

(3) Evaluation of O&M in the Year

- To evaluate the results of the whole O&M works executed in the year including the following objectives of evaluation:
  - Validity of the selected maintenance method;
  - Viability of implementation period of maintenance (the date of commencement and duration);
  - Viability of the estimated O&M cost for the actual O&M works required;
  - Effectiveness of water resources development facilities and river infrastructures;
  - Validity of frequency of maintenance works for each of the objective structures;
  - Effectiveness of dissemination of O&M activities among the local communities; and
  - Progress of community development, which could support the O&M works.
- To revise the O&M manuals, as required, based on the results of evaluation on the O&M works executed in the year.

2.5 Job Description for O&M Works of River Infrastructures

The organization set-up of the Public Corporation is as proposed in Volume III-2 "Supporting Report 2-I – Institutional Plan". The tasks to be undertaken by the each division of the proposed organization-set up are as described hereinafter::

(1) Water Service Divisions

The following works should be undertaken by the four sub-divisions of Water Service Division, namely: Sub-Division I-1 (Dam O&M), Sub-Division I-2 (Upstream O&M), Sub-division II-1 (Irrigation Weir O&M) Sub-Division II-2 (Rubber Dam & Long Storage O&M and Downstream River O&M):

- To propose the necessary O&M plan together with estimation of their necessary O&M cost for the following facilities and infrastructures every December.

O&M Works to be Undertaken by Each of Sub-divisions

Name of sub-division	O&M Works
Sub-Division I-1 (Dam O&M)	O&M of Bili-Bili Dam; O&M of Raw Water Transmission Main; O&M Telemetry hydrological gauging stations; and River Patrol and river maintenance along Jenelata River
Sub-Division I-2 (Upstream O&M)	O&M of five sand pocket dams and three sabo dams; and River Patrol and river maintenance along the upstream of Jeneberang River above Bili-Bili dam reservoir
Sub-Division II-1 (Weirs O&M)	O&M of Bili-Bili Irrigation weir; O&M of Bissua Irrigation Weir; and O&M of Kampili Irrigation Weir River Patrol and river maintenance along Jeneberang River between Kampili Weir and Bili-Bili Dam
Sub-Division II-2 (Rubber Dam & Long Storage O&M)	O&M of Rubber Dam O&M of intake and outlet facilities of Long Storage River Patrol and river maintenance along Long Storage
Sub-Division II-2 (Downstream River O&M)	O&M of riparian structures along Jeneberang between the river mouth and Kampili Weir River Patrol and river maintenance along Jeneberang River between Kampili Weir and Bili-Bili Dam

- To execute the O&M works through either the force-account base or the contract base in accordance with the O&M program;
- To submit the field inspection report to the Head of Programme Subsection every month, and execute the follow-up action for the immediate/emergency repair, as required (by each of sub-division of Water Service Divisions I and II); and
- To submit the monthly and annual reports for O&M works to the Head of Operation Directorate (by each of sub-division of Water Service Divisions I and II).

(2) Program Section under Technical Bureau

The Program Section should be the core to formulate the maintenance program and evaluate the O&M works executed in the year. The principal work items of the Section are as enumerated below:

- To determine the entire scope of the O&M works taking the available fund, and the priorities of maintenance works into account (determination should be jointly made with the Administration & Finance Bureau);
- To formulate a draft of maintenance program, which includes the implementation/disbursement schedule and procurement/execution methods for the O&M works; and
- To evaluate the results of the whole O&M works executed in the year; and
- To revise the O&M manuals, as required, based on the results of evaluation on the O&M works executed in the year.

(3) Administration and Finance Bureau

The Section should undertake the following tasks:

- To determine the entire scope of the O&M works taking the available fund, and the priorities of maintenance works into account (determination should be jointly made with the Program Section);
- To estimate the cost required to the entire O&M works; and
- To input the O&M program into the entire work and budgetary plan of the Public Corporation.

(4) Head of Operations Directorate

As the representative of the Public Corporation, the Head of Operations Directorate should undertake the following tasks:

- To verify and approve the draft of the maintenance program; and
- To request coordinate the budgetary arrangement for the corrective and emergency maintenance to the Ministry of Settlement and Infrastructure.

2.6 Equipment, Tools and Materials for Inspection and Maintenance

The priority equipment, tools and materials to be provided to the staffs of the Public Corporation who are assigned for the inspection and maintenance through force account are as enumerated below:

(1) Equipment, Tools and Materials for Inspection

- ID card
- Uniform
- Camera
- Handy GPS (Global Positioning System)
- Radio communication equipment (hand-talky)
- Measuring tape, pole and staff gage
- Rope
- Stake
- Field book

(2) Equipment, Tools and Materials for Maintenance

As described above, a substantial part of maintenance works would need to be carried out by contract instead of by forces account of the Public Corporation. Accordingly, the heavy equipment and machineries owned by the Public Corporation should be minimal, and the Public Corporation should focus to year-round force account activities such as routine and periodic maintenance, emergency small repair work and flood fighting activities. In order to achieve these force account activities, the following equipment, tools and materials should be prepared for maintenance:

- Mechanical grass cutters for grass cutting, which is a year-around activity to be carried out by force account or small contract;
- Mechanical hand compactors, which are useful for various compaction works as a part of rehabilitation and at same time could be hired out to a contractor;
- Small trucks with a capacity of around 2 tons for use of transportation of materials, equipment and labors;
- Sand and sandbags for flood fighting;
- Front-end loaders and/or backhoes, which are highly useful for loading of various materials.
- Spare parts, which are immediately required in case of trouble during operation, with together consumable and/or damageable parts and spare parts required to inspection and maintenance such as packing, seal-lings, lump, relay, share-pings.

Chapter 3

Technical Guideline on Operation and Maintenance of River Channel and Riparian Structures

3.1 Inspection and Maintenance of Earth Dike

The earth dike was constructed along the downstream of Jeneberang River from the river mouth to Sungguminasa Bridge in 1992. The salient features of the earth dike are as enumerated below:

- Length: 21.3 km in to total, which is divided into right dike of 11.7 km and left dike of 9.6 km.
- Crown width: 3.5 m (covered with gravel pavement).
- Dike Slope: 1 to 2 for both of the land and river sides.

The dike functions to confine the design flood discharge within the river channel and, the routine and periodical inspection of dike would be given to over-growth of weed, crack, and seepage at bank crown, shoulder and slope. Based on the inspection, the preventive and corrective maintenance should be executed including replacement of revetment, foundations and confluent works.

(1) Inspection

The principal items for inspection are as enumerated below:

- Overgrowth of weeds, which may deteriorate the stability and durability of embankment;
- Erosion and/or collapse;
- Cracks (cracks of dike are usually caused by (i) excessive saturation due to seepage of water, (ii) contraction of dike, and (iii) earthquake);
- Leakage of water and piping;
- Descending of crown level;
- Slope failure (slope failure is usually caused by increase in unit weight of soil saturated due to rain water or seepage of water and also by decrease of shearing resistance against the weight.); and
- Cave-in on land side slope (the initial cause of cave-in in the dike is an occurrence of void due to (i) leakage of water, (ii) washing away of backfill materials caused by fault of sluice joint or impervious wall and (iii) insufficient compaction of refilled soil for built-in facility and backfill sand of retaining wall. The void gradually develops into cavities, which appear on the dike crown.

(2) Maintenance

The principal items for maintenance are as enumerated below:

- Removal of grass: To periodically remove the overgrowing grass and weeds on the embankment by the mechanical or manpower cutting measures.
- Rehabilitation of Dike Crown: To fill high quality soil with appropriate moisture content on the dike crown, compact it by tamper for small scale damage or by vibration roller and bulldoze for large scale damage and provide sodding at the dike shoulder.
- Rehabilitation of Dike Slope: To fill high quality soil with appropriate moisture content on the dike slope in due order of stripping, bench cut, staking, slope tamping, sodding and driving of support skewer.
- Rehabilitation of Slope Failure: To remove the muddy and poor quality soil, replace it to high quality soil with enough compaction and provide leakage proof works or mitigate the slope gradient, if necessary.
- Rehabilitation of Cave-in: To conduct the detailed investigation on the cavities in the bank, and remove/reconstruct the embankment body, which has the cavities, or filling up the cavities. and,
- Rehabilitation of Cracks: To excavate the dike body along the crack in V-shape and backfill the high quality soil with sufficient compaction.

3.2 Inspection and Maintenance of Revetment

The following revetment was constructed to prevent scoring and erosion of the aforesaid downstream earth in 1992 and 1993:

- Revetment for low water channel with random masonry of 425 m in length,
- Revetment for low water channel with dry masonry of 996 m in length,
- Revetment for low water channel with wet masonry of 3,592 m in length, and
- Revetment for high water channel with wet masonry of 6,384 m in length.

A careful attention on inspection and maintenance is required as it faces to the rapid discharge flow and tends to be affected by the fluctuation of riverbed. Slope protection in particular should be maintained well even in a small trouble spot, as it is important to prevent the initial destruction, which could lead to the destructive damage of the entire structure. When the foundation is exposed above the riverbed, additional foot protection shall be set steadily and some reinforcement such as riprap and gabions are required, if the local score is found and the foundation is caving.

(1) Inspection

The principal items for inspection are as enumerated below:

- Cracks on the slope pavement;

- Conditions (erosion, scoring, etc) of the foundation and side slope pavement of the revetment (this inspection could be made during only low water level); and
- Conditions of construction joint, and upper/lower ends of the revetment works.

(2) Maintenance

- The necessary rehabilitation should be made based on the results of detailed investigation on the cause of damages; and
- The countermeasures against erosion should be introduced immediately after the new bank erosion is found.

3.3 Inspection and Maintenance of Groyne

The following groyne was constructed to maintain the designed depth of river channel and protect the river dike and revetment.

- Structural type: Permeable pile groyne;
- Number of groyne: 43 units in total;
- Standard dimension of one unit of groyne: 2 m (W) x 2.3 m (L) x 1.2 m(H);
- Depth of pile driving: 2.5 m; and
- Foot protection: by Gabion.

Replacement and/or removal of groyne would be occasionally required in accordance with change of the river flow condition and alignment of river channel in a long lapse of time.

(1) Inspection

The principal items for inspection are as enumerated below:

- Garbage, tress and any other drifting materials twining around groyne;
- Erosion or sedimentation at foundation;
- Cracks on concrete piles and beams; and
- Progress of erosion and/or scoring of the river channel downstream of the groyne.

(2) Maintenance

The principal items for maintenance are as enumerated below:

- Removal of garbage, tress and any other drifting materials twining around groyne;
- Removal of sediment at foundation;
- Backfilling of cracks with high quality concrete; and
- Slope and foot protection works by gabion.

3.4 Inspection and Maintenance of Groundsill

Two units of groundsill were constructed 5.97 km and 9.00 km upstream from the river mouth to minimize the fluctuations of the riverbed level. The salient features of the groundsill are as enumerated below:

- Main concrete body: 1.3 m in crown width x 1.8 m in height x 200 m in length;
- Concrete apron: 3.7 m in width x 200 m in length x 0.8 m in thickness; and
- Foot protection by gabion mattress: 15 m in width x 200 m in length.

When the foundation of the groundsill is damaged, the chemical or cement grouting through holes drilled in the groundsill by concrete cutter would be required to strengthen the foundation. Sheet piling and/or waterproof apron provided at the upstream of the groundsill would be effective to a certain type of damage.

(1) Inspection

The principal items for inspection are as enumerated below:

- Garbage, tress and any other drifting materials twining around groundsill;
- Slope failure of sidewall apron;
- Cracks on the main body and downstream apron; and
- Erosion or scoring of foundation and side slope.

(2) Maintenance

The principal items for n are as enumerated below:

- Removal of garbage, tress and any other drifting materials twining around groundsill;
- Filling of the part of slope failure with high quality concrete;
- Filling the cracks of the concrete structure with high quality concrete; and
- Slope and foot protection works by gabion.

3.5 Inspection, Maintenance and Operation of Sluice Gate

Eleven drainage sluice gates were constructed along the downstream of Jeneberang River from the river mouth to 11km upstream in 1992 to 1993. The salient features of the drainage sluice gates are as enumerated below:

- Number of gate leaves at each of drainage gate: 1 or 2 units;
- Gate type and power source: Roller gate to be lifted by man-power;
- Size of gate leaf: 1.5 to 2 m in width x 1.5 to 2 m in height; and
- Length of drainage culvert: 16 to 19 m.

The conditions of opening and closing of the gates should be confirmed before start of a rainy season. Painting shall be made at least every three years to prevent the gate from rusting. Weeds and sediments could easily accumulate on the bottom of the culvert. They should be detected through the routine inspection and removed through the routine maintenance.

(1) Inspection

The principal items for inspection are as enumerated below:

- Rust and detachment of paint;
- Garbage, sediment and other drifting materials at gate and sluiceway;
- Loosing or missing of bolts and nuts;
- Leakage of gate guide and sill portion;
- Cracks of concrete structure portion; and
- Deformation of gate leaf, hoist and gate frame.

(2) Maintenance

The principal items for maintenance are as enumerated below:

- Lubrication, greasing and painting of gate and other metal portions;
- Removal of garbage, sand, gravel, and other drifting materials accumulated in the culvert;
- Tightening or replacement of bolts and nuts;
- Filling of the cracks and the part of leakage with high quality concrete or other proper materials;
- Repair or replacement of the conduit; and
- Replacement and/or reconstruction of the gate leafs, gate hoist or other mechanical portion based on the detailed investigation and design.

(3) Operation

The sluice gates have an important role to drain the storm rainfall into Jeneberang River. However, if the gates were opened, when the Jeneberang River has the higher water head than the area sheltered by the river dike, the river discharge would reversely flow into the sheltered area possibly causing the man-made flood. In order to avoid such man-made flood and properly drain the storm rainfall into the river, the sluice gate should be operated through the following procedures:

- Assign a gatekeeper for operation of each of the eleven sluice gates during a rainy season from November to May (Note: Any particular gauging keeper is currently not assigned for all of the existing gates. As the results, the gate is left without any maintenance and operation, whereby all of the gate are currently not workable due to mechanical trouble and some of the gate continue to be partially opened during a rainy season);

- Secure the communication line between the gatekeepers as assigned above and the Bili-Bili Dam Control Office/the Monitoring Office so that the gatekeeper could receive information on the flood and/or the instructions on opening/closing gate by the Bili-Bili Dam Control Office/the Monitoring Office as required;
- Close the gates during the period from the prior-flood, the flood period and the post-flood period (refer to subsection 4.5.2); and
- Start open the gates after the gatekeeper is informed from the Bili-Bili Dam Control Office/the Monitoring Office that Jeneberang River enter into the non-flood period.

Chapter 4

Technical Guideline on Operation and Maintenance of Bili-Bili Multipurpose Dam

4.1 Structural Features of Bili-Bili Dam

Bili-Bili Multipurpose Dam was constructed in 1999 for the sake of flood control, municipal water supply, irrigation water supply and supply of river maintenance flow. The salient features of the dam reservoir and structure are as below:

(1) Dam Reservoir

- Design Flood Water Level (DFWL) : EL. 103.0 m
- Surcharge Water Level (SWL) : EL. 101.6 m
- Normal Water Level (NWL) : EL. 99.5 m
- Low Water Level (LWL) : EL. 65.0 m
- Effective Water Depth (SWL-LWL) : 36.6 m
- Reservoir Surface Area at SWL : 18.50 km^2
- Total Storage Capacity : 375,000,000 m^3
- Effective Storage Capacity : 346,000,000 m^3
- Flood Control Capacity : 41,000,000 m^3
- Water Utilization Capacity : 305,000,000 m^3
- Sediment Capacity : 29,000,000 m^3

(2) Main Dam Body

- Type of Dam : Rockfill Type with Central Core
- Height Above Foundation : 73 m
- Crest Length : 750 m
- Crest Width : 10 m
- Crest Elevation : EL. 106.0 m
- Dam Body Volume : 2,760,000 m^3

(3) Left Wing Dam body

- Height Above Foundation : 42 m
- Crest Length : 646 m
- Crest Width : 10 m
- Crest Elevation : 106 m
- Dam Body Volume : 1,470,000 m^3

(4) Right Wing Dam body

- Height Above Foundation : 52 m
- Crest Length : 412 m
- Crest Width : 10 m
- Crest Elevation : 106 m
- Dam Body Volume : 1,060,000 m^3/s

(5) Spillway

- Elevation of Free Flow Crest : EL. 99.5 m
- Elevation of Gated Spillway Crest : EL. 91.8 m
- Width of Gated Spillway Crest : 14 m
- Regular Gate : 7.0 m wide x 7.7 m high x 2 units
- Chute way : 225 m long x 99.5 to 55.0 m wide
- Stilling Basin : 65 m long x 75 m wide
- Outlet Channel : 100 m wide x 400 m long

(6) Outlet Works

- Intake Structure : Inclined intake, 51.5 m high
- Bulkhead Gate : Roller gate, 3.7 m wide x 5.2 m high
- Steel Conduit : 285 m long x 3.7 m dia.
- Control Gate : Jet flow gate, 2.0 m dia.
- Guard Gate : Gate valve, 2.0 m dia.
- Dissipater Basin : 4.0 m wide x 74.1 m long

(7) Monitoring and Control System

- Control Center : Dam Control Station
  INDUK Monitoring Station
- Hydrological Gauge Station : Four Rain Gauge Stations
  Three Rain/Water Level Gauge Stations
  Four Water Level Gauge Stations
  One Repeater Station
- Gage Flow Meter/Opening Gauge : One flow meter for Control Gate
  Two flow meters for Raw Water Transmission Main (One at inlet point and another at outlet point)
  One gate opening gauge for Regular gate
- Data processing and display unit : One set each at Dam Control Station and INDUK Monitoring Station

4.2 Inspection

The principal items for inspection are as enumerated below:

(1) Dam Reservoir and its Surroundings

- Garbage, drifting materials, and others over the surface of the reservoir;
- Sediment deposit in the reservoir;
- Water quality including turbidity;
- Land slide around the dam reservoir;
- Vegetation around the reservoir; and
- Illegal land use around the reservoir.

(2) Dam Body and Foundation

- Movement of structure including the following items:
  - Vertical and horizontal settlement (by hydrostatic settlement gauge);
  - Slip of dam slope;
  - Displacement of rock riprap; and
  - Collapse of foundation and abutment.
- Seepage including the following items at the seepage gauging station:
  - Volume of seepage water;
  - Color of seepage water; and
  - Silt and sand contained in the seepage water.
- Pressure by pressure gauge including the following items
  - Pore pressure; and
  - Earth pressure.

(3) Gates

- Noise or vibration of movable parts and loosing/missing of bolts and nuts;
- Cleanliness of gate leaf, gate hoist and other mechanical parts;
- Rust and detachment of paint;
- Slackness of wire rope;
- Deformation of gate leaf, gate hoist and gate frame, and any other damage of gate levee and hoist;
- Leakage of gate guide and sill portion;
- Abnormal voltage/ampere or temperature of gate hoist; and
- Operational conditions of the local panel, cable connection and power source.

(4) Monitoring and Control System

- Adequacy of consumables such as recording charts and recording pen; and
- Failure of devices.

4.3 Maintenance

The principal items for maintenance are as enumerated below:

(1) Dam Reservoir and its Surroundings

- Removal of garbage, drifting materials, and others over the surface of the reservoir;
- Dredging sediment deposit in the reservoir;
- Landslide protection works (hillside works, etc.) around the dam reservoir; and
- Removal of weeds and reforestation around the dam reservoir.

(2) Dam Body and Foundation

Detailed investigation/design and rehabilitation/reconstruction for the failure parts are required, whenever the excessive movement, seepage, and pressure of the dam body is detected.

(3) Gates

- Lubrication (greasing and/or oiling) of the movable parts of the gate;
- Tightening or replacement of bolts and nuts;
- Cleaning and removal of garbage, sediment and other drifting materials
- Re-painting;
- Re-welding for the detachment of welding parts;
- Replacement and/or reconstruction of the deformation and leakage parts of the gate based on the detailed investigation and design; and
- Repair by the manufacture for abnormal conditions in power supply system, local gate control devices and all other failures of gate control system.

(4) Monitoring and Control System

- Supply of consumables such as recording charts and recording pen;
- Repair or replacement of the failure parts in accordance with the manufacture's manual.

4.4 Operation of Remote Control and Monitoring System of Bili-Bili Multipurpose Dam

4.4.1 Objectives of the System

The Dam Control and Monitoring System (DCMS) was developed in order to support the monitor of the hydraulic and hydrological conditions related to dam reservoir operation and the remote control of the outlet facilities for Bili-Bili Dam. The definite items to be monitored and controlled through DCMS are as enumerated below;

- Objectives of monitoring include (i) inflow discharge into and outflow discharge from the dam reservoir, (ii) opening height of dam outlet structures, (iii) reservoir water level and

storage volume, (iv) rainfall and river water level in Jeneberang river basin, and (v) flow discharge of the Raw Water Transmission Main (RWTM).

- Objectives of remote control include gate opening height of and outflow discharge from Regulating Gates, the Control Gate and the Guard Gate.

4.4.2 Configuration of DCMS

In order to achieve the above objectives, the DCMS is equipped with the following facilities: (1) gauging devises/sensors, (2) Server, (3) Programmable Logic Controller (PLC), and (4) display devices and (5) printers (refer to Figure 4.1). All these equipment other than the gauging devices/sensors are place at the Dam Control Office located at the Bili-Bili dam site and the Office of JRBDP (the Monitoring Office) located in Makassar. The Dam Control Office is to directly undertake all necessary control of the dam outlet facilities and flood warning based on the monitoring results on the hydrological and hydraulic states, while the Monitoring Office is to monitor/supervise the control by the Dam Control Office and disseminate flood information as required.

(1) Gauging Device and Sensors

The DCMS is provided with the following telemetry hydrological gauging stations, the gate flow meters and the gate opening gauges:

(a) Telemetry Hydrological Gauging Stations

There are eleven telemetry-gauging stations (four for rainfall gauge, three for both of rainfall/water level gauge and four for water level gauge) in Jeneberang river basin. These stations gauge the rainfall in the river basin and water level of river/dam reservoir on real-time base and automatically transmit them to PLC installed at the Dam Control Office.

(b) Gate Flow Meter

The flow meters are installed at the Control Gauge, the Guard Gate and the Raw Water Transmission Main (RWTM) to monitor the flow discharge of these gates and RWTM. Among others, the Control and Guard Gate have one flow meter each, while the RWTM has two flow meters at its inlet point just downstream of Bili-Bili Dam and its outlet point located at Somba Opu Water Treatment Plant. All outflow discharges gauged by the flow meter are automatically transmitted to PLC at the Dam Control Office.

(c) Gate Opening Gauge

The sensors for the gate opening height are installed at all outlet structures of Bili-Bili Dam, i.e., the Regulating Gates, the Control Gate, the Guard Gate, and the Bulk Head Gate. The information from the sensors is also transmitted to PLC and used to check the gate operational states.

(2) Programmable Logic Controller (PLC)

The PLC receives the non-manipulated signals and/or pulse from the gauging devices/sensors, manipulates them in particular formats, and transmits them to the Server. The PLC also receives the various digital commands for remote gate control from the Server and manipulates them into the signals and/or pulse applicable to control of hydraulic pump system for opening/closing of the gates. Thus, PLC intermediates between the gauging devices/sensors and the Sever. In order to perform the various tasks, the PLC is provided with eleven processing segments, and each of the segments have the following particular processing tasks.

- PLC-RWL: to process the reservoir water level received from the telemetry gauging station at Bili-Bili dam reservoir;
- PLC-RG1: to receives the opening height of the Regulating Gate No.1 and to calculate its flow discharge;
- PLC-RG2: to receives the opening height of the Regulating Gate No.2 and to calculate its flow discharge;
- PLC-CG: to receives the gate opening height of the Control Gate and to calculate its flow discharge;
- PLC-GG: to receives the gate opening height of the Guard Gate and to calculate its flow discharge;
- PLC-BLK: to receives the gate opening height of the Bulkhead Gate;
- PLC-TM1: to process rainfall and river water level received from the telemetry gauging station at Bili-Bili dam reservoir;
- PLC-TM2: to process rainfall and river water level received from the telemetry gauging station at Bili-Bili dam reservoir;
- PLC-RCC: to process all necessary jobs for remote control of the Regulating Gates, the Control Gate and Guard Gate;
- PLC-MDP1: to process necessary jobs for display of graphic pages on Main Display Panel (called "MIMIC Panel") and the cathode-ray tube (CRT) of PC; and
- PLC-MDP2: to process necessary jobs for display of graphic pages on Main Display Panel (called "MIMIC Panel") and CRT of PC.

(3) Server

The DCMS applies the redundancy server system, where the server consists of one main server and one standby server. The standby server is connected with the main server through LAN. When the primary server is running, the standby server takes a part of processing load but takes over all function of the main server, when the main server fails.

The Server could fulfill the following various multitask functions through window-based application software called "CITECT":

- To updates all digital and analog data transmitted from PLCs;
- To transmit commands for remote gate control to PLCs;

- To transmit constants and parameters used for processing works by PLCs;
- To control all outputs on the under-mentioned display devices and printing devices.

The Server has a function to display a series of graphic pages through CRT of the PC, and the operator could monitor and control the whole system of the dam through these pages on the real time base.

(4) Display Devices

The following windows are displayed through the aforesaid CRT of PC and the Main Display Panel:

- Windows for Graphic User Interface for visual monitoring and remote control;
- Windows for Setting of Constants/Parameters applied to processing works by PLC; and
- Windows for the current operational states of the DCMS, which enables to know the conditions of the entire system configuration, the operational conditions of system devices, the operation records.

(5) Printing Devices

The DCMS are equipped with the Operation Printer and the Alarm Printer. The Operation Printer is place at the Dam Control Office and the Monitoring Office, while the Alarm Printer only at Dam Control Office.

(a) Operation Printer

The Operation Printer prints out the dam operation records at a prefixed interval (currently set at 60 minutes), at the time of gate operation terminated, or at the time when the operator switches on the printing commands. The items to be printed out by the Operation Printer are as enumerated below:

- Date and time of printing out;
- Reservoir water level at the time;
- Effective reservoir storage volume at the time;
- Available reservoir storage volume for water supply at the time;
- Inflow discharge at the time;
- Dam outflow discharges from the Regulating Gates, the Free Flow Chute-way, and the Control Gate; and
- Gate opening height of the Regulating Gates and Control Gates.

In case of interruption of DCMS operation due to power failure, shutoff of the system, pause of the printer and any other reasons, it is required to reset the time setting both for the printer and the Server in order to perform their synchronized operation.

(b) The Alarm Printer

The Alarm Printer prints out the alarms together with their corresponding sates about the reservoir water level, the rainfall/water level transmitted from the telemetry gauging stations and the outlet structures, namely: the Regulating Gate, the Control gates, the Guard gate, and Bulkhead Gate. The major items to be printed out by the Alarm Printer are as enumerated below:

- Date and time of printing out;
- Communication and/or processing faults in the data transmitted from telemetry gauging stations;
- Communication and/or processing faults in the data of reservoir water level transmitted from the telemetry reservoir water level gauging station;
- Abnormal states of outlet structures including the abnormal gate position and excessive gate flow discharge over allowable rate;
- Abnormal raising or descending speed of the reservoir water level; and
- Excessive dam inflow discharge over the flood control capacity.

4.4.3 Monitoring and Remote Gate Operation

(1) Monitoring

The DCMS displays a series of graphic pages to support monitoring of the dam states. The pages to be displayed are as enumerated below:

- Main Dam Mimic: to display the current states and warning messages related to dam reservoir and dam outlet structures including the reservoir water, the reservoir storage volume, and the gate opening height/flow discharge;
- Telemetry Mimic: to display the rainfall, water level and river flow discharge at each of telemetry gauging station together with the basin mean rainfall (Note: The Thiessen Coefficients for estimation of the basin mean rain as well as the constants parameters for conversion of water level to flow discharge could be set through the pages for parameter setting in this Mimic);
- Dam Display Panel: to display view/location map of the dam structures together with photographs of the gate structures;
- Raw Water Transmission Main (RWTM) Mimic: to display the inflow and out flow discharge of RWTM;
- Guard Gate Mimic: to display the gate opening height, gate operation states (raising, stopping or lowering of the gate), and the gate flow discharge measured by flow-meter;
- Control Gate Mimic: to display the gate opening height, gate operation states (raising, stopping or lowering of the gate), and the gate flow discharge measured by flow-meter;
- Regulating Gate Mimic: to display the gate opening height, gate operation states (rising, stopping or lowering of the gate), and the flow discharge for two units of Regulation Gate estimated from the gate opening height; and

- Bulkhead Gate Mimic: to display the gate opening height, and gate operation states such as rising, stopping or lowering of the gate (Note: this display is used only when the maintenance work is made to the Control Gate or Guard Gate).

(2) Remote Control Console (RCC)

The remote control of the dam outlet structures could be made through operation of switch displayed on the RCC.

(a) Remote Control of Guard Gate by RCC

The gate could be in the mode of remote control through pressing on switch of "Remote" on RCC[2]. Then, the gate could be raised, lowered and stopped through pressing of switches of "Raise", "Lower" and "Stop" on RCC, respectively.

(b) Remote Control of Control Gate Mimic by RCC

The basic switch operations to raise, lower and stop the Gate on the RCC are same as those for the above Guard Gate Mimic. In addition, the gate opening height could be automatically set to release the target outflow discharge through the following switch operation:

- Press switch of "Remote" on RCC;
- Press switch pf "Auto" on RCC;
- Input three digits of the target outflow discharge, which should be less than the maximum gate flow capacity flow of 42.4 m^3/s;
- Press switch of "Set" on RCC; and
- Press switch of "Auto Start" on RCC.

(c) Remote Control of Regulating Gate by RCC

RCC has two sets of remote control switches, which are separately used for each of two units of Regulating Gate. The basic switch operations to raise, lower and stop each of the Regulating Gates on the RCC are same as those for the above Guard Gate Mimic. It is, however, noted that two units of the Regulating Gates is not allowed to start to move simultaneously so as to protect the electric motors. Even when the switches of "Rise" or "Lowe" both for two gates are pressed simultaneously, one gate starts to move five seconds after another gate states.

[2] The local control panel is installed beside each of the Regulation Gates, the Control Gate and the Guard Gate in order to directly operate the gates through the panel. The gate could be the remote control mode, only when the door of the local control panel is closed.

4.4.4 Setting of Parameters/Constants for Processing of PLC

The parameters and/or constants, which is required to various processing jobs made in PLC are set through the Window Menu of "Constant Setting" on the CRT of the Server. The items to be set are as enumerated hereinafter:

(1) Parameters for Alarm in Dam Reservoir Operation

The following parameters could be set through the Server as the critical value for alarm on the dam reservoir conditions or for start of the particular dam reservoir operation. The objectives for alarm include the various hydrological indices such as the reservoir water level (RWL), the dam inflow discharge, and the water level/rainfall given from the telemetry gauging stations. When these hydrological indices reach the pre-set alarm level, the alarm lamp in the display page on CRT of the Server will be highlighted so as to make the dam operator to easily recognize the alarm conditions.

(a) Alarm on RWL

- Abnormal raising or lowering rate of RWL (currently set at 50 cm/hour);
- Upper limit of RWL (currently set at Design Flood Water Level of EL. 103 m);
- Lower limit of RWL (currently set at Low Water Level of EL. 65 m); and
- RWL for start of gate operation for flood control (currently set at EL.94.5 m, i.e., 0.1 m below Normal Water Level).

(b) Alarm on Dam Inflow Discharge

- Dam inflow discharge for start of gate operation for flood control (currently set at 600 m^3/s); and
- Upper limit of flood inflow discharge, which could be beyond dam flood control capacity (currently set at 2,040 m^3/s).

(c) Alarm on Water Level and Rainfall Transmitted from the Telemetry Gauging Stations

- Upper limit of basin average rainfall intensities in the whole Jeneberang river basin, in the upper reaches of Bili-Bili dam and in the whole of Jenelata river basin (currently set at 70 mm/hour); and
- Upper limits of river water levels gauged at the telemetry water level gauging stations.

In addition to the above alarm setting, the various limit settings on the gate operation could be made through the Server in order to control the excessive load to the hydraulic motor system for the dam gates. Nevertheless, the initial setting should not be changed, unless the existing motor systems are renewed.

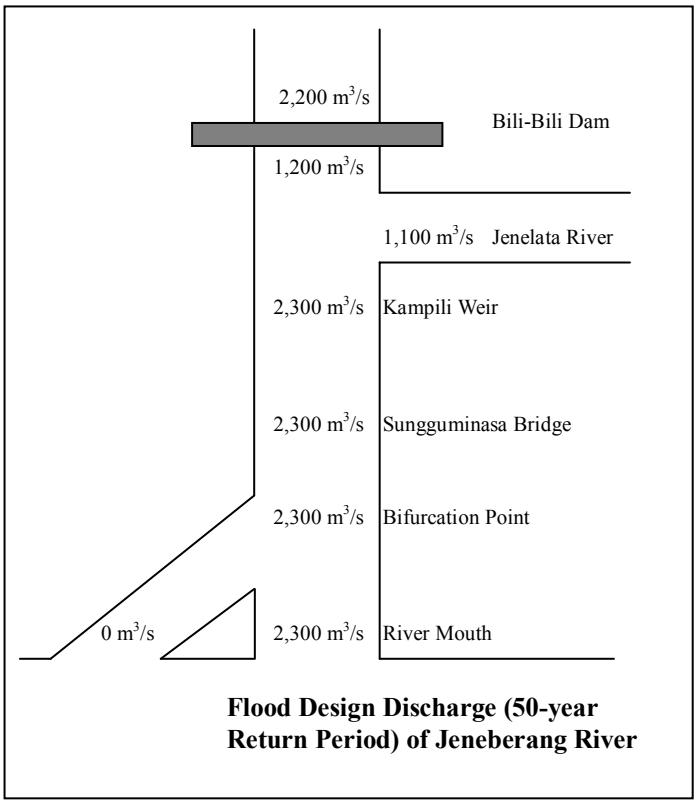
4.5 Bili-Bili Dam Gate Operation for Flood Control

4.5.1 Flood Control Structures of Bili-Bili Dam

The Bili-Bili dam reservoir has a flood control capacity of 41,000,000 m^3 between the Normal Water Level (NWL) of EL. 99.5 m and the Surcharge Water Level (SWL) of EL.101.60 m. The Dam is also equipped with the Free Flow Crest, the Regulating Gate and the Control Gate as the outlet structures to release the flood discharge from the dam reservoir.

It is, herein noted that the hydropower station for Bili-Bili dam is now under construction and scheduled to start its operation in September 2005. After commencement of the hydropower operation, the Guide Vane for hydropower generation will work as a substitute for the Control Gate to release the flood discharge. The aforesaid Free Flow Crest, the Regulating Gate and Control Gate are currently under control of JRBDP as the current dam operator, while the Guide Vane will be operated by PLN on the premises of the instruction of the dam operator for intake discharge to the hydropower station.

The flood control capacity together with the outlet structures has a function to control the design flood discharge of 50-year return period. The peak inflow of the design discharge to the dam reservoir is 2,200 m^3/s, while the peak outflow discharge could be regulated to 1,200 m^3/s by the dam flood control effect. The probable discharge of 50-year return period along the downstream channel would be further regulated to be within the present river channel flow capacity of 2,300 m^3/s.



Flood Design Discharge (50-year Return Period) of Jeneberang River

The principal features of the outlet structures are as enumerated below (refer to Figures 4.2 and 4.3):

- ***Free Flow Crest***: The non-gated spillway with its effective flow width of 70 m is placed on the dam crest of EL. 99.5 m (=NWL). The spillway starts to release the flood discharge, when the reservoir water reaches NWL and further releases the discharge of 430 m^3/s, when the reservoir water level rises to SWL.
- ***Regulating Gate***: Two units of roller gate are placed at the center of spillway. The gate has an effective flow width of 14m in total and an effective range of gate operation from

the fully lowered position at EL. 91.8 m (i.e., 7.7 m below NWL) up to the fully raised position EL. 104.0 m (i.e., 1.0 m above Design Flood Water Level). When the reservoir water level reaches NWL, the gate should be fully opened releasing the discharge of 600 m^3/s. The gate further releases the discharge of 770 m^3/s, when the reservoir water level rises to SWL.

- ***Control Gate***: A jet flow gate of 2 m in diameter is placed at the end of the outlet pipe. The Control Gate releases the maximum outflow discharge of 42.4 m^3/s, through its opening gate diameter of 1.13 m [3, when the reservoir water level is NWL. The maximum outflow discharge from the Control Gate is much smaller than the aforesaid maximum discharge by the Regulating Gate. The Control Gate is, however, far superior to the Regular Gate in the sensitive adjustment of small outflow discharge in a range of less than 50 m^3/s. Such sensitive adjustment of outflow discharge is required in order to minimize abrupt rise of the downstream water level at the beginning of a flood and/or adjust the reservoir water level at the designated level at the end of a flood.
- ***Guide Vane for Hydropower Generation***: As described above, after commencement of operation of the hydropower generation, two units of the Guide Vane installed to each of Turbine No. 1 and No.2 will work as a substitute for the Control Gate to release the flood discharge. The maximum discharge to be released through the Guide Vane is 44.8 m^3/s (13.2 m^3/s to Turbine 1 and 31.6 m^3/s to Turbine 2). The Guide Vane for Turbine No.1 could continue to intake the flood discharge until the reservoir water level reach Design Flood Water Level (DFWL) of EL.103 m, while the Guide Vane for Turbine No. 2 needs to be closed, before the reservoir water level reach EL 100.98 m (2 m below SWL) in order to prevent the Turbine from causing noise, and vibration.

4.5.2 Gate Operation Rule for Flood Control

(1) Reservoir Water Level to Start Preliminary Gate Operation

When the reservoir water level is just at NWL, the flood control gates are fully opened to release the maximum discharge of 642.4 m^3/s [4 in total. Accordingly, as long as the reservoir water level is at NWL and at the same time, the dam inflow discharge is less than the 642.4 m^3/s, the flood control gates should ideally release the discharge in equivalent to the inflow discharge so as to maintain the reservoir water level at NWL keeping a full of the flood control capacity above NWL, and the water stored below NWL for water supply. Such ideal gate operation is however, virtually difficult due to the following restrictions:

a) The dam inflow discharge could be estimated from changes of the gauged reservoir water levels and dam outflow discharges. However, the changes of reservoir water

[3] The full opening diameter of the Control Gate is 2 m, which could release 70 m^3/s, when the reservoir water level is NWL. Nevertheless, the flow capacity of the outlet channel below the Control Gate (called "Dissipater Basin) is limited to 42.4 m^3/s, which is in equivalent to the total net downstream water demand projected in 1997

[4] The Discharge of 642.4 m^3/s is divided into 600 m^3/s from the Regular Gate and 42.4 m^3/s from the Control Gate, After commencement of Hydropower Operation, however, the discharge could be raised up to 645 m^3/s (600 m^3/s from the Regular Gate and 45 m^3/s from Guide Vane at the hydropower station).

levels could be measured only with a one-centimeter interval by the telemetry water level gauging equipment installed at the dam reservoir. The difference of one-centimeter in reservoir water level corresponds to the difference of about 170,000 m^3 in reservoir storage volume, when the reservoir water level is between EL. 95 m and EL. 99.50 m. This difference of 170,000 m^3 in the reservoir storage volume further corresponds to a difference of about 280 m^3/s in the discharge provided that the difference of the storage volume occurs during duration of 10minutes. Due to such difference of the reservoir water level and the storage volume, the necessary outflow discharge estimated from the gauged reservoir water level must be underestimated and the reservoir water level tends to rise, when the actual inflow discharge tends to increase. On the other hand, the discharge would be overestimated, when the actual inflow discharge tends to decrease.

b) If the outflow discharge to be equal to the inflow discharge were unconditionally released, the sudden/excessive increase of outflow discharge would occur and cause abrupt rise of the downstream river water level exposing the river-oriented activities (such as sand mining and fishing) in and around the river channel to danger.

In order to offset the above underestimation/overestimation of the inflow discharge and to avoid the abrupt rise of the downstream water level, the preliminary dam outflow discharge needs to start, when the reservoir water reaches EL. 99.4 m, i.e., 0.1 m below NWL. This boundary water level of EL.99.4 m is defined as the "Gate Operation Starting Water Level" (hereinafter referred to as GOSWL). Moreover, depending on the reservoir water level, the different gate operation for flood control would be required as described below:

a) ***Non-flood Period***: When the reservoir water level is below GOSWL, the reservoir condition is in the "Non-flood Period". During this period, the Regulating Gate should be completely closed. The Guide Vane and/or the Control Gate should be also used only for hydropower generation and/or the downstream water supply but not for releasing of the flood discharge.

b) ***Pre-flood Period***: When the reservoir water level is between GOSWL and NWL and tends to rise, the reservoir condition is in the "Pre-flood Period". During this period, the gate structures should be gradually opened with the designated opening rate as described in the following clause (2).

c) ***Flood Period***: When the reservoir water level is above NWL, the reservoir condition is in the "Flood-period". During this period, all flood control gates should be fully opened, and the flood discharge is released through the flood control gates as well as the Free Flow Crest;

d) ***Post-flood Period***: When the reservoir water level is between GOSWL and NWL and tends to descend, the reservoir condition is in "Post-flood Period". During this period, the flood control gates should be gradually closed with the designated closing rate as described in the following clause (3).

(2) Incremental Rate of Dam Outflow Discharge during Pre-flood Period and Flood Period

The incremental rate of the dam outflow discharge during the aforesaid "Pre-flood Period" is determined on the premises of the following concepts:

- The outflow discharge from the dam reservoir during the aforesaid "Non-Flood Period" is less than 42.4 m^3/s (the maximum outflow discharge from the Control Gate)[5]. On the other hand, the dam outflow discharge would increase to 642.4 m^3/s [6]at the end of the "Pre-flood Period". Thus, the outflow discharge would need to increase from less than 42.4 m^3/s to 642.4 m^3/s during the reservoir water level rises from GOSWL of EL. 99.4 m to NWL of EL. 99.5 m.
- The above increment of the outflow discharge should not cause the rise of downstream river water level at a rate of 50 cm/30 minutes, when the time interval of one-centimeter rise of the reservoir water level is more than 10 minutes.
- In order to cope with the above requirement, the outflow discharge is to be increased every one-centimeter rise of the reservoir water level. At the same time, the outflow discharge is also to be increased every 10 minutes after one-centimeter rise of the reservoir water level, if the same reading of the reservoir water level continues more than 10 minutes.

Based on the above concepts, the following incremental rate of the dam outflow discharge during the Pre-flood Period and Flood Period should be made:

(a) Control Gate

The flow discharge of the downstream river channel in the earlier part of the Pre-flood Period is less than that in the latter part of the Pre-flood Period. Accordingly, the dam outflow discharge tends to cause more abrupt rise of river water level in the earlier part of the Pre-flood Period. Because of these river conditions, the sensitive adjustment of dam outflow discharge is required in the earlier part of Pre-flood Period, and the Control Gate is superior to the Regulating Gate in such sensitive adjustment.

Due to the above backgrounds, the Control Gate should firstly start to its flood control operation through the following procedures:

- When the reservoir water level rises to GOSWL, the Control Gate should start to open and continue to open at a rate of 0.17 m every one-centimeter rise of reservoir water level and/or every 10 minutes after one-centimeter rise of the reservoir water level regardless to the initial gate opening states, until the outflow discharge from the gate reaches its upper limit of 42.5 m^3/s (the gate-opening diameter 1.13m).

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[5] After commencement of hydropower operation, the discharge would increase to 45 m^3/s (the maximum discharge controlled by Guide Vane).

[6] After commencement of hydropower operation, the discharge would increase to 645 m^3/s (600 m^3/s from the Regular Gate the and 45 m^3/s from the Guide Vane).

- The Control Gate should continue to release the upper limit of the outflow discharge (i.e., 42.4 m^3/s), until the end of the Flood-period.

The summary of the gate opening states and the outflow discharge from the Control Gate is as shown in Table 4.1;

(b) Guide Vane

As described above, upon completion of the hydropower plant, the Guide Vane should be used as a substitute of the Control Gate. The operation procedures of Guide Vane are as described below:

- When the reservoir water level rises to GOSWL, the Guide Vane should start to open and continue to release the outflow discharge at the same incremental rates of outflow discharge as those for the Control Gate, until its inflow discharge reaches the upper limit of 44.8 m^3/s.
- The Guide Vane should continue to release the upper limit of the discharge (i.e., 44.8 $m^{3/}$s) until the reservoir water level reaches EL. 100.98 m, which is the highest reservoir water level applicable to the hydropower generation both for Turbine No1 and No.2.
- When the reservoir water level exceeds EL.100.48 m, however, the Guide Vane for Turbine No.2 should be closed, whereby the inlet discharge to the hydropower plant is reduced to 13.2 m^3/s.

The summary of the gate opening states and the outflow discharge from the gate is as shown in Table 4.2.

(c) Regular Gate

After the reservoir water level rises to EL. 99.43 m, the Regular Gate should be gradually opened to release the discharge with the following rate. The Gate should fully opened releasing the discharge of 600 m^3/s, when the reservoir water level reaches NWL (refer to Tables 4.1 and 4.2).

Gate Opening Rate of Regular Gate during Pre-Flood Period

Reservoir Water Level (RWL)	Gate Opening Rate/Step	Incremental Rate of Outflow Discharge
EL. 99.41 <RWL <. 99.42 m	-	-
EL. 99.43 <RWL <. 99.44 m	0.2 m	20 to 25 m^3/s
EL. 99.45 <RWL <. 99.46 m	0.3 m	25 to 30 m^3/s
EL. 99.47 <RWL <. 99.48 m	0.4 m	30 to 40 m^3/s
EL. 99.49 <RWL <. 99.50 m	0.6 m	40 to 80 m^3/s

(3) Reduction Rate of Dam Outflow Discharge during Post-Flood Period

The reduction rate of the dam outflow discharge during the aforesaid "Post-flood Period" is determined on the premises of the following concepts:

- The outflow discharge would need to decrease from 642.4 m^3/s to less than 42.4 m^3/s to during the reservoir water level descends from NWL to GOSWL.
- In order to adjust the reservoir water level to be at GOSWL at the end of the Post-flood, the outflow discharge is to be reduced every one-centimeter descent of the reservoir water level. At the same time, the outflow discharge is also to be reduced every 10 minutes after one-centimeter descent of the reservoir water level, if the same reading of the reservoir water level continues more than 10 minutes.

Based on the above concepts, the following reduction rate of the dam outflow discharge during the Pre-flood Period and Flood Period is decided:

(a) Control Gate

The outflow discharge from the Control Gate should be gradually reduced through the following procedures:

- The Control Gate should continue to release the upper limit of the outflow discharge (i.e., 42.4 m^3/s), until the reservoir water level drops to EL. 99.43 m.
- After the reservoir water level is below EL. 99.43 m, the Control Gate should be gradually closed at a rate of 0.17 m every one-centimeter rise of reservoir water level and/or every 10 minutes after one-centimeter rise of the reservoir water level regardless to the initial gate opening states, until the reservoir water level drops to GOSWL.

The summary of the gate opening states and the outflow discharge from the gate is as shown in Table 4.3.

(b) Guide Vane

Upon completion of the hydropower plant, the Guide Vane should be used as a substitute of the Control Gate. The operation procedures of Guide Vane are as described below:

- The Guide Vane should continue to release the upper limit of the outflow discharge (i.e., 44.8 m^3/s), until the reservoir water level drops to EL. 99.43 m.
- After the reservoir water level is below EL. 99.43 m, the Guide Vane should be gradually closed at the same reduction rates as those for the Control Gate, until the reservoir water level drops to GOSWL.

The summary of the gate opening states and the outflow discharge from the gate is as in Table 4.4:

(c) Regulating Gate

The Regular Gate should be gradually closed with the following rate until the reservoir water level drops to EL. 99.43 m (refer to Table 4.3 and 4.4):

Gate Opening Rate of Regular Gate during Pre-Flood Period

Reservoir Water Level (RWL)	Gate Opening Rate/Step	Incremental Rate of Outflow Discharge
EL. 99.49 ≦RWL < 99.50 m	0.6 m	40 to 80 m^3/s
EL. 99.47 ≦RWL < 99.49 m	0.4 m	30 to 40 m^3/s
EL. 99.45 ≦RWL < 99.47 m	0.3 m	25 to 30 m^3/s
EL. 99.43 ≦RWL < 99.45 m	0.2 m	20 to 25 m^3/s
EL. 99.40 ≦RWL < 99.43 m	-	-

4.5.3 Activities to be taken during Pre-flood Period, Flood Period and Post-flood Period

The activities to be taken during the aforesaid pre-flood, flood period and post-flood period are as described hereinafter:

(1) Pre-flood Period

- To assign a flood operation team composed of the head of dam-sub division, two gate operators, a computer engineer and a telecommunication engineer at the Dam Control Center for monitoring and gate operation for flood control.
- To assign a flood inspection/warning team composed of six field inspectors/warning crews;
- To monitor the telemetry gauging data at the Dam Control Center;
- To execute the remote gate operation in accordance with the procedures described in the above subsection 4.5.2-(2);
- To disseminate the dam discharge warning, whenever such possibility is recognized in the course of the gate operation as any damage by the rapid increase of the river water level would occur to the downstream target area due to the dam outflow discharge;
- To control communication on the radiotelephone system, which connects patrol cars and movable radio, telephones with the Bili-Bili Dam Office;
- To record the flood operation; and

- To require other activities for effective flood operation.

(2) Flood Period

- To monitor the telemetry gauging data at the Dam Control Center;
- To execute Free Flow Operation in accordance with the procedures described in the above subsection 4.5.2-(2);
- To announce the flood period and to notify thereon the Monitoring Center;
- To record the flood operation; and
- To require other activities for effective flood operation.

(3) Post-flood Period

- To monitor the telemetry gauging data at the Dam Control Center;
- To execute the remote gate operation in accordance with the procedures described in the above subsection 4.5.2-(3);
- To control communication on the radiotelephone system which connects the patrol cars with the dam control offices;
- To release the flood period, and to notify thereon the Monitoring Center;
- To record the flood operation;
- To require other activities for effective flood operation; and
- To announce the end of flood operation when the reservoir water level is less the Regulating Gate Operation Water level.

4.5.4 Monitoring, Warning and Adjustment of Dam Outflow Discharge

In spite of the gradual opening of the Regulating Gate and the Control Gate, there still remain possibilities of abrupt rise of downstream water level over the allowable limit of 50 cm/30 minutes due to excessive incremental rate of the dam inflow discharge. Accordingly, monitoring on the rise of downstream water level is required, and in case of such abrupt rise of the downstream of water level, warning should be made to the residents.

It is, however, allowed to increase the dam discharge at a rate exceeding the Allowable Increasing Rate of Dam Discharge but within the increase rate in the inflow when the inflow increases rapidly and such increase in the dam discharge is considered requisite and unavoidable to secure dam safety.

Whenever the dam discharge through the Control Gate and/or the Regulating Gate(s) is commenced or increased in such high rate as would cause some damages to the downstream reaches, the dam discharge warning shall be made in accordance with the procedures as described in the following items (1) and (2).

(1) Monitoring of Dam Outflow Discharge

Throughout the period when the discharging is being made, the head of dam sub-division shall monitor the water level at the Kampili, the Maccini Sombala and the Bayang water level gauge stations on the Jeneberang River in order to check the rising speed of the river water level in the downstream target area.

When it is considered necessary during the discharging by the Reservoir Water level Lowering Operation to stop or decrease the discharge due to the damage to the downstream reaches or other unavoidable reasons, the Head of Dam-sub division may adjust the discharging regardless of the discharging plan.

When it is considered suitable and necessary to resume the discharging after the above suspension, the head of dam-sub division shall newly issue the dam discharge warning and restart the discharging for the Reservoir Water level Lowering Operation after modifying the discharging plan.

(2) Warning and Dissemination on Dam Outflow Discharge

(a) Notice on Discharging by the Reservoir Water level Lowering Operation

Preceding the commencement of the discharging, a notice on the discharging by the Reservoir Water level Lowering Operation shall be given to the related agencies. Whenever the flood period is announced or released, the head of dam sub-division shall notify promptly thereon the Monitoring Center.

(b) Notice on Reservoir Water Lowering Operation

When it is instructed to carry out the Reservoir Water Lowering Operation, the head of dam sub-division shall notify promptly thereon the Monitoring Center. After the completion of the Reservoir Water Lowering Operation, he shall also notify thereon the same Center.

(c) Warning

The warning to the public in the target area on rapid increase in the dam discharges (hereinafter referred to as the dam discharge warning) shall be issued and disseminated whenever such possibility is recognized in the course of the dam discharging as any damage would occur to the downstream target area in relation to the rapid increase of the river water level due to the dam discharge.

(d) Dissemination of Dam Discharge Warning to the Public

Dissemination of the dam discharge warning shall be made to the public in the target area along the Jeneberang River from the Dam to the river mouse. The dam discharge warning

shall be disseminated by sounding of the siren and announcing of warning messages through the use of loudspeakers in accordance with the procedure prescribed hereunder:

- The siren installed in the Bili-Bili Dam Office shall be sounded for about five minutes preceding the commencement of the dam discharge by about thirty minutes;
- The warning sound and message shall be announced twice as shown in Figure 4.4 through use of the sire and loudspeaker installed at the Warning Stations preceding by about thirty minutes the expected arrival time of the dam discharge; and
- The warning message shall also be announced using the loudspeakers installed in the patrol cars to the public in those areas not covered by the warning in the above target area preceding the expected arrival time of the dam discharge at their respective places at least by about thirty minutes.

4.6 Bili-Bili Dam Gate Operation for Water Supply

4.6.1 Water Supply Facilities

The Bili-Bili dam reservoir has a supply capacity of 305,000,000 m^3 between the Low Water Level (LWL) of EL. 65.0 m and the Normal Water Level (NWL) of EL. 99.5 m. The Dam is also equipped with the Control Gate, which functions, as the dam outlet, to control the necessary discharge to be released from the reservoir to fulfill the downstream water demand. As described above, however, the Guide Vane for hydropower plant will take over the function of the Control Gate upon completion of the hydropower plant in September 2005.

The Control Gate is currently under control of JRBDP, while the Guide Vane will be operated by PLN on the premises of the instruction of JRBDP on intake discharge to the hydropower station.

The reservoir water firstly flows into the intake structure, passes the outlet pipe, and finally flows out through the Control Gate and/or the Guide Vane. The principal functions of these outlets and their relevant structures are as described below:

(1) Intake Pipe and Outlet Pipe

The intake structure is the 45 degree inclined concrete pipe placed on the dam abutment and connected to the outlet pipe of the steel conduit. The intake structure and the outlet pipe have the design discharge 44.8 m^3/s for the reservoir water level of LWL.

(2) Control Gate, Dissipater Basin and Diversion Work

As described above, a jet flow gate of 2 m in diameter is placed at the end of the outlet pipe to control the discharge for water supply to the downstream water demand. There are further the following Dissipater Basin and the Diversion Work just downstream of the Control Gate:

- Dissipater Basin, which is a channel of 4m in width, 5.2 m to 9.8 m in depth and 74.1 m in length, aims at dissipating the outflow from the Control Gate so as to reduce the flow velocity and minimize the scoring and erosion on the downstream diversion works and riverbed.
- Diversion Work is a channel of 17 m in width, 5.5 m in depth and 53 m in length together with the fixed weir at the downstream end. The diversion works aim at dividing the water into two ways: (a) to an overflow weir for the downstream water uses and river maintenance flow, and (b) to a conduit of the Raw Water Transmission Main.

The Control Gate releases the maximum outflow discharge of 42.4 m^3/s through its fully gate-opening of 2.0 m in diameter, when the reservoir water level is LWL. Thus, the design discharge of the Control Gate as well as the Dissipater Basin is set at 42.4 m^3/s, while the design discharge of the Diversion Works is set at 44.8 m^3/s, which is equal to that of the aforesaid intake pipe and the outlet pipe. The design discharge for the Control Gate and the Dissipater Basin is derived from the maximum downstream water demand, while the design discharge for the inlet work, the outlet pipe and the Diversion Basin is set as the optimum inflow discharge for hydropower generation. It is herein noted that the water demand, which corresponds to the design discharge of the Control gate and the Dissipater Basin was projected during those days for the detailed design of the Bili-Bili dam in 1988. On the other hand, the updated downstream water demand is limited to 39.45 m^3/s as listed below, and therefore, the design discharge of the Control Gate still keeps the vacant space against the updated water demand.

Monthly Water Demand to be fulfilled by Supply from Bili-Bili Dam

(Unit: m^3/s)

Month	Irrigation* Water	Use of PDAM	Private Factory Use	River Maintenance	Total
Jan.	34.18	1.66	0.50	1.00	37.34
Feb.	33.08	1.66	0.50	1.00	36.24
Mar.	27.57	1.66	0.50	1.00	30.73
Apr.	28.56	1.66	0.50	1.00	31.72
May	35.79	2.16	0.50	1.00	**39.45**
Jun.	32.78	2.16	0.50	1.00	36.44
Jul.	27.74	2.16	0.50	1.00	31.40
Aug.	13.64	2.16	0.50	1.00	17.30
Sep.	7.59	2.16	0.50	1.00	11.25
Oct.	6.44	2.16	0.50	1.00	10.10
Nov.	3.92	1.66	0.50	1.00	7.08
Dec.	16.89	1.66	0.50	1.00	20.05

Note *: The irrigation water demand is expressed as the necessary discharge to be diverted from Jeneberang River to fulfill the crop water requirement on the premises of the no effective rainfall.

(2) Guide Vane for Hydroelectric Power Plant

After completion of the Hydroelectric Power Plant, the outlet pipe branches off to the penstock connected to the turbine of the power plant. However, the water, which flows into the turbine, returns to the Diversion Work so as to fulfill the downstream water demand. Thus, the hydropower generation at Bili-Bili dam is completely dependent on the water to be release for

the sake of supply to the downstream water demand and or/the floodwater spilled from the dam reservoir.

The hydropower plant is to have the two turbines (Turbine No.1 and No.2). The maximum discharge and the upper/lower limit in head for these two turbines designed as listed below:

Maximum Discharge and Design Head of Hydropower Plant

Turbine	Maximum Discharge	Upper Limit of Head for Power Generation (Reservoir Water Level)	Lower Limit of Head for Power Generation (Reservoir Water Level)
Turbine No.1	13.2 m^3/s	EL. 103.00 m	EL. 72.00 m
Turbine No.2	31.6 m^3/s	EL. 100.98 m	EL. 72.00 m
Total	44.8 m^3/s		

As listed above, Turbine No.1 has the upper limit of the head at EL. 103.0 m, while Turbine No.2 EL. 100.98 m. Accordingly, the Guide Vane for Turbine No.1 could continue to intake the discharge until the reservoir water level reach Design Flood Water Level (DFWL) of EL. 103 m, while the Guide Vane for Turbine No. 2 needs to be closed, before the reservoir water level reach EL 100.98 m (2 m below SWL).

The lowest limit of the head both of the turbines is designed at EL. 72.0 m taking the turbine efficiency into account. Accordingly, when the reservoir water level drops below EL. 72.0 m, the Control Gate, instead of the Guide Vane, has to be used for control of the discharge for water supply.

4.6.2 Gate Operation for Water Supply

The water supply to the various downstream water requirements from the Bili-Bili dam reservoir should be made in the following process. However this process should be taken only normal gate operation period except the following two particular cases: (a) the periods of the gate operation for flood control as described in the foregoing subsection 4.5, and (b) the drought management as described in the later subsection 11.4.

(1) Determination on Water Supply to Raw Water Transmission Main (RWTM)

The water supply to the Raw Water Transmission Main from Bili-Bili dam reservoir should be 1.31 (= the updated actual water treatment capacity of 1.19 m^3/s + conveyance loss of 0.12 m^3/s), unless any particular requirement is given from PDAM as the administrator of the treatment plant.

(2) Determination on Water Supply to Bili-Bili, Bissua and Kampili Irrigation Scheme

The maximum water supply to the Irrigation area (23,663 ha) from the dam reservoir should be within a limit of 29.67 m^3/s as allocated in subsection 11.2, and the day-to-day water

requirement should be determined by the administrator of the Bili-Bili Irrigation[7] taking the irrigation schedule as well as the effective rainfall in the irrigation area. The necessary water supply thus determined should be informed to the Public Corporation as the operator of Bili-Bili dam reservoir every week.

(3) Determination on Water Supply to the Downstream Water Use other than the above Items (1) and (2)

There are several water requirements other than the above items (1) and (2) to be fulfilled by supply from Bili-Bili Dam as enumerated below:

- Municipal water to five PDAM intakes located along the downstream of Jeneberang Rive: The supply volume should be limited to 2.16 m^3/s during a dry season from June to November and 1.66 m^3/s during a wet season, unless PDAM inform a particular request to the Public Corporation;
- Industrial water to Takalar Sugar Factory: The supply volume should be limited to 0.5 m^3/s throughout a year, unless the water user informs a particular request to the dam reservoir operator (i.e., Public Corporation);
- River maintenance flow: The minimum river flow discharge of 1.0 m^3/s should be maintained downstream of Kampili weir as the river maintenance flow.

(4) Selection of Outlet Facilities

The Public Corporation as the operator of Bili-Bili Dam should add up the total water requirement and determine the necessary discharge to be drawn off from the dam reservoir for the total water requirement taking the natural flow discharge of Jenelata River into account. Then, the Public Corporation should draw off the discharge through either the following two alternative outlet facilities:

- If the discharge to be drawn off from the dam reservoir is more than 3 m^3/s, which could be regarded as the minimum available discharge to activate the hydropower generation[8], the Public Corporation should inform the discharge to PLN as the operator of hydroelectric power plant to draw off it through the hydropower plant.
- If the discharge to be drawn off from the dam reservoir is less than 3 m^3/s, the Public Operation should draw off it through the Control Gate.

[7] The UPTD Balai PSDA Jeneberang River Region or Dinas PSDA is most likely to be the representative users of the irrigation water.

[8] The minimum discharge to activate the turbine for hydropower generation is determined yet but provisionally assumed at 3 m^3/s. The discharge should be determined by the PLN through consultation with JRBDP as the current dam operator.

Chapter 5

Technical Guideline on Operation and Maintenance of Rubber Dam

5.1 Structural Features

Mean spring high tide at the river mouth of Jeneberang River is at EL. 0.56m, which is almost same as the riverbed level of Jeneberang River at Sungguminasa Bridge located about 9.6km upstream from the river mouth. Accordingly, the salinity water could intrude up to the Sungguminasa Bridge, when the river flow discharge falls to be nil. The following relationship between the extent of the salinity intrusion and the river flow discharge was further clarified in the "Detailed Design and Construction Supervision of Rubber Dam Construction Works for Jeneberang Raw Water Supply Project in the Bili-Bili Multipurpose Dam Project, 1997":

Possible Extent of Salinity Intrusion on Jeneberang River

Flow Discharge (m^3/s)	Extent of Salinity Intrusion from River Mouth (km)
40	3.78
50	3.65
80	3.01
100	2.75
120	2.43
150	2.08
180	1.75
200	1.55
300	0.77

Source: Operation and Maintenance Manual, Detailed Design and Construction Supervision of Rubber Dam Construction Works for Jeneberang Raw Water Supply Project in the Bili-Bili Multipurpose Dam Project, 1997

There exist four water intakes owned by PDAM Makassar for municipal water supply within the extent of possible salinity water intrusion above the existing Rubber Dam located 3.65km upstream from the river mouth. As estimated above, the river flow discharge of more than $50m^3/s$ is required to push back the salinity water intrusion below the site of Rubber Dam. During a dry season from the beginning of July to November, however, the river flow discharge seldom exceeds over $50m^3/s$. Accordingly, the Rubber Dam currently plays a crucial role to prevent the salinity water from intruding to the existing intake points.

The principal structural features of Rubber Dam are as enumerated below (refer to Figure 5.1):

(1) Rubber Gate

- Gate Type : Inflatable rubber-made dam
- Width of Dam : 210 m
- Gate Sharing : Five Spans, which are composed of the following Dam Numbering stating from the right ban side
  Sub-gate No. 1 of 9.5 m in width

Main-gate No. 2 of 59 m in width
Main-gate No. 3 of 59 m in width
Main-gate No. 4 of 59 m in width
sub-gate No. 5 of 9.5 m m in width

- Gate Crest Level : EL. 1.8 m (2 m above the bottom slabs).

(2) Control Device for Rubber Gate

- Water level gauge : One unit of electrode type water level gauging sensor
- Control panel : Five units (one each for five gates of No.1 to No.5)
- Blower : Five units (one each for five gates of No.1 to No.5)
- Valve : Five groups of the following valves (one each for five gates of No.1 to No.5):
  - Deflation valve
  - Deflation time adjust valve
  - Inspection valve
  - Pressure relief valves
- Pipe : Five groups of the following pipes (one each for five gates of No.1 to No.5):
  - Water intake pipe
  - Pressure sensing pipe
  - Air supply/exhaust pipe

(3) Foundation

- Main Body : RC slab with top elevation of EL.-0.20 m, width of 10 m, and length of 221 m.
- Downstream Apron : RC slab with top elevation of EL.-0.20 m, width of 12 m, and length of 221 m.
- Upstream Apron : RC slab with top elevation of EL.-0.20 m, width of 5 m, and length of 221 m.

5.2 Inspection

The principal items for inspection are as enumerated below:

(1) Rubber Gate

- Water in rubber body;
- Clogging of water screen;
- Looseness or missing of the bolts and nuts of the control devices;
- Cut or abrasion at the nylon-reinforced fabric of Rubber;
- Deformation of anchor bolts/nuts of the dam body; and
- Damage on function of pipes and safety valves for the control devices.

(2) Control Device for Rubber Gate

- Slackness of V-belt of motor;
- Abrasion of the blowers;
- Trouble on the radio communication system;
- Leakage of electrical equipment; and
- Trouble on power changer between PLN Line and Generator.

(3) Foundation

- Accumulation of garbage, trees and any other drifting materials;
- Cracks, degradation and discoloration;
- Scoring at revetment or the riverbed protection; and
- Leakage from the joints between slabs

5.3 Maintenance

The principal items for maintenance are as enumerated below:

(1) Rubber Gate

- Occasional opening of the exhaust valve to drain water during a dry season;
- Cleaning of water screen;
- Tightening and replacement of bolts and nuts;
- Repair of damage (i.e., cut or abrasion) at the nylon-reinforced fabric of rubber in accordance with the manufacture's instruction manual; and
- Repair of damage on function of pressure gauge and safety by the manufacture.

(2) Control Device for Rubber Gate

- Tightening of V-belt of motor in accordance with manufacture's manual;
- Greasing;
- Repair for trouble on the radio communication system (to be undertaken by the manufacture); and
- Repair for trouble on power changer between PLN line and generator (to be undertaken by the manufacture).

(3) Foundation

- Removal of garbage, trees and any other drifting materials;
- Rehabilitation or reconstruction for cracks, degradation and discoloration of concrete structure;
- Slope and foot protection works for scoring portion at the side revetment and/or riverbed; and
- Filling leakage portion at the joints with the high quality concrete or other proper materials.

5.4 Operation

The rubber gates of the Dam should be inflated during a period of low flow regime of Jeneberang River in order to prevent the salinity water from intruding into the upstream stretch. On the other hand, the gates should be deflated during a period of high flow regime so as not to hinder the river flow discharge.

(1) Inflating of Rubber Dam

Rubber Dam is equipped with the water level gauging sensor to automatically monitor the overflow depth above the rubber gate crest level. When the overflow depth reaches 0.3 m, the warning siren at the control office of Rubber Dam automatically goes off. Moreover, when the overflow depth reaches 0.4 m, the blowers are automatically activated to start deflating of the rubber gates. This critical overflow depth of 0.4m corresponds to the river water level of EL. 2.2 m or the dam overflow of 74 m^3/s. The rubber gates are deflated in the following orders:

- 1st : Gate No.3 at overflow depth of 0.40 m or river water level of EL. 2.20 m.
- 2nd : Gate No.2 and No.4 at overflow depth of 0.45 m or river water level of EL. 2.25 m*.
- 3rd : Gate No.1 and No.2 at overflow depth of 0.50 m or river water level of EL. 2.25 m.

(*: If the overflow depth of the rubber dam does not reach 0.45 m within 30 minutes after Gate No.3 is deflated, Gate No. 2 and No.4 should be manually deflated in order to prevent river flow discharge from concentrating to gate No.3, which could cause local scoring of the downstream riverbed).

(2) Deflating of Rubber Gate

When the river discharge flowing to Rubber Dam falls below 50 m^3/s, the rubber gates are to be inflated through manual operation of the blowers. The critical river discharge of 50 m^3/s is judged based on the overflow depth of 0.3 m above the crown level of the groundsill, which is located 2.32 km upstream from Rubber Dam. Measurement of the overflow depth above crown of the groundsill needs to be made by manual reading on the staff gauges.

This inflating operation should be made during a period of low tide when the extent of salinity intrusion from the river mouth upward is minimized. Order of inflating of the gates should be as below:

- 1st : Sub-gate No.1 and No.2
- 2nd : Main-gate No.2
- 3rd : Main-gate No 4 and
- 4th : Sub-gate No.3

Chapter 6

Technical Guideline on Operation and Maintenance of Long Storage

6.1 Structural Features

Long Storage is equipped with one inlet and two outlet gates, namely: (a) Intake Gate to inlet the water from Jeneberang River into Long Storage, (b) Flush Gate to release the discharge from Long Storage into the urban drainage channels in Makassar City and (c) Outlet Sluice Gate (Tidal Gate) to release the water stored in Long Storage into the sea. The principal features of these structures are as enumerated below:

(1) Long Storage Channel

- Channel Length & Width : 5,260 m long x 150 m in average.
- Lowest Water Level : EL.1.0 m
- Normal High Water Level : EL.1.8 m
- Dike Crown Level : EL. 2.5 m
- Effective Water Depth : EL. 1.2 m
- Effective Storage Volume : 1,600,000 m^3
- Revetment : 4,900 m long

(2) Intake Sluice Gate and Culvert (from Jeneberang River to Long Storage)

- Invert Level : EL. 0.20 m
- Gate : Steel slide gate with electric drive actuator (2.0 m wide x 2.0 m high x 2 units x 2 sides)
- Culvert : Box Culvert (2 m wide x 2 m high x 2 cells)

(3) Outlet Sluice Gate (from Long Storage to Sea)

- Invert Level : EL. –1.5 m
- Gate : Steel slide gate with electric drive actuator (2.0 m wide x 2.0 m high x 2 units)

(4) Flush Gate (from Long Storage to Urban Drainage Channel in Makassar City)

- Invert Level : EL. 0.2 m
- Gate : Manually operated steel slide gate (1.0 m wide x 1.6 m high x 2 units)

6.2 Inspection

The principal items for inspection are as enumerated below:

(1) Long Storage and its Surroundings

- Growth of on-land weeds around Long Storage;
- Growth of water hyacinth over water surface of Long Storage; and
- Cracks, detachment and other damages of revetment of Long Storage.

(2) Intake Sluice, Outlet Sluice and Flush Gate for Long Storage

- Rust and detachment of paint;
- Garbage, sediment and other drifting materials at gate and sluice way;
- Loosing or missing of bolts and nuts;
- Leakage of gate guide and sill portion;
- Cracks of concrete structure portion;
- Deformation of gate leaf, hoist and gate frame; and
- Availability of power supply for Intake and Outlet Sluice Gate.

6.3 Maintenance

The principal items for maintenance are as enumerated below:

(1) Long Storage

- Removal of weeds and garbage around Long Storage;
- Removal of water hyacinth over water surface of Long Storage; and
- Repair of cracks, detachment and other damages of revetment of Long Storage.

(2) Intake Sluice, Outlet Sluice and Flush Gate for Long Storage

- Lubrication, greasing and painting of gate and other metal portions;
- Removal of garbage, sand, gravel, and other drifting materials accumulated in the culvert;
- Tightening or replacement of bolts and nuts;
- Filling of the cracks and the part of leakage with high quality concrete or other proper materials;
- Repair or replacement of the conduit;
- Replacement and/or reconstruction of the gate leafs, gate hoist or other mechanical portion based on the detailed investigation and design; and
- Repair of power supply source.

6.4 Operation

As listed above, Long Storage is equipped with the three inlet and outlet gates, namely: (a) Intake Gate to inlet the water from Jeneberang River into Long Storage, (b) Flush Gate to release the discharge from Long Storage into the urban drainage channels in Makassar City and (c) Outlet Sluice Gate (Tidal Gate) to release the water stored in Long Storage into the sea. Succeeding to Long Storage. The operation procedures of these inlet and outlet gates are as described hereinafter.

(1) Operation of Inlet and Outlet Sluice Gate

Operation of the Inlet and Outlet Sluice Gate for Long Storage should be synchronized with the aforesaid operation of Rubber Dam as described below:

(a) Operation during Inflating of Rubber Dam

During a period of inflating of Rubber Dam (i.e., a period when the flow, discharge of Jeneberang River is less than 50 m^3/s), the intake sluice should continue to be opened, while the Outlet Sluice is closed, so as to maintain the water level of Long Storage o be the NWL at EL. 1.8 m, which is indispensable to promise sustainable abstraction of water of 200 liter/s from Long Storage to PDAM Maccini Sombala Water Treatment Plant. This Normal High Water Level is further useful to possess the water head for the under-mentioned Flush Gate to release the diluting discharge into the existing drainage channels, namely: Jongaya, Panampu and Sinrijala Drainage Channels.

(b) Operation during Deflating of Rubber Dam

During a period of deflating of Rubber Dam (i.e., a period when the flow, discharge of Jeneberang River is more than 74 m^3/s), the inlet and outlet sluice gates for Long Storage should be operated according to water level of Jeneberang River as below:

- If the water level of Long Storage is higher than the specified LWL of EL. 1.0 m, the inlet gate should continue to be closed. At the same time, the outlet sluice gate should be opened, as required to keep the water level of Long Storage to be below the specified SWL of EL. 2.2 m.
- If the water level of the Long Storage is lower than the specified LWL of EL. 1.0 m, the Inlet Gate should be opened until the water level goes up to the LWL.

(2) Operation of Flush Gate

A channel branches off from the right bank of Long Storage about 600 m upstream from the intake sluice gate and joins to Hartaco Drainage Channel, which is further connected to Jongaya Drainage Channel (refer to Figure 6.1). The flush gate is place at the inlet point to Hartaco Channel.

As described above, operation of the flush gate aims at releasing the water stored in Long Storage into Jongaya Drainage Channel and further Panampu and Sinrijala Drainage Channels so as to dilute the water stagnant in the drainage channels. In order to maximize this diluting effect, the flush gate should be operated in the following manners:

(a) Water Level of Long Storage to Allow Gate Opening of Flush Gate

The flush gate could be opened, provided that the water level of Long Storage is above LWL (EL.1.0 m).

(b) Frequency of Gate Opening

The flush gate should be opened once every day during a dry season and at any time during a rainy season, as long as the water level of the Long Storage is above LWL (EL.1.0 m). Nevertheless, the frequency of gate opening during a dry season should be increased or could be reduced depending of conditions of water and garbage stagnant in the drainage channel.

(c) Discharge to be released from Flush Gate

The water from the flush gate firstly enters into Hartaco Channel before following into Jongaya Drainage Channel and further Panampu and Sinrijala Drainage Channels. The channel flow capacity of Hartaco Channel is estimated at about 2.0 m^3/s, which is far smaller than the flow capacity of Jongaya, Panampu and Sinrijala Drainage Channel. Accordingly, the maximum discharge to be released from the flush gate should be below the channel flow capacity of Hartaco Channel. The gate opening heights of flush gate to release the discharge of 2 m^3/s would vary depending on the water heads of Long Storage and Hartaco Channel as listed below:

Gate Opening Height of Flush Gate

Water Head (m)	Opening Height (m)
2.3	2.3
1.8	1.8
1.3	1.3
0.8	0.8
0.3	0.3

(d) Duration of Opening of Flush Gate

The duration of one sequence of gate opening is preliminarily proposed at about six hours, whereby the water volume of 43,200 m^3 is released into the drainage channel. Nevertheless, the duration should be increased or could be reduced depending of conditions of water and garbage stagnant in the drainage channel.

(3) Operation of Flow Control Gates in Drainage Channels

There are three flow control gates crossing Jongaya, Panampu and Sinrijala Drainage Channels (refer to Figure 6.1). All of these gates are roller gates lifted by manpower. These gates are useful to effect the diluting of drainage channels, and there operation should be synchronized with operation of the above flush gate. The process of gate operation is as below:

- Before commencement of releasing water from flush gate, the gates of Jongaya, and Sinrijala should be closed, while the gate of Panampu should be fully opened. As the results, the water released from the flush gate could concentrate to dilute Panampu Drainage Channel.
- After Panampu Drainage Channel is diluted, the gate of Panampu should be closed and the gate Sinrijala be opened instead so as to concentrate the water from the flush gate into Sinrijala Drainage Channel.
- After Sinrijala Drainage Channel is diluted, the gate of Sinrijala should be closed and the gate of Jongaya be opened instead so as to concentrate the water from the flush gate into Jongaya Drainage Channel.
- Inspection team should be distributed to each of the three drainage channels in order to monitor diluting effects throughout the above three steps of gate operations. The release from the flush gate should continue until the improvement of drainage channel is justified by the inspection teams. In this connection, the aforesaid standard duration of opening of flush gate should be increased or could be decreased based on the judgment of the inspection team.
- After completion of diluting of all drainage channels, their control gates should be fully opened and relocked.

Chapter 7

Technical Guideline on Operation and Maintenance of Irrigation Intake Weirs

7.1 Structural Features

The following three irrigation intake weirs were completed October 2004: (a) Bili-Bili Weir placed just downstream of Bili-Bili Dam, (b) Bissua Weir 7km downstream of Bili-Bili Dam, and (c) Kampili Weir 11km downstream of Bili-Bili Dam. Each of the weirs consists of fixed weir, scoring sluice gates and intake gate together with the flow measuring devices. Bissua and Kampili Weir are further provided with the sediment trap basin just downstream of the intake gate in order to minimize the sediment inflow into the irrigation canal. The salient features of these intake facilities are as enumerated below (refer to Figures 7.1 to 7.3):

(1) Bili-Bili Weir

- Maximum Intake Discharge : 3.90 m^3/s
- Irrigation Area : 2,360ha
- Fixed Weir : Dam up height of 1.7 m
  Crest Length of 66 m
- Scoring Sluice Gate : 1.4 m wide x 2.5 m high x 2 units (Fixed roller gate with electric drive actuator)
- Intake gate : 2.5 m wide x 1.2 m high x 2 units (Fixed roller gate with electric drive actuator)

(2) Bissua Weir

- Maximum Intake Discharge : 21.5 m^3/s
- Irrigation Area : 10,785 ha
- Fixed Weir : Dam up height of 8.2 m
  Crest Length of 223.2 m
- Scoring Sluice Gate : 2.5 m wide x 4.3 m high x 4 units (Fixed roller gate with electric drive actuator)
- Intake gate : 3.0 m wide x 1.9 m high x 4 units (Fixed roller gate with electric drive actuator)
- Sediment Trap Basin : 5.85 m wide x 4 lanes x 120 m long
  Settling capacity of 3,900 m^3
  Sediment flush gate of 2.6 m wide x 1.86 m high x 4 gate (Fixed roller gate with electric drive actuator)
  Overflow spillway of 40 m

- Diversion Gate : <u>To Bissua Primary Canal:</u>
  1.8 m wide x 2.0 m high x 3 units (Fixed roller gate with manual actuator)
  <u>To Mattoagin Primary Canal:</u>
  2.35 m wide x 2.0 m high x 2 units (Fixed roller gate with manual actuator)

(3) Kampili Weir

- Maximum Intake Discharge : 17.40 m^3/s
- Irrigation Area : 10,545 ha
- Fixed Weir : Dam up height of 2.0 m
  Crest Length of 117 m
- Scoring Sluice Gate : 3.0 m wide x 3.5 m high x 2 units (Steel slide gate with electric drive actuator)
- Intake Gate : 2.05 m wide x 3.5 m high x 2 units (Steel slide gate with electric drive actuator)
- Sediment Trap Basin : 7.5 m wide x 250 m long
  Settling capacity of 3,750 m^3
  Sediment flush gate of 1.6 m wide x 2.09 m high x 4 gate (Manually operated steel slide gate)

7.2 Inspection

The principal items for inspection are as enumerated below:

(1) Fixed Weir Portion

- Crack and detachment
- Collapse of foundation or abutment
- Seepage

(2) Gate Portion (Scoring Sluice Gate and Intake gate)

- Noise or vibration of movable parts of gate
- Cleanliness of gate leaf and gate hoist and gate frame
- Detachment of welding part
- Rust and detachment of paint
- Slackness of wire rope
- Loosing or missing of bolts and nuts
- Deformation of gate leaf, hoist and gate frame
- Leakage of gate guide and sill portion
- Abnormal voltage/ampere or temperature of the parts of Gate Hoist
- Operational condition of local control panel

- Operational condition of power supply system
- Defects of measuring devices

7.3 Maintenance

The principal items for maintenance are as enumerated below:

(1) Fixed Weir Portion

- Filling of the failure part (such as cracks and detachment of concrete face or wet masonry) with high quality concrete or other proper materials,
- Reconstruction of the damaged part of foundation and abutment based on the detailed investigation and design;

(2) Gate Portion (Scoring Sluice Gate and Intake gate)

- Lubrication (greasing and/or oiling) of the movable parts of the gate;
- Tightening or replacement of bolts and nuts
- Cleaning and removal of garbage, sediment and other drifting materials
- Re-painting
- Re-welding for the detachment of welding parts
- Replacement and/or reconstruction of the deformation and leakage parts of the gate based on the detailed investigation and design
- Repair by the manufacture for abnormal conditions in power supply system, local gate control devices and all other failures of gate control system
- Repair or replacement

7.4 Operation

7.4.1 Operation of Scoring Sluice Gate

The following gate operation should be made during the non-flood and flood time, which could be declared through the aforesaid floodgate operation of Bili-Bili Dam (refer to subsection 4.5).

- During the non-flood time, the scoring sluice gate should be periodically opened once for one or two weeks to flush the sediment deposit at the upstream of the fixed weir. During this flushing operation, all of the gate should be gradually opened so as not to avoid the unbalanced hydraulic pressure and at the same time, the intake gate should be closed.
- During the flood time, the scoring sluice should be closed in order to prevent the driftwoods, garbage and any other flouting materials from twining around the gate. Immediately after the flood subsides, the scoring gate should be fully opened to flush the sediment, which accumulate upstream of the fixed weir. During this flushing operation, the intake gate should be closed.

7.4.2 Operation of Intake Gate

(1) Operation of Intake Gate for Bili-Bili Weir

The intake gate should be opened, through the following procedures, in accordance with the water requirement for Bili-Bili irrigation area.

- The necessary gate opening height to adjust the intake discharge with the water requirement should be determined through the following formula:

$$Q = C * b * d * \{2g(h_1-d)\}^{0.5}$$

Where, Q : Water requirement of Bili-Bili Irrigation Area (m^3/s)
b : Width of gate (3 m for one gate, 12 m for all of four gates)
d : Gate opening height (m)
h_1 : Upstream water depth at the intake gate (m)
C : Discharge coefficient (= 0.64)

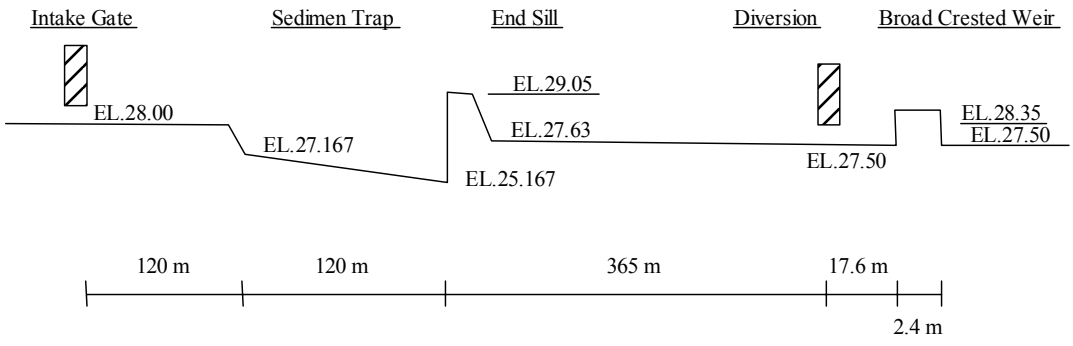
- The upstream water depth at the intake gate changes depending on the variation of the outlet discharge from Bili-Bili Dam (i.e., the discharge from the Control Gate of Bili-Bili Dam or the discharge from the turbine of Bili-Bili hydropower Plant). Accordingly, the operation of the Bili-Bili intake gate should be made based on the information of the outlet discharge from Bili-Bili dam.
- The maximum intake discharge should be 3.90 m^3/s, which corresponds to the flow capacity of the primary irrigation canal

(2) Operation of Intake Gate and Diversion Gates for Bissua Weir

Bissua Weir has the following two gates to control the intake discharge from Jeneberang River into the two primary irrigation channels, namely Bissua PC and Mattoagin PC:

- Intake Gate placed at the fixed diversion on Jeneberang River;
- Diversion Gate placed at 605 m downstream from the above intake gate to control the diversion discharges toward the above two primary irrigation canals:

There are four hydraulic factors to estimate the intake discharge, namely: (i) the opening height of the Intake gate, (ii) the overflow depth at the End Sill, which is placed at the downstream end of the sediment trap, (iii) the opening height of the Diversion Gate and (iv) the overflow depth of the Broad Crested Weir, which is 2.4 m downstream of the above Diversion Gate. The location and invert/crown elevation of the hydraulic structures to dominant the intake discharge are as illustrated in the following Figure:



Longitudinal Profile of Bissua Intake Gate, End Sill and Broad Crested Weir

The operation of the above intake gates and diversion gate should be made through the following procedures:

- The opening height of Intake Gate should be provisionally determined, by the following formula, to correspond to the water requirement of Bissua PC and Mattoangin PC:

  $Q = C * b * d * \{2g(h_1-d)\}^{0.5}$ *(Free Flow)*
  $Q = C * b * d * \{2g(h_1-h_2)\}^{0.5}$ *(Submerged Flow)*

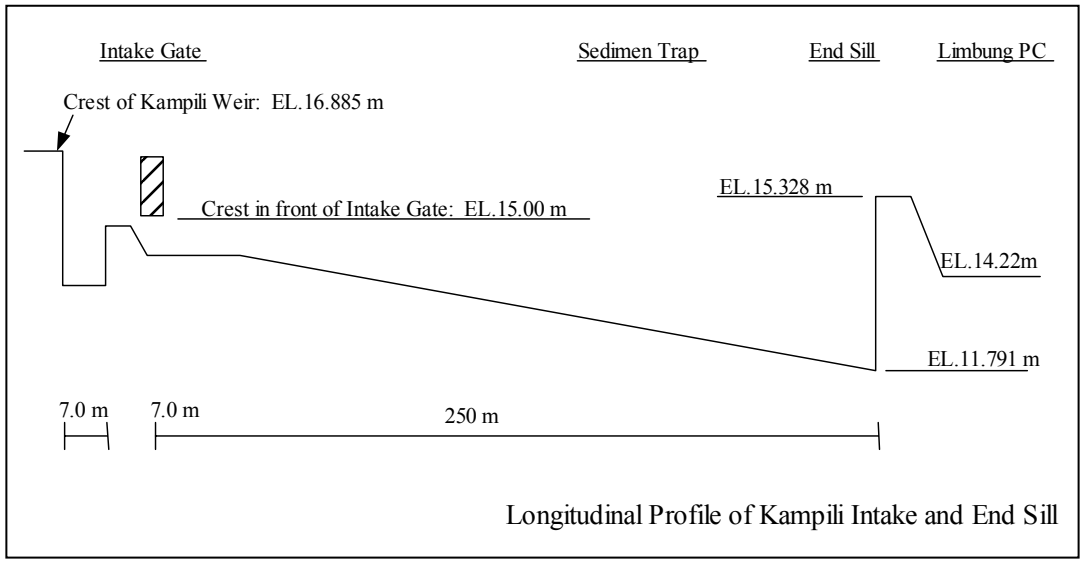
  Where, Q : Water requirement of Bissua PC and Mattoangin PC (m^3/s)
  b : Width of gate (3 m for one gate, 12 m for all of four gates)
  d : Gate opening height (m)
  h_1 : Upstream water depth at the intake gate (m)
  h_2 : Upstream water depth at the intake gate (m)
  C : Discharge coefficient (= 0.64)
- The opening height of Intake Gate should be adjusted based on the overflow depth of the End Sill.
- There are two sets of Diversion Gate: (i) one for Bissua PC and (ii) another for Mattoangin PC. These Diversion gates should be operated through the following procedures:
  - When the overflow depth at Broad Crested Weir toward Mattoangin PC is lower than that for Bissua PC[9], the Diversion Gate for Bissua PC should be fully opened, and the opening height of the Diversion Gate for Mattoangin should be adjusted to meet the water requirement for its downstream water requirement. The adjustment of the gate opening height should be based on the overflow discharge estimated by the overflow depth at the Broad Crest Weir.

[9] The channel flow capacity of Bissua PC and Mattoagin PC are 12.76 m^3/s and 9.14 m^3/s, respectively. Due to these different channel capacities, the overflow depth at the Broad Crested Weir for Mattoagin PC tends to be lower than that for Bissua PC.

– When the overflow depth at Broad Crested Weir toward Bissua PC is lower than that for Mattoangin PC, the Diversion Gate for Mattoangin PC should be fully opened, while the opening height of the Diversion Gate for Bissua PC is adjusted.

(3) Operation of Intake Gate for Kampili Weir

There are two hydraulic factors to estimate the intake discharge, namely: (i) the opening height of the Intake gate, (ii) the overflow depth at the End Sill, which is placed at the downstream end of the sediment trap and/or 250 m downstream of the Intake gate. The location and invert/crown elevation of the hydraulic structures to dominant the intake discharge are as illustrated in the following Figure:



Longitudinal Profile of Kampili Intake and End Sill

The intake discharge should be estimated based on the above hydraulic factors, and the operation of the Intake Gate should be made through the procedures:

- The opening height of Intake Gate should be provisionally determined, by the following formula, to correspond to the downstream irrigation water requirement:

$$Q = C * b * d * \{2g(h_1-d)\}^{0.5} \text{ (Free Flow)}$$

Where, Q : Water requirement
b : Width of gate (2.05m for one gate, 8.2 m for all of four gates)
d : Gate opening height (m)
h_1 : Upstream water depth at the intake gate (m)
C : Discharge coefficient (= 0.64)

- The opening height of Intake Gate should be finally adjusted based on the overflow depth of the End Sill.

7.4.3 Operation of sand Flushing Gate

Among the three irrigation weirs, Bili-Bili Weir is located immediately downstream of Bili-Bili Dam and therefore, the sediment inflow into Bili-Bili Weir is expected to be minimal. From this viewpoint, Bili-Bili Weir is not provided with the sediment flushing gate as well as the sediment trap.

On the other hand, Bissua and Kampili Weir have a substantial catchment area, whereby a significant volume of sediment inflow into the weirs is expected. Due to the background, both of Bissua and Kampili Weir are provided with the sediment flush gate and sediment trap on the premises of the following operation rules:

- The flush gate should be partially opened (say one or two gates to be opened) with an interval of one week to flush the sediment in the sediment trap. The flushing gate should be also fully opened when the depth of sediment accumulated in the sediment trap reaches 10cm.
- The flush gate for Kampili Weir should be fully opened as the emergency spillway, when the inflow discharge exceeds the channel flow capacity of the primary canal.

Chapter 8

Technical Guideline on Operation and Maintenance of Sand Pocket Dam and Sabo Dam

8.1 Structural Features

Five sand pocket dams and three sabo dams were constructed in the upper reaches of Bili-Bili dam in a period from 1997 to 2001 in order to mitigate the sediment inflow into the Bili-Bili dam reservoir and at the same time to contribute to prevention of the local sediment disaster. Among others, however, one sand pocket dam (called "Sand Pocket No.4") and one sabo dam (called "Sabo Dam No.4") were damaged by the extra-ordinary flood in January 2002. Sabo Dam No.4, which is located most upstream among the existing sand pocket dams and sabo dams, in particular, were seriously damaged and abandoned. On the other hand, Sand Pocket No.4 is to be rehabilitated in 2005. The salient features of the existing sand pocket and sabo dams are as listed below:

Salient Features of Main dam Body of Sand Pocket Dam and Sabo Dam

Name of Facility	Dam body material	Distance from End of Bili-Bili Reservoir (km)	Length (m)	Crest Width (m)	Height (m)	Sediment Capacity (m^3)	Year Comple-tion
Sand Pocket No.1	Ruble-concrete	1.8	620	3	7.5	164,000	1997
Sand Pocket No.2	Ruble-concrete	8.0	465	3	7.0	202,000	1997
Sand Pocket No.3	Wet stone masonry	15.0	336	3	7.0	129,000	1998
Sand Pocket No.4	Wet stone masonry	28.0	644	3	7.0	444,000	2000
Sand Pocket No.5	Wet stone masonry	32.0	441	3	7.0	142,300	2000
Sabo dam No.6	Wet stone masonry	42.0	230	3	10.0	74,400	2001
Sabo dam No.8	Wet stone masonry	64.0	104	3	10.0	122,400	2001

Note: There are concrete apron, sub-dam, and floor protection by gabion mattress placed downstream of the main dam.

8.2 Inspection

The principal items for inspection are as enumerated below:

- River flow direction at dam site;
- Crack and detachment of main dam body;
- Sediment deposit upstream of the main dam;
- Accessibility to sand pocket dam/sabo dam; and
- Scoring of the downstream foot protection portion.

8.3 Maintenance

The principal items for maintenance are as enumerated below:

- Keeping of the river flow direction toward the center of the dam body by excavation of the river channel (example of Routine Maintenance);
- Repair of minor damage such as small crack and detachment at main body and other parts of the structure, which is important to stop the progress of the damage leading to the destructive damage (repaired by backfilling of the mortal cement into the cracks and/or chemical grouting along the cracks);
- Filling of groynes or bolder to protect the river channel against serious scoring at the foot protection portion;
- Excavation of sand deposit at the pockets of the dam to increase efficiency of sand trap by the dam; and
- Maintenance of access road including slope protection, repair of pavement, drainage culvert/channel and all other relevant structures.

Chapter 9

Technical Guideline on Operation and Maintenance of Raw Water Transmission Main (RWTM)

9.1 Structural Features

The RWTM is a single pipeline of 17.61 km in length to transmit the raw water of 3.3 m^3/s as the maximum from Bili-Bili Dam reservoir to the downstream Soma Opu Water Treatment Plant for the municipal water supply. The principal structures of RWTM are broadly divided into the Intake, the Pipes and the Chambers. The Chambers are further divided into Flow Meter Chamber, Blow-Off Chamber and Air Valve Chamber, all of which are used for operation and maintenance of the pipelines.

(1) Intake

The intake of RWTM is located at the right side of the aforesaid the Diversion Work just downstream of the Control Gate of Bili-Bili Dam. The intake is composed of screen, intake gate and inlet pipe. Among others, the diversion gate is the slide gate with manual actuator having the maximum opening height of 1.4 m, which is in equivalent to the diameter of the main intake pipes.

(2) Pipe

The pipes to convey the raw water are composed of (i) the upstream pipe of 1,650 mm in diameter and 6.63 km in length and (ii) the downstream pipe of 1,500 mm in diameter and 10.38 km in length. The pipes laid underground are made of the precast concrete, while those in the chambers are steel pipe.

(3) Flow Meter Chamber

There are two flow meter chambers, namely Chamber No.1 at the inlet side and Chamber No. 2 at Somba Opu Water Treatment Plant. The Chambers are used as the space for operation and maintenance of the valves, the flow meters and other relevant devices in the Chambers. The valves installed in the Chambers are as enumerated below:

- Flow meter chamber No.1 : Butterfly valve to control flow discharge of the main pipe of 1,200 m in dia.
  Butterfly valve to control flow discharge of the bypass-pipe of 600 mm in dia.
  Sluice valve to control drainage discharge of the drainage pipe of 150 mm in dia.

- Flow meter chamber No.2 : Butterfly valve to control flow discharge of the main pipe of 1,000 m in dia.
  Butterfly valve to control flow discharge of the bypass-pipe of 600 mm in dia.
  Sluice valve to control drainage discharge of the drainage pipe of 500 mm in dia.

(4) Blow-off Chamber

There are five chambers at the lower ground level along the pipeline. The chambers are used as the space to close/open the main water conveyance pipes and drain the water from the main conveyance pipes to the surrounding outside water channels (such as the river channel and irrigation channel) through the drainage pipe for sake of the maintenance of the main conveyance pipes. Each of chambers is equipped with one unit of butterfly valve to close/open the pipes and one unit of sluice valve to drain the water from the pipes as listed below:

List of Blow-off Chambers

Chamber	Diameter of Main Pipe Controlled by Butterfly Valve	Diameter of Sluice Pipe Controlled by Sluice Valve	Distance from Bili-Bili Dam
Chamber No. 1	1,650 mm.	400 mm.	2.64 km
Chamber No. 2	1,650 mm.	400 mm.	4.93 km
Chamber No. 3	1,650 mm.	400 mm.	6.83 km
Chamber No. 4	1,650 mm.	400 mm.	9.29 km
Chamber No. 5	1,650 mm.	400 mm.	13.56 km

(5) Air Valve Chamber

There are the fifteen air valve chambers at the higher ground level along the pipeline. Each of the chambers are equipped with air valves to let air out of the pipes in case of inletting of water into pipes or to let air into pipes in case of draining of water from the pipes. Further, out of the fifteen chambers, three are equipped with sluice valve to diver the water into local water users. The list of the air valve chambers is as below:

List of Air Valve Chambers

Chamber	Diameter of Air Pipe Controlled byAir Valve	Diameter of Diversion Pipe Controlled by Sluice Valve	Distance from Bili-Bili Dam
Chamber No. 1	150 mm	-	2.77 km
Chamber No. 2	150 mm	-	5.14 km
Chamber No. 3	150 mm	100 mm (for Fire hydrant)	5.66 km
Chamber No. 4	150 mm	-	5.96 km
Chamber No. 5	150 mm	-	6.36 km
Chamber No. 6	150 mm	-	6.55 km
Chamber No. 7	150 mm	-	7.66 km
Chamber No. 8	150 mm	-	8.38 km
Chamber No. 9	150 mm	100 mm (for Fire hydrant)	10.55 km
Chamber No. 10	150 mm	-	11.53 km
Chamber No. 11	150 mm	150 mm (for WTP Borongloe)	12.52 km
Chamber No. 12	150 mm	100 mm (for Fire hydrant)	13.32 km
Chamber No. 13	150 mm	-	13.82 km
Chamber No. 14	150 mm	-	15.10 km
Chamber No. 15	150 mm	-	16.08 km

9.2 Inspection

The principal items for inspection are as enumerated below:

- Leakage of pipe;
- Cleanliness of blow-off valve chambers and air valve chambers;
- Rust and detachment of paint;
- Noise or vibration of movable parts and loosing/missing of bolts and nuts;
- Air pressure of pipe; and
- Operational condition of flow meter.

9.3 Maintenance

The principal items for inspection are as enumerated below:

- Replacement or repair of the leakage parts of pipe;
- Lubrication of the blower-valves, air-valves and all other mechanical facilities;
- Removal of garbage, dust, and ground water in the blow-off valve chambers and air valve chambers;
- Tightening and replacement of bolts and nuts; and
- Repair or replacement of the damaged flow meter.

9.4 Operation

The operation of RWTM is made through the following procedures:

(1) The maximum conveyance capacity of RWTM is 3.3 m^3/s, but the present usual conveyance water volume is limited to more or less 1.1 m^3/s due to the capacity of Water Treatment Plant of Somba Opu. The control of the conveyance water of RWTM is

controlled by the butterfly valve for the main pipe with a diameter of 1,000mm at Soma Opu.

(2) The conveyance water is to be gauged through two flow meters installed at the aforesaid Flow Meter Chamber No.1 (at intake side) and Flow Meter Chamber No.2 (at Somba Opu WTP). The gauged date are transmitted by telemetry communication device to and recorded at the Dam Control Office. The recorded conveyance water could be used as the base for water charge to PDAM.

(3) Any leakage of water from pipes could be detected through monitoring by the aforesaid two flow meters. When the leakage is detected, the leakage should be repaired through the following intake gate and valve operations:

- Close the intake gate;
- Close two butterfly valves at the neighboring blow-off chambers one after another from the upstream toward downstream side;
- Repeat to inspect the reduction rate of water in the pipes between the above neighboring blow-off chambers at the downstream blow-off chamber until detecting the leakage;
- Open all air valves and sluice valves to let air into the pipes and drain the water from the pipes; and
- Identify the leakage pipe by visual inspection in the pipes and replace or repair it.

(4) After repair of leakage as described above is completed, the water should be let into the pipes through the following gate and valve operations:

- Open all air valves to let air out from the pipes and close all sluice gate;
- Open the intake gage;
- Open the butterfly valve for the main pipe at Flow Meter Chamber No.1 at intake point;
- Open the butterfly valves at Blower-off Chambers No.1 to No.5 one after another from the upstream to downstream;
- Open the butterfly valve at Flow Meter Chamber at Soma Opu, after when WTP of Somba Opu is ready to operate; and
- Close all air valves and lock its manhole after the water is conveyed from the intake to Somba Opu WTP.

Chapter 10

Technical Guideline on Flood Management

10.1 Objectives

The flood control capacity of Bili-Bili dam reservoir as well as the river channel flow is within a limit to cope with the flood 50-year return period, and once the flood over the design capacity occurs, the disastrous flood damage including death of people is expected due to flood overflow from the river. In order to minimize such disastrous flood damage, the following flood forecasting, warning and fighting system should be applied to Jeneberang river basin.

10.2 Flood Warning Levels

The warning levels are classified into (1) Step1 for Standby, (2) Step2 for Warning, and (3) Step 3 for Evacuation/Flood Fighting, and determined based on the discharge/water level gauged by the following four principal telemetry stations (refer to Figure 10.1).

Principal Hydrological Gauging Stations for Flood Warning and Evacuation

Name of Gauging Station	Hydrological Data to be Gauged	Critical Discharge to Initiate Each of Steps for Flood Warning and Evacuation		
		Step 1	Step 2	Step 3
Bili-Bili Dam	Bili-Bili Dam Inflow Discharge	642.3 m^3/s	1,000.0 m^3/s	1,200.0 m^3/s
Patarikan bridge	Discharge of Jenelata River	400.0 m^3/s	900.0 m^3/s	1,100.0 m^3/s
Kampili Weir	Discharge of Jeneberang River	1,150.0 m^3/s	1,800.0 m^3/s	2,300.0 m^3/s
Maccini Sombala	Water Level of below Crown Level	1.5 m (EL. 4.7 m)	1.0 m (EL. 5.2 m)	0.6 m (El. 5.6 m)

Note: Step 1 corresponds to the probable flood to about 2-year return period,
Step 2 corresponds to the probable flood to about 20-year return period
Step 3 corresponds to the probable flood to about 50-year return period

In addition to the above principal gauging stations, there also exist the several water level and rainfall telemetry gauging stations, which transmit their gauging data to the Dam Control Office and the Monitoring Office (refer to Figure 10.1). These should be used as the supporting gauging stations and their gauged date should be taken into consideration as the reference for forecasting of the succeeding flood conditions.

Sub Hydrological Gauging Stations for Flood Waning and Evacuation

Name of Gauging Station	Hydrological Data to be Gauged	Use of Gauged Data
Jonggoa Bonto Jai	Water level of the upstream of Jeneberang River from Bili-Bili Dam	Evaluate the succeeding tendency of the increase/ decrease of dam inflow based on rise/drop of the gauged water level
Bayang	Tidal level at river mouth of Jeneberang River	Evaluate the succeeding tendency of the rise/drop of the downstream water level of Jeneberang River on rise/drop of the gauged tidal level.
Malino Jonggoa	Rainfall in upper reaches of Bili-Bili Dam	Evaluate the succeeding tendency of the increase/ decrease of dam inflow based on the increase/ decrease of the gauged rainfall.
Limbua Mangepang	Rainfall in Jenelata River Basin	Evaluate the succeeding tendency of the increase/ decrease of the downstream discharge of Jeneberang River based on increase/decrease of the gauged rainfall.

10.3 Required Work Activities at Each of Flood Warning Levels

The following work procedures should be taken for flood forecasting, warning and fighting:

(1) Preparatory Works for Non-flood Period

The non-flood period is herein defined as the period when the Bili-Bili dam inflow discharge, the river flow discharge and the river water level are less than the levels of Step 1 (for Stand-by) for flood warning described in the foregoing subsection 10.2. During such non-flood period, the following preparatory works should be made:

- To monitor the river flow discharge and the water at the principal and sub flood monitoring points specified in the foregoing subsection 10.2;
- To check workability of the flood control facilities, telemetry gauging devices, and heavy equipment and repair/rehabilitate them as required;
- To check readiness of materials for flood fighting such as gabion, plastic sand bag, sand and stockpile;
- To calibrate the hydrological gauging devices; and
- To check and complete the work references such as the reservoir operation rules and the H-Q curves.

(2) Works for Step 1 of Warning Levels

When the dam inflow discharge, the river flow discharge and the river water level reach the levels of Step 1 of the warning level, the following activities should be taken:

- To monitor the river flow discharge and the water at the principal and sub flood monitoring points specified in the foregoing subsection 10.2;
- To forecast the flood conditions based on the above monitored the river flow discharge and the water as well as the meteorological information provided from Meteorology and Geophysics Agency (BMD);
- To start flood control operation of dam reservoir (refer to subsection 4.5),

- To standby a team for patrol along the potential flood area along the river course; and
- To standby a term to disseminate the flood evacuation to the residents.

(3) Works for Step 2 of Warning Levels

When the dam inflow discharge, the river flow discharge and the river water level reach the levels of Step 2 of the warning level, the following activities should be taken:

- To continue flood control operation of dam reservoir;
- To start patrol along the potential flood area;
- To start to disseminate the flood evacuation to the residents;
- To standby a term to carry out the emergency protection works against flood and
- To issue flood warning to the external relevant organizations as required.

(4) Works for Step 3 of Warning Levels

When the dam inflow discharge, the river flow discharge and the river water level reach the levels of Step 3 of the warning level, the following activities should be taken:

- To continue flood control operation of dam reservoir;
- To continue patrol along the potential flood area along the river course;
- To continue to disseminate the flood evacuation to the residents;
- To issue request of flood evacuation to the external relevant organization as required;
- To dispatch a team for facilitate the flood evacuation and flood fighting; and
- To request the Implementation Unit for Disaster Management (SATLAK PB)[10] to mobilize their personnel, heavy equipment and materials as required to execute the necessary prevention works against flood overflow under technical instruction from the Public Corporation and the necessary rescue works in case of occurrence of flood overflow.

(5) Works after Flood

When the dam inflow discharge, the river flow discharge and the river water level are subsided below the level of Step 1 of the warning level, the following activities should be taken:

- To announce the end of flood operation when the flood is judged to have subsided based on the comprehensive evaluation on the hydrological information from the telemetry gauging stations and the metrological information furnished from the Meteorology and Geophysics Agency;

[10] The SATLAK PB is composed of (a) Mayor of Makassar City as the head of SATLAK PB, (b) the territorial military commander (PALGDAM) and/or the commander of regional military administrative unit (DANREM) as the deputy head of SATLAK PB; (c) the head of provincial police (KAPOLDA) and/or the head of regional police (/KAPOLWIL) as the another deputy head of SATLAK PB; (d) the heads of relevant provincial and regional government agencies such as Water Resources Management Services of Public Works and Housing, Planning and Urban Development Service of Public Works; and (e) the relevant regional communities.

- To evaluate and record the activities taken during the operation for flood warning, evacuation and fighting;
- To request the Governor of South Sulawesi Province to take the necessary coordination for the technical/financial support from the central government as the member of National Coordination Board of Disaster management (BOKORNAS PB);
- To record the flood damages including the extent of flood inundation area; and
- To recommend improvement/revisions on the present operation procedures, if any.

10.4 Center for Flood Forecasting, Warning and Fighting

The principal center should be placed at the existing Monitoring Station for Bili-Bili Dam (the current Project Induk Monitoring Office) in Makassar City, where the Head of the Operations Directorate of Public Corporation should station during a flood and make all determination and issuances for flood warning, evacuation and fighting. The secondary center should be further placed to the Dam Control Office at Bili-Bili dam site having functions to monitor the variations of storm-rainfall intensity in the river basin and flood discharge/water level at the under-mentioned flood monitoring points.

10.5 Necessary Equipment, Tools and Materials for Flood Waning and Evacuation

The following equipment and tools should be used and/or stocked for execution of the objective flood warning and prevention.

(1) Patrol Car

The following equipment currently owned by JRBDP should be used for patrol and disseminating of flood warning:

- Two units of Long Wheel Base 4WD Vehicle equipped with radio-telephone, siren, loudspeaker and warning lamp;
- One Unit of Station Wagon (Kijang Type)
- Three units of motor cycle with a capacity of 100 cc

(2) Communication System

The following communication system should be adapted to the flood warning and fighting works:

- Telemetry network : The existing telemetry networks should be used to collect the hydrological gauging to the Dam Control Office/Monitoring office.
- Handie-Taikie : The Handie-Taikies should be newly procured to communicate between the site inspectors and the Dam Control Office/Monitoring Office.

- Telephone network : The list of telephone numbers for all of the under-mentioned relevant organizations should be prepared to facilitate the necessary communication.

(3) Tools

The following tools should be newly procured for execution of flood warning and prevention works.

- Life Jacket : 50 pc
- Flash Light : 5 pc
- Helmet : 50 pc
- Raincoat : 50 pc
- Rubber Boat : 5 pc
- Water Pump : 5 pc

(*: The above quantities of the tools are the preliminarily estimated figures and subject to revision through the actual experience of the works)

(4) Material

The following materials should be newly procured and stocked for execution of flood warning and prevention works.

Gabion : 50 units
Plastic Sand Bag : 1,000 pc
Sand : 1,000 m^3
Stockpile : 20 pc

(*: The above quantities of the tools are the preliminarily estimated figures and subject to revision through the actual experience of the works)

(5) Flood Risk Map

The flood risk map with the following information should be developed and disseminated among the residents and communities:

- Extent of potential flood inundation area and
- Available evacuation centers and evacuation routes to be taken during a flood.

The flood risk map could be useful for the resident and communities to be aware of the extent of the potential flood inundation area and the available evacuation routes during a flood. The flood risk map could also be the guidance for appropriate urban planning and land development.

The present potential flood inundation area was estimated to cover an extent of about 58.5km^2 spreading out a substantial part of Makassar and Sungguminasa City at the right side bank of Jeneberang as shown in Figure 10.2. The areas not to be inundated would be the east part of Makassar City surrounded by the dike alignments of Jongaya, Panampu drainage channels, the north of the Jl. Urip Sumoharjo, and the slightly elevated area in and around Kel. Tibung and Bontomakkio. In contrast to the area at the right bank, the possible inundation area at the left bank is confined into a rather limited area between the dikes of Jeneberang River and Garassi River.

In addition to the above flood inundation areas, a particular attention should be given to the illegal dwellers living in the flood high water channels. The areas of illegal dwellers are designated as the river administrative area and exposed to the high risk of flood damage. The dominant areas of illegal dwellers are as enumerated below:

- The stretch along right bank 2 to 3 km upstream from river mouth (just downstream fro Rubber Dam); and
- The stretch along left bank 5 to 6 km upstream from river mouth (adjacent to the existing groundsill).

The evacuation centers as well as evacuation routes would be placed in to West side on the Sinrijala-Panampu, or East of Central Ring Road. However, their detailed locations could not be specified in this Study due to the limited information, and should be designated, in the future, by the relevant local government agencies based on the base flood risk map. The flood risk map thus prepared should be disseminated to the public through a bulletin, an information board and other available information tools.

Chapter 11

Technical Guideline on Water Quantity and Drought Management

11.1 Objectives

In order to establish more effective and fair rules over water allocation, the rule of water allocation and reservoir operation rule during a drought year is prepared.

11.2 Granted Water Abstraction Volume from Jeneberang River

The following annual water demand for the source of Jeneberang River has been granted by JRBDP and would be adopted as the customary water use right and as the base of water quantity management by the Public Water Corporation. The list of all users for the granted water demand is as shown in Table 11.1.

Annual Water Demand for the Source of Jeneberang River (Granted by JRBDP)

	Municipal Water Demand*1		Irrigation Water Demand *2		Takalar Sugar Factory Demand		River Maintenance. Flow		Monthly Total	
Month	10^6 m^3	m^3/s	10^6 m^3	m^3/s	10^6 m^3	m^3/s	10^6 m^3	m^3/s	10^6 m^3	m^3/s
Jan.	4.45	1.66	91.53	34.18	1.34	0.50	2.68	1.00	100.00	37.34
Feb.	4.02	1.66	82.88	33.08	1.21	0.50	2.42	1.00	90.53	36.24
Mar.	4.45	1.66	73.86	27.57	1.34	0.50	2.68	1.00	82.33	30.73
Apr.	4.31	1.66	74.03	28.56	1.30	0.50	2.59	1.00	82.23	31.72
May	5.79	2.16	95.85	35.79	1.34	0.50	2.68	1.00	105.66	39.45
Jun.	5.60	2.16	84.96	32.78	1.30	0.50	2.59	1.00	94.45	36.44
Jul.	5.79	2.16	74.29	27.74	1.34	0.50	2.68	1.00	84.10	31.40
Aug.	5.79	2.16	36.53	13.64	1.34	0.50	2.68	1.00	46.34	17.30
Sep.	5.60	2.16	19.66	7.59	1.30	0.50	2.59	1.00	29.15	11.25
Oct.	5.79	2.16	17.25	6.44	1.34	0.50	2.68	1.00	27.06	10.10
Nov.	4.31	1.66	10.17	3.92	1.30	0.50	2.59	1.00	18.37	7.08
Dec.	4.45	1.66	45.23	16.89	1.34	0.50	2.68	1.00	53.70	20.05
Total	60.35		706.24		15.79		31.54		813.92	

Note *1: Monthly average water use change from 1.66 m^3/s to 2.16 m^3/s due to a background that among the PDAM intakes, that for Panaikang WTP takes the whole raw water of 1,000 liter/sec from Lekopancing weir on throughout a rainy season, but have a half of it (500 liter/sec) from Jeneberang River for a dry season.

*2: The gross crop water requirement for the on-going Bili-Bili Irrigation Project.

Among above annual water demands, the irrigation demand is substantially dependent on the rainfall as its water source during a rainy season, although most of the demand is provided from Jeneberang River during a dry season. Thus, the annual irrigation water requirement for the source of Jeneberang River is variable every year depending on the effective rainfall depth. On the other hand, all water demands except the irrigation water demand fully relies on water abstraction from Jeneberang River. Taking these particular differences into account, the water

quantity management should be executed based on the following net annual water requirement for the source of Jeneberang River:

- The annual net water requirement for irrigation use from Jeneberang River should be 382 million m^3/year, which could be promised against a probable drought of 5-year return period through reservoir operation of Bili-Bili dam.
- Other annual net water requirements should be 102.29 million m^3, which is equivalent to the above granted water demand, and could be fulfilled against a probable drought of 10-year return period through the reservoir operation of Bili-Bili Dam.

The above annual net water requirement from Jeneberang River is 489 million m^3 in total as listed below (refer to Table 11.2 and Figure 11.1):

Granted Annual Water Abstraction Volume from Jeneberang River

Month	Municipal Water Demand*1		Irrigation Water Demand *2		Takalar Sugar Factory Demand		River Maintenance. Flow		Monthly Total	
	$10^6 m^3$	m^3/s	$10^6 m^3$	m^3/s	$10^6 m^3$	m^3/s	$10^6 m^3$	M^3/s	$10^6 m^3$	m^3/s
Jan.	4.45	1.66	23.56	8.80	1.34	0.50	2.68	1.00	32.03	11.96
Feb.	4.02	1.66	0.00	0.00	1.21	0.50	2.42	1.00	7.65	3.16
Mar.	4.45	1.66	0.00	0.00	1.34	0.50	2.68	1.00	8.47	3.16
Apr.	4.31	1.66	57.36	22.13	1.30	0.50	2.59	1.00	65.56	25.29
May	5.79	2.16	79.46	29.67	1.34	0.50	2.68	1.00	89.27	33.33
Jun.	5.60	2.16	76.74	29.61	1.30	0.50	2.59	1.00	86.23	33.27
Jul.	5.79	2.16	72.33	27.01	1.34	0.50	2.68	1.00	82.14	30.67
Aug.	5.79	2.16	36.53	13.64	1.34	0.50	2.68	1.00	46.34	17.30
Sep.	5.60	2.16	19.66	7.59	1.30	0.50	2.59	1.00	29.15	11.25
Oct.	5.79	2.16	12.21	4.56	1.34	0.50	2.68	1.00	22.02	8.22
Nov.	4.31	1.66	0.00	0.00	1.30	0.50	2.59	1.00	8.20	3.16
Dec.	4.45	1.66	3.86	1.44	1.34	0.50	2.68	1.00	12.33	4.60
Total	60.35		381.70		15.79		31.54		489.39	

In addition to the above water abstraction allocated to Bili-Bili dam reservoir, there exist numerous local irrigation schemes called “village irrigations”, which are dotted in the upper reaches of Jenelata River or the upper reaches from the Bili-Bili Dam. The right for this particular irrigation use is managed as the customary water use by traditional leaders through general community agreement.

The water abstraction volume required to the village irrigations is, however, not officially registered yet, and its clarification and formal registration would remain as the future issue. Nevertheless, the abstraction volume of village irrigations is presumed to be far smaller than those of large-scale irrigation schemes in the lower reaches, and a substantial part of the abstracted irrigation water return to the river due to the hilly/mountainous topography in the area of the village irrigation. Accordingly, the village irrigation would not have a significant influence to the downstream flow regime of Jeneberang River as well as the inflow regime to the Bili-Bili Dam reservoir.

11.3 Daily Water Distribution

11.3.1 Required Monitoring Works on Water Distribution

The Public Water Corporation has an obligation to distribute the water for the requirement of the above granted water users. In order to ensure the obligation, it is indispensable to precisely monitor the seasonal variations of both river flow discharge and requirement of water users, and decide to the appropriate water distribution based the monitoring results. Such monitoring works would become more crucial issues especially upon completion of the on-going Bili-Bili irrigation project.

From the above viewpoints, the Public Water Corporation should undertake the following monitoring works for the river flow and water intake discharge. The required works are to monitor (1) inflow/outflow of dam reservoir, (2) unregulated flow discharge from the Jenelata River, (3) river flow discharge below the major water intake points and (4) water abstraction volume at all intake points, where the water abstraction is granted. Among these monitoring items, those of items (1) to (3) should be directory monitored by the Public Water Corporation, while the item (4) should be monitored by the water users, and reported to the Public Corporation. .

Required Monitoring Works for River Flow Discharge and Water Use

	Objectives of Monitoring	Device for Monitoring	Monitored by
Monitoring of Flow Discharge	(1) Inflow discharge to Bili-Bili dam reservoir	Dam Control and Monitoring System at Dam Control Office (Existing)	River administrator
	(2) Outflow discharge from Bili-Bili Dam reservoir	Dam Control and Monitoring System at Dam Control Office (Existing)	River administrator
	(3) PDAM Intake to Somba Opu WTP	Dam Control and Monitoring System at Dam Control Office (Existing)	River Administrator
	(4) Runoff discharge from Jenelata River	Dam Control and Monitoring System at Dam Control Office (Existing)	River administrator
	(5) Flow discharge from Kampili Weir	Dam Control and Monitoring System at Dam Control Office (Existing)	River administrator
	(6) Overflow discharge of the lower groundsill (at K5.97)	Staff gauge	River administrator
	(7) Inflow discharge to Long Storage	Off-line gate opening gauge (exist)	River administrator
	(8) Overflow discharge of Rubber Dam	Water level gauge at Rubber Dam (Existing)	River administrator
Monitoring of Water Use	(9) PDAM Intake other than that for Soma Opu	Flow mete (To be newly installed)	PDAM Makassar and Gowa
	(10) Bili-Bili Irrigation System	Staff gauge (Existing)	Dinas PSDA
	(11) Bissua Irrigation System	Staff gauge (Existing)	Dinas PSDA
	(12) Kampili Irrigation System	Staff gauge (Existing)	Dinas PSDA
	(13) - Takalar Sugar Factory	Flow meter (to be newly installed)	Takalar Sugar Factory
	(14) River Maintenance Flow	Estimate from the above (6), (7) and (8)	River Administrator

11.3.2 Required Procedures of Daily Water Distribution

In order to achieve the sustainable water distribution throughout a year, the Public Corporation should take the following work procedures for daily water distribution:

(1) Preparatory Works

The Public Corporation should undertake the following preparatory works for formulation of semiannual water allocation plan and operation plan of the daily water distribution at the end of May (the end of rainy season) and at the end of November (at the end of dry season):

a) To check the updated water supply capacities/workability of water supply facilities, which include the following items:
   - Bili-Bili dam Reservoir;
   - PLN hydropower station;
   - Raw Water Transmission Main (RWTM);
   - Three irrigation intake weirs, namely, Bili-Bili, Bissua, and Kampili weir;
   - Rubber dam and intake/outlet facilities for Long Storage; and
   - PDAM intake facilities.

b) To check and repair all flow meters and hydrological gauging devices to be used for monitor the daily operation of water allocation,

c) To update the H-Q rating curves to be used for monitor the under-mentioned operation of the daily water allocation, and

d) To forecast the meteorological conditions for the succeeding six months based on the information from Meteorology and Geophysics Agency.

(2) Formulation of Water Allocation Plan

The Public Corporation should prepare a draft of the semiannual water allocation plan at the end of May (the end of the rainy season) and at the end of November (the end of dry season). The draft of the plan should stipulate the updated water users and the seasonal variations of their water abstraction volumes for the next six months.

The draft of plan is submitted to, evaluated and finalized by the Water Resources Coordination Committee (PTPA). PTPA would distribute the finalized semiannual water allocation plan within four (4) days at least before commencement of the daily operation for water allocation to the following relevant agencies:

a) Dinas PSDA
b) Balai PSDA
c) PDAM Makassar
d) PDAM Gowa
e) Takalar Sugar Factory
f) PLN and

g) Other agencies as required

(3) Daily Operation for Water Distribution

Based on the above semiannual water allocation plan, the Public Corporation should formulate the daily operation plan for water distribution, which stipulates the time schedule of operation, the necessary personnel in charge and their duties, at the end of November (at the end of dry season). The Public Corporation is further required to undertake the following works:

a) To prepare assignment schedules of the staffs to be engaged (including the gate operator, observer/inspector, security force, telecommunication operator, etc.) every month;
b) To collect the half-monthly water requirement from the following water users:
   - Balai PSDA, which estimates the water volume to be taken from three irrigation weirs (Bili-Bili, Bissua, and Kampili) to their respective irrigation areas taking the cropping schedules and the effective rainfall depth into account;
   - Takalar Sugar Factory, which estimates the half-monthly water requirement taking the necessary water for sugar plantation and refining; and
   - PDAM Makassar and Gowa, which estimate the necessary water intake volumes for their municipal water supply.
c) To estimate the possible discharge to be released from Bili-Bili dam reservoir to the downstream water demand, every half month, based on the above water requirement, the water storage volume stored in the reservoir and the necessary river maintenance flow:
d) To instruct PLN to release the discharge passing through the turbines of Bili-Bili Electric Hydropower Plant in accordance with the above estimation;
e) To monitor and measure the results of daily water allocation:
f) To rearrange the water allocation in accordance with the under-mentioned Step 1 to Step 4 for the drought management on the premises of approval by PTPA as described in the following subsection 11.4, if difficulties arise in fulfilling the requirement of water users as programmed in the semiannual water allocation plan due to the drought.
g) To compile the following records
   - Daily reservoir operation record including daily water supply volumes to each of water users;
   - Records of collection of water service fee from the users.
h) To review the daily water allocation executed for the foregoing six months, and to make the necessary revisions on the procedures for the daily water allocation, as required.

11.4 Drought Management

Bili-Bili dam reservoir is operated, in the normal-drought years, to fulfill the whole requirement for the downstream water use. However, should the dam unconditionally releases its storage water in accordance with the downstream water requirement, the available supply capacity of the dam reservoir possibly drops to zero during an extra-ordinary drought year causing sudden and drastic reduction of available water supply for the whole water use.

In order to avoid such unfavorable conditions, the dam reservoir should gradually reduce the water supply in the extra-ordinary drought year. At the same time, the dam reservoir needs to promise less reduction of water supply for priority water use even in the extra-drought year.

(1) Priority of Water Supply in Drought Years

The priority of water supply during the drought years should be given to municipal water supply and supply for river maintenance flow. These priority water supplies are the basic need for community, and objective of reduction of water supply in the drought year should be addressed to the irrigation water supply.

(2) Reservoir Operation Curve

The Reservoir Operation Curve (RC) is the ruled lowest daily reservoir water levels, and the dam operator should always maintain the reservoir water level (RWL) above. The RC is developed as a curve, which envelops the whole lowest daily reservoir water levels (RWLs) estimated through water supply-demand simulation under the past low flow regimes except those in the extra-ordinary drought years, during which Bili-Bili dam could not fulfill the whole downstream water requirement (refer to Figure 11.2).

Thus, the RC is closely related to the allocated water demand and should be updated according to every renewal of water allocation. However, the present Bili-Bili dam reservoir operation is based on the RC established in 1993, and since then, any updating of RC has never been made in spite of change of the downstream requirement of water use. In this connection, the RC is newly developed based on the new water allocation and the past low flow regime from 1972 to 2001 (refer to Figure 11.3). The present and the newly estimated RCs are as listed below, and the detailed reservoir operation plans in based on the newly developed RC are as described in the under-mentioned item (3) (refer to Figure 11.4).

Present and Newly Established Reservoir Operation Rule Curve

Month	RC on the beginning of the Month (EL. m)	
	Past	Updated
May	99.0	84.0
Jun.	95.0	88.5
Jul.	88.0	84.0
Aug.	81.0	79.5
Sep.	74.0	75.0
Oct.	66.0	70.5
Nov.	65.0	66.0
Dec.	67.0	66.0

Note: The daily RCs are defined as the values interpolated from the above RCs on the beginning of each month.

(3) Procedures to Reduce Supply to Allocated Water Demand in Drought Years

The operator of dam reservoir needs to firstly reduce the irrigation water supply in advance before RWL drops below RC. In order to facilitate the appropriate reduction of water supply, the following steps should be taken in accordance with the reservoir water level and degradation speed of the reservoir water level:

Steps to be taken for Drought Management

Steps	Approx. Leading Time to Next Step	Flood Discharge/Water Level to Commence the Steps	Necessary Activities
Step 1: Standby	10 days	• {RWL < RC +2.0 m} and • The dairy descending rate of RWL > 0.25 m/day	• Setup a dam operation team against drought • Estimate the expected dam inflow discharge based the long term weather forecast • Inform the relevant water councils/committees and water users about possibility reduction of irrigation water supply
Step 2: Coordination	5 days	• {RWL < RC + 1.0 m} and • The dairy descending rate of RWL > 0.25 m	• Estimate and the necessary reduction of irrigation water supply • Proposed the above estimated value to the water council and water users
Step 3: Reduction of Water Supply for Irrigation	2 days	• {RWL < RC + 0.5 m} and • The dairy descending rate of RWL > 0.25 m	• Execute the above estimated necessary reduction of irrigation water supply
Step 4: Stop of Irrigation Water Supply	-	• When RWL = RC	• Reduce 100 % of irrigation water supply
Step 4: Stop of Whole Water Supply	-	• When RWL = LWL	• Reduce a certain volume of municipal water supply from dam reservoir

Chapter 12

Technical Guideline on Management of River Management Area

12.1 River Patrol

12.1.1 Objectives of River Patrol

The River Patrol within the river administrative area aims at maintaining the sustainable river morphologies and preserving the appropriate channel flow as well as environments of the river channel. The major objective items of the patrol are as enumerated below:

(1) Water Abstraction from River:

The patrol should be made to confirm the following items:

- Official permission is granted to the water abstraction;
- Purpose and period of water abstraction is within the allowable limits of the official permission;
- Volume of and facilities used for water abstraction is within the extent of the official permission;

(2) Land Use in River Utilization Area

The patrol should be made to confirm the following items:

- Official permission is granted to the land use;
- Purpose and location of land use is within the allowable limits of the official permission; and
- Land reformation including land excavation and banking follows the permitted specification.

(3) Sand-mining

The patrol should be made to confirm the following items:

- Official license is issued to the mining activities;
- Mining is not too deeply and/or too disorderly made;
- Mining location and volume is being made within the allowable limits of the official permission;
- Mining equipment follows the permitted specification;
- Ex-mining site has been properly cleared and leveled;

- Mined sand is placed at the specified temporary stockyard and in the specified shape;
- No serious turbidity occurs due to cleaning of the mined sand and the sand accumulated in the drainage channel is removed;
- Mined sand is transported through the officially permitted route and in accordance with the specified manners; and
- Road for transportation of the mined sand is properly maintained.

(4) Construction and/or Renovation in River Utilization Area

The patrol should be made to confirm the following items:

- Illegal construction and/or renovation work is not being made in the river corridor;
  River facilities such as the sluice gate, bridge and water intake facilities have the officially permitted structural features and they are located at the permitted site;
  River facilities are used for the sake of the official permitted purposes.
  Construction is in progress in accordance with the officially permitted schedule; and
  River Park and other structures in the river utilization area are judged not to hamper the flood flow, have been removed.

(5) Cleanliness of River Water

The patrol should be made to confirm the following items:

- River water shows no particular color of turbidity, the bubbles, the oil flow and/or the death of fish on the surface of water;
- Effluent into the river does not cause any particular color of turbidity; the bubbles, the oil flow and/or the death of fish on the surface of water;.and
- Garbage is not dumped into the river.

12.1.2 Activities to be taken through River Inspection and Patrol

When the inspector detects violation against the permitted activities in river utilization area, he should take the following actions:

(1) To record the name and address of the violator together with the date, location, and conditions of the violation.
(2) To take photographs of the violation, as required.
(3) To point the violator out his illegal activities.
(4) To give the violator verbal warning on the slight violation and instruct him to stop and/or correct his illegal activities.
(5) To inform the head of division about the condition of violation and receive the necessary actions from him in case that the condition is judged to be serious and need the urgent countermeasures.

12.2 River Survey and Hydrological Measurement

The following aerial-photograph survey, the longitudinal/cross-sectional survey and sounding survey should be made to monitor the river morphologies:

12.2.1 Aerial-photograph

- Objectives : To monitor the land use in the river utilization area and the progress of sediment deposit in river channel due to collapse of Mt. Bawakaraeng;
- Location : Along the downstream of Jeneberang River from river mouth to Bili-Bili dam
  Along the upstream of Jeneberang River from Bili-Bili dam to Mt. Bawakaraeng
- Frequency : Once for five years (for the downstream)
  Once a year (for the upstream)

12.2.2 Longitudinal and Cross-sectional survey

- Objectives : (a) To monitor the tendency of degradation of riverbed along the mainstream of Jeneberang River bellow Bili-Bili Dam, which are likely to be because of excessive sand mining; and
  (b) To monitor the tendency of rise of riverbed along the mainstream of Jeneberang River above the Bili-Bili Dam reservoir, which are caused by the tremendous sediment runoff discharge due to collapse if Mt. Bawakaraeng;
- Location : (a) A length of 9.5 km from river mouth to Sungguminasa Bridge with a longitudinal interval of about 500 m.
  (b) A length of 24.1 km from Sungguminasa Bridge to Bili-Bili Dam with a longitudinal interval of about 1,000m.
  (c) A length of 37.0 km from the upstream end of Bili-Bili dam reservoir to Daraha Bridge with a longitudinal interval of about 1,000 m.
- Frequency : Once a year immediately after a rainy season

(Cross-sectional extent of the above survey items (1), to (4) should be limit to outward bound of the river management area as designated in the subsection 1.1.1)

12.2.3 Spot Sounding Survey

- Objectives : (a) To develop the H-Q rating curves at the key water level gauging stations; and
  (b) To monitor degradation or rise of riverbed at the sites of the principal river structures
- Location : <u>For Development of H-Q Rating Curve</u>
  At the existing telemetry water level gauging stations of:

(a) Jonggoa on Jeneberang River
(b) Bonto Jai on Jeneberang River
(c) Kampili on Jeneberang River
(d) Panaikang Bridge on Jenelata River

For Monitoring of Riverbed

(a) At River Mouth
(b) Downstream and upstream of the existing two groundsills
(c) Downstream and upstream of the existing Rubber Dam
(d) At Sungguminasa Bridge
(e) Downstream below Kampili Weir,
(f) Downstream below Bissua Weir, and
(g) Downstream of Bili-Bili Weir

- Frequency : Bimonthly throughout a year

12.2.4 Discharge Measurement

- Objectives: : To develop the H-Q rating curves together with the above spot sounding survey:
- Location : At the existing telemetry water level gauging stations of:
  (a) Jonggoa on Jeneberang River
  (b) Bonto Jai on Jeneberang River
  (c) Kampili on Jeneberang River
  (d) Panaikang Bridge on Jenelata river
- Frequency : Bimonthly throughout a year

12.3 Inspection and Maintenance on River Channel

Inspection and Maintenance of the river channel aims at maintaining the sustainable river morphologies and preserving the appropriate channel flow as well as environments of the river channel. The major objectives of inspection and maintenance are as enumerated below:

(1) Inspection

River channel survey, visual inspection and other necessary inspection should be carried out to clarify fluctuation of riverbed and degradation of the riverbank. The principal items of inspection are as enumerated below:

- Degradation or rise of riverbed
- Erosion and/or Collapse of River Bank
- Overgrowth of weed and shrub on River Bank
- Garbage in river channel

(2) Maintenance

The principal items for maintenance are as enumerated below:

• Prevention of degradation of river bed	:	(a) Control of sand mining, and (b) Construction of groundsill or riverbed girdle.
• Prevention of rise of riverbed	:	(a) Mechanical excavation of riverbed, (b) Construction of sand trap dams, and (c) Reforestation in the upper reaches.
• Prevention erosion/collapse of river bank	:	(a) Slope and foot protection works, (b) Construction of groyne, and (c) Gabion works
• Removal of weed/shrub on river bank	:	(a) Mechanical removal, (b) Removal by manpower, and (c) Removal by defoliation
• Removal of garbage in river channel	:	(a) Patrol to check dumping of garbage, (b) Demonstration of prohibition of dumping of garbage by sign boards, and (b) Removal by manpower.

12.4 Land Use Control in River Management Area

The river management area is classified into the three categories: (a) the river utilization area, where the land of the river corridor had been acquired by the river administrator, (b) the circumference of Bili-Bili dam reservoir, where the land of ground levels of less than SWL (EL.101.6m) had been acquired by the river administrator; and (c) the river control area, where the land belongs to the private. The Public Water Corporation should undertake the flowing tasks for land use control in each of these three kinds of river management areas:

(1) Land Use Control in River Utilization Area

JRBDP as the current river administrator had constructed river dike of 9.6km in length along the left and right bank of the downstream of Jeneberang River from the river mouth up to Sungguminasa Bridge. The hinterland of the river dike is the densely populated area of Makassar City and its outskirts, and therefore, the river dike takes a role as the important flood control facility. In order to keep the design river flow capacity, the JRBDP had also acquired the whole land of river corridor along the river dike as the flood high water channel. The average width of flood high water channel (the river corridor) is about 200 m in total of the right and left bank.

The Public Corporation as the new river administrator should control the land use in the above flood high water channel (i.e., the river utilization area) through the following activities:

- To prohibit any illegal land use in the above high water channel exerting major effort to evacuate the existing illegal dwellers in the flood in particular, who are the great hindrance against the safety flow of flood discharge, and at the same time, exposed to the high risk of flood damage,
- To limit the allowable land use to those for the public interests such as the river-park and public ground, and
- To limit the structures in the flood high water channel to those not to hamper the flood flow and/or riparian structures such as water level gauging stations and drainage sluice, which need to be unavoidably constructed with in the river corridor.

(2) Land Use Control in River Authority Area

The river corridor of 100m in width along both of the right and left river bank of the upstream channel from the above river utilization area could be specified as the river control area. The land of this river corridor belongs to the private land, and therefore, the authority of land control by the river administrator would hardly prevail over the river corridor. Nevertheless, the Public Corporation should monitor, as the river administrator, the progress of land exploitation in the river corridor, and control the excessive exploitation, whenever it is judged to cause the significant effect on the river morphology, river flow conditions, and/or river environment.

(3) Circumference of Bili-Bili dam Reservoir

The Public Corporation should control any removal of grass/trees and/or logging activities in its management area around the dam reservoir in order to preserve the natural environment of the area. The Public Corporation should also control all construction works in the subject area on the premises that construction of structures except those for the public interests such road and riparian structures should be prohibited in the area.

12.5 Control of Sand-mining

The current excessive sand mining activities cause the serious degradation of the downstream riverbed of Jeneberang River below Bili-Bili dam. In order to minimize such serious degradation of riverbed, any sand mining activities below Bili-Bili Dam should be preferably prohibited, and the sand minor should be guided to transfer their mining sites to the upstream of Bili-Bili Dam. The potential sand mining sites upstream of the Bili-Bili dam would be placed at the upstream of the reservoir area and the sabo pocket dams No.1 to 4 as shown in Figure 13.1. Many difficulties are, however, foreseeable in putting an end to the downstream mining taking accessibility to the upstream mining site and dispute on conventional territories of each of sand minors into account. From these viewpoints, the Public Corporation should take the following activities:

- To stop any renewal of mining license for the downstream channel below Bili-Bili dam:

- To carry out the river channel survey at the every end of rainy season and clarify the tendencies of degradation of riverbed at each of the major river structures based on the results of the river channel survey;
- To estimate the sediment deposit on the riverbeds at each of the major river structures after stop of renewal of mining license;
- To estimate the allowable sand mining volume and the available mining sites on the downstream of Jeneberang River based on the results of clarification on the above.
- To carry out the river patrol to control the illegal sand mining activities (refer to subsection 13.1).

12.6 Control of Illegal Water Abstraction and Illegal Effluent/Garbage Dumping

The Public Corporation should control the water abstraction from Jeneberang River to be made within a limit of the granted water use right and/or customary water use right through the river patrol as described in subsection 31.1. The Public Corporation should also control the illegal effluent and dumping of garbage into the river through the river patrol so as to preserve the appropriate river environment.

Table 1.1 Land Use in River Administration Area along River Dike Section (1/2)

Left Bank from River Mouth to Sungguminasa Bridge

Inside of Dike			
No.	Distance (m)	Length (m)	Land Use Type
1	0-1072	1072	Water Body
2	1072-1500	428	Bare Land
3	1500-2127	627	Paddy Field
4	2127-2298	171	Bare Land
5	2298-2848	550	Settlement
6	2848-3792	944	Paddy Field
7	3792-3878	86	Settlement
8	3878-4595	717	Paddy Field
9	4595-5421	826	Settlement
10	5421-5698	277	Paddy Field
11	5698-5820	122	Settlement
12	5820-6255	435	Estate Crop Field
13	6255-6990	735	Settlement
14	6990-7479	489	Estate Crop Field
15	7479-7554	75	Settlement
16	7554-7931	377	Paddy Field
17	7931-8473	542	Settlement
18	8473-8545	72	Paddy Field
19	8545-8609	64	Settlement
20	8609-8704	95	Paddy Field
21	8704-9272	568	Settlement

Total			
	Water Body	1,072	(11.6%)
	Bare Land	599	(6.5%)
	Paddy Field	3,109	(33.5%)
	Settlement	3,568	(38.5%)
	Estate Crop Field	924	(10.0%)
	Bush	-	(0.0%)
	Dry Farm Land	-	(0.0%)
	Grass Land	-	(0.0%)
	Forest Area	-	(0.0%)
	Scrub Land	-	(0.0%)
	Grand Total	9,272	(100.0%)

Outside of Dike			
No.	Distance (m)	Length (m)	Land Use Type
1	0-3160	3,160	Bare Land
2	3160-3327	167	Rubber Dam
3	3327-4958	1,631	Bush
4	4958-5041	83	Dry Land Farm
5	5041-5420	379	Bush
6	5420-5792	372	Dry Land Farm
7	5792-5888	96	Bush
8	5888-6086	198	Dry Land Farm
9	6086-6350	264	Bush
10	6350-7066	716	Dry Land Farm
11	7066-7319	253	Bush/Bare Land
12	7319-7584	265	Dry Land Farm
13	7584-7851	267	Bush/Bare Land
14	7851-8223	383	Dry Land Farm
15	8223-9028	794	Bush/Bare Land
16	9028-9272	244	Dry Land Farm

Total			
	Water Body	-	(0.0%)
	Bare Land	3,160	(34.1%)
	Paddy Field	167	(1.8%)
	Settlement	-	(0.0%)
	Estate Crop Field	-	(0.0%)
	Bush	3,684	(39.7%)
	Dry Farm Land	2,261	(24.4%)
	Grass Land	-	(0.0%)
	Forest Area	-	(0.0%)
	Scrub Land	-	(0.0%)
	Grand Total	9,272	(100.0%)

Note:

Water Body	Area that covered by water e.g. river, canal
Bare Land	Empty Area from plants or artificial activities e.g. river deposit bar
Paddy Field	Area that planted by paddy
Settlement	Housing Area and it surrounding, including front yard, back yard, plantation between houses
Estate Crop Field	Area that dominated by estate trees, usually around settlement
Bush	Area that dominated by bushes
Dry Farm Land	Farm area that dominated by dry farm e.g. non-irrigated agricultural field, sugar cane field, corn field, etc.
Grass Land	Area that dominated by grass for livestock's
Forest Area	Area that dominated by forest trees, commonly in hilly or mountainous area
Scrub Land	Area that dominated by scrubs plants

Table 1.1 Land Use in River Administration Area along River Dike Section (2/2)

Right Bank from River Mouth to Sungguminasa Bridge

Inside of Dike			
No.	Distance (m)	Length (m)	Land Use Type
1	0-1045	1045	Bare Land, Bush
2	1045-1976	931	Bush, Bare Land
3	1976-2000	24	Settlement
4	2000-3427	1427	Bush, Bare Land
5	3427-3440	13	Settlement
6	3440-3752	312	Bush
7	3752-4573	821	Bare Land, Bush
8	4573-5118	545	Bush, Bare Land
9	5118-5526	408	Estate Crop Field
10	5526-5624	98	Bush
11	5624-5745	121	Settlement
12	5745-6023	278	Bush
13	6023-6426	403	Settlement
14	6426-6759	333	Bush
15	6759-6871	112	Water Pond
16	6871-7188	317	Bush
17	7188-8402	1214	Dry Farm Land
18	8402-10040	1638	Bush, Bare Land
19	10040-10460	420	Dry Farm Land
20	10460-10670	210	Bare Land, Bush
21	10670-11020	350	Dry Farm Land
22	11020-11510	490	Bush
23	11510-11680	170	Settlement
24	11680-11880	200	Bare Land, Bush

Total			
	Water Body	112	(0.9%)
	Bare Land	2,276	(19.2%)
	Paddy Field	-	(0.0%)
	Settlement	731	(6.2%)
	Estate Crop Field	408	(3.4%)
	Bush	6,369	(53.6%)
	Dry Farm Land	1,984	(16.7%)
	Grass Land	-	(0.0%)
	Forest Area	-	(0.0%)
	Scrub Land	-	(0.0%)
	Grand Total	11,880	(100.0%)

Outside of Dike			
No.	Distance (m)	Length (m)	Land Use Type
1	0-342	342	Bush, Bare Land
2	342-770	428	Dry Farm Land
3	770-912	142	Bush
4	912-1145	233	Water Body
5	1145-1287	142	Bush
6	1287-1532	245	Dry Farm Land
7	1532-1813	281	Bush
8	1813-1989	176	Paddy Field
9	1989-2134	145	Settlement
10	2134-2539	405	Paddy Field
11	2539-2984	445	Settlement
12	2984-3167	183	Paddy Field
13	3167-3426	259	Grass Land
14	3426-3440	14	Rubber Dam
15	3440-4456	1016	Bush
16	4456-10190	5734	Settlement
17	10190-10290	100	Paddy Field
18	10290-10670	380	Settlement
19	10670-11020	350	Paddy Field
20	11020-11290	270	Estate Crop Field
21	11290-11510	220	Settlement
22	11510-11680	170	Paddy Field
23	11680-11880	200	Dry Farm Land

Total			
	Water Body	233	(2.0%)
	Bare Land	-	(0.0%)
	Paddy Field	1,398	(11.8%)
	Settlement	6,924	(58.3%)
	Estate Crop Field	270	(2.3%)
	Bush	1,923	(16.2%)
	Dry Farm Land	873	(7.3%)
	Grass Land	259	(2.2%)
	Forest Area	-	(0.0%)
	Scrub Land	-	(0.0%)
	Grand Total	11,880	(100.0%)

Note:

Water Body	Area that covered by water e.g. river, canal
Bare Land	Empty Area from plants or artificial activities e.g. river deposit bar
Paddy Field	Area that planted by paddy
Settlement	Housing Area and it surrounding, including front yard, back yard, plantation between houses
Estate Crop Field	Area that dominated by estate trees, usually around settlement
Bush	Area that dominated by bushes
Dry Farm Land	Farm area that dominated by dry farm e.g. Non-irrigated agricultural field, sugar cane field, corn field, etc.
Grass Land	Area that dominated by grass for livestock's
Forest Area	Area that dominated by forest trees, commonly in hilly or mountainous area
Scrub Land	Area that dominated by scrubs plants

Table 1.2 Land Use in River Administration Area along Non-dike River Dike Section (1/2)

Left Bank from Sungguminasa Bridge to Bili-Bili Dam

No.	Distance (m)	Length (m)	Area (ha)	Land Use Type
1 -1	9270-10490	1220	12.85	Settlement
1 -2			0.14	Paddy Field
2 -1	10490-11240	750	2.92	Bare Land
2 -2			4.19	Settlement
2 -3			0.65	Paddy Field
3 -1	11240-11430	1190	13.32	Paddy Field
3 -2			1.76	Settlement
4 -1	11430-13470	1040	6.15	Bare Land
4 -2			3.68	Dry Land Farm
4 -3			1.21	Paddy Field
4 -4			0.09	Estate Crop Field
5 -1	13470-15560	2090	10.14	Dry Land Farm
5 -2			8.46	Estate Crop Field
5 -3			2.02	Paddy Field
6 -1	15560-16220	660	3.02	Bare Land
6 -2			0.85	Dry Land Farm
6 -3			2.91	Paddy Field
7 -1	16220-16490	270	2.39	Paddy Field
7 -2			0.70	Estate Crop Field
7 -3			0.07	Settlement
8 -1	16490-17760	1270	7.11	Bare Land
8 -2			6.03	Paddy Field
8 -3			1.44	Dry Land Farm
8 -4			2.29	Estate Crop Field
9 -1	17760-17880	120	0.67	Estate Crop Field
9 -2			0.48	Paddy Field
9 -3			0.02	Bare Land
10 -1	17880-18860	980	2.95	Bare Land
10 -2			8.52	Estate Crop Field
10 -3			0.02	Settlement
11 -1	18860-18920	60	0.58	Estate Crop Field
11 -2			0.04	Dry Land Farm
12 -1	18920-19060	140	1.28	Dry Land Farm
12 -2			0.01	Estate Crop Field
13 -1	19060-19660	600	4.50	Bare Land
13 -2			2.32	Dry Land Farm
13 -3			0.08	Water Body
13 -3			1.33	Estate Crop Field
14 -1	19660-19970	310	2.66	Estate Crop Field
14 -2			0.34	Water Body
14 -3			1.29	Paddy Field
15 -1	19970-20150	180	1.88	Paddy Field
16 -1	20150-20830	680	3.56	Bare Land
16 -2			0.61	Estate Crop Field
16 -3			1.01	Paddy Field
16 -4			1.90	Dry Land Farm
17 -1	20830-20940	110	1.19	Dry Land Farm
17 -2			0.05	Water Body
18 -1	20940-23740	2800	6.84	Bare Land
18 -2			17.86	Dry Land Farm
18 -3			1.50	Estate Crop Field
18 -4			3.50	Paddy Field
19 -1	23740-23910	170	1.87	Paddy Field
20 -1	23910-24900	990	7.03	Bare Land
20 -2			4.32	Estate Crop Field
20 -3			1.74	Dry Land Farm
20 -4			0.73	Paddy Field
20 -5			1.10	Forest Area
20 -6			0.02	Scrub Land
21 -1	24900-25330	430	3.50	Dry Land Farm
21 -2			0.87	Forest Area
22 -1	25330-27340	2010	6.30	Bare Land
22 -2			9.36	Dry Land Farm
22 -3			5.25	Grass Land
22 -4			1.04	Scrub Land
23 -1	27340-27450	110	0.46	Scrub Land
23 -2			0.82	Grass Land
24 -1	27450-29110	1660	11.97	Bare Land
24 -2			1.57	Dry Land Farm
24 -3			0.05	Grass Land
24 -4			0.13	Scrub Land
24 -5			3.60	Estate Crop Field
24 -6			0.01	Paddy Field
24 -7			0.57	Settlement
25 -1	29110-30110	1180	11.44	Estate Crop Field
25 -2			2.22	Settlement
25 -3			1.83	Paddy Field

Total	Water Body	-	0.47	0.2%
	Bare Land	13,440	62.37	26.1%
	Paddy Field	1,810	41.27	17.3%
	Settlement	1,220	21.68	9.1%
	Estate Crop Field	1,670	46.78	19.6%
	Bush	-	-	0.0%
	Dry Farm Land	2,770	56.87	23.8%
	Grass Land	-	6.12	2.6%
	Forest Area	-	1.97	0.8%
	Scrub Land	110	1.65	0.7%
	Grand Total	21,020	239.18	100.0%

Note:

Water Body	Area that covered by water e.g. river, canal
Bare Land	Empty Area from plants or artificial activities e.g. river deposit bar
Paddy Field	Area that planted by paddy
Settlement	Housing Area and it surrounding, including front yard, back yard, plantation between houses
Estate Crop Field	Area that dominated by estate trees, usually around settlement
Bush	Area that dominated by bushes
Dry Farm Land	Farm area that dominated by dry farm e.g. non-irrigated agricultural field, sugar cane field, corn field, etc
Grass Land	Area that dominated by grass for livestock's
Forest Area	Area that dominated by forest trees, commonly in hilly or mountainous area
Scrub Land	Area that dominated by scrubs plants

Table 1.2 Land Use in River Administration Area along Non-dike River Dike Section (2/2)

Right Bank from Sungguminasa Bridge to Bili-Bili Dam

No.	Distance (m)	Length (m)	Area (ha)	Land Use Type
1 -1	11440-11700	260	1.49	Bare Land
1 -2			1.09	Settlement
2 -1	11700-11880	180	1.58	Bare Land
2 -2			0.08	Settlement
3 -1	11880-12110	230	2.33	Paddy Field
3 -2			0.10	Bare Land
4 -1	12110-12390	280	3.18	Bare Land
4 -2			0.28	Paddy Field
5 -1	12390-12480	90	0.89	Paddy Field
5 -2			0.23	Bare Land
6 -1	12480-13140	660	5.44	Bare Land
6 -2			1.86	Paddy Field
7 -1	13140-13500	360	2.60	Paddy Field
7 -2			1.05	Estate Crop Field
8 -1	13500-14310	810	7.08	Estate Crop Field
8 -2			1.12	Paddy Field
8 -3			0.23	Settlement
8 -4			0.01	Dry Land Farm
9 -1	14310-15930	1620	12.79	Dry Land Farm
9 -2			3.61	Settlement
9 -3			0.09	Water Body
10 -1	15930-16430	500	5.23	Settlement
11 -1	16430-16820	390	2.23	Dry Land Farm
11 -2			0.63	Settlement
11 -3			0.59	Paddy Field
11 -4			0.49	Estate Crop Field
12 -1	16820-16890	70	0.45	Paddy Field
12 -2			0.38	Estate Crop Field
13 -1	16890-17640	750	2.31	Bare Land
13 -2			4.33	Estate Crop Field
13 -3			1.36	Paddy Field
13 -4			0.66	Settlement
14 -1	17640-18210	570	5.42	Paddy Field
14 -2			0.77	Estate Crop Field
14 -3			0.01	Bare Land
15 -1	18210-18380	170	1.41	Dry Land Farm
15 -2			0.52	Paddy Field
15 -3			0.01	Bare Land
16 -1	18380-18920	540	6.90	Bare Land
16 -2			0.77	Dry Land Farm
16 -3			0.10	Estate Crop Field
17 -1	18920-19250	330	2.50	Dry Land Farm
17 -2			0.38	Paddy Field
17 -3			0.52	Estate Crop Field
18 -1	19250-19350	100	0.87	Estate Crop Field
18 -2			0.09	Dry Land Farm
18 -3			0.01	Paddy Field
19 -1	19350-20430	1080	4.03	Bare Land
19 -2			5.54	Settlement
19 -3			2.76	Estate Crop Field
19 -4			0.47	Paddy Field
20 -1	20430-20600	170	0.41	Estate Crop Field
20 -2			1.32	Dry Land Farm
20 -3			0.01	Paddy Field
21 -1	20600-20900	300	1.65	Dry Land Farm
21 -2			1.27	Estate Crop Field
21 -3			0.08	Settlement
22 -1	20900-21020	120	1.29	Estate Crop Field
22 -2			0.06	Settlement
23 -1	21020-21080	60	0.21	Paddy Field
23 -2			0.94	Estate Crop Field
24 -1	21080-21300	220	1.43	Estate Crop Field
24 -2			1.11	Paddy Field
25 -1	21300-21580	280	3.14	Paddy Field
25 -2			0.03	Estate Crop Field
26 -1			1.08	Paddy Field
26 -1	21580-21730	150	0.49	Estate Crop Field
27 -1	21730-21820	90	1.20	Paddy Field
27 -2			0.02	Estate Crop Field
28 -1	21820-22260	440	4.38	Dry Land Farm
28 -2			0.04	Paddy Field
29 -1	22260-22490	1230	1.23	Estate Crop Field
29 -2			1.16	Dry Land Farm
30 -1	22490-23730	240	5.30	Bare Land
30 -2			5.77	Dry Land Farm
30 -3			1.27	Estate Crop Field
30 -4			0.52	Water Body
31 -1	23730-23910	180	1.72	Dry Land Farm
31 -2			0.10	Paddy Field
32 -1	23910-24370	460	5.22	Paddy Field
33 -1	24730-25380	1010	7.93	Bare Land
33 -2			2.57	Dry Land Farm
33 -3			0.31	Paddy Field
34 -1	25380-25570	190	1.39	Dry Land Farm
35 -1	25570-26160	590	6.78	Bare Land
35 -2			0.94	Estate Crop Field
35 -3			0.87	Dry Land Farm
36 -1	26160-27050	890	1.24	Grass Land
36 -2			0.31	Bare Land
37 -1	27050-27210	160	3.91	Bare Land
37 -2			3.30	Grass Land
37 -3			0.90	Estate Crop Field
37 -4			0.02	Dry Land Farm
38 -1	27210-27450	240	0.59	Estate Crop Field
38 -2			0.78	Dry Land Farm
38 -3			0.45	Paddy Field
39 -1	27450-27530	80	0.26	Bare Land
39 -2			1.42	Dry Land Farm
39 -3			0.87	Paddy Field
39 -4			0.03	Estate Crop Field
40 -1	24530-30450	2920	0.16	Estate Crop Field
40 -2			0.62	Paddy Field
40 -3			0.09	Scrub Land
41 -1	30450-30760	310	21.77	Bare Land
41 -2			6.65	Estate Crop Field
41 -3			1.14	Scrub Land
41 -4			0.21	Paddy Field
41 -5			2.05	Dry Land Farm
41 -6			0.33	Grass Land
41 -7			0.62	Settlement
42 -1	30760-31520	760	2.99	Scrub Land
42 -2			56.27	Bili-Bili Dam Comple
42 -3			0.05	Scrub Land
43 -1	31520-32110	590	4.44	Settlement
43 -2			1.57	Paddy Field
43 -3			0.10	Bili-Bili Dam Comple

Total	Water Body	-	0.61	0.2%
	Bare Land	6,140	127.91	46.5%
	Paddy Field	2,210	34.42	12.5%
	Settlement	1,090	22.27	8.1%
	Estate Crop Field	5,960	36	13.1%
	Bush	-	0	0.0%
	Dry Farm Land	3,620	44.9	16.3%
	Grass Land	890	4.87	1.8%
	Forest Area	-	0	0.0%
	Scrub Land	760	4.27	1.6%
	Grand Total	20,670	275.25	100.0%

Water Body	Area that covered by water e.g. river, canal
Bare Land	Empty Area from plants or artificial activities e.g. river deposit bar
Paddy Field	Area that planted by paddy
Settlement	Housing Area and it surrounding, including front yard, back yard, plantation between houses
Estate Crop Field	Area that dominated by estate trees, usually around settlement
Bush	Area that dominated by bushes
Dry Farm Land	Farm area that dominated by dry farm e.g. non-irrigated agricultural field, sugar cane field, corn field, etc
Grass Land	Area that dominated by grass for livestock's
Forest Area	Area that dominated by forest trees, commonly in hilly or mountainous area
Scrub Land	Area that dominated by scrubs plants

Table 2.1 List of River Infrastructure

Structure			River		Number of Units	Structural Type	Structural Size	Year of Completion
1st Classification	2nd Classification	Major Component	Name of River	River Order				
Riparian Structure	Jetty		Jeneberang	1st	1	Rubble Aggregate	4.5 m (W) x 3.5m (H) x 100m (L)	1993
	River Dike	Right Lower Dike	Jeneberang	1st	1	Earth Dike	4,920 m in length	1993
		Right Upper Dike	Jeneberang	1st	1	Earth Dike	6,740 m in length	1992
		Left Lower Dike	Jeneberang	1st	1	Earth Dike	4,950 m in length	1993
		Left Upper Dike	Jeneberang	1st	1	Earth Dike	4,700 m in length	1992
	Revetment	Low Water Dike (1)	Jeneberang	1st	1	Random Masonry	425 m in length	1993
		Low Water Dike (2)	Jeneberang	1st	1	Dry Masonry	996 m in length	1993
		Low Water Dike (3)	Jeneberang	1st	1	Wet Masonry	250 m in length	1993
		Low Water Dike (4)	Jeneberang	1st	1	Wet Masonry	927 m in length	1992
		Low Water Dike (5)	Jeneberang	1st	1	Wet Masonry	1,370 m in length	1992
		Low Water Dike (6)	Jeneberang	1st	1	Wet Masonry	1,045 m in length	1992
		High Water Dike (1)	Jeneberang	1st	1	Wet Masonry	1,990 m in length	1993
		High Water Dike (2)	Jeneberang	1st	1	Wet Masonry	305 m in length	1992
		High Water Dike (3)	Jeneberang	1st	1	Wet Masonry	2,305 m in length	1992
		High Water Dike (4)	Jeneberang	1st	1	Wet Masonry	680 m in length	1993
		High Water Dike (5)	Jeneberang	1st	1	Wet Masonry	420 m in length	1993
		High Water Dike (6)	Jeneberang	1st	1	Wet Masonry	684 m in length	1992
	Groundsill	Lower Groundsill	Jeneberang	1st	1	Concrete Apron and Bed Protection with Gabion Mattress	Approx. 200m (W)	1992
		Upper Groundsill	Jeneberang	1st	1			1992
	Groyne	Groyne (R-1)	Jeneberang	1st	3	Pile Groyne of Permeable Type	6m (W) x 1.5m (H) x 5 to 29m (L)	1993
		Groyne (R-2)	Jeneberang	1st	7			1993
		Groyne (R-3)	Jeneberang	1st	3			1993
		Groyne (R-4)	Jeneberang	1st	8			1992
		Groyne (R-5)	Jeneberang	1st	5			1992
		Groyne (L-1)	Jeneberang	1st	3			1993
		Groyne (L-2)	Jeneberang	1st	4			1993
		Groyne (L-3)	Jeneberang	1st	4			1992
		Groyne (L-4)	Jeneberang	1st	6			1992
	Drainage Sluice Gate	Bayang	Jeneberang	1st	1	Box Culvert with Steel Slide Gate	2.0m(W) x 2.0m(H) x 2units x 19.0m (L)	1993
		Taeng	Jeneberang	1st	1		2.0m(W) x 2.0m(H) x 2units x 16.5m (L)	1992
		Lambengi	Jeneberang	1st	1		1.5m(W) x 1.5m(H) x 1unit x 16.0m (L)	1992
		K7.00	Jeneberang	1st	1		1.5m(W) x 1.5m(H) x 1unit x 16.5m (L)	1992
		Bili-Bili	Jeneberang	1st	1		1.5m(W) x 1.5m(H) x 1unit x 16.0m (L)	1992
		Sungguminasa	Jeneberang	1st	1		1.7m(W) x 1.7m(H) x 1unit x 16.3m (L)	1992
		K9.10	Jeneberang	1st	1		1.5m(W) x 1.5m(H) x 1unit x 16.5m (L)	1992
		K9.60	Jeneberang	1st	1		1.5m(W) x 1.5m(H) x 1unit x 16.0m (L)	1992
		Batang Kaluku No.1	Jeneberang	1st	1		1.7m(W) x 1.7m(H) x 2units x 17.5m (L)	1992
		Batang Kaluku No.2	Jeneberang	1st	1		1.7m(W) x 1.7m(H) x 2units x 17.5m (L)	1992
		Batang Kaluku No.3	Jeneberang	1st	1		1.7m(W) x 1.7m(H) x 2units x 17.5m (L)	1992
Irrigation Intake Weir	Bissua Weir	Diversion Weir	Jeneberang	1st	1	Concrete gravity	239.3m (L) x 8.2m (H)	2004
		Intake Structure	Jeneberang	1st	1	Fixed wheel	3.0m (W) x 1.9m (H) x 4gates	
	Kampili Weir	Diversion Weir	Jeneberang	1st	1	Masonry	91.0m (L) x 9.0m (H)	2004
		Intake Structure	Jeneberang	1st	1	Steel slide	2.05m (W) x 1.5m (H) x 4 gates	
	Bili-Bili Weir	Diversion Weir	Jeneberang	1st		Concrete gravity	69.0m (L) x 2.0m (H)	2004
		Intake Structure	Jeneberang	1st		Fixed wheel	2.5m (W) x 1.2m (H) x 2 gates	
Bili-Bili Dam	Dam Body	Main Dam	Jeneberang	1st	1	Center core type rockfill	10m (W) x 73m (H) x 750m (L)	1999
		Left Wing Dam	Jeneberang	1st	1	Center core type rockfill	10m (W) x 42m (H) x 646m (L)	1999
		Right Wing Dam	Jeneberang	1st	1	Center core type rockfill	10m (W) x 52m (H) x 412m (L)	1999
	Non-gated Spillway	Free Flow Crest	Jeneberang	1st	1	Free flow crest	70m (H) with	1999
		Chuteway	Jeneberang	1st	1	Straite open chute	55m to 99.5m (W) x 225m (L)	1999
		Stilling Basin	Jeneberang	1st	1	Horizontal apron type	75m (W) x 65m (L)	1999
		Outlet Channel	Jeneberang	1st	1	Channel without timebering	100m (W) x 400m (L)	1999
	Outlet Waterway	Intake Structure	Jeneberang	1st	1	Inclined concrete pipe	51.5m (H)	1999
		Outlet Pipe	Jeneberang	1st	1	Steel Conduit	3.7m (dia.) x 285m (L)	1999
		Dissipater Basin	Jeneberang	1st	1	Hydraulic jump type	4.0m (W) x 74.1m (L)	1999
		Diversion Works	Jeneberang	1st	1	Concrete channel with overflow wier	17.0m (W) x 50m (L)	1999
	Gate	Regular Gates	Jeneberang	1st	2	Roller Gate	7.9m(W) x 7.7m (H) x 2units	1999
		Bulkhead Gate	Jeneberang	1st	1	Roller Gate	3.7m (W) x 5.2m (H)	1999
		Control Gate	Jeneberang	1st	1	Jet Flow Gate	2.0m (dia.)	1999
		Guard Gate	Jeneberang	1st	1	Gate Valve	2.0m (dia.)	1999
	Building	Control Station	Jeneberang	1st	1	RC Frame Building	1,141 m2, 2-storey	1999
		Monitoring Station	Jeneberang	1st	1	RC Frame Building	2,592m2, 2-storey	1999
	Dam Remote Control Device	Gate Flow Meter	Jeneberang	1st	3			1999
		Gate Opening Gauge	Jeneberang	1st	4			1999
		PLC	Jeneberang	1st	1			1999
		CPU	Jeneberang	1st	5			1999
		Remote Control Console	Jeneberang	1st	1			1999
		Display Panel	Jeneberang	1st	2			1999
		Printer	Jeneberang	1st	3			1999
	Telemetry Hydrological Gauging Station	Bayang	Jeneberang	1st	1	Water Level Gauging Station		1999
		Maccinni Sombala	Jeneberang	1st	1	Rain/Water Level Gauging Station		1999
		Kampili	Jeneberang	1st	1	Rain/Water Level Gauging Station		1999
		Bont Jai	Jeneberang	1st	1	Water Level Gauging Station		1999
		Jonggoa	Jeneberang	1st	1	Rain/Water Level Gauging Station		1999
		Bili-Bili	Jeneberang	1st	1	Telemetry Gauging Station		1999
		Malino	Salo Malino	2nd	1	Rain Gauging Station		1999
		Jenelata	Jenelata	2nd	1	Water Level Gauging Station		1999
		Mangempang	Jenelata	2nd	1	Rain gauging Station		1999
		Limbunga	Jenelata	2nd	1	Rain Gauge Station		1999
RWTM	Water Transmission Pipe	Raw Water Trasmission Main (RWTM)	Jeneberang	1st	1	Single Pipe Line	6.63km (L) with 1,650mm in dia., 10.38km (L) with 1,500mm in dia.	1996
Sand Pocket and Sabo Dam	Sand Pocket Dam		Jeneberang	1st	1	Gravity dam by wet stone masonry	3m (W) x 620m (L) x 7.5m (H)	1997
	Sand Pocket Dam No.3		Jeneberang	1st	1	Gravity dam by rubble-concrete	3m (W) x 336m (L) x 7.0m (H)	1997
	Sand Pocket Dam No.2		Jeneberang	1st	1	Gravity dam by wet stone masonry	3m (W) x 465m (L) x 7.0m (H)	1998
	Sand Pocket Dam No. 4		Jeneberang	1st	1	Gravity dam by wet stone masonry	3m (W) x 644m (L) x 7.0m (H)	2000
	Sand Pocket Dam No. 5		Jeneberang	1st	1	Gravity dam by wet stone masonry	3m (W) x 441m (L) x 7.0m (H)	2000
	Sabo Dam No. 4		Jeneberang	1st	1	Gravity dam by wet stone masonry	3m (W) x 150m (L) x 8.0m (H)	2000
	Sabo Dam No. 8		Salo Kausisi	2nd	1	Gravity dam by wet stone masonry	3m (W) x 104m (L) x 10.0m (H)	2001
	Sabo Dam No. 6		Salo Malino	2nd	1	Gravity dam by wet stone masonry	3m (W) x 230m (L) x 10.0m (H)	2001
						Sub-total		
Long Storage and Rubber Dam	Barrage		Long Storage	2nd		Earth dike	200m (W) x 200m (L) x 3.5m (H)	1993
	Outlet Sluice		Long Storage	2nd		Box culvert		1993
	Revetment		Long Storage	2nd		Wet Masonry	400m in length	1993
	Tidal Gate		Long Storage	2nd		Steel Slide Gate	2.0m(W) x 2.0m(H) x 2 gates	1993
	Flushing Gate		Long Storage	2nd	1	Steel Gate	1.0m(W) x 1.6m(H) x 2 gates.	2001
	Revetment		Long Storage	2nd	1	Wet Masonry	2300m in length	2001
			Long Storage	2nd	1	Wet Masonry	2600m in length	2001
	Intake Sluice Gate		Long Storage	2nd	1	Box culvert with movable gates	2.0m(W) x 2.0m(H) x 2units x 42.74m (L)	1993
Rubber Dam	Rubber Dam		Jeneberang	1st	1	Inflatable rubber-dam	210m (W) x 2m(H) with main dam (3 spans x 59m) and sub-dam (2 spans x 9.5m)	1996

Table 4.1 Gate Operation Rule for Regular Gate and Control Gate during Pre -Flood and Flood Period

Step	Reservoir Water Level (EL.m)	Time Interval from the above Step (minute)	Regular Gate		Control Gate		Total Outflow Discharge (m^3/s)
			Gate Opening Height (m)	Out Flow Discharge (m^3/s)	Gate Opening Height (m)	Out Flow Discharge (m^3/s)	
1	99.40		0.0	0.0			
2	99.41		0.0	0.0			
3	99.41	10 mninuts from the beging of the above step	0.0	0.0	Open at 0.17m/step until the gate opening height reaches	Increase until outflow discharge reaches 42.4m^3/s.	Increase until outflow discharge reaches 49.4m^3/s.
4	99.42		0.0	0.0			
5	99.42	10 mninuts from the beging of the above step	0.0	0.0			
6	99.43		0.2	7.0	1.13	42.4	49.4
7	99.43	10 mninuts from the beging of the above step	0.3	27.1	113	42.4	69.5
8	99.44		0.5	49.9	113	42.4	92.3
9	99.44	10 mninuts from the beging of the above step	0.7	75.4	113	42.4	117.8
10	99.45		1.0	103.7	113	42.4	146.1
11	99.45	10 mninuts from the beging of the above step	1.30	134.8	113	42.4	177.2
12	99.46		1.60	168.6	113	42.4	211.0
13	99.46	10 mninuts from the beging of the above step	1.90	205.2	113	42.4	247.6
14	99.47		2.30	244.6	113	42.4	287.0
15	99.47	10 mninuts from the beging of the above step	2.80	286.6	113	42.4	329.0
16	99.48		3.30	331.4	113	42.4	373.8
17	99.48	10 mninuts from the beging of the above step	3.90	379.0	113	42.4	421.4
18	99.49		4.50	429.3	113	42.4	471.7
19	99.49	10 mninuts from the beging of the above step	5.10	482.3	113	42.4	524.7
20	99.50		5.50	538.1	113	42.4	580.5
21	99.50	10 mninuts from the beging of the above step	5.80	600.0	113 *	42.4	642.4

* : Gate should be closed when the reservoir water level reaches EL. 100.0m in order to avoid the overflow at the dissipator basin.

Table 4.2 Gate Operation Rule for Regular Gate and Guide Vane during Pre -Flood and Flood Period

Step	Reservoir Water Level (EL.m)	Time Interval from the above Step (minute)	Regular Gate		Guide Vane	Total Outflow Discharge (m^3/s)
			Gate Opening Height (m)	Out Flow Discharge (m^3/s)	Outflow Discharge (m^3/s)	
1	99.40		0.0	0.0		
2	99.41		0.0	0.0		
3	99.41	10 mninuts from the beging of the above step	0.0	0.0	Increase until outflow discharge reaches 44.8m^3/s.	Increase until outflow discharge reaches 49.4m^3/s.
4	99.42		0.0	0.0		
5	99.42	10 mninuts from the beging of the above step	0.0	0.0		
6	99.43		0.2	7.0	44.8	51.8
7	99.43	10 mninuts from the beging of the above step	0.3	27.1	44.8	71.9
8	99.44		0.5	49.9	44.8	94.7
9	99.44	10 mninuts from the beging of the above step	0.7	75.4	44.8	120.2
10	99.45		1.0	103.7	44.8	148.5
11	99.45	10 mninuts from the beging of the above step	1.30	134.8	44.8	179.6
12	99.46		1.60	168.6	44.8	213.4
13	99.46	10 mninuts from the beging of the above step	1.90	205.2	44.8	250.0
14	99.47		2.30	244.6	44.8	289.4
15	99.47	10 mninuts from the beging of the above step	2.80	286.6	44.8	331.4
16	99.48		3.30	331.4	44.8	376.2
17	99.48	10 mninuts from the beging of the above step	3.90	379.0	44.8	423.8
18	99.49		4.50	429.3	44.8	474.1
19	99.49	10 mninuts from the beging of the above step	5.10	482.3	44.8	527.1
20	99.50		5.50	538.1	44.8	582.9
21	99.50	10 mninuts from the beging of the above step	5.80	600.0	44.8*	644.8

*: The Guide Vane for Turbine 1 should be closed reducing its outflow disharge to 13.2m^3/s, when the reservoir water level reaches EL. 100.98m .

The Guide Vane for Turbine 2 should be futher closed reducing the total outflow disharge of guide vane to zero, when the reservoir water level reaches EL. 103m .

Table 4.3 Gate Operation Rule for Regular Gate and Control Gate during Post-Flood Period

Step	Reservoir Water Level (EL.m)	Time Interval from the above Step (minute)	Regular Gate		Control Gate		Total Outflow Discharge (m^3/s)
			Gate Opening Height (m)	Out Flow Discharge (m^3/s)	Gate Opening Height (m)	Out Flow Discharge (m^3/s)	
1	99.50		5.80	600.0	1.13	42.4	642.4
2	99.49		5.50	538.1	113	42.4	580.5
3	99.49	10 mninuts from the beging of the above step	5.10	482.3	113	42.4	524.7
4	99.48		4.50	429.3	113	42.4	471.7
5	99.48	10 mninuts from the beging of the above step	3.90	379.0	113	42.4	421.4
6	99.47		3.30	331.4	113	42.4	373.8
7	99.47	10 mninuts from the beging of the above step	2.80	286.6	113	42.4	329.0
8	99.46		2.30	244.6	113	42.4	287.0
9	99.46	10 mninuts from the beging of the above step	1.90	205.2	113	42.4	247.6
10	99.45		1.60	168.6	113	42.4	211.0
11	99.45	10 mninuts from the beging of the above step	1.30	134.8	113	42.4	177.2
12	99.44		1.0	103.7	113	42.4	146.1
13	99.44	10 mninuts from the beging of the above step	0.7	75.4	113	42.4	117.8
14	99.43		0.5	49.9	113	42.4	92.3
15	99.43	10 mninuts from the beging of the above step	0.3	27.1	113 *	42.4	69.5
16	99.42		0.2	7.0			
17	99.42	10 mninuts from the beging of the above step	0.0	0.0			
18	99.41		0.0	0.0			
19	99.41	10 mninuts from the beging of the above step	0.0	0.0			
20	99.40		0.0	0.0			
21	99.40	10 mninuts from the beging of the above step	0.0	0.0			

Close at 0.17m/step until outflow dischage drops to be equal to downstream water demand.

Decrease until outflow dischage drops to be equal to downstream water demand.

Decrease until outflow dischage drops to be equal to downstream water demand.

Table 4.4 Gate Operation Rule for Regular Gate and Guide Vane during Post Period

Step	Reservoir Water Level (EL.m)	Time Interval from the above Step (minute)	Regular Gate		Guide Vane	Total Outflow Discharge (m^3/s)
			Gate Opening Height (m)	Out Flow Discharge (m^3/s)	Out Flow Discharge (m^3/s)	
1	99.50		5.80	600.0	44.8	644.8
2	99.49		5.50	538.1	44.8	582.9
3	99.49	10 mninuts from the beging of the above step	5.10	482.3	44.8	527.1
4	99.48		4.50	429.3	44.8	474.1
5	99.48	10 mninuts from the beging of the above step	3.90	379.0	44.8	423.8
6	99.47		3.30	331.4	44.8	376.2
7	99.47	10 mninuts from the beging of the above step	2.80	286.6	44.8	331.4
8	99.46		2.30	244.6	44.8	289.4
9	99.46	10 mninuts from the beging of the above step	1.90	205.2	44.8	250.0
10	99.45		1.60	168.6	44.8	213.4
11	99.45	10 mninuts from the beging of the above step	1.30	134.8	44.8	179.6
12	99.44		1.0	103.7	44.8	148.5
13	99.44	10 mninuts from the beging of the above step	0.7	75.4	44.8	120.2
14	99.43		0.5	49.9	44.8	94.7
15	99.43	10 mninuts from the beging of the above step	0.3	27.1	44.8	71.9
16	99.42		0.2	7.0	↑	↑
17	99.42	10 mninuts from the beging of the above step	0.0	0.0		
18	99.41		0.0	0.0	Decrease until outflow dischage drops to be equal to downstream water demand.	Decrease until outflow dischage drops to be equal to downstream water demand.
19	99.41	10 mninuts from the beging of the above step	0.0	0.0		
20	99.40		0.0	0.0	↓	↓
21	99.40	10 mninuts from the beging of the above step	0.0	0.0		

Table 11.1 Diversion Water Requirement Granted by JRBDP for the Source of Jeneberang River

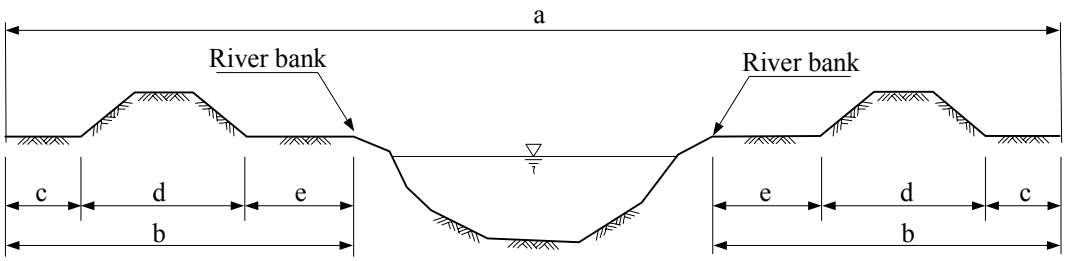
(unit: m^3/s)

Water User			Water Requirement											
Sector	Name of User	Intake Point	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Irrigation	Bili-Bili Irrigation	Bili-Bili Weie	0.88	0.00	0.00	2.20	2.96	2.95	2.69	1.36	0.76	0.45	0.00	0.14
	Bissua Irrigation	Bissua Weir	4.00	0.00	0.00	10.07	13.51	13.48	12.29	6.21	3.45	2.08	0.00	0.66
	Kampili Irrigation	Kampili Weir	3.92	0.00	0.00	9.85	13.20	13.18	12.02	6.07	3.38	2.03	0.00	0.64
	Sub-total		8.80	0.00	0.00	22.13	29.67	29.61	27.01	13.64	7.59	4.56	0.00	1.44
Municipal	PDAM Makassar	Somba Opu	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31	1.31
		Ratulangi	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
		Macchini Simbala	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
		Panaikang	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.50	0.50	0.00	0.00
	PDAM Gowa	Bajeng	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
		Borong Loe	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
		Tompo Balang	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
		Pandang-Pandang	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
	Sub-total		1.66	1.66	1.66	1.66	2.16	2.16	2.16	2.16	2.16	2.16	1.66	1.66
Industry	Takalar Sugar Factory	Bissua Weir	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
River Maintenance	None	None	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total			11.96	3.16	3.16	25.29	33.33	33.27	30.67	17.30	11.25	8.22	3.16	4.60

(unit: $10^6 m^3$)

Water User			Water Requirement												
Sector	Name of User	Intake Point	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
Irrigation	Bili-Bili Irrigation	Bili-Bili Weie	2.35	0.00	0.00	5.71	7.92	7.64	7.21	3.64	1.96	1.22	0.00	0.38	38.03
	Bissua Irrigation	Bissua Weir	10.72	0.00	0.00	26.11	36.17	34.94	32.93	16.63	8.95	5.56	0.00	1.76	173.77
	Kampili Irrigation	Kampili Weir	10.49	0.00	0.00	25.53	35.37	34.16	32.20	16.26	8.75	5.43	0.00	1.72	169.91
	Sub-total		23.56	0.00	0.00	57.36	79.46	76.74	72.33	36.53	19.66	12.21	0.00	3.86	381.70
Municipal	PDAM Makassar	Somba Opu	3.51	3.17	3.51	3.40	3.51	3.40	3.51	3.51	3.40	3.51	3.40	3.51	41.31
		Ratulangi	0.18	0.17	0.19	0.18	0.19	0.18	0.19	0.19	0.18	0.19	0.18	0.19	2.20
		Macchini Simbala	0.25	0.22	0.24	0.23	0.24	0.23	0.24	0.24	0.23	0.24	0.23	0.24	2.84
		Panaikang	0.00	0.00	0.00	0.00	1.34	1.30	1.34	1.34	1.30	1.34	0.00	0.00	7.95
	PDAM Gowa	Bajeng	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.63
		Borong Loe	0.04	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.33
		Tompo Balang	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.94
		Pandang-Pandang	0.35	0.31	0.35	0.34	0.35	0.34	0.35	0.35	0.34	0.35	0.34	0.35	4.11
	Sub-total		4.45	4.02	4.45	4.30	5.79	5.60	5.79	5.79	5.60	5.79	4.30	4.45	60.30
Industry	Takalar Sugar Factory	Bissua Weir	1.34	1.21	1.34	1.30	1.34	1.30	1.34	1.34	1.30	1.34	1.30	1.34	15.77
River Maintenance	None	None	2.68	2.42	2.68	2.59	2.68	2.59	2.68	2.68	2.59	2.68	2.59	2.68	31.54
Total			32.03	7.64	8.46	65.55	89.26	86.23	82.14	46.33	29.15	22.01	8.19	12.33	489.31

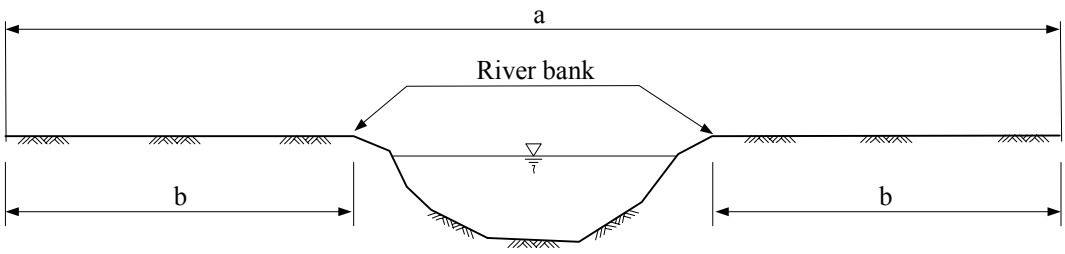
River with Dyke



Notes:

a : River administration area
b : River Corridor
c : W = 3m in urban area, W = 5m in rural area
d : River dyke area
e : Flood channel

River without Dyke



Notes:

a : River administration area
b : River corridor (W = 100 m (A > 500 km^2), W = 50 m (A < 500 km^2))

Figure 1.1 River Administration by Public Corporation

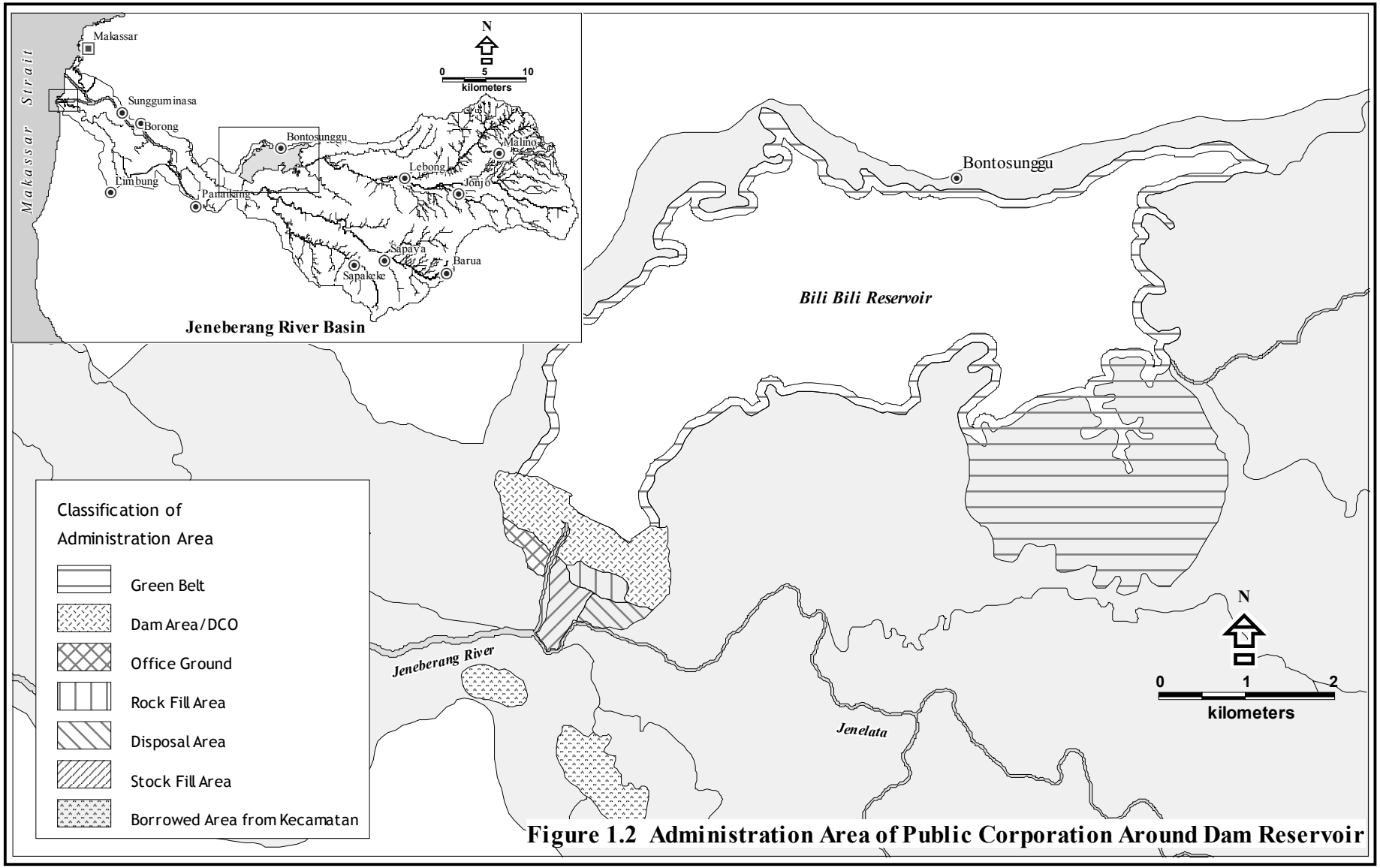


Figure 1.2 Administration Area of Public Corporation Around Dam Reservoir

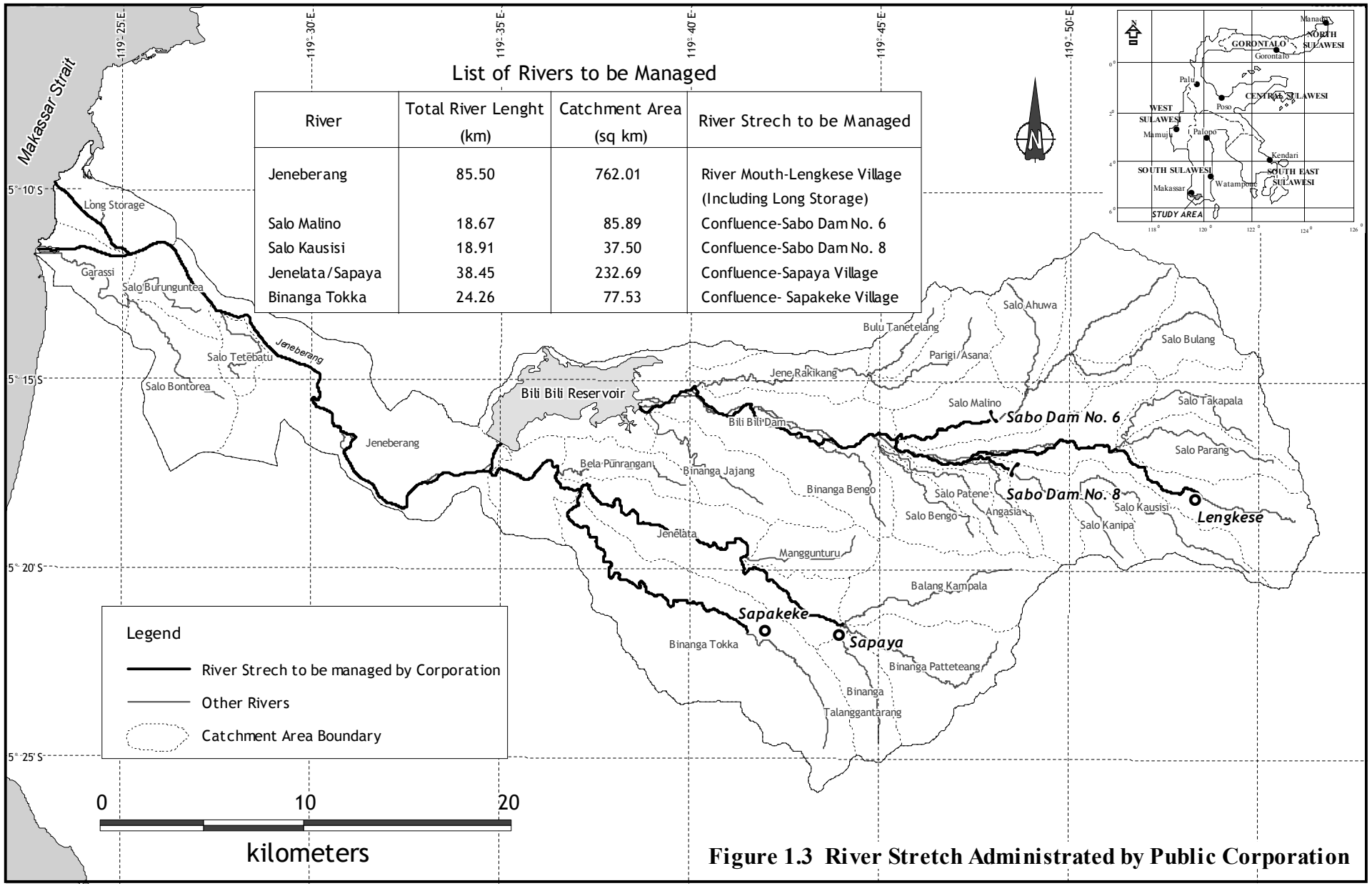


Figure 1.3 River Stretch Administrated by Public Corporation

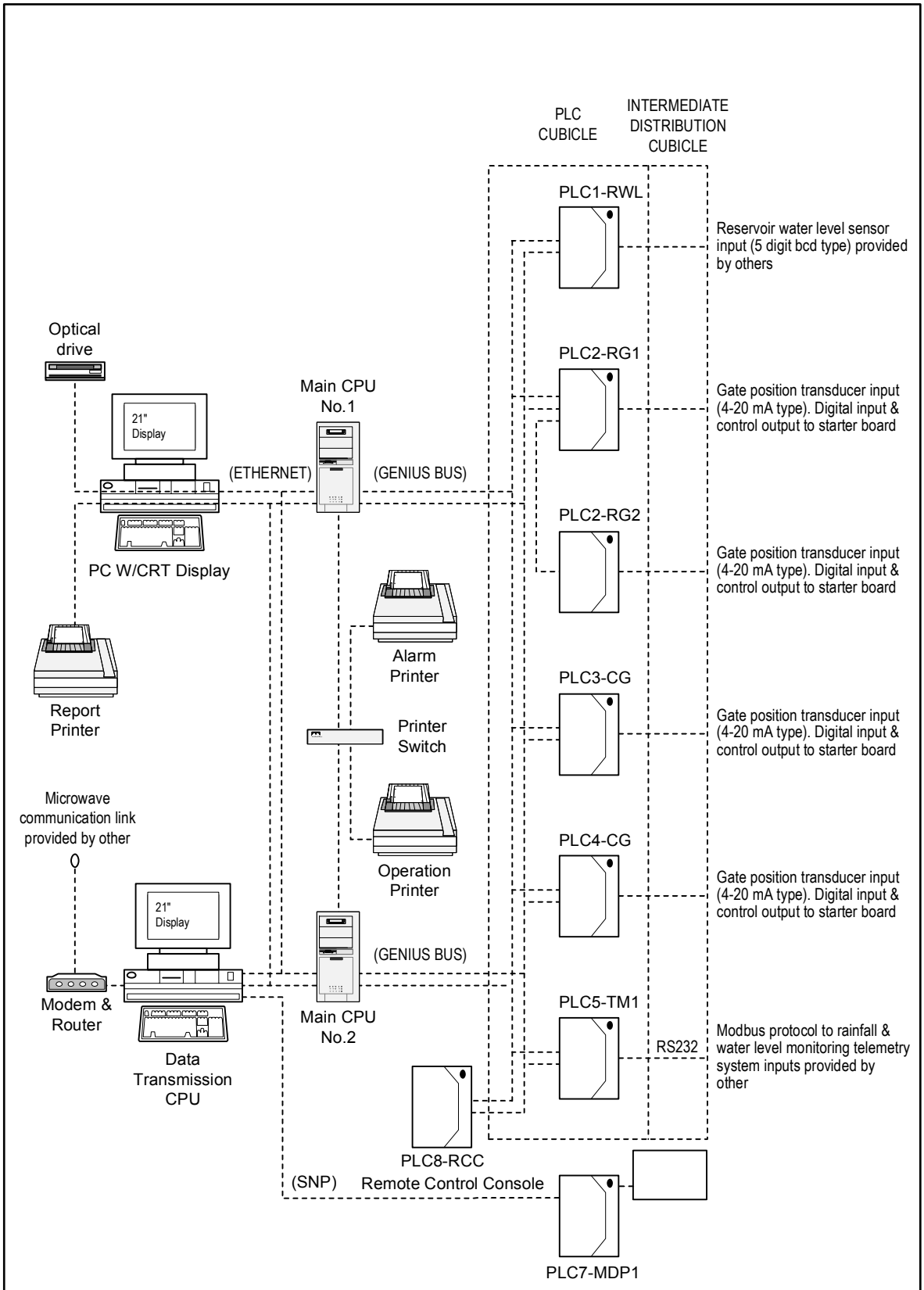


Figure 4.1 Configuration of Dam Control and Monitoring System (DCMS)

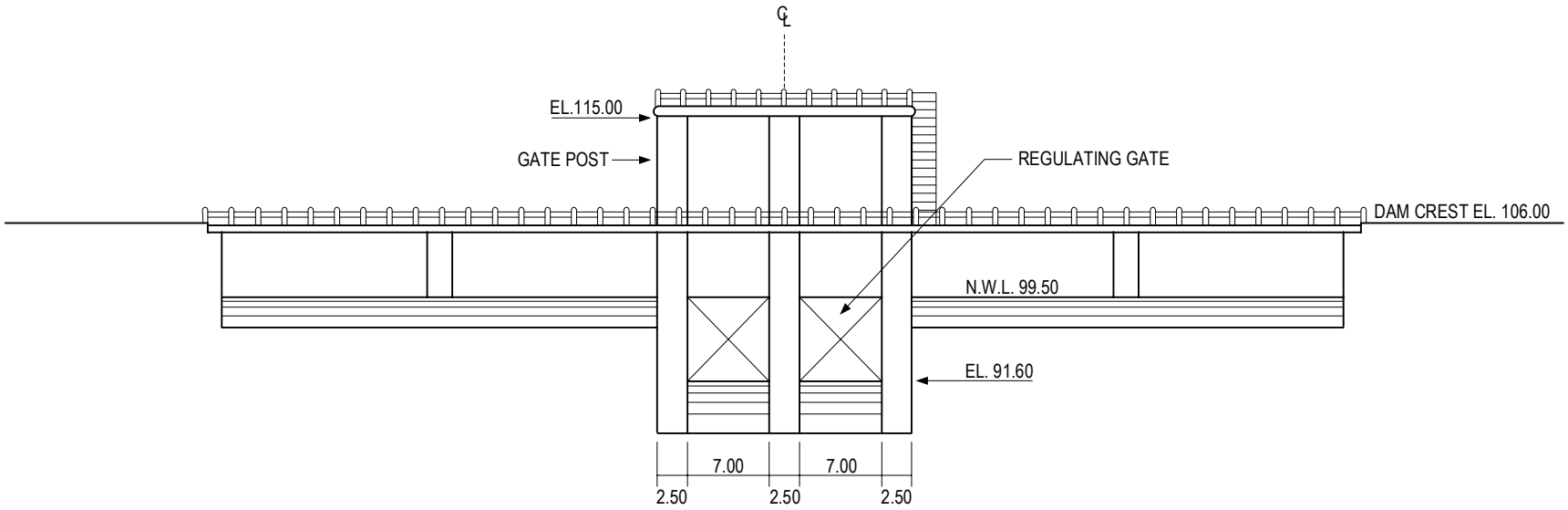


Figure 4.2 Regular Gate and Spillway

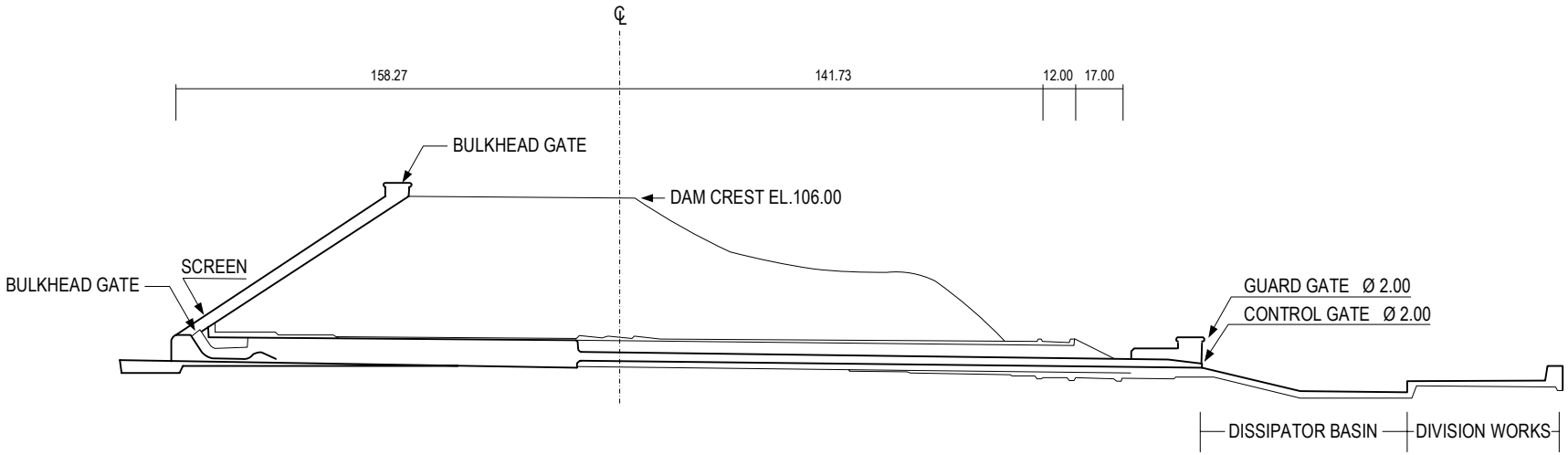
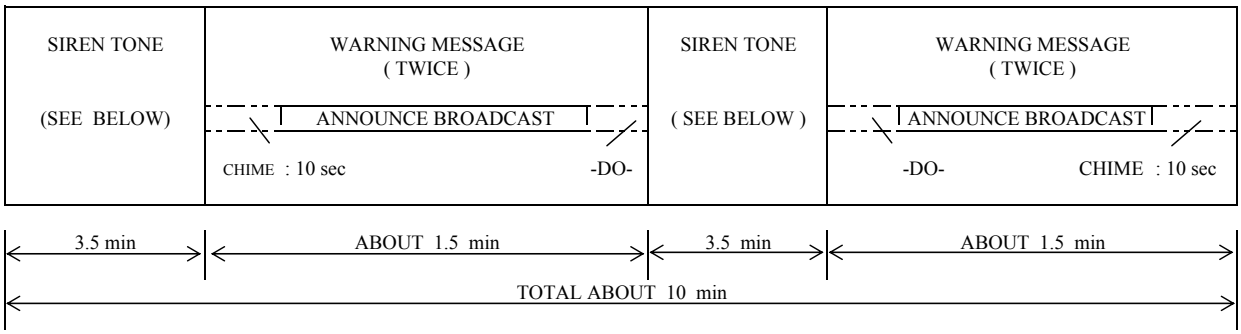
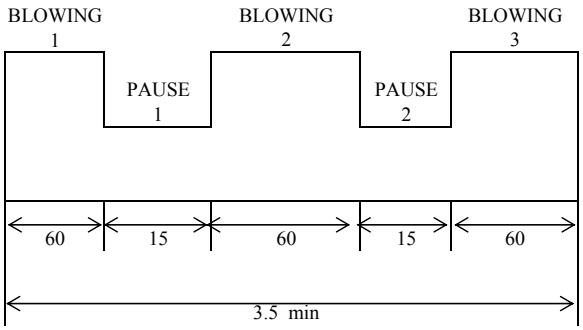


Figure 4.3 Control Gate, Bulkhead Gate and Guard Gate



BROAD CASTING PATTERN



NOTE ;

THE COMBINATION OF BLOWING TIME, PAUSE TIME AND NUMBER OF SCUNDING CAN BE ADJUSTED WITHIN THE FOLLOWING CONDITIONS .

BLOWING TIME : MAX. 60 SECONDS BY 5 SECONDS STEP

PAUSE TIME : MAX. 60 SECONDS BY 5 SECONDS STEP

NUMBER OF SOUNDING : MAX. 5 TIMES

SIREN TONE PATTERN

Figure 4.4 Broad Casting and Siren Tone Pattern

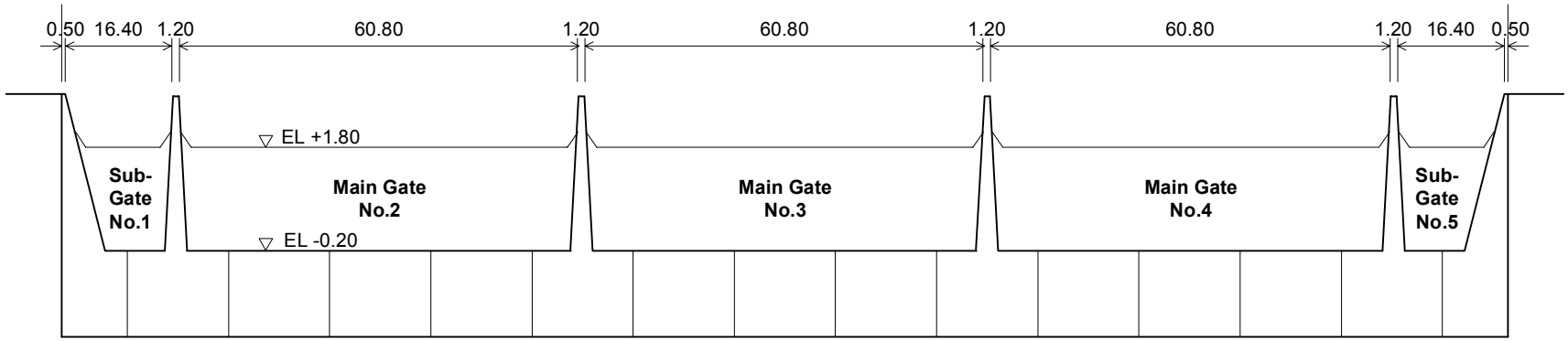


Figure 5.1 Front View of Rubber Dam

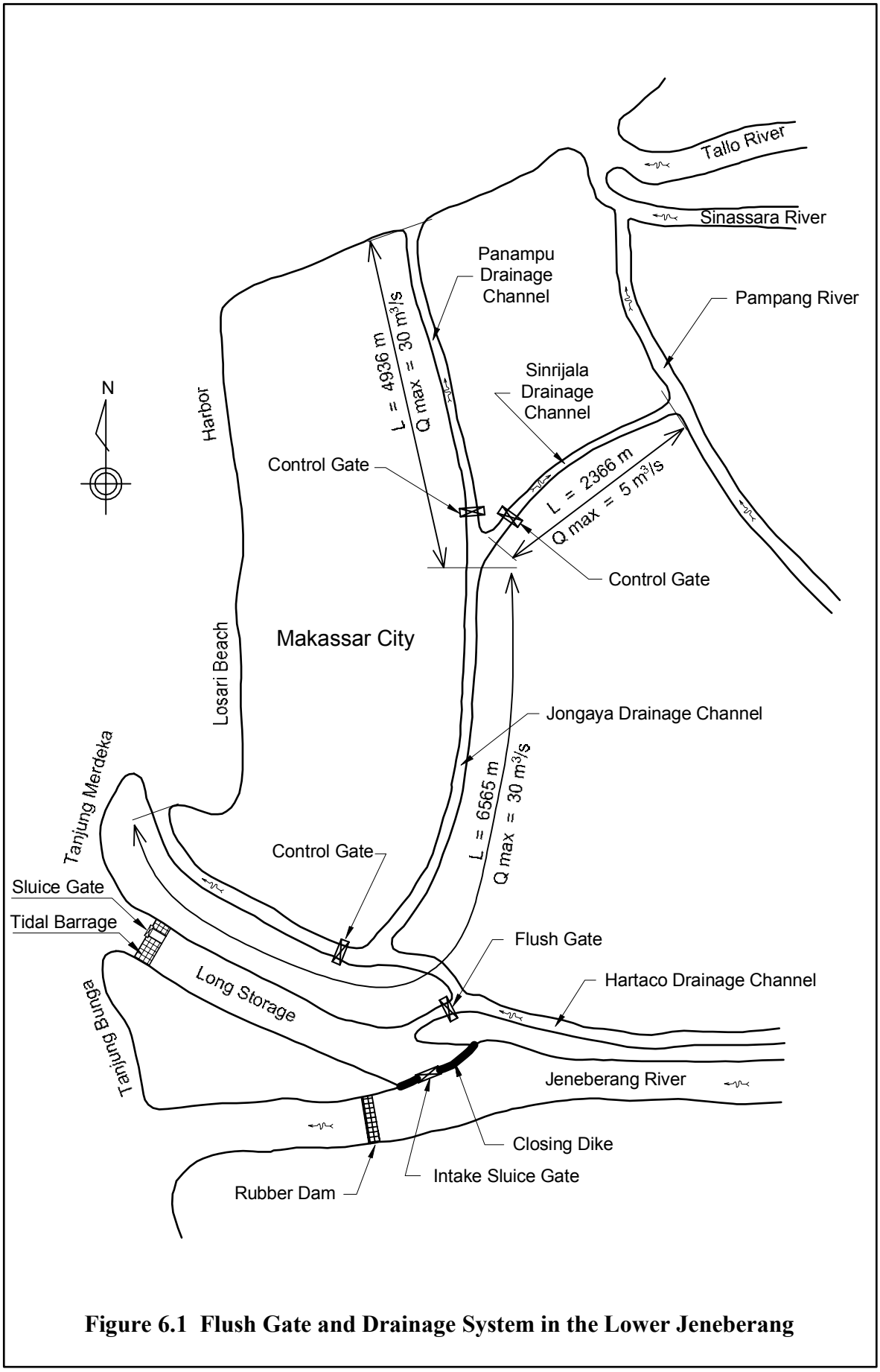
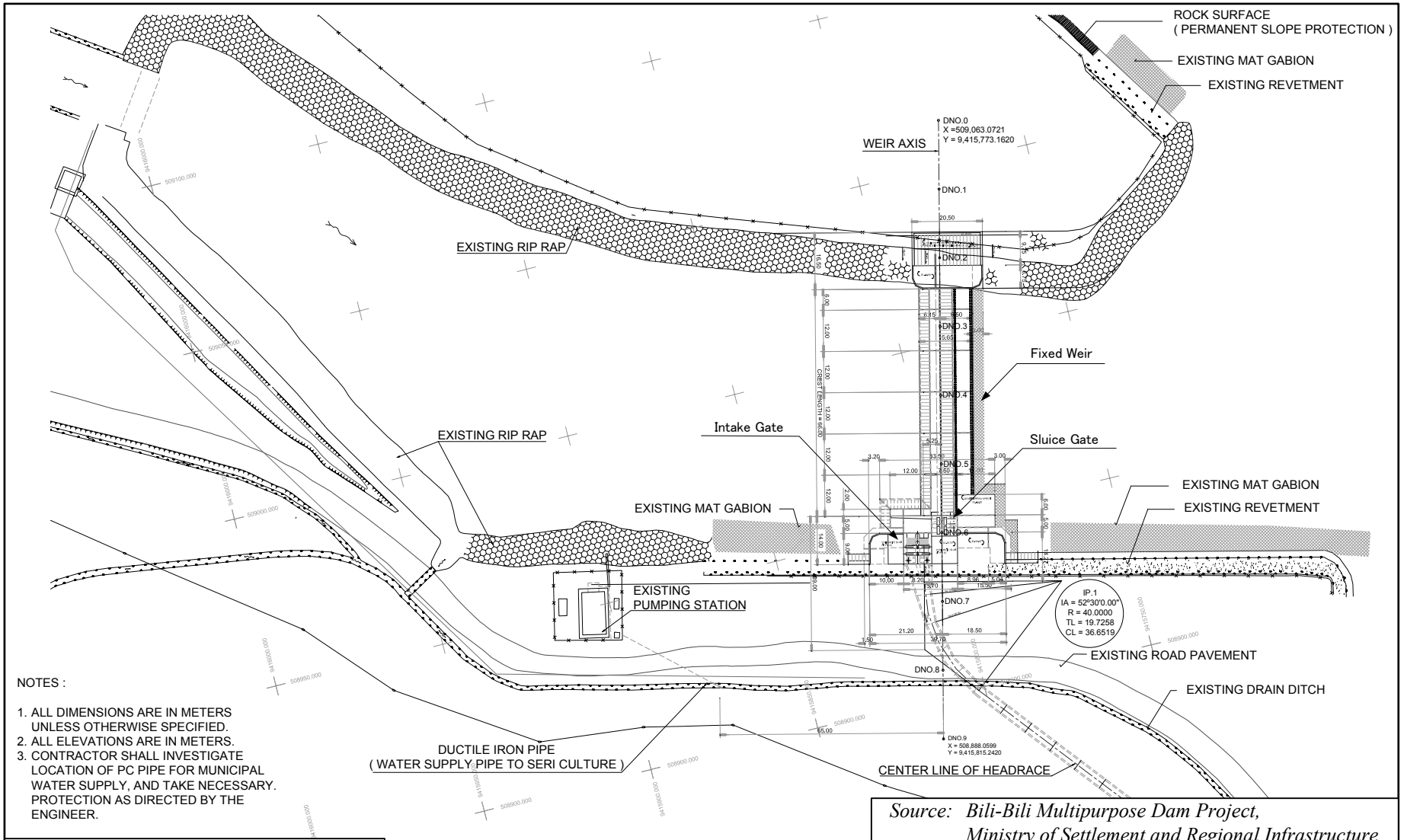


Figure 6.1 Flush Gate and Drainage System in the Lower Jeneberang



NOTES :

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. ALL ELEVATIONS ARE IN METERS.
3. CONTRACTOR SHALL INVESTIGATE LOCATION OF PC PIPE FOR MUNICIPAL WATER SUPPLY, AND TAKE NECESSARY. PROTECTION AS DIRECTED BY THE ENGINEER.

Figure 7.1 Plan of Bili-Bili Weir

Source: Bili-Bili Multipurpose Dam Project,
Ministry of Settlement and Regional Infrastructure
Directorate General of Water Resources
Jeneberang River Basin Development Project

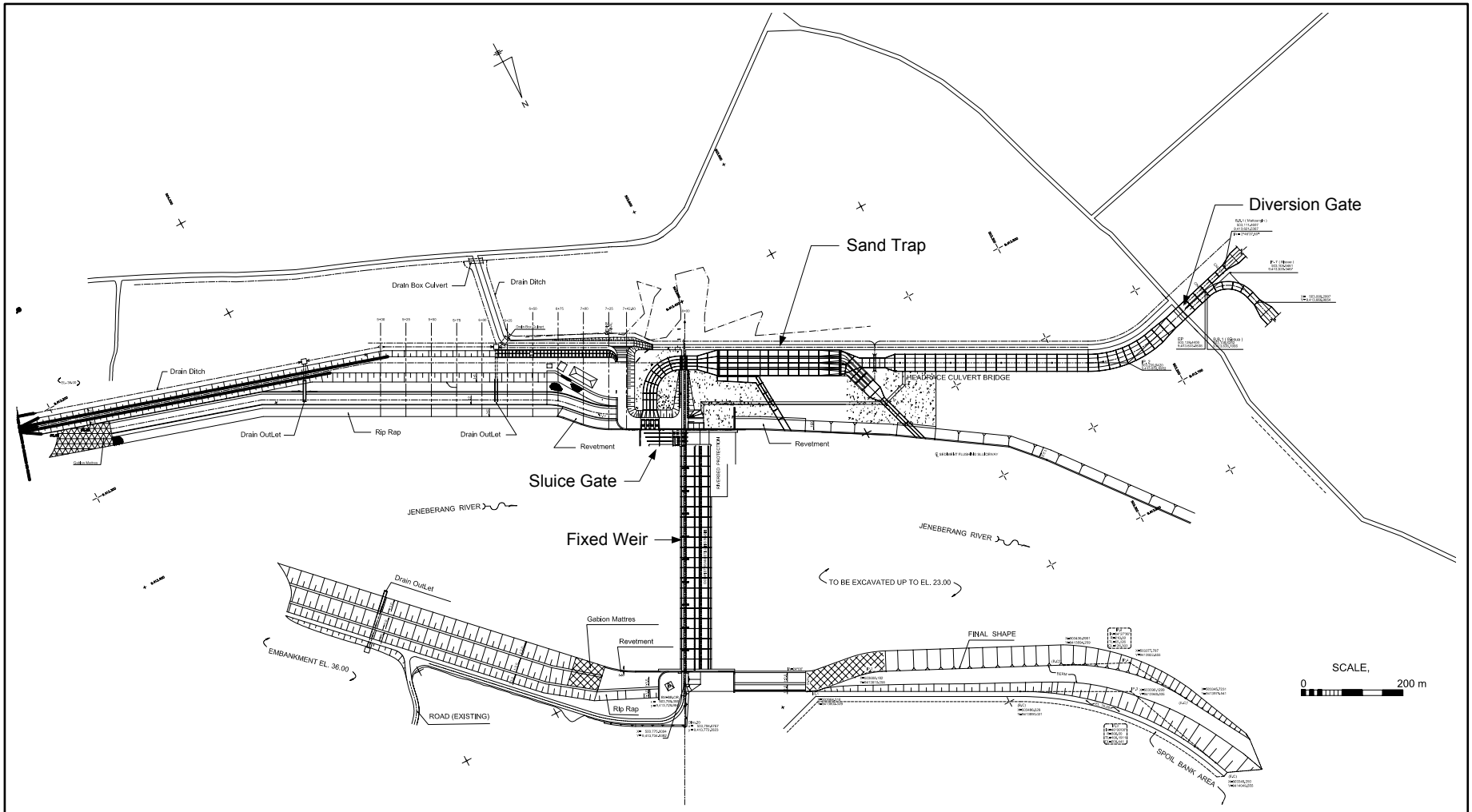


Figure 7.2 Plan of Bissua Weir

Source : Regional Gowa - Takalar Irrigation Project ,
Ministry of Public Works
Directorate General of Water Resources Development
in the South Sulawesi Superior Irrigation and Swamp Project

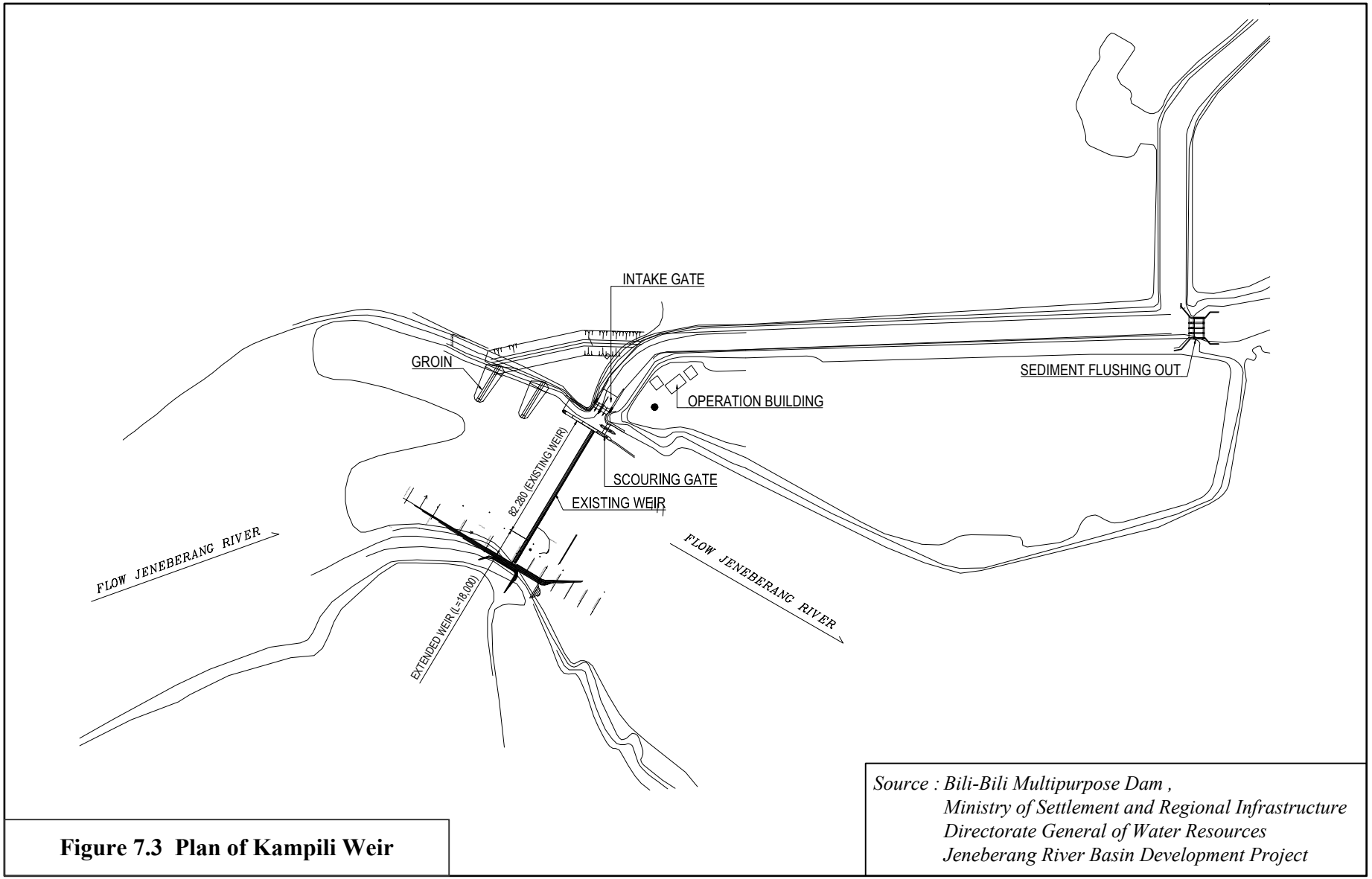
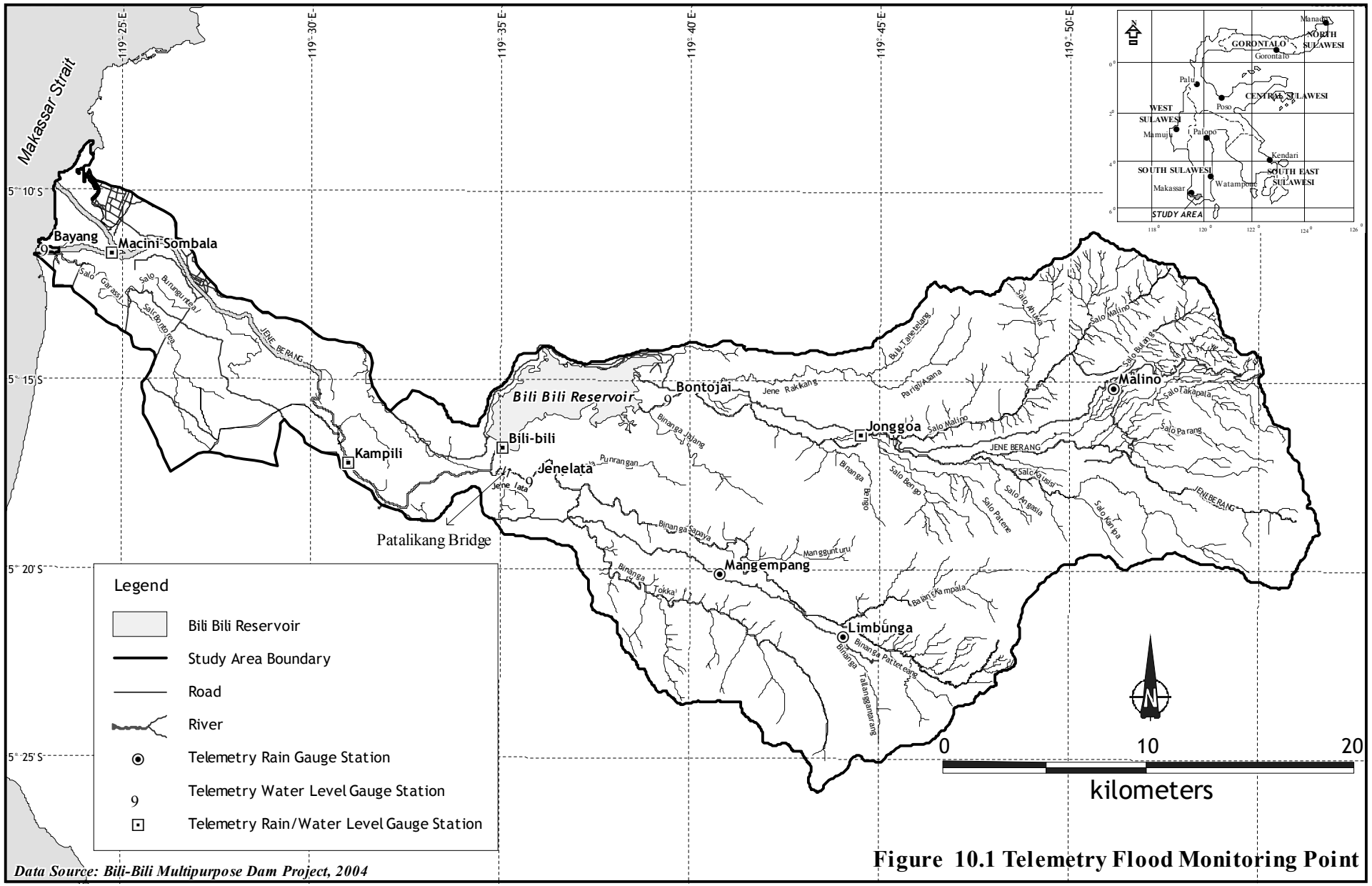


Figure 7.3 Plan of Kampili Weir

Source : Bili-Bili Multipurpose Dam ,
Ministry of Settlement and Regional Infrastructure
Directorate General of Water Resources
Jeneberang River Basin Development Project



Data Source: Bili-Bili Multipurpose Dam Project, 2004

Figure 10.1 Telemetry Flood Monitoring Point

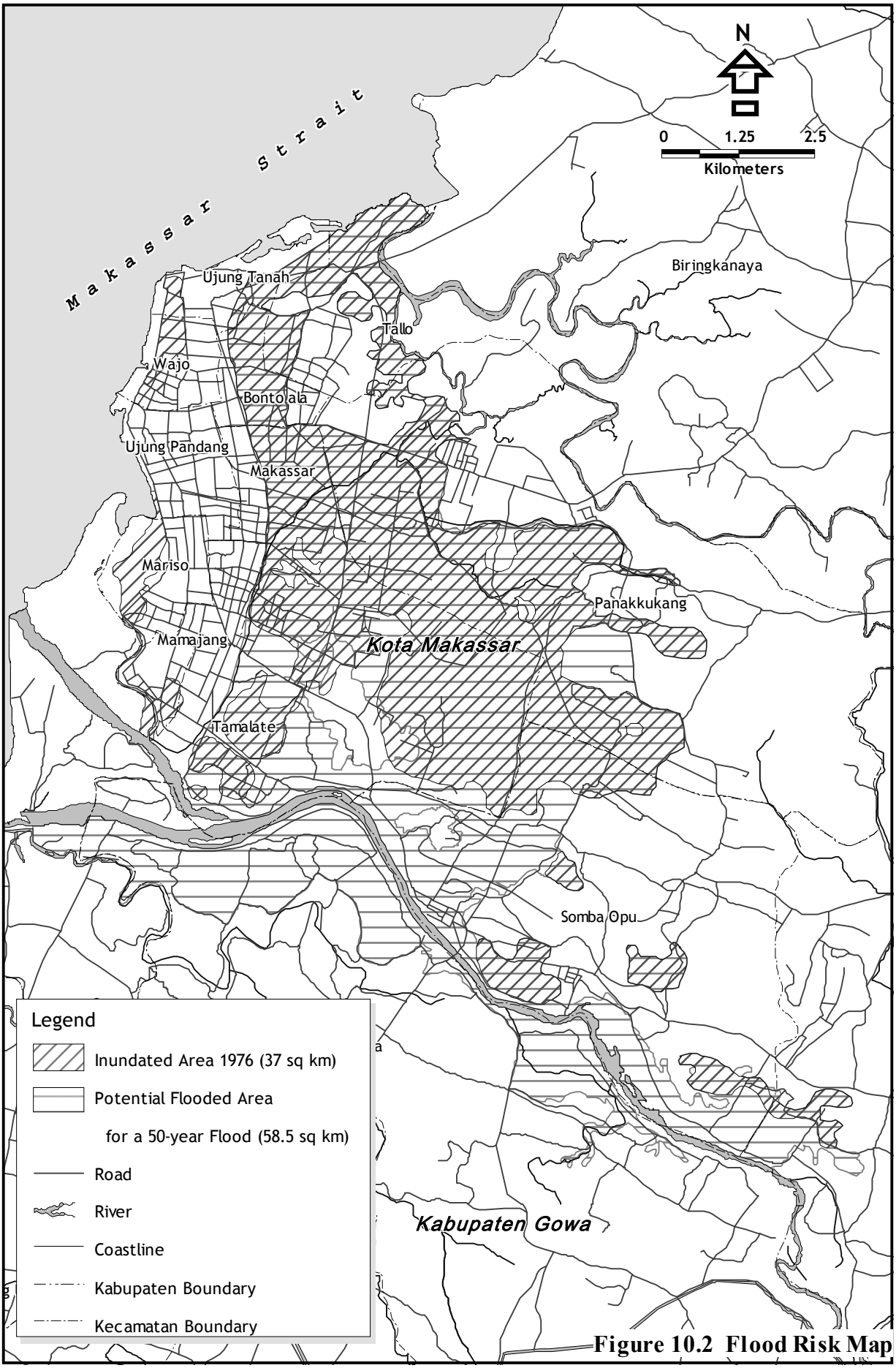


Figure 10.2 Flood Risk Map

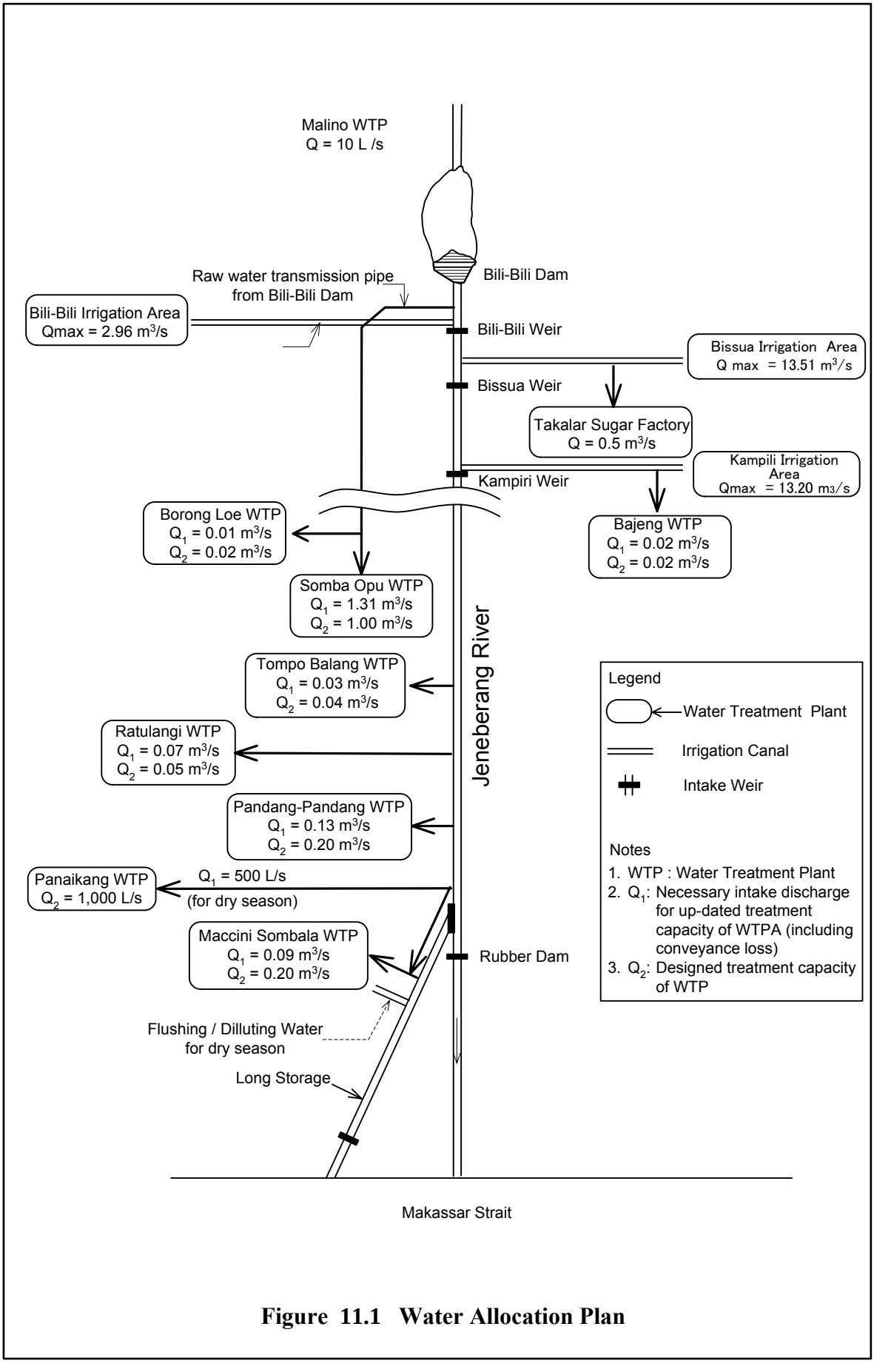


Figure 11.1 Water Allocation Plan

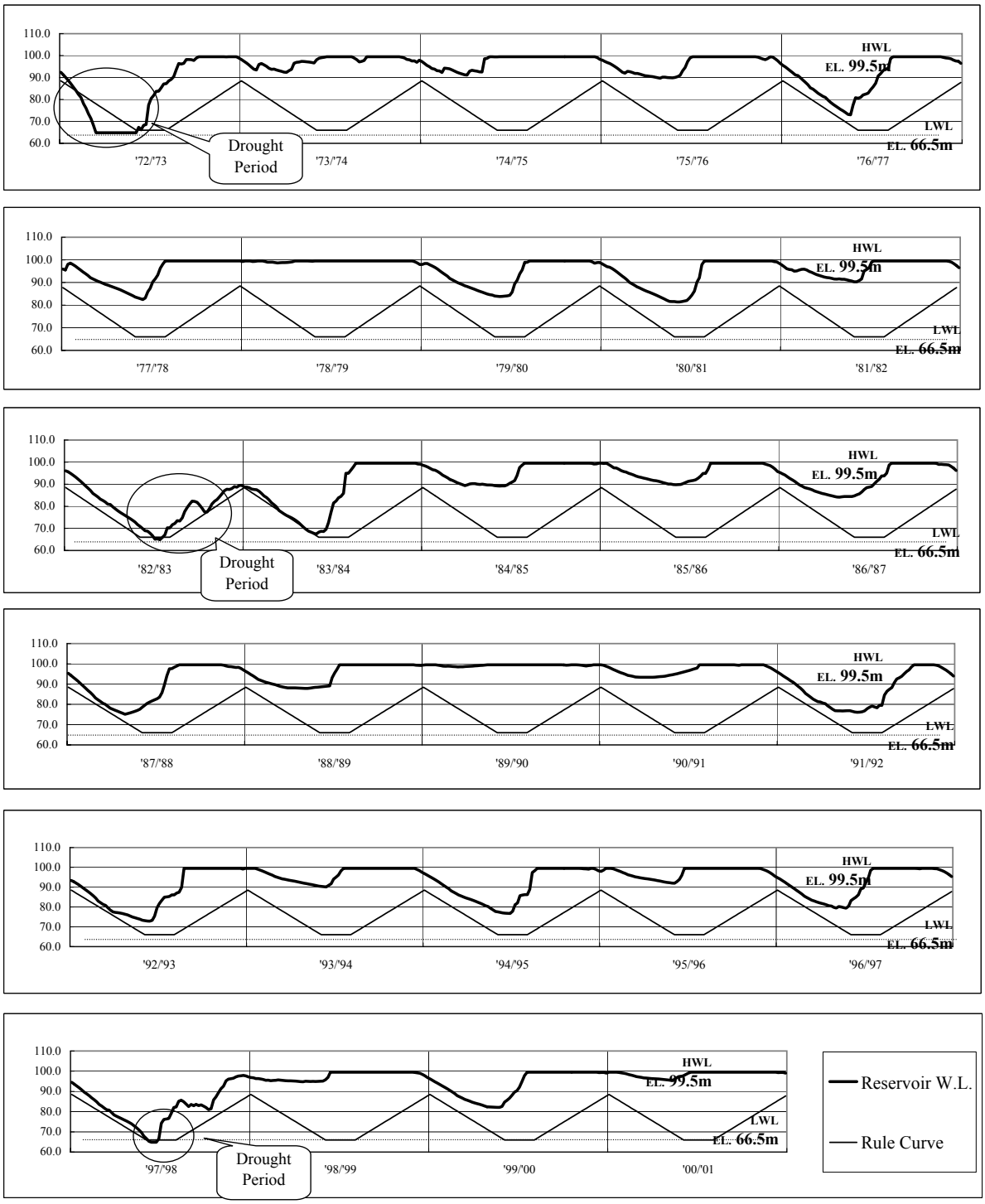


Figure 11.2 Fluctuation of Reservoir Water Levels

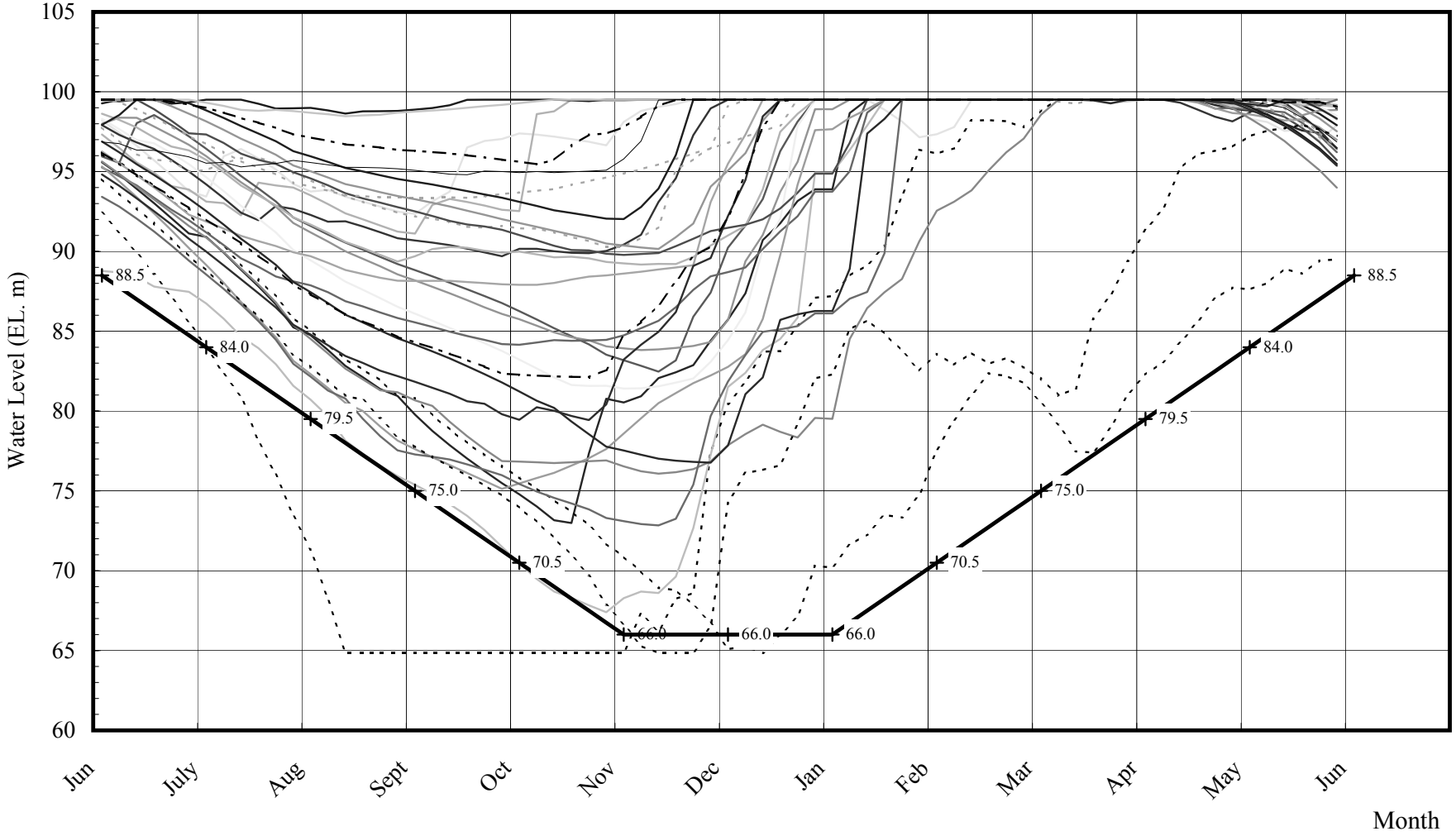


Figure 11.3 Simulated Reservoir Water Level and Rule Curve

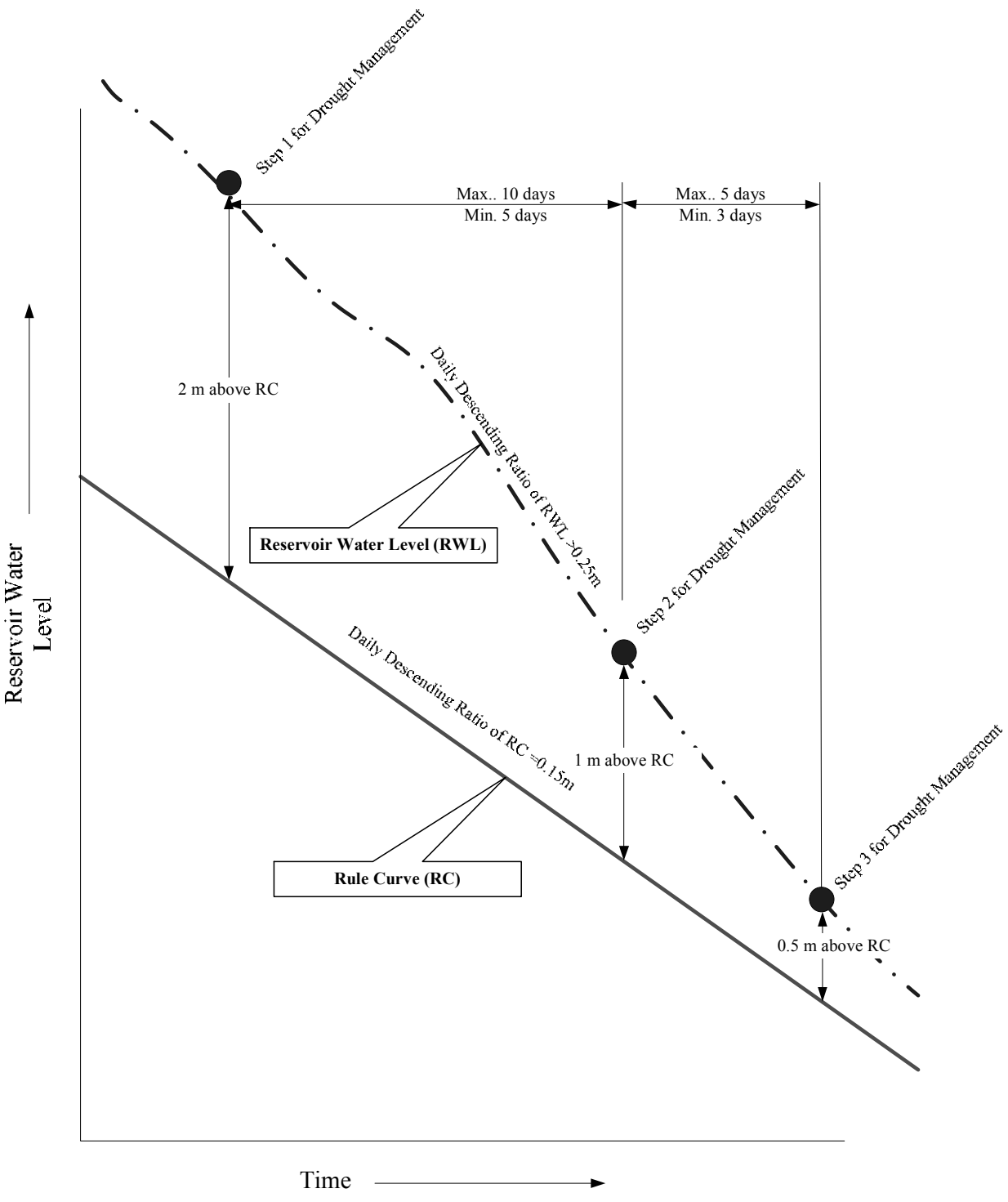


Figure 11.4 Concept of Reservoir Operation in Drought Years

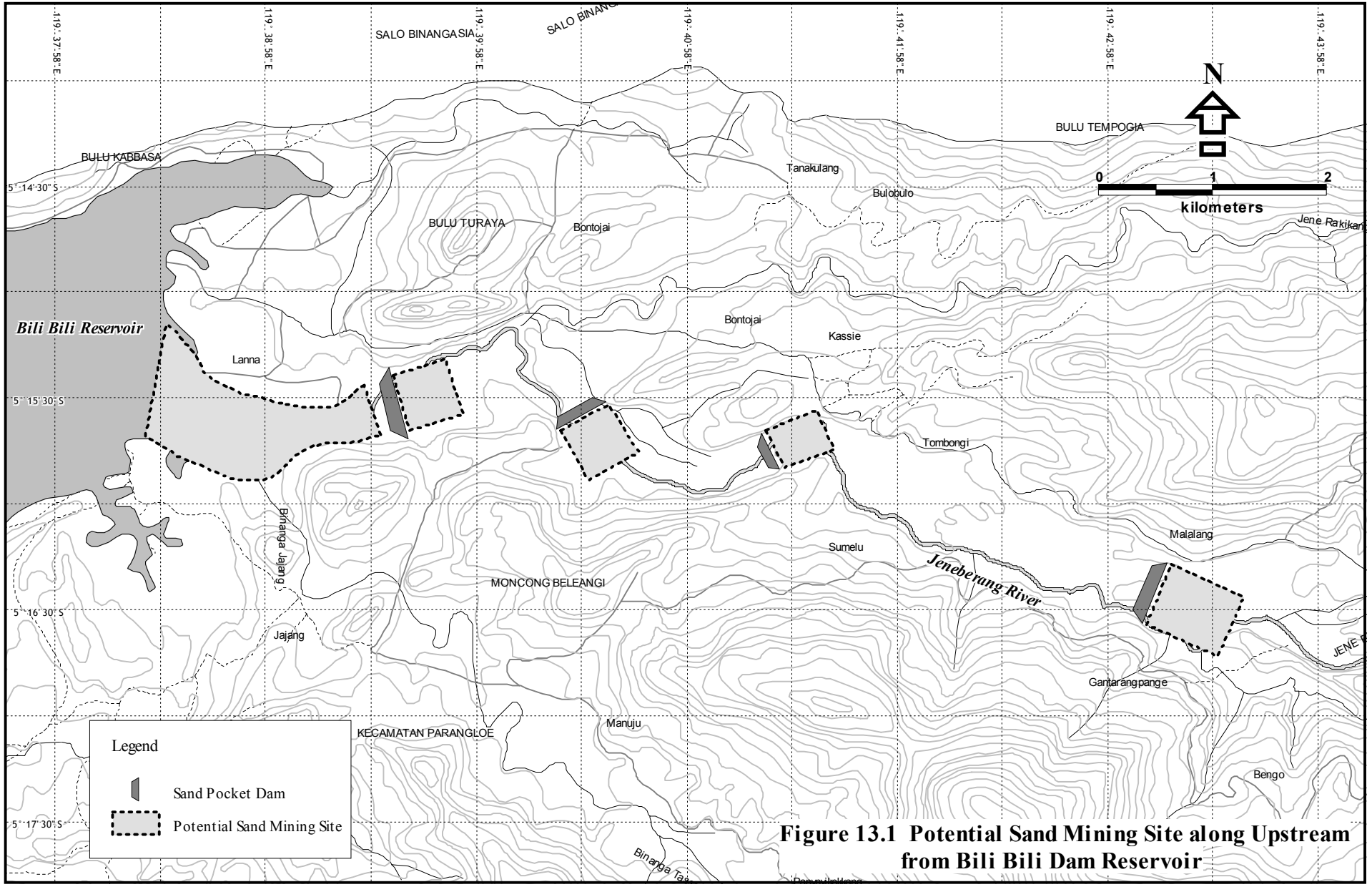


Figure 13.1 Potential Sand Mining Site along Upstream from Bili Bili Dam Reservoir

Part II

GUIDELINES AND MANUALS FOR FINANCIAL AND ACCOUNTING

GUIDELINES AND MANUALS – PART II

ADMINISTRATIVE AND FINANCIAL MANAGEMENT

Guidelines and manuals related to (1) accounting (2) reporting (3) finance (4) corporate management and (5) public relations are listed, and contents summary are shown in the Table below.

Basically all PJT I's guidelines and manuals should be applied to PJT J except director's authorization as mentioned in the Main Report Chapter 10.

The following three guidelines and manuals were newly produced under the subcontract with PJT I.

1) Guidelines of Quarterly Financial Report Formulation

   Full text is attached hereto.

2) Accounting System General Ledger Book I – Operational Manual

3) Accounting System General Ledger Book II – Technical Reference

   Only a cover sheet, an abstract and a table of contents are attached hereto. Please see a separate volume submitted by PJT I for the detail of manual.

Guidelines and Manuals

	Name	Contents	Documentation by PJT I
1	**Accounting**		
(1)	Finance accounting standard	International standard of accounting	Standar Akuntasi Keuangan (SAK)
(2)	Accounting guideline for SOE	Manual for implementation of accounting and formulation of financial report	Kimpraswil Minister Decree No.49/KPTS/M/2000
(3)	ASGL computer system	Hardware specification, Source code, operation manual	General guidelines of ASGL System & Back up data to be provided
(4)	ASGL accounting manual	Transaction data, Verification & authorization, input, Output: daily journal of sales & account receivable, purchase & account payable, cash & bank payment, cash & bank receipt, memorial	General guidelines of ASGL System
(5)	Verification System	General procedure of verification process	QI/PJT/47
(6)	Accounting policy of PJT I	General guideline for financial accounting of the corporation	KP.001/KPTS/DA/2000
(7)	Depreciation	Owned assets depreciation/amortization	KP.001/KPTS/DA/2000
(8)	Managed assets	Administrative Guidelines for State-Owned-Inventories/State Assets Managed by JasaTirta I, Determination of Types of State-Owned-Inventories/State Assets Managed by JasaTirta I	Kep.MPW No.180/KPTS/2004& Kep.MPW No.181/KPTS/2004
(9)	Elimination	Work instruction of assets elimination criteria	QI/PJT/26
(10)	Historical record	Work instruction of historical assets record for aiming at maintenance activity	QI/PJT/39
(11)	Goods inventory record & General administration of Goods inventory record	Work instruction accounting/report goods inventory by determining assets type (managed or owned etc.)	MI/PJT/01& 11
(12)	Owned assets		Same as above
2	**Reporting**		
(1)	Financial statement	B/S, P/L, Cash flow	KP.001/KPTS/DA/2000
(2)	Evaluation	Report on Performance Assessment through to Trimester II Year 2004	KEP-100/MBU/2002
a)	Finance	ROE(15)/ROI(10)/Cash R(3)/Current R(4)/Collection P(4)/PP(4)/TATO(4)/Equity R(6)=50:2001/44.5 & 2003/41.0	KEP-100/MBU/2002
b)	Operation	35:2001/34.4 & 2003/34.0	KEP-100/MBU/2002
c)	Administration	15:2001/15.0 & 2003/15.0	KEP-100/MBU/2002
(3)	Monthly report		Guideline of monthly financial report
(4)	Quarterly Financial Report	Financial Report Trimester II Year 2004	Guideline of quarterly financial report
(5)	Annual report	Annual Report Year 2003	KEP-101/MBU/2002 & QP/PJT/22
(6)	Audit		
a)	Internal audit	Procedure of internal audit & Implementation	QP/PJT/37 & MP/PJT/14
b)	Outside audit		
3	**Finance**		
(1)	Payment authority		
a)	Advance payment	General procedure of request and responsibility of advance payment	KP.085/KPTS/DU/1993, No.065/KPTS/DA/98,No.042/KPTS/DA /99 & QP/PJT/51
b)	Bill payment	Procedure of bill payment	QP/PJT/52
(2)	Collecting revenue	General procedure of collecting revenue	MP/PJT/16
a)	PLN	The amount of kWh production recorded on Minutes of Meeting. PJT I issues Water Fee Collection Letter one a month.	
b)	PDAM & Industry	Water Abstraction Enactment(SP3AP) will be signed by customer, Balai PSDA and PJT I. Based on the SP3AP the local government(Revenue Agency) issues Fee Enactment(SKI)	

	Name	Contents	Documentation by PJT I
c)	Non-water services	Issue invoice letter based on contract according to the progress of work	
(3)	Procurement	Adjustment on Authorization Limit for Goods and Services Procurements, Construction Services and Consultancy Services(9/30)	KP046/KPTS/DA/2003
a)	Construction	Procedure of Construction Procurement	QP/PJT/28
b)	Consultancy	Procedure of Consultancy Service Procurement	QP/PJT/29
c)	Goods and Other Services procurement	Procedure of Goods and Other Services procurement	QP/PJT/27
(5)	Self management work	Maintenance, repair of infrastracture and equipment	QP/PJT/10
(6)	Contract work	Supervisory work of contractor, providing mataerials and equipment	QP/PJT/11
(7)	Tax payment rule	PPN(VAT):15th of next month, PPh(Salary WH tax):10th of nex month,Angsuran PPh Badan(Corp tax installment):15th of nex month	MP/PJT/17 & List of Types of Corporate Tax
(8)	Cash management	Weekly by Finance Bureau	
a)	Petty cash management	Maximization of bank interest income	KP054/KPTS/DA/1999
b)	Operational cash management	Weekly/monthly cash availability	KP054/KPTS/DA/1999
(9)	Pension rule	Contribution to retirement pension, Social insurance, Employee about 30% and the Company 70% to be contributed	General Guideline of PJT I Salary System 2004
(10)	Duty trip allowance rule	Modifications on Stipulations concerning Official Trips	1.Procedule MP/PJT/20 2.Guideline KP.164/KPTS/DA/2003(9/30) 3.Tariff KP.165/KPTS/DA/2003
(11)	Health, Safety & Insurance		1.Procedule QP/PJT/12 2.PT.ASKES Health Insurance 519.1/13-08/0704, KP.009/BA/DA/2004 3.JAMSOSTEK(labor social insurance)
(12)	PGPS salary	Salary of PNS is paid by Central government	GR No.26/2001
4	**Corporate Management**		
(1)	Corporate plan		
a)	5 year plan	Procedure of long term plan formation	BUMN Master plan, KEP-102/MBU/2002 & QP/PJT/16
b)	Annual plan	Procedure of company work plan and budget formation	KEP-101/MBU/2002 & QP/PJT/22
c)	Review of Annual budget plan	Procedure of company work plan and operational formation	QP/PJT/25
(2)	Tariff making	Tariff Evaluation Team (TET) formed by MSOE, MOF, MSRI, Local government, PLN, PDAM and Industry and PJT I&II	Tariff making procedure
(3)	Monthly management report	From each water service division and administrative bureau to each responsible Director	Problems to be solved if any and ratification of agenda of the last meeting
5	**Public relations**		
(1)	PUKK now changed to PKBL (Program Kemitraan & Bina Lingkngan)	Procedure of arranging and monitoring of PUKK	MP/PJT/01
(2)	Customer satisfaction	Questionnaire to stakeholders asking water quality, quantity and customers' impression to PJT I regarding reliability, responsibility, assurance, etc.	QI/PJT/22

PEDOMAN PENYUSUNAN LAPORAN KEUANGAN TRIWULAN DI LINGKUNGAN PERUM JASA TIRTA I

PERUSAHAAN UMUM (PERUM) JASA TIRTA I

Jl. Surabaya 2A Malang-65115 PO. BOX 39
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Certificate No. ID03/0127

PEDOMAN PENYUSUNAN LAPORAN KEUANGAN TRIWULAN DI LINGKUNGAN PERUM JASA TIRTA I

LATAR BELAKANG

Laporan Keuangan Triwulan merupakan pertanggung jawaban Direksi kepada Dewan Pengawas atas penyelenggaraan Perusahaan setiap triwulan, yang menyajikan laporan tentang hasil kegiatan usaha Perusahaan sampai dengan triwulan yang bersangkutan.

Laporan Keuangan Triwulan disampaikan kepada Dewan Pengawas dengan tembusan kepada Menteri BUMN dan Menteri Kimpraswil.

ISI LAPORAN KEUANGAN TRIWULAN

Kata Pengantar
Kata Pengantar berisi uraian tentang maksud dan tujuan penyusunan laporan Triwulanan dan ditandatangani oleh Direktur Utama.

I. Pendahuluan

A. Umum

Pendahuluan berisi uraian singkat tentang posisi keuangan dan perolehan laba Perusahaan dan hal-hal yang dominan yang mempengaruhi perkembangan Perusahaan sampai dengan periode yang bersangkutan.

B. Kondisi Intern Perusahaan

Hal-hal intern yang mempengaruhi perkembangan Perusahaan, seperti sumberdaya, penggantian Direksi/Dewan Pengawas, perubahan struktur organisasi, perkembangan diversifikasi usaha dan lain-lain.

C. Kondisi Ekstern Perusahaan

Hal-hal ekstern yang mempengaruhi perkembangan Perusahaan, antara lain:

1. Tindakan Pemerintah di bidang ekonomi yang mempengaruhi perkembangan Perusahaan
2. Adanya penugasan oleh Pemerintah
3. Hal-hal mempengaruhi perkembangan Perusahaan di bidang ekonomi, politik, sosial, budaya, peraturan pemerintah, teknologi, pesaing dan pemasok.

II. Garis Besar Laporan Keuangan Triwulan

A. Ikhtisar Laporan Keuangan

Berisi garis besar Laporan Triwulanan Perusahaan dalam bentuk tabel tentang realisasi produksi dan pendapatan, Laba/Rugi Usaha, Laba Sebelum Pajak, Investasi, Piutang dan jumlah Pegawai seperti di bawah ini:

Uraian	Satuan	RKAP	RKAP s.d. TW	Realisasi s.d. TW	Pencapaian thd RKAP	Pencapaian thd RKAP TW
Produksi						
Laba/Rugi						
- Pendapatan						
- Beban						
- Laba Usaha						
Laba Sebelum Pajak						
Investasi						
Piutang						
Jumlah Pegawai						

B. Penjelasan terhadap Ikhtisar Laporan Keuangan

Berisi uraian/penjelasan singkat tentang pencapaian target dan evaluasinya meliputi produksi/penjualan, pendapatan usaha, beban usaha, laba sebelum pajak, investasi dan piutang.

III. Laporan Keuangan dan Penjelasannya

A. Laporan Keuangan s.d. Triwulan

1. Neraca

Adalah laporan yang menunjukkan posisi keuangan Perusahaan pada triwulan tertentu. Neraca terdiri atas aktiva dan kewajiban & ekuitas, merupakan laporan keuangan yang memberikan informasi tentang jumlah kekayaan/harta dan kewajiban/hutang Perusahaan pada triwulan tertentu dengan dibandingkan triwulan sebelumnya.
Bentuk Neraca disajikan seperti pada Tabel A.

2. Perhitungan Laba/Rugi

Adalah laporan yang menunjukkan hasil operasi yang telah dicapai dan biaya yang telah terjadi pada suatu periode tertentu.
Laba/Rugi Usaha berisi uraian singkat tentang laba/rugi usaha yang diperoleh baik dalam jumlah maupun persentasenya terhadap RKAP.
Bentuk Laba/Rugi disajikan seperti pada Tabel B.

3. Laporan Arus Kas

Adalah laporan yang menunjukkan perubahan kas dan setara kas berdasarkan aktivitas operasi, investasi dan pendanaan sampai dengan triwulan tertentu.
Bentuk Arus Kas disajikan seperti pada Tabel C.

B. Penjelasan Laporan Keuangan

1. Penjelasan Pos-pos Neraca

Berisi penjelasan pos-pos neraca yang meliputi aktiva, kewajiban dan ekuitas

2. **Penjelasan Pos-Pos Perhitungan Laba/Rugi**

Berisi penjelasan pos-pos Laba/Rugi yang meliputi pendapatan, beban dan laba yang dicapai.

IV. Informasi Pendukung

Berisi antara lain

A. Gambaran mengenai Dunia Usaha

Berisi uraian tentang perkembangan dunia usaha antara lain: kebijakan di bidang moneter dan fiskal.

B. Investasi dan Sumber Pembiayaan

Investasi dan Sumber Pembiayaan berisi uraian tentang investasi yang mencakup pengadaan/pembangunan aktiva tetap/aktiva lain-lain yang diperlukan untuk kelangsungan dan pengembangan usaha.
Investasi/penyertaan disajikan seperti pada form Lampiran 1.

C. Piutang

Berisi uraian tentang upaya yang ditempuh dalam menyelesaikan masalah piutang pada Triwulan yang bersangkutan.

D. Pengembangan Sumberdaya Manusia

Berisi uraian tentang peningkatan pendidikan dan pelatihan yang telah dilaksanakan pada Triwulan yang bersangkutan.

E. Penilaian Kinerja

Berisi uraian tentang penilaian kinerja selama periode triwulan yang bersangkutan, meliputi aspek keuangan, operasional dan administrasi.

F. Program Kemitraan dan Bina Lingkungan

Berisi uraian tentang realisasi program Kemitraan dan Bina Lingkungan sampai dengan periode triwulan yang bersangkutan.

G. Aset Kelola

Berisi uraian tentang aset-aset yang dikelola Perusahaan (bukan aset dimiliki) beserta nilainya pada periode yang bersangkutan.

NERAC
WILAYAH SUNGAI .....
PERIODE TRIWULAN .... DAN PER .....

(dalam rupiah)

URAIAN	PER	PER LAN
AKTIVA		
1. AKTIVA LANCAR		
a. Kas		
b. Bank		
c. Deposito Jangka Pendek		
d. Piutang Usaha		
e. Penyisihan Piutang		
f. Piutang Lain-lain		
g. Uang Muka Kerja		
h. Pendapatan Yang Akan Diterima		
i. Pajak Dibayar Dimuka		
j. Sediaan		
Jumlah Aktiva lancar		
2. AKTIVA PAJAK TANGGUHAN		
3. INVESTASI JANGKA PANJANG		
4. AKTIVA TETAP		
a. Tanah		
b. Bangunan & Gedung		
c. Peralatan Mesin		
d. Peralatan Kantor dan Rumah Tangga		
e. Akumulasi Penyusutan		
5. AKTIVA DALAM PELAKSANAAN		
6. AKTIVA LAIN-LAIN		
a. Biaya Yang Ditangguhkan		
b. Jaminan Pelanggan		
c. Aktiva Dipinjam Pihak III		
d. Aktiva Tidak Produktif		
e. Akumulasi Amortisasi		
TOTAL AKTIVA		
KEWAJIBAN DAN EKUITAS		
1. KEWAJIBAN JANGKA PENDEK		
a. Kewajiban Usaha		
b. Kewajiban Pajak		
c. Kewajiban Jangka Pendek Lain-lain		
d. Pendapatan Diterima Dimuka		
Jumlah Kewajiban Jangka Pendek		
2. KEWAJIBAN JANGKA PANJANG		
3. EKUITAS		
a. P M N		
b. PMP belum ditetapkan statusnya		
c. Cadangan Umum/Tujuan		
d. Laba Yang Ditahan		
e. Laba Tahun Berjalan		
Jumlah Ekuitas		
TOTAL KEWAJIBAN DAN EKUITAS		

TABEL B

PERHITUNGAN LABA/RUGI
WILAYAH SUNGAI .....
PER S/D TRIWULAN .....

(dalam rupiah)

NO.	URAIAN	PROGRAM TAHUN ...		REALISASI S.D TW	% thd RKAP	% thd RKAP TW
		RKAP	S.D TW			
I.	PENDAPATAN USAHA					
1	JASA AIR					
	a. PLN					
	b. PDAM					
	c. Industri					
2.	JASA NON AIR					
	a. Pariwisata					
	b. Peralatan					
	c. Konstruksi					
	d. Konsultansi					
	e. Jasa Lain-lain					
II.	BEBAN USAHA					
1.	O&P					
2.	Pegawai					
3.	Umum					
4.	Perjalanan Dinas					
5.	Jasa					
6.	Pemasaran					
7.	Penyusutan					
8.	Dewan Pengawas					
9.	Penyuluhan					
10.	Pembinaan					
11.	Pengembangan SDM					
12.	Litbang					
13.	Perlindungan DPS					
III.	LABA/ RUGI USAHA					
IV.	PENDAPATAN DILUAR USAHA					
1.	Jasa Bank					
2.	PGPS					
3.	Lain-lain					
V.	BEBAN DILUAR USAHA					
VI.	LABA/ RUGI DILUAR USAHA					
VII.	LABA/ RUGI SEBELUM PAJAK					

ARUS KAS
WILAYAH SUNGAI .....
TRIWULAN .....

(dalam rupiah)

URAIAN	RKAP TAHUN	REALISASI S.D TRIWULAN ...
ARUS KAS DARI AKTIVITAS OPERASI		
1. Laba sebelum pajak dan pos luar biasa		
2. Penyesuaian untuk merekonsiliasi laba(rugi) bersih menjadi kas bersih dari akivitas operasi :		
- Penyusutan dan amortisasi		
- Penyisihan kerugian piutang		
Laba Operasi Sebelum Perubahan Modal Kerja		
- (Kenaikan) penurunan dalam aktiva operasi :		
- Kenaikan (penurunan) Piutang		
- Kenaikan (penurunan) Persediaan		
- Kenaikan (penurunan) Pajak Dibayar Dimuka		
- Kenaikan (penurunan) dalam kewajiban operasi :		
- Kenaikan (penurunan) Kewajiban		
- Kenaikan (penurunan) Kewajiban Pajak		
- Kewajiban Pajak Penghasilan		
- Kenaikan (penurunan) Aktiva Pajak Tangguhan		
Arus Kas dari kegiatan Operasi		
Arus Kas Bersih Dihasilkan Dari Aktivitas Operasi		
ARUS KAS DARI AKTIVITAS INVESTASI		
1. Pengadaan Aktiva Tetap		
2. Pengadaan Aktiva Lain-lain		
3. Investasi Dalam Pelaksanaan		
4. Penjualan/penurunan aktiva		
3. Penyertaan		
Arus Kas Bersih Digunakan Untuk Aktivitas Investasi		
ARUS KAS DARI AKTIVITAS PENDANAAN		
1. Dana Pembangunan Semesta		
2. Dana Program Kemitraan dan Bina Lingkungan		
3. Dana Sosial dan Pendidikan		
4. Jasa Produksi		
5. Bonus Karyawan		
6. PMN		
7. Tambahan Modal		
8. PMN Yang Belum Ditetapkan Statusnya		
9. Penggunaan Cadangan Umum/Tujuan		
Arus Kas Bersih Digunakan Untuk Aktivitas Pendanaan		
Kenaikan (Penurunan) Bersih Kas dan Setara Kas		
Kas dan Setara Kas Awal Periode		
Kas dan Setara Kas Akhir Periode		

PROGRAM VS REALISASI PENGGUNAAN DANA INVESTASI
TRIWULAN .....

NO.	U R A I A N	RKAP TAHUN	REALISASI SD TRIWULAN ..	% REAL THD RKAP
	INVESTASI & PENYERTAAN			
	INVESTASI RUTIN			
	a. Tanah			
	.....			
	b. Bangunan & Gedung			
	.....			
	c. Peralatan mesin			
	.....			
	d. Peralatan kantor			
	.....			
	e. Peralatan umum			
	.....			
	T o t a l			

PIUTANG USAHA DAN PIUTANG LAIN-LAIN MENURUT UMUR
WILAYAH SUNGAI .....
TRIWULAN .....

(dalam rupiah)

NO.	URAIAN	PER 1 JAN ...	RKAP	REALISASI S.D TRIWULAN				JUMLAH SD TW ..	% THD REAL 1 JAN	% THD RKAP
				1 bln	2-6 bln	>6-12 bln	> 12 bln			
I	**PIUTANG USAHA**									
1	**Piutang Jasa Air**									
a.	PLN									
b,	PDAM									
c.	INDUSTRI									
	Sub Total 1									
2	**Piutang Jasa Non Air**									
a.	PERALATAN									
b.	KONSTRUKSI/KONSULTANSI									
c.	LAIN-LAIN									
	Sub Total 2									
	JUMLAH PIUTANG USAHA									
II	**PIUTANG LAIN-LAIN**									
	TOTAL									

THE STUDY
ON
CAPACITY DEVELOPMENT
FOR JENEBERANG RIVER BASIN MANAGEMENT
IN THE REPUBLIC OF INDONESIA

ACCOUNTING SYSTEM GENERAL LEDGER (ASGL)

BUKU I:

MANUAL OPERASI

JASA TIRTA I

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Abstrak

Accounting System General Ledger (ASGL)

Accounting System General Ledger software (Program ASGL) telah diaplikasikan di Perum Jasa Tirta I sejak tahun 1997. Keberadaan program ini sangat besar sekali manfaatnya bagi perusahaan terutama dalam pembentukan Database keuangan yang merupakan sumber data utama dalam penyusunan Laporan Keuangan dan Laporan Manajemen lainnya.

Software ASGL ini dibangun oleh perusahaan bekerja sama dengan Kantor Akuntan Publik Gatot Permadi Joewono Jakarta yang mengacu kepada Manual Sistem Informasi Akuntansi yang disusun oleh Lembaga Managemen Fakultas Ekonomi Universitas Brawijaya Malang.

Software ini dibangun dengan menggunakan bahasa pemrograman Clipper yaitu salah satu software sistem manajemen database yang banyak digunakan terutama dalam aplikasi keuangan, personalia, dan dministrasi perkantoran lainnya.

Teks program yang dibuat melalui Clipper telah dicompiler menjadi file jenis execute yang diberi nama ASGL.EXE, yang selanjutnya dihubungkan (Link) dengan software lain yang dapat dijalankan dibawah operating System Windows.

Dalam aplikasinya, program ini tetap mengacu pada prinsip akuntansi yang lazim digunakan diantaranya Siklus Akuntansi secara umum yaitu mulai dari pengumpulan transaksi/kejadian sebagai sumber data, dikelompokkan dan dicatat kedalam buku harian yaitu buku harian Kas, Bank, Penjualan/Piutang, Pembelian/Hutang dan Buku Memorial kemudian dijurnal dengan memberi kode perkiraan (account) yang sesuai, diposkan ke Buku Besar Perkiraan sehingga menghasilkan saldo

masing-masing perkiraan, memindahkan saldo tersebut kedalam neraca saldo dan mengihtisarkannya dalam laporan keuangan sehingga menghasilkan Laporan Keuangan.

Dalam pembangunan Pprogram telah didesain agar Basis Data, Struktur Data dan filed penghubung secara otomatis dikerjakan oleh program, dan program akan mengecek sendiri seluruh basis data akuntansi yang akan diaksesnya, sehingga dalam menjalankan program ini tidak ada pengaturan file secara manual.

Untuk mengetahui hubungan diantara file-file database dalam program ini serta file yang aktif dan proses yang dilakukan dalam setiap aktivitas terlihat dalam Buku Penjelasan Pemrograman. Gambaran buku tersebut adalah sebagai berikut :

1. Gambaran Umum Sistem Informasi,
2. Gambaran umum ASGL, Bagan Alur ASGL
3. Menu program yang terstruktur sehingga memudahkan dalam pengoperasainnya
4. Proses yang dilakukan dalam setiap langkah yang digambarkan dengan bagan alur proses, menjelaskan aktivitas yang dilakukan sehingga menghasilakn file-file database.
5. Struktur data dari masing-masing file Database.

Untuk memudahkan dalam mengaplikasikan program ASGL ini telah disusun Buku Manual Operasi sebagai pengangan bagi user, terutama dalam memahami fungsi program dan proses data didalamnya. program dan struktur data serta file2 yang terkait dalam program ini.

Buku Manual Operasi ini pada dasarnya dibagi menjadi 5 bagian , yaitu :

1. MEMULAI PROGRAM

   Menjelaskan tentang cara / langkah dalam mempersiapkan hardware, software sampai dengan siap dijalankan/ dioperasikan.

2. DATA PREPARE

   Menjelaskan tentang prosedur yang harus dilakukan saat pertama kali program diinstalasi.

3. SRUKTUR MENU

   Menjelaskan tentang seluk beluk menu yang terdapat didalam program, mulai dari kegunaan sampai dengan cara mengakses menu tersebut.

4. DATA AKSES

   Menjelaskan tentang prosedur/langkah/cara yang dilakukan dalam mengakses data, baik menambah, memperbaiki, menghapus record data.

5. DATA PROSES

   Menjelaskan tentang proses-proses yang dilakukan dan kegunaan dari proses tersebut dalam hal pembuatan laporan, perawatan data dan pengamannya.

DAFTAR ISI

THE STUDY
ON
CAPACITY DEVELOPMENT
FOR JENEBERANG RIVER BASIN MANAGEMENT
IN THE REPUBLIC OF INDONESIA

ACCOUNTING SYSTEM GENERAL LEDGER (ASGL)

BUKU II:

PENJELASAN PEMROGRAMAN
(TECHNICAL REFERENCE)

JASA TIRTA I

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DAFTAR ISI

Halaman

PENDAHULUAN

Clipper merupakan software sistem manajemen database yang banyak digunakan, terutama dalam aplikasi keuangan, personalia, dan inventory serta administrasi perkantoran lainnya.
Clipper dikembangkan oleh CA-Clipper yang merupakan perusahaan pengembang Sistem komputer untuk aplikasi database.
Clipper merupakan sistem software yang berdiri sendiri dan mempunyai banyak fasilitas untuk mengembangkan suatu aplikasi. Dengan Clipper melalui compiler dapat dibuat file Jenis execute, dimana jenis file ini dapat dijalankan diberbagai Komputer dengan operating sistem yang berbeda.
Program Accounting System General Ledger (ASGL) yang dikembangkan ini ditulis dengan bahasa clipper dan dicompiler menjadi ASGL.EXE yang selanjutnya dihubungkan (Link) dengan software lain yang dapat dijalankan dibawah operating System Windows.

Buku penjelasan pemrograman ini memuat beberapa hal sebagai berikut :

1. Gambaran Umum Sistem Informasi, Gambaran umum ASGL, Bagan AlurLASGLI
2. Menu program yang terstruktur sehingga memudahkan dalam pengoperasainnya
3. Proses yang dilakukan dalam setiap langkah yang digambarkan dengan baga alur proses, menjelaskan aktivitas yang dilakukan sehingga menghasilakn file-file database.
4. Struktur data dari masing-masing file Database.