No.

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

FINAL REPORT

VOLUME III-1
SUPPORTING REPORT 1

March 2005

Japan International Cooperation Agency

GE
JR
05-015

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

FINAL REPORT

VOLUME III-1
SUPPORTING REPORT 1

March 2005

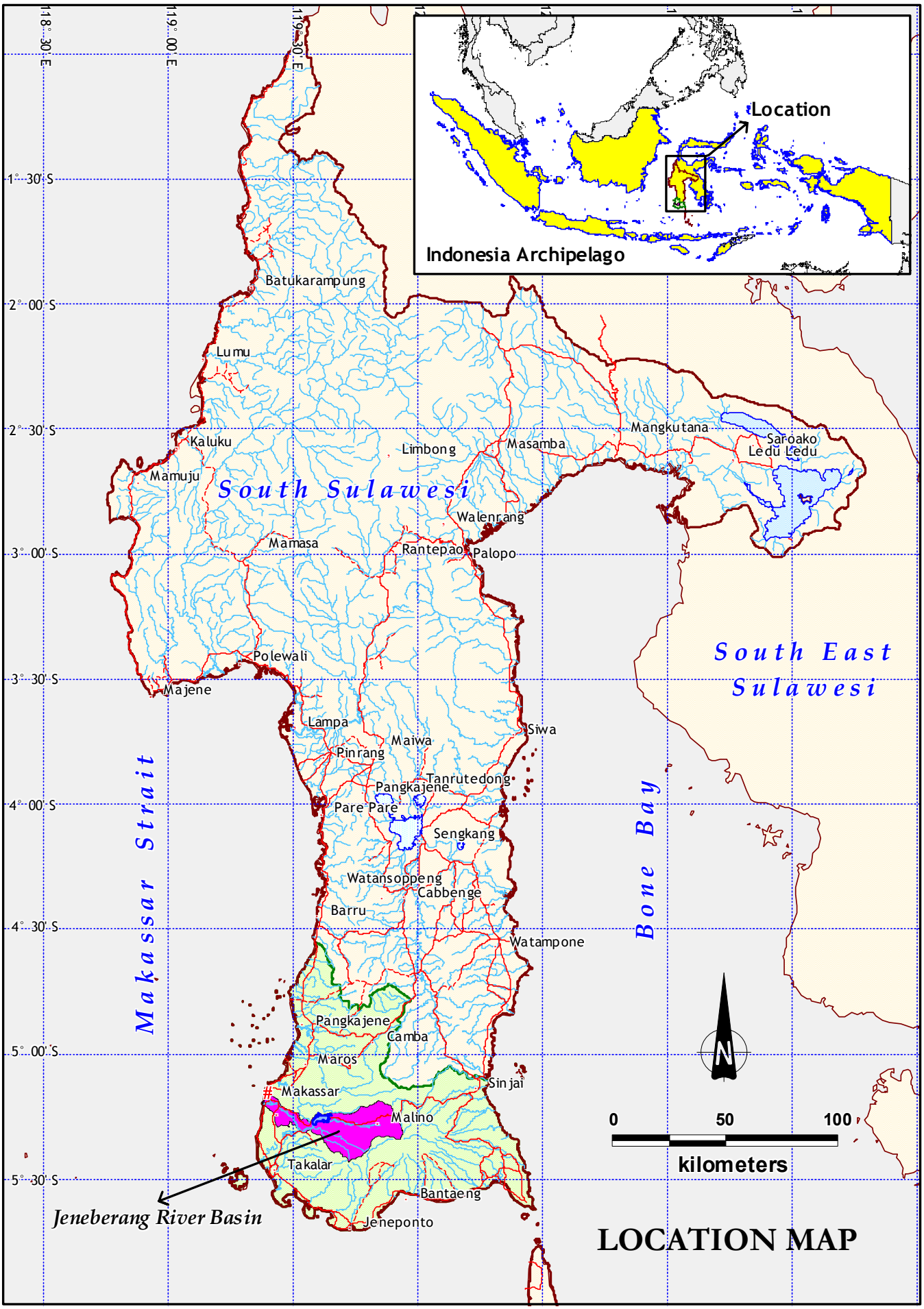
Japan International Cooperation Agency

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)


Location
Indonesia Archipelago
118° 30' E
119° 00' E
119° 30' E
1° 30' S
2° 00' S
2° 30' S
3° 00' S
3° 30' S
4° 00' S
4° 30' S
5° 00' S
5° 30' S
Batukarampung
Lumu
Kaluku
Mamuju
South Sulawesi
Limbong
Masamba
Mangkutana
Saroako
Ledu Ledu
Walenrang
Mamasa
Rantepao
Palopo
Polewali
Majene
Lampa
Siwa
Maiwa
Pinrang
Tanrutedong
Pangkajene
Pare Pare
Sengkang
Watansoppeng
Cabbenge
Barru
Watampone
Pangkajene
Camba
Maros
Sinjai
Makassar
Malino
Takalar
Bantaeng
Jeneponto
Jeneberang River Basin
Makassar Strait
Bone Bay
South East Sulawesi
N
0
50
100
kilometers
LOCATION MAP

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

FINAL REPORT

Volume III-1 Supporting Report 1

Table of Contents

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)

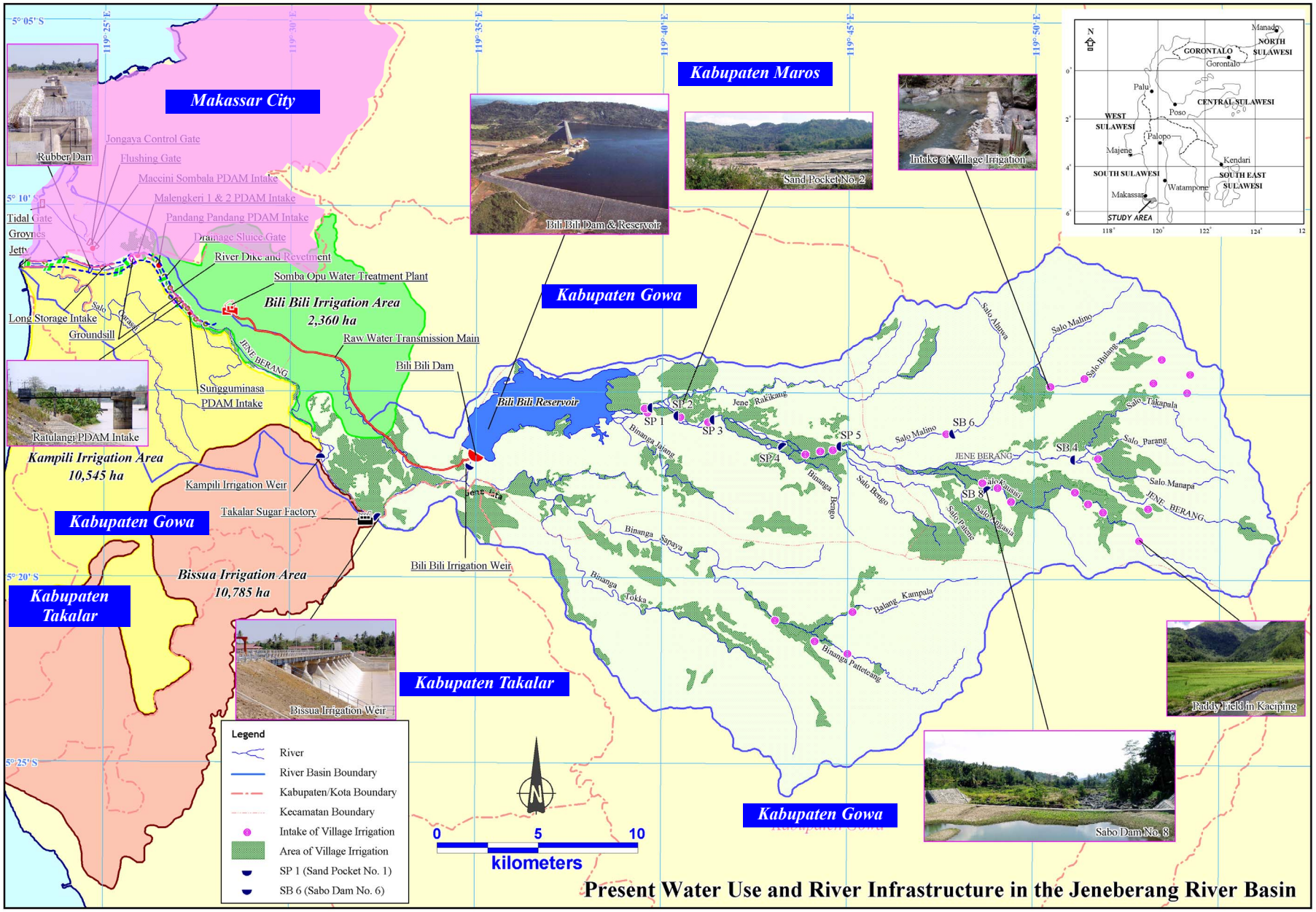
ABBREVIATION	BAHASA INDONESIA	ENGLISH
Kapolwil	Kepala Polisi Wilayah	Head of the Regional Police
Kepmen	Keputusan Menteri	Ministerial Decree
Keppres	Keputusan Presiden	Presidential Decree
KIMA	Kawasan Industri Makassar	Makassar Industrial Zone
Kimpraswil	Departemen Pemukiman dan Prasarana Wilayah	Ministry 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


Makassar City
Kabupaten Maros
Kabupaten Gowa
Kabupaten Takalar
Kabupaten Gowa
Kabupaten Takalar
Kabupaten Gowa
Rubber Dam
Jongaya Control Gate
Flushing Gate
Maccini Sombala PDAM Intake
Malengkeri 1 & 2 PDAM Intake
Pandang Pandang PDAM Intake
Drainage Sluice Gate
River Dike and Revetment
Somba Opu Water Treatment Plant
Bili Bili Irrigation Area
2,360 ha
Raw Water Transmission Main
Bili Bili Dam
Bili Bili Reservoir
Long Storage Intake
Groundsill
Sungguminasa
PDAM Intake
Ratulangi PDAM Intake
Kampili Irrigation Area
10,545 ha
Kampili Irrigation Weir
Takalar Sugar Factory
Bissua Irrigation Area
10,785 ha
Bili Bili Irrigation Weir
Bissua Irrigation Weir
Bili Bili Dam & Reservoir
Sand Pocket No. 2
Intake of Village Irrigation
Paddy Field in Kaciping
Sabo Dam No. 8
SP 1
SP 2
SP 3
SP 4
SP 5
SB 4
SB 6
SB 8
Legend
River
River Basin Boundary
Kabupaten/Kota Boundary
Kecamatan Boundary
Intake of Village Irrigation
Area of Village Irrigation
SP 1 (Sand Pocket No. 1)
SB 6 (Sabo Dam No. 6)
0
5
10
kilometers
STUDY AREA
Present Water Use and River Infrastructure in the Jeneberang River Basin

Supporting Report A

SOCIO ECONOMY OF THE STUDY AREA

Supporting Report A

SOCIO ECONOMY OF THE STUDY AREA

Table of Contents

List of Tables

Supporting Report A

SOCIO-ECONOMY OF THE STUDY AREA

A1 Socio-economic Profile of the Study Area

The Jeneberang River basin belongs to the province of South Sulawesi and extends over the three districts, namely Makassar City (Kota), Takalar District (Kabupaten) and Gowa District. Both Takalar and Gowa Districts benefit from newly irrigated water from the river basin. Both population and economic scales of the South Sulawesi Province are relatively small, compared with those of Java, but far exceed national average level.

The three districts, which the Jeneberang River basin extends, account for the largest segment of the population and economic performance of South Sulawesi Province. Makassar City as a capital of the province leads the manufacturing, commercial, and service activities of the province. An economic presence of Gowa and Takalar District is less significant, dependent on agriculture and labor-intensive industry.

A1.1 Population

(1) Population of the Study Area

Population of South Sulawesi Province amounts to approximately 8 million as of year 2002. Both population growth (1.1 % per annum) and density (127.7) of the province are close to the national average and have shown rather modest trends in recent years. Except Makassar City, South Sulawesi Province in general is less populous region. Population trend of the Study area is presented in Table A1.1.

Population of the Study area amounts to around 1.9 million as of year 2002 and have grown at rather higher ratio (1.4 %), reflecting a continuous influx of population into Makassar and development of residential estates in Gowa. Makassar City accounts for almost 60 % of the total population of the Study area, and is an exceptional in the province, in which it shows a nature of urbanization with heavy density of 6,416 persons per km^2. Accordingly, the Study covers relatively dense area (719.4 persons per km^2).

Table A1.2 shows that average household size in the Study area has attained the declining trend (from 4.6 persons per family in 2000 to 4.3 in 2002) as a positive result of family planning program. The sub-districts (Kecamatan) with average household size over 5.0 are a minority in the Study area, revealing the gradual shift to an urbanization and nuclear household.

The total workforce in the province amounts to around 3.1 million in 2002, and the ratio of workforce to the entire population is approximately 40 %. Notable changes in age composition have not been taken place in recent years.

A1.2 Economic Performance

(1) Gross Regional Domestic Product (GRDP)

Indonesia, along with other South-East Asian countries, was severely affected by the economic crisis during 1997/98. The economic crisis also hit the economy of South Sulawesi Province, and brought about a contraction of 5.3 % in 1998 compared to a growth of 4.3 % in the previous year (both in real-terms). However, the provincial economy immediately recovered owing to a revitalization of export-oriented industries (as a result of currency depreciation), and has maintained a steady growth since then.

Table A1.3 presents GRDP trend in the province and Study area in recent years. Average annual GRDP growth rate of South Sulawesi Province and the Study area has been 4.3 % and 6.0 % respectively between 1998 and 2002 in real terms, achieving a growth trend of the per-capita income (3.1 % and 4.4 % respectively) at the same period.

Also in every district in the Study area, both GRDP and per-capita income grow steadily after the economic crisis. Makassar City attains the higher annual GRDP growth rate of 6.9 %. Economic activities in the Study area have been largely concentrated (almost 78 % of the total GRDP) in Makassar. Per-capita income also increases, having been supported by the declining trend of population growth.

(2) Structure of Regional Economy

In the South Sulawesi Province, agricultural sector (food crops production sub-sector) is mainstay of the economy, accounting for 37.5 % (in 2002) of the total GRDP. This figure has been however declining from 45.8 % (in 1998) due to the shift to service-oriented economy. From Table A1.4, notable features of the economic structure of the province are summarized as follows;

- Manufacturing industry accounts for the small segment (11.4 % of the total GRDP in 2002) in the economy, and the process of industrialization has been slow. Among the manufacturing industries, agro-processing, wooden-products and cement / quarrying have a dominant share.
- Service-related industry (trading) expands steadily, benefiting from sophisticated access infrastructure such as sea / air ports in Makassar.
- Only Makassar shows the features of urbanization, explained by the higher contribution of manufacturing and service industry. Other districts in the Study area have almost same industrial structure as rural economy, where agricultural sector accounts for more than 45 % of the total GRDP in the district.

It is supposed that the Study area will further shift to service-oriented economy and gradual industrialization in the future, taking into account the past trend of economic structure. This change in structure will be generated at first by agro-processing industry and mining

development, followed by the related service industry. In accordance with such a structural change, a conversion of the existing agricultural and forestry area into housing and industrial estates will continuously take place in the Study area.

(3) Employment

As presented in Table A1.5, the sectors which absorb the workforce most is agriculture (57.9 % of the total workforce in 2002) in South Sulawesi, showing the feature of agriculture-based economy. In the Study area and Makassar, however, the major sector is replaced with trading, accounting for 28.7 % of total workforce of the Study area and 37.1 % of Makassar respectively. Agricultural workforce is more dominant in other districts such as Gowa, Takalar and Maros. It is also noted that the relatively larger workforce share by public administration is a common feature seen among the districts of the Study area.

(4) International Trade

The value of total commodity export from South Sulawesi Province amounts to US$ 744 million in 2001, and records steady growth from US$ 598 million in 1998. This growth trend has been largely explained by the currency devaluation at the time of economic crisis. Main export commodities have been nickel (43.6 % of the total value in 2001), cacao (24.4 %) and shrimp (12.7 %). Major destination of export includes Japan, Malaysia, Singapore, Philippine and United States.

The value of total import has faced a sharp decline as a result of adverse impact of economic crisis, although potential needs of import are rather strong. The amount drops from US$ 330 million in 1998 to US$ 206 million in 2001. Major commodity is machinery imported from Singapore and China.

(5) Investments

Foreign and domestic investment in South Sulawesi Province was severely affected by the economic crisis, but has been recovered in recent years. In 2002, the number of approved domestic investment project only amounts to 15, and the value of investment records Rp. 146,059 million. Domestic investment has been mainly directed to manufacturing industry and transportation sectors. While, the number of foreign direct investment reaches to 16 projects, amounting to US$ 382.8 million in 2002. Foreign investment mostly occurs in manufacturing and service industries.

(6) Prices

Inflation in the Study area takes place at the rather higher rate of growth (much lower, however, compared to the other Eastern Indonesia cities), reflecting the recent growth of economic activities and the resultant increase in demand. In Makassar, the inflation recorded 8.25 % per annum in 2002, and declined from 11.77 % in 2001.

Since the economy was severely influenced by the economic crisis, the past trend (Table A1.6) has been rather fluctuating, but indicates the average rate of escalation of 7.36 % per annum (eliminating the effect of economic crisis).

A1.3 Profile of Economic Sector

(1) Agriculture and Fishery

Agricultural sector still remains as mainstay one. Paddy production is most important crop. Paddy from the province accounts for almost 75 % (3,728 thousand tons in 2002) of the total production in the entire Sulawesi Island, although the area of paddy filed (822.6 thousand ha in 2002) has been in declining trend since 1999 (902.3 thousand ha), partly due to a declining trend of paddy price. As shown in Table A1.7, such a declining trend in paddy field has been also true for the Study area, particularly in the urbanized area, Makassar.

Other important basic staples in terms of production volume include maize, casaba, and sweet potato. Food crop production is significant activity in Gowa District in the Study area, accounting for almost 43 % of the total district GDP.

Plantation crops production is also active, and represented by sugar cane, tall coconut, coconut palm, cocoa, cacao in terms of volume of production. Large portion of the plantation crop production has been managed by the small estates, and the contribution of large private estates is very small. However, the Study area holds relatively smaller presence in the plantation crop production of the province.

Marine and blackish water fishery is another major activity in the Study area, particularly in Takalar and Maros District. Fishery sub-sector occupies the share of 21 % and 27 % respectively of each total GRDP.

(2) Mining and Quarrying

In South Sulawesi, mining and quarrying has not been negligible sector. The most intensive production takes place for limestone, and is utilized by domestic cement industry. Nickel production has an export value, and became one of the major economic drivers in the province.

In the Study area, limestone mining, clay extraction for brick and ceramic production, and sand mining for construction material are activities of importance. Particularly for sand mining, some non-permitted exploitation has been taking place particularly in the downstream of the Jeneberang River. As indicated in Table A1.8, such exploitation has been also encouraged by an increase in construction material prices in the recent years. Such a price increase might have reflected the limited supply (due to tighter mining control by the authority).

(3) Manufacturing Industry

Manufacturing industry itself has been on the expansionary trend; however, an extent of contribution to the entire economy of the province has been stagnant since economic crisis. This trend is also true to urban and industrialized district such as Makassar. Manufacturing sector is expected to act as a main driver of the regional economy by local governments, considering its industrial linkage with related industries including transport, public utility and financial services.

In South Sulawesi Province, activity of manufacturing sectors is largely seen in Makassar City, since approximately 53 % of total GRDP by manufacturing industry of the province has been generated by Makassar in 2001. Accordingly, manufacturing industry of Makassar is more dominant among the Study area, amounting to some 90 %. Among the manufacturing sub-sectors, three sub-sectors, namely agro-processing, wooden and cement products have a dominant share.

The number of large and medium industrial establishments in the Study area amounts to 46 and 131 units respectively as of 2002 as presented in Table A1.9. Most of these industrial establishments are located in Makassar City. The dominant types of industry are agro-processing and wooden product manufacturing as far as large and medium scale industry is concerned.

The largest sub-sector in terms of gross output value has been a cement production, followed by agro-processing and wooden products. The value of gross output of these major sub-sectors (Rp. 7,122,262 million in 2002) accounts for almost 94 % of the total manufacturing sector. Value-added ratio to the gross output is calculated as approximately 0.45 for the entire manufacturing industry.

(4) Service Industry

Service industry shares approximately 43 % of the total GRDP of the province. A GRDP share of service sector in Makassar City rises to 71 %, reflecting its feature of urbanization. On the other hand, the share of other districts in the Study area (Gowa and Takalar) remains relatively lower (around 41 %). It is of distinctive feature common to the Study area that public administration activity accounts for a large share (almost a third of service industry in Gowa and Takalar). Excluding public administration, service sub-sectors of importance in the regional economy include construction, trading, transportation, communication and financial services.

Growth of construction sub-sector peaked in 2000 and has shifted to gradual declining trend. Construction sector, however, still holds an expectation of growth, powered by the real estate development which undergoes in the coastal area of Makassar and the surrounding metropolitan area. Trading has been rapidly growing sub-sector since year of 2000, accounting for around 15 % of the total GRDP of the province in 2002. In the Study area, trading is also concentrated in Makassar City.

Tourism sub-sector

One of the potential sub-sectors is a tourism related industry in the Study area, considering the cultural and scenic resources such as historical sites in Gowa, Malino highlands, water falls, Bili-Bili reservoir and its surrounding and coastal area. Malino highland has already obtained business-oriented attentions from tourism industry.

Looking at the present economic performance of hotel and recreational business, however, it is judged as rather insignificant. The share of hotel and recreational business only accounts for 0.3 % of the total GRDP of the province and even less in case of the Study area.

The number of guest for accommodation facility in the province has increased as shown in Table A1.10, and amounted to 2,740 per day on average. Among this, foreigner guest shares around 10 %. Out of 8,000 rooms available in the province, around 3,800 rooms are located in the Study area, accounting for almost 47.5 %.

A1.4 Social Aspects

(1) Human Development

Major human development indicators in the South Sulawesi Province have been improved in the past years, as indicated in Table A1.11. Of importance is life expectancy, which increases from 63.7 in 1996 to 71.0 in 2001 on the provincial average. Educational-related indicators such as literacy ratio and average schooling period have also favorably improved.

Table A1.12 explains educational attainment performance as of year 2002. In the province, around 28.6 % of the total population over 10 years-old has not joined any formal education, and only 14.3 % has finished senior high school. This figure is largely improved in Makassar. Only 13.3 % of over 10 year-old population has not attended to school, and as many as 31.3 % of such population has finished senior high school. In other districts of the Study area, the almost same performance of educational attainment as the provincial average is observed.

(2) Basic Infrastructure

Diffusion ratio of piped-water and electricity varies among the districts in the Study area. As shown in Table A1.13, compared to electricity supply (62.5 % in 2002), piped-water supply (23.5 % in 2002) has not been widely diffused among the households of the entire Study area. One of the major reasons is an availability of alternative sources of water such as ground water and vender's supply.

It is also estimated that Makassar City holds the highest diffusion ratio for both water (36.7 %) and power (70.5 %) among the Study area, reflecting the higher household income. Piped water supply has been particularly low in the districts of Gowa, Takalar and Maros.

(3) Household Expenditure

Basic human needs such as education, health, water and electricity will be met in accordance with the rise in household income and resultant expenditure level. According to Socio-economic Survey (SUSENAS) 2002 and Table A1.14, the largest per-capita expenditure class observed in Makassar belongs to the range of Rp. 200,000 - 300,000, and Rp. 100,000 - 150,000 in Gowa and Takalar Districts.

These figures are then translated to be monthly household expenditure of Rp. 840,000 - 1,260,000 (for Makassar) and Rp. 430,000 - 630,000 (for others), based on the average household size. In Makassar, more than a quarter of the total household in the entire Study area belongs to the said expenditure class. In Gowa and Takalar Districts, as many as around 37 - 50 % of the population belongs to the largest expenditure class. Makassar is the wealthiest district, followed by Gowa.

(4) Poverty

Table A1.15 reports that the number of poor household amounts to 234,554 units, although the definition of "poor" is not explained. Based on this figure, poverty ratio to the entire household is estimated to be approximately 12.8 % in the province. Poverty ratio of the Study area (i.e. Makassar, Gowa and Takalar) is also estimated to be 9.8 %, but presents an insignificant gap in the ratio between the urban (Makassar-9.6 %) and rural (Gowa-9.7 % and Takalar-11.1 %) districts.

Besides, BPS also indicates the necessary expenditure to satisfy the minimum food and living essentials for each district, as Rp. 117,000 per capita / month in Makassar and Rp. 87,000 in Gowa. Population with per-capita expenditure below these lines is classified as poor. Monthly per-capita expenditure class shown in Table A1.14 also gives similar poverty ratios if those poverty lines are applied. It is then inferred that the poor household can afford the monthly expenditure of no more than around Rp. 420,000 in urban or Rp. 380,000 in rural area.

A1.5 Socio-economic Activity Related to River Basin Management

(1) Sub-district (Kecamatans) in the river basin

Sub-districts (Kecamatans) which belong to the Jeneberang River basin includes as follows. Demographic information at sub-district level[1] reveals the density gap, which accounts for the difference in degree of urbanization (urban, semi-urban and rural).

[1] Official information / data on economic performance and structure at Kecamatan level is not available.

(Urban sub-district)

Sub-district	District	Location in river basin	Density (/km^2)	Large and medium manufacturing units
Mariso	Makassar	Downstream	29,276	3
Mamajang	Makassar	Downstream	27,238	2

(Semi-urban sub-district)

Tamalate	Makassar	Downstream	7,322	4
Somba Opu	Gowa	Downstream	3,101	14
Pallangga	Gowa	Downstream	1,418	3
Bajeng	Gowa	Downstream	894	1

(Rural sub-district)

Bontomarannu	Gowa	Midstream	314	1
Polombangkeng U.	Takalar	Midstream	190	1
Parangloe	Gowa	Upper to mid stream	83	1
Bungaya	Gowa	Upstream	93	-
Tinggimoncong	Gowa	Upstream	117	3

Source : BPS, Kabupatens in Figure 2002, except industrial units of Pallanga, Tinggimoncong sub-districts (from BAPEDALDA.

Agglomeration of industrial units is largely seen in Makassar City but outside of the river basin area. In the semi-urban sub-districts of downstream area such as Tamalate, Somba Opu and Pallangga, there are some factories scattered. These sub-districts, although the manufacturing industry is not main economic sector yet, are vested with relatively plain grounds, and access to river water and trunk road to the market.

(2) Upstream area

Kecamatan Tinggi Moncong is located in the upstream area, and this sub-district has a large paddy field area, public and industrial forest. This is also larger producer of vegetable crops compared to the other basin sub-districts. Horticulture in this sub-district has grown during 1990s. Kinds of commodity developed include potato, cabbage, leek, tomato, broad bean and pea. Horticulture farming in the upstream have raised living standard of local people.

Compared to paddy and dry field farming, horticulture farming is more intensive. An application of hydrological system (modification of dike embankment according to rainfall condition) and crop shifting system (based on market demand), and usage of extensive fertilizer and pesticide have been observed in this area. Industrial forest which supplies firewood and other wood products has been also developed.

This sub-district is also well known as a tourism area, represented by Malino highland. Income generation opportunity has been abundant either through working for hotel and other types of accommodation or sales of vegetable.

While, change on land use pattern has been obvious in the upstream. There observes a tendency of forest conversion into horticulture farming and settlements in the form of resort facility construction. An intensive forest conversion in the upstream area generates adverse impacts on watershed basis and soil erosion.

(3) Midstream area

Sub-districts in the midstream area of the river basin earn incomes mainly from the primary industries such as paddy farming, horticulture crop farming, forestry, C-class mining and some agro-processing industries. Bili-Bili reservoir recently opened new income generation opportunities through floating net cage farming, food stalls and boat rental.

PT. INHUTANI (government-owned industrial forestry company) also provides a new field of job opportunity as farm workers, and allows local farmers to cultivate alley crops around the main crop. However, incomes generated from those new efforts were still considered as small.

Being based on the primary industries, this area also faces forest conversion into commercial usage and over application of fertilizer and pesticide as in the upstream area. Furthermore, an issue of river bed erosion and effluent discharge from agro-processing industry has been apparent in this area.

(4) Downstream area

Reflecting high population density and some industrial concentration, sub-districts in this area holds more assets to be protected from a threat of flood, and can be given the priority of river improvement and other flood mitigation works. In the downstream area of the river basin, a variety of livelihood is seen including service industries, construction, sand mining, fishery, coastal tourism, showing the urban characteristics and generating the higher clean water demand compared to the other river basin areas.

Furthermore, at the right side of the Jeneberang River mouth, urbanization and landscaping (namely Tanjung Bunga Development) have been undergoing, converting the existing swap area into commercial complex and large-scale housing estates, together with infrastructure development.

On the other hand, those areas may generate much higher risks of effluent and waste discharge. Along the river line, there observe many cases of non-permitted land usage even in the river corridor area. Intensive monitoring and control on waste discharge and land usage around this area should be imperative. Excessive extraction of ground water also needs to be curved by charging reasonable incentives to the existing and potential users.

Sand mining is conducted mainly around the rubber dam and at the left side of the Jeneberang River mouth, bringing about severe river bed erosion. The number of active miner has decreased due to tighter control by the local government, and mining activity in the lower reach is presently limited to traditional mining (manual excavation).

(5) Issues and conflicts related to river basin management

As mentioned in the above, there are some issues related to river basin management, triggered by socio-economic activities. Although generating favorable socio-economic progress,

development around the river basin also brings about issues that require adequate consideration by the authority or administrator. Some of these issues can be also considered as conflicts that have been generated between the upper and down stream of the basin. Major conflicts are summarized as follows;

- Clear water provision for municipal requirement needs to be further challenged, since the raw water may be increasingly polluted by the over usage of fertilizer and pesticide in the upstream area.
- Forest conversion into commercial usage will further provide the pressure onto the watershed basis and soil conservation, resulting in increasing sediment flows onto reservoir and earlier loss of reservoir function.

A2 Regional Development

A2.1 Regional Development Strategy and Plan by Provincial Level

Based on the rule of regional autonomy, district governments have been empowered to play a major role in their regional development planning. While, the role of provincial government has became limited to the coordination on the inter-district issues such as security, water resource, and environmental management. Under such a demarcation, the provincial development strategy and plan has been set as a sort of guidance paper, which each district authority is expected to refer to for their planning of regional development and sector program.

Provincial Government of South Sulawesi presently prioritizes the following development program areas as the target to be addressed by district governments under its Strategic Plan (RENSTRA) and Five-year (2001-2005) Socio-Economic Development Program (PROPEDA). An implementation of the program in the above area is then to be authorized through Annual Implementation Program (REPETADA).

A. Improvement of Quality of Life for Population

Priority Area of Program and Activity

1. Promotion of Quality, Relevant and Equal Education
2. Comprehensive Religious Development
3. Improvement of Health and Nutrient Services
4. Enhancement of Cultural and Art Activities
5. Employment Development

Supporting Area of Program and Activity

1. Population Control / Family Planning
2. Improvement of Social Welfare
3. Construction of Sport Facility
4. Women Empowerment
5. Promotion of Young Fellowship

B. Strengthening of Regional Economic Resilience

Priority Area of Program and Activity

1. Product Competitiveness Raising
2. Stabilization of Economic Democracy
   (Equal access to business information and financial resource)
3. Assurance of Regional Food Security
4. Strengthening of Regional Economic Structure
5. Reinforcement of Economic Integration of Sulawesi Island
6. Sustainable Natural and Marine Resources Management

Supporting Area of Program and Activity

1. Management of Water Resource and Transportation Infrastructure, Improvement of Regional Infrastructure, and Development of Communication Infrastructure
2. Facilitation and Management of Inter-district Issues

C. Improvement of Environmental Quality
Priority Area of Program and Activity
1. Management of Regional Legislative System
2. Strengthening of Law Enforcement and Society Order
Supporting Area of Program and Activity
1. Promotion of Access to Information by Population

D. Empowerment of Government Institution
Priority Area of Program and Activity
1. Empowerment of Government Institution
2. Empowerment of Social (political, economic, cultural and educational) Institution
Supporting Area of Program and Activity
1. Promotion of Policy Study and Research
2. Capacity Building of Development Planning

A2.2 Regional Development Strategy and Plan by District Level

Each district belonging to the Study area also prepares PROPEDA and REPETADA annually as a specific program document, and spatial plan. Major issues, development strategy and potentials recognized in the latest available documents by each district government are summarized as follows;

Makassar City (PROPEDA 2001-2005)

Key Issues for regional development	- Quality of urban facility and utility is not property maintained - Capacity development of human resources for urban development and management is not optimized - Market for manufacturing industry is stagnant - Women's participation in socio-economic activity is still weak - Unemployment rate is still high
Key Strategy	- Capacity development for urban development and management - Promotion of market-oriented economic development and local resource utilization - Improvement of accessibility to housing and basic infrastructure - Improvement of social welfare and promotion of community participation
Major Potential	- Marine resource - Large population, and superiority of the geographical location in Eastern Indonesia

Gowa District (RENSTRA / PROPEDA 2001-2005)

Key Issues for regional development	- Economic base of community / people is weak - Natural resource management is not optimized - Government role is not well institutionalized or weak - Living standard of community is low
Key Strategy	- Empowerment of economic base and improvement of investment condition - Improvement of natural resource utilization and management - Improvement of human resource quality through overriding budget allocation for education and capacity building - Strengthening the institution and role of government - Improvement of living standard of community
Major Potential	- Abundant natural resources such as water and suitable land for agriculture - Tourism and cultural resources - Strategic geographical location

Takalar District (RENSTRA 2000-2004)

Key Issues for regional development	- Productivity in agricultural sector is still low - Community still depends on small-scale agriculture and handicraft industry - Income distribution is not evenly made, ratio of poverty is high - Human resource quality and technological level are still low - Agro-business and industry are not well run
Key Strategy	- Improvement of human resource - Empowerment of general public and its institutions through increasing community participation - Improvement of accessibility to infrastructure and other public facilities to stimulate investment and business activities - Inter-connection of intelligence in the region
Major Potential	- Availability of basic and social infrastructure - Geographic location as supporting area for Makassar - Marine resource and human resource for fishery - Wide range of agricultural product and land - Tourism and maritime spots

Maros District

Key Issues for regional development	- Regional economic basis is not well established - Natural resource and environmental protection are not properly managed - Cultural activity is rather stagnant - Capacity of local public administration is weak
Key Strategy	- Creation of the necessary factor conditions and improvement of institutions for public officials to improve their presence in all the economic sectors
Major Potential	- Marine resource - Wide range of agricultural product and land

What is frequently emphasized throughout the regional development documents in the Study area is a necessity of i) proper utilization and management of natural resources, ii) strengthening the growth basis for major economic sector (i.e. agriculture, agro-related and manufacturing industries), and iii) capacity building for public administration services. Potential resources hold less variety among the district governments of the Study area and are limited to marine and tourism resources, and wide range of agricultural product.

Based on the strategic direction, priority programs in each sector are then to be formulated during REPETADA preparation by each district government also with reference to the said provincial guidance. After the regime of regional autonomy is legalized, however, consultation and coordination with the provincial government at the time planning process have been less facilitated.

A2.3 Integrated Spatial Plan in the Study Area

(1) *Mamminasata* Metropolitan Spatial Plan

Makassar City and its surrounding districts of Maros (some parts only), Gowa (only Sungguminasa part), and Takalar were designated as a metropolitan area known as

Mamminasata[2]. Badan Kerjasama Pengembangan Metropolitan *Mamminasata* (BKPMM) was officially legislated by the regional regulation and established as an independent board from government structure.

In 2003, BKPMM prepared *Mamminasata* Metropolitan Spatial Plan (2003-2012), that was also legislated by the regional regulation. The plan is designed to inhibit a rapid urbanization and over-density in Makassar and deal with urban management difficulties faced by each district government. This spatial plan includes the guidance document for planning, land use concept, and the mid-term infrastructure proposals (2004-2008). Land use concept is to categorize the metropolitan districts into the following areas;

Area Category	Concept
International Service Center	In Makassar City, other district capitals - Functioning as a center of trade, banking, tourism, maritime activities
Regional Service Center	In the outskirts of Makassar City, other district capitals - Functioning as higher-education center and central market for agricultural and marine products
Local Center	In the outskirts of Makassar City, other district capitals - Functioning as residential areas surrounded by green-belt zone and integrated with drainage and solid waste management system
Protected Zone	Included protected forest in town, forest reserve, water reserve, coastal area, historical sites
Utilization zone	Utilized for productive and social activities, including industry, tourism, education, health, housing, agriculture, and so on

The mid-term infrastructure program covers the sectors of water resource management, water supply, waste management, road, electricity, transportation (air, sea, and railway), telecommunication, tourism, industry, trade center. Of those water and related sectors, the projects that have implications to the Jeneberang River basin management are identified as follows;

[2] *Mamminasata* area covers the western and upper-middle parts of the Jeneberang River basin.

Sector	Program	Volume	Agency	Cost (million)
Water resource management	Physical environmental management	-	District gov. PSDA	Rp. 400
Waste water management	Construction of (communal) septic tank	100 units	District gov. DINAS Spatial Plan	Rp. 2,400
	Construction of waste water treatment plant	4 units	ditto	Rp. 6,060
	Construction of feces waste treatment plant	4 units	ditto	Rp. 10,500
Municipal water supply	(Makassar) Somba Opu WTP improvement	1,000 l/s	Dir. of Metropolitan City (DOMC)	Rp. 75,400
	Raw water transmission installation	11,000 m	ditto	Rp. 77,000
	PVC pipe installation	41,000 m	DOMC, DINAS Spatial Plan, City gov.	Rp. 3,240
	(Sungguminasa) Centrifugal pump (50 l/s, h-60 m)	2 units	DOMC	Rp. 500
	PVC pipe installation		DOMC, District gov.	Rp. 6,140
Industrial Development	Study / Planning for Industrial Center Development		DINAS Spatial Plan DINAS Industry District gov., BKPMM	Only study budget
	Land acquisition		Private investor	Rp. 1,000

Most water resource management projects are planned for other river basins. Industrial center plan and water supply capacity enhancements in Makassar and Sungguminasa will increase raw water demand from Bili-Bili reservoir (not quantitatively estimated for industrial center). Furthermore, waste water and feces treatment plants are identified to deal with chaotic effluent discharges in Makassar and the downstream of the river basin. This initiative will contribute to an improvement of river water quality.

An implementation of the plan and its supporting projects need to be listed also in the budget plan of the responsible central departments or provincial / district governments.

(2) Major Development Activity in the Study and *Mamminasata* Area

A distinctive issue on the development activity in the Study and *Mamminasata* area has been a recent change in land use pattern, as a result of a rapid conversion of agricultural into residential-commercial area in Makassar and the surroundings. Although the local government plans that the agricultural area needs to be appropriately protected from the rapid urbanization, effective regulation and mechanism have not been practiced yet.

Some real estate and related development is proceeding or planned in the Study area. Around the lower Jeneberang River basin, a large-scale residential and commercial complex development has been promoted by Gowa-Makassar Tourism Development Corporation (GMTDC). Housing development has been largely undertaken by refilling the formerly fishpond and inundated area.

There has been another large-scale housing and shopping mall development (Penakkukang Mas) in sub-district of Panakkukang in Makassar, which has been almost completed. Provincial BAPEDDA also addresses to the plan of resort facility development (villa, golf course) in the periphery of the Jeneberang River basin in Gowa.

A2.4 Existing Priority Program for Water Resource Sector

As documented in the above spatial plan, the followings have been prioritized as supporting programs in water resource related sectors, upon the agreement of the regional governments concerned.

Sub-sector	Activity	Location	Term
Water Resources / Irrigation	Study		
	- F/S on Tallo River Water Resources Utilization	Makassar, Gowa	Short-term
	- F/S on Maros River Water Resources Utilization	Maros	Short-term
	- M/P of Water Transportation System and Recreational Facilities in Tallo River, Sal Pampang	Makassar, Gowa	Mid-term
	- F/S on Water Transportation System and Recreational Facilities in Pamukullu River and Pappa	Takalar	Long-term
	Construction		
	- Installation of Transmission Plumbing System and Distribution of Clean Water (with discharge rate of 2,000 liter / sec from Bili-Bili	Makassar	Short- and mid-term
	- Construction of Pamululu Irrigation System	Maros	Mid- and long-term
	- Construction of Bontosunggu Dam	Maros	Mid- and long-term
	- Construction of Pamukullu Dam	Takalar	Not-specified
	- Construction of Water Transportation System and Recreational Facilities in Tallo River, Sal Pam Pang	Makassar, Gowa, Maros	Not-specified
Flood Control / Drainage	Study		
	- Master Plan on Flood Control and Drainage of Makassar	Makassar, Gowa,	Short-term
	Construction		
	- Opening of Daya Primary Drainage Line (Makassar and Bone Tanjora)	Makassar	Short-term
	- Opening of Batangase, Tomalia, and Other Primary Drainage Line	Maros	Short-term
	- Construction of Secondary and Tertiary Drainage in Area V (Daya and its vicinity)	Makassar	Short-term
	- Opening of Garassi River Line	S. Minasa	Not-specified
	- Construction of Primary Daya Drainage Line (Makassar and Bone Tanjora)	Makassar, Maros	Mid-term
	- Tallo River Flood Control Construction	Makassar, Maros	Mid-term
	- Construction of Primary Drainage in Batangase, Tomalia, and others	Maros	Long-term
	- Construction of Bontosunggu Dam	Maros	Not-specified

However, most of the above supporting programs have not identified the source of fund, and the demarcation among the central, provincial and district governments has not been clarified nor coordinated yet in the planning document.

A2.5 Public Expenditure of Regional Governments

Regional government finances the routine and development expenditure. Both routine and development expenditure has been in an increasing trend, due to the transfer of authority to district governments. However, the budget amount of regional government is judged as insufficient for adequate level of public services.

One of the important features seen in routine expenditure record is a heavy resource concentration in personnel expenditure, as shown in Table A2.1. In the poorly revenue-based districts such as Gowa and Takalar, almost 80 % of the routine expenditure is spent on personnel expense. Every local government in the Study area is in short of repair and maintenance expenses for proper management of infrastructure and public facilities.

Table A2.2 indicates the details of development expenditure by sector. Development expenditure has been also increased as a result of transfer of responsibility for budget disbursement to the projects in respective sector. Budget of the provincial government is largely allocated to the sectors such as agriculture, transportation, water resource and irrigation, environment, and subsidy for district governments. District governments in the Study area put a rather stronger budgetary emphasis to cooperatives, community empowerment, dwelling development, health and welfare, and education, aside from capital-oriented sectors.

A3 Community Organizations and Activities

Community organization in general in the Study area can be categorized into: i) common public organization and ii) Non-Government Organization (NGO). Common public organizations are usually religion and profession-based, or based on women and youth group. Many could trace their roots to government-initiated programs and were linked to governmental organizations of the New Order era. Some still have deep roots in their corresponding societies and have managed to become independent, e.g. women organization (PKK) and village resilience organizations (LKMD).

Non government organizations were initially known for their advocating roles, especially to channel suppressed voices of the people during the New Order administration. Economic crisis during 1997-1998 stimulated a growth of community service-oriented NGOs.

Concerning the common public organization, equal participation by men and women seems difficult. It is indicated that generally women group activity and its capacity development is rather constrained by for their domestic work, even though their participation in the society is significant.

In NGOs activities, tendency of equal participation has been well promoted, especially in the urban area. Even in the rural area, women participation is being mainstreamed. In Gowa District, two communication forums for women are set up. In Takalar District, similar movement comes from grassroots level, and plural village community groups are re-organized into a women forum to ensure their opportunity to voice their needs.

A3.1 Community Organizations in Makassar

Makassar City, as the capital of South Sulawesi and the largest city of the Eastern Indonesia is host to a gargantuan amount of NGOs. The very first local NGOs were born in the mid 80s and their ranks swelled to its peak in 1996-1998, stimulated by conditions for endorsements by the financial donors for an increased involvement of NGOs in absorbing aids more effectively.

In year 2000, South Sulawesi-based NGOs annexed themselves into one forum associative group (FIK-ORNOP), a vessel actually established back in 1990 as FIK-LSM. At its birth, it registered 41 members, out of 60 existing NGOs at that time. A standardization in 2003 led to the abolishment of some members. At present, the forum consists of 38 members as quoted in Table A3.1. Another 100 or so are in the pipeline, waiting for admittance into the forum. Their scopes of activity usually revolve around legal aids, community development, human resources development, environment and rural economy development.

A3.2 Community Organizations in Gowa

Advantage access to Makassar contributes significantly to the developments and growth of Gowa-based NGOs. Gowa District Government registers 104 common public organizations and

53 NGOs including 13 women organizations. Most of common public organizations in Gowa are the organizations with main activities to serve the members internally, not for providing services to the society. More than 30 % are religion-based and some 21 % are youth groups, followed by 19 % of profession-based.

NGOs provide services to the society, presenting them with opportunity to work with other institution and organization which enhances their credibility as a worth partner. NGOs contribute to the sectors that are not covered by the common public organizations such as environment and community development. So far their activities mostly focus on ombudsman and community work through participating in the several government-initiated programs.

A3.3 Community Organizations in Takalar

There are about 28 active NGOs, and the District Takalar is currently working with NGOs through providing 20 field officers to support community groups (KSM) at the village level. Activity of NGOs in Takalar started recently. Influenced by some foreign aid program, NGOs has been formed one by one to fulfill the basic needs of community. Comparing to other districts, the District Government of Takalar allocates more fund and takes more initiative to collaborate with NGOs in supporting community groups. This system was originally introduced during the poverty alleviation program initiated by JICA. Community organizations in Gowa and Takalar Districts are categorized as follows;

Type of activity	Gowa		Takalar	
	CPOs	NGOs	CPOs	NGOs
Religion-based	32 (30 %)	3 (6 %)		3 (11 %)
Profession-based	20 (19 %)	-		-
Youth and sports	22 (21 %)	-		-
Woman empowerment	12 (11 %)	3 (6 %)		2 (7 %)
Environment	2 (2 %)	10 (19 %)		7 (25 %)
Community development	-	12 (23 %)		7 (25 %)
Health/nutrition, culture/arts	2 (2 %)	1 (2 %)		-
Legal aid	-	3 (6 %)		2 (7 %)
Human resources development	3 (3 %)	4 (7 %)		2 (7 %)
Business/industry	2 (3 %)	3 (6 %)		-
Others	9 (9 %)	14 (26 %)		5 (18 %)
Total	104	53	n.a	28

Tables

Table A1.1-a Population Trend of the Study Area

	1998	2000	2002	Average growth rate	Population density -02
South Sulawesi	7,624,525	7,801,678	7,960,991	1.09 %	127.7
Makassar	1,066,757	1,100,019	1,127,785	1.40 %	6,416.3
Gowa	494,725	512,876	528,313	1.66 %	280.5
Takalar	224,794	229,718	232,681	0.87 %	410.7
Study area total	1,786,276	1,842,611	1,888,779	1.41 %	719.4
Maros	265,283	272,116	278,833	1.25 %	172.2

Source : BPS, South Sulawesi in Figures 2002

Table A1.1-b Population by Kecamatan of the Study Area

Makassar	2000	2002	Household size -02
- Mariso	51,419	53,282	4.6
- Mamajang	59,689	61,286	4.3
- Tamalate	130,777	133,119	4.2
- Rappocini	128,637	128,855	4.3
- Makassar	80,593	84,104	4.6
- Ujung Pandang	27,254	29,889	5.0
- Wajo	34,833	35,402	4.6
- Bontoala	57,406	59,549	4.8
- Ujung Tanah	44,373	46,129	5.1
- Tallo	116,633	120,786	4.5
- Panakkukang	124,861	129,651	4.1
- Manggala	77,443	81,102	4.4
- Biringkanaya	96,057	100,018	4.0
- Tamalanrea	82,641	85,140	3.0

Gowa	2000	2002	Household size -02
- Bontonompo	58,319	60,038	4.5
- Bajeng	68,693	70,763	4.4
- Pallangga	66,491	68,493	4.6
- Barombong	26,003	26,787	4.7
- Somba Opu	84,566	87,115	4.8
- Bontomarannu	41,973	43,241	4.5
- Parangloe	25,151	25,907	4.0
- Tinggimoncong	31,414	32,364	4.9
- Tombolo Pao	22,106	22,791	5.1
- Bungaya	28,610	29,475	3.9
- Tompobulu	27,890	28,721	4.2
- Biringbulu	31,660	32,618	3.3

Takalar	2000	2002	Household size -02
- Mangarabombang	32,613	33,563	4.4
- Mappakasunggu	25,118	25,430	4.7
- Polombangkeng S.	23,124	23,471	4.0
- Polombangkeng U.	38,939	40,338	3.8
- Galesong S.	43,410	44,479	4.6
- Galesong U.	38,614	39,319	4.4
- Pattalassang	28,345	28,967	4.5

Maros	2000	2002	Household size -02
- Mandai	25,659	26,054	n.a
- Moncongloe	9,335	9,483	n.a
- Maros Baru	20,750	21,629	n.a
- Lau	20,755	21,104	n.a
- Turikale	34,146	35,210	n.a
- Marusu	21,050	21,718	n.a
- Bontoa	23,999	23,877	n.a
- Bantimurung	26,513	27,030	n.a
- Simbang	19,701	20,013	n.a
- Tanralili	21,419	21,462	n.a
- Tompobulu	11,905	12,120	n.a
- Camba	13,337	13,551	n.a
- Cenrana	12,988	13,242	n.a
- Mallawa	10,559	10,703	n.a

Source : BPS, Makassar, Gowa, Takalar, Maros in Figures 2002

Note : Shaded Kecamatans belong to the Jeneberang River basin area.

Note : Total population for each district (Kabupaten or Kota) in Table 2.1-b does not coincide with the figure in Table 2.1-a, due to difference in data source (i.e. BPS by Kabupaten and BPS Province).

Table A1.2 Average Household Size in the Study Area

	2000	Number of Household	2002	Number of Household
South Sulawesi	4.4	1,760,024	4.3	1,830,336
Makassar	4.6	237,084	4.2	270,509
Gowa	4.4	116,803	4.4	119,894
Takalar	4.5	50,796	4.3	54,495
Study area total	4.6	404,683	4.3	444,898
Maros	4.6	59,472	4.5	61,856

Source : BPS, South Sulawesi, Makassar, Gowa, Takalar, Maros in Figures 2001 and 2002

Table A1.3 GRDP Trend of the Study Area (in 1993 constant price)

			1998	2000	2001	2002	Average annual growth rate (real)
South Sulawesi	GRDP	Rp. mil	9,366,229	10,101,948	10,603,661	11,092,996	4.3 %
	Per-capita	Rp.	1,228,434	1,294,843	1,343,632	1,389,587	3.1 %
Makassar	GRDP	Rp. mil	2,212,970	2,589,535	2,704,974	n.a	6.9 %
	Per-capita	Rp.	2,074,484	2,354,082	2,392,969	n.a	4.9 %
Gowa	GRDP	Rp. mil	487,879	508,704	531,557	n.a	4.4 %
	Per-capita	Rp.	974,199	911,865	1,017,361	n.a	2.6 %
Takalar	GRDP	Rp. mil	213,666	229,260	238,696	248,631	3.9 %
	Per-capita	Rp.	916,627	998,007	1,028,075	1,070,862	4.0 %
Study area total	GRDP	Rp. mil	2,914,515	3,327,499	3,475,227	n.a	6.0 %
	Per-capita	Rp.	1,631,615	1,805,861	1,857,301	n.a	4.4 %
Maros	GRDP	Rp. mil	314,804	329,579	340,875	n.a	2.7 %
	Per-capita	Rp.	1,192,368	1,233,043	1,258,806	n.a	1.8 %

Source : BPS, GRDP in South Sulawesi and South Sulawesi, Makassar, Gowa, Takalar, Maros in Figures 1999-2002
Note : Per-capita GRDP is partly calculated by the Study team.

Table A1.4 Sector Contribution to GRDP in the Study Area (%, in 2002 current price)

	South Sulawesi		Makassar	Gowa	Takalar	Maros
	1998	2002	2001	2001	2002	2001
1. Agriculture	45.8	37.5	2.3	45.3	48.8	69.0
(Farm crops)	(35.8)	(27.7)	n.a	(43.0)	(25.3)	(39.7)
(Fishery)	(8.2)	(8.5)	n.a	(0.4)	(21.0)	(26.6)
2. Mining & Quarrying	6.0	7.7	0.02	7.5	0.7	1.3
(non-oil / gas)	(4.5)	(6.4)	n.a	n.a	(0.7)	(1.3)
3. Manufacturing industry	11.2	11.4	26.7	5.7	9.3	1.5
(Food, beverage, tobacco)	(5.9)	(6.4)	n.a	n.a	n.a	n.a
(Wood products)	(1.8)	(1.5)	n.a	n.a	n.a	n.a
(Cement / Quarrying)	(2.6)	(2.7)	n.a	n.a	n.a	n.a
4. Public Utility Industry	0.9	1.1	2.7	1.8	0.9	0.7
5. Construction	4.4	4.0	8.0	3.3	4.9	1.2
6. Trading, Hotel, Restaurant	13.2	16.5	27.4	10.5	9.3	6.6
(Wholesale / Retail)	(12.0)	(15.1)	n.a	(9.3)	(8.7)	(5.9)
(Hotel)	(0.2)	(0.2)	n.a	(0.2)	(0.0)	(0.02)
7. Transportation & Communication	5.8	7.0	12.9	4.7	4.0	7.0
8. Financing Services	3.9	3.6	5.1	3.7	6.2	2.6
9. Other Services inc. public admin.	8.6	10.9	14.9	17.6	15.9	10.2
(Entertainment / Recreation)	(0.1)	(0.1)	n.a	(0.01)	(0.01)	(0.03)

Source : BPS, GRDP in South Sulawesi and South Sulawesi, Makassar, Gowa, Takalar, Maros in Figures 2002
Note : Per-capita GRDP is partly calculated by the Study team.

Table A1.5 Workforce Distribution by Sector in 2002 in Percentage

	South Sulawesi	Makassar	Gowa	Takalar	Study area total	Maros
Agriculture	57.9	1.5	44.3	58.1	22.2	49.2
Mining and Quarrying	0.4	0.6	0.1	0.2	0.4	-
Manufacturing	5.6	11.6	6.4	8.5	9.7	5.2
Public Utilities	0.3	1.4	0.3	0.1	0.9	-
Construction	3.0	8.3	8.2	5.1	7.8	6.0
Trade, Hotels and Restaurant	15.6	37.1	18.7	16.4	28.7	17.9
Transportation and Communication	5.0	10.8	6.6	5.5	8.8	7.8
Finance, Insurance and Real Estate	0.4	1.6	0.9	-	1.2	0.2
Public Administration and Others	11.7	26.6	14.4	6.2	20.0	13.7

Source : BPS, South Sulawesi in Figure 2002

Table A1.6 Average Inflation Trend in Kota Makassar

	1996	1997	1998	1999	2000	2001	2002	Term average*
General to commodities	4.56 %	8.20 %	67.89 %	1.64 %	9.73 %	11.77 %	8.25 %	7.36 %

Source: BPS, South Sulawesi in Figure, 2002

Note : Term average is derived by excluding the figure in 1998 to better represent the likely trend, since this period was faced by the economic crisis.

Table A1.7 Paddy Field (wet and dry) and Production Trend

	Area (ha)		Production (thousand ton)	
	1999	2002	1999	2002
South Sulawesi	902,286	822,586	3,870.0	3,728.0
Makassar	4,139	2,172	19.5	11.0
Gowa	45,953	45,241	205.9	232.0
Takalar	23,857	21,409	124.0	118.3
Study area total	73,949	68,822	349.4	361.3
Maros	39,757	41,257	218.6	223.9

Source : BPS, South Sulawesi, Makassar, Gowa, Takalar and Maros in Figure, 2002

Table A1.8 Average Wholesale Prices of Sand and Gravel Products in South Sulawesi

	Unit	1999	2002	2003	2004
Sand	Rp. / m^3	26,000	-	40,500	41,667
Gravel	Rp. / m^3	39,700	59,584	87,500	92,000
River stone	Rp. / m^3	-	47,500	51,200	52,755

Source: BPS South Sulawesi in Figure 2002, Makassar Revenue Office for 2003-04

Table A1.9 Number of Industrial Establishments (registered) in 2002

	Makassar	Gowa	Takalar	Total
Large unit	40	5	1	46
Medium unit	111	16	3	131
Dominant type of industry	1) Agro-processing 2) Wooden product 3) Print / publication	1) Agro-processing 2) Wooden product	n.a.	

Source: BPS, South Sulawesi, Makassar, Gowa and Takalar in Figure, 2002

Table A1.10 Number of Accommodation Establishment and Guest in 2003

Classification	Number of establishment	Number of room	No. of guest per day ('99) Local	Foreign	Total	No. of guest per day ('03) Local	Foreign	Total
Star-class (five and four)	6	907	203	20	223	272	106	378
Star-class (three to one)	41	1,665	160	77	237	488	51	540
Non-star class	362	5,360	736	18	754	1,805	17	1,821

Source : BPS, Hotel and Other Accommodation Statistics in Indonesia, 2003

Table A1.11 Selected Human Development Indicators

	Unit	1996	2001	Ratio of improvement
Life Expectancy	Years	63.7	71.0	12.7 %
Average Schooling Period	Years	5.6	6.8	21.4 %
Literacy Ratio	%	77.7	82.8	6.7 %

Source: BAPPEDA I South Sulawesi

Table A1.12 Percentage of Population over 10 Years-old by Educational Attainment in 2002

	Never / not yet attended school	Primary School	Junior High School	Senior High School	University
South Sulawesi	28.6	31.8	16.5	14.3	2.6
Makassar	13.3	18.3	19.1	31.3	7.6
Gowa	30.3	27.5	17.7	14.5	2.4
Takalar	36.9	30.6	15.5	10.6	1.3
Maros	35.8	31.3	14.2	12.9	1.6

Source: BPS, South Sulawesi in Figure, 2002

Table A1.13 Diffusion Ratio of Domestic Piped-water / Electricity in 2002

	No. of Domestic Customer (piped-water)	No. of Domestic Customer (electricity)	No. of Household (reported)	Diffusion Ratio (piped water)	Diffusion Ratio (electricity)
Makassar	99,324	190,749	270,509	36.7 %	70.5 %
Gowa	3,870	72,032	119,894	3.2 %	60.1 %
Takalar	1,401	13,816	54,495	2.6 %	25.4 %
Study area total	104,595	276,597	444,898	23.5 %	62.2 %
Maros	3,710	n.a	61,856	6.0 %	n.a

Source: BPS, South Sulawesi, Gowa, Takalar and Maros in Figure, 2002

Note : Diffusion ratio is not officially announced, therefore calculated by the Study team based upon household number.

Table A1.14 Monthly Per-capita Expenditure Class in 2002 (percentage)

Expenditure Class (Rp.)	Less 60,000	60,000 -79,999	80,000 -99,999	100,000 -149,999	150,000 -199,999	200,000 -299,999	More 300,000
South Sulawesi	1.03	4.88	10.98	36.76	22.01	16.42	7.92
Makassar	0.10	2.25	5.10	16.70	21.70	28.87	25.28
Gowa	1.93	7.61	17.21	37.46	17.80	13.52	4.47
Takalar	-	1.89	13.40	49.29	25.12	8.87	1.44
Study area total	0.62	3.73	9.58	26.66	21.02	22.01	16.39
Maros	0.13	2.00	10.24	47.20	23.26	11.82	5.34

Source: BPS, Socio-economic Survey (SUSENAS) South Sulawesi, 2003

Table A1.15 Number of Poor Household in 2002

	South Sulawesi	Makassar	Gowa	Takalar	Study area total	Maros
Poor household	234,554	26,080	11,629	6,034	43,743	3,076
Total household	1,830,336	270,509	119,894	54,495	444,898	61,856
Poverty ratio	12.8 %	9.6 %	9.7 %	11.1 %	9.8 %	5.0 %
Poverty line (per capita / month)	Rp. 101,292	Rp. 117,071	Rp. 87,117	Rp. 88,255	n.a.	Rp. 97,973

Source: BPS, South Sulawesi for the number of poor and total household. Poverty line is derived from BPS, National Poverty Survey, 2003

Table A2.1 Public Expenditure (Routine) by Regional Governments in 2002

(million Rp.)	South Sulawesi	Makassar	Gowa	Takalar	Maros
Personnel expenditure	212,188.0	240,981.8	117,947.7	63,043.0	
Pension expenditure	-	26.4	1.2		
Material expenditure	41,643.0	42,386.3	9,608.9	7,985.1	
Repair and maintenance	10,779.3	10,653.3	1,869.6	1,028.1	
Inspection	10,859.9	2,085.1	1,652.8	1,049.5	n.a
Grant for lower (income) regions	5,399.7	-	557.1	730.0	
Loan repayment and interest	1,729.6	2,518.5	3,578.0	170.0	
Unpredictable expenditure	5,580.9	-	955.2	-	
Unclassified and other expenditure	38,253.7	31,482.7	9,692.6	3,855.7	
Total (2002) *	326,443.0	330,134.1	145,863.0	78,043.4	103,309.7
Total (2001) *	147,786.4	104,443.3	129,560.2	30,637.2	40,628.4

Source : BPS, South Sulawesi in Figure

Note : Figure of Province South Sulawesi, Kabupaten Takalar and Maros is of year 2001 and 2000.

Table A2.2 Public Expenditure (Development) by Regional Governments in 2002

(million Rp.)	South Sulawesi	Makassar	Gowa	Takalar	Maros
Agriculture and forestry	17,357.8	848.3	6,467.4	2,657.5	
Industry	617.7	184.9	662.5	58.6	
Mining and energy	436.4	-	589.3	789.0	
Transportation	24,350.8	-	11,877.1	6,319.6	
Tourism and telecommunication	1,082.7	585.7	640.6	140.4	
Trade, business, and cooperatives	5,290.1	1,219.6	19,510.5	2,319.6	
Manpower	593.4	303.5	569.8	84.3	
Water resource and irrigation	12,181.0	-	1,373.8	100.0	
Regional development and settlement	3,060.8	19,811.3	5,977.2	2,439.0	
Environment and land utilization	7,386.3	623.0	490.0	825.1	n.a
Religion	486.9	500.0	1,368.7	336.2	
Dwelling and settlement	5,421.3	6,674.6	4,647.6	4,142.9	
Population and family planning	100.0	3,549.3	100.0	270.0	
Welfare, health and women issue	5,537.3		5,103.1	2,643.9	
Science and technology research	1,358.3	1,049.0	1,712.4	623.9	
Law issue	219.9	200.0	75.0	55.6	
Government apparatuses and controlling	7,773.0	13,078.5	8,547.4	3,093.1	
Political, information and communication	982.7	210.0	216.5	118.5	
Security and defense	306.1	-	325.8	206.4	
Education and cultural issue	3,207.4	2,056.9	4,137.4	3,018.8	
Subsidy to lower (income) region	21,501.1	-	-	-	
Total (2002) *	119,201.0	50,894.6	74,391.7	30,242.3	52,806.3
Total (2001) *	161,150.7	27,773.4	48,912.5	9,890.1	22,404.5

Source : BPS, South Sulawesi in Figure

Note : Figure of Province South Sulawesi, Kabupaten Takalar and Maros are of year 2001 and 2000.

Table A3.1 List of NGOs (FIK ORNOP SULSEL)

No	Name	Notary Deed	Location of Activity	Main Activity
1	BLPM (Center Training & Development of Human Resources)	No:147/ 1997	Provinces of Sulawesi, Maluku, West Papua, East Kalimantan	- Study on Social Issues - Skill Development - Information Service
2	JATI Institution	No:28/ 1998	South Sulawesi	- Community Economic Development - Environment - Advocacy of Human Right Collision - Child Alternative Model Development
3	KRA-AIDS (Global Awareness Movement)	No:27/ 1994	Makassar, Pare-Pare	- Health / HIV-AIDS Prevention
4	LAMBEQ SIAPPER (Foundation for Forest Conservation)	No:154 /1990	Makassar, Polmas	- Housing Construction and Cultivation
5	LBH-P2I (Society For Legal Aid & Women's Empowerment)	No:2/ 1995	South Sulawesi	- Legal Aid Service - Women Empowerment
6	LBH PERBINDO (Society for Legal Aid & Labor Empowerment)	No:3/ 1998	Makassar	- Legal Aid Service - Training of Labor Organization - SME Development - Women Empowerment
7	LBH-UP (Society for Legal Aid)	No:7 /1983	Makassar	- Advocacy - Legal Aid - Research & Study
8	LEKMAS (Institute of Social Study & Consultant South Sulawesi)	No:16/ 1992	Makassar, Gowa, Maros, Mamuju, Luwu, Enrekang, Takalar, Majene, Barru, Toraja, Wajo	- Capacity Building - Community Institution Development - Policy Study - Training for Poor Village (IDT) - SME Development
9	LEPPSEM (Institute of Construction & Development for Socio-Economic Community	No:46/ 1995	Central/South Sulawesi, Bone, Wajo, Sidrap, Luwu, mamuju, Polmas	- Study on Social Issues - Training for Community
10	LIPKEM (Foundation for community Health & Economic Development)	No:39/ 1997	Makassar, Jeneponto, Gowa	- Capacity Development - Livelihood Support - Health & Environment - Horticulture Support
11	LKPMP (Institution of Study for Community Development)	No:3/ 1993	Makassar, Pinrang	- Training - Agribusiness - Health Program
12	LKPM (Institution of Community Development Study)	No:5/ 1998	Makassar, Gowa, Jeneponto, Takalar, Majene, Polmas, Pare-Pare, Tator, Soppeng, Bulukumba	- Community Development - SME Development - Training for Marginal Area Community - Training of Development Motivator
13	LML (Institution of Environmental Partner)	No:56/ 1996	Makassar, Gowa, Takalar, Bulukumba, Enrekang, Pangkep, Bantaeng, Jeneponto	- Water Supply & Sanitation - Agriculture & Forestry Support - Livelihood Support - Health & Environment - Horticulture Support - Fishery Support - Community Development - SME Development

No	Name	Notary Deed	Location of Activity	Main Activity
14	LP2EM (Institution of Study for Economic Development and Community)	No: 9/ 1996	Pare-Pare	- Entrepreneur Training - Fishery Assistance - Handicraft Support - Community Development
15	LP3M (Institution of Rural, Coastal Community Study)	No:158/ 1986	Makassar, Selayar	- Training - Health
16	LPPI (Institution of Indonesian Rural Empowerment)	No:15/ 1996	Gowa, Barru, Sidrap, Enrekang, Toraja, Pare-pare	- Capacity Building for Rural Community - Assistance for Horticulture
17	LPSP (Institution of Rural Development)	No: 3/ 1995	Polmas, Majene, Mamuju	- HIV/AIDS Prevention
18	LPUKM (Institution of SME Support)	No: 78/ 1992	Makassar	- SME Development - Environmental Health - Community Development
19	LSIC (Insan Cita Institution Study)	No: 41/ 1998	Makassar	- Human Resources Development - Policy Study
20	PKBI (Indonesian Planned Parenthood Assocation / IPPA)	No: 3/ 1995	Makassar, Maros, Majene, Barru, Polmas, Gowa, Enrekang, Bantaeng, Mamuju	- Family Planning - Women Empowerment
21	WALDA (Wahana Lestari Persada)	No:15/ 1992	Tanatoraja	- Natural Resources Management - Human Resources Development
22	WWL (Wahana Wisata Lingkungan)	No:8/ 1996	Makassar City; Districts of Gowa, Takalar, Maros, bone, tanatoraja, Jeneponto	- Environmental Training - Eco-tourism Support - Capacity Building for Community - Capacity Building of Gerabah Worker - Community development
23	YAPTA-U (Institution of PABBATA UMMI)	No:6/ 1997	Makassar, Bone, Polmas, Jeneponto	- Family Service - Assistance for Marginal Child
24	YAPIT (Institution of Islamic Study)	No:8/ 1996	Bone, Soppeng	- Agriculture, Fishery Support - Community Development - Land Rehabilitation and Conservation
25	YASINDO (Institution of Indonesian Ocean)	No:7/ 1995	Makassar, Selayar, Gowa, Bantaeng, Bulukmba, Sinjai, Pangkep	- Costal Natural Resources Management - Fishery Community Suppor - Rural Community Assistance
26	YASMIB (National Partnership Foundation)	No:9/ 1999	Makassar, Wajo	- Human Resources Development - Community Development
27	YASPINDO (Indonesian Care Foundation)	No: 21/ 1994	Makassar, Enrekang Gowa, Maros, Selayar	- Community Development - HIV/AIDS Prevention - Training
28	ASE South Sulawesi Institution	No: 34/ 1997	Luwu	- Human Resources Development - Community Development
29	MASAGENA Institution	No;96/ 1994	Makassar	- Information Service - Community Development
30	YBM (Binamandiri Institution)	No:44/ 1991	Makassar, Maros, Bulukumba, Palopo, Takalar	- Entrepreneurship - Culture and Tourism - Health and Environment - Gender
31	Sawerigading Institution	No;6/ 1998	Makassar	- Community Development - Women Empowerment - Environment
32	YCMI (Institution of Cipta Mandiri Indonesia)	No:5/ 1991	Makassar	- Community Development
33	YGC (Institution of Celebes Style)	No:26/ 1995	Makassar	- Consultation and Carrier Assistance - Book Distribution Service

No	Name	Notary Deed	Location of Activity	Main Activity
34	YKL (Institution of Sea Conservation)	No:196/ 1997	Makassar, Barru, Pangkep, Takalar, Pinrang	- Environmental, Social Issue Study - Coastal Area Community Support - Coastal Area Management
35	YKPM (Social Studies & Empowerment Foundation)	No: 30/ 1999	Makassar	- Economic and Policy Study
36	YLK-SS (Institution of South Sulawesi Consumer)	No: 26/ 1973	Makassar	- Advocate on Consumer Rights - Survey on Trading Practice
37	YTMI (Indonesian Self-Supporting Growth Institution)	No:1/ 1995	Makassar, Wajo, Luwu, Barru, Soppeng, Polmas, Gowa, Bulukumba	- Environment - Women Empowerment - Community Development
38	YTS (Tengko Situru Institution)	No:141/ 1992	Tanatoraja	- Community Development

Supporting Report B

IRRIGATION SECTOR STUDY

Supporting Report B

IRRIGATION SECTOR STUDY

Table of Contents

List of Tables

List of Figures

Supporting Report B

IRRIGATION SECTOR STUDY

B1 Overview of National Irrigation Sector Policy

B1.1 Role of Irrigation Sector

The irrigated area in Indonesia was increased by about 1.1 million ha over the 23 -year period from 1976 (3.9 million ha) to 1999 (5.0 million ha). This has been achieved under the strong leadership and support of the Government to ensure the self-sufficiency in rice production. The new agriculture development for 2000-2004 issued in November 2000 gave somewhat a different policy emphasizing the role of agribusiness in the national economy, although maintaining food security policy. Its food security improvement programs are to:

- increase food supply by increasing rice production and reducing food imports;
- promote food diversity by increasing the production of non-rice food crops;
- improve food-related institutions by developing and strengthening food-related distribution and marketing systems; and
- promote the development of the food processing business and industry.

The current trade liberalization is forcing farmers and agro-related people to face serious price competition between local and imported rice. Under such circumstances, the public focus on food policy seems to be shifting to stable food supply rather than food self-sufficiency. Consequently, the role of irrigation sector will have to be tailored to support the new food policy.

Since 1999 in which the irrigated area peaked, the irrigated paddy fields have been decreasing due to deterioration of irrigation systems, rapid urbanization over agriculture lands, etc. Coupling with population pressure, this fact results in decrease in per capita rice supply capacity at national level even though paddy yield has been stable and the supply deficit has been partly supplemented by imported rice.

To enable the irrigation sector to contribute towards stable food supply, therefore, special attention should be paid to the following issues:

- deterioration of irrigation facilities;
- malfunction of irrigation facilities due to poor operation and maintenance caused by the unsuccessful hand-over to the water users associations for the reduction of budgetary burden;
- transfer of irrigated land to other land use on the populous Java Island; and
- abandoned irrigation areas on the outer islands.

To improve the above situations, it is a prerequisite to remove a vicious cycle of malfunction of irrigation system and poor operation and maintenance of irrigation facilities. Specifically, it is necessary to put in place such countermeasures as revision of some irrigation areas to an appropriate size, small-scale water resource development, and selection of a structural design manageable for farmers in addition to rehabilitation of deteriorated irrigation facilities. This is required in order to enable water management institutions and users to carry out operation and maintenance of irrigation systems in an efficient and effective manner.

B1.2 Irrigation Management Policy[1]

(1) Cost recovery and system transfer policy

The development and following operation and maintenance of irrigation systems have been shouldered by a significant share of public investments. In 1987, the Government adopted the irrigation operation and maintenance (O&M) policy (IOMP), which aimed at nationwide introduction of irrigation service fee (ISF), improved management of large irrigation systems according to procedures for efficient O&M and the transfer of irrigation system of less than 500 ha to water users association (WUA). ISF was intended to cover the full O&M expenditure of public irrigation systems. However, the ISF collection remained in low level and the system turnover was achieved unexpectedly gradual. Consequently, O&M and rehabilitation continued to be primarily the Government's responsibility.

(2) Irrigation management policy reform

With the national political reform that took place in 1998, the Government issued a new national water resources policy (NWRP) with the supports from international agencies and donor countries, in such forms as World Bank supported water resources sector adjustment loan (WATSAL), ADB supported capacity building project in the water resources. In line with the new water resources policy, the President of Indonesia issued, in April 1999, a decree on irrigation management policy reform (IMPR) with participatory irrigation development and management as the core of reform agenda. The broad principles for the IMPR are: (i) redefinition of tasks and responsibilities for irrigation management institutions; (ii) empowerment of WUA; (iii) irrigation management transfer (IMT); (iv) restructuring finances for irrigation management; and (v) sustainable management of irrigation. Further elaboration on these guiding principles has been detailed in presidential and ministerial regulations, particularly Government Regulation No. 77, December 2001 (PP77/2001). This regulation is followed by two Ministerial Decrees, one regarding WUA empowerment and the other IMT.

(3) Decentralization policy

Decentralization also provides a new framework of irrigation management. The Kabupaten governments were conferred to hold authority and responsibility for most irrigation matters, in

[1] Paras. (1) to (3) referring to Participatory Irrigation Sector Project, Final Report, ADB (TA No. 3793-INO), July 2002

such a way that assets and staff had been transferred to the Kabupatens in most irrigation systems. Provinces have several important roles in irrigation and water resources management including: (i) managing river basins that cross Kabupaten boundaries; (ii) assisting the national government in water resources management; (iii) in some cases directly managing portions of irrigation system crossing Kabupaten boundaries; and (iv) assisting Kabupaten governments when so requested by Kabupatens in irrigation and water resources management. The national government is responsible for setting national policies, standards and guidelines, macro planning and other aspects of sector management. Kabupaten governments are expected to play the key role of providing WUA under the new policies.

B1.3 Legal Framework of Irrigation Development and Management

The new Water Law has been approved by the national assembly on February 19, 2004, and enacted dated March 18, 2004. The old water law (UU 11/1974) stipulated that water resources are totally controlled by the minister in charge of the central government. With the Presidential Instruction (Inpres 3/1999) in April 1999 to direct the reform of the water resources and irrigation sector in a comprehensive manner, a draft legislative proposal was completed in June 2001. After various amendments, the final bill was formally submitted to the House of Representatives (DPR) by the President in October 2002.

The new Law on Water Resources was formulated to anticipate future problems and paradigm shifts in water resources management such as:

- enhance integrated water resources management in order to achieve its sustainable utilization;
- manage water in broader perspectives, i.e. society, ecology and economy as well as for the wealthy of human beings and living creatures;
- balance conservation and utilization of water resources;
- shift water resources management from centralist to decentralist;
- give a better assurance of the basic right of water for all people; and
- ensure a democratic mechanism and process in policy adoption.

The new Water Law openly encourages stakeholders to participate in all steps of water resources development and management from the preparation of strategic policy and plan to the design, construction, operation and maintenance, and in-stream water quality monitoring works. Through deliberation in DPR, the draft has been modified to increase the governments' share of responsibilities and duties concerning water resources management, utilization and conservation aiming at reduction of the heavy burden on water users.

The main principles of irrigation management policy are stated, involving somewhat contradiction to the principles in IMPR in 1999 and PP 77 in 2001, as follows:

- Development/construction and operation and management of irrigation schemes are responsibilities of the Government and the Regional Governments in accordance with

their jurisdiction and these activities will be implemented with participation of WUAs; and

- Funding for construction and operation and maintenance of tertiary irrigation systems is the responsibility of farmers and community, while the government will provide financial assistance if required.

Abstracts of provisions in new Water Law related to the irrigation development and management are shown in Table B1.1 together with elucidation of some provisions, and they are summarized below:

(1) Water **r**esources utilization (Chapter IV - Article 41)

Development of irrigation systems:

a. The Government is responsible for the development of primary and secondary irrigation systems across provinces.
b. The provincial government is responsible for the development of primary and secondary irrigation systems across districts/cities.
c. The district (Kabupaten)/city government is responsible for the development of primary and secondary irrigation systems in a single district/cities.
d. The development of primary and secondary irrigation systems shall be arranged with participation of the community.
e. The development of primary and secondary irrigation systems may be done by WUAs or the other parties in accordance with their needs and abilities.
f. The WUA is responsible for the development of tertiary irrigation systems, but the governments may to some extent facilitate such development.

Management of irrigation systems:

g. The district/city government is responsible for management of irrigation area of less than 1,000 ha (small irrigation area), located in a single district/city.
h. The provincial government is responsible for management of irrigation area of 1,000 to 3,000 ha in area (medium-sized irrigation area) or a small irrigation area located across districts/cities.
i. The Government is responsible for management of irrigation area of an area larger than 3,000 ha (large irrigation area), or a medium-sized irrigation area located across provinces, in nationally strategic, and across countries.

(2) Construction, operation and maintenance (Chapter VII - Article 64)

a. The Government and the regional governments are responsible for activities of operation and maintenance of primary and secondary irrigation systems.
b. WUAs may participate in activities of operation and maintenance of primary and secondary irrigation systems within their capacity and ability.
c. WUAs are responsible for the activities of operation and maintenance of tertiary irrigation systems.

(3) Financing (Chapter X - Article 78)

a. The Government and regional governments are responsible for financing of construction, and O&M activities of primary and secondary irrigation systems, and may get the participation of the farmers.

b. The farmers are responsible for financing of construction, and O&M activities of tertiary irrigation systems, and may be assisted by the Government and/or regional governments.

With enactment of the new Water Law, the Government is revising the controversial Government Regulation No.77/2001 on Irrigation, that intended to transfer the management of primary and secondary irrigation systems to WUAs.

B2 Overview of Irrigation and Irrigation Management in South Sulawesi Province

B2.1 Agriculture and Agro-economy

South Sulawesi Province with a land area of 62,362 km^2 is administratively composed of 23 Kabupatens (Districts), 1 municipality, 275 Kecamatans (Sub-districts) and 3,226 Desas (villages). The main economic activity of the province is agriculture sector accounting for 39 % of the total gross regional domestic product (GRDP). The food crops agriculture is a leading sub-sector accounting for 38 % of the sector GRDP followed by the estate crops. The provincial per capita GRDP in 2000 is estimated at Rp. 3.5 million.

The latest agriculture census in the province was made in 1993, and the current conditions of agriculture and agro-economy as of 2001 is estimated based on the 1993 agriculture census. The number of farm households in the province in 2001 is estimated at about 1,140,000 which accounts for about 64 % of the total households of about 1,795,000. The primary farming activity of the farm households in the province is food crops production followed by estate crops production. Food crops farmers represent some 82 % of the total farmers.

The current land holding status in the province is assessed at 1.28 ha/household, of which the paddy field occupies about 0.55 ha or 43 %. Household with less than 0.5 ha accounts for 29 %, and the remaining 71 % have the farm size larger than 0.5 ha.

The largest farm land category in the province is paddy fields occupying 629,000 ha or about 32 % of the total farm land of 1,970,000 ha, followed by estate crop land and dry land/gardens accounting for 24 to 27 % as summarized below:

Present agricultural land use in the Province in 2001

Land Use Category	Area (ha)	Ratio (%)
Paddy Fields	629,400	32 %
Home Gardens	146,700	7 %
Dry Land/Gardens	529,800	27 %
Upland Fields	148,300	8 %
Estate Crop Land	516,500	26 %
Total Farm Land	1,970,700	100 %

Source: the study on the comprehensive recovery program for irrigation agriculture, JICA, 2003 / Laporan Tahunan 2001, Dinas Pertanian Tanaman Pangan Sulawesi Selatan

Paddy production is the largest food crops agriculture sub-sector, representing 68 % of the total harvested area with food crops (not including vegetables) in 2001. Maize production follows with an area of 20 %, and the other crops are groundnut, tubers such as cassava, sweet potatoes, etc. The major food crops produced in the province in 2001 were 4.2 million tons of paddy and 0.88 million tons of maize, respectively. The South Sulawesi Province has been recognized as one of the most important granary in Indonesia, particularly for supplying paddy and other food crops for other provinces in the Sulawesi region.

B2.2 Irrigation

The existing potential irrigation areas in South Sulawesi Province are estimated at 503,748 ha, consisting of 320,907 ha under 250 government developed irrigation schemes and 182,841 ha under 1,287 village irrigation schemes. The government developed irrigation schemes consist of 57 technical irrigation schemes with potential irrigation areas of 237,657 ha, 132 semi-technical irrigation schemes with potential irrigation areas of 72,981 ha and 61 simple irrigation schemes having potential areas of 10,269 ha. There are 63 large scale irrigation schemes each of which has a potential irrigation area of more than 500 ha, and these schemes cover 260,173 ha or 81 % of the potential irrigation area of government developed irrigation schemes.

The table below shows the area and percentage of irrigated and rainfed paddy fields to the total paddy fields of South Sulawesi Province in comparison with those of the whole country. Irrigated paddy in the province is slightly below the national level in ratio:

Classification of Paddy Fields

Condition of Paddy Field	South Sulawesi Province		Whole Country	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Irrigated Paddy Fields	318,800	60.7	4,868,800	62.5
Rainfed Paddy Fields	247,600	39.3	2,918,600	37.5
Total	629,400	100.0	7,787,400	100.0

Source: The study on the comprehensive recovery program for irrigation agriculture, JICA, 2003 / Laporan Tahunan Dinas Tahun 2001, Dinas Pertanian Tanaman Pangan dan Hortikultura, Sulawesi Selatan. In the case of the whole country, the areas of each paddy field type exclude those of Maluku and Irian Jaya.

The table below shows the area and percentage of the respective categories for South Sulawesi Province in comparison with those of the whole country. The technical system is far behind the national level:

Classification of Categories of Irrigation Systems depending on Technical Level

Technical Level	South Sulawesi Province		Whole Country	
	Area (ha)	Ratio (%)	Area (ha)	Ratio (%)
Technical Systems	87,000	27.3	2,214,300	45.5
Semi-technical Systems	82,900	26.0	979,200	20.1
Simple Systems	148,900	46.7	1,675,300	34.4
Total	318,800	100.0	4,868,800	100.0

Source: The study on the comprehensive recovery program for irrigation agriculture, JICA, 2003 / Laporan Tahunan Dinas Tahun 2001, Dinas Pertanian Tanaman Pangan dan Hortikultura, Sulawesi Selatan. In the case of the whole country, the areas of each paddy field type exclude those of Maluku and Irian Jaya.

B2.3 Agriculture Supporting Systems and Institutions

The government agricultural support systems in the province include the Food & Horticulture Crops Agriculture Services Office, Estate Crops Services Office, Livestock Services Office and Food Security Agency. The government agricultural support institutional arrangements at district level are not consistent with the provincial arrangements and there are differences among the districts concerned.

A number of farmers' organizations involved in agricultural activities have been formed in the province. Among these, the major one is the Farmers' Group (Kelompok Tani/KT), of which only 20 % of KTs are active and advanced and the remaining KTs are merely dormant organizations. The activities of KTs are generally limited to technical issues such as scheduling of farming operations and their economic activities such as group purchasing and marketing are seldom practiced. General problems encountered by KTs are; (i) limited group funds, (ii) not well organized as a group, and (iii) limited economic activities as a group. Further strengthening and establishment of KTs as business entities will become one of the essential factors in the future promotion and development of regional agriculture and for the establishment of agribusiness oriented agriculture in the province.

Some 442 Village Unit Cooperatives (KUD) exist in the province with activities varying from dormant status to actively operated status. The main activities of KUDs are distribution of farm inputs, procurement of paddy, rice milling, supply of daily commodities, and deposit and credit services.

The numbers of Rural Extension Centers (Balai Penyuluhan Pertanian/BPP) and Field Extension Workers (Penyuluhan Pertanian Lapangan/PPL) deployed in the province. The number of BPPs and PPLs in the province as a whole is 201 and 2,111, respectively, in 2001.

B2.4 Irrigation Management and Water Users Associations

In South Sulawesi, the water resources and irrigation sector is administered by Dinas PSDA (provincial water resources services/PWRS). Under the Head of Dinas PSDA, Sub-divisions are set up to handle technical and administrative matters and Regional Technical Implementation Units (Balai PSDA/UPTD) as its branch offices are established to conduct water resources management and coordinate with district/municipal governments. At district/municipal level, Dinas PSDA (district water resources services/DWRS) and its branch offices are responsible for implementing irrigation management, providing services to the existing WUA and promoting new WUA establishment. As for staff availability, the vacancy is more or less 50 %.

The WUA establishment target set up by PWRS South Sulawesi is 3,302 for 250 government developed irrigation schemes and 1,149 for 1,287 village irrigation schemes. Up to now, 2,224 WUAs have been established in government developed irrigation schemes. Because of slow progress of legal registration in local courts of justice, 119 WUAs have been legitimized till now. The latest monitoring and evaluation record on WUA performance in 250 government developed irrigation schemes reveals that 144 WUAs are evaluated as "Developed", 1,183 WUAs as "Under development" and 823 WUAs as "Not yet developed".

The total of 24 Kabupaten and municipal governments in South Sulawesi for 2000 revenue was Rp.1,537 billion, while the total expenditure was Rp.1,473 billion. The actual expenditure for the water resources and irrigation sector amounted to Rp.5,153 million or 1.02 % of the total expenditure. The consolidated per capita provincial revenue for 2001 comprised Rp.62,910 for

its own fiscal capacity consisting of its own source revenue, non-tax from natural resources and share taxes and Rp.376,750 for general allocation fund plus contingency.

B3 Irrigation Schemes in Jeneberang River Basin

B3.1 Historical Background of Irrigation Schemes in Jeneberang River Basin

A vast low-lying paddy fields with a total area of about 24,000 ha has been developed in the lower basin of Jeneberang river, extending in the southern part of Makassar city, the capital of South Sulawesi Province. This area has been known as a granary of Sulawesi island, however suffering from repeated flood mainly from the Jeneberang River in the wet season. While, the paddy based agriculture in the area was facing the shortage of irrigation water in the dry season. In addition, Makassar city has been critical both in domestic and industrial water supply. To mitigate flood problems and develop water resources both for agriculture and urban development, the Government launched an integrated water resources development project of Jeneberang River in 1979.

The Government of Japan has been providing technical and financial assistance through JICA and OECF (JBIC) to date. The JICA carried out a two - phasing studies on Jeneberang river flood control and water resources development in 1979 and 1981, and the 1981 feasibility study formulated the irrigation schemes in the basin as well as the construction of Bili-Bili Multipurpose dam. The multi-purposes Jeneberang river basin development project has been implemented with the financial assistance from OECF since 1983. The implementation sequence was: (i) the lower Jeneberang river urgent flood control works (1983 - 1993); (ii) construction of the Bili-Bili multipurpose dam (1986 - 1997); (iii) other related works including raw water transfer works for Makassar city, fresh-water impounding works at the estuary of Jeneberang river, and urban drainage improvement works (1991 - 1993); and (iv) construction and rehabilitation of Bili-Bili irrigation project consisting of three schemes of Bili-Bili (existing), Bissua (new) and Kampili (existing) (1998 - 2004).

B3.2 Agriculture and Agro-economic Development Plan

(1) Development target areas

The areas of Bili-Bili irrigation project lies on the downstream basin of the Jeneberang River, and administratively belong to two Kabupatens of Takalar and Gowa, and Makassar city. The Bili-Bili irrigation project is composed of three irrigation schemes; Kampili, Bili-Bili and Bissua. The twelve Kecamatans and 124 villages are involved in the development target areas. The gross and net irrigation service areas are 45,500 ha and 23,663 ha, respectively[2], as classified below.

[2] There are inconsistencies in figures of irrigation area (ha) throughout this paper, because there are differences in irrigation development area between planned and actual. These figures are being confirmed based on the tertiary developments by the Bili-Bili irrigation project office at present.

Gross area and irrigation service area

unit : ha

Scheme	Gross area	Irrigation service area
Bili-Bili (existing)	7,050	2,360
Bissua (existing and new)	20,000	10,758
Kampili (existing)	18,450	10,545
Total	45,500	23,663

Note: A part of old Kampili scheme (17,480 ha) is divided into two sub-systems by water intake alteration; one (6,935 ha) is merged with new Bissua scheme, and the other (10,545 ha) remain under the existing Kampili weir.

Source : (i) Final Design Report on Detail Design and construction Supervision of Bili-Bili Irrigation Project, December 1999, and (ii) Operation and Maintenance Manual (2nd Draft) Detail Design and construction Supervision of Bili-Bili Irrigation Project, November 2003.

(2) Agriculture and agro-economic conditions before development

The Bili-Bili irrigation project area extends in the alluvial low-lying land formed by meandering of the Jeneberang River. Ground elevation of paddy fields in the system area varies from EL. 30 m in the upstream hilly zone to EL. 2 m or less in the coastal zone. Soil in the higher elevation area is classified as Brown Mediteran, while those in the lower elevation are dominated by Gray Alluvial soil. These soils are generally suitable for irrigated agriculture of paddy and palawija.

The land of 45,500 ha was classified into eight types of land use as shown below.

Land Use of Bili-Bili Irrigation Project Area

Unit : ha/%

Wet land paddy	Upland crops	Estate (sugar-cane)	Orchard	Bush / swamp	Forest	Fishpond/ lake	Village & others	Total
23,330	5,442	1,079	2,440	1,767	1,480	2,182	7,780	45,500
51.3	12.0	2.4	5.4	3.9	3.3	4.8	17.1	100.0

Source: Final Design Report on Detail Design and construction Supervision of Bili-Bili Irrigation Project, December 1999

The average farm size in Takalar, Gowa and Makassar was 0.92 ha, 0.97 ha and 0.78 ha, respectively. About 43 % of the above farm land was used for wet land paddy cultivation. The small land holders with less than 0.5 ha account for about 45 % of total farm households. The average net farm size in the proposed Bili-Bili irrigation project area was estimated at 0.8 ha[3] composed of 0.6 ha of paddy field and 0.2 ha of upland field. Most of the farmland is owned by owner-farmers. The owner-farmer in ratio was estimated at 88 % on an average, varying from 91 % in Gowa to 73 % in Makassar as of 1993.

The agriculture in terms of cropping pattern in the proposed Bili-Bili irrigation project area was the wet season paddy cultivation from December to April, and dry season paddy from May to November where irrigation water was available or palawija crops without irrigation. The cropping intensity was about 160 %, comprising 125 % of paddy and 35 % of palawija crops. The preferred palawija crops were mungbeans, followed by soybeans and maize. The unit yields

[3] The figures of land holding sizes mentioned here are based on the planning and design of the Bili-Bili irrigation project in 1999. The facts seem that the actual sizes are smaller than these figures. This will be able to be clarified and confirmed by the on-going tertiary development works carried out by the Bili-Bili irrigation project office.

of paddy was estimated at 4.9 tons/ha (irrigated) and 3.9 tons/ha (rainfed) in the wet season and 4.4 tons/ha (irrigated) in the dry season.

(3) Agriculture and agro-economic development plan

(a) Constraints to agricultural development

The constraints to agricultural development were identified in two aspects of agriculture and irrigation. The constraints to agricultural aspect were; lack of farming resources (poor fund, small land size, low technical level, etc.), and poor and insufficient institutional support services. The irrigation aspect includes insufficient water resources and dry season rain, low-capacity and deteriorated existing irrigation facilities, poor drainage, lack of on-farm network, lack of farm and rural roads and inactive WUAs.

(b) Concept of irrigated agricultural development

The main concepts of irrigated agriculture were; maximum and effective use of Bili-Bili reservoir, raising crop intensity with three crops a year, involvement of beneficiaries in on-farm (tertiary) development, and strengthening agricultural supporting services, extension services and credit in particular.

(c) Proposed cropping pattern, yields and benefit

The cropping pattern applied to the whole Bili-Bili irrigation project is three irrigated crops a year, consisting of full two paddy crops of wet and dry (200 %) and partly the palawija crops (40 %). The palawija crops are mixed with soybeans (15 %), mungbeans (10 %), groundnuts (8 %) and maize (7 %). The proposed cropping pattern is shown in Figure 3.1. To mitigate the peak irrigation requirement, the cropping pattern is divided into three groups in such a manner that the cultivation of each group starts at different time slipped by about a half month.

The anticipated yields of paddies were estimated to be 5.5 tons/ha of wet season paddy and 6.0 tons/ha of dry. The gross return and net benefit after deducting production cost without family labor cost were assessed to be about Rp. 13.2 million/ha (US$ 1,833/ha equiv.).

B3.3 Water Requirement and Water Balance

(1) Irrigation water requirement

The irrigation water requirement was computed by the FAO's empirical method on a half-month period basis for the 26 year period from 1972 to 1997. Effective rainfall and an adequate percolation rate of 2 mm/day were incorporated in the computation. The results of net field requirements for the 26 year period are tabulated below, and its maximum was calculated at 1.08 lit/sec/ha on paddy field.

Computed Half-monthly Net Irrigation Field Water Requirement

Unit : lit/sec/ha

Month		Min.	Max.	Aver.	Month		Min.	Max.	Aver.
Jan.	1st	0.00	0.62	0.08	Jul.	1st	0.21	0.92	0.76
	2nd	0.00	1.00	0.15		2nd	0.30	0.78	0.68
Feb.	1st	0.00	0.64	0.09	Aug.	1st	0.42	0.56	0.50
	2nd	0.00	0.91	0.18		2nd	0.28	0.44	0.39
Mar.	1st	0.00	0.83	0.18	Sep.	1st	0.04	0.51	0.34
	2nd	0.00	0.82	0.22		2nd	0.00	0.63	0.43
Apr.	1st	0.00	0.75	0.24	Oct.	1st	0.00	0.63	0.42
	2nd	0.00	0.87	0.48		2nd	0.00	0.52	0.32
May	1st	0.21	1.01	0.67	Nov.	1st	0.00	0.31	0.09
	2nd	0.30	1.08	0.92		2nd	0.00	0.22	0.02
Jun.	1st	0.26	1.04	0.84	Dec.	1st	0.00	0.30	0.03
	2nd	0.61	1.01	0.87		2nd	0.00	0.42	0.08
					Annual average		0.23	1.08	0.98

Source : Final Design Report on Detail Design and construction Supervision of Bili-Bili Irrigation Project, December 1999

The designed net field requirement was set at 1.17 lit/sec/ha taking the prevailing planning standard. The overall irrigation efficiency is estimated at 68.85 % from the head intake down to the tertiary level, composing of tertiary canals of 85 %, secondary canals of 90 % and main canals of 90 %. The design unit discharges of the respective canals are given as: 1.35 lit/sec/ha for tertiary canal, 1.48 lit/sec/ha of secondary canal and 1.65 lit/sec/ha at the head discharge.

The diversion water requirements at the respective headgates of Bili-Bili, Bissua and Kampili diversion dam are tabulated below.

Half-monthly irrigation water demand at headgate intakes

Month		Bili-Bili (2,360 ha) headgate Q (m^3/sec)			Bissua (10,760 ha) headgate Q (m^3/sec)			Kampili (10,540 ha) headgate Q (m^3/sec)			Aver. Total Volume
		Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	(MCM)
Jan.	1st	2.13	0.00	0.19	9.69	0.00	0.86	9.49	0.00	0.84	3.56
	2nd	3.43	0.00	0.35	15.63	0.00	1.61	15.31	0.00	1.58	7.13
Feb.	1st	2.19	0.00	0.21	10.00	0.00	0.97	9.80	0.00	0.95	4.01
	2nd	3.12	0.00	0.42	14.22	0.00	1.94	13.93	0.00	1.90	6.95
Mar.	1st	2.84	0.00	0.42	12.97	0.00	1.94	12.71	0.00	1.90	8.02
	2nd	2.81	0.00	0.52	12.81	0.00	2.37	12.55	0.00	2.32	10.45
Apr.	1st	2.57	0.00	0.57	11.72	0.00	2.58	11.48	0.00	2.53	10.69
	2nd	2.98	0.00	1.13	13.60	0.00	5.16	13.32	0.00	5.06	21.38
May	1st	3.46	0.72	1.58	15.78	3.28	7.21	15.46	3.21	7.06	29.84
	2nd	3.70	1.03	2.17	16.88	4.69	9.90	16.53	4.59	9.70	43.71
Jun.	1st	3.56	0.89	1.98	16.25	4.06	9.04	15.92	3.98	8.85	37.41
	2nd	3.46	2.09	2.05	15.78	9.53	9.36	15.46	9.34	9.17	38.75
Jul.	1st	3.15	0.72	1.79	14.38	3.28	8.18	14.08	3.21	8.01	33.85
	2nd	2.67	1.03	1.60	12.19	4.69	7.32	11.94	4.59	7.17	32.30
Aug.	1st	1.92	1.44	1.18	8.75	6.56	5.38	8.57	6.43	5.27	22.27
	2nd	1.51	0.96	0.92	6.88	4.38	4.20	6.74	4.29	4.11	18.53
Sep.	1st	1.75	0.14	0.80	7.97	0.63	3.66	7.81	0.61	3.58	15.14
	2nd	2.16	0.00	1.01	9.85	0.00	4.63	9.64	0.00	4.53	19.15
Oct.	1st	2.16	0.00	0.99	9.85	0.00	4.52	9.64	0.00	4.43	18.71
	2nd	1.78	0.00	0.76	8.13	0.00	3.44	7.96	0.00	3.37	15.20
Nov.	1st	1.06	0.00	0.21	4.84	0.00	0.97	4.75	0.00	0.95	4.01
	2nd	0.75	0.00	0.05	3.44	0.00	0.22	3.37	0.00	0.21	0.89
Dec.	1st	1.03	0.00	0.07	4.69	0.00	0.32	4.59	0.00	0.32	1.34
	2nd	1.44	0.00	0.19	6.56	0.00	0.86	6.43	0.00	0.84	3.80
						Total					**407.06**

MCM: million cubic meter
Source: Final Design Report on Detail Design and construction Supervision of Bili-Bili Irrigation Project, December 1999

(2) Water balance simulation

With the above computed irrigation demands on a field water requirement basis, the water balance simulation was made at the full development stage of Jeneberang river including the water supply from the Bili-Bili reservoir and water demands for municipal supply, river maintenance and other industrial purposes on a five-day period basis . The simulation gave a result as summarized below that the failure in full supply of irrigation water took place five times for the 26-year period, thus the proposed cropping pattern and intensity matched the project concept of ensuring 80 % assurance. It should be noted that almost a full double - cropping of paddy except two years was ensured.

Result of Water Balance Simulation (1972 - 1997)

Order	Year	Area irrigated (%)			Cropping intensity (%)
		Wet paddy	Dry paddy	Parawija	
1	1972	100	79	0	179
2	1983	100	98	0	198
3	1997	100	100	4	204
4	1982	100	100	17	217
5	1992	100	100	35	235
6	1976	100	100	40	240
7 - 26	Years rest	100	100	more 40	240

Source: Final Design Report on Detail Design and construction Supervision of Bili-Bili Irrigation Project, December 1999

B3.4 Major Features of Bili-Bili Irrigation Project

The service area of Bili-Bili irrigation project is 23,660 ha, originally intended in the development plan, under the three irrigation sub-systems (schemes). Irrigation water is taken at three weirs on the main stream of Jeneberang rive and supplied to the respective schemes through the respectively independent irrigation networks. A general layout of the irrigation schemes and its irrigation diagram are shown in Figures 3.2 and 3.3, respectively. The features of three irrigation schemes are briefly outlined below.

(1) Bili-Bili irrigation scheme

The irrigation area is about 2,380.8 ha (originally intended at 2,360 ha) irrigated by the Bili-Bili weir newly constructed at immediately downstream from the Bili-Bili dam. Five existing small weirs, namely Rindam, Pakato, Bontomanai, Kajenjeng and Koccikang, were incorporated in the irrigation network down from the Bili-Bili weir, to utilize the existing irrigation facilities and canals. The irrigation network has a headrace channel of about 1,360 m in length, followed by one primary and eight secondary canals with length of about 8 km and 19 km, respectively. Except the concrete lined headrace channel, almost all the primary and secondary canals are of earthen type unlined. The head discharge at the Bili-Bili intake is 3.9 m^3/sec. The Bili-Bili irrigation schemes are composed of 54 tertiary blocks. The irrigation is in operation from September 2003. The features of Bili-Bili irrigation scheme is shown in Table 3.1.

(2) Bissua irrigation scheme

The Bissua irrigation schemes covers 10,572.2 ha area (originally intended at 10,760 ha), consisting of a newly developed area of 3,823.8 ha and a part of Kampili irrigation network area of 7,748.9 ha. The irrigation water is diverted from the Bissua weir newly constructed on the Jeneberang river about 6 km downstream from the Bili-Bili dam. The irrigation network has two primary canals of the Bissua of about 12 km long and Mattoangin of about 12 km long, and 28 secondary canals of about 27 km long in total. The Bissua primary canal crosses Limbung primary canal of Kampili irrigation scheme and supplies water to the area formerly belonging to the old Kampili scheme. The Mattoangin primary canal also supplies water to the Palleko secondary canal in the old Kampili scheme. Both the Bissua and Mattoangin primary canals are fully conrete-lined, while the rest secondary canals are of earthen type unlined. The head

discharge at the Bissua intake is 19.7 m^3/sec. The Bissua irrigation schemes are composed of 165 tertiary blocks. The Bissua weir was completed at the end of April 2004 and irrigation was immediately serviced on May 1, 2004. The features of Bissua irrigation scheme is shown in Table 3.1.

(3) Kampili irrigation scheme

The head regulator of the existing Kampili irrigation scheme is a historic diversion weir on the Jeneberang river constructed in and around the year 1937, located about 10 km downstream from the Bili-Bili dam or 20 km upstream from its estuary. The Kampili area has been facing shortage of irrigation water in the dry season, however, mainly because its head capacity and main canal network downward did not have enough capacity to irrigate the full Kampili scheme area of 17,450 ha. It was planned in the Bili-Bili irrigation project that a downstream part of the Kampili scheme was shifted to the area commanded by the new Bissua scheme as well as the rehabilitation of historic Kampili weir. Consequently, the existing Kampili irrigation scheme was divided into two irrigation areas; 10,540 ha commanded by the Kampili weir, and 6,910 ha by the Bissua weir.

The irrigation network has one primary and 35 secondary canals with length of 13.5 km and about 178 km, respectively. All the existing primary and secondary canals were concrete lined under the rehabilitation works. The head discharge at the Kampili intake is 17.4 m^3/sec. The Kampili irrigation schemes are composed of 207 tertiary blocks. The rehabilitation of Kampili weir was also completed at the end of April 2004 and irrigation was immediately serviced on May 1, 2004. The features of Kampili irrigation scheme is shown in Table 3.1.

B3.5 Tertiary Development

The tertiary development, by either rehabilitating existing or constructing new tertiary canals, was to be implemented by benefited farmers under the WUAs, in principle. In the Bili-Bili irrigation project, tertiary blocks of 426 in total number are developed. The average area of tertiary block in the whole system is 55.0 ha, ranging from 0.9 ha to 169.4 ha. A WUA is formed by a single tertiary block or multiple blocks depending upon those scale, prevailing local customs, etc. The total number of WUAs is 307. The number of WUAs' member is not confirmed yet. The list and features of tertiary development is shown in Table 3.2, and summarized below.

List and Features of tertiary development

Irrigation scheme	Nos. of tertiary blocks	Irrigation area (ha)	Area of tertiary Block (ha)			Nos. of WUA	WUAs' member
			Min.	Max.	Average		
Bili-Bili	54	2,380.8	0.9	157.4	44.1	20	n.a.
Bissua	165	10,572.7	4.5	169.4	64.1	126	n.a.
Kampili	207	10,464.6	5.0	160.6	50.5	161	n.a.
Total	426	23,414.1	0.9	169.4	55.0	307	n.a.

Source : Bili-Bili Irrigation Project Office

A fairy large variation in area of tertiary blocks is seen, however, this would be able to be balanced under formation of WUAs, combining multiple small tertiary blocks.

The current conditions of tertiary development in the respective three schemes are outlined below:

(1) Tertiary development in Bili-Bili scheme

There are existing tertiary canals of about 33 km in length, and no any additional canal would be required. WUAs in the scheme are to rehabilitate the existing tertiary canals including necessary division facilities by themselves.

(2) Tertiary development in Bissua scheme

The newly developed area of about 3,823 ha requires to construct new tertiary canals of 90 km long. The tertiary development here has been carried out as a part of the main construction works funded by JBIC.

(3) Tertiary development in Kampili scheme

There are existing tertiary canals of about 178 km in length for 17,480 ha including the area now belonging to the Bissua system. The present canal density is far less, as low as 10 m/ha, for proper on-farm water management. As the model development, those for 1,000 ha area have been constructed under the main works. The improvement for the remaining area is expected to be provided by the Government.

Anticipating full commissioning of three irrigation schemes in the beginning of May 2004, all the tertiary canals except some areas in the Kampili and Bissua schemes are ready for receiving water from those primary and secondary systems.

B3.6 Future Irrigation Development in Jeneberang River Basin

In 2000 to 2001, the Directorate General of Water Resources (DGWR) of the Ministry of Settlement and Regional Infrastructure made a comprehensive water management plan study for Maros - Jeneponto river basin, that is surrounding river basin of the Jeneberang river with the financial assistance of JBIC[4]. The objectives of the study were to formulate the comprehensive water management master plan for seven river basins (total catchment area of about 3,700 km^2) with setting a target year at 2020. The Jeneberang river basin is one of seven target basins. The master plan report proposed to expand the irrigation area by about 2,550 ha including the sugarcane plantation of 2,100 ha, and also supply fresh water to Gumanti fish pond area of about 3,200 ha.

[4] Refer to "Final Report, Consulting Engineering Services for Comprehensive Water Management Plan Study for Maros - Jeneponto River Basin, November 2001, CTI Engineering International Co., Ltd."

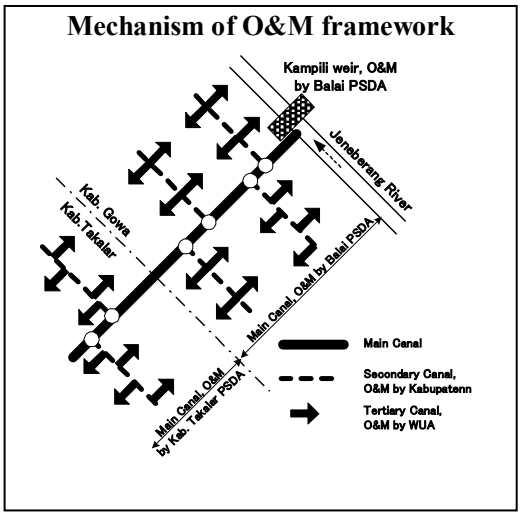
For these future irrigation development in the Jeneberang basin, the water resources so far developed specifically by the Bili-Bili dam does not meet its water demand. Therefore, a storage dam named "Jenerata Dam" was proposed on the Jenerata river about 5 km upstream from its confluence to the Jeneberang river, immediately downstream from the Bili-Bili diversion weir. The Jenerata reservoir is expected to have an effective storage capacity of 91 MCM. These development projects were planned beyond the year 2010 for the Jenerata dam and the 2015 for the irrigation facilities.

It is noted that the report of irrigation sector hereof does not discuss the above future irrigation development, but focuses only on the on-going Bili-Bili irrigation project (23,660 ha), since the future plan has not been officially visualized yet.

B4 Institutional Setting and Water Management of Bili-Bili Irrigation Project

B4.1 Organization for O&M of Bili-Bili Irrigation Project

B4.1.1 Government organization of O&M



All the three irrigation schemes are still in custody of the Jeneberang River Basin Development Project (JRBDP or Proyek Induk) under the Directorate General of Water Resources (DGWR), the Ministry of Settlement and Regional Infrastructure. According to the DGWR's regulation, the PIRASS has to take care of the completed project for a two-year period after the completion. The actual transfer of all the irrigation facilities constructed and rehabilitated to the local Government is expected to take place in the year 2006. Immediately after the transfer, the operation and maintenance of irrigation schemes is to be commissioned in the organizational framework as outlined below.

In accordance with the new Water Law, the Provincial governments through the Balai PSDA in charge of the Jeneberang and surrounding basins will be responsible for operation and maintenance of two weirs of Bissua and Kampili, as both the weirs service two Kabupatens of Gowa and Takalar. The Bili-Bili weir, servicing only the Kabupaten Gowa, will be operated and maintained by the Gowa's government. The primary and secondary canals that cover the service areas over the two Districts (Kabupatens) are operated and maintained by the Balai PSDA and a Kabupaten government. The governments of Gowa and Takalar are responsible for operation and maintenance of primary and secondary irrigation canals that individually serve the areas within a Kabupaten. While, the tertiary systems belong to WUAs, responsible for operation and maintenance of these facilities. The O&M mechanism discussed here is schematically explained for the case of Kampili irrigation scheme, as illustrated above.

The Kabupaten Gowa established Dinas PSDA. The Takalar reorganized the Public Works Office in the Kabupaten level and established Sub-Dinas PSDA. Both the above PSDAs in Kabupatens are directly in charge of operation and maintenance of primary and secondary systems. The project consultant to the Bili-Bili irrigation project proposes, in its O&M manual, to strengthen the existing six Cabang (section) Dinas and to establish one new Cabang Dinas for the Bissua schemes. It also proposes to establish and strengthen 27 Julu (sub-section) under the Kabupatens' Dinas PSDA. The Julu is responsible for making decision of O&M policies such as grouping or Golongan system, irrigation water distribution schedule, and priorities in maintenance in primary and secondary systems. Each Cabang will be headed by a section chief and assisted by four unit staff dealing with administration, operation, maintenance and tertiary

system. A Julu will be headed by a sub-section chief who supervises four field workers of weir keeper, gate keeper, canal foreman and WUA guider. The proposed O&M organization for the primary and secondary systems is shown in Figure 4.1, including list of proposed areas of Cabang and Julu with those staff number.

B4.1.2 Irrigation Committee

The Kabupaten's Dinas PSDA will be responsible for making basic and annual O&M policies including irrigation calendar, water distribution, irrigation methods, rotation programs and repair and maintenance programs in collaboration of Dinas Cabang and WUAFs / WUAs. These policies and programs are discussed and endorsed by the Irrigation Committee established under the Kabupaten's head (Bupati). The decision of Dinas PSDA is passed to Provincial Dinas PSDA through Balai PSDA for approval and further implementation. Those policies and programs collected from the respective Kabupatens are discussed and endorsed by the Provincial Water Resources Coordination Committee (PTPA). The Kabupaten irrigation committees are sub-committees of PTPA.

Thus, the irrigation committee has to play an important role in water management in the Kabupaten level. The Kabupaten Gowa has established the irrigation committee in October 2003. Its decree stipulates that:

a. the purposes of committee are to coordinate the policy in improving irrigation management in terms of irrigation water supply and WUA empowerment;
b. the meetings are held periodically at least once a three-month period; and
c. the committee is composed of twenty members including Bupati and Kabupaten Secretary as advisors.

The irrigation committee is chaired by the Assistant Secretary for Development Administration. Its members are the representatives of PSDA as the committee's secretariat, BAPPEDA, Police, PDAM and other relevant Kabupaten governmental agencies. All the chair-persons of GP3As, NGO and Hasanuddin University are also members of committees.

A critical discussion in the irrigation committee will take place when draught be progressing or expected. As mentioned in section 3.3, abnormal draughts are seen four times in the water balance simulation for the past 26 year period from 1972 to 1997. In any case, however, paddy cultivations were almost out of significant draught effects, while the palawija crops would have seriously suffered. In such a case, the reservoir operation would restrict the water supply for irrigation first, placing priority of water supply on domestic use, in accordance with the reservoir operation rule, as discussed separately in this report. Keeping a close communication with the agencies responsible for reservoir operation, the Kabupaten's Dinas PSDA has to make revised water distribution programs in consultation with the irrigation committee, together with water saving campaign for farmers through Cabangs and WUAs.

B4.1.3 Water Users Association (P3A)

The formation and re-formation of WUAs were set out since 1998 when the detailed design of the Bili-Bili irrigation project was started under the guidance of Dinas PSDA of the Province. By the end of the year 2003, WUAs of 307 in number, covering the whole irrigation systems, were formed on the basis of 426 tertiary blocks. The 307 WUAs form federations of WUA (GP3A) of 28 in number along secondary canals in principle. The distribution of WUAs and WUA federation is shown in Figure 3.3 and Table 3.2, and summarized below.

Distribution and main features of WUAs and WUA federation

Irrigation scheme	Nos. of tertiary blocks	Irrigation area (ha)	Average area of tertiary block (ha)	Nos. of WUA	Nos. of WUA federation	Nos. of WUA member
Bili-Bili	54	2,380.8	44.1	20	4	n.a.
Bissua	165	10,572.7	64.1	126	11	n.a.
Kampili	207	10,464.6	50.5	161	13	n.a.
Total	426	23,414.1	55.0	307	28	n.a.

Source : Bili-Bili Irrigation Project Office

The organization charts of WUA and WUA federation are shown in Figure 4.2. It is intended to form higher federation along the primary canals, called MWUA or IP3A. The action for this is to be taken after the anticipated revision of the Government Regulation No.77/2001 on irrigation be clarified in the light of new Water Law.

B4.2 Present Conditions of Water Users Association

The study team made a field reconnaissance of an advanced WUA federation together with member WUAs in the Kampili scheme. The name of WUA federation is Sirannuang, and the WUAs interviewed are four members, named Binabbasa, Renggang, Tangke Balda and Tangke Bajeng, all of which belong to Tanabangka Village (Desa), Kabupaten Gowa. Its irrigation area is located about 20 km south from Makassar city. The information obtained here are outlined below.

<u>WUA organization and activities</u>

- Most WUAs were established in and around 1993 as farmers groups called “Mandor”, and these were named P3A in 1996.
- All the benefited farmers are members of WUA.
- The master list of WUA members is available only for Renggang, and it records member’s name, irrigated area, number of field piece and village name. Numbering plot registration referring to maps has not been available yet.
- WUAs had several meetings, such as general assemblies twice a year, in 1990’s, however have few meetings except occasional ones guided by NGOs.
- WUA’s chief and other board members are selected by village conference at Mosque chaired by the village chief. No conference records are available.
- All the WUA’s board members are without pay on a volunteer basis.

- No WUAs have own office, and no record keeping and documentation system are available.
- No assets and fund savings are with WUAs at all.

Land tenure, agriculture and agro-economy

- All the WUA members are owner - farmers.
- The average land holding is as small as about 0.3 - 0.4 ha only, of which 0.2 ha irrigated in these WUAs, as in a case of Renggang that the member households of 150 in number have 55 ha of land and 30 ha irrigated.
- The farming is two paddies followed by upland crops (palawija) a year when water is available, and one paddy and palawija when water is scarce.
- Most of harvested paddies are for home-consumption, and supplemental incomes are from bricks production, part-time labor works at construction works, Makassar port, etc.

Water management

- WUAs have rehabilitated and constructed tertiary canals by themselves with technical assistance from NGO. These activities are well advancing other than almost all WUAs in the Bili-Bili irrigation project.
- Water delivery schedule is prepared by gate keepers (Mandor) in consultation with WUA.
- The major maintenance works such as desilting and weed cutting are conducted by WUAs' members themselves twice a year, and routine maintenance is made by two gate keepers.

Irrigation service fee (ISF)

- WUAs paid ISF at rate of Rp. 5,000/ha for three years of 1993 to 1995 when irrigation water was properly supplied, however, they quitted ISF payment since then because of insufficient water supply.
- WUA members pay service charge to Mandor in kinds (paddy) at a fixed rate (approximately 4 to 5 liters/0.3 ha). Half of paddy is kept by Mandor, and other half is to be given to WUA for its O&M fund, however, such sharing hardly takes place.
- Farmers are willingly to pay ISF as far as irrigation water is sustainably supplied.
- In 2002, the Gowa government started to collect ISF at a rate of Rp.50,000 /ha/crop directly from farmers without through WUA federation. This is WUAs' strong complaint against the government.

B4.3 O&M Cost and Irrigation Service Fee (ISF)

B4.3.1 Present Financial Conditions

(1) Irrigation service fee (ISF)

The fees for irrigation service paid by WUA members are composed of three charges; (i) charge for exploitation and maintenance funding (IPEP), (ii) charge for irrigation service (IPAIR), and (iii) membership fee of WUA. IPEP is a fixed rate amounting to Rp. 5,000/ha/crop. IPAIR is a flexible rate to be agreed between the respective Kabupaten government and irrigation system. Both IPEP and IPAIR are collected by WUAs themselves (actually collected by gate keeper/Mandor) and paid to the Kabupaten government as its revenue. The irrigation service fee (ISF) is defined as a total amount of IPEP and IPAIR. The membership fee is collected within WUA for operation and maintenance of tertiary system, WUA's activity funding including fees for Mandor.

The following table shows the ISF collection performance in the Sulawesi Province since 1988/89 to fiscal year 2000.

ISF collection performance in South Slawesi Province[5]

Unit:Rp. million

No.	Year	IPEP			IPAIR		
		Target	Collected	Rate (%)	Target	Collected	Rate (%)
1.	1988/89	-	24.9	-	-	-	-
2.	1989/90	300.0	238.2	79.4	-	-	-
3.	1990/91	300.0	183.2	61.1	172.1	86.4	50.2
4.	1991/92	200.0	142.2	71.1	244.2	107.3	44.0
5.	1992/93	200.0	146.8	73.4	273.1	151.3	55.4
6.	1993/94	55.0	100.9	183.5	382.1	201.7	52.8
7.	1994/95	100.0	59.7	60.0	1,400.4	503.6	36.0
8.	1995/96	100.0	60.5	60.5	812.8	382.5	47.1
9.	1996/97	50.0	87.4	174.7	812.8	559.6	68.9
10.	1997/98	64.5	66.0	102.3	1,581.9	584.9	37.0
11.	1998/99	-	-	-	-	104.4	-
12.	1999/00	-	-	-	518.7	216.6	41.8
13.	2000	-	-	-	810.9	87.7	10.8

Source : Pemerintah Provinsi Sulawesi Selatan Dinas PU Pengairan. Informasi Data January 2001/Dinas PSDA, South Sulawesi Province

(2) O&M expenditure

The public expenditure for irrigation O&M are from three fund sources; (i) central government budget (APBN), (ii) Kabupaten government budget (APBDI), and (iii) charge for irrigation service (IPAIR). The annual expenditure for irrigation O&M in the South Sulawesi Province for a past eight year period (1993 - 2000) was Rp. 32,170/ha, ranging from Rp. 5.4 billion to Rp. 11 billion, or from Rp. 18,000/ha to Rp. 33,000/ha, as shown below.

[5] No data on ISF collection performance are available in the provincial offices in 2001 onward because of decentralization. These data are held by the respective Kabupaten offices, and not given to Province.

ISF collection performance in South Slawesi Province

No.	Year	Target area (ha)	O&M Expenditure (Rp.million)				O&M exp. per ha (Rp.)
			APBN	APBDI	IPAIR	Total	
1.	1993/94	260,317	3,776.5	4,406.0	201.7	8,384.2	32,200
2.	1994/95	253,377	3,549.0	4,311.0	503.6	8,363.6	33,009
3.	1995/96	369,031	2,759.0	5,675.5	382.5	8,817.0	23,892
4.	1996/97	306,250	3,164.8	6,666.6	300.0	10,131.4	33,082
5.	1997/98	300,114	-	5,040.0	350.0	5,390.0	17,960
6.	1998/99	310,089	-	-	-	11,069.6	35,698
7.	1999/00	310.080	-	-	-	8,657.0	27,919
8.	2000	310,089	-	-	-	7,051.0	22,739

Source : Pemerintah Provinsi Sulawesi Selatan Dinas PU Pengairan. Informasi Data January 2001/Dinas PSDA, South Sulawesi Province

B4.3.2 Update of Required O&M Cost

At present, no ISF is paid systematically in the Bili-Bili irrigation project, as known from interviews outlined above. The O&M cost, as a basis of estimating ISF, is being updated by the Bili-Bili irrigation project office. The total annual O&M cost is preliminarily estimated at about Rp. 8.2 billion, as shown in Table 4.1. The O&M cost is composed of the following six items: (i) staff salary; (ii) O&M offices running cost including power supply to weir intakes, equipment and transportation, office supply and communication; (iii) repair & maintenance and depreciation of O&M machinery; (iv) canal maintenance; (v) materials for canals and structures; and (vi) emergency allowance.

An issue in connection with appropriating the amount of ISF to be collected from the beneficiaries is the source of funding for the O&M staff assigned in the Kecamatan and Kabupaten water services offices. The employees in terms of employment status are classified into state employee (PNS) and non state employee (non - PNS). The following table indicates the O&M cost, in consideration of employment status at both the Kecamatan and Kabupaten levels:

Updated Annual O&M Cost of Bili-Bili Irrigation Project

Unit : Rp. million

Description	Intake	Primary and Secondary Canals	Total
1. O&M staff salary	365	3,598	3,963
1.1 PNS at Kec. level	13	939	952
1.2 PNS at Kab. level	111	880	991
1.1 Non - PNS	242	1,778	2,020
2. O&M office running cost	269	714	983
3. Repair & maintenance and depreciation of O&M machinery	193	1,732	1,925
4. Canal maintenance	0	769	769
5. Materials for canals and structures	36	319	355
6. Emergency allowance	20	180	200
Total (1) (including all PNS)	883	7,312	8,195
Total (2) (excluding PNS at Kab. level)	773	6,432	7,205
Total (3) (excluding all PNS)	760	5,492	6,252

Source : Bili-Bili Irrigation Project Office

From the above table, amount of the ISF adopted to the Bili-Bili irrigation project would be appropriated to be Rp. 7,205 million for the command area of 23,660 ha, or Rp. 304,000/ha/year (equivalent to US$ 38/ha/year). This amount is worked out by deducting salary of state employees at the Kabupaten levels, because they are not fully engaged in the O&M activities for the Bili-Bili irrigation project, hence their salary would have to be funded by the government's recurrent budget.

B4.3.3 ISF and Financial Capacity of Irrigated Farmers

As mentioned in section 4.2 above, the Kabupaten Gowa has levied the ISF on irrigation beneficiaries with an amount of Rp. 50,000/ha/crop. This ISF amount would be rather politically rated than through consideration of actual O&M cost as estimated above. In case of 240 % cropping intensity as envisaged in the project design, the annual ISF to be collected from the beneficiaries is simply rated at Rp. 120,000/ha/year, that is corresponding to about 40 % only of assessed ISF rate of Rp. 304,000/ha/year. The study team acknowledged through the field reconnaissance that farmers are reluctant, in general, to pay such highly rated ISF at Rp. 50,000/ha/crop.

While, the farmers' economy is preliminarily re-assessed by the current market prices of agro-products and inputs. The table below shows its results in comparison with those estimated in the detailed design of Bili-Bili irrigation project in 1999.

Re-assessment of net income per household

Unit : Rp. 1,000/ha

Crop	Planned in 1999	Re-assessment	Balance / (%)
Dry paddy (100 %)	6,293	4,840	1,453 / (76.9 %)
Wet paddy (100 %)	5,693	4,340	1,353 / (76.2 %)
Palawija (40 %)	1,213	970	243 / (80.0 %)
Total	13,199 (US$ 1,833 equiv.)	10,150 (US$ 1,269 equiv.)	3,049 / (76.9 %) (US$ 564 equiv. / 69.2 %)

The re-assessment reveals that the farmers' income sharply dropped. The above farm income is based on that all the agro-products are sold in markets and also family labor costs are not taken into account. The main reasons for lowered income are: firstly low market price of paddy from Rp. 1,200/kg down to Rp. 1,000/kg[6]; and secondarily inflated labor costs as much as twice or more.

As mentioned in sub-section 4.3.2, the irrigation service fee was assessed at Rp. 304,000/ha/year, covering O&M costs of intakes and primary and secondary canals. Its amount is corresponding to about 3 % part of the re-assessed farm income, thus the irrigated farmers are capable of bearing the full O&M costs required for the Bili-Bili irrigation project.

[6] Data of market prices of paddy and agro-inputs (fertilizers, etc.) are sourced from Agriculture, Food Crops and Horticulture Department in South Sulawesi Province. Paddy prices at farm gate further fall at harvesting seasons as low as Rp. 800/kg.

However, the dominant farmers in this area are small landholders of as low as less than 0.5 ha[7], or presumably irrigated fields of 0.3 ha on an average as seen in the short field reconnaissance by the study team (see section 4.2). In case of irrigated fields of 0.3 ha, a farmer's net income is roughly estimated at about Rp. 3.0 million or US$ 380 equivalent annum only. With the assessment conditions that the cropping intensity is 240 % by mobilizing all the workable family members, another revenue opportunities such as brick production and part-time workers would be narrowed. It would be reasonably thought, therefore, that prior to ISF paying farmers may tend to allocate the resources to food expense, repayment of debt / interest for agro-inputs and/or family welfare, education expense, religious activities, etc.

It is noted that the case above is of owner-farmers. The tenant farmers[8] with small land holding face more serious conditions. ISF would be beyond tenant farmers in mind unless the landowners would bear ISF.

B4.4 Operation and Maintenance of Irrigation Facilities

B4.4.1 O&M Guidelines and Manuals

An operation and maintenance manual for the Bili-Bili irrigation project is being drafted by the project consultant. This manual aims to give a guideline to operation and maintenance (O&M) staff who will undertake the O&M activities for the Bili-Bili irrigation project. The manual covers general and detail procedures on irrigation and maintenance and farm water management. The contents of the manual and supporting documents are outlined below.

Main text :

- Description of the project;
- Basic of O&M of irrigation facilities for rice culture;
- O&M of the sub-projects' irrigation facilities;
- Cropping plan and water distribution;
- Water management in tertiary block;
- Organization for O&M;
- Data collection and evaluation; and
- Financial aspect.

Supporting documents :

- Associated tables, figures and drawings supporting main texts;
- Calculation tables and rating curves for water measuring devices;
- List of water measuring and gate structures;
- Forms for O&M; and

[7] The accurate distribution of landholding sizes in the Bili-Bili irrigation project area are not found at present. These will be expected to be identified in the process of ongoing tertiary development works.

[8] The distribution of land tenure conditions are not found at present in the Bili-Bili irrigation project area, and this will be identified in the process of ongoing tertiary development works. An officer in Dinas Pertanian suggests that tenancy rate in the Province is as high as about 70 % of all the farm households.

- Discharge comparison between actual measurement and calculation by formula.

This manual is exhaustive and covers all the components required for operating and maintaining the respective three irrigation schemes under the Bili-Bili irrigation project, although editing for brush-up including finalization of financial aspects is necessary. In due consideration of proper irrigation scheme management in a participatory manner under the guideline of the new water law, however, the following issues are extracted from the above O&M manual:

- The current draft manual may be adequate and practical for higher rank O&M officers and highly educated people in concerned engineering fields, but too sophisticated for working level officers and field operators and workers; and
- The draft manual does not contain manual and guideline for farmers and WUA members who actually participate in the tertiary level management and cooperate with O&M agencies in main and secondary level management.

With the above facts pointed out, it would be proposed to produce the following two types of manuals and guidelines in more elaborated manners:

(1) Water users association (P3A) strengthening module (for trainers use)

This module is used for training the trainers who train the WUA members and also used for training WUA members. The manual covers the whole spectrum of activities in pre-irrigation, irrigation and post-irrigation during the entire cycle of cropping seasons. The manual specifies the activities that should be done per hierarchical level of the organization, such as administrative agencies at national, local and village level, and farmers groups from WUA federation (GP3A) to individual farmers. The module focuses on the flow of WUA management, comprising stepwise activities. With an emphasis of participatory process in management and O&M of irrigation schemes, it would be necessary to include a guideline for PCM, aiming at applying participatory assessment of WUA activities using the PCM method.

(2) Maintenance and rehabilitation guide for water users association (P3A) (for WUA member farmers)

The manual will present, in a simple way, on how WUA member can perform his/her role in maintenance and rehabilitation works. The definition of technical terms is simplified for easy understanding and procedures for actual maintenance and rehabilitation are localized for ease in application. Many illustrations are included to enhance the learning process.

B4.4.2 Head Discharge Measurement

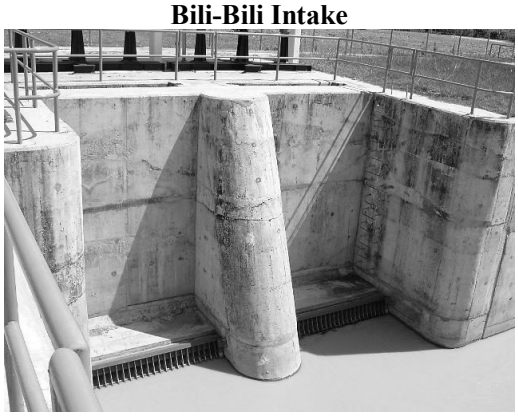
The study team reviewed the measurement methods of head discharge at the intake gates of Bili-Bili, Bissua and Kampili diversion weirs in terms of its accuracy and maneuverability. Materials used for the review are draft O&M manual for the Bili-Bili irrigation project (May 2004) and construction drawings, and eye-confirmation at the sites. As a result, the Bili-Bili

intake would not give gate operators any significant stress, however, both the intakes at Bissua and Kampili require careful gate operation to perform discharge control, as mentioned below.

(1) Bili-Bili Intake

Two electric driven intake gates are installed at the right bank of diversion weir. Each gate has the size of 1.2 m high and 2.5 m wide, as shown in Figure 4.3. The Bili-Bili intake is designed at the discharge of 3.9 m^3/sec, encountering the in-flow up to 4.7 m^3/sec. The water intake is hydraulically designed by orifice or undershot type, and no submerged condition in the downstream of intake gate will take place. As no specific measurement devices are provided at the intake, the discharge has to be measured by an empirical hydraulic equation below.

Bili-Bili Intake



$$Q = C * a * b * (2gh)^{1/2}$$

Where, Q : discharge (m^3/sec)
C : coefficient
a : gate opening (m)
b : gate width (2.5 m for 1-gate, or 5.0 m for 2-gate)
h : upstream water depth at intake gates

Although the above equation gives actual discharge accurately, it is proposed to conduct actual flow measurement using adequate current meters at the various water stages to confirm the above hydraulic coefficient "C".

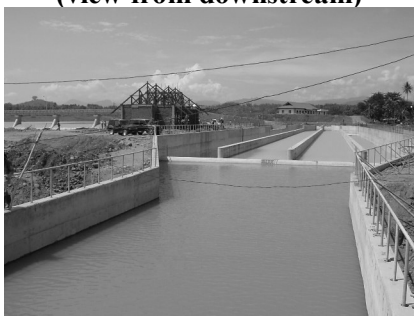
Through the inspection at the intake site by the study team, it is desirable to install a device at the gate operation deck indicating numerical values including upstream water level, gate opening heights, water level at the appropriate point of the downstream main canal, and computing tables. Moreover, a computerized device showing the current intake discharge is best for accurate gate maneuvering.

(2) Bissua Intake

Four electric driven intake gates are installed at the left bank of diversion weir. Each gate has the size of 1.9 m high and 3.0 m wide, as shown in Figure 4.4. The Bissua intake is designed at the discharge of 17.8 m^3/sec, encountering the in-flow up to 25.0 m^3/sec. The water intake is hydraulically designed by orifice or undershot type. There are two discharge control points, one is at the intake gates and the other at the end sill of sediment trap about 220 m in distance along the headrace and sediment trap channels downstream from the intake slide gates. The draft O&M manual gives the following empirical equation that measures the discharge at the end sill.

Bissua Sand Trap End Sill (view from upstream)

Bissua Sand Trap End Sill (view from downstream)



$$Q = C_d * 2/3 * (2/3 * g)^{1/2} * b * h^{3/2} = 1.71 * b * h^{3/2}$$

Where, Q : discharge (m^3/sec)
Cd : discharge coefficient (= 1.03)
b : width of weir (sill) (=25.85 m)
h : water head depth at sill upstream (m)

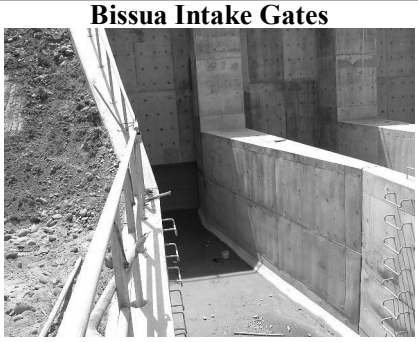
As far as the hydraulic condition at the end sill is maintained in complete overflow at any stage, the intake discharge can be adequately measured by the above equation, subject to the cross-check confirmation by current meter measurement. However, there may be the following potential issues, making the discharge measurement complicated:

a. the water level immediately downstream from the end sill fluctuates by operation of cross regulator gates provided at the bifurcation structure that dividing irrigation water into two primary canals of Bissua and Mattoangin; and
b. as the canal width abruptly constricted at the end sill (refer to photo), the discharge coefficient (C_d) may have to be reviewed because constriction flow along both the canal vertical walls would take place.

As no statement about the hydraulic conditions at the various stages is given in the draft O&M manual, it would have to be clarified in the final O&M manual.

The intake gate is hydraulically designed by orifice or undershot type, but submerged condition in the downstream will prevails. No adequate measurement is, therefore, expected at this point. Consequently, the intake water control has to be based on the hydraulic measurement at the end sill about 220 m away from the intake gates. It would be proposed that:

Bissua Intake Gates



a. the hydraulic conditions at the various stages have to be confirmed, whether submerged conditions take place, and a proper measurement method with adequate devices has to be established in case of submerged flow; and

b. an adequate device or an operation rule instruction indicating the hydraulic conditions at the end sill has to be installed at the intake gate control place for proper gates operation.

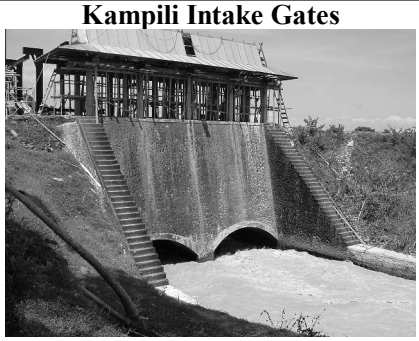
When possible, a computerized device showing the current intake discharge may be installed at the operation deck above the intake gates.

(3) Kampili Intake

Four electric driven intake gates are installed at the left bank of diversion weir. Each gate has the size of 1.5 m high and 2.05 m wide, as shown in Figure 4.5. The Kampili intake is designed at the discharge of 19.7 m^3/sec, encountering the in-flow up to 20.88 m^3/sec. The water intake is hydraulically designed by orifice or undershot type. There are two discharge control points, one is at the intake slide gates and the other at the end sill of sediment trap about 400 m in distance along the headrace and sediment trap channels downstream from the intake gates.

Kampili Sand Trap End Sill

Kampili Intake Gates



The draft O&M manual specifies the end sill structure as the discharge measurement point, but no measuring equation is given. Scrutinizing the drawings with eye-observation at the intake site, there would be a possibility of submerged flow taking place at the end sill at some hydraulic stages. The final O&M manual is expected to clarify the definite measurement method as well as the hydraulic conditions at the intake facilities. An adequate device or an operation rule instruction, as proposed for the Bissua intake, indicating the hydraulic conditions at the end sill has to be installed at the intake gate control place for proper gates operation.

B5 Capacity Development in Irrigation

B5.1 Present Conditions of Capacity Development

Various capacity development programs in the irrigation sector have been provided in the South Sulawesi Province with the assistance from the international agencies and donor countries (World Bank, ADB, JICA, Netherlands, etc.) as well as by the government itself. These programs cover both the government officials involved in irrigated agriculture and farmers as WUAs' members. The recent and on-going capacity development programs are: (i) ADB funded Farmer managed irrigation systems project (FMIS) for the period from 1997 to 2002; and (ii) World Bank/ Government of Netherlands funded Water resources and irrigation reform implementation program (IWIRIP) that has commenced in 2001. Both the programs are briefly outlined below.

(1) Farmer managed irrigation systems project (FMIS)

The ADB funded farmer managed irrigation system project (FMIS) was a nationwide project, and the South Sulawesi Province was one of target areas. FMIS was designed to follow the past ADB's initiatives and experience from the implementation of the 1987 government adopted irrigation O&M policy (IOMP), particularly the program to turn small irrigation systems over to WUA. FMIS adopted objectives of participatory planning and improvement of schemes, including mobilizing farmer contributions of labor and materials towards the costs of improvement of village (non-publicly managed) irrigation schemes. The specific components of FMIS are: (i) rehabilitation and improving FMIS; (ii) strengthening Kabupaten and Kecamatan support services; (iii) strengthening WUA and local irrigation organization; and (v) project management support. The target FMISs in the South Sulawesi Province were 149 schemes with the total area of 17,149 ha.

Along with the project implementation, various materials and tools necessary for trainings of government officials and WUA members were developed, and the training programs were provided intensively. The training programs covered a wide range of subjects including project appraisal by the government officials, project planning, design, construction, O&M, WUA strengthening and women group development. The total participants to these training programs amounted to about 5,000 in the South Sulawesi Province. The table below shows the performance of training programs achieved in the South Sulawesi Province.

The project completion report in the South Sulawesi Province was prepared in March 2004, by which the final project evaluation was made by ADB in March 2004. While, as a continued assistance by ADB, the nationwide participatory irrigation sector project (PISP) has been formulated, involving the South Sulawesi Province, however, its loan agreement between the Government and ADB yet to be concluded (as of May 2004).

Performance of capacity building program in FMIS in South Sulawesi Province

Fiscal year and main training theme	Nos. of participants	Training days	Nos. of target groups
1. FY1997/98 - Design	36 (36)	6 (6)	1 (1)
2. FY1998/99 - Project appraisal - Project planning - Construction supervision - Facilities O&M - WUA and WID	631 (508)	56 (57)	16 (16)
3. FY1999/2000 - Project appraisal - Project planning - Construction supervision - Facilities O&M - WUA and WID	1,287 (1,551)	163 (163)	33 (33)
4. FY2000 - Construction supervision - Facilities O&M - WUA and WID - MIS/BME	875 (1,057)	72 (72)	15 (15)
5. FY2001 - Construction supervision - Facilities O&M - WUA and WID	419 (419)	60 (60)	12 (12)
6. FY2002 - Women movement OJT - O&M OJT	1,728 (1,788)	156 (171)	52 (57)
Total	4,976 (5,358)	513 (529)	129 (134)

Note: Figures in ( ) are planned.
Source: Irrigation and Swamp Superior Project in South Sulawesi Province

(2) Water resources and irrigation reform implementation program (IWIRIP)

IWIRIP consists of three components: (i) basin water resources management (BWRM); (ii) quality assurance; and (iii) irrigation management reform (PKPI). IWIRIP - PKPI covers thirteen provinces in Indonesia, and the South Sulawesi Province is one of them. This components includes support for legislation and institutional development, improvement of irrigation management and empowerment and institutional development of WUA federations. The program started in 1999 under the Java irrigation and water resources management project (JIWMP). In 2002, the irrigation reform activities were carried over to one of components of IWIRIP funded by the Netherlands and supervised by the World Bank. This program is based on the legal framework of INPRES 3/99 (April 1999), that later evolved into the government regulation PP77/01 (December 2001) and relevant ministerial decrees. The five principles are adopted to the program: (i) redefinition of tasks and responsibilities for irrigation management institutions; (ii) empowerment of WUA; (iii) irrigation management transfer (IMT); (iv) restructuring finances for irrigation management; and (v) sustainable utilization.

The South Slawesi Province is one of target area, in which two Kabupatens, Pinrang and Gowa are selected as the PKPI activities areas. Six WUA federations (92 WUAs) with a total irrigation

area of about 5,920 ha in the Kampili irrigation scheme in Kab. Gowa are the activities fields. In the provincial and Kabupaten levels, both the provincial and Kabupaten BAPPEDAs are responsible for IWIRIP-PKPI programs. An Indonesian consultant in charge of the South Sulawesi Province is stationed in the provincial BAPPEDA, and six NGOs as community organizers are engaged in the PKPI activities at the six WUA federation in the Kampili scheme.

The main activities have been concentrated in the training for government officials at its all levels. The community organizers are assisting target WUAs in their institutional empowerment, however, the transfer of irrigation system as intended in the IWIRIP is reported[9] to be still in a preparatory stage as identified in the field reconnaissance by the study team in Tanabangka village involved in this program

B5.2 WUA Empowerment

B5.2.1 Approach to WUA Empowerment

WUA empowerment is a fundamental factor to enable irrigation sustainable. Various approaches are being attempted in WUA empowerment under the international agencies funded programs. A process adopted in most cases is formation / reformation of WUA followed by participatory rural assessment, formation of WUA federation, legalization of WUA, transfer of irrigation management to WUA, collection of ISF and arrangement of service agreement between government and WUA. As methodologies of training WUA members as well as concerned government officers and dissemination of WUA empowerment, seminar and lecture types activities are mainly employed.[10]

Empowerment may be defined that the respective WUA members can develop a capacity to identify their problems and also to solve problems by themselves. Only a series of lecture based trainings would be insufficient to realize the real empowerment. An appropriate way would be a cycle of participatory based approaches, starting from participatory problems/objectives analysis by such a method as project cycle management (PCM) followed by lectures/workshops, field practices by WUA members together with concerned government officials, and feedback of participatory results to WUA activities. This cycle would have to be repeated until WUA members recognize that the irrigation system are really theirs.

WUA members may be able to identify, in the course of participatory process, shortcomings of various agricultural and social supporting systems such as rural credits, agricultural extension services, marketing, etc., and may generate ideas to improve the situation collectively and/or individually. A proposal to form WUA as a business entity is one of ideas like in Philippines where WUA (called Irrigator Association) is registered in the Security Exchange Commission (SEC) and regarded as non-profit organization.

---

[9] (1) Progress report for thirty second quarterly period April - June 2003, IWIRIP - PKPI, DHV, September 2003 / (2) Study team's interview in BAPPEDA, South Sulawesi Province

[10] Information from government officer and consultant engaged in IWIRIP-PKPI, BAPPEDA, South Sulawesi Province

JICA has started a three - year program of technical assistance in empowerment of WUAs composed of five WUA groups at Tanabangka village (about 300 ha) in the Kampili irrigation scheme. It is highly expected that a practical WUA empowerment program will be implemented with introducing a cycle of participatory based approaches at a core area in the Bili-Bili irrigation project. Consequently, the results obtained and lessons learnt from the technical assistance will be extended over the whole Bili-Bili irrigation project for its sustainable management.

B5.2.2 Technical Assistance to WUA Empowerment

(1) Study on WUA empowerment for enhancement of turnover program

With launching water resources management reform policy in 1999 and the World Bank assisted water resources sector adjustment loan (WATSAL), the Government made a study on WUA empowerment[11] in 2000/01 with the assistance from the Government of Japan through JICA (the WUA empowerment study). The WUA empowerment study aimed to formulate detailed action plans for the improvement of irrigation management and empowerment of WUAs for the management of the turnover program. The action plans formulated in this study are composed of twelve actions as listed below.

Action plans for improvement of irrigation management and empowerment of WUAs

Action plans on irrigation and WUA management
Preparatory activities
Action - 1 : Public awareness of government policy amongst government officials
Action - 2 : Inventory of irrigation system and WUAs
Core activities
Action - 3 : Public awareness and capacity building at WUA level
Action - 4 : Training of WUAs leaders
Action - 5 : Start - up financial assistance
Action - 6 : Formulation/reformulation of WUAs, GWUAs and IWUAs
Action - 7 : Kabupaten irrigation improvement fund
Action - 8 : Improved O&M and joint management
Action - 9 : Collection of ISF and government support
Action - 10 :Rehabilitation of irrigation system
Action - 11 :Monitoring and evaluation
Action plan on irrigated agriculture
Action - 12 :Enhancement plan on agriculture

Source : The study for improvement of irrigation management and empowerment of water users associations for enhancement of turnover program in the republic of Indonesia, main report, November 2001, JICA

(2) JICA's technical assistance in WUA empowerment Project in the Bili-Bili irrigation project

The new Water Law enacted on March 18, 2004 alters the irrigation management policy from "transfer of irrigation management to WUA (PKPI)" to "irrigation management by government

[11] The study for improvement of irrigation management and empowerment of water users associations for enhancement of turnover program in the republic of Indonesia, main report, November 2001, JICA

with due participation of farmers (PIP)". This is fairly drastic policy alteration, and PIP aims at farmers' participation in all the stages of irrigation development from its initial planning to system management. PIP also intends to transfer technical knowledge to farmers by showing the actual effects of O&M and management activities.

As a follow-up action of JICA's WUA empowerment study coupled with the new Water Law, JICA has started a three - year program of technical assistance in empowerment of WUA in the South Sulawesi Province in April 2004. The target area is a group of five WUAs at Tanabangka village in the Kampili irrigation scheme. The technical assistance program aims at strengthening WUAs organization, achieving adequate water management, enhancing technical capacity for irrigation facilities management, and improving farming systems. The assistance program is under preparation by the Benefit Management Department of Dinas PSDA with assistance from JICA.

(3) NGO's assistance in WUA empowerment

There are 88 NGO groups formally registered in 2003 in Kabupaten Gowa, that occupies the most part of the Bili-Bili irrigation project area. Most of NGOs' activities is village development or community empowerment. Of 88 NGOs, three groups are concentrated in irrigation development, namely: (i) **Yapsdamdes** (Yayasan Pengembangan Sumberdaya Masyarakat Desa); (ii) **Lembaga Pelangi** (Lembaga Pengembangan dan pelayanan anak dan gizi); and (iii) **LSIC** (Lembaga studi Insan Cita).

Yapsdamdes cooperates with the project consultant to the Bili-Bili irrigation project in reforming the organization of WUAs since 1998 when its construction design was started. Based on the WUAs formed by irrigation services of Kabupaten Gowa, **Yapsdamdes** assisted WUAs in reforming them along the irrigation canals and water flows direction. The socialization of reorganized WUAs is made together with the WUAs' management board. **Yapsdamdes** handled 250 WUAs simultaneously in the whole coverage of Bili-Bili irrigation project area. WUAs were assisted in setting up their management board, and estimating their own coverage area. These activities were performed based on the detailed topographic design maps showing alignment of irrigation facilities and each paddy plot produced by the project consultant. However, WUAs face difficulty in identifying who is the WUA members and in making the list of their members.

LSIC, the NGO engaged in IWIRIP-PKPI in the South Sulawesi Province, is working for institutional strengthening of WUA at federation level. There are six WUA federation (GP3As) already formed in the Kampili irrigation scheme. Trainings being conducted are for Chairmen of WUA and FWUA level only. They were encouraged to work in administrative management, for example the formal registration for the establishment of the organizations.

At the farmer level, **Lembaga Pelangi**, an NGO who gain the respect and trust from the community through its community development program since 1996, especially in children nutrition and women empowerment program realized the needs of tertiary development

channels in Tanabangka village in Kabupaten Gowa and also in the Kampili irrigation scheme. WUAs and a WUA federation had already been set up with the assistance from two NGOs of **Yapsdamdes** and **LSIC**. **Lembaga Pelangi** encourage the existing WUAs' members to work hand in hand together to develop new tertiary channels. This work started with identifying the members of WUA, followed by the following activity sequence:

- identify WUA members one by one based on the topographic design maps and through a series of meetings by a method of participatory rural appraisal (PRA);
- estimate the size of land area of each member through participatory field works;
- hold a series of meeting among WUA members to develop commitments in working together; and
- conduct construction and rehabilitation of tertiary canals jointly by WUA members.

Although the target groups for the above activities are only four WUAs, both the farmers and the NGO experienced significant energy and patience. The strengthening program started with increasing of awareness, and doing together the physical work, constructing tertiary and field ditches in order to develop team work attitudes in the organization. These efforts are still continued. The performance in Tanabangka village was recognized as a result of the advanced WUA empowerment activities, thus it was selected as the model area for the JICA's technical assistance program for WUA empowerment in Indonesia as outlined above.

B6 Irrigation Sector's Involvement in Jeneberang River Basin Management

B6.1 Demarcation of Irrigation Management

The Jeneberang Public Corporation (the Corporation) is to be established, and it will undertake a comprehensive river basin management of the Jeneberang river. An issue in connection with the water management of Bili-Bili irrigation project is the demarcation of irrigation facilities O&M. The irrigation facilities are largely divided into two categories; ones are weir and intake facilities constructed on the rivers that are directly related to river management itself, and the others are irrigation canal networks below the weir and intake facilities. Taking the various factors such as physical nature of facilities in connection with river control, relevant laws and regulations, and presently functioning organizations into consideration, and through the discussions with the various stakeholders in the course of the study, the irrigation management responsibility would be demarcated as follows:

(1) Three weirs with intake structures, Bili-Bili, Bissua and Kampili provided on the Jeneberang river are operated and maintained by the Corporation;
(2) All the irrigation facilities below the above three intakes are operated and maintained by Balai PSDA at provincial level, Dinas PSDAs at Kabupaten level, Caban Dinas at Kecanatan level, and WUAs, as discussed in section 4.1; and
(3) Balai PSDA is responsible for coordinating the water allocation at the intakes between the three irrigation schemes of Bili-Bili, Bissua and Kampili, and the Corporation.

In particular, Balai PSDA play an important role in adjustment of water intake from the river in terms of quantity and timing when serious draughts take place and a careful operation of the Bili-Bili reservoir is required. The draught management for the irrigation side is discussed in section 6.3.

B6.2 Financial Sharing to Jeneberang River Basin Management

(1) Sharing of ISF to cover O&M cost of Irrigation Intake Facilities

Irrigation sector is the largest water user, accounting for about 80% of total water demand (irrigation and municipal water without hydropower) from the Jeneberang river, or about 43% of average annual runoff (950 MCM) at the Bili-Bili dam site. The irrigation sector should bear an equitable portion of water resources O&M costs accordingly. There are two ways of interpretation in this regard.

(1) Sharing of ISF to cover O&M cost of Irrigation Intake Facilities

Present Government Regulation No.77/2001 admits collecting ISF from irrigation beneficiaries (farmers) to cover irrigation O&M cost. This GR is, however, subject to revision because of introduction of new policy enacted by New Water Resource Law No. 7/2004 in March 2004.

Nevertheless, this paragraph describes a case that the concept of ISF would continue to exist in the future.

One of issues in the study is how the irrigation sector should be involved in the Jeneberang river basin management. Specifically, does the irrigation sector pay charge in cash to the proposed public corporation to be established for its basin management? In terms of ensuring water resources for a longer period by basin conservation to be born by the public corporation, the answer may be "Yes". If so, further question is whether to add the charge on, or to share a part of irrigation service fee (ISF) collected from irrigated farmers.

As discussed in sub-section 4.3.3 above, farmers seem to be capable, merely seeing the farmers' balance sheet, of paying pay such charge as the corporation may requires in addition to ISF. However, the dominant farmers are small landholders and their economic situation may not allow them seeing beyond ensuring their own livelihood, unless the social and agricultural supporting services would be sufficiently provided. In principle, however, paying ISF enough to recover the costs for operation and maintenance of primary and secondary systems including weirs and intakes would be prerequisite for realizing sustainable irrigation schemes.

The study team recommends that financial involvement of irrigation sector in the river basin management would be a matter of ISF sharing among the stakeholders including WUA and such public corporations. In the light of operation and maintenance of weirs and intakes to be undertaken by the Corporation, the O&M costs for these facilities have to be paid to the Corporation. The O&M cost for weirs and intakes corresponds to about ten percent (10%) as estimated in sub-section 4.3.2. Consequently, it is recommended to share a ten percent (10%) part of actually collected IFS to the Corporation, while the governments have to determine the adequate ISF rates in due consideration of socio-economic and current agricultural supporting conditions, also make an extensive campaign to collect ISF in collaboration with WUAs and related stakeholders.

(2) Government Responsibility to Pay O&M Cost

Description in (1) above was given on the basis of concepts set out in existing Government Regulation No.77/2001 on Irrigation. Recently, however, a revised concept of O&M of irrigation was introduced in the New Water Resources Law No.7/2004 that was enacted in March 2004.

The New Water Law set forth the principles of irrigation O&M and water management fee as follows:

Article 64 (6):

Operation and maintenance of irrigation system shall be as follows:

a the operation and maintenance of primary and secondary irrigation systems shall be under the authority and responsibility of the Government and the regional governments according to their authorities.
b. the operation and maintenance of tertiary irrigation systems shall be under the authority and responsibility of water users association.

Article 80 (1):

The users of water resources for basic daily needs and people's agriculture shall not be charged water management fees.

The elucidation (Para.I.12) states further detail:

- Due to the limited ability of the farmers using water, the use of water for people's agricultural activities is free from the obligation to pay the water resources management services but not eliminating the obligation to pay the costs for development, operation and maintenance of tertiary irrigation

The above clearly prescribes the government obligation for the O&M of irrigation facilities, which include the obligation for funding of O&M cost.

The concept set forth in New Water Law is quite different from the beneficiary-to-pay principle prescribed in the existing GR No.77/2001.

(3) Assumption in this Study

Considering the concepts in (1) and (2) above, this Study proposes the following principles may be set out:

(a) Irrigation O&M cost shall principally be paid by farmers (as beneficiary) based on beneficiary-to-pay principle
(b) On account of the farmers' limited ability to pay, the government takes over from farmers the obligation of paying the O&M cost from farmers. This government obligation should also be applied to the O&M service cost incurred by the public corporation.
(c) The compensation to the corporation will be in the form of either subsidy or service fee under the concept of PSO (public service obligation)

O&M service fee to be paid by the government to the corporation shall include O&M cost of irrigation weir and intake stated in (1) above and also the allocated portion of O&M cost of Bili Bili dam/reservoir.

B6.3 Water Management by Accurate Discharge Measurement

The basis of proper water management both in the irrigation system and river control relies on the accurate discharge measurement at the control points. For sustaining mutual trust between the irrigation management sides and the Corporation, the discharge control at the three intakes is indispensable. The study team identified that supplemental devices with regulating rules would have to be provided at the respective three intakes, that enable the Corporation to undertake accountable water delivery.

B6.4 Draught Management

The water balance simulation for the 26 year period from 1972 to 1997 suggests that almost a full double - cropping of paddy except two years was ensured, as discussed in section 3.3. On the other hand, the palawija crops with the proposed cropping intensity of 40% suffer the draught rather than paddies. When water shortage takes place or is foreseen, the irrigation will be required to reduce the water supply in accordance with an operational regulation of the Bili-Bili reservoir, placing a priority of water supply on domestic use. The reduced quantity and its duration will be agreed between the Balai PSDA and the Corporation. The following draught management would have to be undertaken:

(1) The reduction of irrigation water supply in quantity is adopted at a same reduced rate over the irrigable area, in principle;
(2) The quantity and schedule of reduced water supply are decided on the basis of actual crop planting area, crops' growing stages, kinds crops with draught tolerance, in consultation with the irrigation committees; and
(3) The Corporation assists Balai PSDA and Kabupaten Dinas PSDA in conducting water-saving campaign.

B7 Transfer Knowledge in Irrigation Sector Study

The irrigation planning / irrigation facilities expert of the study team made the following lecture for the counterpart staff as a part of transfer knowledge programs on May 28, 2004:

(1) Findings and recommendation obtained in the study; and
(2) Case study of irrigation management transfer (IMT) in Philippines

Tables

Table B1.1 Abstracts of Provisions in Water Law related to Irrigation Development and Management

Chapter	Article	Provision
Chapter IV Water Resources Utilization	**Article 41**	(2) The authority and responsibility for the development of primary and secondary irrigation systems shall be with the Government and the regional governments, on the conditions that: a. the authority and responsibility for the development of primary and secondary irrigation systems across provinces shall be within the Government; b. the authority and responsibility for the development of primary and secondary irrigation systems across districts/cities shall be within the provincial government; c. the authority and responsibility for the development of primary and secondary irrigation systems in a single district/cities shall be within the concerned district/city government; (3) The right and responsibility for the development of tertiary irrigation systems shall be with the water user associations. (4) The development of irrigation systems as mentioned in paragraph (2) shall be arranged with participation of the community. (5) The development of primary and secondary irrigation systems may be done by the water user associations or the other parties in accordance with their needs and abilities. (6) Ruling on the development of irrigation systems shall be further stipulated in a government regulation.
Chapter VII Construction, Operation and Maintenance	**Article 64**	(6) The activities of operation and maintenance of irrigation system shall be as follows: a. The activities of operation and maintenance of primary and secondary irrigation systems shall be the rights and authorities of the Government and the regional governments in accordance with their authorities. b. the activities of operation and maintenance of tertiary irrigation systems shall be the rights and authorities of the water user associations.
Chapter X Financing	**Article 78**	(3) The financing of construction, and operation and maintenance activities of the irrigation system shall be arranged as follows: a. the financing of construction, and operation and maintenance activities of primary and secondary irrigation systems shall be borne by the Government and the regional governments in accordance with their authorities and may get the participation of the farmers; b. the financing of construction, and operation and maintenance activities of tertiary irrigation systems shall be borne by the farmers and may be assisted by the Government and/or the regional governments, except for the weir, 50 m canal or the weir, and tertiary boxes as well as tertiary supplemental buildings which shall be borne by the Government and/or the regional governments; c. the financing of the operation and maintenance of the tertiary irrigation systems shall be borne by the farmers and may be assisted by the Government and/or the regional governments.

(table continued)

Elucidation of provisions in Water Law

Chapter	Article	Elucidation of provision
Chapter IV Water Resources Utilization	**Article 41**	(2) Development of irrigation system by the Government and the regional governments includes the development of 50-meter pilot canal from the tapping building/tertiary intake.
Chapter IV Water Resources Utilization	**Article 41**	The criteria in the division of responsibilities in the irrigation management are, besides using the administrative area as the basis, also based on the area strata, as follows: - Irrigation area of less than 1,000 ha (small irrigation area), located in a single district/city shall be within the responsibility of the concerned district/city government. - Irrigation area of 1,000 to 3,000 ha in area (medium-sized irrigation area) or a small irrigation area located across districts /cities shall be within the responsibility of the concerned provincial government. - Irrigation area of an area larger than 3,000 ha (large irrigation area), or a medium-sized irrigation area located across provinces, in nationally strategic, and across countries shall be within the responsibility of the Government. The implementation of the responsibility may be arranged in a deconcentration or assistance scheme. (3) This provisions mean to state that it is the farmers who have the rights and responsibilities for the development of tertiary irrigation system, but the Government may to some extent facilitate such development. This implies that it is the government who still has the authority and responsibility. (4) Community includes the water users association. Participation of the community here means encouraging the water users association in general and the farmers in particular to take an active role in the development of primary and secondary irrigation system. (5) The other parties mean a group of people other than the water users association, individuals or enterprises who for their needs and on the considerations/advice/recommendations of the government in stages by extent of authorities, are considered able to develop an irrigation system. Irrigation system development must be in line with the regional spatial plan. Development in the sense of construction work may be done with other parties on the construction design already approved by the government. Irrigation system development may also be done by a third party under the supervision of the government. Provision on the approval and supervision by the government will be determined in laws and regulations. Abilities of the farmers mean their ability in institutional, technical and financing sense.
Chapter VII Construction, Operation and Maintenance	**Article 64**	a. Operation and maintenance activities of primary and secondary irrigation systems will be undertaken by the Government and the regional governments, but the water users association may also participate in accordance with their capacity and ability.

Source: Directorate General of Water Resources

Table B3.1 Main Features of Bili-Bili Irrigation System

Description	Bili-Bili Irrigation Scheme		Bissua Irrigation Scheme		Kampili Irrigation Scheme	
1. Irrigation area	2,360 ha		10,760 ha		10,540 ha	
2. Primary canal						
- Head discharge	3.9 m^3/sec		19.7 m^3/sec		17.4 m^3/sec	
- Nos. of canal	2		2		1	
- Total length	9.4 km		23.7 km		13.5 km	
3. Secondary canal						
- Discharge	1.3 - 0.02 m^3/sec		2.4 - 0.1 m^3/sec		2.4 - 0.2 m^3/sec	
- Nos. of canal	5		28		5	
- Total length	18.6 km		27.2 km		75.4 km	
4. Related structures	New	Rehab.	New	Rehab.	New	Rehab.
- Weir	-	5	1	-	-	1
- Division str.	3	-	12	-	-	15
- Offtake	14	19	30	-	26	37
- Culvert	4	-	19	-	25	4
- Drainage culvert	-	2	22	-	3	6
- Aqueduct	-	2	1	-	2	-
- Drops	2	2	17	-	1	-
- Bridge	-	8	12	-	-	5
- Foot bridge	9	3	51	-	6	4
- Side spillway	2	1	4	-	1	1
- Buffalo wallow	-	-	2	-	-	3
- Washing step	-	-	13	-	-	-
- Drain inlet	-	-	-	-	-	-
- Syphon	-	-	-	-	1	1
- Tunnel	1	-	-	-	-	-
- Gates	118	56	291	-	185	487
5. Drainage canal						
- Discharge	46.4 - 0.7 m^3/sec		6.2 - 1.0 m^3/sec		41.5 - 1.2 m^3/sec	
- Nos. of canal	4		7		10	
- Total length	24.1 km		15.5 km		61.5 km	
6. Drain related structures						
- Bridge	2		5		9	
- Culvert	-		-		-	
- Drain inlet	-		-		40	
- Drain junction	3		-		8	
- Drain gate	14		-		-	
7. Tertiary development						
- Rehab. existing tertiary canal						
- New tertiary canal	32.75 km		-		177.75 km (*)	
	-		90 km		n.a.	

Note: The above figures do not necessarily present the current status, since these are based on the 1999 design report. The right figures upon the completion of construction works are being prepared by the project office and will be available soon.

(*): Existing tertiary canal for the area of 17,560 ha, a part of which belongs to Bissua irrigation scheme

Source: Final Design Report on Detail Design and construction Supervision of Bili-Bili Irrigation Project, December 1999

Table B3.2 List and Features of Tertiary Development and Water Users Association (P3A)

Sr. No.	Name of GP3A		Nos. of Tertiary Block	Irrigation Area (ha)	Area of Tertiary Block (ha)			Nos.of P3A	Nos. of P3A Member
					Min. area (ha)	Max. area (ha)	Average area (ha)		
(1)	**Bili - Bili Irrigation Area**								
1.	Bajiminasa		14	573.9	8.0	74.0	41.0	6	N.A.
2.	Julkanaya		8	482.9	5.5	157.4	60.4	5	N.A.
3.	Somba Opu		25	778.8	0.9	116.0	31.2	6	N.A.
4.	Pa'Rappunganta		7	545.2	62.7	97.7	77.9	3	N.A.
	Sub-total		**54**	**2,380.8**	**0.9**	**157.4**	**44.1**	**20**	
(2)	**Bissua Irrigation Area**								
5.	Harapan Tani		14	633.0	4.5	105.3	45.2	10	N.A.
6.	Wira Tani		11	771.0	5.0	97.4	70.1	11	N.A.
7.	Hasanuddin		10	616.9	21.5	120.6	61.7	9	N.A.
8.	Abbulosibatang (1)		14	802.9	8.8	110.4	57.4	13	N.A.
9.	Abbulosibatang (2)	(*)	32	1,510.0	5.0	169.4	47.2	15	N.A.
10.	Assamaturn (2)	(*)	26	2,439.0	11.2	122.6	93.8	19	N.A.
11.	Tunas Baru	(*)	13	750.0	19.9	111.9	57.7	12	N.A.
12.	Tolawu	(*)	9	486.7	13.1	81.3	54.1	9	N.A.
13.	Matompo Dalle	(*)	8	537.2	8.7	98.5	67.2	7	N.A.
14.	45 Ranggong Dg. Romo	(*)	9	522.0	6.0	132.9	58.0	9	N.A.
15.	Sitallassi	(*)	19	1,504.0	7.5	126.8	79.2	12	N.A.
	Sub-total		**165**	**10,572.7**	**4.5**	**169.4**	**64.1**	**126**	
(3)	**Kampili Irrigation Area**								
16.	Minasa Baji		9	296.0	10.0	63.7	32.9	7	N.A.
17.	Jatia		24	1,046.0	8.0	98.2	43.6	16	N.A.
18.	Pallangga		29	956.0	9.0	79.5	33.0	18	N.A.
19.	Tubarania		6	208.0	14.2	95.5	34.7	6	N.A.
20.	Assamaturu (1)		26	1,187.6	6.0	124.9	45.7	19	N.A.
21.	Kalukuang		21	1,474.0	14.7	103.7	70.2	13	N.A.
22.	Passereanta		19	1,144.0	5.0	117.0	60.2	15	N.A.
23.	Galesong Utara		8	482.0	20.0	101.4	60.3	8	N.A.
24.	Sirannuang		18	856.0	8.4	115.5	47.6	14	N.A.
25.	Paraikatte		7	530.0	24.4	160.6	75.7	6	N.A.
26.	Sipakainga		14	796.0	17.0	114.7	56.9	14	N.A.
27.	Bontosallang		13	517.0	23.4	128.8	39.8	14	N.A.
28.	Pantang Mundur		13	968.0	20.5	94.0	74.5	11	N.A.
	Sub-total		**207**	**10,460.6**	**5.0**	**160.6**	**50.5**	**161**	N.A.
	Total		**426**	**23,414.1**	**0.9**	**169.4**	**55.0**	**307**	**N.A.**

Note (*) : Originally belong to Kampili Irrigation Area, and to be irrigated from the newly constructed Bissua Weir.

Source : Bili - Bili Irrigation Project Office

Table B4.1 Updated O&M Cost of Bili-Bili Irrigation Project

Table B4.1 (1) Annual O&M Cost Updated

Unit : Rp. million

	Intake	Primary & Secondary Canal	Total
1. O&M Staff Salary	365.4	3,597.8	3,963.2
1.1 State employer at Kec. level	(13.3)	(939.2)	(952.5)
1.2 State employer at Kab. level	**(110.6)**	**(880.2)**	**(990.8)**
1.3 Non-state employer	(241.5)	(1,778.4)	(2,019.9)
2. Annual runing cost	269.0	714.0	983.0
2.1 Power supply	(190.0)	(0.0)	(190.0)
2.2 Equipment & Transport	(67.0)	(603.0)	(670.0)
2.3 Office supply / communication	(12.0)	(111.0)	(123.0)
3. Machinery repair & maintenance, and depreciation cost	193.0	1,732.0	1,925.0
4. Canal maintenance	0.0	769.0	769.0
5. Material for structures and canals	36.0	319.0	355.0
6. Emergency maintenance costs & others	20.0	180.0	200.0
Total (1) (including all state employer salary)	883.4	7,311.8	8,195.2
Total (2) (excluding state employer salary at Kab. level)	772.8	6,431.6	7,204.4
Total (3) (excluding all state employer salary)	759.5	5,492.4	6,251.9

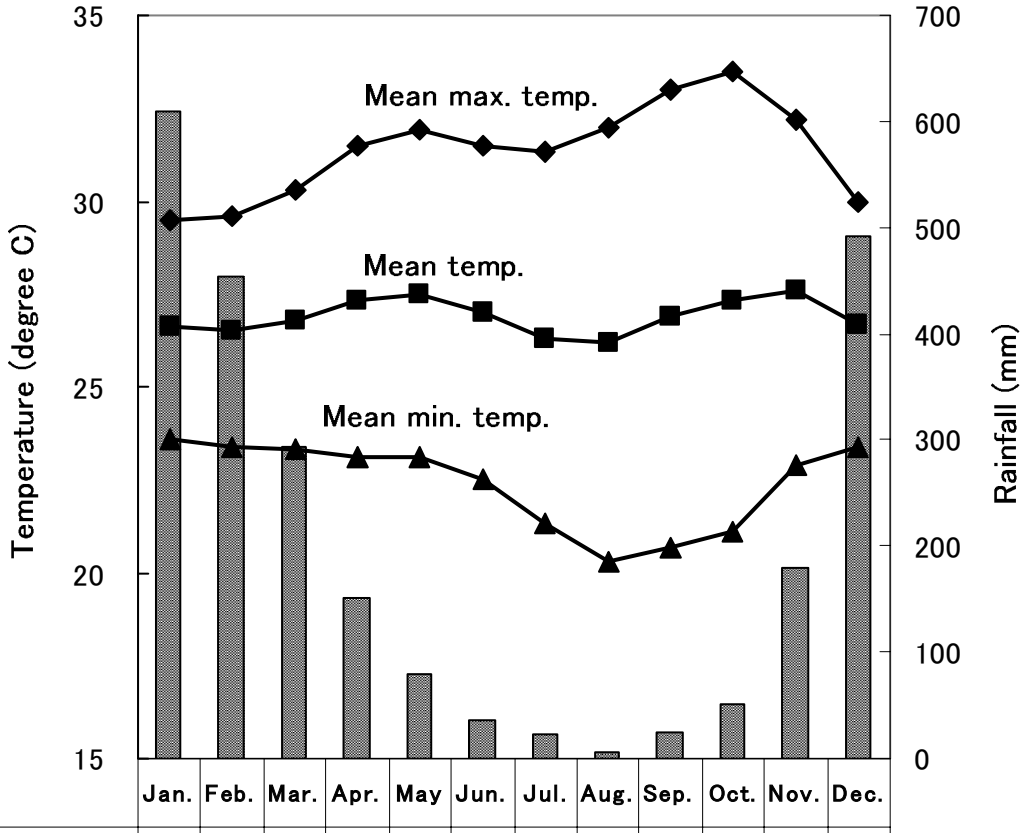
Table B4.1 (2) Breakdown of O&M Staff Salary

Unit : Rp. million

	State Employer			Non-State Employer		
O&M Agency	Intake	Canal	Total	Intake	Canal	Total
UPTD Kec. Pallangga	0.0	172.5	172.5	35.3	252.3	287.6
UPTD Kec. Barombong	0.0	129.8	129.8	0.0	114.6	114.6
UPTD Kec. Bajeng	0.0	179.6	179.6	0.0	198.5	198.5
UPTD Kec. Bontonompo	0.0	189.9	189.9	0.0	154.0	154.0
UPTD Kec. Bontomarannu	0.0	127.6	127.6	76.6	199.2	275.8
UPTD Kec. Bissua	13.3	139.8	153.1	23.6	213.6	237.2
(UPTD Kecamatan Total)	(13.3)	(939.2)	(952.5)	(135.5)	(1,132.2)	(1,267.7)
Dinas PSDA Gowa	0.0	586.7	586.7	11.8	246.2	258.0
Sub Dinas Pengairan Takalar	110.6	293.5	404.1	94.2	400.0	494.2
(Dinas Kabupaten Total)	(110.6)	(880.2)	(990.8)	(106.0)	(646.2)	(752.2)
Total	123.9	1,819.4	1,943.3	241.5	1,778.4	2,019.9

Source : Bili-Bili Irrigation Project Office

Figures



	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Rainfall (mm)	610	454	294	152	79	36	22	6	24	52	179	492
Mean temp. (degC)	26.6	26.5	26.8	27.3	27.5	27.0	26.3	26.2	26.9	27.3	27.6	26.7
Mean. max. temp.(degC)	29.5	29.6	30.3	31.5	31.9	31.5	31.3	32.0	33.0	33.5	32.2	30.0
Mean min. temp.(degC)	23.6	23.4	23.3	23.1	23.1	22.5	21.3	20.3	20.7	21.1	22.9	23.4

Group	Cropping Pattern
Group – A	Wet Paddy / Dry Paddy / Palawija
Group – B	Wet Paddy / Dry Paddy / Palawija
Group – C	Wet Paddy / Dry Paddy / Palawija

Figure B3.1 Proposed Cropping Pattern

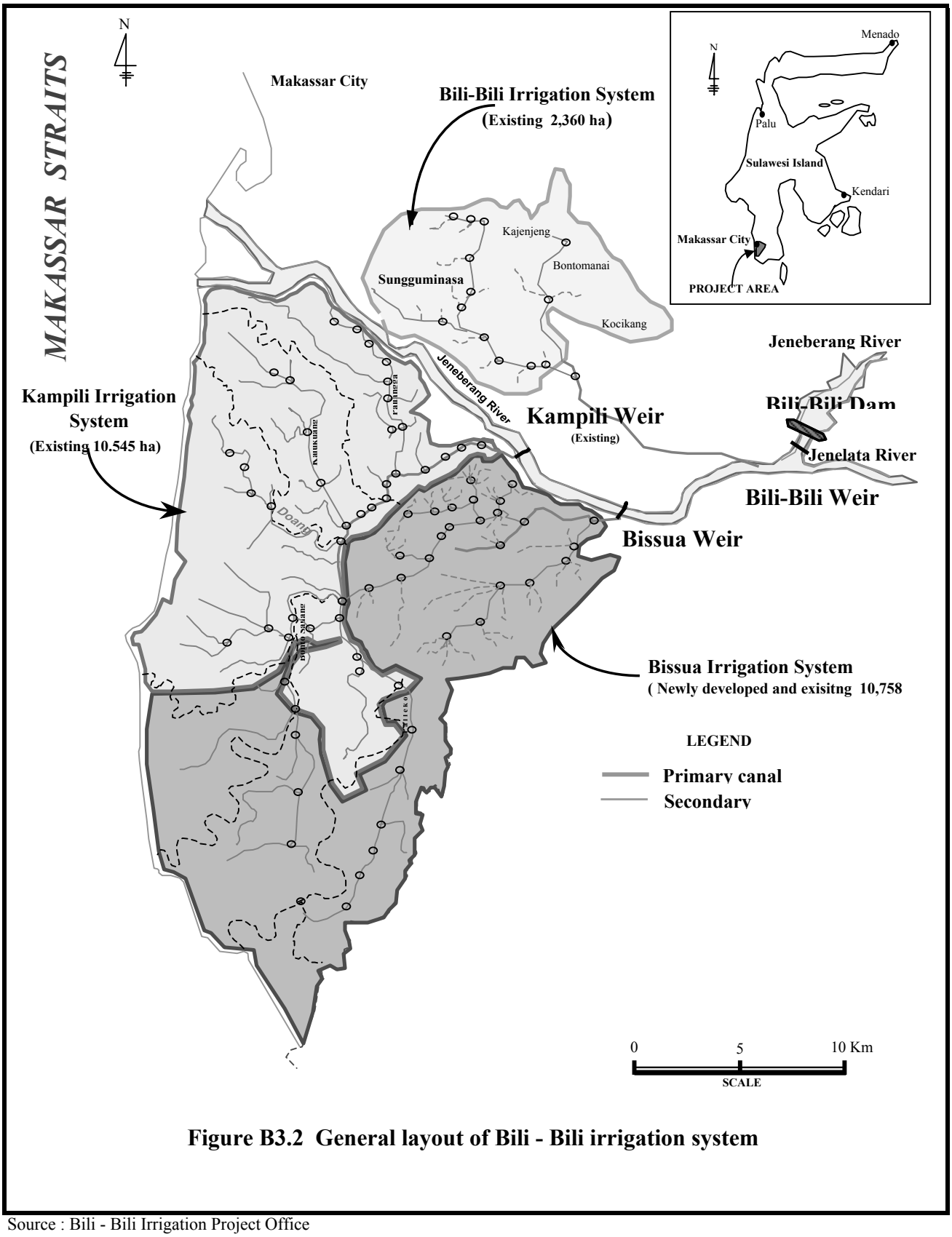


Figure B3.2 General layout of Bili - Bili irrigation system

Source : Bili - Bili Irrigation Project Office

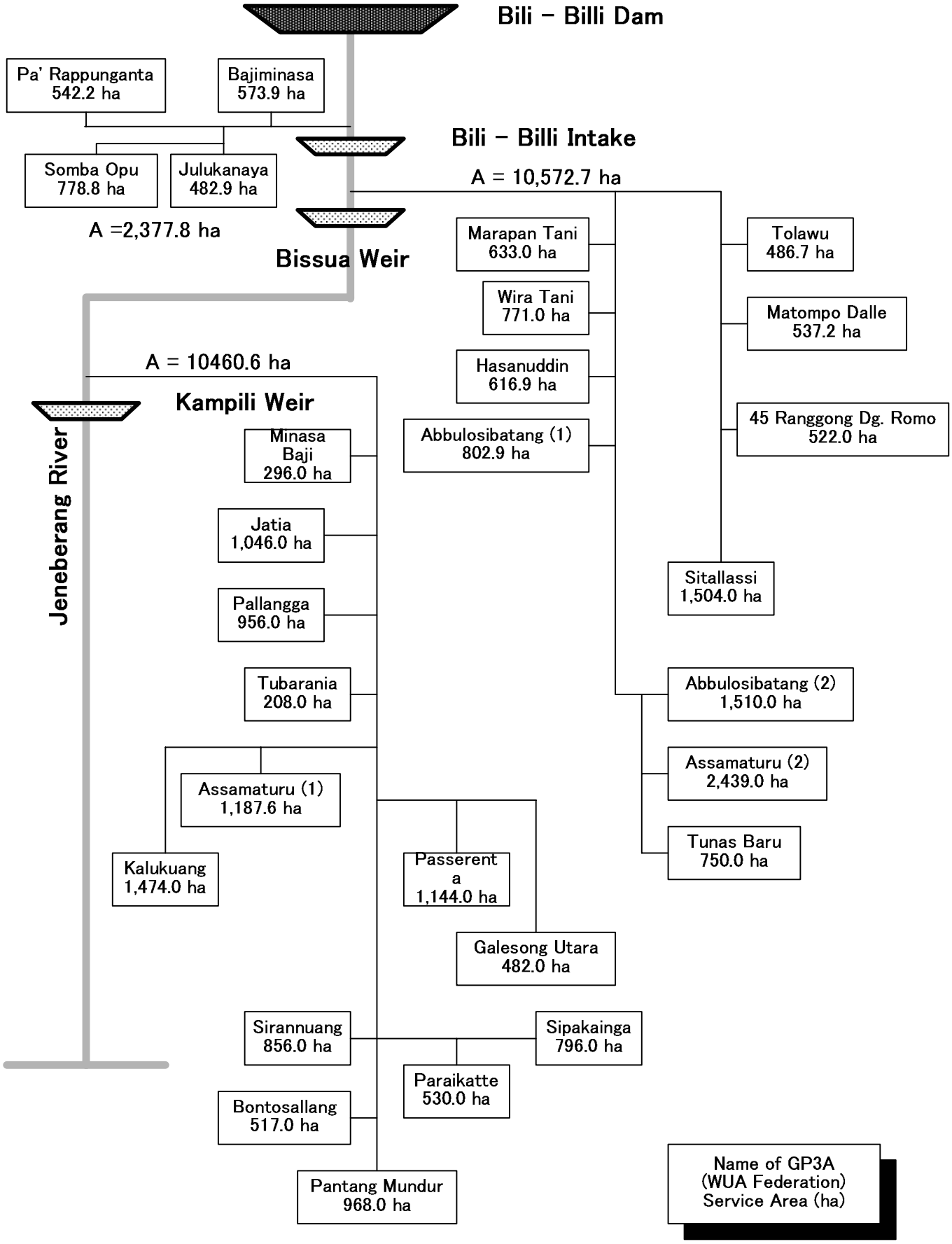
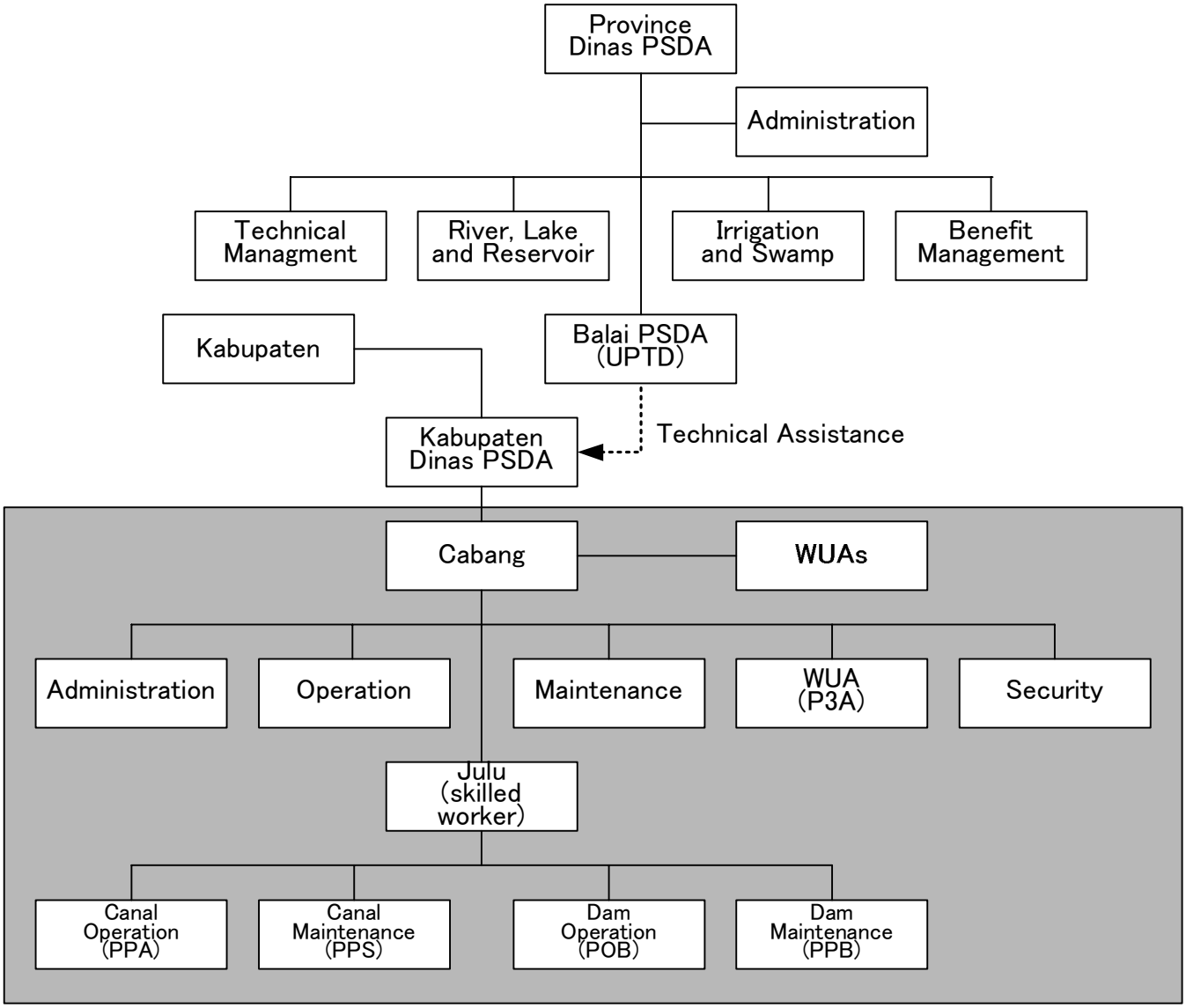


Figure B3.3 Diagram of Irrigation and Water Users Association Federation (GP3A)

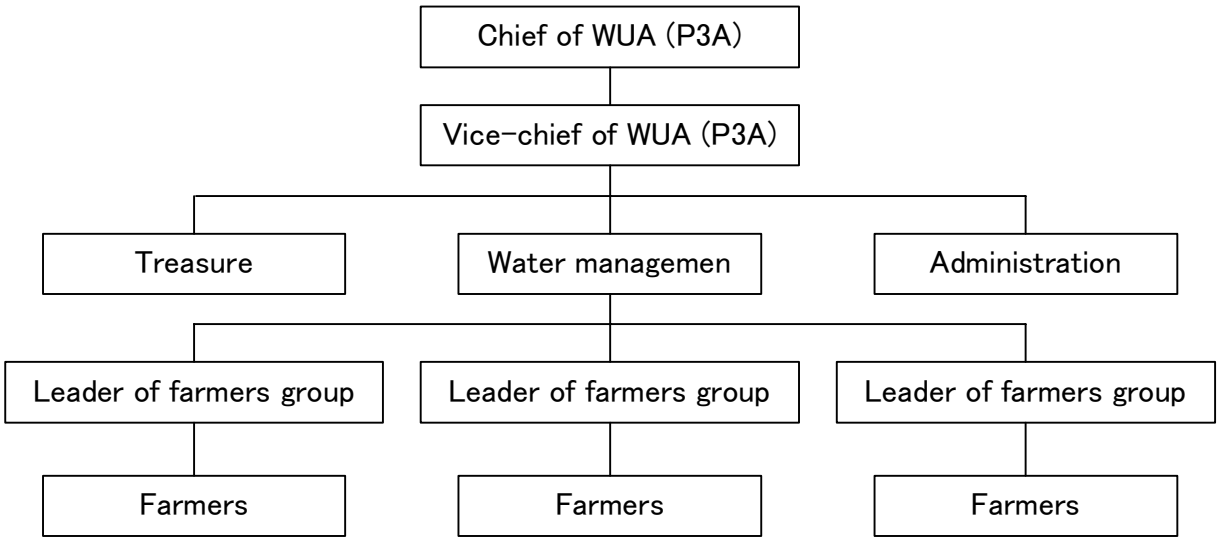


List of Cabang and Julu Offices

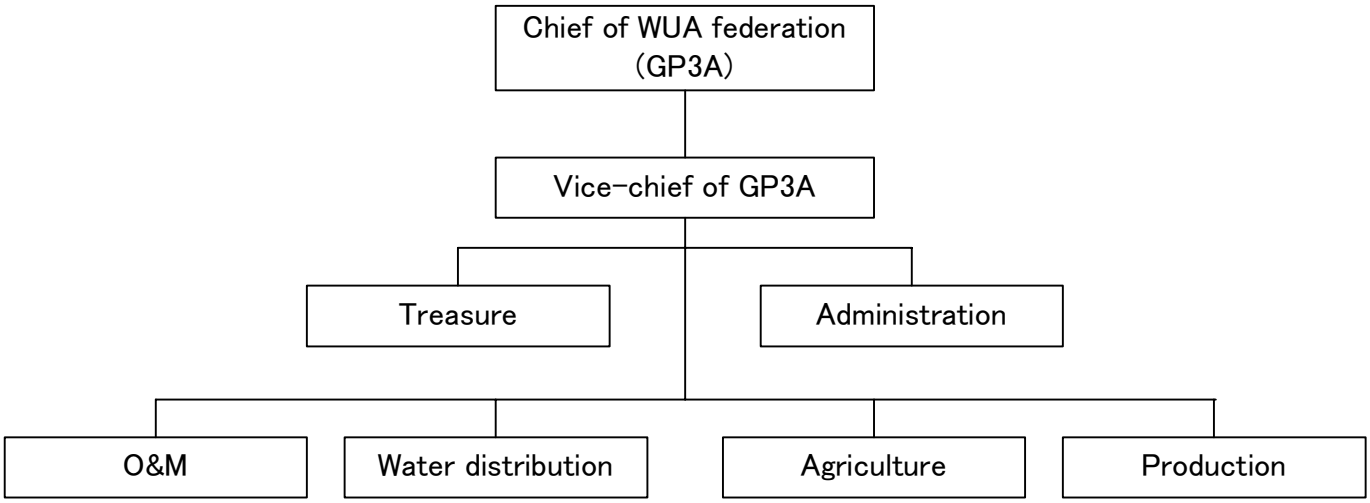
No.	Cabang	Irrigation area (ha)	Nos. of Julu	Staff and worker number		Remarks
1.	Pallangga	2,952.86	4	Head of Cabang	1	Existing
				Sub-Cabang	8	
				Julu skilled worker	4	
				PPA	22	
				PPS	14	
				POB	3	
				PPB	3	
				Total	55	
2.	Bajeng	2,641.80	4	Head of Cabang	1	Existing
				Sub-Cabang	7	
				Julu skilled worker	4	
				PPA	19	
				PPS	9	
				Total	40	
3.	Bontonompo	3,766.55	4	Head of Cabang	1	Existing
				Sub-Cabang	6	
				Julu skilled worker	4	
				PPA	11	
				PPS	10	
				Total	32	
4.	Barombong	2,043.86	3	Head of Cabang	1	Existing
				Sub-Cabang	5	
				Julu skilled worker	3	
				PPA	7	
				PPS	7	
				Total	23	
5.	Takalar	n.a.	4	Head of Cabang	n.a.	Existing
				Sub-Cabang	n.a.	
				Julu skilled worker	n.a.	
				PPA	n.a.	
				PPS	n.a.	
				POB	n.a.	
				Total	n.a.	
6.	Bontomarannu	2,357.30	4	Head of Cabang	1	Existing
				Sub-Cabang	5	
				Julu skilled worker	4	
				PPA	19	
				PPS	9	
				POB	5	
				PPB	8	
				Total	51	
7.	Bissua	3,845.44	4	Head of Cabang	1	To be
				Sub-Cabang	5	formed
				Julu skilled worker	4	newly
				PPA	15	
				PPS	15	
				POB	3	
				PPB	2	
				Total	45	

Source : Operation and Maintenance Manual (2nd draft), Detail Design and construction Supervision of Bili – Bili Irrigation Project, November 2003

Figure B4.1
Proposed Organization for O&M of Primary and Secondary Systems

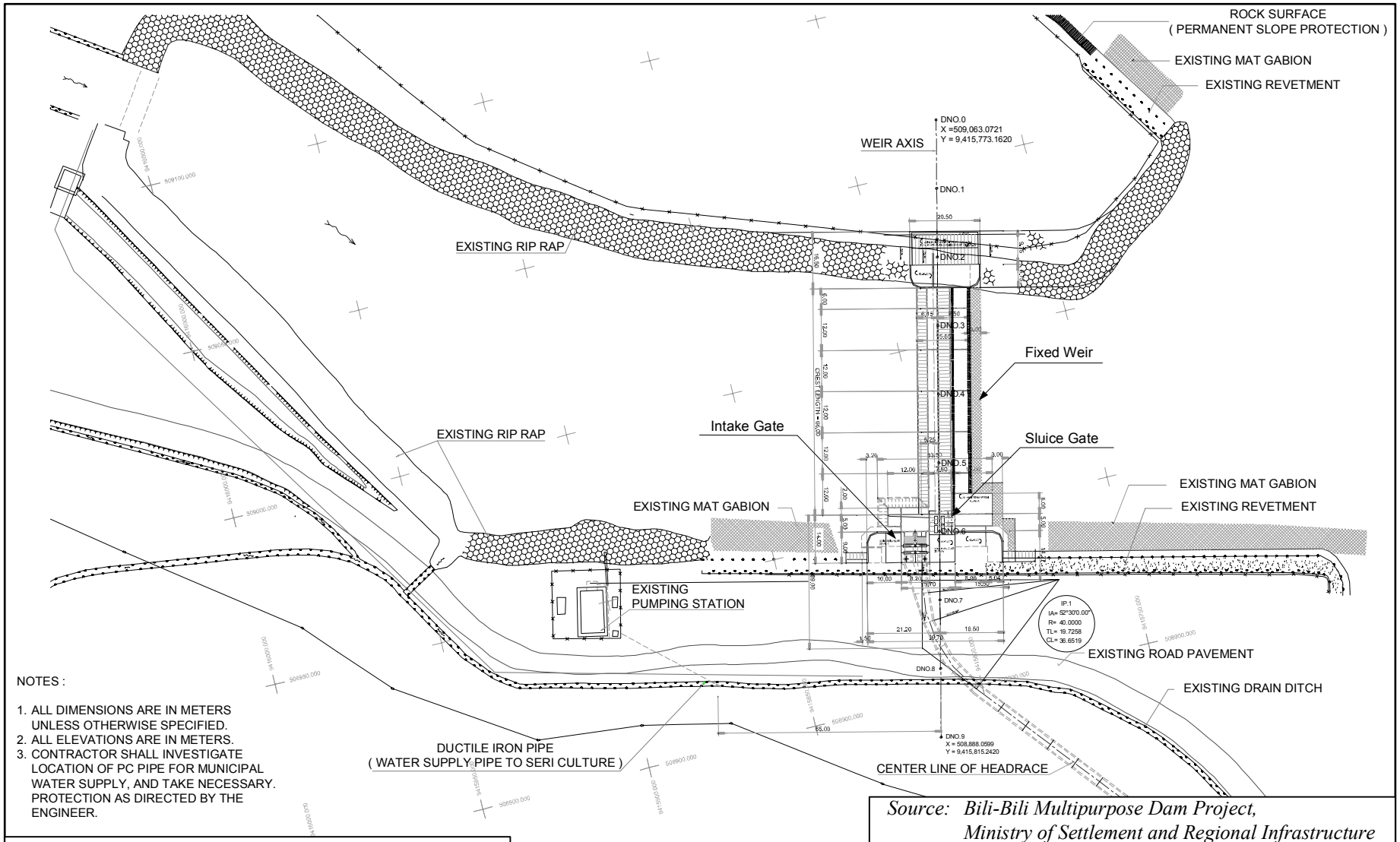


Organization of water users association (P3A)



Organization of water users association federation
(GP3A)

Figure B4.2 Organization of WUA (P3A) and WUA Federation (GP3A)



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 B4.3 Intake Structure 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

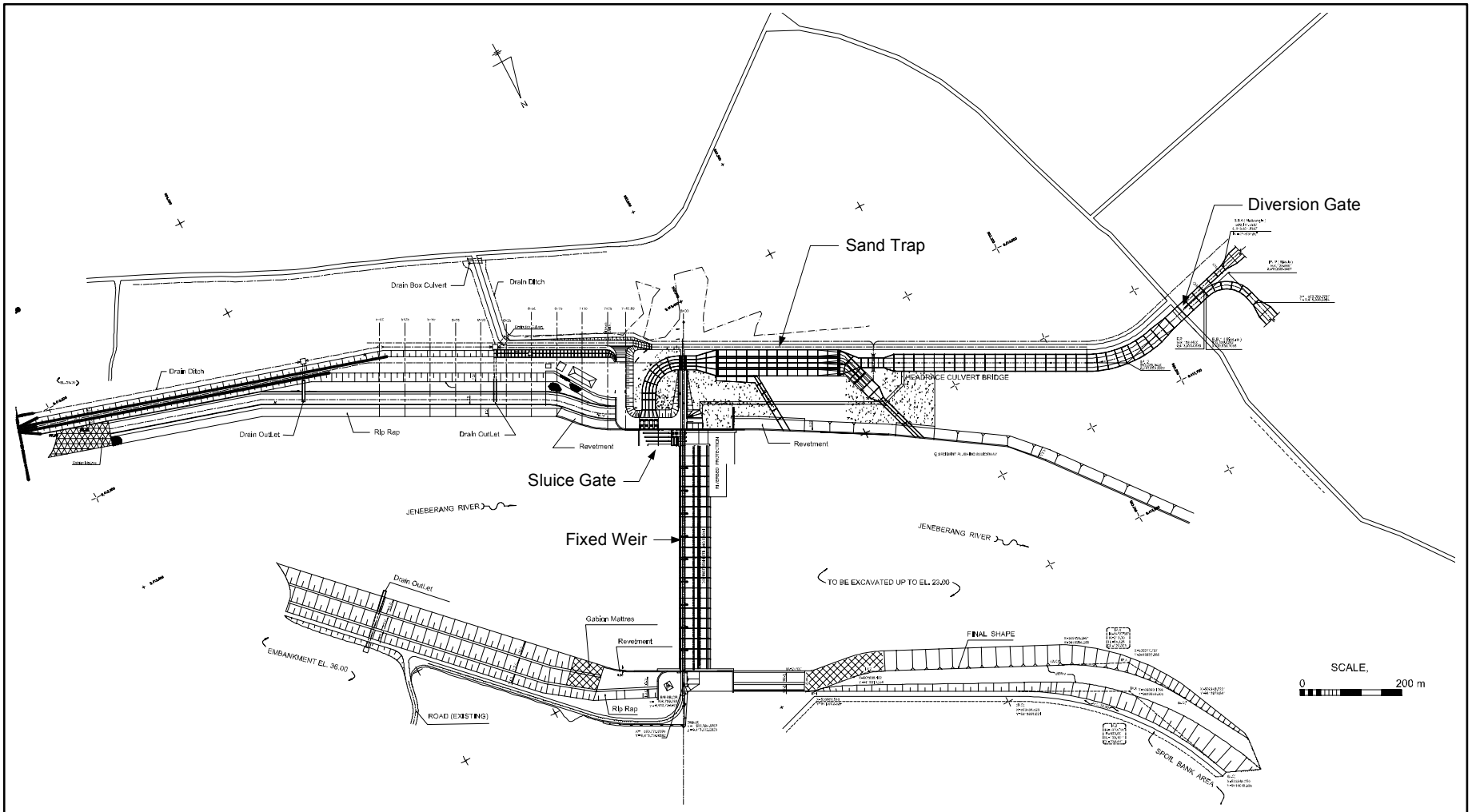


Figure B4.4 Intake Structure of Bissua Weir

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

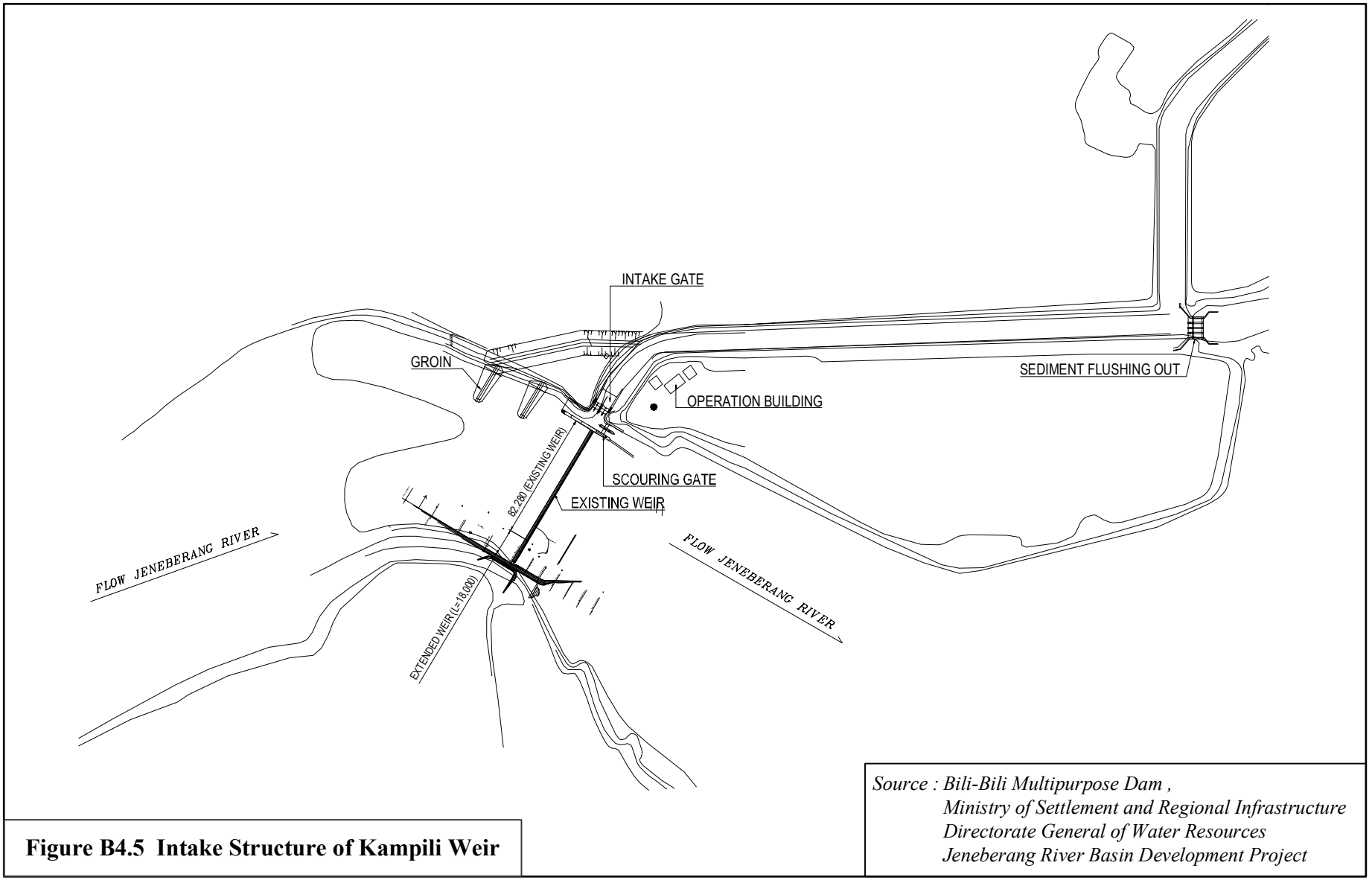


Figure B4.5 Intake Structure of Kampili Weir

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

The Study on Capacity Development for Jeneberang River Basin Management

Outcomes of Irrigation Sector Study

Y. Murai
Irrigation Planner & Facilities Management
May 28, 2004

Updated Annual O&M Cost for Bili-Bili Irrigation Project

Unit : Rp. million

Description	Weir/ Intake	Primary/ 2ndry Canals	Total
1. O&M staff salary (expt. PNS Kab.)	254	2,718	2,972
2. Office running cost	269	714	983
3. O&M running cost	193	1,732	1,925
4. Canal maintenance	0	769	769
5. Materials	36	319	355
6. Emergency allowance	20	180	200
Total	773	6,432	7,205

Source : JRBDP office (draft estimation)

Appropriated Irrigation Service Fee (ISF)

- Logically estimated:
  - Rp. 304,000/ha/year (Rp. 7,205 mill / 23,690 ha)
  - (equivalent to US$ 38/ha/year)
- Presently levied ISF in Gowa
  - Rp. 50,000/ha/crop ⇒ Rp. 120,000/ha/year
    (Cropping intensity = 240%)
- Gap between logically estimated and presently levied
  - Rp. 120,000 / Rp. 304,000 = about 40% !!

Farmer's Capacity to Pay ISF

Re-assessment of Net Income per Household (Preliminary)

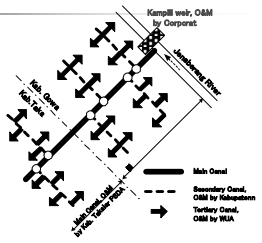
Unit : Rp. '000

Crop	Planned in 1999	Re-assessed in 2004	Balance
Dry paddy (100%)	6,293	4,840	1,435 (76.9%)
Wet paddy (100%)	5,693	4,340	1,353 (76.2%)
Palawija (40%)	1,213	970	243 (80.0%)
Total	13,199	10,150	3,049 (76.9%)
(US$ equivalent)	**(US$ 1,833 eq.)**	**(US$ 1,269 eq.)**	**(US$ 564 eq.)**

Ratio of ISF : Rp.304,000 / Rp. 10,150,000 = 3%

Demarcation of Irrigation Management

- O&M of Bili-Bili, Bissua and Kampili Weirs / Intake by the Jeneberang Public Corporation
- O&M of Irrigation Canals by PSDAs and P3As
- Balai PSDA coordinates between Stakeholders



Financial Sharing to Corporation
(preliminary proposal)

10% of ISF collected

Updated Annual O&M Cost

Weirs/ Intakes :	**Rp. 773 million (12.3%)**
Primary / secondary canals :	**Rp. 5,492 million (87.7%)**
Total :	**Rp. 6,252 million (100%)**

Accurate Discharge Measurements at Intakes

Desirable to Provide Discharge Indicating Devices
(Possibly, Digitally Indicating Discharge and Accumulated Water Quantity)


Bili-Bili Intake

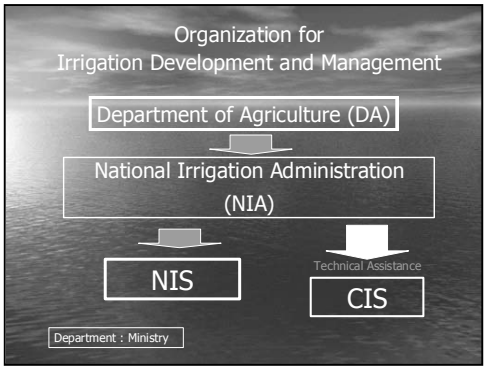

Bissua Intake


Kampili Intake

TERIMAKASIH !!

Y. Murai

Figure B7.1 Lecture Material on Findings and Recommendation in the Study



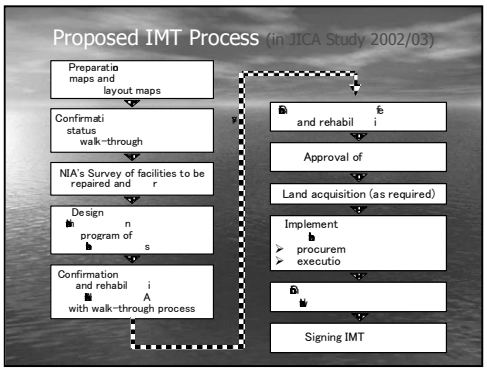


Figure B7.2 Lecture Material on Case Study on Irrigation Management Transfer (IMT) in Philippines (1/2)

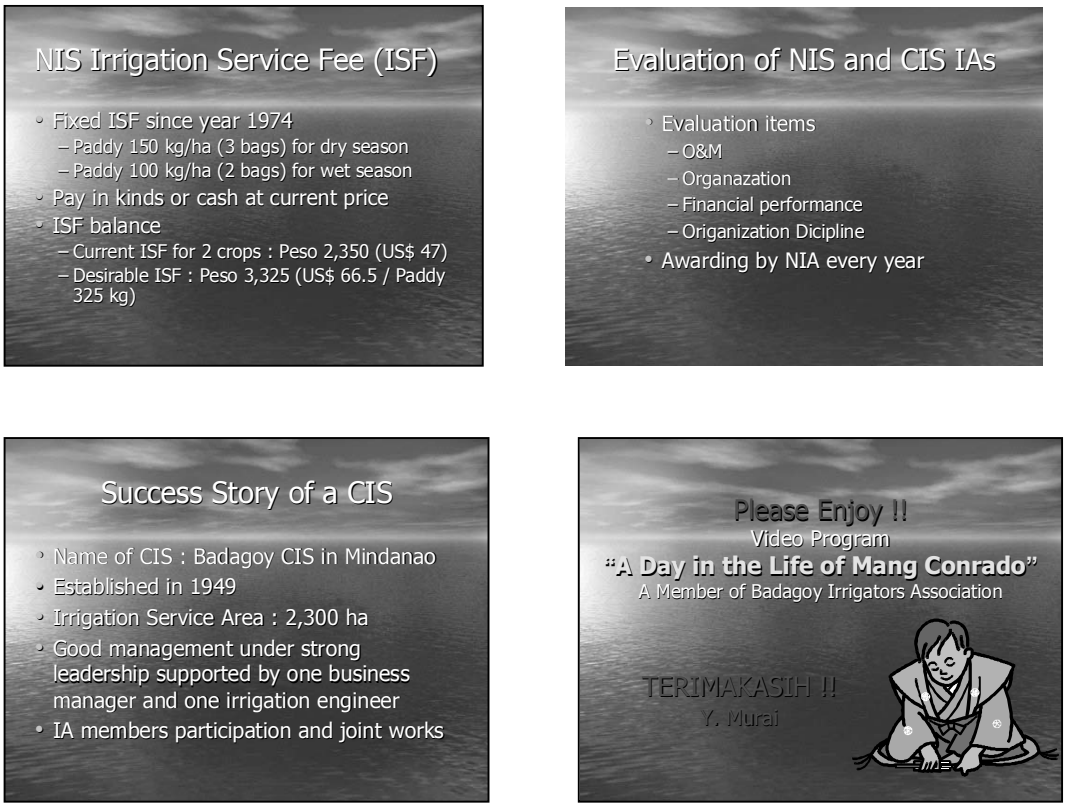


Figure B7.2 Lecture Material on Case Study on Irrigation Management Transfer (IMT) in Philippines (2/2)

Supporting Report C

WATER SUPPLY SECTOR STUDY

Supporting Report C

WATER SUPPLY SECTOR STUDY

Table of Contents

List of Tables

List of Figures

Supporting Report C

WATER SUPPLY SECTOR STUDY

C1 Present Water Use of the Jeneberang River for Municipal Water Supply

The field investigations for the water supply sector study have been carried out initially for one (1) month from the middle of February to the middle of March 2004 and later for a half (0.5) month in May 2004. As a result of the field investigations conducted in these two (2) periods, it was clarified that the following utilities are taking water from the Jeneberang River for the purpose of municipal and industrial water supply under the approval of the Jeneberang River Basin Development Project Office (JRBDP):

1) PDAM Makassar
2) PDAM Gowa
3) Sugar factory in Takalar Regency (PT. Perkebunan Nusantara IV (Persero))

Out of the above utilities, the largest water user of the Jeneberang River is the PDAM Makassar which is serving the water supply for most parts of Makassar City. Of the total clean water production capacity of 2,340 liter/sec for existing water treatment plants owned by PDAM Makassar, the annual water abstraction from the Jeneberang River is around 1,250 liter/sec, or about 53% of the total.

The water supply for the service area of PDAM Gowa is wholly dependent on the water resources of the Jeneberang River basin.

Prior to the start of the present field investigation, it was informed that the Jeneberang River water is being extracted at the nearby location of Bissua weir so as to supply industrial water to two (2) factories, paper factory in Gowa Regency and sugar factory in Takalar Regency. However, it was found that the former factory had been abolished about 7 years ago and that at present only the sugar factory in Takalar Regency is in operation. The person in-charge of the sugar factory informed the JICA Study Team that it is allowed to pump up the river water of 500 liter/sec from the Jeneberang River for the use of processing in the factory as well as for irrigating the fields in the plantation.

At present, the factory is applying to the JRBDP/Dinas PSDA to increase the water extraction from the Jeneberang River to 1,000 liter/sec, but it has not been approved by the JRBDP/Dinas PSDA.

On the other hand, the PJT I's report on review of F/S of water resources management in Jeneberang water basin (August 2002) states that three other factories; (i) tapioka factory, (ii) ice factory (PT Cahaya IM) and (iii) PT Sutera Alam in Gowa Regency, are taking water from the

Jeneberang River. It was later informed that water taken by these factories is not much in quantity, at least negligible in water balance analysis.

In addition to the aforesaid municipal uses of the Jeneberang River water, the JRBDP releases the water of the Long Storage to the Jongaya canal in Makassar City in the dry season in order to dilute the polluted canal water and flush pollutants therein when the bad smell spreads along the canal, although the water use is not categorized as the municipal water use.

The present water use of the Jeneberang River is schematically shown in Figure C1.1.

C2 Present Condition of Water Supply in Service Area of PDAM Makassar

C2.1 Present Condition of Service Area

According to the company profile of the PDAM Makassar, 55.2% of households in the service area are covered by the water supply system thereof. The water production and number of consumers in the service area are shown in the following table:

Water Production and No. of Registered Consumers in Service Area of PDAM Makassar for Recent Five (5) years

Year	Total Production Output at 5 Water Treatment Plants (liter/sec)	No of Registered Consumers (Nos.)
1999	1,287.3	83,882
2000	1,234.5	91,016
2001	2,040.4	101,015
2002	2,045.4	116,870
2003	2,355.6	N.A.

Source: Informasi PDAM Kota Makassar

On the other hand, the Ministry of Health has surveyed the population covered by each water source of piped water from PDAM Makassar, groundwater from shallow well, etc. in 2003 as shown in Table C2.1. As seen in the Table, it is estimated that population covered by the piped water of PDAM Makassar would be slightly less than 50 %. Thus, many people in the service area of PDAM Makassar still rely on groundwater from shallow wells.

In the Water Supply Master Plan for PDAM Makassar (September 2000), the per capita water consumption was tentatively estimated at 133 liter/person. But, the report states that the value is still inaccurate and that it is too hard to estimate it with any accuracy for the following particular reasons specific to the service area:

i) The survey conducted in Kacamatan Makassar and Mariso shows that almost all legal consumers of the PDAM Makassar service area supply or sell their piped water to another 1.3 households (neighbors) in Kecamatan Makassar and 1.6 in Kecamatan Mariso.
ii) The sold water volume is not too large (usually 10 liter per capita per day) because most of the neighbors take clean water of PDAM only for drinking and cooking and use groundwater from shallow wells for other purposes.

C2.2 Existing Water Supply System

At present, water for supplying to Makassar City is taken from the two (2) rivers, the Jeneberang River and Maros River. The Panaikang water treatment plant (WTP) with a treatment capacity of 1,000 liter/sec whose water source is Lekopancing weir on the Maros River had been a sole bulk supplier of the treated water for Makassar City until the 1st Stage of Somba Opu WTP with a capacity of 1,000 liter/sec was put in operation in 2001.

At present, the PDAM Makassar has the following five (5) WTPs for water supply to its own service area in Makassar City:

List of Existing Water Treatment Plants and Their Capacities

No.	Name of Existing Water Treatment Plant (WTP)	Water Source	Capacity of Water Treatment Plant (liter/sec)	Starting Year of Operation
1	Ratulangi	Jeneberang River	50	1924
2	Panaikang	Maros River	1,000	1977
3	Antang	Maros River	90	1985, 1992, 2003
4.	Maccini Sombala	Jeneberang River	200	1994
5.	Somba Opu (1st Stage)	Jeneberang River (Bili-Bili Dam)	1,000	2001
	Total		2,340	

The service area covered by each of the above five (5) water treatment plants (WTPs) is shown in Figure C2.1. As seen in the Figure, the Somba Opu, the newest and most modernized one, covers mainly the northern part of Makassar City where the KIMA industrial area is situated. The water processed in the Somba Opu WTP is conveyed to the KIMA industrial area through distribution pipeline and KIMA clean water service reservoir.

According to the "Informasi PDAM Kota Makassar, 2003", the actual output of each WTP in 2003 is as follows:

Actual Water Production Output of Each WTP in 2003

No.	Name of Existing Water Treatment Plant (WTP)	Capacity of Water Treatment Plant (liter/sec)	Actual Output in Year 2003 (liter/sec)	
			In December	Yearly
1	Ratulangi	50	65.89	62.4
2	Panaikang	1,000	1,078.28	983.2
3	Antang	90	36.8	31.3
4.	Maccini Sombala	200	91.81	87.5
5.	Somba Opu	1,000	1,191.5	1,191.5

As shown in the above table, the Panaikang and Somba Opu WTPs are operated in excess of their nominal capacities to meet the increasing water demands in Makassar City.

The present situation of the above five (5) existing WTPs is explained in the following paragraphs:

C2.3 Somba Opu Water Treatment Plant

The Somba Opu WTP is located in northern part of Gowa Regency which is adjacent to southeastern fringe of Makassar City. The development plan of the Somba Opu was originally proposed in the JICA study on Ujung Pandang Water Supply Project in 1985. The study contemplated to construct the project with a total treatment capacity of 2,000 liter/sec in two (2) stages, each stage with the capacity of 1,000 liter/sec. The stage-1 development was completed in 2001 with a finance of JBIC. The present yard of the Somba Opu WTP with

ground elevation of about 11 m has a sufficient land space (about 15 ha) to accommodate the stage-2 plant with a capacity of 1,000 liter/sec.

The source of raw water for the Somba Opu WTP is existing Bili-Bili Dam which is connected by the about 17 km long raw water pipeline of 1,650 mm and 1,500 mm in diameter. The raw water quality of Bili-Bili Dam is usually good except for limited period of the peak wet season when consecutive heavy rainfalls take place in the catchment, causing high turbidity of the reservoir water. In the dry season, turbidity is less than 10 NTU, which is treated by the direct filtration. When the turbidity level rises to hundreds of NTU in the rainy season, the conventional processing (coagulation, floccules, sedimentation, and filtration) is the most appropriate for treating the raw water. Except for the high turbidity in the limited period of the wet season that takes place rarely, there are no other issues on water quality of raw water from Bili-Bili Dam.

As of May 2004, on the other hand, a very high turbidity condition of water released from the Bili-Bili Reservoir has continued after occurrence of landslide in uppermost catchment of the Jeneberang River in the end of March 2004 as discussed in the succeeding Subsection C6.3.1.

Besides, the Somba Opu WTP is conservatively designed for floccules through filtration including the following processes:

- Pre-adjustment of pH by Hydrated Lime,
- Spreading of Aluminum Sulfate (Alum),
- Hydraulic mixing,
- Floccules Hydraulic (partition) - 4 pools,
- Sedimentation of Horizontal Stream (4 pools),
- Supply for next spreading of Alum (before filtration),
- Filtration (16 self backwashing filter),
- Water storage (10,000 m^3),
- Spreading of Chlorine after filtering,
- Adjustment of pH after filtering.

In addition, the following complementary water processing procedures are performed therein:

- Cleaning of filter surface by scratchier
- Traveling bridge (4), to release mud
- Processing of waste
- Water storage (pool)/mud dryer (8)

The clean water storage volume of 10,000 m^3 is secured for the detention time of around 3 hours. Besides, five (5) units of pumps are installed in the Somba Opu WTP for distributing water to the consumers.

C2.4 Panaikang Water Treatment Plant

The Panaikang WTP with a capacity of 1,000 liter/sec is located around 4 km east of the old Makassar City. It was initially built in 1970, consisting of the standard Degremont type of plant. At present, the WTP is operated for water supply mainly to the northern area of Makassar City. The raw water comes from Lekopancing intake on the Maros River through about 26 km long raw water conveyance canal. Recently, raw water of 500 to 600 liter/sec is pumped up from the lower Jeneberang to the Panaikang WTP in order to supplement the chronic shortage of raw water conveyed from the Maros River during the dry season.

Concerning the raw water from the Maros River, the following problems are pointed out in the previous studies in relation to water supply for Makassar City:

(1) Sedimentation at Lekopancing intake structure site on the Maros River

The Maros River basin is covered with the comparatively dense forest, but the river transports a large quantity of sediments during the wet season, which deposit in front of the intake structure. Hence, sediments at Lekopancing weir site have to be removed every dry season.

(2) Insufficient quantity of raw water conveyed from the Maros River

In the dry season, it is not possible to constantly feed in the canal the design discharge of 1,000 liter/sec at the Lekopancing intake site due to the small streamflow of the Maros River. Besides, water in the raw water conveyance canal is extracted at some places for the irrigation purpose on the way to the Panaikang WTP. For these reasons, the raw water from the Maros River could not meet the requirement for the Panaikang WTP. At present, the raw water for Panaikang WTP is supplemented by pumping up raw water from the lower Jeneberang (at Malengkeri intake) and conveying it to the WTP through pipeline.

During the dry season in year 1997, for instance, water supply from the WTP became less than 200 liter/sec. In such an event, many people in the service area had to get water from existing public wells or buying it from the vender.

(3) Pollution of raw water in canal

At present, there are houses on both sides of the raw water conveyance canal connecting the Lekopancing weir and Panaikang WTP. The density of houses becomes higher in the downstream section, and especially it passes through the built-up areas in the lowermost 10 km section to the Panaikang WTP. Since no proper garbage disposal system has been provided in the city area, it is reported that garbage and even human pollutants are disposed of in the canal. Accordingly, the raw water is much contaminated until it reaches the Panaikang WTP.

As mentioned above, presently, the availability of raw water from the Maros canal is not sufficient from both the quantitative and qualitative viewpoints, mainly in the dry season.

The project concept report on Indonesian Urban Services Improvement Project, which was prepared in July 2003 under the World Bank, recommends to replace the water sources of the Panaikang WTP with the Bili-Bili Dam through installation of new raw water pipeline which is to pass through the populated area of Makassar City. On the other hand, the PDAM Makassar has plans to increase the plant capacity by another 1,000 liter/sec in the medium to long term.

In addition, the report on Feasibility Study/Detailed Design for Utilization Capacity of Ujung Pandang Water Supply Development Project (September 1999) proposes to increase the water production capacity of Panaikang WTP by 200 liter/sec so as to meet the water demands in Makassar City. The historical records on water production of the Panaikang WTP indicate that the plants have been operated over the nominal capacity of 1,000 liter/sec during the wet season.

The existing capacity of reservoir at Panaikang WTP is 10,000 m^3, which is equivalent to 2.8 hours of detention time for water supply capacity of 1,000 liter/sec, while the guidelines of Dinas Cipta Karya specified the required detention time to be 3.6 hours or 15 % of daily production. If capacity of the plant will be increased to 1,200 liter/sec, a reservoir capacity equivalent to a detention time of 3 hours should be secured.

The highest water elevation (altitude) of the reservoir is 12.0 m, while average land elevation of the service area covered by the Panaikang WTP in Makassar City is about 3.0 m. This is marginal in terms of water distribution by gravitation from reservoir to the service area located about 4 km west of the plant. Actually water supply from the Plant to the service area (4 km west) is usually not pumped, but done by gravity (the pump is installed, but rarely operated to save electricity cost).

C2.5 Other Small Water Treatment Plants in Makassar City

There are three (3) smaller scales of water treatment plants in Makassar City in addition to the aforesaid Somba Opu WTP and Panaikang WTP. These are Maccini Sombala WTP, Antang WTP and Ratulangi WTP. These existing mini-WTPs are explained hereunder.

(1) Maccini SombalaWTP

The Maccini Sombala WTP with a capacity of 200 liter/sec is located on the right bank of the Long Storage in the lower Jeneberang. During the field investigation, the JICA Study Team inspected the WTP. It serves the southern part of Makassar City.

At present, two chemicals, aluminum sulphate and calcium hydro-chloride, are used for the water treatment. The water quality of the lower Jeneberang is slightly deteriorated, showing the high BOD values some times.

(2) Antang WTP

The Antang WTP is equipped with a capacity of 90 liter/sec, which is located about 12 km southeast of the central part of Makassar City. Since the altitude at the plant is about 30 m, it serves the elevated areas in the western area of Makassar City. The plant is operated on alternate days to alleviate the acute water shortages in the nearby areas. The area served is separated and isolated pressure zone from the PDAM water supply network.

Its raw water is pumped from upper reach of the canal from Lekopancing weir where the quality is still in the acceptable range for the raw water source. It is reported that PDAM Makassar has a plan to expand the water treatment capacity by 50 liter/sec, since there is a land suitable for expanding the plant at the present site.

(3) Ratulangi WTP

The Ratulangi WTP with a capacity of 50 liter/sec was built in 1983. The oldest plant serves the western part of the city. The plant is operated on alternate days to alleviate the acute water shortages in the nearby areas. It was originally designed for 100 liter/sec, but it is operated at half capacity due to its poor condition. Because of the deterioration of the plants and facilities, the required rehabilitation includes refurbishment of the disused settling tanks and filter beds.

C2.6 Clean Water Service Reservoir

The following table shows capacities of service reservoirs provided at the respective WTP sites:

Existing Clear Water Service Reservoirs in Makassar City
Data source: Rencana Induk Penyediaan Air Berish PDAM Makassar, September 2000

No.	Name of Existing Water Treatment Plant (WTP)	Capacity of WTP (liter/sec)	Type	Capacity of Service Reservoir (SR) (m^3)	Retention Time of SR for Capacity of WTP (hours)
1	Ratulangi	50	Above ground	1,800	14.2
			Tower	750	
2	Panaikang	1,000	Above ground	10,000	2.8
3	Antang	90	- do -	106.5	0.3
4.	Maccini Sombala	200	- do -	400	0.6
5.	Somba Opu	1,000	- do -	10,000	3.3

C2.7 Distribution Pipeline

The total length of water distribution pipes in the Makassar City is about 2,842 km and their diameters range from 50 mm to 1,100 mm as shown below:

i) 50 to 150 mm : 2,544 km
ii) 200 to 350 mm : 223 km
iii) 375 to 450 mm : 53 km
iv) 500 to 1,100 mm : 23 km

The approximate alignment of existing and planned main distribution pipelines in the service area of PDAM Makassar is shown in Figure C2.2.

C2.8 Organization of PDAM Makassar and Its Capacity Development

The total number of staff of PDAM Makassar was 598 persons in 1999. The organization structure of PDAM Makassar is shown in Figure C2.3.

The organizational structure of PDAM is continually developed to meet the need of the customers and in accordance with the Ministry of Home Affairs Regulation No. 7 (Year 1998) regarding Organizational Structure of PDAM. More specifically, institutional development comprises four (4) stages within a 5 year period as shown below. Actually, organizational development is a continual evolutional process with changes occurring as a result of changes in number of customers and employees needed to maintain institutional quality.

i) Stage I : In this stage, focus of attention will be placed on training of key employees to prepare for the expansion of organization (departments, divisions and sections) for the next stage. This program also aims to strengthen the capabilities of (1) assessing water resource quality and distribution system, (2) decreasing loss of water, and (3) carrying out routine procedure, such as change of customer's water meter periodically.

ii) Stage II : When the number of costumer reaches around 150,000, the second stage of organizational structure will be implemented to meet the service requirement for increasing customers.

iii) Stage III : This stage is similar to the Stage II, implemented as the intermediate effort between Stage II and IV.

iv) Stage IV : This is the last stage. This stage will be conducted when the number of costumer reaches 400,000. Possibly, at this stage, it is advantageous to keep small service offices in every part of Makassar City as water bill payment office that will also receive requests for new connection and receive complaints from customers.

The PDAM Makassar has conducted the training of the staff by dispatching them to Jakarta and Surabaya. At present, the PDAM Makassar has a plan to set up a staff training center in a yard of the Somba Opu WTP. If the plan is realized, it is expected that the staff of other PDAMs in South Sulawesi Province be trained in the training center in order to enhance the capability of the various fields.

C2.9 Present Issues of Water Supply in Service Area of PDAM Makassar

While the water supply system in Makassar City is well operated as a whole, the PDAM Makassar now faces the following issues:

(1) Issues Related to Panaikang WTP and Development Plan for Makassar City Water supply

With regard to the Panaikang WTP which is one of the main WTPs to produce clean water for Makassar City, some issues have been pointed out as mentioned above. Those are i) sedimentation at Lekopancing weir site, and ii) insufficient water quantity/quality in the dry season. To solve these issues, some measures have been suggested in the past studies. One of these measures is to construct new pipeline instead of the existing canal connecting the Lekopancing weir and Panaikang WTP, since inflow of pollutants from the built-up areas along the canal is the major cause of degradation of water quality.

Meanwhile, PDAM Makassar is pumping up and conveying raw water from the lower Jeneberang to the Panaikang WTP in order to supplement raw water in the dry season. To solve the water quality issue, on the other hand, the 2003 World Bank study suggests conveying clean water from the Bili-Bili Dam to the Panaikang WTP. To realize the plan, a new pipeline needs to be provided to take water from the raw water transmission main (RWTM) connecting Somba Opu WTP and Bili-Bili Dam. As pointed out by the World Bank study, a social environmental study will need to be carried out since the pipeline will have to pass through the built-up area in Makassar City.

Besides, the expansion plans of the existing Panaikang WTP are suggested by PDAM and the previous study. These would affect the expansion of the Somba Opu WTP, in case the raw water is wholly conveyed from Bili-Bili Dam in the future. It is advisable that a master plan study on the future Makassar City water supply be carried out to determine the most appropriate plan for upgrading the Panaikang WTP and Somba Opu WTP, as well as to clarify the future water demands for the piped water and exploitable groundwater resources in the service area as mentioned in the succeeding Section C4.

(2) High Unaccounted-for Water Ratio

It is reported by the PDAM Makassar that the unaccounted-for water ratio in its service area is very high at about 51 %. According to information from the PDAM Makassar, the unaccounted-for water is composed mainly of the following elements:

- Illegal connection,
- Fire fighting,
- Social use,
- Meter inaccuracy,
- Error in meter reading, and
- Physical loss including water leakage in water transmission/distribution pipes

It is considered that the commercial loss such as error in metering and illegal pipe connections accounts for a relatively high portion of the water loss. Yet, the composition of the commercial loss and physical loss (leakage in transmission/distribution pipes) has not been clarified. On the other hand, the previous studies projected that the unaccounted-for water ratio will be decreased to 25 % to 30 % as described in the succeeding Chapter C4. As a matter of course, it is essential to reduce the unaccounted-for water ratio to improve the financial status of PDAM Makassar. To reduce it, as the first step, it is advisable to carry out the water leakage tests to find out the areas in Makassar City where the high water leakage takes place. In parallel, it is needed to repair or replace inaccurate meters and improve tariff collection system through training of the concerned staff in order to reduce the commercial loss.

(3) Increase in Water Tariff

In the service area of PDAM Makassar, the water tariff system is set up by dividing the consumers into 17 categories. For every consumer category, the water rate is determined for each of four (4) ranges of total monthly water consumption volume, namely i) less than 10m^3, ii) 10-20 m^3, iii) 20-50 m^3, and iv) over 50 m^3, so as to charge the higher water rate with increase of water consumption volume. Also, higher water rates are applied to the industrial categories and large-scale water consumers of some household categories. Especially, the water tariff rate for industrial use is ranked as the highest one out of the rates in such major cities in Indonesia as Jakarta, Surabaya, and Medan.

As mentioned in the foregoing Section C2.1, people in Makassar City, especially those of the low income class, usually use the piped water only for drinking and cooking purposes and groundwater in shallow well for other purposes including bathing and washing, even though the water quality is low. As of May 2004, on the other hand, the PDAM Makassar intends to raise the water tariff, and the relevant bill has passed the provincial parliament. There is a fear that the rise of water tariff will make people reluctant to utilize the clean water to the same extent as before. Since the clean water is the basic human need (BHN), the water tariff should be maintained as long as possible at an adequate level within a range of affordability to pay for the people.

On the other hand, this matter is related to the financial status of PDAM Makassar. To stabilize the water tariff in the future, it is needed to reduce the unaccounted-for water at the earliest opportunity in accordance with the corporate plan prepared by the PDAM Makassar. Besides, it is necessary to examine the least cost measures for expanding water production capacity in order to meet increasing water demand in Makassar City.

(4) Constraint of Water Demand and Water Supply Capacity

As indicated in earlier Subsections of this Chapter, the total production output of water in the five (5) existing WTPs in Makassar City reached about 2,356 liter/sec in 2003, which is larger than the total water production capacity of 2,340 liter/sec. This means that some of these existing WTPs, especially Panaikang and Somba Opu WTPs, have been operated in excess of

their nominal capacities in order to meet the increasing water demand in the service area of the PDAM Makassar.

The aforesaid present situation in Makassar City implies that the mean daily water demand has already exceeded the total water production capacity. In general, is larger than the mean daily demand. Although the maximum daily demand is not known because of lack of reliable data, it would presumably be 15 to 30 % larger than the present water production capacity. Thus, the balance of water demand and water supply capacity is already greatly constrained, requiring installation of new WTPs at an early stage to cope with the increasing water demands.

C3 Present Condition of Water Supply in Service Area of PDAM Gowa

C3.1 Present Situation of Service Area of PDAM Gowa

The service area of the PDAM Gowa covers the area along right and left banks of the Jeneberang River and other isolated areas in Malino and Bajeng. At present, the total number of pipe connections in the service area numbers about 8,300 as shown in the following table:

No. of House Connections to Water Supply System of PDAM Gowa

No.	Sub-Area Served	Number of Households Served (Nos.)
1.	Area along lower reach of the Jeneberang River	7,131
2	Malino	760
3	Bajeng	277
4	Borong Loe	107
Total		8,275

Source: PDAM Gowa Office

According to the chief of PDAM Gowa, at present, there are about 5,000 applicants for the pipe connection in the service area and the total number of pipe connections therein is estimated to reach about 10,000 at the end of this year (2004).

At present, water is being produced at the existing five (5) water treatment plants as mentioned in the following Section C3.2. In addition, usually, water of 40 to 50 liter/sec is being supplied from the water supply system of PDAM Makassar. For the water supplied from PDAM Makassar, PDAM Gowa has paid the water charge thereto at a rate of about Rp. 500 per m^3. For the water supply from PDAM Makassar in December 2003, PDAM Gowa paid a total amount of about Rp. 62 million to the PDAM Makassar. However, recently, PDAM Makassar notified to PDAM Gowa that the water rate is to be raised to Rp. 2,000 per m^3 in March to April of this year.

The latest water tariff system in PDAM Gowa was set up in 2001. The average and maximum water tariff rates are Rp. 1,000/m^3 and Rp. 1,190/m^3, respectively. According to the in-charge of PDAM Gowa, the average water tariff rate of Rp.1,000/m^3 is much cheaper than the rates in the neighboring PDAMs which are approximately Rp. 2,000/m^3 in PDAM Makassar and Rp. 1,500/m^3 in PDAMs Maros and Takalar.

According to the in-charge of PDAM Gowa, the unaccounted-for water ratio is estimated to be a little less than 50 %, although the distributed water is not measured accurately except for the water conveyed from PDAM Makassar.

C3.2 Existing Water Supply System

There are five (5) water treatment plants that are being operated by PDAM Gowa for water supply to its service area, and their total capacity comes to 290 liter/sec as shown in the following table:

List of Existing Water Treatment Plants Operated by PDAM Gowa

No.	Name of Existing Water Treatment Plant (WTP)	Water Source	Capacity of Water Production (liter/sec)
1	Bajeng WTP	Jeneberang River	20
2	Borong Loe WTP	Jeneberang River	20
3	Malino WTP	Spring*	10
4.	Unit Tompo Balang	Jeneberang River	40
5.	Unit Pandang-Pandang	Jeneberang River	200
Total			290

Note: *; The water source of the Malino WTP is spring water in upper reach of the Jeneberang River. Hence, no chemicals are used for the water treatment.

The water production records of the above five (5) WTPs are shown in Table C3.1.

Out of the total water treatment capacity of 290 liter/sec, the water production is usually performed with only the total capacity of about 190 liter/sec because of troubles of pumping facilities, with exception of the Bajeng WTP which was constructed with the financial assistance of JICA. Those pumps require repairs very frequently. For this reason, about 50% of households in the service area are not adequately supplied with piped water.

The Pandang-Pandang WTP was transferred from the PDAM Makassar and is now being operated in cooperation with PDAM Makassar. It is the largest WTP with a capacity of 200 liter/sec, while the capacities of other four (4) WTPs are small at 40 liter/sec or less than it. On the other hand, the Pandang-Pandang WTP has not been fully operated because of its higher operation cost up to now, as the unit water production cost thereof is higher than the buying cost of water from PDAM Makassar. Since the price raising for the water transference is requested from PDAM Makassar as mentioned above, the PDAM Gowa is now planning to utilize the plant more intensively than before.

The Malino and Bajeng WTPs are isolated from the other ones located in the lower reach area adjacent to Makassar City. The Malino WTP is located far upstream of the Bili-Bili Dam where the resort area exists. Its water source is spring water yielded in the Jeneberang River basin.

As seen in Figure C1.1, the water source of the Bajeng WTP is water conveyed by irrigation canal from the Bissua weir which is under construction as of May 2004. According to the PDAM Gowa office, the water demand in a service area covered by the Bajeng WTP is still immature, since the service area is generally blessed with abundant groundwater.

The Borong Loe WTP with a capacity of 20 liter/sec is producing water diverted from the raw water transmission pipeline connecting the Bili-Bili intake and Somba Opu WTP. While, at the Tompo Balang WTP with a capacity of 40 liter/sec, raw water is extracted directly from the Jeneberang River.

At the existing WTPs other than the Malino WTP where spring water used as the raw water has very good quality, the following chemicals are used to treat the raw water:

- Aluminum sulfate ($Al2(SO4)_3 \cdot 18H_2O$) for coagulation
- Calcium hypo-chloride (CaCl2O: Kaporit) for sterilization

The monthly water productions of each WTP in 2002 and 2003 are shown in Table C3.1.

C3.3 Tax paid by PDAM Gowa and Financial Assistance from Central and Local Governments

Regarding the water tax, the chief of the PDAM Gowa office informed the JICA Study Team that the office pays a water tax to the tax collecting office of provincial government of South Sulawesi at a rate of Rp. 10/m^3 for year 2003.

On the other hand, the PDAM Gowa receives the financial assistance from the central and local governments through supply of distribution pipes. In general, the distribution pipes of 100 to 150 mm are supplied to the PDAM Gowa as the subsidy from those governments. The total prices of distribution pipes supplied in 2003 are equivalent to the amounts shown in the following table:

Financial Assistance from Central and Local Governments

Government	Equivalent Price of Supplied Pipes (10^6 Rp)
1) Central Government	1,500
2) South Sulawesi Province	1,000
3) Gowa Regency	200

Data Source: PDAM Gowa office

C3.4 Organization of PDAM Gowa and Its Capacity Development

Figure C3.1 shows the organization structure of PDAM Gowa. The total number of staff of PDAM Gowa office is 68 persons, out of whom two (2) persons are public officer and other staffs are employees of PDAM Gowa.

The staffs are engaged in O&M of WTP and water distribution facilities, logistic matters, and water tariff collection.

The capacity development of the staff is usually done through training in PDAM Makassar.

C3.5 Present Issues and Problems on Water Supply to Service Area of PDAM Gowa

The present issues and problems on water supply in the service area of PDAM Gowa which are obtained through discussions with the staff of the PDAM Gowa office are itemized as follows:

1) Shortage of budget for regular maintenance works

- Although water leakage is taking place in water distribution tower completed recently, the PDAM Gowa office has no budget to repair it.
- Existing pumps at the intake sites become out of order so frequently. While it takes 1 to 2 months to repair the pumps, they are damaged within 1 to 2 weeks after the repair. It is better to procure new pumps rather than undertake repair, but the PDAM Gowa office lacks fund to purchase them.

2) Non-revenue water

- While the yearly revenue of PDAM Gowa office is about Rp. 500 million, a yearly water tariff equivalent to a total amount of about Rp. 200 million could not be collected from the consumers.
- However, the PDAM Gowa office could not strongly request strongly them the payment because of the low water quality and frequent interruption of water supply attributed to the pump damages and failure of other equipment and facilities.

3) Low water quality

- The raw water taken from the lower Jeneberang is in the deteriorated condition in the dry season, revealing high BOD values. Usually, PDAM Gowa is making the best efforts to remove bacteria contained in the raw water, but don't perform other treatments to the sufficient level.
- The PDAM Gowa is willing to get more raw water from Bili-Bili Dam, which is much superior to water of the lower Jeneberang in water quality.

4) Securing fund to expand distribution pipeline

- In the past, the distribution pipes were installed with the financial assistance of the Government of Japan. There are other areas that need to be supplied with piped water. Accordingly, the PDAM Gowa office is willing to install new pipelines in those areas with funding from the donor countries.

C4 Municipal Water Demand Projection

C4.1 General Tendency of Water Consumption and Groundwater Use in Makassar City and Its Surroundings

In Makassar City, the number of households served by the PDAM supply system is still limited to about 50 % of the total population. The remaining 50 % of households rely on the private wells and public faucets. It is noted that the service coverage ratios in the surrounding regencies such as Gowa, Maros and Takalar are much smaller as compared with that in Makassar City, while an independent regional PDAM operates the water supply system for each of those regencies.

The number of households served by PDAM and annual total water production and per capita water consumption in each PDAM's service area of Makassar, Gowa, Maros and Takalar in 2000 are summarized in the following table:

Area Coverage, Number of Households Served, Annual Production and Per Capita Water Consumption in Each Service Area of Each PDAM in 2000

item	Unit	City/Regency			
		Makassar	Gowa	Takalar	Maros
(1) Area coverage ratio by PDAM					
- Total area of City/Regency	km^2	175.9	1,833.3	566.5	1,619.0
- Service area of PDAM	km^2	175.9	79.5	55.5	188.2
- Area coverage ratio	%	100	4.2	9.8	11.6
(2) Service coverage in household number					
- Total number of households	Nos.	237,085	107,485	47,788	57,493
- Number of households served	Nos.	72,970*	2,315	919	2,861
- Service coverage ratio	%	30.7	2.2	1.9	5.0
(3) Annual water production and per capita consumption					
- Annual water production	m^3/year	16,239	348	68	471
- Per capita consumption	liter/day	120	86	42	96

Source: Comprehensive Water Management Plan Study for Maros-Jeneponto River Basin, Final Report, November 2001

Note: * According to the company profile of PDAM Makassar (2003), the number of served households in 2000 is 91,016 as described in the foregoing Section C2.1. It appears that the smaller number in the above table was estimated in the past study.

The above values are water consumption from the taps connected to the PDAM's piped water supply system. It has to be noted that, even in the Makassar City area, a lot of people use the piped water only for dinking, while they use the groundwater in shallow well for other uses such as washing and bathing. Moreover, it is confirmed through the interviews with the citizens of Makassar City that they are willing to utilize the groundwater for the whole domestic use for the economical reason, if the water quality thereof is acceptable.

The same tendency on preference of groundwater is indicated by the firm owners in the KIMA industrial estate located in the northern part of Makassar City. The general tendency obtained concerning the industrial water use in Makassar City is described below:

1) In general, the industrial water is supplied both through the piped water supply system and from the firm's own well.
2) To save the water charge to be paid to PDAM, the firms utilize groundwater as long as possible. Moreover, some firms expressed the willingness to introduce the water recycling technology through technical assistance from foreign countries including Japan.

Concerning the groundwater use, however, it appears that the groundwater quality in Makassar City is getting deteriorated due to the poor wastewater management. To make it possible to accurately project the future water demand for the piped water, it is essential to clarify the availability of groundwater in Makassar City from the quantitative and qualitative viewpoints. In fact, it is reported that certain family who used groundwater in the previous house has to rely on the PDAM's piped water in the present new house due to the worsened water quality of groundwater.

For the purpose of clarifying the groundwater availability, it is recommended to carry out the master plan study including the water demand projection based on the exploitable groundwater resources, as well as the formulation of a future water supply plan for Makassar City and its surroundings.

C4.2 Municipal Water Demand Projected and Water Supply and Water Resources Development Plans Prepared in Previous Studies

C4.2.1 General

The water demand projection for Makassar City was carried out in the course of the following five (5) previous studies:

i) Master Plan and Feasibility Study on Water Supply Development Project in 1985 under JICA (the 1985 JICA study)
ii) Comprehensive Water Management Plan Study for Maros-Jeneponto River Basin in 2001 under JBIC (the 2001 JBIC study)
iii) Study on Indonesian Urban Water Resources Improvement Project in July 2003 (the 2003 World Bank's study)
iv) Water Supply Master Plan for PDAM Makassar (Rencana Induk Penyediaan Air Bershi PDAM Makassar) in September 2000
v) Study on Water Supply Improvement Service in 2003

Of the above five (5) previous studies, the 1985 JICA study was performed about 20 years ago and the projection covers only up to year 2005. Hence, the projection results are used in this Study only for reference.

C4.2.2 Water Demands Projected in Each of the Previous Studies

The results of municipal water demand projections in the four (4) previous studies are summarized in the following paragraphs:

(1) Master Plan and Feasibility Study on Water Supply Development Project in 1985 under JICA

The 1985 JICA Study projected the water demand in the service area of PDAM Makassar at 326,000 m^3/day or 3,780 liter/sec in year 2005, which consists of 72 % of domestic water demand and 28 % of non-domestic water demand. It proposed to construct the Somba Opu WTP in two (2) stages, of which the 1st stage with a capacity of 1,000 liter/sec is completed.

(2) Comprehensive Water Management Plan Study for Maros-Jeneponto River Basin in 2001 under JBIC

In the 2001 JBIC study, the municipal water demand was projected for each of Makassar City and its surrounding four (4) regencies, namely Gowa, Maros, Takalar and Jeneponto. The target year was set at year 2020. The procedures and assumptions applied to the municipal water demand projection are as follows:

i) The water use sector is divided into three (3) sectors, namely the domestic, public/commercial and industrial sectors, for each of which the future water demands are projected.
ii) In estimating the domestic water demands, the number of households served by the PDAM water supply system in 2020 is projected taking into account the population increase, the PDAM's expansion plan of service area, and the "affordability to pay" of people in the service area which is based on the projected incomes in the future. The per capita water consumption in 2020 is set at 200 liter/sec for Makassar City with reference to the guideline of the Cipta Karya which recommends adopting 190 liter/sec as the target value. While, the smaller value of 150 liter/sec is adopted for the other four (4) regencies.
iii) The commercial/public and industrial water demands are estimated assuming that they will increase in accordance with the projected increment of annual growth ratios of their GRDPs, respectively.
iv) It is assumed that the target unaccounted-for water ratio which is expressed as the conveyance loss will decrease to 30 % in 2020, which consist of water loss of 5 % in raw water transmission system and loss of 25 % in the distribution pipelines from water treatment plants.

As a result of the municipal water demand projection in the 2001 JBIC study, the total municipal water demand in the service areas of PDAM Makassar and PDAM Gowa in 2020 are projected to be 164.9 MCM (5,215 liter/sec) and 25.6 MCM (810 liter/sec), respectively, as shown in Table C4.1 and summarized below:

Results of Water Demand Projection in the 2001 JBIC Study

Item of Water Demand	Unit	Yearly Water Demand			
		Year 2010		Year 2020	
		Makassar	Gowa	Makassar	Gowa
(1) Water Requirement					
- Domestic use	MCM	52.2	7.3	97.8	16.7
- Commercial/public use	MCM	10.3	0.9	15.8	1.1
- Industrial use	MCM	2.5	0.2	3.9	0.4
Total	MCM	65.0	8.4	117.5	18.2
(2) Unaccounted-for water (conveyance loss)	MCM	26.2	3.4	47.4	7.4
(3) Total Water Demand	MCM	91.2	11.8	164.9	25.6
	liter/sec	2,892	374	5,215	810

Source: Comprehensive Water Management Plan Study for Maros-Jeneponto River Basin, Final Report, November 2001

(3) The Study on Indonesian Urban Water Resources Improvement Project in July 2003

The Indonesian Urban Water Resources Improvement Project under the World Bank aims at investing and assisting the PDAM focusing on optimizing existing assets and their mode of operation so that the cashflow of the PDAM is increased in the short term. According to the World Bank's report, numerous PDAMs have prepared a financial recovery action plan (FRAP) with support from the Bank, which includes rescheduling of existing debts, revision of tariffs, etc. The study on the project deals with 11 PDAMs in Indonesia under the water services improvement component of the urban water supply and sanitation project. Of the 11 PDAMs, the PDAM Makassar is the largest one.

The 2003 World Bank study projects the water demands in the service area of PDAM Makassar applying the following procedures and assumptions:

i) The population in the service area will increase at an annual average growth rate of 2.7 % for the period from 2002 to 2020.
ii) The number of pipe connection will increase by 3,000 in 2004, 7,000 in 2005, and 10,000 in 2006. After 2007, it increases annually by 10,000 between 2007 and 2009, 5,000 between 2010 and 2015, and 6,000 between 2016 and 2020.
iii) The water consumption per connection is kept constant at 25 m^3/month between 1992 and 2020.
iv) The present high unaccounted-for water ratio of 51 % will be decreased to 25 % in 2008 in accordance with the corporate plan and proposal of PDAM Makassar, which outline the future development to the year 2008.

The results of the water demand projection are shown in Table C4.2 and summarized in the following table:

Results of Water Demand Projection in the 2003 World Bank Study

Item	Unit	Year		
		2002	2010	2020
I. Service Coverage				
- Total urban population	(Persons)	1,130,000	1,398,434	1,825,351
- Total connections at end of year	(Nos.)	108,833	178,000	233,000
- Population served at end of year	(Persons)	827,131	1,352,800	1,770,800
- Population coverage	(%)	73	97	97
II. Water Production				
- UFW at end of year	(%)	51	25	25
- Average consumption	(m^3/conn/month)	25	25	25
- Average demand at household	(liter/sec)	-	1,670	2,188
- Required production rate (total demand)	(liter/sec)	-	2,226	2,917

Data Source: PDAM Makassar

(4) Water Supply Master Plan for PDAM Makassar (Rencana Induk Penyediaan Air Bershi PDAM Makassar) in September 2000

The master plan study carried out by PDAM Makassar in September 2000 projected the water demand in Makassar City in 2020. The projection assumed the following future conditions:

- Population of 1,065.3 thousand in 1999 will increase to 2,097.3 in 2020 at an average annual growth rate of 3.2 %.
- Service coverage of 26 % and per capita consumption of 108 liter/day in 1999 will increase to 75 % and 112 liter/day, respectively, in 2020.
- Unaccounted-for water ratio will decrease from 52% in 1999 to 30 % in 2020.
- Some of water produced in WTPs of PDAM Makassar will be sold to PDAM Gowa and PDAM Maros.

It appears that the population increase rate of 3.2 % adopted in the projection is rather high as compared with the recent projections, while the unaccounted-for water ratio of 30 % in 2020 that was adopted in the previous study are considered adequate.

In the course of reviewing the previous study, there seemed to be some inconsistencies in the numerical calculations. The JICA Study Team corrected the inconsistent values. As a result, the water demand in the service area of PDAM Makassar in 2020 was estimated at 5,204 liter/sec on daily average basis, which is almost same as the water demand (5,215 liter/sec) estimated in the 2001 JBIC study. The projected water demands on daily average basis in the study are shown in Figure C4.1.

(5) Study on Water Supply Improvement Service in 2003

In the past study, the PDAM Makassar was working on the water demand projection to update the water demand projection carried out in the above WB's study. As discussed in the following Section C4.3, the JICA Study Team revised the water demands projected in the previous study applying the same basic conditions as those therein where appropriate.

C4.2.3 Comparison of Municipal Water Demand Projected in 2001 JBIC Study and 2003 World Bank's Study

As a result of the review of the previous water demand projections, methodologies and procedures in the previous two (2) studies, namely the 2001 JBIC study and 2003 World Bank's study, are assessed to be comparatively consistent. Nonetheless there is a large difference between the projected water demands in the service area of PDAM Makassar in both studies, especially for those in 2020. The unaccounted-for-water ratio of approximately 30 % in the former study does not, however, differ significantly from 25 % in the latter study.

The per capital water consumption of 200 liter/day in 2020 that is adopted in the former study is considered adequate and not overestimated. As mentioned in the following Subsection C4.2.4, the study assumes that the water demand would be sufficed with surface water taking into account the further aggravation of groundwater quality in the service area in the future.

The projection in the latter study is based on the corporate plan of PDAM Makassar which includes a plan of the future pipe connections in the service area. In addition, it appears that the projection is made on a premise that the water supply will rely on groundwater resources exploitable in the service area. Besides, it appears that the plan places a focus on the improvement of the PDAM's cashflow by means of minimizing the investments and maximizing the revenues.

As emphasized in the foregoing Section C4.1, it is essential to clarify the exploitable groundwater resources in the service area in order to accurately estimate the water demand for the piped water.

C4.2.4 Water Supply and Water Resources Development Plans in Previous Studies

To meet the higher future demands in Makassar City and Gowa Regency, the 2001 JBIC study proposed to develop water resources around the Makassar City area which include the Maros River basin.

The 2003 World Bank's study projected a very moderate increase of water demands. It proposes the expansion plans of the Panaikang WTP by 500 liter/sec and replacement of the current source of Panaikang WTP with Bili-Bili Dam. Other planned works to secure the water production include upgrading of Antang WTP by 50 liter/sec and rehabilitation of Ratulangi WTP.

The 2003 World Bank's study suggested in its Project Concept Report on the Indonesian Urban Water Services Improvement Project (July 2003) to implement the following projects for the Makassar City water supply under the finance from the World Bank:

1) Engage consultants to conduct a detailed review of the recently completed master plan, and to prepare detailed design of the proposed works under the financing plan including assisting with the construction supervision,
2) Construct a transmission pipeline to supply Panakinang WTP from the Bili-Bili reservoir.
3) Add another 50 liter/sec capacity to the Antang WTP to enable daily supply to the neighboring areas in the elevated area of the city. The source of supply would be more secure once the Bili-Bili reservoir to Panaikang WTP transfer pipeline is completed.
4) Upgrade the capacity of the Panaikang WTP by adding another two 250 liter/sec process units (total 500 liter/sec)
5) Establish a trial zonal system by constructing an elevated storage and modifying the local reticulation pipe work to demonstrate the effectiveness of this approach not only to improve pressures but in facilitating the control of the unaccounted-for water (UFW).
6) Implement a UFW reduction program. Firstly, mains meters should be checked and repaired if necessary to ensure the production is recorded accurately. Leak detection equipment, suitable for use in areas or where water tables are high should be procured. Then, using a zonal approach, prioritize the areas by blocks for action. The nature of the UFW including the proportion of physical works, illegal connection, and inaccurate meters or meter readers, should be ascertained in order to determine the most effective means of loss reduction. The reduction in UFW to 25 % by the year 2009 would result in a water savings of about 1,130 liters/sec which is equivalent to about half of the current production capacity.
7) Undertake a distribution system expansion program including the installation of 48,500 new connections by 2009, with 3,000 to 10,000 new connections per annum. This represents an increase in sales of approximately 460 liters/sec. Given the already high service area coverage, most of the new connections will be in the newly developed areas of the city. The expansion program would increase the total connections to about 173,000.

C4.3 Water Demand Projection Adopted

C4.3.1 Projection of Water Demand on Average Daily Demand Basis

In this Study, an attempt was made to project the water demands for service area of PDAM Makassar applying the basic conditions worked out in the study on Water Supply Improvement Service by PDAM Makassar in 2003 that are deemed to be appropriate. In the projection, besides, the basic conditions applied to the latest water demand forecast for Surabaya City[/1] that

[/1] : Additional Engineering Services on Review of water Resources Development Study for Water Supply in Brantas River Basin, Component Study (2A), Volume 4-Appendices to master Plan and Feasibility Study for Karang Pilang III & IV Projects, October 2002.

was carried out in October 2002 were also taken into consideration. The basic conditions applied to the water demand projection are summarized below:

i) Population increase: 2.5 % per annum until 2020

ii) Service coverage
- Domestic water; 56.3 % in 2002 to 81 % in 2020
- Social water; constant at 9 % between 2003 and 2020

iii) Per capita daily water consumption
- Domestic water; 144 liter/day in 2002 to 172 liter/day in 2020
- Social water; it will increase gradually from 30 liter/day in 2002 to 40 liter/day in 2020.

iv) Industrial water demand
- The present demand of 35 liter/sec will increase to 57 liter/sec in 2005 as projected in "F/S and D/D for Utilization of Additional Production Capacity of Ujung Pandang Water Supply Development Project (Stage I), September 1999".
- After 2006, the industrial demand is projected to increase at an annual average growth rate of 4.9 % which corresponds to that of GRDP in Makassar City between 1998 and 2001.

v) Unaccounted-for water ratio
- It is projected to reduce from 51% in 2002 to 30% in 2009 and thence to be constant at 30% until 2020.

The water demands in service area of PDAM Makassar which are estimated based on the basic conditions mentioned above are tabulated in Table C4.3.

According to the aforesaid latest study for Surabaya City, the average per capita water consumption for domestic water in Surabaya City is derived to be 178 liter/day. Hence, the projected unit water consumption of 172 liter/capita/day for the year 2020 is judged to be in the conservative range in consideration of the future served people in Makassar City.

With regard to the unaccounted-for water (UFW), the aforesaid study for Surabaya City contemplates to reduce the UFW ratio in Surabaya City from the present 41 % to 30 % in 2025 in the two stages, namely stage 1 program and stage 2 program spanning between 2003 and 2008 and between 2009 and 2025, respectively. As seen in the programs proposed for Surabaya City, the reduction of unaccounted-for water requires elaborated and time-consuming works. Judging from the UFW reduction plan for Surabaya City, it may be too optimistic to assume to reduce it from the present 51 % to 30 % in 2009, although the assumption is adopted in this Study with reference to the programs suggested in the aforesaid 2003 World Bank's study. In case the UFW reduction assumed herein is not attained, the water demands in service area of PDAM Makassar would increase much more than those in Table C4.3 and Figure 4.2. It is

recommended to revise the water demand projection based on the concrete UFW reduction programs which are expected to be worked out by the PDAM Makassar from now on.

As a result of the water demand projection carried out in this Study, the water demand in service area of PDAM Makassar in 2020 is derived at 4,404 liter/sec as shown in Table C4.3. The adopted water demand in 2020 is about 15 % smaller than those estimated in the two (2) previous studies, the 2001 JBIC study and Water Supply Master Plan for PDAM Makassar (September 2000).

C4.3.2 Maximum Daily Water Demand

In general, the water production and supply capacity needs to be expanded to meet the maximum daily water demand in the water supply system. The maximum daily water demand is estimated by the following formula:

$$Qd_{max} = Qd_{average} \times P_f$$

Where, Qd_{max} : Maximum daily water demand (liter/sec)
$Qd_{average}$: Average daily water demand (liter/sec)
P_f : Factor showing a ratio of average daily water demand to maximum daily water demand

No reliable data to estimate the "P_f" value could be collected during the field investigations. On the other hand, the aforesaid study on Water Supply Master Plan for PDAM Makassar (September 2000) adopted 1.7 as the "P_f" value to estimate the maximum daily water demand in the service area of PDAM Makassar. However, the value seems to be considerable large, resulting in necessity of large amount of investments for provision of new water treatment plants.

Table C4.3 shows the maximum daily water demands in case the 1.15 is adopted as the "P_f" value only for reference. It is recommended to consistently clarify the factor in the successive master plan study as proposed in the foregoing Section C4.1 and Subsection C4.2.3.

C5 Operation and Maintenance (O&M) for Water Supply Facilities

C5.1 General

In connection with the municipal water supply from the Jeneberang River, the existing intake facilities on the Jeneberang River are operated and maintained by PDAM Makassar, PDAM Gowa and sugar factory in Takalar Regency with the exception of intake facilities for the raw water transmission main (RWTM) from Bili-Bili Dam to Somba Opu WTP, which is owned by the Jeneberang River Basin Development Project Office (JRBDP).

After establishing the Jeneberang Public Corporation, it is expected that the municipal water extracted from the Jeneberang River will constitute one of the important revenues to run the corporation. Hence, it is necessary to monitor the discharges taken at the intake sites through coordination with the PDAMs and the sugar factory. For the time being, only the produced water volumes at each WTP are disclosed by the PDAM offices, and those extracted at the intake sites by pumping are not made clear. Since the water leakage usually takes place also on the raw water pipeline to a WTP, the corporation needs to receive the operation records of pumping facilities at intake site from the PDAMs and sugar factory in the acceptable forms in addition to records of water production at each WTP, in order to accurately measure the extracted water volumes from the river and to charge the raw water tariff to the concerned utilities in the future.

C5.2 Main Features of Raw Water Transmission Main (RWTM) from Bili-Bili Dam

At present, the Raw Water Transmission Main (RWTM) with a maximum conveyance capacity of 3,300 liter/sec is operated and maintained by the Jeneberang River Basin Development Project Office (JRBDP) so as to transmit the raw water released from Bili-Bili Dam to Somba Opu WTP. Its capacity can accommodate the future expansion of water treatment capacity of Somba Opu WTP (and water transmission to Panaikang WTP if proposed). The O&M thereof will be transferred to the Jeneberang Public Corporation after establishing it.

Figure C5.1 shows the schematic overall plan of RWTM including the related projects such as Bili-Bili Dam and Somba Opu WTP together with distribution pipeline. The profile along the raw water pipeline is shown in Figure C5.2. The main features of RWTM are as follows:

- Pipeline: 17 km long single pipeline consisting of upstream 6.63 km long section of 1,650 mm in diameter and downstream 10.38 km section of 1,500 mm in diameter
- Flow meter chamber with valves : 2 places (at the uppermost and lowermost points on the pipeline)
- Blow-off chamber with valves : 5 places
- Air valve chamber with valves : 15 places
- Hydrant chamber with valves : 3 places

According to the in-charge of the JRBDP, the above equipment and facilities are operated and maintained by two (2) staff of the office. In addition, the in-charge informed that the water flow cannot be measured at present, since the upstream flow meter doesn't work properly out of two (2) flow meters installed on the pipeline route.

In the second field assignment of the water supply expert of the JICA Study Team in May 2004, the expert inspected the Raw Water Transmission Main (RWTM) together with the counterpart personnel. As a result, the present conditions of the machine and equipment along RWTM were clarified as follows:

1) As informed by the in-charge, the Flow Meter No.1 did not function, while the Flow Meter No.2 was measuring discharges flowing inside the pipe whose data were transmitted to the Dam Control Office on the Bili-Bili Dam through the telemetering system. It is considered important to accurately measure the discharge conveyed through the RWTM and to inform it to the PDAM Makassar on a regular basis. To enable it, the Flow Meter No.1 should be repaired in an early stage.
2) When the Bili-Bili Irrigation Project was under construction, the excess water in the RWTM was diverted into the existing irrigation canal by operating the valves in the blow-off chambers. It is reported that no diversion for the irrigation purpose is now required since the irrigation facilities have almost been completed.
3) It seemed that the Blow-off No.1and No.2 worked properly. On the other hand, the inspection team could not find out entrance covers of the Air Valve No.1 and No.2 chambers, probably because local inhabitants had covered them with earth materials. The entrance covers of those chambers are designed to be put almost at same level as ground on either side of the public road connecting the Bili-Bili Dam and Somba Opu WTP. Although the situation might take place through temporary activities of the local people because the both sides of the public road are generally densely built up, it is preferred that the entrances of Air Valve and Blow-off Valve chambers on ground should be enclosed by stakes with placard showing properties of JRBDP in order to maintain them in proper condition.
4) At the Blow-off No.3 and No.4 valve chambers, water of the RWTM was flowing into the nearby open channels. According to information from the O&M staff of JRBDP, the Blow-off No.3 and No.4 valves are opened to supply some quantity of domestic water to the nearby households and water of about 10 liter/sec to existing fishponds, respectively. The water supply from the Blow-off No.3 is going to stop until creation of the corporation. On the other hand, it was reported from the fishpond owner that fish eggs have recently become unable to hatch due to inflow of the high turbidity flow from the Bili-Bili Dam.

C5.3 Existing O&M Manual for Raw Water Transmission Main (RWTM) from Bili-Bili Dam

The Raw Water Transmission Main (RWTM) is operated and maintained in accordance with the manual which was prepared by the Jeneberang River Basin Development Project Office (JRBDP). The parts describing the substantial matters are a few pages and written in the

Indonesian language. The main contents thereof translated into English are shown in Table C5.1.

According to the O&M staff of JRBDP, the equipment of RWTM are operated and maintained in accordance with the O&M manual, but a problem on O&M thereof is insufficient budget usable for repairs.

For O&M of RWTM, an annual budget of 35 million Rupiah is allocated to the JRBDP after completion thereof in August 1999. Besides, about 150 million Rupiah was spent as additional O&M cost to repair water leakage near the Blow-off Valve No.4 which took place in 2000. According to the O&M staff, on the other hand, the annual budget is required to be increased to 50 million Rupiah to enable the satisfactory O&M works for RWTM.

C5.4 Matters to be Incorporated in O&M Manual for RWTM

According to the O&M staff of JRBDP, the following activities are usually undertaken as the ordinary O&M activities for RWTM

- Greasing of machine and equipment every 2 to 3 months
- Painting of the same 3 to 4 times per year

However, the O&M manual shown in Table C5.1 doesn't state the above maintenance works. Besides, it was observed in the aforesaid site inspection that the sufficient greasing and painting were not being done, probably due to shortage of budget. It is advisable that the O&M manual include the following:

i) Instruction manuals of machines/equipment prepared by the manufacturers
ii) Routine maintenance work; required frequencies of inspections of machines/equipment in valve chambers and greasing/painting of machines/equipment, and other necessary routine O&M activities
iii) Maintenance work in emergency cases; procedures/methods, tools, power supply required for urgent repair works

C5.5 Matters to be Considered in Preparing O&M Manual for Flushing/Diluting Water to Jongaya Drainage Canal

The JICA Study Team could not find out the specific O&M manual for releasing flushing/diluting water from Long Storage to existing Jongaya Drainage Canal in Makassar City. In the dry season, the Jeneberang mainstream water is flowed down into Jongaya Drainage Canal with the definite operation rule for gates on drains/channel as explained in the successive Chapter C6. It is recommended to prepare the O&M manual which specifies periods and frequencies of the gate operations in compliance with the extent of pollution in the Jongaya Drainage Canal.

C6 Recommendations on Management of Water Use of the Jeneberang River

C6.1 General

After creation of the Jeneberang Public Corporation in the near future, the Corporation will have to be responsible for management of the Jeneberang River water taken by various utilities in terms of the water quantity and quality. As discussed in Chapter C1, at present, the following utilities are taking water from the Jeneberang River for the purpose of municipal water supply:

- PDAM Makassar
- PDAM Gowa
- Sugar factory in Takalar Regency

Out of the above the three (3) utilities, the PDAM Makassar will continue to be the largest water consumer for the Jeneberang River in order to meet the increasing water demand in its service area. Besides, the Corporation will be requested by the concerned local government offices to release the Jeneberang River water to the Jongaya drainage canal during the dry season so as to improve the water quality in the canal.

Since the municipal water will constitute the major source for revenue of the Corporation, it is needed to accurately measure the water volume abstracted at each intake point on the Jeneberang River, based on which the Corporation is to bill water tariff to each utility. Moreover, the Corporation is obliged to supply water of good quality to the water utilities for the municipal water supply undertaken by PDAM. In this respect, it is recommended for the Corporation to monitor the Jeneberang river water quality at eight (8) places selected in the succeeding Subsection C6.3.1.

C6.2 Quantitative Management of Water Taken from the Jeneberang River

Except for the Raw Water Transmission Main (RWTM) connecting the Bili-Bili intake structure and Somba Opu WTP on which flow meters are installed as discussed in the foregoing Section C5.2, no apparatus to measure the water taken from the Jeneberang River is installed at the other intake sites at present. In order to keep on financial management of the Corporation in a sound state, it is needed to measure the quantity of water taken from the Jeneberang River and bill the raw water tariff to each utility based on the measured water quantity. Ideally, it is preferable to install an apparatus to measure water quantity on each of the raw water conveyance routes from the Jeneberang River. This should cover not only existing ones, but also new ones to be installed under the formal approval of and agreement with the Corporation in the future.

With regard to water conveyance route to be newly provided from now on, the agreement concluded between the Corporation and utility should prescribe that the apparatus has to be installed under the responsibility of each utility. To install the apparatus on existing water conveyance routes, on the other hand, it is considered that the Corporation and each utility will

have to negotiate to determine how the necessary costs for installing the apparatus will be borne by each party. This matter is further discussed in the following subsections.

C6.2.1 Raw Water Transmission Main Connecting Bili-Bili Intake Structure and Somba Opu WTP

The raw water transmission main is now owned and operated by the Jeneberang River Basin Development Project Office (JRBDP) and will be transferred to the Corporation on creation thereof. As stated in the foregoing Section C5.2, the flow in the transmission pipe connected to the Somba Opu WTP is being measured by the Flow Meter No.2 located close to the WTP on the transmission pipe. Although the quantity of raw water conveyed to the WTP can be measured with the Flow Meter No.2, it is recommend to repair the Flow Meter No.1 at the early stage in order to enable to monitor water loss in the transmission pipe which results ultimately in loss of revenue of the corporation.

C6.2.2 Other Existing Water Conveyance Pipelines Operated by PDAMs and Sugar Factory

For the other PDAM's water conveyance pipelines which are owned and operated by PDAM and sugar factory in Takalar, the Jeneberang River water is being pumped up from the Jeneberang River to covey it to each WTP. At present, there is no apparatus to measure the raw water pumped up from the Jeneberang River. Although the treated water quantity is being measured in each WTP, it hardly represents the accurate raw water quantity taken from the Jeneberang River, since it doesn't include losses of water in the pipeline and WTP. For these water conveyance pipelines, it is conceivable to measure the water quantity with the following procedures and methods:

i) To establish a system of recording the pumping operation data to calculate the water quantities on hourly basis,
ii) To install a flow meter on the pipeline, with which discharge inside pipeline will be measured continuously, or
iii) To install a broad weir on channel connected to the pipeline, so as to measure the water level thereat which will be converted into discharge.

Ideally, it is the most preferable to adopt the method in ii) above in order to accurately measure the quantity of raw water fed from the Jeneberang river. In such a case, however, the Corporation might have to bear the whole cost for construction of flow meter chamber and procurement and installation of flow meter, which is estimated to be much higher than those of the other two (2) methods.

It is recommended to select the most suitable method for each water conveyance pipeline after confirming the applicability of the above three (3) methods through coordination with the concerned office of PDAM and/or sugar factory offices, and taking into account budgets of the Corporation applicable thereto.

C6.2.3 Water Release to Jongaya Drainage Canal

The Jeneberang River Basin Development Project Office (JRBDP) is presently responsible for management of the Jongaya Drainage Canal in the lowermost reach of the Jeneberang River which is one of principal drainage channels for the Makassar City area, while its secondary drainage canals are managed by Cipta Karya of Makassar City. It is expected that the management of Jongaya Drainage Canal would be transferred from JRBDP to the Cipta Karya at the time of establishing the Corporation, since it exclusively contributes to improve the environmental circumstance of the city as discussed hereunder.

During the dry season of June to September when bad smell spreads along the Jongaya Drainage Canal due to pollution of the canal water, the JRBDP is obliged to release the flow (about 1.5 m^3/sec on average according to the information obtained from the JRBDP) of the Jeneberang mainstream to the Jongaya Drainage Canal for two weeks a month, for instance 1st and 3rd week in each month. During the week, the control gates on respective reaches are operated to dilute the polluted water in the Jongaya Drainage Canal as follows:

(i) The water level of the lower Jeneberang will be raised by keeping the control gate thereon close (the rubber gate is out of order as of May 2004). After it rises to a certain water level, the control gate on the intake channel is opened, while those on three drainage channels, namely the Hartaco, Panampu and Sinlijaya Drainage Channels (See Figure C6.1 for location of these drainage channels and control gates), will be closed to store water flowing from the Jeneberang mainstream and dilute the polluted water in the Jongaya Drainage Canal.

(ii) When the water level of the Jongaya Drainage Canal rises to a certain water level, the control gate on the intake channel is closed and those on the other three (3) drainage channels will be opened.

(iii) The gate operations in i) and ii) are repeated for the week.

It is not clear whether the water quantity released from the Jeneberang mainstream could suffice the water requirement to improve the aggravated environmental condition of the Jongaya Drainage Canal. In this respect, it is advisable to monitor the water quality of the Jongaya Drainage Canal and seashore zone water in order to determine the quantity of water to be released from the Jeneberang mainstream thereto, which is required to satisfy the water quality standards separately to be determined. It is foreseen that required quantity of water to be released from the Jeneberang mainstream to Jongaya Drainage Canal would increase with the population increase in the future, unless the sewerage system is introduced in Makassar City.

One of the ways to accurately estimate quantity of water to be released from the Jeneberang mainstream is to observe the water levels of the lower Jeneberang and Jongaya Drainage Canal with automatic water level recorder (AWLR) or manual reading gage.

C6.3 Management of Water Quality of the Jeneberang River

C6.3.1 Items of Water Quality to be Monitored

The Jeneberang River is a bulk water source of drinking water for people living in areas extending along the river, which include Makassar City and Gowa Regency. It is anticipated that the stable river flow regulated by the existing Bili-Bili Dam will be able to meet the increasing domestic and industrial water demands in those areas. To enable to supply safe drinking water to consumers at economically adequate water tariff, the Corporation will be obliged to monitor the raw water quality of the Jeneberang River and take necessary measures to improve the water quality if the river water quality is aggravated to the extent that dose not satisfy the prescribed river water standards.

In general, it is recommended to measure the following water quality items at intake site for water supply on a continuous basis:

- Water temperature,
- Turbidity
- pH value,
- Electric conductivity,

As long as the water quality analyses of the Jeneberang River conducted so far are concerned, the items of water quality which need to be monitored in particular are supposed to be biological oxygen demand (BOD), as well as turbidity among the above items as explained hereunder.

(1) Biological oxygen demand (BOD)

During the dry season, the BOD value becomes very high in the lower reach on which water intake facilities of PDAM Makassar and Gowa are located. Some water samples taken in the lower reach during the dry season show the values which exceed by far the allowable limits of raw water. The water quality condition will be more worsened with the population increase. The JICA Study Team saw children swimming in Jongaya Drainage Canal, although its water quality has worsened to a considerable extent as mentioned above. Thus, the water quality in the lower reach needs to be monitored and publicly notified to people approaching thereto by installing placards and/or through media if it is harmful for human health to use or enter into the water.

Besides, an attention needs to be paid to the upstream reach of the Bili-Bili Reservoir, since there is a possibility that the water quality therein will also become deteriorated through population increase and tourism development in the upper reach. To prevent the BOD value of the Jeneberang River water increasing beyond the allowable limits, it is needed to diffuse the septic tank in each of households and buildings situated in the basin.

(2) Turbidity

After the large-scale landslide in the uppermost mountainous area of the Jeneberang River Basin took place in the end of March 2004, a lot of sediments are flowing down into the Bili-Bili Reservoir. Since then, the high turbidity flow containing a large quantity of sediments is released from the Bili-Bili Reservoir and is conveyed to the Somba Opu WTP. This has necessitated larger quantity of chemicals to treat the high turbidity of raw water from the Jeneberang River, which is reported to come to 4 to 5 times the requirements under the usual water quality conditions of raw water from the Bili-Bili Dam (condition in May 2004). This situation has taken place not only in the Somba Opu WTP, but also in other WTPs along the downstream reach of the Jeneberang River. Eventually, the high turbidity flow has resulted in much higher water production cost and higher loss of raw water at those WTPs.

In addition, it is reported by people in Makassar City that the piped water conveyed from WTP in the city has come to contain impurities from time to time after the occurrence of the landslide. This implies that sometimes the water treatment was not sufficiently conducted in the WTP due to excessive turbidity of raw water from the Jeneberang River. In this respect, it is recommended that, in the future, the Corporation would provide adequate information on raw water quality to the concerned PDAMs at certain intervals in order that they could produce domestic water of good quality.

C6.3.2 Locations Selected for Water Quality Monitoring

To monitor the raw water quality and provide the water utilities and people in the riparian areas therewith, it is recommended that the Corporation will undertake the water quality monitoring on the Jeneberang River. The following eight (8) locations are preliminarily proposed as the sampling points in the order from upstream to downstream reach of the Jeneberang River:

i) Sabo dam No.4 site
ii) Sand pocket dam No.2 site
iii) Bili-Bili Reservoir, at three different depths
iv) Bili-Bili intake site (after release from Bili-Bili Dam)
v) Kampili weir site
vi) Malengkeri intake site for Maccini Sombala WTP
vii) Long Storage
viii) Jongaya Drainage Canal

Although ideally the Corporation will build and operate the laboratory for the water quality analyses in the future, the laboratory test may be entrusted to one of existing laboratories in Makassar City. It is advisable that the water quality analyses including sampling be performed at each of the above eight (8) locations at least once a month and that the analyses results should be publicly disclosed to the concerned utilities and people in the riverine areas.

C7 Matters to be Kept in Mind for Adequate Basin Management and Suggestions to Keep Close Coordination between Jeneberang Public Corporation and Utilities

C7.1 Items to be Kept in Mind for Adequate Basin Management on Side of Utilities

It is suggested that the utilities will keep in mind the following matters to keep on the sustainable basin and water use management of the Jeneberang River:

i) To pump up the Jeneberang River water in accordance with the water demand and avoid pumping up the excess water that might cause the water shortage in the peak dry season. In view of the water use management, each utility should perform the following:
   - To set up the system to measure the water quantity pumped up at the intake site as mentioned in the foregoing Section C6.2,
   - To inform the Corporation of the planned intake discharge on a weekly basis and make a record of water levels and pumping operation outputs on hourly basis, and
   - To pay the raw water tariff to the Corporation for the raw water quantity billed

ii) To follow the direction to restrict or reduce the quantity of water taken from the Jeneberang River, which may be given by the Corporation when the critical draughty condition takes place under the low reservoir water level,

iii) To monitor change of river water quality and inform it to the Corporation when phenomenon to indicate the significant change including rapid increase of turbidity is seen in the river at each intake site,

iv) To properly maintain pumps and other machines at intake site in order to avoid outflow of oil and lubricants from them into the river, and inform it to the Corporation if such incidence occurs,

v) To rehabilitate the intake structures and adjacent river banks in case they are damaged due to flood and/or landslides.

C7.2 Suggestions to Keep Close Coordination between Jeneberang Public Corporation and Water Utilities

As mentioned in the preceding Section C7.1, the water utilities are needed to take some activities to adequately perform the basin management of the Jeneberang River, while the Corporation will be obliged to manage the water quantity to be taken by each utility, as well as the water quality. To enable the effective and efficient use of the Jeneberang River water under the sustainable basin management, it is essential to keep a close coordination between the Corporation and water utilities such as PDAM Makassar, PDAM Gowa and various factories.

To keep on and strengthen the coordination and cooperation between the Corporation and concerned utilities, it is advisable to establish a committee (herein provisionally named Water Utilities Coordination Committee for the Jeneberang River Basin / WUCCJRB:) as a sub-committee of PPTPA. The WUCCJRB will be composed of the Corporation as the chair agency and utilities which are granted the water abstraction permit under agreements on

payment of water tariff concluded with the Corporation. For the time being, the following water utilities will be the candidate members of the WUCCJRB:

i) PLN Wilayah of South Sulawesi
ii) PDAM Makassar
iii) PDAM Gowa
iv) PIRASS/Balai PSDA representing WUAs
v) Sugar factory in Takalar, and other factories
vi) Cipta Karya of Makassar City if the Jongaya Drainage Canal is transferred under its management

The committee meeting will be held every week in order for the Corporation to notify the water quantity to be allocated to each utility in the next week and discuss the issues and problems related to the water extraction from the Jeneberang River and basin management. Prior to holding the meeting, each utility shall submit the next week's schedule of water extraction from the Jeneberang River at the respective intake sites and pump operation records in the previous week, and other related information.

The Corporation will examine whether the water quantities demanded by the respective water utilities for the next week can be secured under the condition of inflow and reservoir water level of the Bili-Bili Dam in order to determine the water volumes released from the Bili-Bili Dam in the next week, taking into account the water requirement for downstream irrigation areas. When needed to restrict the water quantities allocated to the water utilities for the reason of the critical draught, the Corporation will determine the restricted water quantity for each utility in consideration of the priorities of water use mentioned above. The main agenda of the committee meeting will be as follows:

(a) Information on hydro-meteorological conditions, such as expected inflow, reservoir water level and remaining effective reservoir storage, which is to be notified from the Corporation,
(b) Water quantity which is allowed to be taken at each intake structure of the water utilities (The water quantity will be determined by the Corporation based on the aforesaid examination), and
(c) Problems and issues related to the operation of intake facilities and basin management.

Tables

Table C2.1 Population by Water Source in Makassar City in 2003

No.	Kecamatan	Population	Total Population by Water Supply System							
			Served by PDAM's Piped Water		Private Shallow Well (Groundwater)				Others (PAH and PMA)	
					Withdrawal by Pump		Withdrawal by mannual			
		(Persons)	(Persons)	(%)	(Persons)	(%)	(Persons)	(%)	(Persons)	(%)
1	Biringkanaya	100,018	5,075	5.1	15,187	15.2	30,372	30.4	49,384	49.4
2	Bontoala	59,549	47,460	79.7	2,313	3.9	4,624	7.8	5,152	8.7
3	Makassar	84,103	26,875	32.0	17,387	20.7	8,694	10.3	31,147	37.0
4	Mamajang	61,284	27,555	45.0	12,757	20.8	6,379	10.4	14,593	23.8
5	Manggalla	60,118	15,693	26.1	15,471	25.7	7,736	12.9	21,218	35.3
6	Mariso	53,283	29,453	55.3	9,648	18.1	4,825	9.1	9,357	17.6
7	Panakkukang	129,652	87,916	67.8	27,194	21.0	13,598	10.5	944	0.7
8	Rappocini	120,856	48,217	39.9	24,816	20.5	12,408	10.3	35,415	29.3
9	Tallo	120,786	68,280	56.5	15,498	12.8	30,994	25.7	6,014	5.0
10	Tamalanrea	52,150	2,173	4.2	6,204	11.9	2,408	4.6	41,365	79.3
11	Tamalate	51,415	22,926	44.6	12,357	24.0	6,179	12.0	9,953	19.4
12	Ujung Pandang	34,460	32,329	93.8	1,386	4.0	693	2.0	52	0.2
13	Ujung Tanah	46,130	21,501	46.6	4,930	10.7	9,858	21.4	9,841	21.3
14	Wajo	57,189	40,902	71.5	10,683	18.7	5,341	9.3	263	0.5
Total		1,030,993	476,355	46.2	175,831	17.1	144,109	14.0	234,698	22.8

Note

PAH: Penauspungan Air Hujan (Storage of rainwater at each household)

PMA: Penauspungan Mafe Air (Storage of water other sources than rainwater at each household)

Data Source: Provincial Office of the Ministry of Health

Table C3.1 Annual Water Production of Each WTP in PDAM Gowa in 2003

1) In Year 2002

(unit: m^3)

Month	Water Tretment Plant in PDAM Gowa				
	Tompo Balang	Pandang-Pandang	Malino	Limbung	Bolongloe
Jan.	18,388	161,984	9,311	110	0
Feb.	21,931	165,079	10,366	1,047	0
Mar.	23,494	0	9,480	960	0
Apr.	23,382	0	9,061	1,190	0
May	25,563	0	9,249	240	0
Jun.	26,434	0	9,123	1,861	0
Jul.	24,970	0	11,343	2,058	0
Aug.	28,261	0	11,965	3,964	0
Sep.	21,253	144,405	9,916	5,034	2,160
Oct.	21,787	188,197	10,831	5,415	2,273
Nov.	32,076	136,275	12,187	4,446	2,405
Dec.	30,516	123,262	11,558	5,423	3,878
Yearly	298,055	919,202	124,390	31,748	10,716
Total	1,384,111				

Data Source: PDAM Gowa

2) In Year 2003

(unit: m^3)

Month	Water Tretment Plant in PDAM Gowa				
	Tompo Balang	Pandang-Pandang	Malino	Limbung	Bolongloe
Jan.	25,920	165,881	15,304	N.A.	0
Feb.	24,192	167,050	13,045	N.A.	0
Mar.	25,056	0	12,682	N.A.	0
Apr.	25,920	0	10,561	N.A.	0
May	26,784	0	13,224	N.A.	0
Jun.	55,620	0	17,185	N.A.	0
Jul.	34,452	0	17,497	N.A.	0
Aug.	45,072	0	16,246	N.A.	0
Sep.	35,820	192,540	17,637	N.A.	2,160
Oct.	22,572	250,930	16,279	N.A.	2,603
Nov.	39,204	181,700	16,263	N.A.	2,600
Dec.	34,236	164,350	15,264	N.A.	6,358
Yearly	394,848	1,122,450	181,187	-	13,721

Data Source: PDAM Gowa

Table C4.1 Water Demand Projection by the 2001 JBIC Study

1) Domestic Water Demand

Year	Item	Makassar	Gowa	Maros	Takalar
2000	Households Connected	72,970	2,315	2,861	919
	Persons per Household	5.10	4.78	4.71	4.80
	Persons in Connected Households	372,100	11,100	13,500	4,400
	Liters Per Capita Consumption (liter/day)	120	86	96	42
	Domestic Water (liter/sec)	517	11	15	2
	Demand (MCM/year)	16.30	0.35	0.47	0.07
2010	Households Connected	188,017	38,095	14,734	12,244
	Persons per Household	4.75	4.45	4.38	4.46
	Persons in Connected Households	893,100	169,500	64,500	54,600
	Liters Per Capita Consumption (liter/day)	160	118	123	96
	Domestic Water (liter/sec)	1,654	231	92	61
	Demand (MCM/year)	52.16	7.30	2.9	1.91
2020	Households Connected	303,064	73,874	26,607	23,568
	Persons per Household	4.42	4.14	4.08	4.15
	Persons in Connected Households	1,339,500	305,800	108,600	97,800
	Liters Per Capita Consumption (liter/day)	200	150	150	150
	Domestic Water (liter/sec)	3,101	531	189	170
	Demand (MCM/year)	97.78	16.74	5.95	5.35

2) Total Water Demand

Year	Demand Item	Makassar	Gowa	Maros	Takalar
2000	(1) Household Use	16.24	0.35	0.47	0.07
	(2) Commercial/Public Service Use	6.72	0.71	0.47	0.32
	(3) Industrial Use	1.59	0.16	0.03	0.06
	(4) Sub-total of Water Demand	24.55	1.22	0.97	0.45
	(5) Conveyance Loss (Recorded Rate of Loss*[1])	23.59 (49%)	2.72 (69%)	0.86 (47%)	0.21 (32%)
	(6) Total	48.14	3.94	1.83	0.66
2010	(1) Household Use	52.16	7.3	2.9	1.91
	(2) Commercial/Public Service Use	10.3	0.88	0.58	0.39
	(3) Industrial Use	2.5	0.24	0.04	0.09
	(4) Sub-total of Water Demand	64.96	8.42	3.52	2.39
	(5) Conveyance Loss I *[1]	21.65	2.81	1.17	0.8
	(6) Conveyance Loss II *[2]	4.56	0.59	0.25	0.17
	(7) Total	91.17	11.82	4.94	3.35
2020	(1) Household Use	97.78	16.74	5.95	5.35
	(2) Commercial/Public Service Use	15.78	1.09	0.72	0.47
	(3) Industrial Use	3.92	0.38	0.06	0.14
	(4) Sub-total of Water Demand	117.48	18.21	6.73	5.96
	(5) Conveyance Loss I *[1]	39.16	6.07	2.24	1.99
	(6) Conveyance Loss II *[2]	8.24	1.28	0.47	0.42
	(7) Total	164.88	25.56	9.45	8.36

Notes *1: Conveyance loss recorded by PDAM in 1999/2000 (refer to Table A.4.1.11)

*2: Conveyance Loss 1: Projected Conveyance loss of 25% from water treatment plant to individual users (= (4) x (1//0.75-1)

*3: Conveyance Loss II: Projected Conveyance of 5% from individual users to water treatment plant (={(4)+(5)}x(1//0.95-1)

Data Source: Consulting Engineering Services for Comprehensive Water Management Plan Study for maros-Jeneponto River Basin, Final Report, November 2001

Table C4.2 Water Demands and Water Supply Development Plan by the 2003 World Bank Study

1) Assumption and Criteria for Planning Purposes

Items	Unit	Year				
		2002	2005	2010	2015	2020
I. Service Coverage						
- Total urban population	(Persons)	1,130,000	1,224,024	1,398,434	1,597,696	1,825,351
- Growth rate	(%)		2.7	2.7	2.7	2.7
- No. of people per connection	(Nos.)		7.6	7.6	7.6	7.6
- Additional new connection during year*	(Nos.)		7,000	5,000	5,000	6,000
- Total connections at end of year	(Nos.)	108,833	133,000	178,000	203,000	233,000
- Population served at end of year	(Persons)	827,131	1,010,800	1,352,800	1,542,800	1,770,800
- Population coverage	(%)	73	83	97	97	97
II. Water Production						
- UFW at end of year	(%)	51	40	25	25	25
- Average consumption	(m^3/conn/month)	25	25	25	25	25
- Average demand	(liter/sec)		1,232	1,670	1,907	2,188
- Required production rate	(liter/sec)		2,053	2,226	2,543	2,917
- Production capacity	(liter/sec)		2,290	2,840	2,840	2,840
- WTP upgrades	(liter/sec)		550*			

Notes
1. Assumed only half of the new connections in year 2004 are found under the proposed project.
2. *; Expansition plan of existing WTPs
- Antang WTP : 50 L/scc in Dec. 2006
- Panaikang WTP: 500 L/sec in Dec. 2008
Total : 550 L/sec

Source: Indonesian Urban Water Services Improvement Project by the World Bank, project Concept Report, July 2003

2) Implementation Schedule

	Total	Cash Projection (Rp million)					
		Year 1 2004	Year 2 2005	Year 3 2006	Year 4 2007	Year 5 2008	Year 6 2009
a) Engineering Consultants	1,600	1,200	400				
・ Review master plan	4,050		2,000	1,300	250	250	250
・ Detailed design and constrcution supervision							
b) Head works							
・ Connect Panaikang WTP to transmission from Bili Bili	33,000			11,000	22,000		
・ Add 50 L/S to Antang WTP	3,500			3,500			
・ Add 500 L/S to Panaikang WTP	35,000			10,000	15,000	10,000	
c) Head works							
・ Distribution system expansion	22,400			5,600	5,600	5,600	5,600
・ New house connections*	24,250	750	3,500	5,000	5,000	5,000	5,000
・ UFW reduction program	19,500	2,000	3,500	3,500	3,500	3,500	3,500
Annual Total	143,300	3,950	9,400	39,900	51,350	24,350	14,350

Note: Assumed only half of the new connections in year 2004 are found under the proposed project
Source: Indonesian Urban Water Services Improvement Project, project Concept Report, July 2003

Tabel C4.3 Water Demands projected in This Study

Basic Conditions and Assumptions for Water Demand Projection

1) Number of people per household extension	6 (Persons)
2) Number of people per social extension	100 (Persons)
3) Average water consumption per extension	26-31 (m3/month)
4) Average water consumption for social	30 (liter/capital/day)
5) Annual population increase rate	2.5 (%)

Range of Unit Water Consumption

26 (m3/month)	=144 (liter/capita/day)
31 (m3/month)	=172 (liter/capita/day)

Water Demand Projection

Item		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Population	person	1,148,312	1,177,020	1,206,445	1,236,606	1,267,522	1,299,210	1,331,690	1,364,982	1,399,107	1,434,084	1,469,936	1,506,685	1,544,352	1,582,961	1,622,535	1,663,098	1,704,676	1,747,293	1,790,975
Service Coverrage																				
- Domestic Service	%	56.3	56.6	58.7	60.7	62.7	64.8	66.8	68.8	70.9	72.9	74.9	77.0	79.0	81.0	81.0	81.0	81.0	81.0	81.0
- Social Service	%	8.7	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Total service coverage	%	65.0	65.6	67.7	69.7	71.7	73.8	75.8	77.8	79.9	81.9	83.9	86.0	88.0	90.0	90.0	90.0	90.0	90.0	90.0
Served Population																				
- Population with domestic connection	person	647,034	666,600	707,796	750,635	795,174	841,471	889,585	939,579	991,517	1,045,465	1,101,490	1,159,664	1,220,057	1,282,745	1,314,253	1,347,110	1,380,787	1,415,307	1,450,690
- Population with social connection	person	99,400	105,932	108,580	111,295	114,077	116,929	119,852	122,848	125,920	129,068	132,294	135,602	138,992	142,466	146,028	149,679	153,421	157,256	161,188
Total Served population	person	746,434	772,532	816,376	861,930	909,251	958,400	1,009,437	1,062,428	1,117,437	1,174,533	1,233,785	1,295,265	1,359,049	1,425,212	1,460,281	1,496,788	1,534,208	1,572,563	1,611,877
Number of Pipe Connections																				
- Number of Domestic Extension	nos.	107,839	111,100	117,966	125,106	132,529	140,245	148,264	156,597	165,253	174,244	183,582	193,277	203,343	213,791	219,042	224,518	230,131	235,884	241,782
	nos.	994	1,059	1,086	1,113	1,141	1,169	1,199	1,228	1,259	1,291	1,323	1,356	1,390	1,425	1,460	1,497	1,534	1,573	1,612
Total Number of Connections	nos.	108,833	112,159	119,052	126,219	133,670	141,414	149,463	157,825	166,512	175,535	184,905	194,633	204,733	215,216	220,502	226,015	231,665	237,457	243,393
Annual Increase in Number of Connectio	nos.		3,326	6,892	7,167	7,451	7,745	8,048	8,362	8,687	9,023	9,370	9,729	10,099	10,483	5,287	5,513	5,650	5,792	5,936
Water Demand Projection																				
- Unit water consumption for domestic water	m^3/mon./ connect.	26.0	26.3	26.5	26.8	27.0	27.3	27.6	27.8	28.1	28.4	28.7	29.0	29.2	29.5	29.8	30.1	30.4	30.7	31.0
- Unit water consumption for social water	liter/mon. /person	30.0	30.5	31.0	31.5	32.0	32.5	33.0	33.5	34.1	34.6	35.2	35.8	36.3	36.9	37.5	38.1	38.7	39.4	40.0
Water Consumption by sector																				
i) Domestic water consumption	liter/sec	1,082	1,125	1,207	1,292	1,382	1,477	1,577	1,682	1,792	1,909	2,031	2,159	2,293	2,435	2,519	2,608	2,699	2,794	2,892
ii) Sosial water consumption	liter/sec	35	37	39	41	42	44	46	48	50	52	54	56	58	61	63	66	69	72	75
iii) Industrial demand	liter/sec	35	42	50	57	60	63	66	69	72	76	80	84	88	92	96	101	106	111	117
Total Water Consumption	liter/sec	1,151	1,205	1,296	1,390	1,484	1,584	1,689	1,799	1,915	2,036	2,164	2,298	2,440	2,588	2,679	2,775	2,874	2,977	3,083
Average Daily Demand																				
- Unaccounted-for Water (UFW)	%	51	49	46	41	38	35	32	30	30	30	30	30	30	30	30	30	30	30	30
- Average daily demand	liter/sec	**2,349**	**2,362**	**2,399**	**2,356**	**2,394**	**2,437**	**2,483**	**2,570**	**2,735**	**2,909**	**3,092**	**3,284**	**3,485**	**3,697**	**3,827**	**3,964**	**4,106**	**4,252**	**4,404**
Maximum Daily Demand																				
- Peak factor (Ratio of average daily dem to maximum daily demand)	-	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15
- Maximum daily demand	liter/sec	2,702	2,717	2,759	2,709	2,753	2,802	2,856	2,955	3,145	3,345	3,555	3,776	4,008	4,251	4,402	4,559	4,722	4,890	5,065
- Production capacity	liter/sec	2,290	2,290	2,340	2,340	2,340	2,890	2,890	2,890	2,890	2,890	2,890	2,890	2,890	3,440	3,440	3,440	3,440	3,440	3,440
(Capacity to be added)	(liter/sec)		(50)			(550)								(550)						

Table C5.1 Existing Operation and Maintenance Manual for Raw Water Transmission Main (RWTM) for Somba Opu WTP (1/2)

I. Operation Manual for Gate/Valve
1) Before operating the gates, make it sure that all gates of air valves are fully opened.
2) Intake gate shall be slowly opened till the gate is fully opened, while butterfly gate at Flow Meter No.1 is still closed.
3) Butterfly gate with diameter of 1.20m at Flow Meter No.1 shall be slowly opened by opening time of 1 minute per 1^{o}, and shall be opened to 90^{o}, and backed it up by sluice gate with diameter of 0.40 m, and at Blow-off No.1 the gate shall be suitably opened so that water in discharge facility No.1 does not overflow, while butterfly gate with diameter of 1.65 m at Blow-off No.1 is still closed. Sluice gate with diameter of 0.60 m shall be closed; sluice gate with diameter of 15 m shall be suitably opened according to the natural silk requirement.
4) Butterfly gate with diameter of 1.65 m at Flow Meter No.1 shall be slowly opened after water from Discharge Facility No.1 is smoothly and steadily out-flowed, and then similar to the opening method of Flow Meter No.1, Blow-off No.2 shall be suitably opened so that water in the channel does not overflow, while butterfly gate with diameter of 1.65 m at Blow-off No.2 is still closed.
5) Butterfly gate with diameter of 1.65 m at Blow-off No.2 shall be slowly opened after water from Discharge Facility No.2 is smoothly and steadily out-flowed, and then similar to the opening method of Flow Meter No.1, Blow-off No.3 shall be suitably opened so that water in the channel does not overflow, while butterfly gate with diameter of 1.50 m at Blow-off No.3 is still closed.
6) Butterfly gate with diameter of 1.50 m at Blow-off No.3 shall be slowly opened after water from Discharge Facility No.3 is smoothly and steadily out-flowed, and then similar to the opening method of Flow Meter No.1, Blow-off No.4 shall be suitably opened so that water in the channel does not overflow, while butterfly gate with diameter of 1.50 m at Blow-off No.4 is still closed.
7) Butterfly gate with diameter of 1.50 m at Blow-off No.4 shall be slowly opened after water from Discharge Facility No.4 is smoothly and steadily out-flowed, and then similar to the opening method of Flow Meter No.1, Blow-off No.5 shall be suitably opened so that water in the channel does not overflow, while butterfly gate with diameter of 1.50m at Blow-off No.5 is still closed.
8) Butterfly gate with diameter of 1.50m at Blow-off No.5 shall be slowly opened after water from Discharge Facility No.5 is smoothly and steadily out-flowed, and then similar to the opening method of Flow Meter No.1, but using sluice gate with diameter of 0.50m, at Flow Meter No. 2 shall be suitably opened so that water in flushing channel does not overflow, and butterfly gate with diameter of 1.00 m at downstream venturi at Flow Meter No.2 shall be closed, while butterfly gate with diameter of 1.00 m at upstream venturi shall have to be opened previously.
9) Butterfly gate with diameter of 0.60m at Flow Meter No.2 shall be closed, while sluice gate with diameter of 0.15m at Flow Meter No.2 shall be suitably opened according to the BLPP requirement.
10) Butterfly gate with diameter of 1.00m at downstream venturi shall be opened when WTP Batangkaluku or Somba Opu is ready to operate.
11) All air valve gates shall be closed back and its main hole shall be securely locked.

Table C5.1 Existing Operation and Maintenance Manual for Raw Water Transmission Main (RWTM) for Somba Opu WTP (2/2)

II. Manual for Security and Maintenance of Gates/Valves
1) Strict security shall be applied to the operated gates to prevent unauthorized operation.
2) During operating time of Jeneberang Raw Water Transmission Main Pipe, authorized personnel shall be dispatched to inspect any possible leakage and immediately close the butterfly gate at Blow-off chamber where there are leakages in its downstream.
3) If leakage occurs when the upper stream butterfly gate is already closed, repair shall be done immediately.
4) Operation of butterfly gate at the Blow-off shall be restored when repair is completed as conducted in the above step 2.

Figures

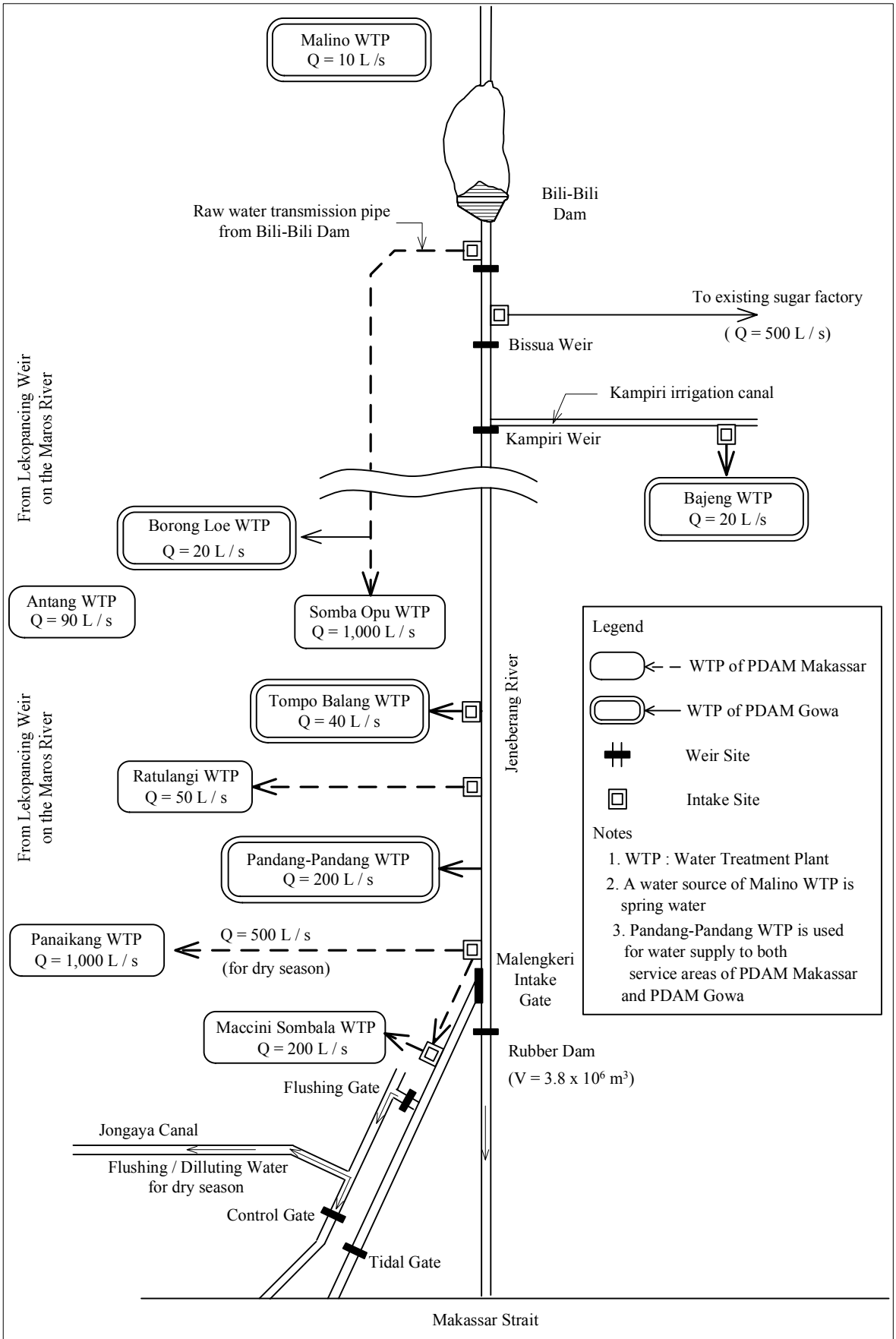


Figure C1.1 Schematic Map on Water Use of the Jeneberang River for Municipal Water Supply

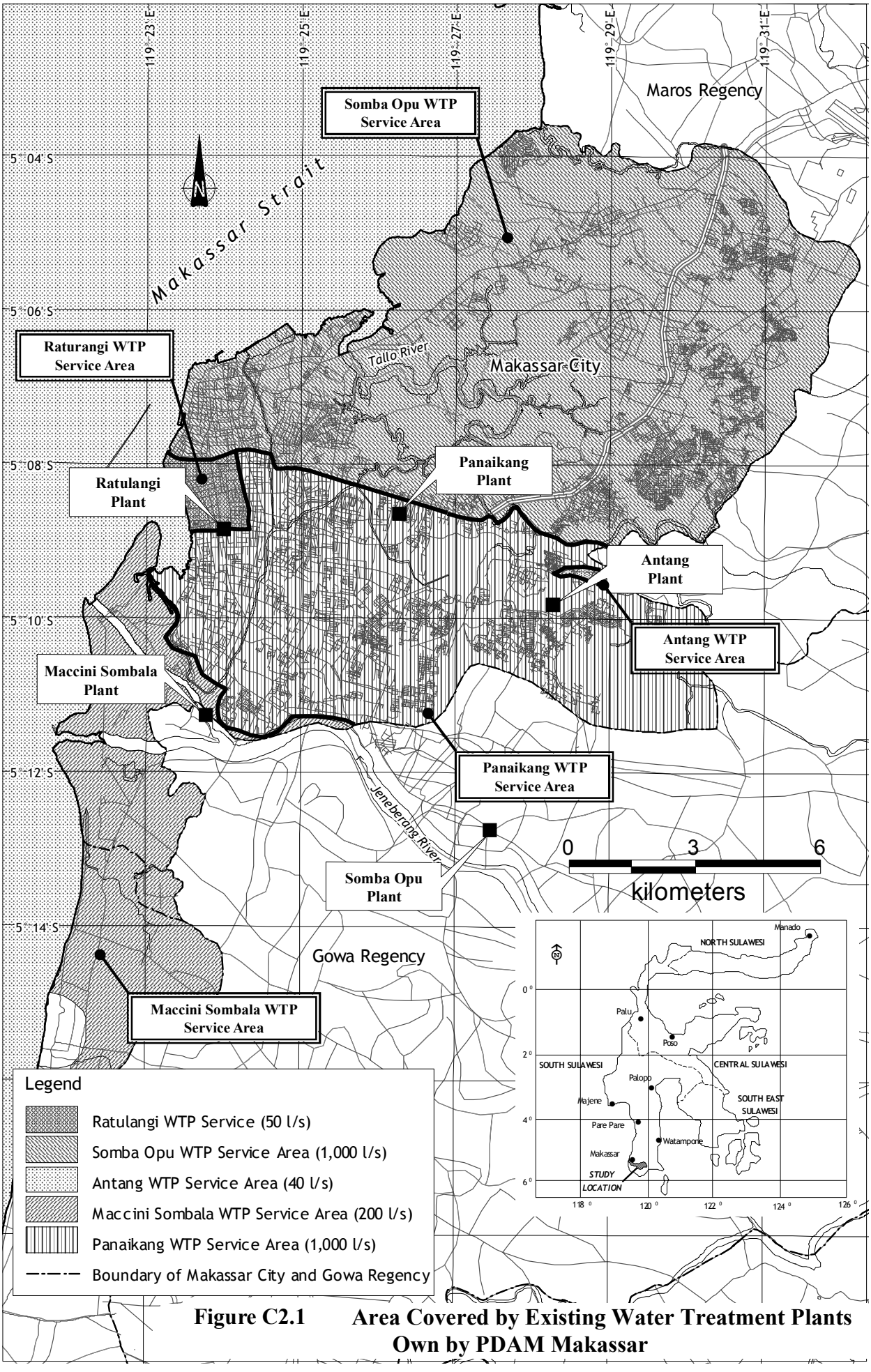


Figure C2.1 Area Covered by Existing Water Treatment Plants Own by PDAM Makassar

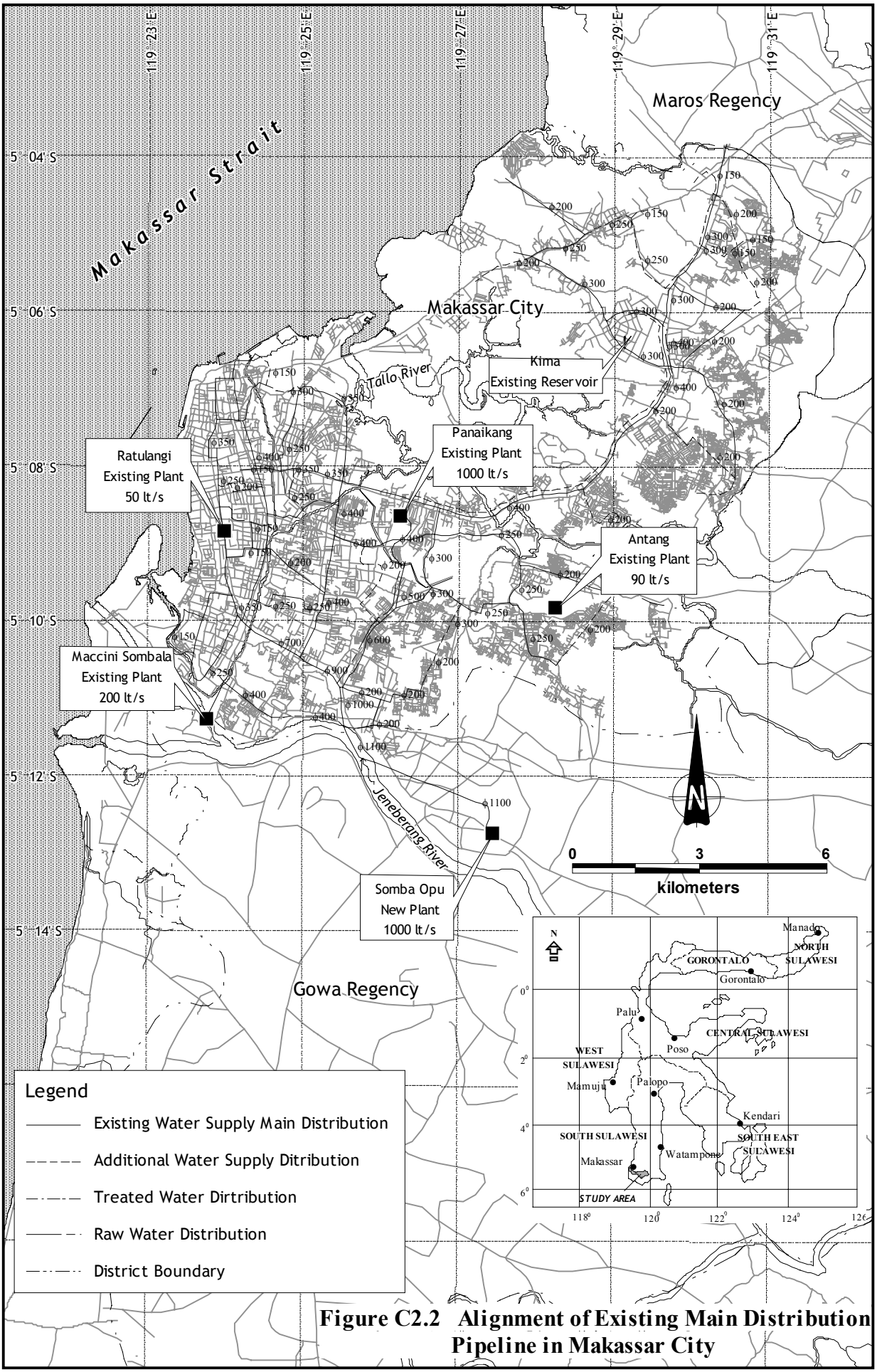
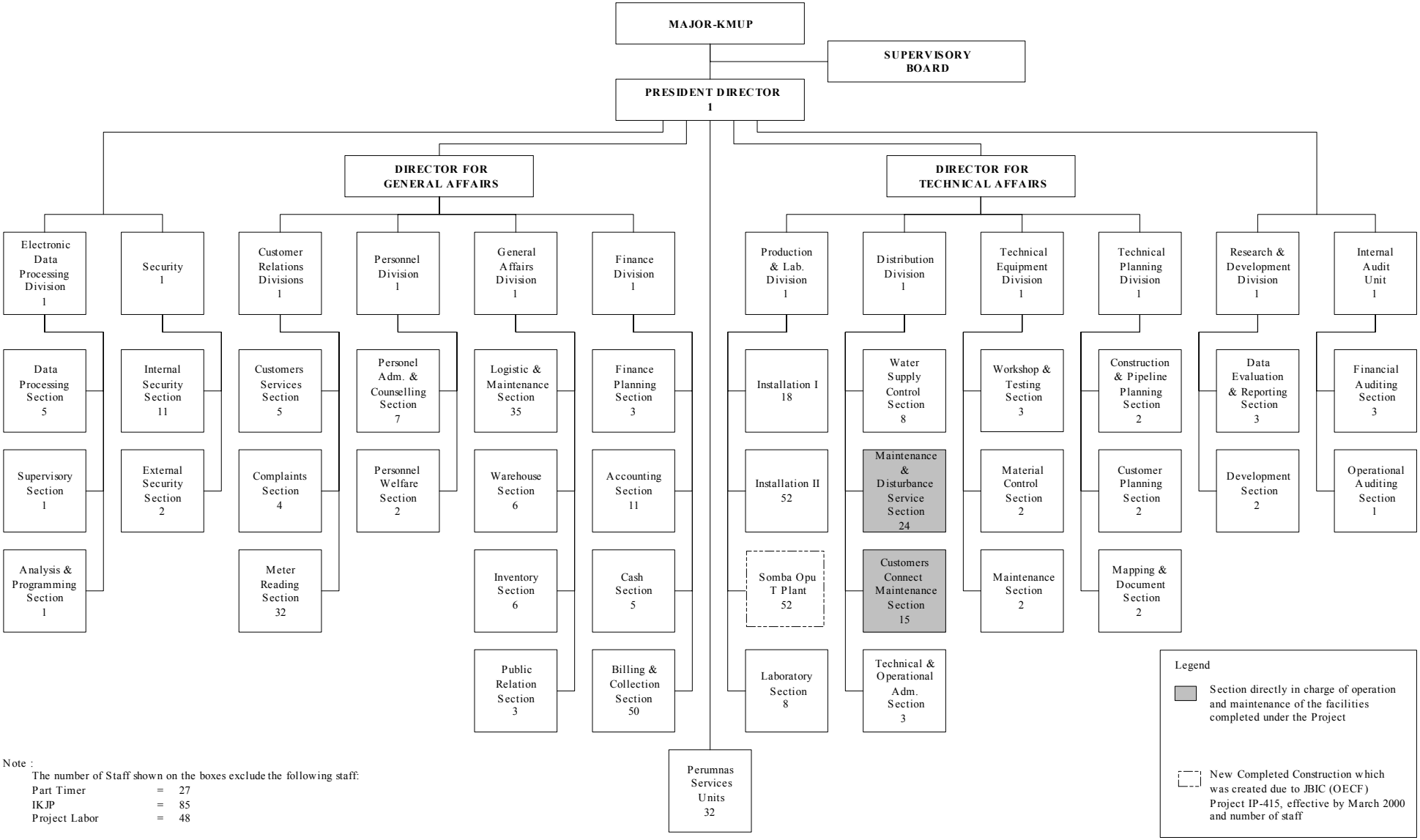


Figure C2.2 Alignment of Existing Main Distribution Pipeline in Makassar City



Note :
The number of Staff shown on the boxes exclude the following staff:

Part Timer	=	27
IKJP	=	85
Project Labor	=	48

Figure C2.3 Organization Structure of PDAM Makassar

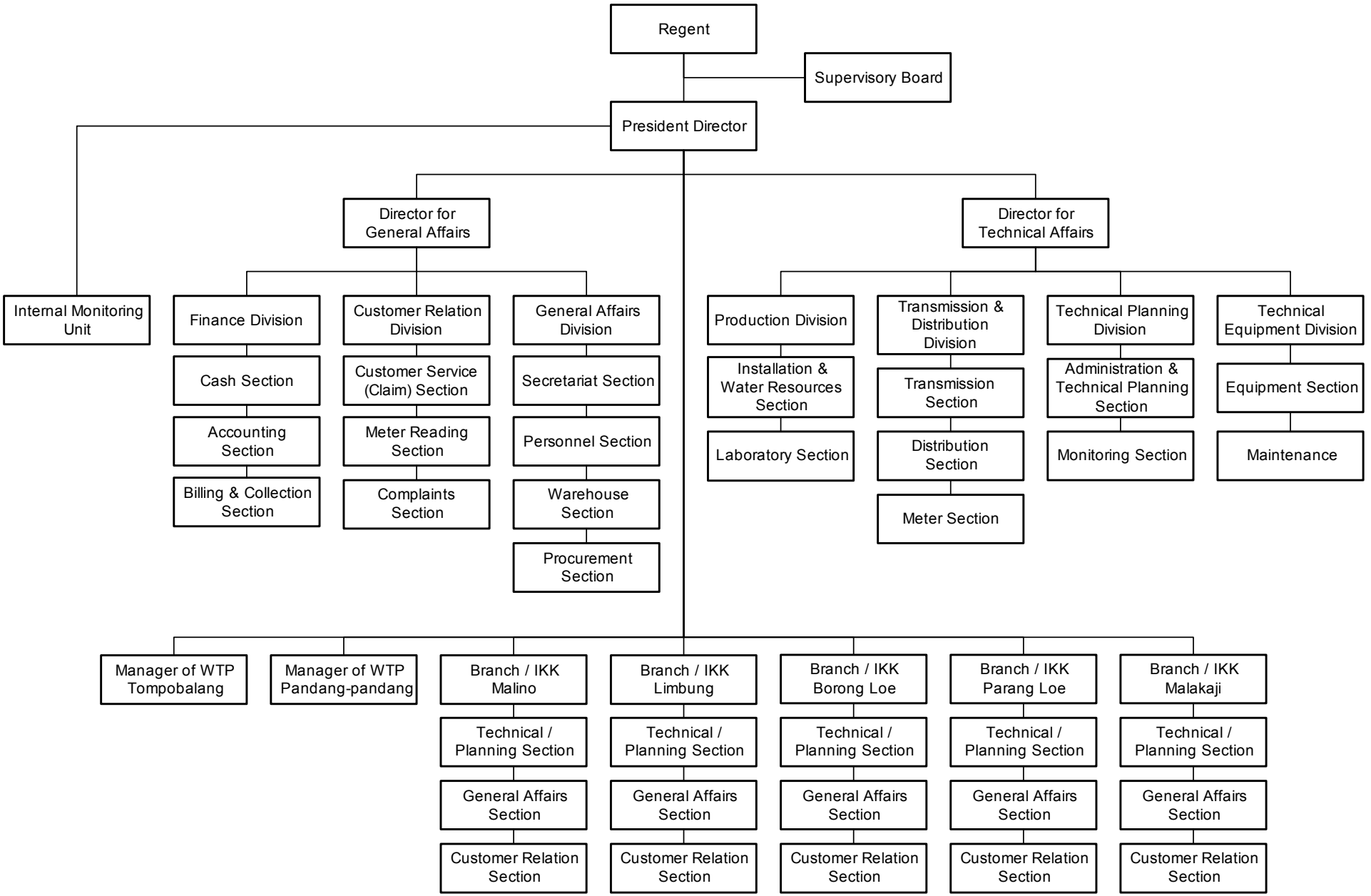


Figure C3.1 Organization Structure of PDAM Gowa

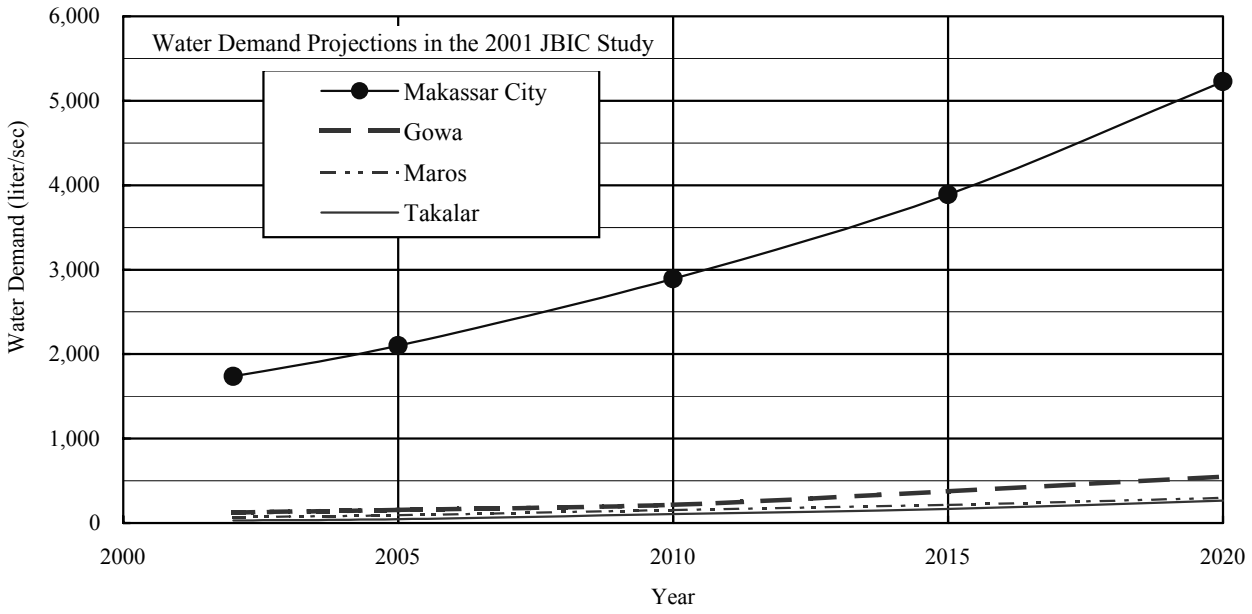


Figure C4.1 Water Demand for Each Region, Projected in the 2001 JBIC Study

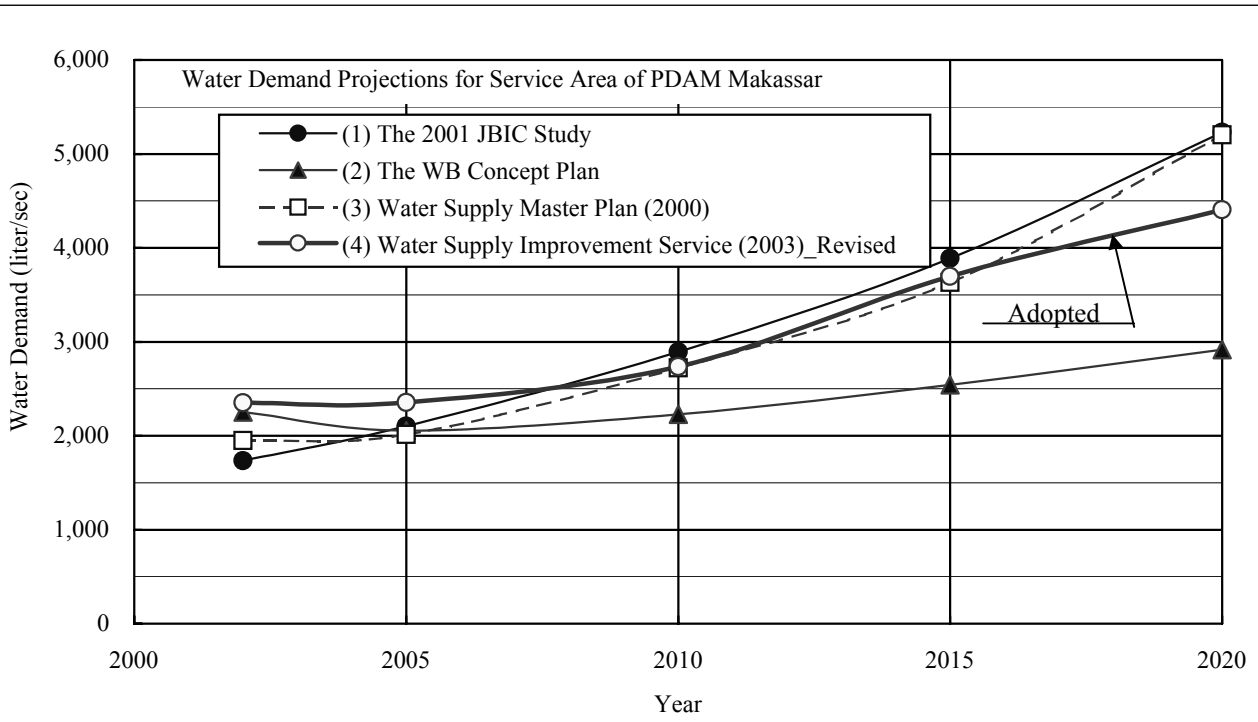


Figure C4.2 Comparison of Previous Water Demand Projection for Service Area of PDAM Makassar

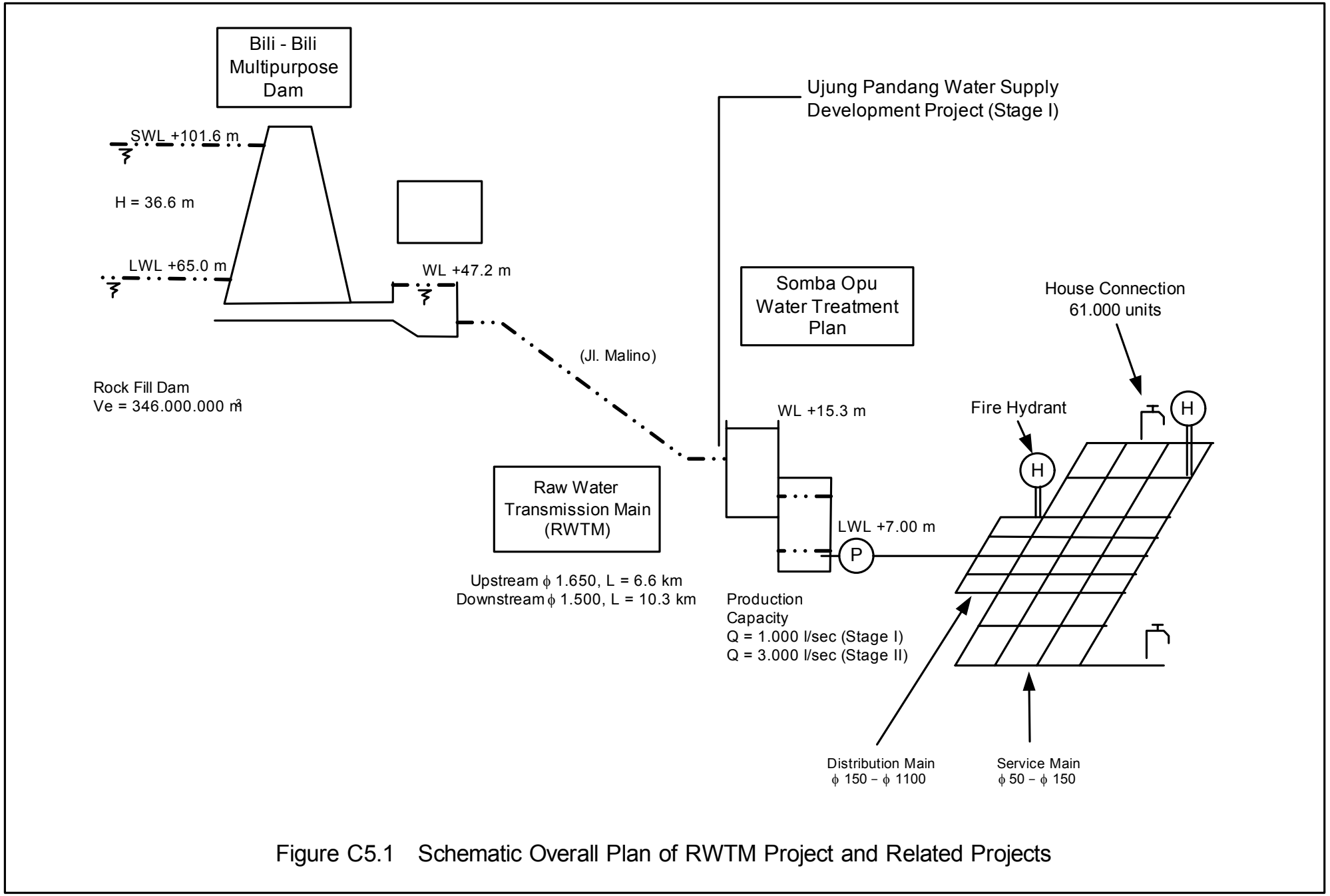
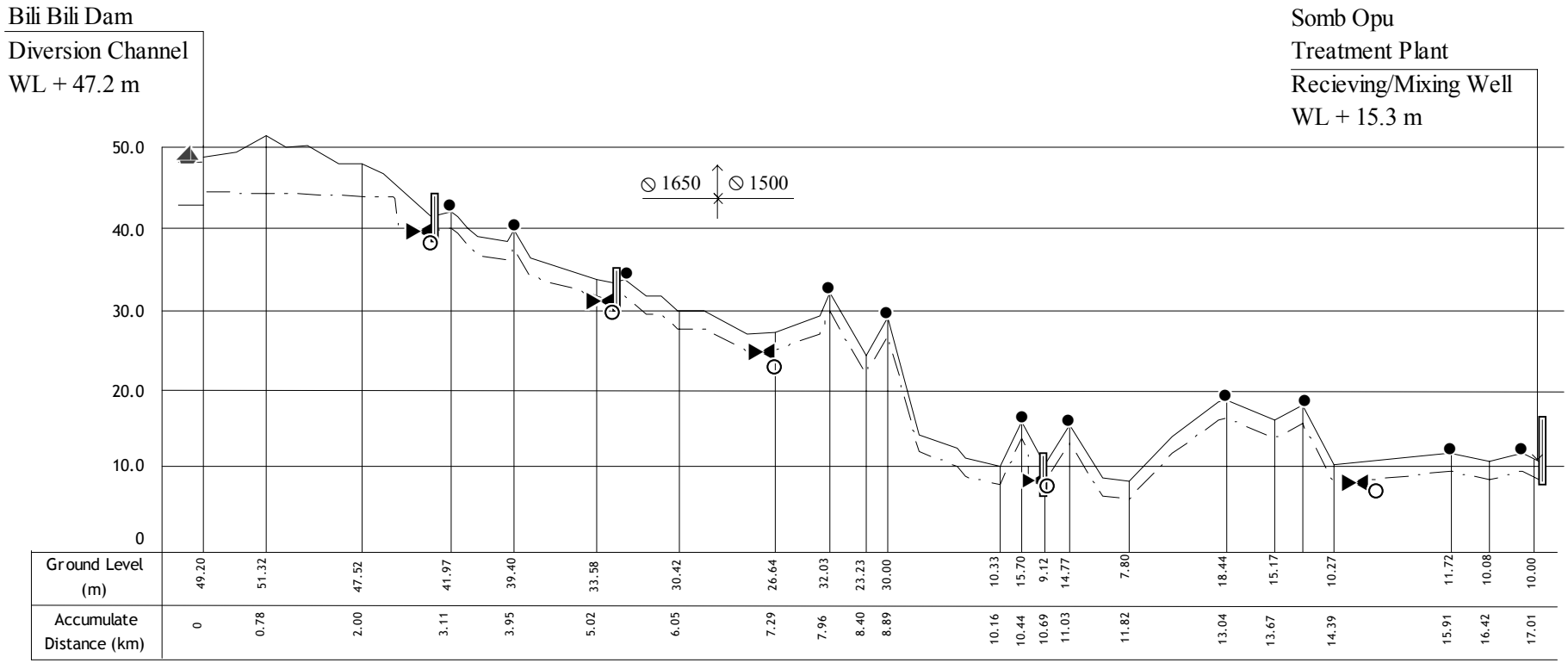


Figure C5.1 Schematic Overall Plan of RWTM Project and Related Projects



P R O F I L E

Legend

- Division Valve
- Blow Off
- Air Valve

Figure C5.2 Profile of RWTM Pipeline

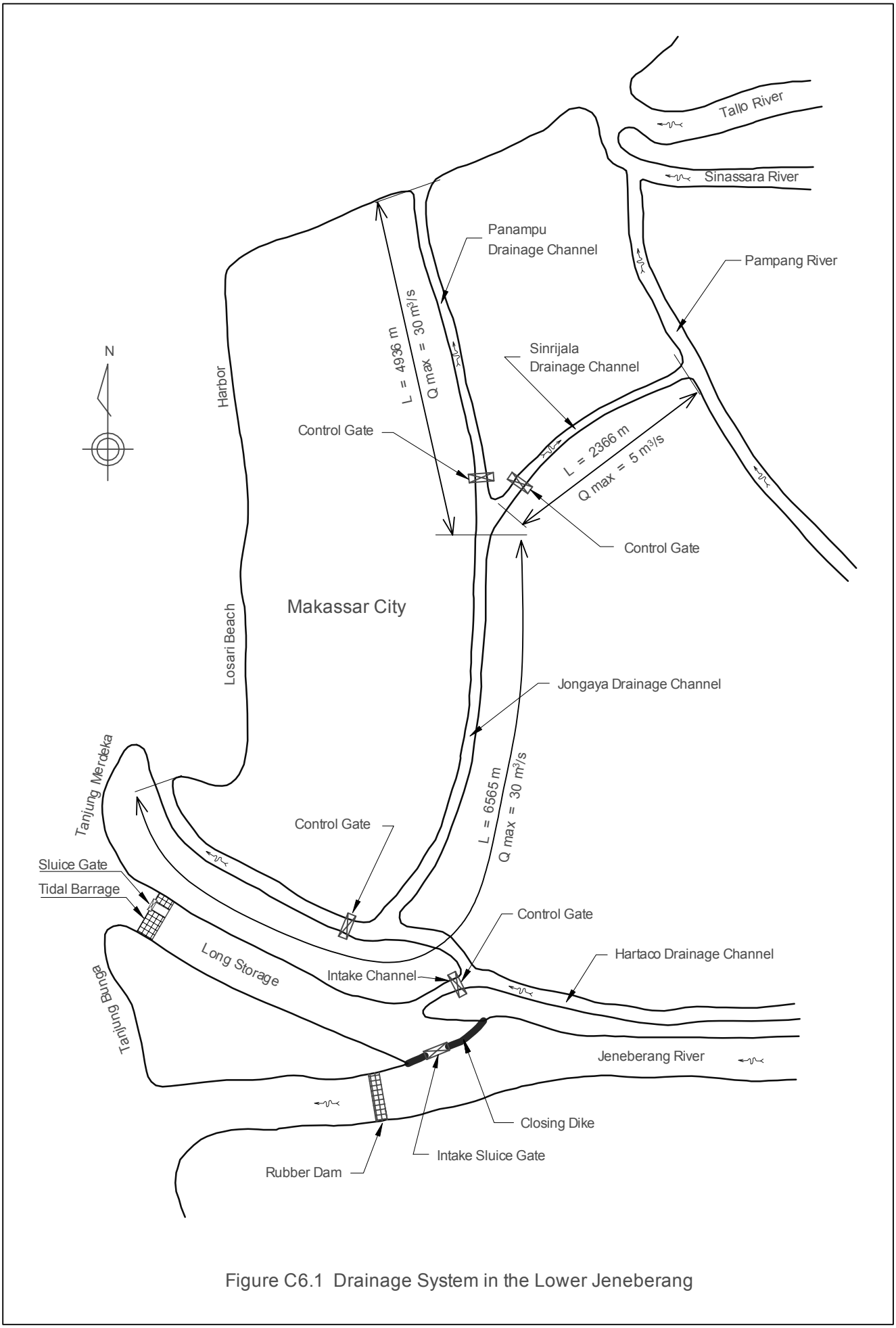


Figure C6.1 Drainage System in the Lower Jeneberang