SUMMARY

INTRODUCTION

1. Study Background: After the economic crisis in 1997, the Indonesian Government moved to redraw its development strategy, and the Five-Year National Development Program (PROPENAS 2000-2004) was prepared focusing on globalization and decentralization. In the process of decentralization, South Sumatra Province and each District/City are requested to establish master plans in various fields and to promote the regional development plan. Among these plans, the establishment of a master plan of comprehensive water management in the Musi River Basin is deemed urgent.

2. With the above background and upon request of the Government of Indonesia, JICA dispatched a Study Team on August 5, 2002. The **study objectives** are: to prepare a Master Plan of Comprehensive Water Management of the Musi River Basin; and, to transfer technology to counterpart personnel in the course of the Study.

POLICY BACKGROUND FOR BASIN WATER MANAGEMENT

National and Regional Development Plans

3. In the Second Twenty-Five Year Long Term Plan (**PJP II**, 1994-2019), Indonesia aims to enter "the take-off stage". In the water sector, PJP II emphasizes sustainable development, more effective and efficient management of water resources in an integrated manner, and greater attention is placed on sustaining self-sufficiency in rice and on the O&M of water resources infrastructure.

4. In 1999, the new Government administration moved to redraw its development strategy, articulated by the General Guideline for National Development, 1999-2004 (**GBHN**). Based on the GBHN, the Five-Year National Development Program (**PROPENAS**, 2000-2004) was presented. The program for development and management of water resources in PROPENAS includes concrete activities for the water resources sector reform under the strategy given in GBHN.

5. Strategic Planning of Regional Development of South Sumatra Province, 2000-2004 directs regional government policy for the welfare of the people concentrating on environmental continuity and future sustainable development. Almost all the regional development plans include as common understanding; development of human resources, balanced development for environmental conservation and sustainable development, development of basic infrastructure for isolated areas.

Basic Laws

6. The New Autonomy Law (**Law No. 22** of 1999) and the Government Regulation on Fiscal Balance (**Gov. Reg. No. 25** of 1999) are the basic laws for the achievement of the directions given in GBHN and PROPENAS. In the water sector, the **New Water**

Resources Law, which amends Law No. 11 of 1974, is presently waiting for approval by national assembly.

WATSAL and Related Projects

7. Water Resources Sector Adjustment Loan (**WATSAL**) is a World Bank loan for the balance of payments assistance and to support the Sector Reform Program. The Sector Reform Program has four major objectives: (1) to improve the national institutional framework for water resources development and management; (2) to improve the organizational and financial framework for river basin management; (3) to improve regional water quality management regulatory institutions and implementation; and, (4) to improve irrigation management policy, institutions and regulations. The **present Study** is the realization of sub-objective 2.1 Improvement of Provincial Regulatory Management of River Basins and Aquifers.

8. Java Irrigation Improvement & Water Management Project (**JIWMP**) is a WB loan project, undertaken since 1999, to pilot the reforms raised in WATSAP (program formulated by WATSAL). The Indonesian Water Resources and Irrigation Reform Implementation Program (**IWIRIP**) is a Dutch Grant WB project for FY2001-2003 to pilot water resources and irrigation sector reforms based on the WATSAL program. Water Resources and Irrigation Sector Management Program (**WISMP**) will start in 2004 as a program after IWIRIP.

Leading Actors in Water Sector for Musi River Basin

9. Since the Musi River Basin stretches over several districts and municipalities, the Provincial Government is responsible for management. The Water Resources Service (**Dinas PU Pengairan**) is an Implementation Element of the Provincial Government in the field of water resources management led by the Head of Service.

10. The Water Resources Management Unit for Musi River Basin (**Musi Balai PSDA**) has been established also upon request of WATSAP in March 2002 as a technical implementation office under Dinas PU Pengairan. Major tasks are those for management, operation and maintenance of the Musi River Basin.

PRESENT CONDITIONS IN THE BASIN

General Natural Conditions

11. The **meteorological conditions** in the Study Area are affected by tropical monsoons. Mean annual rainfall varies between less than 2,000 mm in the coastal plain and 3,500 mm in the eastern foot of the Barisan Range. The rainy season is usually from October to April, and the dry season in the rest of the year. Mean daily temperature shows less seasonal variation around 28°C with a mean minimum of about 20°C and a mean maximum of 35°C at altitudes lower than 150m from mean sea level. Relative humidity is high throughout the year between 60% and 90%.

12. The lower Musi River, downstream stretches from the confluence of the Komering River, has an **average flow** of about 2,500 m^3/s with fluctuations in dry and rainy seasons between 1,400 and 4,200 m^3/s. Normally, the flow of the Musi River and its tributaries has higher and lower peaks in between February and March, and July and September, respectively.

Socioeconomic Conditions

13. South Sumatra Province is composed of seven **Regencies** (Musi Banyuasin (new), Banyuasin, Muara Enim, Lahat, Musi Rawas, Ogan Komering Ilir: OKI, and Ogan Komering Ulu: OKU) and four **Municipalities** (Palembang, Perabumulih, Pagaralam, and Lubuk Linggau). In this report, "Musi Banyuasin" implies the old Kabupaten, and "Musi Banyuasin (new)" implies the new Kabupaten.

14. Total **population** of the Musi River Basin as of 2002 is estimated at 6,338,000. It shares approximately 3% of the total population of the nation. **GRDP** of South Sumatra Province in 2001 was Rp.45,383 billion (approx. US$4.4 billion) and shared 3.0% of the national GDP. The per capita GRDP in the same year was Rp.6.5 million (approx. US$630) that is 8.4% lower than that of the nation. Per capita GRDP of South Sumatra Province without oil/gas was Rp.4.3 million (US$417), 30% lower than that of the nation at Rp.6.1 million (US$594).

15. Socioeconomic framework plan for the target year 2020 has been set. Population of South Sumatra Province as of 2020 is estimated at 9,840,000 against that at 7,146,000 in 2002. Economic growth target in the moderate growth scenario in agriculture is set at 3.4%, with mining at 1.9%, manufacturing at 2.8%, services at 5.0%, total at 3.9%.

Land Use and Watershed Management

16. Comparison of the **land use** in 1980 and that in 2000 revealed a large decrease in the natural forest area from 19% in 1980 to 7% in 2000. Conversely, areas for other agricultural land, sort of rice field, mixed garden, and agriculture plantation has increased.

17. The total **forest** area in South Sumatra Province was 43,721 km^2 in 1980, consisting of 11,826 km^2 of protection forests and 31,895 km^2 of production forest. The current forest interpreted from Landsat TM satellite image in 2000 is only 14,141 km^2. Most of the reduction is of illegal logging. The Government of South Sumatra Province made a forest land use plan in 1999 for expanding forest estate area. The plan includes expansion of the forest area from 14,141 km^2 to 35,440 km^2 within 15 years.

Natural Environment

18. There are 65 production **forests** in South Sumatra Province. Based on the national policy to rehabilitate tropical forests in the country, all logging concessions should have been stopped operations by 2002 until further announcement. Legally, therefore, there

should not be log production from the production forests anymore. The Reforestation Fund consists of money collected from concessionaries by the Ministry of Forestry. Replanting after logging is not executed properly at many concession areas.

19. Existing and potential **issues in natural environment conservation** are identified as follows: Existing threats from activities in forestry, estate, and agriculture to natural environment and water resources are: expansion of wasteland and erosion; poor species diversity in forestry, estate and agriculture; and forest fire and haze. The goal of sustainable nature conservation is to protect and conserve the whole set of regional ecosystem in a healthy, reproductive condition.

Water Quality

20. Present water quality data are available mainly at BAPEDALDA. BOD and COD concentrations are generally low and the level of organic pollution in the Musi River Basin is judged low. Solid contents (TSS) in some sections are particularly high. DO concentrations are generally moderate. Fecal coliform exceeding the drinking water standards is found. Very low pH values are detected in the small rivers that originate in peat swamps. Pesticides are detected though under the standard. Average values of toxic substances, e.g., heavy metals, cyanide, phenols, were within the standard quality. Salinity levels in the lowland area reach unacceptable levels for agriculture after a prolonged dry season.

Social Environment

21. Questionnaire survey was conducted to identify issues on social environment. Rivers are very important to people's daily life since the river is the source of water for drinking and washing almost everyday by the majority of people (68% and 63% in total respectively). In addition, more than 45% say they use rivers for defecation. Usage of rivers other than drinking and washing vary among areas.

22. Conservation and sustainable use of forest ecosystem and forest biodiversity are critical components to alleviate poverty and support sustainable development. Encroachment (invasion of forest areas by people farming lands without concession) and illegal logging (log cutting for the purpose of marketing wood products without receiving concession) are the most emergent threat to the forest ecosystem.

23. Conflicts in water use between rice fields and fishponds are identified in the Basin. A water users association (WUA) is considered less functional. **Development and conservation in swamp** require a long time period. Needed are: inter-agency coordination in lowland management, and community involvement in project planning and implementation. **Drought** problem is distinguished in the lower Komering River Basin.

Hydrological Analysis

24. As a **hydrological monitoring network**, the number of the rainfall gaging stations in the Basin including those under BMG is deemed sufficient for the practice of river basin management. Present issues on rainfall observation are the necessity of proper observation at these stations, proper storage of observed data, and data exchange between the related agencies. Water level and discharge measurement stations should be installed in tributaries where measurement is presently not conducted.

River Conditions, Flooding and Inundation

25. In the Musi River Basin, **flush floods** and debris flow occur in the upstream reaches. Areas flooded by the Musi River and tributaries in the middle reaches are generally of natural retarding, and in these areas, people live following the river regime. **Bank erosion** is commonly found in the middle reaches. Palembang is located along the Musi River at approximately 85km from the sea, and to mitigate the **inundation**, improvement works, e.g., channel improvement and construction of detention ponds, have been carried out. Inundation is, however, still a problem when heavy rain occurs.

26. As structural **measures**, river training works have been constructed in many locations to protect riverbanks from erosion. Non-structural measures introduced by the local people include stilt houses, wooden approach paths, use of boats, etc.

Water Use

27. Domestic water supply systems are presently operated and maintained by regional PDAMs using collected water charges. Service ratio is low at 31% in Palembang, and rather low in districts as 9% in Muara Enim to 1% in Musi Banyuasin (old). Per capita daily use ranges from 210 liter/person/day in Palembang to 91 in Lahat. **Industrial water** demand in 2001 is estimated at 365 million m^3/year. The demand for **mining water** use in 2001 is estimated at 115 million m^3/year. There are many tourist sites and **tourism water** use could be defined as water used by tourists.

28. Irrigation systems are classified into four categories: technical, semi-technical, simple and communal. In 2000, the total harvested irrigation area in South Sumatra Province was 77,804 ha, consisting of 60,079 ha for two-cropping paddy and 17,725 ha for one-cropping paddy. Harvested swamp areas in South Sumatra Province in 2000 are 267,497 ha, consisting of 9,039 ha for two-cropping paddy and 258,458 ha for one-cropping paddy. Present **irrigation water** demand and **swamp area** demand are estimated at 2,757.6 and 920.3 million m^3/year, respectively. Water demand for **aquaculture** in 2001 is estimated at 504 million m^3/year.

29. Large-scale hydropower use in the Basin is only the Musi Hydropower Station. It is scheduled to start operation in 2005. The catchment area is 587 km^2. Musi Hydropower Station is consumptive use type because it drains water outside of the Musi River Basin. Consumptive use of the station is estimated at 897 million m^3/year starting from 2006.

30. Present water demand in each sector was estimated in million m^3/year, as shown in the table below with the share in the total amount. As shown in the table, irrigation and swamp water shares almost 80% of the total consumptive water use in the Basin.

Sector	Present	
Domestic	93.6	(2.0%)
Industrial	364.7	(7.7%)
Mining	115.4	(2.4%)
Irrigation	2,757.6	(57.8%)
Swamp	920.3	(19.3%)
Aquaculture	504.0	(10.6%)
Tourism	0.15	(0.0%)
Livestock	14.9	(0.2%)
Hydropower	0.0	(0.0%)
Total	4,770.7	(100.0%)

Inland Waterway Transportation

31. The Musi River and eight major tributaries are used for **inland waterway** transportation. As reported, the total navigable stretch is 1,880 km out of the total river stretch of 2,630 km. Inland waterway for large vessels is in the downstream stretches from around Palembang. In other stretches, relatively smaller boats use rivers. Palembang Port is on the left bank of the Musi River and is one of the first class river ports/harbors in Indonesia. **Maintenance dredging** is basically conducted every year in the Musi River. Annual dredging volume is generally about two to three million cubic meters with the cost at Rp.6.7 billion in 1997/98.

Organization, Institution and Legal System

32. Directorate General of Water Resources (DGWR), Ministry of Settlement and Regional Infrastructure: KIMPRASWIL is responsible for water resources development and management on the national level. Besides Dinas PU Pengairan and Musi Balai PSDA, various **organizations** relate to the water management of the Basin, namely Provincial Forestry Service, BAPPEDA of South Sumatra Province, Settlement and Regional Infrastructure Service of Districts and Municipalities, Provincial Mining Service, Provincial BAPEDALDA, and others.

33. Laws and regulations on water management can be divided into two; namely, water resources, and spatial and environmental management. The basic and encompassing law on the former is Law No. 11/1974 (UU11/74: Water Resources), whose revision is now under discussion in the government. Among the various regulations, new Government Regulation on Water Resources Management (Draft) is very important for the water management in the Basin.

34. Expenditures of South Sumatra Province are divided into two: routine expenditure (salaries, etc.) and development expenditure (projects implementation). Source of the development expenditure consists of both local budget (APBD) and the central government funds (APBN). Actual expenditure of South Sumatra Province in

2001 was Rp.1,275 billion (approx. US$124 million). Of this, total development expenditure was Rp.919 billion, 72% of the total. Actual expenditure for water resources and irrigation in 2001 was Rp.89.4 billion, 10% of the development expenditure. Of this, 13% (Rp.11.7 billion) was from APBD and 87% was from APBN. The local budget for water resources and irrigation is constant, between Rp.10 to 15 billion.

35. As for the FY2002 **development budget of Regency/Municipality** in South Sumatra Province, that of MUBA is the largest at Rp.293 billion (US$32.5 million) while that of OKU is the smallest at Rp.40 billion. The budgets for water resources and irrigation sector of the regencies are between Rp.0.8 to 10.8 billion, or the shares in the development budget are at 2% to 7%. The budget seems small, but it is because the works for large-scale infrastructure has been implemented by APBN.

Database System Established in the Study

36. Existing Geographical Information Systems (GIS) in South Sumatra Province consists of the BAPPEDA GIS Database and the Forest GIS Database. Other than GIS, the Regional Management Information System (MIS) is being established in South Sumatra Province. **GIS database** has been established in the study for the use of future management of the basin. The 1/250,000 scale GIS data have been collected from the Forest Department and BAPPEDA. They include administration information on roads, water bodies, river villages, catchment information; land use; spatial planning; forest planning, etc. The 1/50,000 topographic data are also included in the database.

ISSUES ON WATER MANAGEMENT

37. Public Consultation Meetings (PCM) were held as a bottom up process for the master plan formulation. Pre-PCM was held for three times in the course of the field reconnaissance. Each Pre-PCM was held at a representative city in the basin; at Sekayu in lower area, at Muara Enim in middle area, and at Lubuk Linggau in upper area. PCM (1) was held in Palembang to conduct cause-effect analysis and objective tree development based on the results of Pre-PCM. PCM (2) was held to conduct alternative analysis on the draft master plan.

38. Issues on water management identified through field investigation, interview, review of existing reports, PCMs, etc. can comprehensively be summarized as follows: Water Use: Lack of water; Deficit in water balance in the future; Water imbalance by tributary; Sectorwise conflict; Navigation trouble due to sedimentation. Environment: Water quality deterioration (urban and rural areas); Devastation of watershed; Severe life condition in migration sites in tidal swamp. Flood: Deterioration of river regime (extreme draught); Bank erosion and sedimentation; Flush flood damage; Rain inundation in urban areas. Institution: Improper information dissemination; Lack of guidelines for law enforcement; Lack of capacity in human resources; Lack of coordination between organizations.

RELATED PROJECTS AND PROGRAMS

39. The Study Team confirmed what is needed in the future after checking the **projects and programs** already implemented, ongoing, or scheduled against the issues identified. They are: Programs for whole basin and for multi-sector are needed; Management of spatial irrigation and swamp development in view of land and water resources availability is needed; Necessity of watershed management for fundamental solution of various basin's problems; There is a necessity of paying much attention to environmental improvement; Monitoring of data and information is needed for the management; and, Continuous effort of institutional improvement in line with the direction of WATSAP and New Government Regulation on Water Resources are needed.

SKELETON OF THE COMPREHENSIVE WATER MANAGEMENT MASTER PLAN

40. The **policy** for the formulation of the Master Plan is as follows: Proper management of water and the river basin is urgent in the Musi River Basin for the sustainable development of South Sumatra Province. This Master Plan is to show principles and an overall direction for water management in the Musi River Basin. Attention has been paid that the Master Plan should focus on what is important, what is urgent, what is comprehensive in the Basin. "Comprehensive" includes: Issues for the whole Musi River Basin; Issues relating to multiple sectors, e.g. water quality and water supply, watershed devastation and water quality; Issues of conflict between sectors or users.

41. **Prerequisite** for the master plan formulation has been set as follows: National Background and Regional Development Target has been referred to PJP II, GBHN, PROPENAS, and regional development strategies. Target Year for the master plan formulation was set at 2020.

42. As **Socioeconomic Framework to the Target Year**, population is projected in ×1,000 persons as follows (percentage in parenthesis is annual increase rate):

Year	2002	2005	2010	2020
Total	7,146 (2.1%)	7,565 (1.9%)	8,344 (2.0%)	9,840 (1.7%)

GRDP is projected as a moderate growth scenario as follows:

	Actual GRDP in 2000	GRDP in 2020	Growth 2000-2020
Total	Rp. 25,890 billion	Rp. 55,883 billion	3.9 %/year

43. Super Goal for Comprehensive Water Management of the Musi River Basin has been set as: Increase the physical and mental happiness of people through the proper management of the river basin; Maintain sustainable development with conservation of environment; and Realize equitable, balanced and sustainable regional development in the whole basin.

44. Master Plan Components were formulated focusing on what should be started now as presented in **Figure S-1**.

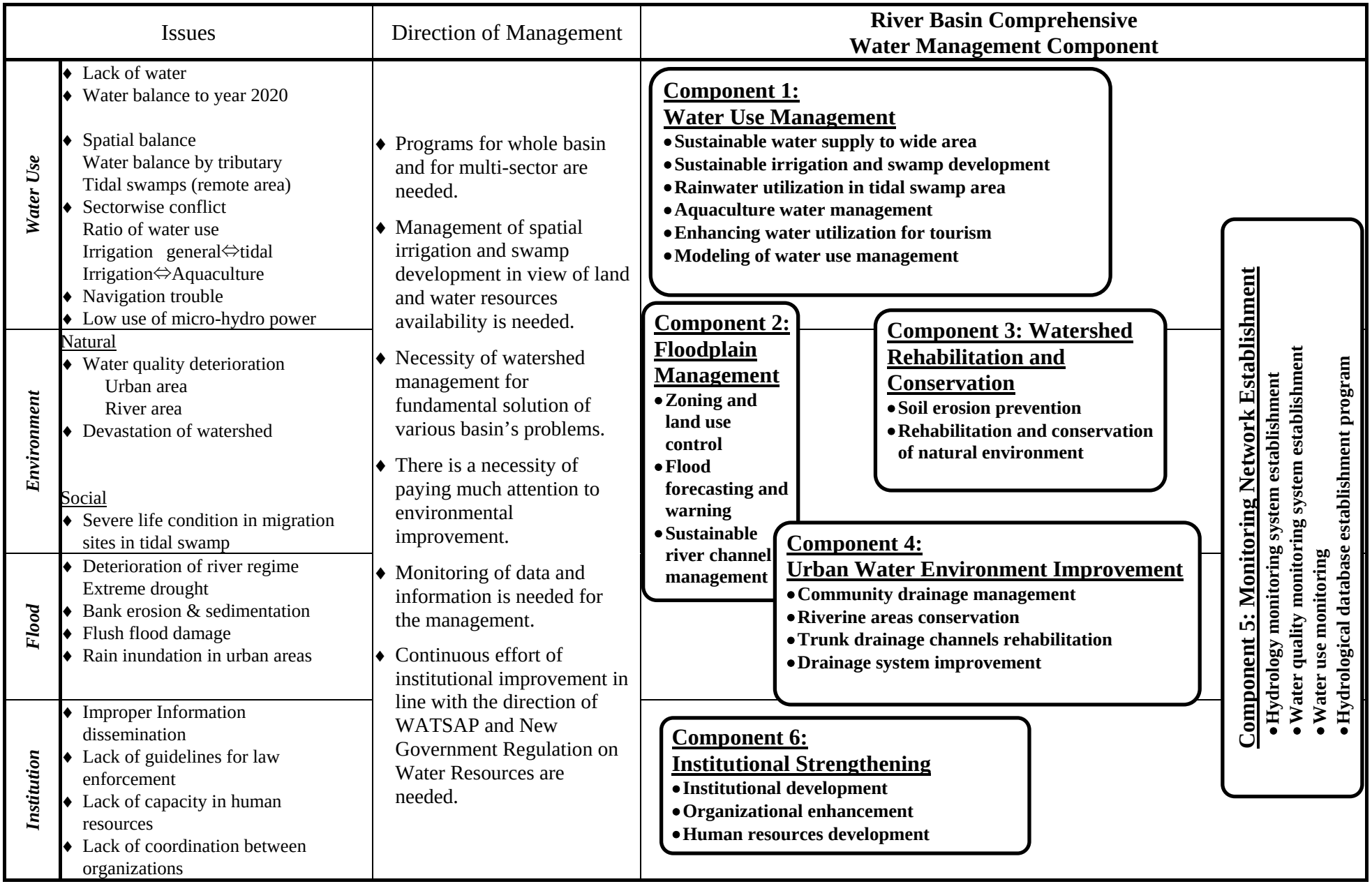

Figure S-1 Master Plan Components

PROGRAMS BY COMPONENT

45. Component 1: Water Use Management: For the water use management in the Musi River Basin, attention should be paid to the Provincial direction saying that the water resources should always be protected, conserved and maintained by realizing comprehensive management that ensures sustainable development, and one of the goals of water resources development is to support stabilization of the rice self-reliance. Considering the identified issues, provincial strategies and super goal, the following objectives of the water use management are identified: (i) promote water utilization for basic human needs; (ii) promotion of water utilization for sustainable development; and, (iii) development of water management system.

- Program 1-1: Sustainable Water Supply to Wide Area: Each PDAM formulates sustainable water supply plan for the future expansion of the water supply system with bottom-up approach based on Demand-Response Approach.
- **Program 1-2**: Sustainable Irrigation and Swamp Development: Based on the identified potential irrigation and swamp development areas, development target should firstly be established giving self-reliance target. Pre-F/S, F/S and D/D shall follow to achieve the targeted development.
- **Program 1-3**: Rainwater Utilization in Tidal Swamp Area: The program is to improve living environment in the remote tidal swamp areas where water for basic human needs is lacking.
- **Program 1-4**: Aquaculture Water Management: Redistribution of fishponds and irrigated paddy field.
- Program 1-5: Enhancing Water Utilization for Tourism: Enhance water utilization in tourism sector for balanced and sustainable regional development.
- **Program 1-6**: Modeling of Water Use Management: Water use management model shall be used for testing development scenarios and leading statements of the environmental impacts. Information and Knowledge Base with Basin and Environmental Modeling, and Impact Assessment Tools.

Note: Program Numbers in bold characters are priority programs.

46. Component 2: Floodplain Management: In the rainy season, the Musi River flows down in the wide floodplains along the Musi mainstream and major tributaries in the middle and downstream areas. Floodplains are important for the water resources because they serve for flood and erosion control, help maintain high water quality, and contribute to sustaining groundwater supplies. The water holding capacity including those by the natural retarding in the middle and lower reaches should be maintained in order to preserve water resources in the Basin. The other issues of floodplain

management in the Musi River Basin include those for flush floods in the mountainous areas and riverbank erosion in the Musi mainstream and major tributaries.

- **Program 2-1**: Zoning and Land Use Control: There exist laws and regulations to control activities in the floodplain areas, thus the zoning of the floodplain areas is deemed urgent.
- Program 2-2: Flood Forecasting and Warning: The objective is to reduce damages by flush floods in the mountain areas.
- Program 2-3: Sustainable River Channel Management: Maintenance of river channel shall be carried out under the present system continuously. In addition, local regulation concept of river corridor management should be prepared.

Note: Program Numbers in bold characters are priority programs.

47. Component 3: Watershed Rehabilitation and Conservation: The Study Team concluded that the devastation of the forests is in the critical status in the Musi River Basin. Programs for Soil Erosion Prevention, and Rehabilitation and Conservation of Natural Environment were proposed. As actions against soil erosion, the Plan proposes three measures: **1)** reforestation on land with major constraints for agriculture development (Program 3-1 to 3-3), **2)** law enforcement on production forest and logging in general (Program 3-4 and 3-5), and **3)** inner- and inter-basin coordination of policies and projects (Program 3-6). For healthier, sustainable natural environment in the future, the Plan also proposes additional three measures: **4)** forest area increase (Program 3-7 and 3-8), **5)** conservation of river environment (Program 3-9), and **6)** conservation of swamp and mangrove forest (Program 3-10 to 3-12).

- **Program 3-1**: Application of Agroforestry on Land with Major Constraints: To reduce erosion in farmer's plantation area that shares 80% of the erosion constraints area of 3,400 km^2.
- Program 3-2: Land Use Regulation on Land with Major Constraints:
- **Program 3-3**: Strengthening of Agriculture/Estate/Forestry Extensions
- **Program 3-4**: Reforestation of Production Forest: Force relevant enterprises to replant in the logged production forest in case the reforestation fund has been paid already.
- Program 3-5: Enforcement of Prevention of Illegal Logging
- **Program 3-6**: Inner- and Inter-Basin Coordination:
- **Program 3-7**: Rehabilitation of Existing Protected Forests
- Program 3-8: Increase in the Area of Designated Protected Forests
- Program 3-9: Management of River Environment

- Program 3-10: Conservation of Tidal Swamp Forests
- Program 3-11: Collection of Basic Data for Mangrove Area around the Proposed New Port
- Program 3-12: Conservation of Freshwater Swamp Area

Note: Program Numbers in bold characters are priority programs.

48. Component 4: Urban Water Environment Improvement: Urban areas scattered in the Musi River Basin have various living environment problems. Especially, deterioration of water environment in the urban areas is one of the major issues for the comprehensive water management. This problem is distinguished and serious in Palembang whose population is approximately 1.5 million and shares nearly one fourth of the basin's population of 6.3 million. Basin wide water quality condition is not a very critical condition except in some limited locations. The monitoring system should be established firstly and the water quality data should be accumulated before the basin wide water quality control issue is discussed. Proposed programs are as follows:

- **Program 4-1**: Community Drainage Management: The objective is to realize better water environment in the community level. Involvement of local community as a driving force is important.
- Program 4-2: Riverine Areas Conservation: The objective is to conserve the river function to avoid inundation in the urban areas.
- **Program 4-3**: Trunk Drainage Channels Rehabilitation: The program is to establish a maintenance and rehabilitation system in Dinas PUP Palembang, which is a basis for the construction of new drainage structures.
- Program 4-4: Drainage System Improvement: This is to raise the capacity of drainage system in Bendung and Buah Drainage systems.

Note: Program Numbers in bold characters are priority programs.

49. Component 5: Monitoring Network Establishment: Monitoring is a basic work for the collection and accumulation of necessary data and information for the basin water management. Without such data and information, no study can be conducted, and no evaluation for implemented projects can be carried out. Data observation should be steady, continuous, and for a long period. Data storage should be systematic, accurate, and easy to maintain. A system for the effective use of data should be maintained properly and should be open to users. Through the review of the existing systems, it is confirmed that coordination between relevant agencies are strongly needed under the leadership of Musi Balai PSDA (Dinas PU Pengairan), and improvement and construction of facilities are also proposed. Proposed programs are as follows:

- **Program 5-1**: Hydrological Monitoring System Establishment: Coordination with BMG for the rainfall data sharing is important. Monitoring facilities should be improved.

- **Program 5-2**: Water Quality Monitoring System Establishment: Leading agency should be Musi Balai PSDA, and coordination with BAPEDALDA is indispensable.
- Program 5-3: Water Use Monitoring: It should be linked to water exploitation licensing under the new regulation.
- **Program 5-4**: Hydrological Database Establishment: Water Resources Data and Information Unit (Program 6-5-1) should be responsible for this program.

Note: Program Numbers in bold characters are priority programs.

50. Component 6: Institutional Strengthening: Objectives of this component are to establish and/or enhance necessary organizational and institutional mechanism as well as human resources capability that are important keys to certain and firm implementation of the whole Master Plan. New Water Resources Law (Draft) shows the new policy of water resources management while New Government Regulation on Water Resources Management (Draft) stipulates more detailed provisions on systems and procedures for water resources management in the reformed stage as well as ethical codes. They are the basis of the institutional strengthening programming.

Program 6-1: Introduction of Incentive Mechanism

- Program 6-1-1: Personnel Management with Incentive Mechanism

Program 6-2: Program of Transparency with Public Relations

- Program 6-2-1: Annual Report on Water Resources Management
- Program 6-2-2: Publishing Picture Booklet on Water Resources Management
- **Program 6-2-3**: Official Web Site of Water Resources Management

Program 6-3: Promotion of Participation with Public Consultation

- Program 6-3-1: Making Guideline of Public Consultation for Water Resources Management

Program 6-4: Establishment of Disclosure System

- Program 6-4-1: Establishment of Disclosure System for Water Resources Management

Program 6-5: Organizational Enhancement

- **Program 6-5-1**: Establishment of Water Resources Data and Information Unit in Balai PSDA
- Program 6-5-2: Enhance the Function of Finance Section in Balai PSDA
- **Program 6-5-3**: Activation of PTPA/PPTPA

- Program 6-5-4: Increase in revenue of WUA by increase in income of members by enhancing extension activities
- Program 6-5-5: Establishment of Coordinating Network for daily works

Program 6-6: Human Resources Development

- **Program 6-6-1**: Training for Operating Techniques for Government Employees of Balai PSDA
- **Program 6-6-2**: Training for Management and Planning for Related Government Employees
- **Program 6-6-3**: Training for Operation & Maintenance of Irrigation System
- **Program 6-6-4**: Joint Training with NGOs to informal leaders and selected people

Note: Program Numbers in bold characters are priority programs.

IMPLEMENTATION PLAN AND COST ESTIMATES

51. Since a lot of input of fund and human resources is necessary for the implementation of the proposed programs, priority of each program should be judged, and the implementation plan in accordance with the priority has been prepared. Priority has been decided based on the following factors and selected priority programs are shown in bold characters in the pervious paragraphs: prerequisite to the other programs; degree of seriousness; requirement of an early start; and other factors.

52. Implementation schedule of the priority projects is in **Figure S-2**:

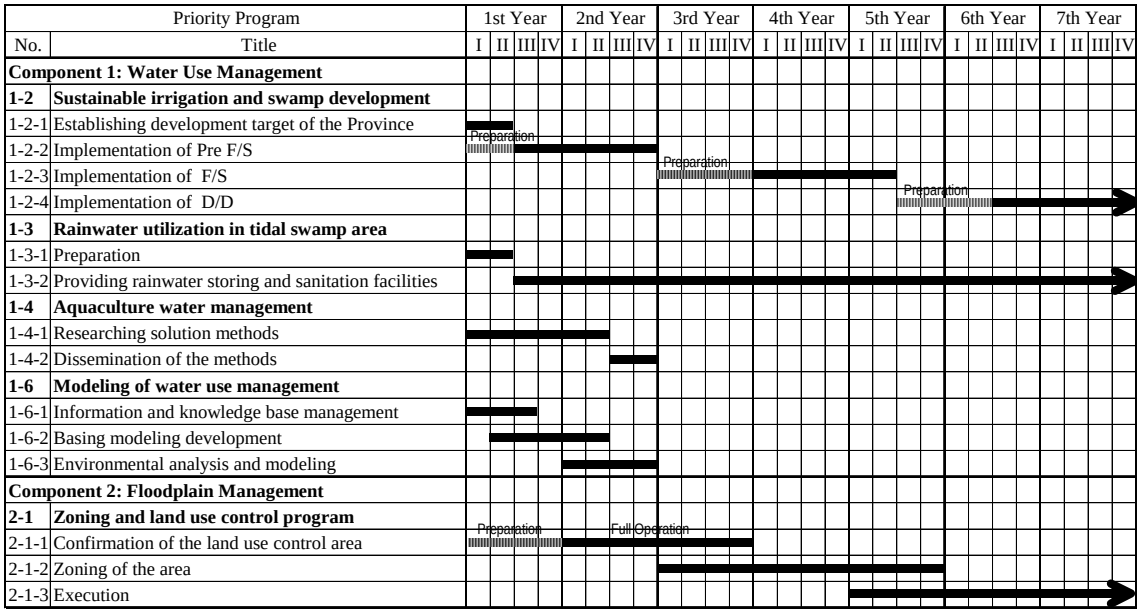

Figure S-2 (1/2) Implementation Schedule for Priority Programs

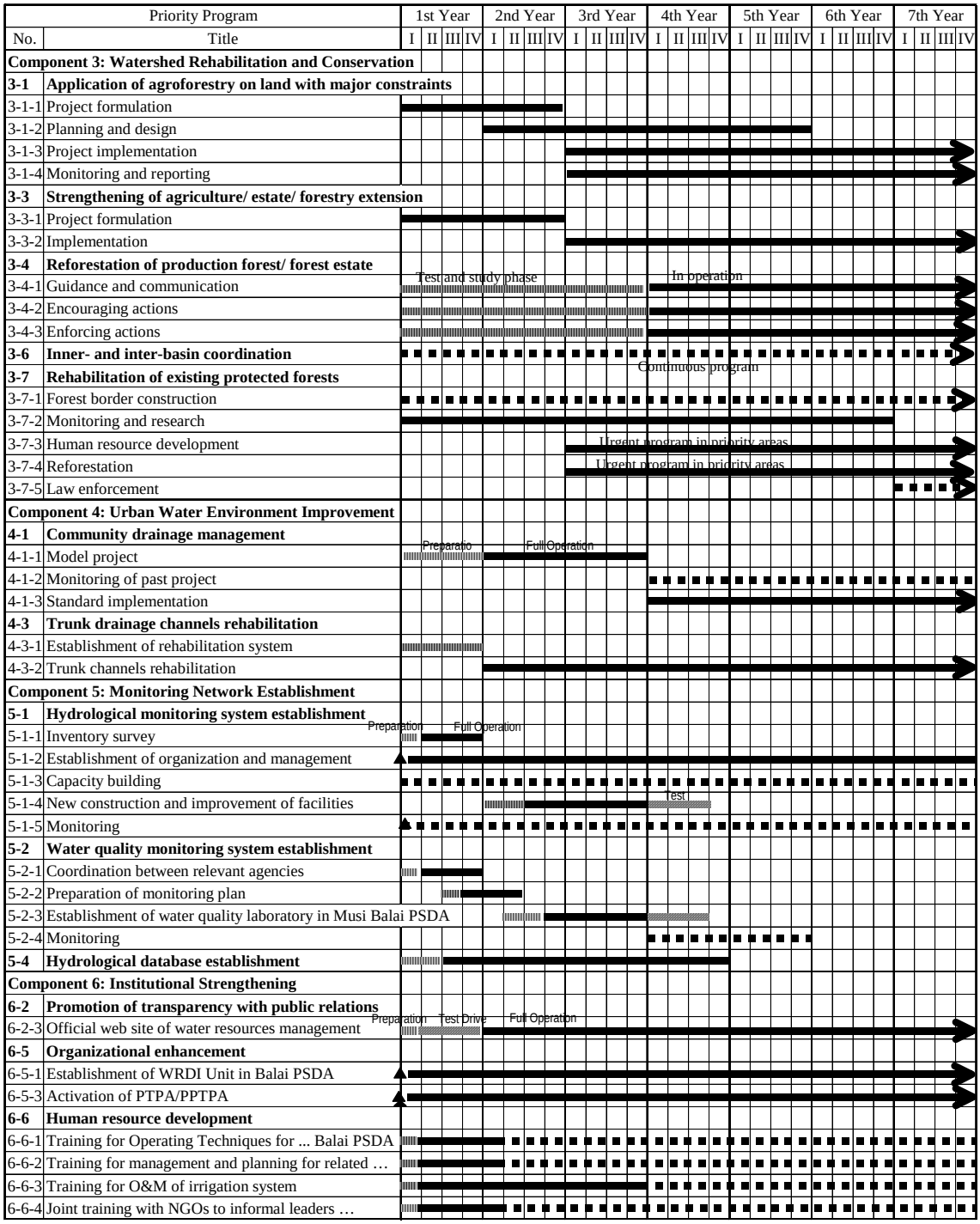

Figure S-2 (2/2) Implementation Schedule for Priority Programs

53. Among others, tasks of the key organizations are summarized as follows: Governor of South Sumatra Province is responsible for Musi River Basin comprehensive water management; PTPA shall make recommendation to the Governor on matters declared in the New Government Regulation on Water Resources; BAPPEDA conducts overall coordination for the implementation of the water management; Dinas PU Pengairan acts as a leading organization for the implementation of water management; Musi Balai PSDA acts as the operator for the water management;

Forest Service acts as a leading organization for the implementation of Component 3; DGWR of Kimpraswil acts as a leading organization for the implementation of national programs.

54. Costs for the implementation of priority programs have been estimated with the annual budget as shown in **Table S-1**.

Table S-1 Annual Budget for Priority Programs

(Unit: Rp. million)

Component and Program		Leading Agency	Year							
			1st	2nd	3rd	4th	5th	6th	7th	after
Component 1: Water Use Management										
1-2	Sustainable irrigation and swamp development	DGWR	664	1,270	0	14,000	7,000	13,650	27,300	40,950
1-3	Rainwater utilization in tidal swamp area	DPUP	19,870	19,870	19,870	19,870	19,870	19870	19,870	59,610
1-4	Aquaculture water management	DPUP	36	37	6	6	6	6	6	→
1-6	Modeling of water use management	DGWR	6,773	6,772	12	12	12	12	12	→
Component 2: Floodplain Management										
2-1	Zoning and land use control program	DPUP		39	39					
Component 3: Watershed Rehabilitation and Conservation										
3-1	Application of agroforestry on land with major constraints	Forest Service	0	539	1,149	1,149	28,389	7,143	7,142	
3-3	Strengthening of agriculture /estate /forestry extension	Forest Service	-	-	1,333	1,333	1,333	1,333	1,331	
3-4	Reforestation of production forest /forest estate	Forest Service	29	29	30					
3-6	Inner- and inter-basin coordination	Governor	-	-	-	-	-	-	-	
3-7	Rehabilitation of existing protected forests	BKSDA	319	319	1,284	1,284	1,209	1,209	7,863	
Component 4: Urban Water Environment Improvement										
4-1	Community drainage management	Palemb.		220	220					
4-3	Trunk drainage channels rehabilitation	Palemb.	3,350	3,350	3,350	3,350	3,350	3,350	3,350	10,050
Component 5: Monitoring Network Establishment										
5-1	Hydrological monitoring system establishment	BPSDA	8005	60098	1,14898	98	98	98	98	→
5-2	Water quality monitoring system establishment	BPSDA		3,042	3,042	291	291	291	291	→
5-4	Hydrological database establishment	BPSDA	100	303	125	125	125	125	125	→
Component 6: Institutional Strengthening										
6-2-3	Official website of water resources management	DPUP	205	72	72	72	72	72	72	→
6-5-1	Establishment of Water Resources Data and Information Unit in Balai PSDA	DPUP	-	-	-	-	-	-		-
6-5-3	Activation of PTPA/PPTPA	Governor	-	-	-	-	-	-		-
6-6-1	Training for operating techniques for government employees of Balai PSDA	DPUP	45							
6-6-2	Training for management and planning for related government employees	DPUP	45							
6-6-3	Training for operation & maintenance of irrigation system	DPUP	242	242	24					
6-6-4	Joint training with NGOs to informal leaders and selected people	DPUP	128							

Note: DPUP: Dinas PU Pengairan of South Sumatra Province; Forest Service: Forest Service of South Sumatra Province; Governor: Governor's Office of South Sumatra Province, BKSDA: Balai KSDA of South Sumatra Province; Palemb.: Dinas Kimpraswil of Kota Palembang, BPSDA: Musi Balai PSDA

PROJECT EVALUATION

55. Water use management modeling needs technical assistance based on experience of practices in water use modeling in Asian monsoon regions. Financially, some projects require input from APBN (from outside, e.g. foreign aid).

TECHNOLOGY TRANSFER

56. Technology transfer has been carried out mainly for the nine counterpart personnel from the Planning Unit, Dinas PU Pengairan, South Sumatra Province. **Targets** to be achieved in the present study were determined at the beginning stage through the interview with the Study Team member and the counterpart.

57. Overall evaluation is as follows: Every party was aware of the importance of the technology transfer. Of the nine counterparts from the Planning Unit, three gained much through on-the-job training, two gained intensive technology transfer, and the remaining four could not attend to the study. Technology transfer on GIS has been conducted intensely and successfully to the nominated two counterparts as well as to the other three engineers attended to the training voluntarily.

CONCLUSION AND RECOMMENDATION

Conclusion

58. The water in the Musi River Basin is used for various purposes, and it is indispensable resources not only for the people live in the Basin but for the whole of the nation. In the Basin, development has progressed without paying much attention to the conservation of the basin, and there exist various problems.

59. The formulated Comprehensive Water Management Plan of the Musi River Basin is composed of six components. Each component consists of concrete programs. Programs that should be given higher priority have been selected as priority programs. Introduction of the formulated management plan through implementation of the priority programs is indispensable for the sustainable development in the Musi River Basin maintaining balance between the development and conservation.

Recommendation

60. Implementation of the priority programs according to the proposed schedule is highly recommended for the introduction of the Comprehensive Water Management Plan to the Musi River Basin. Implementation of the key actions for the start of the management implementation is recommended as follows:

61. It is recommended that **BAPPEDA** of South Sumatra Province would coordinate for the following actions: (i) The proposed Comprehensive Water Management Plan should be legalized in the coming Strategic Plan 2004-2008, South Sumatra Province; and, Provincial Government Decree for the implementation of the proposed master plan should be prepared and adopted.

62. Program 1-6: Modeling of Water Use Management is one of the most urgently needed programs since the Model is the basic tool for the proper water management. The implementation of the program needs a technical assistance from the advanced countries with much experience in basin water management modeling in the Asian monsoon regions. **DGWR** is recommended to start preparation of TOR for the technical assistance.

63. Hydrological and water quality data are needed for the use in the Water Use Management Model as discussed above. Without these data, the model cannot be properly used; hence, close coordination with the water use management modeling is needed. It is recommended that **Musi Balai PSDA** with the coordination of Dinas PU Pengairan start discussion with BMG, BAPEDALDA, PDAMs for the future monitoring network in the Basin, and to prepare TOR to obtain APBN.

64. Floodplain management should be considered as a program in a long span of 50-100 years, but it should be started urgently before uncontrolled developments proceed in the floodplains. It can be said that the action of **Dinas PU Pengairan** greatly influences the future of the Musi River Basin. It is recommended to formulate a responsible group under Dinas PU Pengairan and to start necessary action.

65. Forest Service of South Sumatra Province can start leading action for the programs for watershed rehabilitation and conservation. Establishment of a task force and its activation is deemed urgent. It is also recommended to start discussion with Kimpraswil for the inclusion of the Musi River Basin into "List of Priority River Basins for Reforestation" prepared jointly by Ministry of Forest and Kimpraswil.

66. Dinas Kimpraswil of Palembang Municipality is recommended to start for the program implementation. Selection of NGOs who will be involved in the Community Drainage Management Program is deemed urgent. Proper schemes for the assistance of activities by NGOs should also be considered.

67. Dinas PU Pengairan is recommended to identify the program covered by WISMP. It should be conducted continuously for the progress of the program in the Musi River Basin under the WISMP.