CHAPTER 7

COMPREHENSIVE WATER MANAGEMENT MASTER PLAN

7.1 Component 1: Water Use Management

7.1.1 Identification of Programs and Objective

Overview

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 (Dinas PUP) 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.

If water resources utilization proceeds out of control, it results in environmental damage and degradation of water resources, which ultimately reduces the supporting capacity of the environment and resources, thus endangering the implementation of sustainable development.

Identified Issues of Water Use Management

Many problems are raised in answers to the questionnaire survey, etc. 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

Each PDAM supplies potable water for domestic purpose, including small industrial purposes, etc. However, quantity and quality of supplied water are not sufficient. In addition, there still remain numbers of urban and rural inhabitants who cannot receive portable water supply services. This issue is to be solved mainly from the viewpoint of basic human needs.

Necessity of Sustainable Irrigation and Swamp Development

Irrigation and swamp development is necessary in order to achieve the stable self-reliance of rice and food security at provincial and national level, as well as to realize sustainable regional development. This issue is to be solved in a sustainable way,

namely, be developed with the water resources management that ensures the preservation of the supporting capacity of the environment and the conservation of water resources.

Water Supply to Transmigration Farmers in Tidal Swamp Area

Living environment of the transmigration farmers in tidal swamp area is undesirable mainly because of difficulties of obtaining drinking and cooking water. This issue is to be solved from the viewpoint of basic human needs.

Conflict between Aquaculture and Irrigation Water Uses

Aquaculture in paddy fields experiences severe conflicts with irrigation. Irrigation water cannot reach to the downstream of irrigation system due to aquaculture. On the other hand from aquaculture side, quantity and quality of water is not stable due to irrigation. This issue should be solved in order to realize equitable and sustainable regional development.

Enhancing Water Utilization for Tourism

Dinas PUP, South Sumatra Province has an intension to utilize water resources to support the tourism development, like canal network improvement at Karang Anyar. However, utilization of river water is difficult because of flow regimes, etc. This issue should be solved in order to realize balanced and sustainable regional development.

Necessity of Water Management Model

It is difficult to manage water resources in a comprehensive way, because the system is highly complex. This issue should be solved in order to achieve sustainable development with conservation of environment in the whole Musi River Basin.

Objectives of Water Use Management

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 Komering, 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, because water deficits can be controlled to some extent by adjusting cropping pattern.

Komering Irrigation Project

Stage I and Stage II (Phase 1 & 2)

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 (254 mcm):

Stage III

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 as: Komering I Dam (120 million m^3), Komering II Dam (40 million m^3) and Muaradua Dam (150 million m^3). Stage III is expected for feasibility study. By this feasibility study, topological, geological and socio-economical data of those dam/reservoir sites are to be collected. Without these data, evaluation of this development is not possible.

Lakitan Irrigation Project

New irrigation development (13,950ha) of Lakitan Irrigation Project is evaluated, and its dependability has been estimated at more than 80%.

Temedak Irrigation Project

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

Method of Potential Irrigation and Swamp Area Estimation

Potential land mentioned in **Sub-Section 3.9.5 Potential Land Resources** are allocated to each sub-basin based on the ratio of its basin area to that of regency/municipality. Three on-going and in-coming irrigation projects as discussed above were included in potential land.

Using these potential lands and projected 2020 water uses, water balance has been carried out to estimate the dependability of agricultural development. In the water balance, diversion at Randu from the Komering River to the Organ River was not considered because a weir is to be constructed at the diversion site. Determination procedure of potential irrigation and swamp area at each sub-basin is as follows:

(1) Give potential areas with double cropping.

(2) If dependability is less than 80% (using considerable deficits), some double cropping area is simply changed to single cropping by try and error.

(3) If dependability is still less than 80%, areas of swamp, communal and/or simple irrigation are reduced by try and error.

(4) If dependability is still less than 80%, semi-technical irrigation area is reduced by try and error

(5) Potential development areas are determined, if dependability becomes over 80%

Potential Irrigation and Swamp Area

Based on the study, the potential areas in the Basin are summarised, as shown 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

Irrigation Type	Potential Land (ha)	Potential Irrigation and Swamp Area (ha)		
		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 Use of Potential Irrigation and Swamp Area

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

Self-Reliance Circumstances of Rice

Indonesia achieved self-reliance of rice in 1984 by the introduction of high yield varieties and irrigation development. However, recent urbanization and industrialization around large cities have resulted in the decrease of productive paddy fields. On the other hand, the demand for rice has increased in accordance with the

population growth. In addition, rice production decreased drastically by El Niño in 1994 and 1997. In 1998, the rice production also decreased by the long drought and price increase of agricultural inputs which was triggered by the monetary crisis in mid 1997. Under these circumstances, self-reliance ratio dropped to 84.2 % in 1999. Rice import of the country and South Sumatra Province is, as follows:

Table 7.1.2 Imports of Rice of Indonesia (Net Weight: 1,000 million ton)

Year	1997	1998	1999	2000	2001
Total	349,681	2,895,118	4,751,398	1,355,666	644,733

Source: Statistik Indonesia 2001

Table 7.1.3 Imports of Rice of South Sumatra Province (Unit: kg)

Year: 1999	2000	2001
Husked Rice: 64,873	Husked Rice: 23,622, Semi-milled/Wholly Milled Rice: 63,380,263	Semi-milled/Wholly Milled Rice: 6,244

Source: Statistik Perdagangan Luar Negeri Ekspor 1999, 2000 & 2001

Potential Irrigation and Swamp Development Area

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 7.1.4 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

Potential Development and Rice Self-Reliance

"Study for Formulation of Irrigation Development Program 1993, JICA," nominated South Sumatra Province as a potential food resources area for the rice self-reliance at the national level. By this study, large irrigation development was targeted for South Sumatra Province as indicated below.

Table 7.1.5 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 7.1.4**). 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.

There is a necessity of program for irrigation and swamp development in order to realize the sustainability of irrigation and swamp development, thus contributing to the stable self-reliance of rice and food security at provincial and national level. So as to realize the sustainability, proper distribution of development areas should be determined based on the re-established development target and potential areas in each sub-basin.

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 (World Bank, 1998, *Demand Responsive Approaches to Community Water Supply: Moving from Policy to Practice, East and Southern Africa*) has been proposed in the sustainable water supply to wide area under the Program 1-1.

Objective, Program Area and Executing Agency

Objectives of the program 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 Dinas PUP of South Sumatra Province, and PDAMs. PDAMs shall be responsible for implementation of the formulated plan.

Activities

Figure 7.1.1 explains how to realize the concept of Demand-Responsive Approach to the activities under the Program.

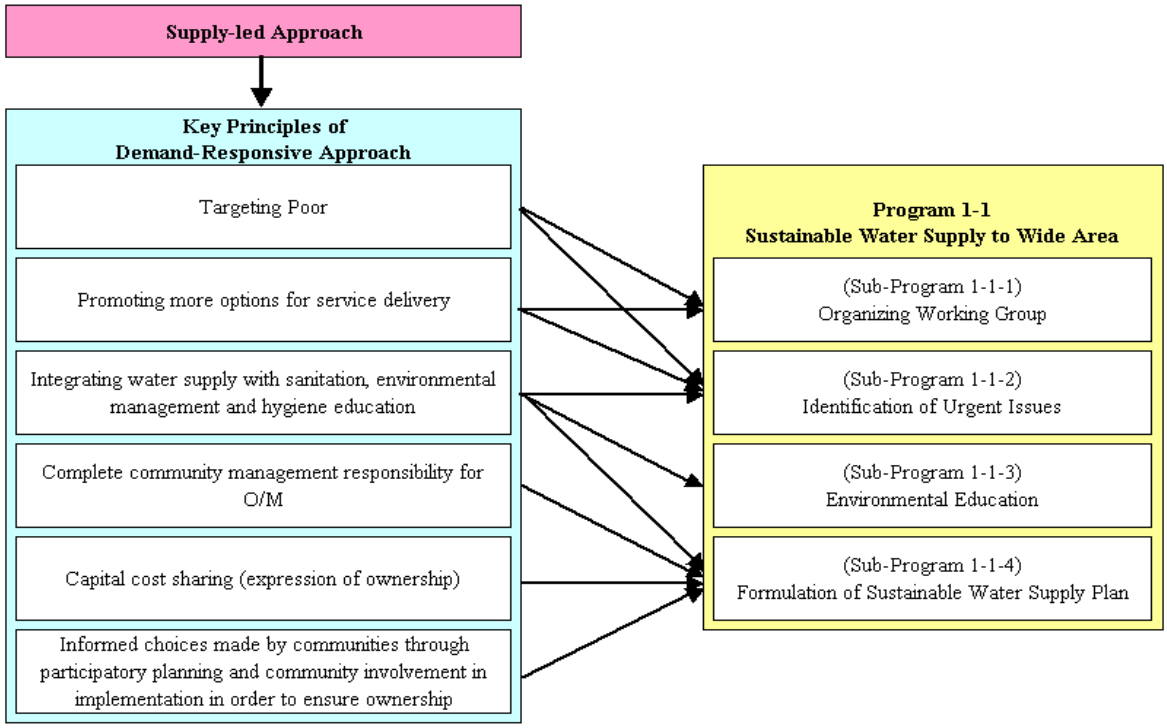


Figure 7.1.1 Demand-Responsive Approach and the proposed Program

Organizing Working Group (Program 1-1-1)

This sub-program includes the activities of Dinas PUP of South Sumatra Province and PDAMs: (1) opening public consultation in each commanding area; (2) increasing understanding of the program approache; 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 of South Sumatra Province, 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 and labor availability, 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 of South Sumatra Province, 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 of South Sumatra Province, 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.

Cost and Beneficiaries

Program Cost

The following program cost should be burdened by the Dinas PUP.

- Plan formulation: 13 (person) × 18 (month) × 4 (day/month) × 150,000 (Rp./day) × 8 (PDAM) = Rp. 1,123.2 million
- PC: 100 (person/day) × 150,000 (Rp./day) × 2 (time) = Rp. 30 million
- Administration (5%): Rp. 57.7 million
- Total: Rp. 1,210.9 million

Beneficiaries

5.5 million rural and urban inhabitants in the Basin, who do not receive portable water supply (2000)

Implementation Schedule

Implementation period is 1.5 years.

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.

In line with this context, this program, sustainable irrigation and swamp development, 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. **Figure 7.1.2** shows concept flow of this sustainable development. In the concept flow, there are four main subjects, re-establishing development target, pre F/S, F/S and D/D.

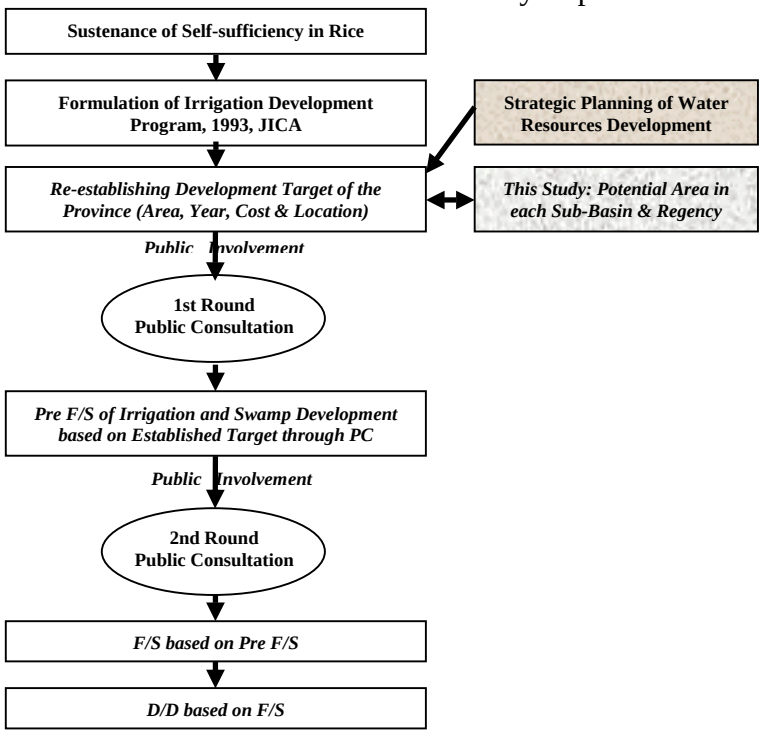


Figure 7.1.2 Concept Flow of Sustainable Irrigation and Swamp Development

In re-establishing development target (development area, target year, project location and investment cost, etc.) based on the Study for Formulation of Irrigation Development Program, the following viewpoint must be considered:

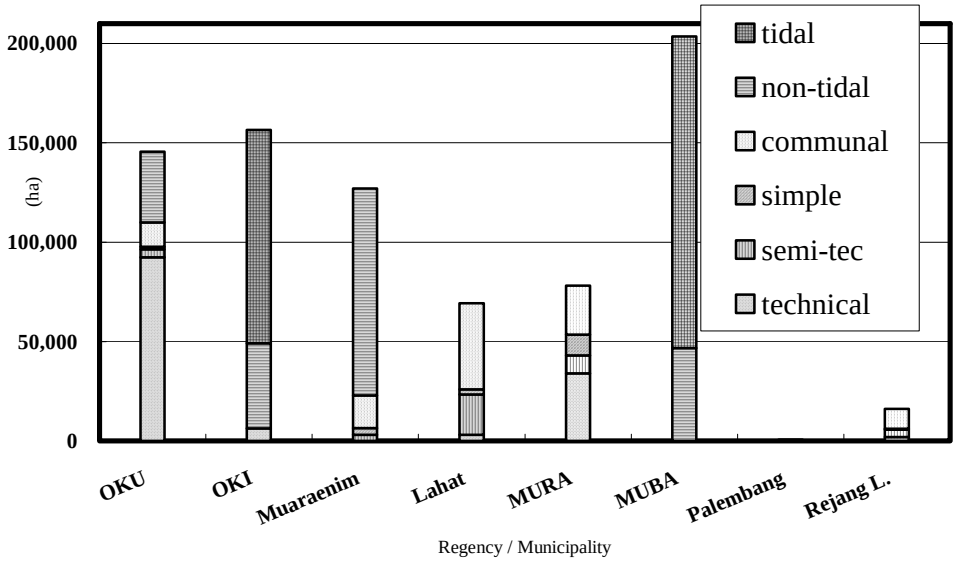
Potential Irrigation and Swamp Area

As a result of this Study, 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 7.1.6 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 7.1.3 shows potential irrigation and swamp area, determined on the potential land and water resources, in each regency/municipality and sub-basin. The paddy demand is foreseeable based on the projected population and projection of per capita rice consumption, while the paddy supply depends upon the irrigation and swamp development speed determined by target year and target development area. Therefore, the target year, target development area and investment cost should be determined firstly by the national and provincial policies/intensions to food/rice security with mutual consent.



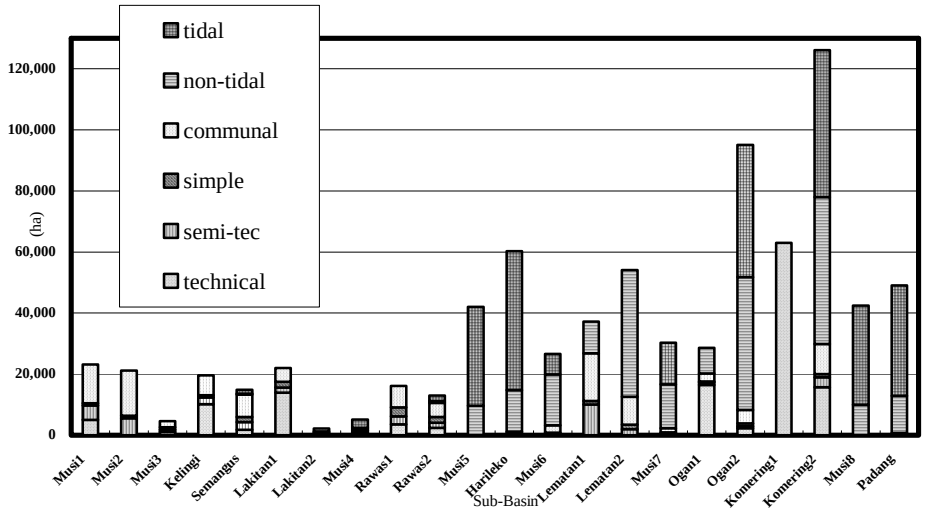


Figure 7.1.3 Potential Irrigation & Swamp Development Area by Regency and by Sub-basin

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 Provincial Government of Bengkulu, Jambi, and Lampung, and, regency and municipality governments in the Province.

Activities

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

This sub-program includes the activities of DGWR and Dinas PUP: (1) determining target areas and year of irrigation and swamp development based on the results of this Study; (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) executing 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. The scope of this pre F/S will include: survey on water, land and human resources; survey on soil conditions and cropping pattern; irrigation and drainage planning; natural and social environment; cost estimates and implementing schedule; and, economic and financial analysis.

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. The scope of F/S shall include: supervision of sub-contracted work; collection and review of existing data and information; survey of project area (natural, socioeconomic and environmental condition); formulation of development plan; environmental study; formulation of implementation plan; cost estimation; and project evaluation.

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. D/D shall be carried out with the following scope:

detail design and preparation of drawing; construction planning and cost estimates; and preparation of tender documents.

Cost and Beneficiaries

Program Cost

- Establishing Development Target: Establishment Rp. 13.5 million; PC Rp. 15 million; Administration Rp. 1.4 million; Total Rp. 29.9 million
- Pre F/S: Engineering Rp. 1,800 million; Administration Rp. 90 million; PC Rp. 10 million; Total 1,905 million
- F/S (for irrigation and swamp development area of 80,000ha): Engineering Rp. 16,000 million; Investigation Rp. 4,000 million; Administration Rp. 1,000 million; Total Rp. 21,000 million
- D/D (for the area of 80,000ha): Engineering (a) Rp. 45,000 million; Engineering (b) Rp. 18,000 million; Investigation Rp. 15,000 million; Administration Rp. 3.9 million; Total Rp. 81,900 million
- Total: Rp. 104,835 million

Beneficiaries

Direct, Basin population 6.9 million persons (2002); indirect, 206 million population of Indonesia (2000)

Implementation Schedule

Implementation period is 8.5 years.

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. There are two facility alternatives of how to tap the rainwater, namely, individual water tank and communal rainwater pond. Based on the preliminary study, individual water tank is recommended because this method is already successfully practiced under afore-mentioned South Sumatra Swamp Improvement Project, JBIC.

With the rainwater storing facilities, only drinking and cooking water will be stored. Therefore, washing and bathing water will be still surface water. Under this situation, the focus is the water related diseases. Hence, sanitation facilities are necessary at the same time. Mostly, type of human waste disposal in the area is toilet on river/canal. Considering water conditions of the area, toilet with pit privy should be avoided because the pit is filled with water when tidal water is high. Therefore, septic tank should be designed to place on the ground.

Objective, Program Area and Executing Agency

Objectives of the program are: (1) to provide rainwater storing and sanitation facilities to transmigration 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

Preparation (Program 1-3-1)

This sub-program includes the activities of 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 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 m^3) 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.

Cost and Beneficiaries

Program Cost

- Facilities: 2 million (water tank 1 mil; septic tank 1 mil) (Rp./HouseHold) × 92,000 (HH) = Rp. 184 billion: Oki (10%) 18.4; Muba (25%) 46; Banyuasin (65%) 119.6; Rp. billion, respectively.
- Preparation and Administration (8%): Rp. 14.7 billion: Province (1% of Facilities Cost) 1.8; Oki (10% of the rest) 1.3, Muba (25% of the rest) 3.2, Banyuasin (65% of the rest) 8.4, Rp. million, respectively.
- Total: Rp. 198.7 billion: Province 1.8; Oki 19.7; Muba 49.2; Banyuasin 128; Rp. billion, respectively.

Beneficiaries

Around 370,000 persons (92,000 households) in the tidal swamp area (2002) in former MUBA and OKI (mostly former MUBA)

Implementation Schedule

Implementation period is 10 years.

7.1.8 Aquaculture Water Management

Aquaculture Water Management (Program 1-4) has been identified as follows: Aquaculture practiced in the Basin can be classified into fishpond, paddy field, fish cage and fence. The major issues relating water management occur in the aquaculture in fishpond located in paddy field especially in MURA, namely there are conflicts between aquaculture and irrigation. These conflicts are:

- From irrigation side: irrigation water cannot reach to the downstream of irrigation system because the aquaculture use is not included in the scope of original system design.
- From aquaculture side: quality and quantity of water are not stable due to the influence of irrigation.
- From operational aspect: operation of checks and intake gates becomes complicated because their water use patterns are different.

Objective, Program Areas and Executing Agencies

Objectives of the program are: (1) to develop solving methods of conflicts between aquaculture and irrigation water uses; and (2) to realize equitable and sustainable regional development. In order to solve the conflicts, areas for aquaculture and irrigation are better to be separated from the viewpoint of water management, e.g., 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. Implementation of the program is to be carried out by regencies/municipalities. The program area shall be the whole Musi River Basin, and 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.

At present, conflicts between aquaculture and irrigation occur in the Basin. The following table shows present aquaculture areas:

Table 7.1.7 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

Activities

Researching Solution Methods (Program 1-4-1)

This sub-program includes of the activities of Dinas PUP under the coordination with Agriculture and Estate Services of South Sumatra Province, Bengkulu Province, and

relevant Kabupatens and Kotas: (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.

Cost and Beneficiaries

Program Cost

- PC: 100 (person/day) × 150,000 (Rp./day) = Rp. 15 million
- Research and dissemination: 3 (person) × 24 (month) × 5 (day/month) × 150,000 (Rp./day) = Rp. 54 million
- Administration (5%): Rp. 3.5 million
- Total: Rp. 72.5 million

Implementation Schedule

Implementation period is 2 years.

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. There is therefore a need to enhance the water utilization for tourism for balanced and sustainable regional development in the Basin.

Objective, Program Area and Executing Agency

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

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. Candidates of program sites are, as follows:

Table 7.1.8 Candidates of Tourism Resources for Program

Regency/ Municipality	Candidates of the Program
OKU	Ranau Lake, Bendali Rantau K
OKI	Teluk Gelam Lake, Lebung Karangan
Muaraenim	Gemuhak Hot Water, Segayam Lake
Lahat	Tepian Lematang, Ribang Gayau
MURA	Rayo Lake, Karya Sakti Hot Water
MUBA (new)	Sekayu
Banyuasin	Padang River
Pagaralam	Thebat Gheban, Lematang Water Fall
Prabumulih	Bunut Lake
Rejang Lebong	Talang Kering Lake, Air Sempiang Water Fall

Implementation (Program 1-5-2)

This sub-program includes the activities of Regency/Municipality Governments under the coordination of Dinas PUP South Sumatra Province with cooperation of Bengkulu Provincial Government: (1) implementation of Program; and (2) tourism education to society.

Cost and Beneficiaries

Program Cost

- SID and implementation: Rp. 5 billion (per site, assumed based on Karang Anyar) × 10 (sites) = Rp. 50 billion
- Administration (5%): Rp. Rp. 2,500 million: Province Rp. 250 million; Each Regency/Municipality Rp. 225 million
- Total: Rp. 52,500 million: Province Rp. 250 million; Each Regency/Municipality: Rp. 5,225 million

Beneficiaries

4.9 million population of South Sumatra Province (2001)

Implementation Schedule

Implementation period is 5 years.

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.

Three main elements of the model are, as follows (**Figure 7.1.4**):

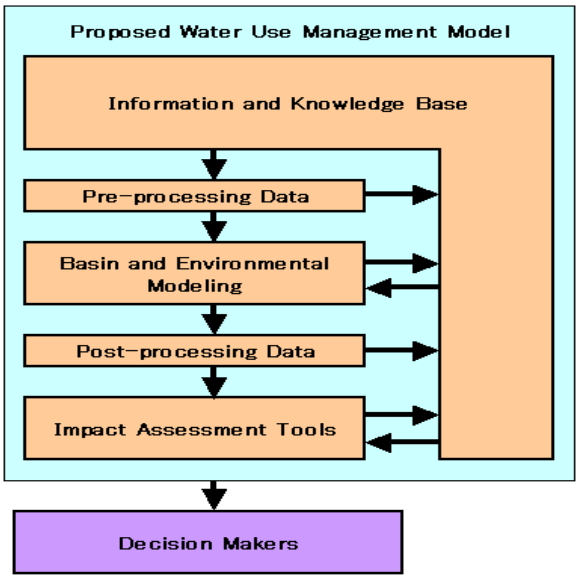


Figure 7.1.4 Proposed Water Use Management Model

Information and Knowledge Base

The information and knowledge base will be a comprehensive system covering all aspects of water resources development in the Basin. The base is expected to be dynamic, and should undergo progressive updating by Musi Balai PSDA and related agencies. It is important therefore that the user interfaces and data structures are designed to permit this easily. The base will include, but not be restricted to:

- Primary hydrological (quantity, quality) databases
- Primary water use databases, including both consumptive and non-consumptive uses and detailed information on existing water-related infrastructure
- Socio-economic databases
- Land use and soils databases (GIS)
- Elevation models of floodplains (GIS)
- River cross sections
- Freshwater and estuary ecosystems, fisheries and environmental databases
- Results of modeling runs and impact assessment

Basin and Environmental Modeling

Containing the primary simulation models (hydrological, basin simulation and hydrodynamic models) and the secondary models (water quality, sediment and environment as required).

The hydrological model should have a strong conceptual and deterministic base, and should be a continuous simulation model, running on as long a period of homogeneous historical rainfall records as can be constructed. The model should be able to be run on daily time steps.

The basin simulation model will be the core of the Modeling. It is a tool through which the impacts of water resources developments, such as irrigation, hydropower, and wastewater discharge are synthesized on water availability and quality downstream. The model will permit integration of impacts from a wide variety of developments with complex or simple operational procedures. The model will be driven by inputs derived from observed stream-flow and data generated by the hydrological model. It is expected to run in a continuous simulation mode. It will represent the river system, major infrastructure, and diversions and return flows from uses from the main stream and its tributaries. The model will be demonstrated to be capable of modeling pollutant and sediment transport, albeit in a simplified manner. Multi-purpose reservoir simulations will be required, incorporating complex operational rules, and permitting synthesis of power production. Among other things, output from the model will include time series of river flows and quality at desired locations, reservoir operations, hydropower production, irrigation diversions and demands, and drainage returns.

The hydrodynamic model should extend from midstream include the river mouth delta and major swamp canals. The hydrodynamic model would be run with upstream inputs from the basin simulation and hydrological models. The hydrodynamic model will include water quality components. The model will include salinity, as saline intrusion is an impact of water resources development. Erosion/sedimentation, acidification and pollution are also important considerations.

Impact Assessment Tools

Most of the environmental and socio-economic impacts will be associated with the aquatic environment, and consideration must be given to the development of appropriate indicators, through which potential impacts can be captured. In line with this idea, tools for the determination and assessment of environmental and socio-economic impacts will be developed. The hydrodynamic model should provide primary data for development of the indicators. It will also be important to consider navigation requirements, and the potential impact of changes in flow on this.

Objective, Program Area and Executing Agency

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, 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 DGWR of Kimpraswil, and Dinas PUP of South Sumatra Province. Related agencies shall be Forestry Service of South Sumatra Province, Meteorological and Geophysical Agency (BMG) and Regional Technical Implementation Unit (UPTD).

Activities

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.

Cost and Beneficiaries

- Engineering: 60 (m/m) × 200 (Rp. Million/m/m) = Rp. 12,000 million
- Hardware, Software and Workshop: Rp. 900 million
- Administration (5%): Rp. 645 million
- Total: Rp. 13,545 million

Implementation Schedule

Implementation period is 2 years.

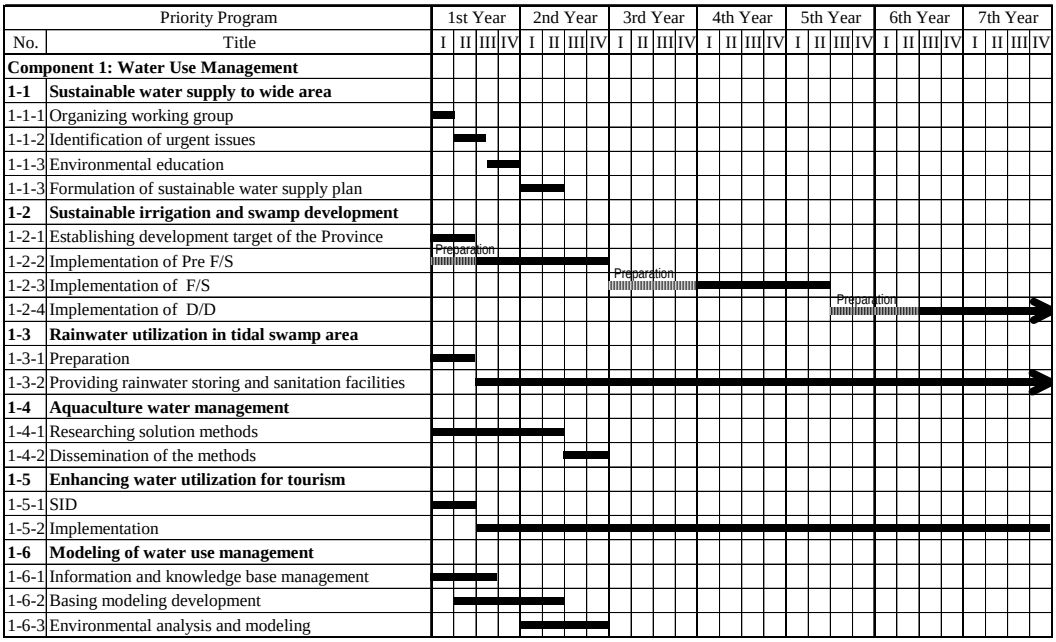


Figure 7.1.5 Implementation Plan of Water Use Management Programs

7.1.11 Selection of Priority Programs

Selection Criteria

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

Selection of Priority Programs

Scores of each program is determined using the criteria, as follows:

Table 7.1.9 Score of Each Program

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

Based on the results, 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 of river inundation.

Topographically the portion of mountainous areas in the Musi River Basin is small, and it is rather difficult to find effective dam/reservoir sites to store water. Instead the basin has extensive natural retarding basins along the middle and lower reaches, serving for flood mitigation during rainy season and sustaining water supply during dry season for the lower basins including Palembang City.

Other issues of floodplain management in the Musi River Basin include those for flush floods in the mountainous areas and river bank erosion in the Musi mainstream and major tributaries. Thus the programs under the Component 2 have been identified as follows:

- Floodplain Management
- Flood Forecasting and Warning
- 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 by flooding and river to be in the basin.

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). Floodplain management commonly includes flood damage mitigation (flood preparedness measures, emergency response measures, etc.), land use and zoning plans, flood forecasting and warning, disaster management (disaster reduction, flood fighting, etc.), etc. In order to maintain water-retarding function in floodplains, land use control and zoning are commonly applied. Of these, measures that are realistic in the Musi River Basin are zoning and land use control in the floodplains in the middle and lower basins, and flood warning and evacuation in the upstream flush flood areas.

Existing Regulations

There exist the following laws and regulations for floodplains to be protected and conserved.

- Law No. 11/1974 (Water Resources)
- Government Regulation No. 27/1991 (Swamps)
- Government Regulation No. 35/1991 (Rivers)
- Ministerial Regulation of Ministry of Public Works No. 63/PRT/1993 (River Channel, River Usage and Non-usage Areas, Old Unfunctional Rivers)
- Ministerial Letter of Home Affairs No. 179/1996 (Organization Guidelines of Basin Water Resources Management Unit (Balai PSDA))
- Presidential Letter No. 32/1990 (Protected Area Management)

Among others, the following are the declaration related to the floodplain management.

(1) Government Regulation No.27/1991 (Swamps)

In the Regulation, the followings are subject for conviction, namely, (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.

(2) Ministerial Regulation of Ministry of Public Works No.63/PRT/1993 (River Channel, River Usage and Non-usage Areas, Old Unfunctional Rivers)

Ministerial Regulation 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. River borders with dike is at least 3 m (in urban areas) or 5 m (outside urban areas). River border without dikes is 10-30 m (in urban areas) or 50-100 m (outside urban areas). Tidal-influenced river border is at least 100 m and functions as green-belt.

River borders may not be used for: dumping of garbage, soil and suspended wastes, development of permanent buildings, houses, and commercial facilities. Land areas outside of authorized river areas may be used with permission from the government, users are subject to maintenance fee. Authorized river areas are (i) within 100 m from the river (for water retention areas), and (ii) floodplains. Authorized river areas may be used for certain usage with permission.

(3) Presidential Letter No.32/1990 (Protected Area Management)

Protected areas mainly function to protect environment and its sustainability that cover natural resources, etc. Among others, “Water retention areas (with heavy rainfall) are included as protected areas.

Zoning of the Floodplain Areas

As discussed above, 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 3,360km^2 and the breakdown by river basin is as shown in the **Table 7.2.1**.

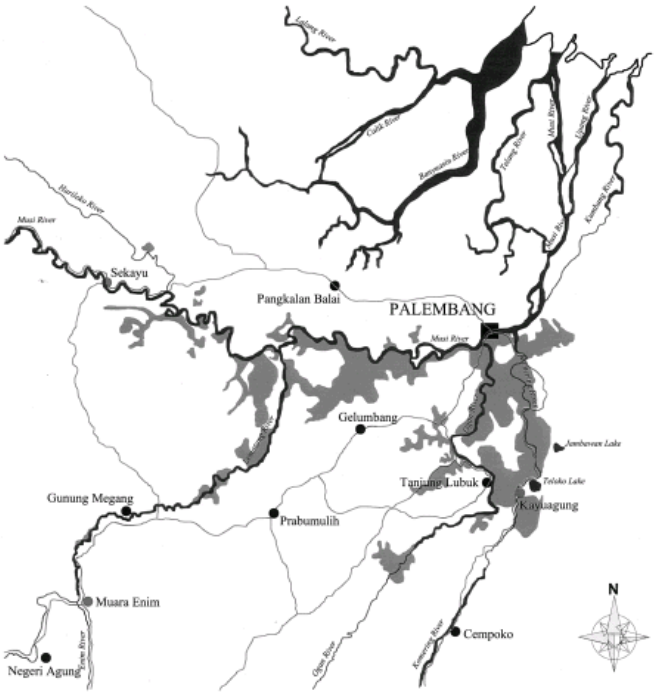


Figure 7.2.1 Identified Floodplain Areas

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 already compiled as the GIS database by this Study, land use types in the identified floodplains were confirmed as shown in **Table 7.2.2**. As shown in the table, 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

Evaluation of Effect of Flood Retardation

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 present flow duration curve was obtained as an average of observed data in 1995, 1996, and 2000 at Tebing Abang station on the Musi River at just downstream of the Lematang River confluence. The flood retarding capacity was assumed at 1.7 billion m^3 from the floodplain area of 3,363 km^2 and an average depth of 0.5 m.

Figure 7.2.2 compares the flow duration curves under the present condition and without floodplains. From the illustration, the following have clarified:

- The annual maximum daily discharge of 3,656 m^3/s under the present condition would increase up to 4,040 m^3/s under no-floodplain condition.
- The present 365-day (12 months) discharge of 584 m^3/s would decrease to 481 m^3/s if no floodplains.
- The 125-day discharge would be the same for both conditions under present and no-inundation.

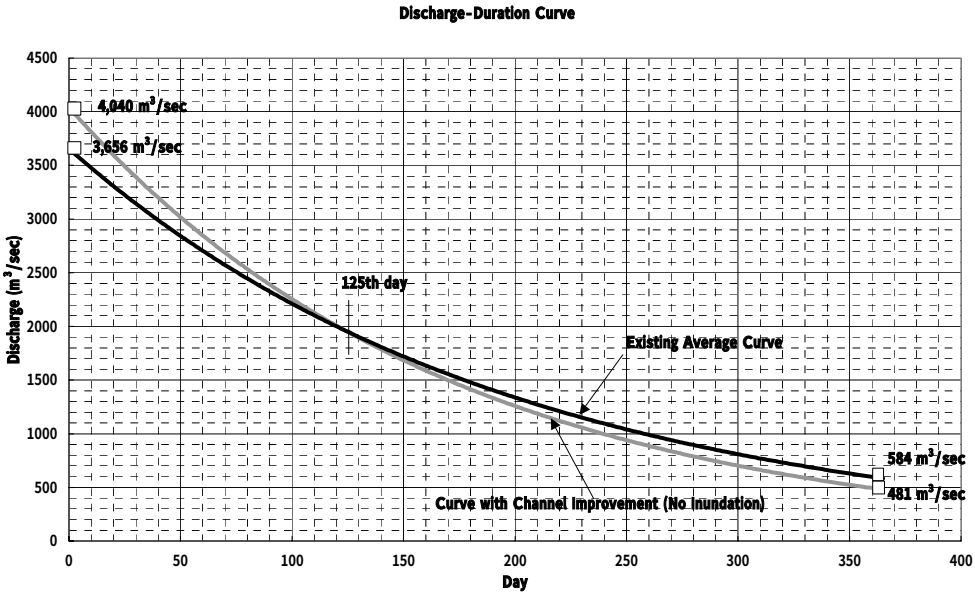


Figure 7.2.2 Comparison of Discharge Duration Curves with and without Floodplains

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

Zoning and Land Use Control Program consists of the following sub-programs.

(1) Confirmation of the Land Use Control Area

Land use control area proposed by the Study Team is 1/250,000 topographic map basis as discussed above. Detailed study using remote sensing methods for the confirmation of the necessary land use control area shall be conducted.

The primary objective of remote sensing methods for mapping flood-prone areas is to provide with a practical and cost-effective way to identify following items of floodplain: Where the floodplain and flood-prone areas are; How often the floodplain will be covered by water; How long the floodplain will be covered by water; At what time of year flooding can be expected.

With remote sensing methods, the extent of floodplains and flood-prone areas can be identified at small to intermediate map scales (up to 1:50,000) over entire river basins. Most satellite coverage for a single full scene extends over a large area (usually more than 33,000km^2).

(2) Zoning of the Area

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.

(3) Execution

Land use control shall be executed. Periodical patrol for the proper land use shall be conducted. 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.

Implementation schedule of Zoning and Land Use Control Program is shown in **Figure 7.2.3**. Implementation cost has been estimated at Rp. 78 million (US$0.009 million).

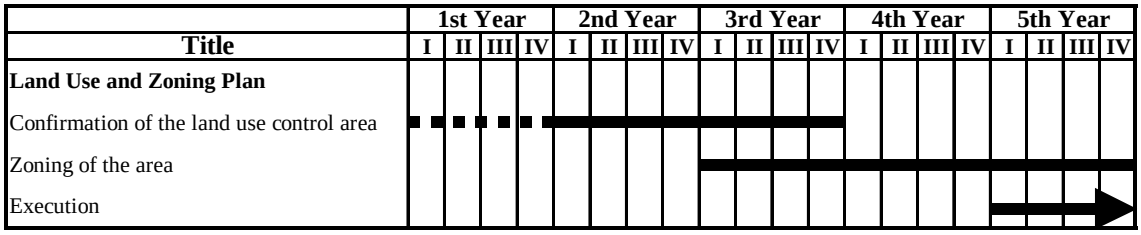


Figure 7.2.3 Implementation Schedule of Zoning and Land Use Control Program

7.2.3 Flood Forecasting and Warning

Flood forecasting and warning can be applied in the area where flush floods occur. Detailed information is not available for the flush flood in mountain areas, and more study is needed to identify what is needed. Dinas PU Pengairan of South Sumatra Province identified the following possibility of flood forecasting and warning system introduction. **Flood Forecasting and Warning Program (Program 2-2)** shall be as follows:

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**. 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 7.2.4**.

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

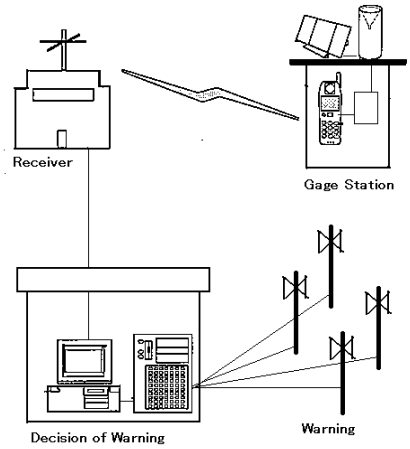


Figure 7.2.4 Flood Forecasting and Warning System

Implementation schedule of Flood Forecasting and Warning Program is shown in **Figure 7.2.5**. Implementation cost has been estimated at Rp. 5,843 million (US$0.647 million).

Title	1st Year				2nd Year				3rd Year			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
Flood Forecasting and Warning System												
Inventory Survey	■	■	■	■	■							
Installation of Warning System					■	■	■	■				
Execution									■	■	■	▶

Figure 7.2.5 Implementation Schedule of Flood Forecasting and Warning System

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. Bank protection works identified for future implementation are listed in **Table 7.2.4**.

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.

Table 7.2.4 Bank Protection Works Identified for Future Implementation

No.	Location	Length (m)	Bank
Musi River			
A	**MUBA**		
1	Epil	600	Left
2	Bailangu	650	Left
3	Sekayu	400	Left
4	Sukarame	240	Left
5	Rantau Panjang	230	Left
6	Karang Anyar	420	Left
7	Karang Waru	400	Left
8	Bumiayu	640	Left
9	Ulak Paceh	900	Left
10	Tanjung Durian	400	Left
11	Napal	450	Left
12	Rantau Kasih	360	Left
13	Karang Ringin	500	Left
14	Ulak Teberau	430	Left
15	Kasmaran	270	Left
16	Toman	220	Left
17	Babat	300	Left
B	**MURA**		
1	Sungai Pinang	580	Left
C	**LAHAT**		
1	Tebing Tinggi	870	Left
Harileko River			
A	**MUBA**		
1	Teluk	600	Left
2	Epil	400	Right
3	Muara Teladan	100	Right
Rawas River			
A	**MURA**		
1	Muara Rawas	240	Right
2	Ulak Macang	660	Right
3	Dusun Pau	500	Right
4	Tebing Tinggi	420	Right/Left
5	Batu Kucing	830	Right/Left
6	Balam	770	Right
7	Tanjung Raja	640	Right/Left
8	Bingin Teluk	1880	Right
9	Mandi Angin	870	Right
10	Alai	900	Right
11	Biaro	980	Right/Left
12	Karang Dapo	850	Left
13	Rantau Kadam	740	Right
14	Pantai	800	Right
15	Lubuk Umbai	900	Right
16	Muara Rupit	250	Right/Left
17	Lesung Batu	600	Right/Left
18	Kertadewa	800	Right
Lematang River			
A	**LAHAT**		
1	Prabu Menang	380	Right
2	Kebur	480	Left
3	Banjar Sari	450	Right
4	Lahat	280	Left
B	**MUARA ENIM**		
5	Sungai Rotan	960	Right
6	Sukarami	670	Right
7	Kuripan	700	Left
8	Belimbing	400	Left
9	Teluk Lubuk	400	Left
10	Beruge	870	Left
11	Tanjung	740	Right
12	Tanjung Muning	680	Right
13	Perjito	740	Right
14	Pinang Belarik	700	Right
15	Gunung Megang Luar	680	Left
Ogan River			
A	**OKI**		
1	Tanjung Raja	580	Left
2	Sri Jabo	700	Right
3	Sungai Pinang	420	Left
4	Embacang	460	Left
5	Lubuk Keliat	400	Left
6	Kalampadu	380	Left
7	Sukacinta	480	Left
8	Seri Kembang	520	Left
B	**OKU**		
9	Kuang Anyar	450	Left
10	Suka Pindah	380	Left
11	Munggu	270	Left
12	Kedaton	260	Left
13	Bunglai	180	Left
14	Peninjauan	370	Left
15	Belatung	360	Left
16	Lubuk Batang	870	Left
17	Terusan	400	Left
18	Tanjung Kemala	230	Left
19	Baturaja	980	Right/Left
20	Pusar	300	Left
21	Kedaton	450	Left
22	Tubohan	870	Left
23	Gunung Liwat	450	Left
24	Sukarame	420	Left
25	Gunung Meraksa	600	Left
Komering River			
A	**OKU**		
1	Rasuan	580	Right
2	Pulau Negara	600	Left
3	Matas	720	Left
4	Damarpura	960	Left
5	Muara Dua	860	Right/Left

Implementation schedule of Sustainable River Channel Management Program is shown in **Figure 7.2.6**. Implementation cost has been estimated at Rp. 198,440 million (US$21.963 million).

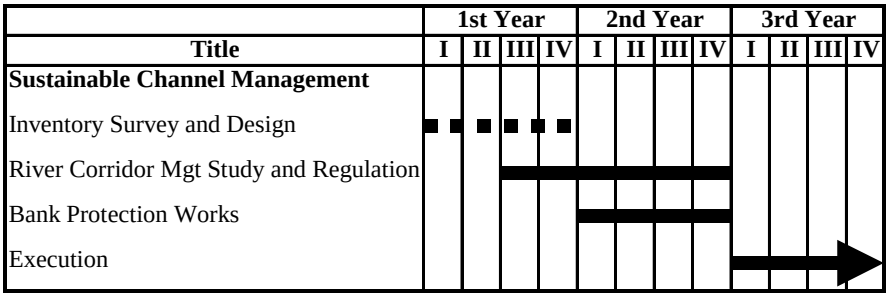


Figure 7.2.6 Implementation Schedule of Sustainable Channel Management Program

7.2.5 Selection of Priority Programs

Various programs have been identified and proposed in order to achieve the objectives of each component. Since a lot of input of fund and human resources is necessary for the implementation of these programs, priority of each program should be judged, and the implementation plan in accordance with the priority has been prepared. Priority in this Study has been decided based on the following categories:

- Prerequisite to the other programs

- Degree of seriousness
- Requirement of early start
- Economic feasibility, cost scale etc.

As a result of study on the component of floodplain management in the previous chapter, the following three programs were developed:

- Program 2-1: Zoning and Land Use Control Program
- Program 2-2: Flood Forecasting and Warning Program
- Program 2-3: Sustainable River Channel Management Program

Discussions were made to give priority on the above programs for their implementation as presented below.

Deterioration of the river regime will worsen the water deficit situation in the water balance in the Musi River Basin. Thus, the conservation of floodplains through zoning for land use control and building control, and the maintenance of the present river regime is a basin wide request. Furthermore, land use control and building control in the zoned area should be started as early as possible, since the uncontrolled development may progress due to the absence of the zone. Land use and zoning program should be given higher priority.

Flood forecasting and warning program needs more investigation at each site. Sustainable channel management program shall be conducted with the continuous and sustainable manner by Dinas PU Pengairan of South Sumatra Province. Thus the priority of these two programs in the comprehensive water management is judged low. Priority of floodplain management (Component 2 of the Master Plan for Musi River Basin Comprehensive Water Management) is shown in **Table 7.2.5**.

Table 7.2.5 Priority of Floodplain Management

	Programs of Floodplain Management	Prerequisite to Other Programs	Degree of Seriousness	Requirement of Early Start	Cost Scale	Total	Priority Order
1	Land Use and Zoning (Program 2-1)	5	3	5	5	18	1
2	Flood Forecasting and Warning (Program 2-2)	1	3	5	5	14	2
3	Sustainable Channel Management (Program 2-3)	1	3	5	3	12	3

Note) Score 5 (High Priority); 3 (Middle Priority); 1 (Low Priority)

Thus land use and zoning program (Program 2-1) was selected as priority project of floodplain management (Component 2).