

CHAPTER 7

COMPREHENSIVE WATER MANAGEMENT MASTER PLAN

7.1 Component 1: Water Use Management

7.1.1 Identification of Programs and Objective

PROPENAS 2000-2004 has formulated five development priorities. Of these, closely related to the present master plan is; accelerating economic recovery and strengthening the foundation of sustainable and fair development on the basis of the people's economic system. PROPENAS stipulates that this aim can be realized only with the management of natural resources, which ensures the preservation of the supporting capacity of the environment and the conservation of natural resources. In line with PROPENAS, Strategic Planning of Water Resources Development 2000-2004, Water Resources Service of South Sumatra Province, describes the water resources should always be protected, conserved and maintained by realizing comprehensive management that ensures sustainable development. One of the goals of water resources development is to support stabilization of the rice self-reliance and food security.

Many problems are raised for water use management. According to diagnosis of these problems from the viewpoint of water use management, major issues to be solved are identified, as follows:

- Water Supply to Wide Area
- Necessity of Sustainable Irrigation and Swamp Development
- Water Supply to Transmigration Farmers in Tidal Swamp Area
- Conflict between Aquaculture and Irrigation Water Uses
- Enhancing Water Utilization for Tourism
- Necessity of Water Management Model

Considering the identified issues, provincial strategies and super goal, the following objectives of the water use management are identified as: (1) Promote water utilization for basic human needs; (2) Promotion of water utilization for sustainable development; and, (3) Development of water management system.

7.1.2 Evaluation of Major On-going and In-coming Irrigation Development Projects

Three on-going and in-coming irrigation projects, namely Komerling, Lakitan and Temedak Irrigation Projects, have been evaluated from the viewpoint of water resources development as a basis of water management planning. Using projected 2020 water uses for sectors other than irrigation and swamp as discussed in **Sub-Section 3.9.4**,

water balance analysis has been carried out in order to confirm their 80% dependability, which is the standard method for planning irrigation development in Indonesia. In the dependability confirmation, considerable water deficits (annual deficits more than 10% of annual total irrigation demand) are counted.

In Stage I and Stage II (Phase 1 & 2) of **Komering Irrigation Project**, new irrigation development of 63,058ha (Stage I 20,968ha and Stage II 42,090ha) has been evaluated. As a result, dependability of the development has been estimated at more than 80%, meaning this development is possible from the viewpoint of water resources, by the water supply from Lake Ranau (Effective Capacity: 254 mcm): New irrigation development under Stage III is 57,600ha (13,100ha in South Sumatra Province and 44,500ha in Lampung Province). Water resources for this development are planned with Komering I Dam (120 million m³), Komering II Dam (40 million m³) and Muaradua Dam (150 million m³). A feasibility study is needed to judge the dependability of water with these dams.

New irrigation development (13,950ha) of **Lakitan Irrigation Project** is evaluated, and its dependability has been estimated at more than 80%. New irrigation development (5,000ha) of **Temedak Irrigation Project** has been evaluated under the presence of Musi Hepp with whose dependability at more than 80%.

7.1.3 Potential Irrigation and Swamp Area

Using the potential lands as identified in **Sub-section 3.9.5** and projected 2020 water use, water balance has been checked to estimate the dependability of agricultural development. Potential irrigation and swamp area at each sub-basin has been determined for the 80% dependability.

The potential areas in the Basin are obtained as summarized in **Table 7.1.1**. Consequently, potential area of technical irrigation becomes 137,500ha, which is greater than the land potential for technical irrigation, 70,400ha. This increase comes from the developments of Komering, Lakitan and Temedak Irrigation Projects.

Table 7.1.1 Potential Irrigation and Swamp Area in the Basin

Unit: ha

Irrigation Type	Potential Land	Potential Irrigation and Swamp Area		
		Double Cropping	Single Cropping	Total
Technical	70,400	137,500	0	137,500
Semi Technical	61,500	40,100	0	40,100
Simple	25,000	18,300	0	18,300
Communal	189,200	106,800	0	106,800
Non-tidal	321,700	167,900	62,300	230,200
Tidal	264,000	220,700	43,300	264,000
Total	931,800	691,300	105,600	796,900

Water requirements for the potential irrigation area and potential swamp area have been estimated at 11,668.4 and 7,271.6, respectively in mcm/year with a total of 18,940.0. Based on this water balance, ratio of water use, under potential irrigation and swamp area and other projected 2020 consumptive water uses, is estimated, as follows:

(1) Potential Water Use (mcm/year):	21,760
(2) Water Deficit:	866
(3) Water Use: (1)-(2)	20,894
(4) Potential Surface Water:	73,700
(5) Water Use Ratio: (3)/(4)	28%

7.1.4 Potential Irrigation and Swamp Development and Rice Self-Reliance

Based on the potential and present harvest areas, potential irrigation and swamp development areas in the Basin (as of 2000) are estimated, as follows: The totals for potential development area for irrigation and swamp are estimated at 207,000ha and 376,000ha, respectively

Table 7.1.2 Potential Irrigation and Swamp Development in the Basin

Unit: ha

Irrigation Type		Double Cropping	Single Cropping [#]	Total
Technical	- Potential Area	137,500	0	137,500
	- Present H. Area	25,483+25,589*	357	51,429
	- Potential Dev.	86,428	-179	86,249
Semi Technical	- Potential Area	40,100	0	40,100
	- Present H. Area	10,549	1,859	12,408
	- Potential Dev.	29,551	-930	28,621
Simple	- Potential Area	18,300	0	18,300
	- Present H. Area	11,143	5,234	16,377
	- Potential Dev.	7,157	-2,617	4,540
Communal	- Potential Area	106,800	0	106,800
	- Present H. Area	14,441	10,265	24,706
	- Potential Dev.	92,359	-5,133	87,226
Non-tidal	- Potential Area	167,900	62,300	230,200
	- Present H. Area	2,411	78,111	80,522
	- Potential Dev.	165,489	-7,906	157,583
Tidal	- Potential Area	220,700	43,300	264,000
	- Present H. Area	1,314	44,415	45,729
	- Potential Dev.	219,386	-558	218,828

#) Decrease: evaluated at 50% area, *) Komering Irrigation Project, Stage II, Phase 1

“Study for Formulation of Irrigation Development Program 1993, JICA,” designated South Sumatra Province as a potential food resources area for the rice self-reliance at the national level with large irrigation development targeted follows:

Table 7.1.3 Target Development in South Sumatra by Study for Formulation of Irrigation Development Program,1993 (Unit: ‘000ha)

Development	1994-2003	2004-2018	Total
New Construction	37.4	229.6	267.0
Rehabilitation	1.1	0.0	1.1
Small Scale	37.0	0.0	37.0
Total	75.5	229.6	305.1

Roughly speaking, 300,000ha irrigation development was targeted, and 47,000ha and 20,000ha (equivalent to double cropping) have already been developed by Komering Irrigation Project (Stage I and Phase1 of Stage II) and by communal irrigation

development, respectively. Development remained for the Province is thus 233,000ha. On the other hand, potential irrigation and swamp development areas in the Basin are estimated at 207,000ha and 376,000ha, respectively (Table 7.1.2). Therefore, full irrigation development and some swamp development in the Basin will meet the said target.

Considering land potential outside of the Basin (OKI: 15,000ha of irrigation and 354,000ha of agricultural swamp; MUBA: 305,000ha of agricultural swamp), however, even after realization of this target, there is still large room remained for development in the swamp area and upland area, around 1 million ha and 15,000 ha, respectively. In addition, there remain also rainfed areas.

7.1.5 Sustainable Water Supply to Wide Area

This Sub-Section discusses **Sustainable Water Supply to Wide Area (Program 1-1)**. It has been pointed out in many areas in the world that the supply-led approaches in water supply sector had been financially and operationally unsustainable and, therefore, failed to supply clean water to the poor or rural communities. The same situations have been identified in water supply in rural areas, e.g. village systems, in the Musi River Basin. Thus application of Demand-Responsive Approach has been proposed in the sustainable water supply to wide area.

Objectives of the Sustainable Water Supply to Wide Area (Program 1-1) are: (1) to formulate sustainable water supply plan to wide area; and (2) to promote physical and mental happiness of wider people by the plan.

The program area is the whole Musi River Basin. The executing agency shall be Water Resources Service of South Sumatra Province, and PDAMs. PDAMs shall be responsible for implementation of the formulated plan. Figure 7.1.1 explains how to realize the concept of Demand-Responsive Approach to the activities under the Program:

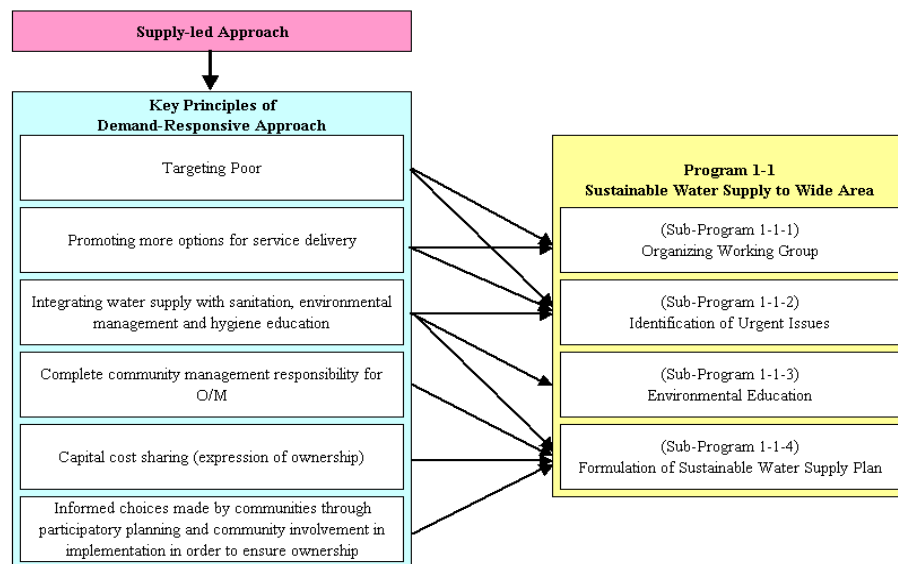


Figure 7.1.1 Demand-Responsive Approach and the proposed Program

Organizing Working Group (Program 1-1-1)

This sub-program includes the activities of Dinas PUP and PDAMs: (1) opening public consultation in each commanding area; (2) increasing understanding of the program approach; and (3) organizing working groups comprising around 10 members each, including representatives of urban poor, rural habitants, NGOs and normal water users.

Identification of Urgent Issues (Program 1-1-2)

This sub-program includes the activities of Dinas PUP, PDAMs and working groups: (1) understanding household water economy (water availability, access, use, direct financial costs, economic and social returns to water use, flexibility in household expenditure, etc.); (2) identifying impacts of changes of water resources and for whom within and between households; (3) understanding relationship between water use and household poverty; and (4) identification of urgent and key issues.

Environmental Education (Program 1-1-3)

This sub-program includes the activities of Dinas PUP, PDAMs and working groups: (1) understanding relationship between water supply, environmental management and public hygiene; and (2) formulating environmental and hygiene education program of how to change a way of life in order to improve their hygiene, etc.

Formulation of Sustainable Water Supply Plan (Program 1-1-4)

This sub-program includes the activities of Dinas PUP, PDAMs and working groups: (1) identifying what intervention benefits which people and what cost; (2) identifying appropriate technological choices; (3) holding public consultation; and (4) formulating sustainable water supply plan to wider people including hygiene education program.

7.1.6 Sustainable Irrigation and Swamp Development

This Sub-Section discusses on **Sustainable Irrigation and Swamp Development (Program 1-2)**. “Study for Formulation of Irrigation Development Program, 1993, JICA” designated South Sumatra Province as a potential food resources area for the rice self-reliance at the national level, giving 120% of the self-reliance rate of Zone 2 (South Sumatra, Jambi, Bengkulu and Lampung) and about 300,000ha of irrigation development in South Sumatra Province until 2018. The provincial goals of water resources development include supporting stabilization of the rice self-reliance.

This program is proposed in order to promote stable self-reliance of rice and food security at provincial and national level. The development must be sustainable way, namely water resources utilization must proceed with control, ensuring the conservation of water resources and environment. In re-establishing development target, the following three viewpoints must be considered:

Potential Irrigation and Swamp Area

It has been concluded that full irrigation development and some swamp development in the Basin will meet the said 300,000ha of irrigation development. Potential development areas are summarized as follows:

Table 7.1.4 Potential Development Area in the Basin

Development Type	Potential Development Area (ha in equivalent double cropping)
Technical	86,200
Semi Technical	28,600
Simple	4,540
Communal	87,200
Non-tidal	158,000
Tidal	219,000

Figure 7.1.2 shows potential irrigation and swamp area in each regency/municipality and sub-basin. The development target should be determined firstly by the national and provincial policies/intensions to food/rice security with mutual consent.

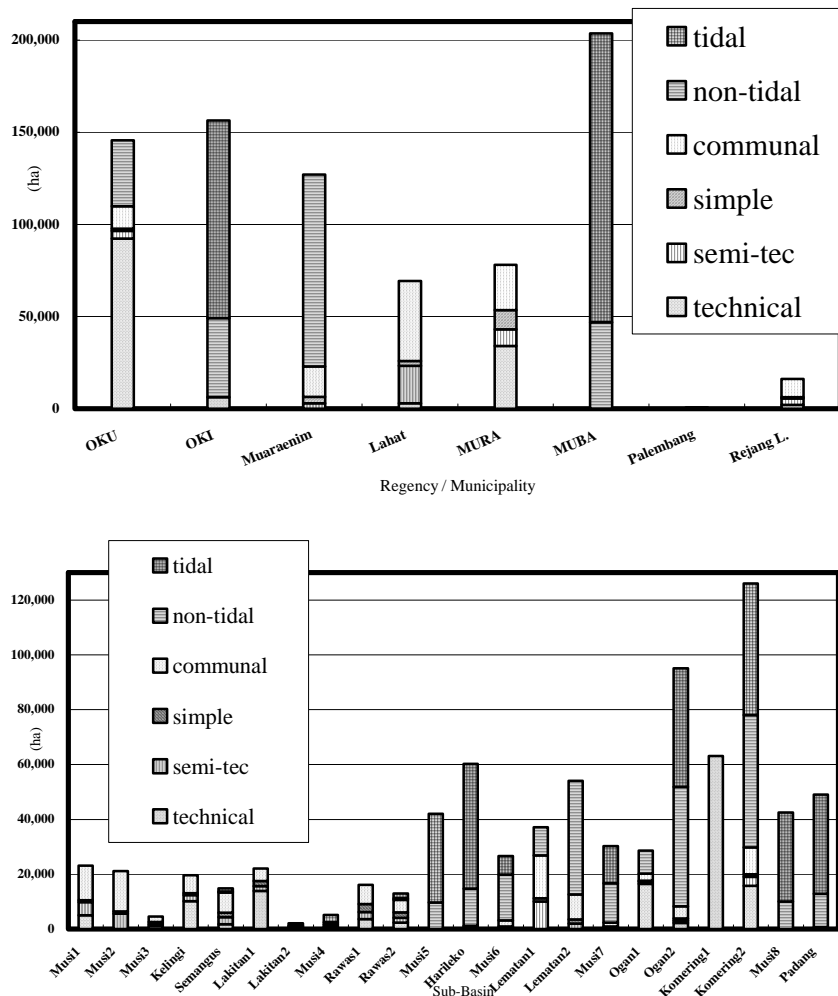


Figure 7.1.2 Potential Irrigation & Swamp Development Area by Regency and by Sub-basin

Objective, Program Area and Executing Agency

Objectives of the program are: (1) to promote stable self-reliance of rice and food security at provincial and national level; and (2) to carry out Pre F/S, F/S and D/D aiming to realize sustainable irrigation and swamp development in South Sumatra Province.

Public consultation from the beginning stage of the irrigation and swamp development is indispensable based on Presidential Instruction N0.3/1999 (PKPI). The program area is South Sumatra Province. The executing agency shall be DGWR of Kimpraswil, and Dinas PUP of South Sumatra Province. Related agencies shall be regency and municipality governments in the Province. Activities will be as follows:

Establishing Development Target of the Province (Program 1-2-1)

This sub-program includes the activities of Ministry and Service: (1) determining target areas and year of irrigation and swamp development based on the results of this Study; and (2) determining candidate locations for irrigation and swamp development; and, (3) holding public consultation. Roles of communities, WUAs and local governments are important in the irrigation and swamp development. Public consultation will be held, mainly aiming at: providing community's intension; participating in establishing development target and decision making; and, educating themselves on irrigation water conservation.

Implementation of Pre F/S (Program 1-2-2)

This sub-program includes the activities of DGWR and Dinas PUP: (1) preparation for Pre F/S; (2) execution of Pre F/S; and (3) holding public consultation. Pre F/S will be carried out in order to clarify the irrigation and swamp development based on the established target.

Implementation of F/S (Program 1-2-3)

This sub-program includes the activities of DGWR and Dinas PUP: (1) Preparation for F/S; and (2) execution of F/S. F/S shall be carried out based on the Pre F/S.

Implementation of D/D (Program 1-2-4)

This sub-program includes the activities of DGWR and Dinas PUP: (1) Preparation for D/D; and (2) execution of D/D.

7.1.7 Rainwater Utilization in Tidal Swamp Area

Rainwater Utilization in Tidal Swamp Area (Program 1-3) has been identified as follows: The rainwater (about 2,000 mm/year) will be stored during rainy season, and utilized for drinking and cooking during dry season. **Objectives** of the Program are: (1) to provide rainwater storing and sanitation facilities to transmigrant farmers in tidal swamp area; and (2) to increase the physical and mental happiness of the farmers. The

program areas shall be the tidal swamp area in South Sumatra Province. The executing agency shall be Dinas PUP of South Sumatra Province and Regency Governments of OKI, MUBA (new), and Banyuasin. **Activities** are as follows:

Preparation (Program 1-3-1)

This sub-program includes the activities of the Regency Governments under the coordination of Dinas PUP: (1) surveying number of the target farmers, their present facilities of water supply and sanitation, and costs; and (2) opening public consultation.

Proving Rainwater Storing and Sanitation Facilities (Program 1-3-2)

This sub-program includes the activity of the Regency Governments under the coordination of Dinas PUP: (1) providing one water tank and one septic tank to each subject household. Rainwater storing facilities (one polyethylene water tank, 3 m³) are to be provided to subject farm households to store rainwater during rain season, and use for drinking and cooking purposes during dry season. The function of the storing facilities is supplemental one because inhabitants possess some storing tanks already. Sanitation facilities (one septic tank placing on the ground) are to be provided to subject households in order to avoid water related diseases accrue from the surface water use for washing and bathing.

7.1.8 Aquaculture Water Management

Aquaculture Water Management (Program 1-4) has been identified as follows: There are conflicts between aquaculture and irrigation. In order to solve the conflicts, areas for aquaculture and irrigation are better to be separated from the viewpoint of water management, e.g. check/gate operation and farm conditions, etc. If land uses cannot be controlled, aquaculture areas are better to be gathered by reallocation or exchange of farm lots.

Objectives of the **Aquaculture Water Management (Program 1-4)** are: (1) to develop solving methods of conflicts between aquaculture and irrigation water uses; and (2) to realize equitable and sustainable regional development. Present aquaculture areas are tabulated in **Table 7.1.5**. The executing agency shall be Water Resources Service, Agriculture Service, and Fishery Service of, South Sumatra Province. Related agencies shall be Regency and Municipality Governments. **Activities** are as follows:

Table 7.1.5 Present Aquaculture Area of Fishpond

(ha)

OKU	OKI	Muaraenim	Lahat	MURA	MUBA	Palembang	Pagaralam	Prabumulih	Rejang L.	Total
3,550	164	409	1,552	703	275	29	169	12	545	7,408

Researching Solution Methods (Program 1-4-1)

This sub-program includes of the activities of Dinas PUP: (1) holding public consultation; (2) investigating situations of conflicts, including their background and

history, locations, numbers of cases, land tenure system, etc.; and (3) surveying methods of reallocation or exchange of farm lots.

Disseminating of the Methods (Program 1-4-2)

This sub-program includes the activity of Dinas PUP: (1) disseminating the methods to regencies/municipalities.

7.1.9 Enhancing Water Utilization for Tourism

Enhancing Water Utilization for Tourism (Program 1-5) shall be as follows: Strategic Planning of Water Resources Development, South Sumatra Province, stipulates that the Government of South Sumatra Province develops and utilizes the water resources to support the developments of the superior sectors, including tourism sector. Being a highly labor-intensive industry, tourism is expected to make a significant contribution to the economies and significant role in generating employment opportunities to localities where it is promoted.

Objectives of the Program are: (1) to support tourism development by promotion of water utilization; and (2) to realize balanced and sustainable regional development. The program area shall be the Musi River Basin (except Palembang because it has Karang Anyar Project already), and the executing agency shall be Dinas PUP of South Sumatra Province and Regency/Municipality Governments in the Basin. Activities are as follows:

Survey, Investigation and Design (SID) (Program 1-5-1)

This sub-program includes the activities of Regency/Municipality Governments under the coordination of Dinas PUP: (1) opening public consultation; (2) selection of program site; (3) collection of natural, economical and social data including traffic and communication; and (4) SID of water network and financial analysis.

Implementation (Program 1-5-2)

This sub-program includes the activities of Regency/Municipality Governments under the coordination of Dinas PUP: (1) implementing civil works; and (2) tourism education to society.

7.1.10 Modeling of Water Use Management

Modeling of Water Use Management (Program 1-6) has been identified as follows: The water use management model will facilitate the testing of development scenarios (unique combination of hydrological conditions, water demands and proposed interventions) proposed by planners (e.g. MP Team mentioned in draft New Governmental Regulation, Article 24), leading to statements of the environmental impacts associated with each scenario. The model must be designed to ensure replicable and auditable tests, and to be accessible in a secure manner to planners.

Objectives of the Program are: (1) to promote a mechanism to improve sustainable water management in the Basin; (2) to promote equitable and balanced water uses in the Basin; and (3) to enhance conservation of environment of the Basin. The program is sublet to international consultants of advance countries with much experience of water management modeling in Asian monsoon regions, and to contribute: (1) supporting decision making (not a substitute for decision making); (2) providing effective and replicable outputs; (3) transparent and flexible management; and (4) scenario management. The program area shall cover the whole Musi River Basin, and the executing agency shall be Ministry of Settlement and Regional Infrastructure, and Water Resources Service of South Sumatra Province. Activities shall be as follows:

Information and Knowledge Base Development (Program 1-6-1)

This sub-program includes: (1) review of relevant programs; (2) identify actual modeling needs and data requirement; (3) establishment of database structures, and computer and communication networks; (4) establishment of database access; (5) preparation of procurement packages; (6) information and knowledge base development; and (7) public consultation/workshop.

Basin Modeling Development (Program 1-6-2)

This sub-program includes: (1) hydrological review; (2) review of historic water resources development and water use; (3) review of available models; (4) design of modeling structure; (5) preparation of procurement packages; (6) development of models; and (7) workshop.

Environmental Analysis and Modeling (Program 1-6-3)

This sub-program includes: (1) identification of data needs; (2) tools for impact analysis; (3) environmental assessments; (4) scenario modeling and evaluation; and (5) workshop.

7.1.11 Selection of Priority Programs

Priority programs are selected based on the following category, and giving scores of high priority (score=5), middle priority (score=3) and low priority (score=1) for each category and sum up them: Prerequisite to Other Programs; Degree of Seriousness; Requirement of Early Start; Degree of Accelerating Economic Recovery of the Basin. Scores of each program is determined using the criteria, as follows:

Table 7.1.6 Priority Program Selection for Component 1

Program	Pre-requisite	Seriousness	Early start	Acceleration	Total Score	Rank
1-1 Sustainable Water S. to Wide Area	1	3	1	3	8	5
1-2 Sustainable I&S Development	5	3	3	5	16	2
1-3 Rainwater U. in Tidal Swamp Area	3	5	5	3	16	2
1-4 Aquaculture Water Management	3	5	5	3	16	2
1-5 Enhancing W. Utilization for Tourism	1	3	1	3	8	5
1-6 Modeling of Water Use Management	5	5	5	5	20	1

Based on the results, programs 1-1 and 1-5 are judged to have less priority. Therefore, the following programs are selected as priority programs:

- Program 1-2: Sustainable Irrigation and Swamp Development
- Program 1-3: Rainwater Utilization in Tidal Swamp Area
- Program 1-4: Aquaculture Water Management
- Program 1-6: Modeling of Water Use Management

7.2 Component 2: Floodplain Management

7.2.1 Identification of Programs and Objectives

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 maintaining high water quality, and contribute to sustaining groundwater supplies. Most of the floodplains in the Basin are swamp/marsh and tidal swamp rice fields. People's lives in these areas are those fit to the natural phenomena. Needed is the conservation of these natural retarding basins in the middle and lower reaches.

Other issues of floodplain management in the Musi River Basin include those for flush floods in the mountainous areas and riverbank erosion. Thus the programs under the Component 2 have been identified as follows: Floodplain Management; Flood Forecasting and Warning; and, Sustainable River Channel Management. The objectives of the Floodplain Management in the Musi River Basin are to maintain the original function of the river basin as well as to minimize damages.

7.2.2 Floodplain Management

Floodplain management should be considered as a program in a long span of 50-100 years, but it should be started before uncontrolled developments proceed in the floodplains. In this sense, Musi River Basin is still not yet late to start management, but coming ten years might affect greatly the future of the Basin. Floodplain management is applied in various countries as non-structure type measures of flood damage reduction (Annex H6.2.6). Zoning and land use control are considered realistic to maintain water-retarding function in floodplains in the Musi River Basin. The Government Regulation No.27/1991 (Swamps) declares for conviction, (i) to reclaim swamps and develop swamp reclamation channels without permission, (ii) to dump solid or suspended contaminants in or surrounding the swamp reclamation system. Ministerial Regulation of Ministry of Public Works No.63/PRT/1993 (River Channel, River Usage and Non-usage Areas, Old Unfunctional Rivers) defines river borders and decrees details of their utilization. River borders may not be used for: dumping of garbage, solid and suspended wastes, developing permanent buildings, houses, and commercial facilities. Presidential Letter No.32/1990 (Protected Area Management) defines protected areas

mainly function to protect environment and its sustainability that cover natural resources, etc.

Existing laws and regulations already control the activities in the floodplains, thus needed is the actual zoning of floodplain areas in the Musi River Basin. There presently exists no clear zoning of floodplain areas for this purpose. The Study Team identified floodplains in the middle and lower reaches of the Musi mainstream and major tributaries based on the 1/250,000 maps as shown in **Figure 7.2.1**.

The total area of the identified floodplain is approximately 3,360km² and the breakdown by river basin is in **Table 7.2.1**.

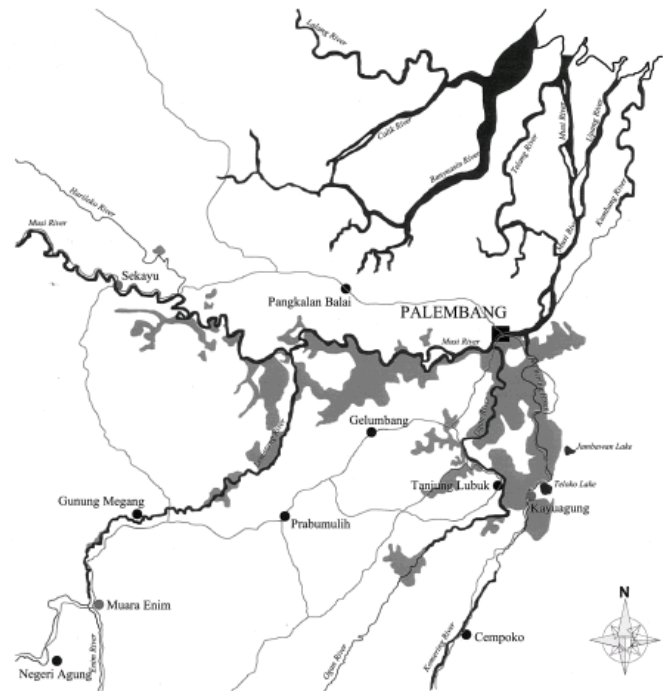


Figure 7.2.1 Identified Floodplain Areas

Table 7.2.1 Floodplain Areas by River Basin

River	Area (km ²)	River	Area (km ²)
Musi	1,126	Semangus	-
Harileko	4	Lematang	299
Rawas	84	Ogan	432
Lakitan	68	Komering	1,350
Kelingi	-	Total	3,363

By using the land use data of the year of 2000, land use types in the identified floodplains were confirmed as shown in **Table 7.2.2**. Land use in the floodplains is mainly swamp and tidal swamp rice field.

Table 7.2.2 Land Use of Identified Floodplains

Land Use Type	Area (km ²)
Swamp / Marsh	828
Tidal Swamp Rice Field (single crop)	1,819
Others	716
Total	3,363

Effect of flood retardation by the floodplains has been evaluated comparing the present flow duration curve with floodplains and the assumed one without floodplains. The flood retarding capacity was assumed at 1.7 billion m³ from the floodplain area of 3,363 km², an average depth of 0.5 m. As a result, the following were confirmed. The annual maximum daily discharge of 3,656 m³/s under the present condition would increase up to 4,040 m³/s under no-floodplain condition. The present 365-day (12 months) discharge of 584 m³/s would decrease to 481 m³/s if no floodplains.

Zoning and Land Use Control Program (Program 2-1)

Confirmation of the Land Use Control Area

Land use control area proposed by the Study Team is 1/250,000 topographic map basis. Detailed study using remote sensing methods for the confirmation of the necessary land use control area shall be conducted. With remote sensing methods, the extent of floodplains and flood-prone areas can be identified map scales up to 1:50,000.

Zoning of the Area and Execution

After the confirmation of the area, zoning shall be conducted in the spatial plan of the relevant Kabupaten and Kotamadya. Socialization of the spatial plan and explanation to the public for the necessity and importance of the floodplain management is important. Then, land use control shall be executed. The subject floodplains are basically maintained for the present use of non-tidal irrigation, swamps, etc., thus these areas shall better be incorporated into the provincial rice production designated areas for sustainable maintenance. Periodical patrol for the proper land use shall be conducted.

7.2.3 Flood Forecasting and Warning

Flood Forecasting and Warning (Program 2-2) can be applied in the area where flush floods occur. Since not much information is available for the flush flood in the mountainous areas, inventory survey should firstly be conducted based on the proposal as shown in **Table 7.2.3**.

Table 7.2.3 Possible Location for Flood Forecasting and Warning System

Gage Location	Receiver (Dinas PU District)	Decision of Warning (Dinas PU District)	Control (Dinas PU Province)
OKU			
Muaradua Kisam	Muaradua	Baturaja	Palembang
Pulau Beringin	Muaradua	Baturaja	Palembang
Pasar Banding Agung	Muaradua	Baturaja	Palembang
Pengandonan		Baturaja	Palembang
Lahat			
Tebing Tinggi		Lahat	Palembang
Padang Tepung	Pagar Alam	Lahat	Palembang
Pendopo	Pagar Alam	Lahat	Palembang
Tanjung Sakti	Pagar Alam	Lahat	Palembang
Kota Agung		Lahat	Palembang
MURA			
Surulangun	Muara Rupit	Lubuk Linggau	Palembang
Muara Kelingi		Lubuk Linggau	Palembang
Muara Lakitan		Lubuk Linggau	Palembang

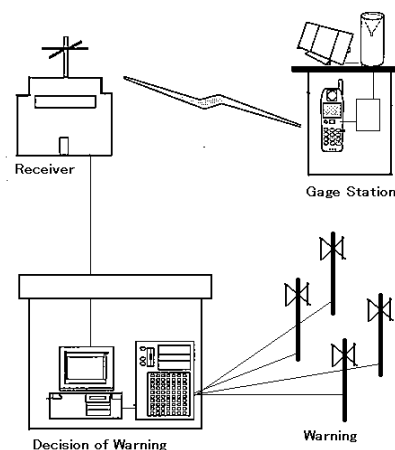


Figure 7.2.2 Flood Forecasting and Warning System

Warning system against flush flood is established by use of automatic rain gage and GSM-digital mobile phone, which is economical than use of traditional Argos Satellite System or INMARSAT Satellite System. The composition of the system is shown in **Figure 7.2.2**.

7.2.4 Sustainable River Channel Management

Bank erosions occur in the Musi mainstream and major tributaries. Riverbank protection works are presently conducted by Dinas PU Pengairan of each Kabupaten using APBD. The works include gabion revetment, concrete revetment, gabion jetty, bamboo net jetty, etc. and designing and construction technique are already well established. Thus **Sustainable River Channel Management Program (Program 2-3)** has been identified to carry out the sustainable channel management under the present system continuously.

In addition to the works, Dinas PU Pengairan of South Sumatra Province is recommended to prepare local regulation concept of river corridor management. The concept will include guidelines of river areas and their utilization, and will be formulated based on study on flood water level, flood discharge, river morphology, landslide, catchment area, etc. under with/without dike conditions in both rural/urban areas.

7.2.5 Selection of Priority Programs

Priority programs have been selected through the same procedure with Component 1 as shown in **Table 7.2.4**. As a result Program 2-1: Zoning and Land Use Control has been selected as a priority program for Component 2.

Table 7.2.4 Priority Program Selection for Component 2

Program	Pre-requisite	Seriousness	Early start	Cost Scale	Total Score	Rank
2-1 Zoning and Land Use Control	5	3	5	5	18	1
2-2 Flood Forecasting and Warning	1	3	5	5	14	2
2-3 Sustainable Channel Management	1	3	5	3	12	3

7.3 Component 3: Watershed Rehabilitation and Conservation

7.3.1 Identification of Programs and Objectives

In the management of natural environment in the Basin, watershed rehabilitation is the most important measure to achieve: to decrease flood, and to stabilize water regime; to decrease soil erosion in the watershed and hence reduce sedimentation in rivers; to conserve and rehabilitate ecological resources; and, to increase groundwater resource.

As direct actions against soil erosion, the Plan proposes three programs: **1)** reforestation on land with major constraints for agriculture development, **2)** law enforcement on production forest (HP) and logging in general, and **3)** inner- and inter-basin coordination of policies and projects. For healthier, sustainable natural environment in the future, the Plan also proposes additional three programs for conservation within the watershed: **4)** forest area increase, **5)** conservation of river environment, and **6)** conservation of swamp and mangrove forest.

These six programs cover most part of the Province. The following **Figure 7.3.1** shows conceptual locations of project target areas.

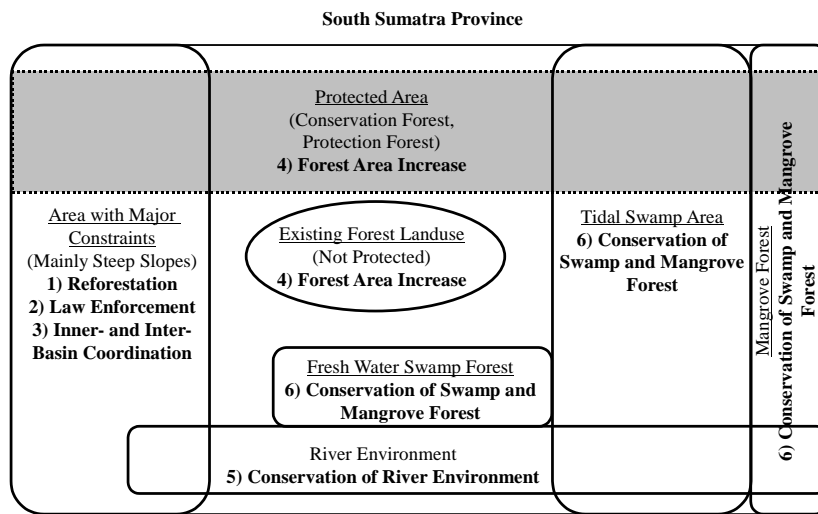


Figure 7.3.1 Conceptual Map of Target Areas

7.3.2 Soil Erosion Prevention -Reforestation on Land With Major Constraints-

The objectives are: to introduce better land management on the most critical areas within the Musi River Basin, and to convert garden-type land use on steep slopes to forest-type land use. Leading institutions shall be; Kabupaten-level and Kecamatan-level forest, estate, and agriculture office, and extension offices, in cooperation with Provincial offices. Also, Provincial- and Kabupaten-level BAPPEDA shall be responsible for legislative action for land use regulation. Forest rehabilitation and community involvement in such action is now experimented in the Kerinci Seblat National Park. Researchers and NGOs involved in such an action are expected to take further leading role within the Musi River Basin.

Duration of the project shall be as follows: Preparation of land use regulation will need discussion with Kabupatens, and may take 3 years. Drawing and formalizing the regulation may need 2 more years. Public hearing and consultation at areas that will be subject of the regulation must be started during these 5 years. After the first 5 years, detailed zoning of the target area will start, followed by projects for land use change and modification of agriculture technology.

Existing land use type within the area of land with major constraints (**Figure 7.3.2**) is predominantly the farmer’s plantation.

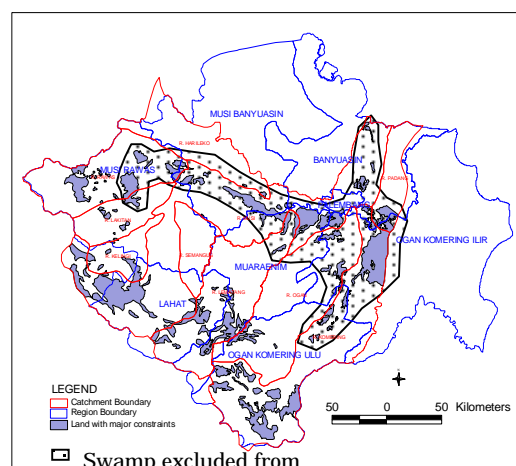


Figure 7.3.2 Land with Major Constraints (Not Suitable for Agricultural Use)

Project target for erosion prevention in the land with major constraints should, therefore, concentrate on farmer's plantation area. Priority areas area recommended to be chosen from areas that already have plan for farmer's plantation development, and areas that have community organization to prepare or implement such plan.

Application of Agroforestry on Land with Major Constraints (Program 3-1)

Farmers who are using the land with major constraints are encouraged to introduce agroforestry in their garden, mixed garden, and estate. By this conversion, farmers can obtain various food crops near their house with less labor, and some crop for market for cash income. Currently, such lot is used mainly for rubber and coffee, and market-keen farmers often cut down their trees and change their strategy for income. Introduction of agroforestry lower farmers' temptation for this short cycle of tree cutting.

Also, farmers must receive stronger education of agricultural technology about farming on slope for their individual plantation. Technique for soil conservation, such as terracing, alley cropping and check dam must be applied by all farmers on slope. As an effective measure for soil conservation, no-tilling farming is gaining popularity in many countries in the world, including those in tropical climate.

Slope more than 15 % is recommended for conversion to permanent forest. Farmers must be educated so that they themselves can measure the steepness of slope with simple tools. Non-wood products such as honey, latex, and spices may be obtained from the permanent forest.

Land Use Regulation on Land with Major Constraints (Program 3-2)

The area of land with major constraints must be recognized in Kabupaten and Provincial level spatial plan. The spatial plan must also state a list of suitable land use (ex. permanent forest) for the area. The draft of the plan must be explained to all the stakeholders and communities possibly affected by the designation. The scientific base of the regulation must be well explained, and mitigating measures for impact on local economy must be sought both by the government and local community.

To realize the plan, a land use regulation ordinance regarding the area must be prepared and activated. Based on the regulation, local government should start community projects for tree planting, terrace preparation, check dam construction, and other prevention measures against soil erosion.

Strengthening of Agriculture/Estate/Forestry Extensions (Program 3-3)

In the autonomy society, government office that directly face local residents need to play the most important function. It is expected to gather opinions of residents, at the same time to provide information about policies and projects of the government. For better land management, integrated consulting must be provided for farmers. Such consulting may cover technique for collecting non-tree crops from permanent forest, site preparation, terracing, and living fences. In past decades, such consulting has been

provided to individual farmers through small, government-supervised demonstration projects at extension offices.

In the year 2000 (pre-autonomy), there were 89 agriculture extensions in South Sumatra Province. In average, each office had 21 staff (including Rank II to other). Given that agriculture land use (dry land agriculture, farmer's plantation, mixed garden, rice field) amounts 30,752 km² in the Province, each office is expected to supervise 346 km², or 19 km² for each staff (Rank II to Rank IV).

To fulfill the expected task of the extension, each office shall consist of at least four units: Planning and logistics, Monitoring, Demonstration Field and Nursery, Production/ Communication/ Consultation. Since the staff need to know the local people and their economic condition well, it is best to hire them from local community. Management of nursery may also create jobs in local community. The monitoring also will benefit from the experience of locals. Transfer of information on environmental condition is also expected by hiring local residents for such positions.

7.3.3 Soil Erosion Prevention -Law Enforcement against Destruction of Forest-

Law enforcement against destruction of forest is a part of soil erosion prevention and consists of two programs, namely, Reforestation of Production Forest, and Enforcement of Prevention of Illegal Logging.

Reforestation of Production Forest and Forest Estate (Program 3-4)

The objective of the program is: to make sure that the obligation of reforestation by the forest companies are fulfilled as intended, and to rehabilitate forest resource of the Province for sustainable use in the future. More concretely, this program is to enforce reforestation obligation at Production Forests and Forest Estate. This project is to legalize inspection and monitoring by the Province, the concession provider, on reforestation activities by the concessionaire, or the previous concessionaire. The total area of Production Forests covers 25 % of the Province. Just management is essential for safe and prosperous life in South Sumatra for long term.

Leading Institution shall be Provincial Forestry office, in cooperation with Forest Police, Kabupatens, and forestry extension offices in each Kecamatans. Provincial Forest Office will need close communication with existing and former concessionaire and their business associations to share understandings of the common merit of reforestation. Provincial Forest Office may also need to report to and consult with Ministry of Forestry to establish stronger legal action to monitor the use of Reforestation Fund.

Preparation of the project shall be for three years, and monitoring and reforestation execution will follow. There are about 25,220 km² production forests in the Province. The area is divided into 66 locations. Of these, all areas that have received the Reforestation Fund must be investigated. Areas, however, that falls in either one of following three criteria may be considered as special priority sites: 1) those that directly located along the major tributaries, 2) those on the land with major constraints, or on

steep slopes, and 3) those that located next to protected forests (HSA and HL). Priority also may be given to Kabupatens that expressed stronger concern for their own natural resource, and willingness to cooperate in the investigation.

To secure the required reforestation done, three types of policies need to be implemented: 1) Guidance and communication, 2) Encouraging actions for reforestation, and 3) Enforcing actions. Components of these actions are explained in **Table 7.3.1**.

Table 7.3.1 Actions for Reforestation of Production Forests

Guidance and communication	
<ul style="list-style-type: none"> * The Province must make sure that all forest company that obtain concession in the Province has sufficient number of reforestation staff in local offices. The staff must be educated and trained well according to the ITTO international guideline for rehabilitation and reforestation of tropical forests. * An investigation team must be formed to evaluate the achievement of concessionaire, as well as to discuss better systems to encourage sustainable forest production. The team should include members from forest industry, forestry research, environmental NGOs, and provincial and local government. 	
Encouraging Actions	Enforcing Actions
<ul style="list-style-type: none"> * Corporation that achieved its reforestation obligation is given priority consideration at renewal of concession. * Additional grant may be considered to support maintenance work for reforestation. 	<ul style="list-style-type: none"> * The timing of DR payment must be delayed to after completion of reforestation. * Sabotage fine must be charged for those received the DR but missed to achieve agreed reforestation. * Names of the companies that failed obligatory reforestation must be announced in mass media. * Log production allowance must reflect amount of reforestation work achieved. Those failed to realize obligatory area/ number must be limited their production.

Enforcement of Prevention of Illegal Logging (Program 3-5)

The objectives of the program are; to create atmosphere in local community against illegal logging activities, and to catch and punish those that involve in illegal logging activities. More concretely, this program is to minimize logging activities without proper concession. Leading Institutions shall be Provincial Forestry Office and Forest Police. Daily patrol and alert raising effort need cooperation of local residents and local government. Center for International Forest Research (CIFOR), Bogor has good experience in research and proposal against illegal logging.

Coordination of investigation team and planning of work may take three years. Investigation and community education will follow. Since most of remaining forest is now located in remote area in mountain and swamp, illegal logging activities area reported from these areas as well. In that case, target area may be Kabupatens Banyuasin, OKI, MuRa, Lahat, and OKU. Priority also may be given to Kabupatens that expressed stronger concern for their own natural resource, and willingness to cooperate in the investigation. Effort must be concentrated on measures that can take place close to where people live.

Major tasks that should be realized in the Province are described in **Table 7.3.2**.

Table 7.3.2 Examples of Measures against Illegal Logging

License control	* Kabupatens and Province monitor and control licensing activities, over-rule and stop any licensing that is against the moratorium policy.
Education and community organization	* Local communities near illegal logging site must be given information about how logging on steep slope increase threat of flooding and landslide. * Local residents must be encouraged to report any illegal or suspicious activities to Provincial Forest Office or other appropriate public offices.
Patrol and police work	* In mountain area, access to forest is limited to certain roads. In swamp area, logs are cut and stored in small canals or rivers in dry season, so that they can be flush out in wet season. By patrolling in such limited area, evidences of logging activities will be collected, and arrests may be made with less effort.
Counter-action	* Loggers usually construct wooden log-road in forest to pull the cut log on it. Destroying such log-road repeatedly would express local decision to fight with the loggers and discourage logging activity.

7.3.4 Soil Erosion Prevention -Inner- and Inter-Basin Coordination-

Soil Erosion Prevention -Inner- and Inter-Basin Coordination (Program 3-6)- has been proposed. The objectives are: to realize sound and comprehensive resource management of the Musi River Basin, and to encourage local government to manage their own land and water resources in coordination with other government body within the same sub-basin. The program is to organize and practice inter-sector coordinating body (PPTPA) for the Basin, and to organize and practice sub-basin level coordination so that local interest and problems are better reflected to the decision making of the whole Basin.

For formation of Musi River Basin PPTPA, leading institution will be the Governor's Office. For sub-basin level organization, leading institution will be Kabupatens, with help from Provincial Governor's Office, and the PPTPA itself. Member of sub-basin level organization will consists of similar combination as the PPTPA, but of local level. For better communication, concentrated efforts for resource management, and for empowerment of local autonomy, the Plan proposes to establish Kabupaten or sub-basin level inter-sector organization. For example, sub-basins are grouped in **Table 7.3.3**. The organization will consist of public offices, local communities, and NGOs, related to spatial planning, forestry and conservation, agriculture, water resource management etc.

Table 7.3.3 Sub-Basins and Shared Concerns

Groupings of Sub-basins	Shared Concerns
Rawas, Lakitan	National Park management and control of logging and encroachment
Lematang	Water resource conservation for urban and industrial water needs
Musi, Harileko, Semangus, Kelingi	Water resource conservation
Ogan, Komering	Reduction of sand deposition, increase of water flow

In Indonesia, watershed rehabilitation and conservation is in progress in some basins. There is designation for areas for reforestation by "List of Priority River Basins for Reforestation (Ministry of Forest – Kimpraswil)" and "River Basins for Reforestation and Rehabilitation on SK21 (Ministry of Forest)", the Musi River Basin, however, is not included in either list.

7.3.5 Rehabilitation and Conservation of Natural Environment -Expansion of Forest Area-

Rehabilitation of Existing Protected Forests (Program 3-7)

The objectives of the program are: to cover the designated area with tree species native to the locations, and to rehabilitate biodiversity within the designated protected areas. Leading institutions shall be; for HSA, National Balai KSDA and Provincial Forestry Office; for HL, Kabupatens in cooperation with Provincial Forestry Office. Duration of the project shall be: Upgrade planning with involvement of extension officers for three years. Implementation will follow.

Project area shall be within the existing Conservation Forests (HSA), and Protection Forests (HL). A total of 80 % of the area of HSA and HL is covered by natural land use. The rest of 20 %, or 1,555 km² is the target area for reforestation. Also, forest land use of 8,477 km² (72%) is the target area for rehabilitation of natural habitat.

Table 7.3.4 shows that existing forestland use in the Province is much smaller than legally protected forest area. Rehabilitation of forest stands at least within the legally designated area will substantially increase the ratio of forest cover in the Musi River Basin.

Table 7.3.4 Area of Sub-Basins and Ratio of Protected Forests

Sub-Basin	TN, HAS (km ²)	HL (km ²)	Protected Area Total (km ²)	Sub-Basin Total (km ²)	Protected (%)	Forest Land Use Area (km ²)	Forest Land Use (%)
Rawas	1,663.59	0	1,663.59	6,026	28%	315.10	5.2%
Lakitan	748.45	20.65	769.10	2,763	28%	109.02	3.9%
Harileko	175.19	192.37	367.56	3,765	10%	8.59	0.2%
Musi	511.07	785.55	1,296.62	15,320	8%	1,409.18	9.2%
Kelingi	42.92	9.55	52.47	1,928	3%	148.14	7.7%
Lematang	190.83	1,045.76	1,236.59	7,340	17%	548.40	7.5%
Ogan	.13	562.01	562.14	8,233	7%	237.83	2.9%
Komering	.00	1,046.97	1,046.97	9,908	11%	752.34	7.6%
Padang	587.67	190.58	778.25	2,513	31%	64.19	2.6%
Total	3,919.85	3,853.44	7,773.29	57,796	13%	3,592.79	6.2%

Source: Protected Area: Provincial Forestry Office Sub-basin area: Progress Report Annex 2.7.1
Forest land use area: Land Use 2000

For rehabilitation of protected forest, six actions are needed for simultaneous implementation (see **Table 7.3.5**).

Table 7.3.5 Project Components for Rehabilitation of Protected Forest

Forest Border Construction	Reconstruction of Forest Area boundary
	Maintenance and secure of Forest Area boundary
Forest Rehabilitation	Maintenance of area, which is forest fire/ cutting wood/ damaging/ illegal digging, which is already rehabilitation year before.
	Rehabilitation of conservation area that already damage by natural or artificial succession and make priority for local plant.
Habitat Rehabilitation	Identification of concerning biodiversity potency in preserved area
	Perpetuation and rehabilitation of rare flora and fauna
Law Enforcement	Making of patrol road/ Zones border
	Making of spying tower (height ± 12 m, border ± 4 m2)
	Shelter construction (12 m2)
	Gate construction
Human Resource Development	Arrangement planning of preserved forest management unit
Monitoring and Research	Habitat guideline
	Evaluation of conservation area function
	Inventory of preserved area

As of 2001, there are a total of 60 staffs of Balai KSDA for management of protected forests. They are stationed at seven locations. Considering whole protected forest, however, simple calculation tells that one staff is responsible for 129.55 km² of protected forest in average. Number and training of station staff is the key to successful rehabilitation of protected forest.

Increase in the Area of Designated Protected Forests (Program 3-8)

The objective is to include as much remaining tree stands within protected areas. The program includes; identification of remaining forest area, and expand existing borders and new designation of Protected Forests

Provincial Forestry Office shall conduct Identification in cooperation with National Nature Conservation office (Balai KSDA). Dishut Kabupaten (Kabupaten-level forest office) and Desa-level Penyuluh (extension) shall conduct detailed identification and coordination with landowners. Kabupatens and Kecamatan must be encouraged to nominate local protection forests.

Such local protection forests may include historical sites, area with religious or cultural importance. Area may be as small as a few hectares. Regulation of use in the area may be decided by local residents, as long as the area remains to be covered mostly by tall woods. Maintenance and patrol activities may also be conducted by local residents.

Forest identification may be revised every 5 years. Effort for new designation may continue throughout the target years. Forest identification will be done for whole Province outside of already protected forests (HSA, HL). Priority for identification work, however, may be set for one or more sub-basins or Kabupatens for quick execution of the policy.

Steps for designation of new protected forest are summarized in **Figure 7.3.3** and **Table 7.3.6**.

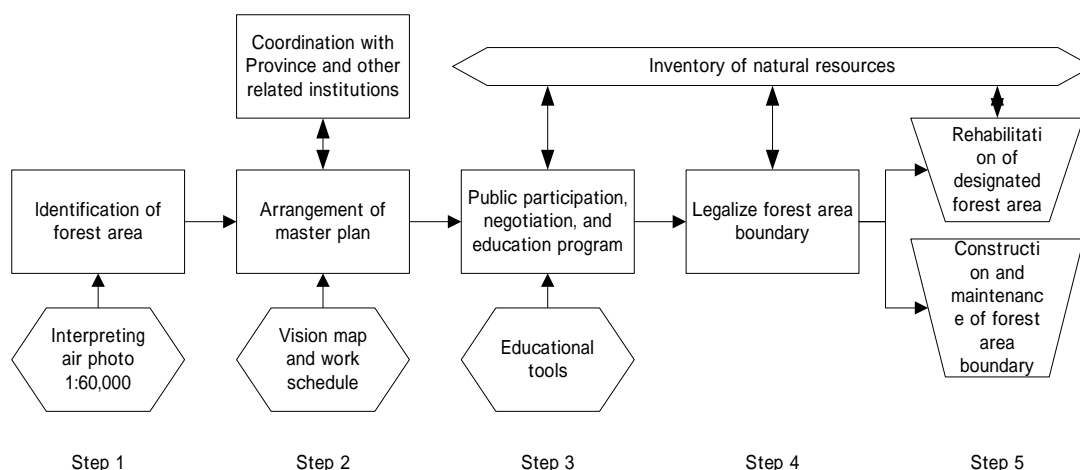


Figure 7.3.3 Five Steps for Designation of New Protected Forest

Table 7.3.6 Project Components for New Designation of Protected Forests

Component	Tasks	Province		Kabupatens, Kecamatan
		Forestry	Nature Conservation	
Forest identification	Satellite photo preparation	O		
	Field observation (sample)	O	O	O
	Differentiation standard model	O		
	Preparation of preliminary forest map	O		
On-site identification	Forest map improvement	O	O	O
	On-site marking of forest to be conserved		O	O
	Identification of human pressure on forest, stake holders		O	O
Forest conservation	Alternative resource development with consultation with stake-holders	O		O

7.3.6 Rehabilitation and Conservation of Natural Environment -Management of River Environment-

Management of River Environment (Program 3-9)

The objectives are: to recognize the location, area, and condition of mining, fishing and other economic activities in rivers, and to control and separate above activities safely so that impacts from activities would not conflict each other. This program aims to conserve multi-functional river environment

Leading institutions shall be Provincial Water Resource Management Office, in coordination with Kabupatens and Kecamatan, and Provincial and local BAPPEDA for water quality monitoring, and Kota social workers for compromising conflicting resource use.

Duration of the project shall be: Preparation of river map for three years, implementation of monitoring and management up to 2020, and longer. The project areas shall be all eight major tributaries in the Musi River Basin. However, it would be possible to select priority areas for urgent investigation and control. The priority areas

must be chosen from; 1) areas under active sand/gravel mining activities, 2) areas under potential threat of chemical water pollution, and 3) areas suffering from significant sedimentation. Monitoring must also be conducted in the area where major water diversion is planned for irrigation, power generation, and other uses. The pre-project condition must be documented and utilized by planners and engineers to avoid substantial impact from the planned activities.

As far as the Team observed, priority areas may include sections of the rivers Martapura - Kayu Agung of the Komering River for serious sedimentation and loss of water; Lubuk Sepang - Lahat - Niru of the Lematang River for sand and gravel mining, urbanization, diesel power plant (Lahat, Muara Enim), pulp factory, oil refinery (Niru), oil pipeline; and Sugi Waras - Muara Enim of the Lematang (Air Enim) River for gravel mining.

7.3.7 Rehabilitation and Conservation of Natural Environment -Conservation of Swamp and Mangrove Forests-

Conservation of Tidal Swamp Forests (Program 3-10)

The objectives of the program are; to recognize the location, area, and condition of remaining swamp forests; and to stop local farmers to clear those remaining forests. This program aims to conserve remaining tidal swamp forest, and regulate land clearance.

Leading institutions shall be Provincial Forestry office, in cooperation with National Nature Conservation office (Balai KSDA), Kabupatens, and agriculture/estate/forestry extension offices in each Kecamatan. A few international institutions and NGOs (e.g. Wetland International: WI) have already conducted related studies in the area. Another institution, the Center for International Forestry Research (CIFOR) has conducted a study on the cause of forest fires in Musi Banyuasin. The European Union has been conducting the Forest Fire Prevention and Control Project (FFPCP). The project office is located in Palembang.

Duration of the project shall be preparation phase of three years, and implementation up to 2020. The project area shall be tidal swamp area in Banyuasin and OKI Kabupatens, excluding the transmigration project areas. Forest identification may be conducted mainly in Palembang. After the preliminary forest map is prepared, major task will be transferred to field, and the leading agency will be Kabupatens or Kecamatan. Project duration from on-site inventory and forest conservation may take about 5 years. The action is the same with those presented in **Table 7.3.6**.

It is very important that local communities are involved from the earliest stage into the designation process. Identification of forested area, inventory of forest resources are good opportunities for government to work together with local residents. The draft of forest plan must be explained to communities possibly affected by the designation. The scientific base of the regulation must be well explained, and mitigating measures for impact on local economy must be sought both by the government and local community.

Collection of Basic Data for Mangrove Area around the Proposed New Port (Program 3-11)

The objectives of the program are; to prepare for the detailed environmental impact assessment of the port; and to obtain data on natural environment to predict the impacts from construction and operation activities. The program is to acquire basic data of mangrove ecosystems around the proposed site for the Tanjung Api-Api Port. Leading institutions shall be Provincial BAPPEDALDA, in cooperation with national and provincial office and research institutions for communication and transportation, fishery, nature conservation, trade and economics, and spatial planning. Duration of the project shall be research period of three years for good observation of seasonal dynamics of natural environment.

The project area shall be at least 5 km radius from the proposed site of the port. It should include Sunsang town for study on social environment. Precise study area must be determined in the preliminary phase of the research project, to include the possible area to be affected by the port. Project component shall be of the study that include natural and social environment.

Conservation of Freshwater Swamp Area (Program 3-12)

This program aims at land use regulation in freshwater swamp. The objectives are to conserve the swamp function of retaining the floodwater in wet season, to avoid serious flooding in downstream, especially in Palembang City. The leading institutions shall be Kabupaten BAPPEDA, in cooperation with Provincial BAPPEDA, and Kabupaten agriculture office (for rice farming).

Duration of the program shall be three years for preparation of local land use ordinance. Regular budget for monitoring and implementation of the ordinance shall be used. The project area shall be freshwater swamp area in 5 Kabupatens of OKI, Muara Enim, Musi Rawas, Musi Banyuasin, and Banyuasin. Project component shall be as follows: Each of the 5 Kabupatens is recommended to prepare local land use regulation and enforce it.

7.3.8 Selection of Priority Programs

Priority programs have been selected through the same procedure with Component 1 as shown in **Table 7.3.7**.

Table 7.3.7 Priority Program Selection for Component 3

Program	Pre-requisite	Seriousness	Early start	Cost scale	Total Score	Rank
Soil erosion prevention						
3-1 Application of agroforestry on land with major constraints	5	5	5	3	18	1
3-2 Land use regulation on land with major constraints	5	5	5	1	16	6
3-3 Strengthening of agriculture/ estate/ forestry extension	5	5	5	3	18	1
3-4 Reforestation of production forest/ forest estate	5	5	5	3	18	1
3-5 Enforcement of prevention of illegal logging	3	5	3	5	16	6
3-6 Soil erosion prevention –inner and inter-basin coordination	5	3	5	5	18	1
Biodiversity rehabilitation and conservation						
3-7 Rehabilitation and conservation of natural environment	5	5	5	3	18	1
3-8 Increase in the area of designated protected forests	3	5	3	3	14	8
3-9 Management of river environment	1	1	1	5	8	11
3-10 Conservation of tidal swamp forests	1	3	3	3	10	10
3-11 Collection of basic data for mangrove area around the proposed new port	5	3	3	1	12	9
3-12 Conservation of freshwater swamp area	1	3	1	3	8	11

As a result the following were selected as priority programs for Component 3.

- Program 3-1 Application of Agroforestry on Land with Major Constraints
- Program 3-3 Strengthening of Agriculture/ Estate/ Forestry Extension
- Program 3-4 Reforestation of Production Forest and Forest Estate
- Program 3-6 Inner- and Inter-Basin Coordination
- Program 3-7 Rehabilitation of Existing Protected Forests

7.4 Component 4: Urban Water Environment Improvement

7.4.1 Identification of Programs and Objectives

Urban areas scattered in the Musi River Basin have various living environment problems. Especially, deterioration of water environment is one of the major issues for the comprehensive water management of the Musi River Basin. 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. It is reported that the number of persons treated for waterborne or water-related diseases in Palembang Municipality amounted to 102,343 (1986). Cause and effect of the urban water environment problem is summarized as **Figure 7.4.1**.

The objective of the Urban Water Environment Improvement is to solve these urban water environmental problems in Palembang as a pilot city with the following programs.

- Community Drainage Management Program
- River Areas Conservation Program
- Trunk Drainage Channels Rehabilitation Program
- Drainage System Improvement Program

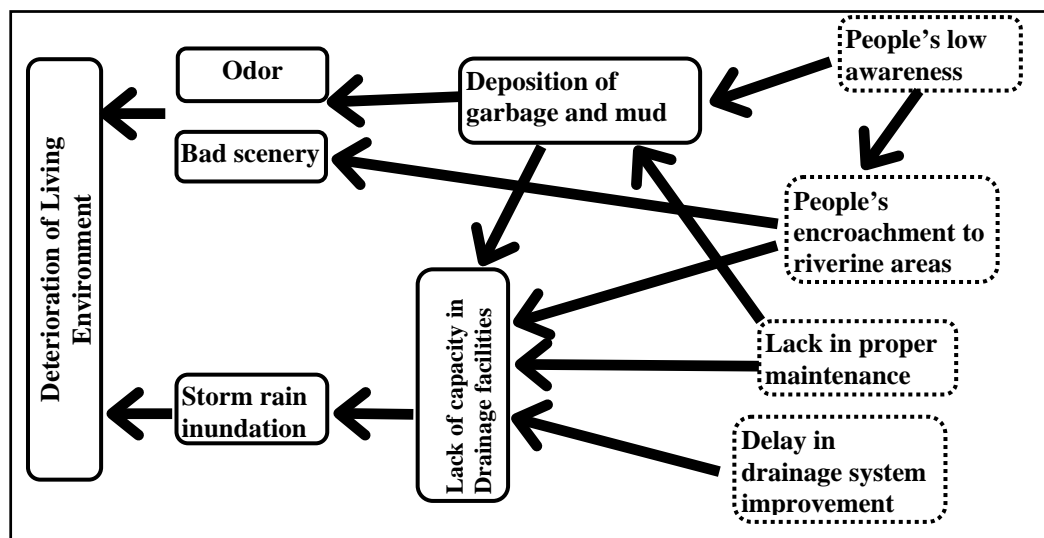


Figure 7.4.1 Cause and Effect of the Urban Water Environment Problem

7.4.2 Community Drainage Management

For the improvement of urban environment, involvement of the community is indispensable. Though improvement or new construction of infrastructure will be needed, improved environment can be achieved with the people's willingness. **Community Drainage Management Program (Program 4-1)** is proposed as the start of the urban environment improvement.

The **objective** of the program is to realize better water environment in the community level through the following activities. Leading institution is Dinas Kimpraswil of Palembang Municipality. Relevant community organizations are NGOs, schools, etc. Activities include the following:

- Choose one drainage area: Chosen area is recommended to have strong, existing community organization.
- Preparation meeting with key persons in community
- 1st meeting with the community: objectives, free discussion
- 2nd meeting: trip to good example.

- 3rd meeting: PCM list up project components, decide on future vision. Project components may include following actions.
- Commencement of the project
- Evaluation meetings in every 2 months.
- Final meeting for the model project
- Summarize and share the obtained know-how for future phase. Formulate project terms for the following standard implementation.

Follow the project procedure learned from the model project, two or three projects in one two-year term are recommended to conduct. By the year 2020, eight implementations, 19 drainage systems, may be covered by the improvement project. In the standard implementation, it is important to include a visit to the community that already experienced the project, so that participants in the new project can directly communicate with the people who already experienced the difficulties and rewards of the improvement work.

7.4.3 Riverine Areas Conservation

Boundary of river area (right-of-way) and conservation of the area are declared in Ministerial Regulation of Ministry of Public Works No.63/PRT/1993. The boundary of the river area is not clear in everywhere. River areas in the urban cities are sometimes not controlled and the environmental condition is worst with illegally built houses and dumping of garbage, etc. Conservation of river area is important for urban environment improvement. **Riverine Areas Conservation Program (Program 4-2)** has been proposed as follows:

The objective of the program is to conserve the river function of floodwater retention in wet season and to allow smooth flow of the water to avoid inundation in the city. Palembang Municipality BAPPEDA, in cooperation with Provincial BAPPEDA, and the Municipality social workers shall be the leading institutions.

Three years for preparation of local land use ordinance, and regular budget for monitoring and implementation of the ordinance afterward shall be considered. Palembang Municipality is recommended to prepare local land use regulation and to enforce it.

Houses in the river area of the Musi River have been used as affordable housing in Palembang City. Although these houses may interrupt the flow of the water in the river, it will be socially difficult to remove the houses in a short time period. The City government is recommended to implement land use regulation on the river area to control the style of construction work to minimize impact on the river flow. The experiment of Palembang City shall be applied to other large cities and towns on major tributaries, such as Muararupit, Muarabeliti, Lubuklinggau, Lahat, and Baturaja.