

**CB**  
**COMMUNITY AND BENEFICIARIES'**  
**PARTICIPATION SURVEY**

THE STUDY  
ON  
COMPREHENSIVE MANAGEMENT PLAN  
FOR  
THE WATER RESOURCES OF THE BRANTAS RIVER BASIN  
IN  
THE REPUBLIC OF INDONESIA

**FINAL REPORT**

**TABLE OF CONTENTS**

**CB    Community and Beneficiaries' Participation Survey**

<b>The Findings of the Questionnaire Survey .....</b>	<b>CB-1</b>
(1)    Irrigation Water Users.....	CB-1
(2)    Fishery Water Users.....	CB-7
(3)    Industrial Water Users .....	CB-9

**Report on Community and Beneficiaries' Participation Survey**



## The Findings of the Questionnaire Survey

The survey covered some selected water service beneficiary groups of the Brantas river basin, including irrigation, fishery and industrial water users. The survey focused on the beneficiaries' consciousness about water resources, efficient use and their socioeconomic condition.

### (1) Irrigation Water Users

The area of the land operated is relatively small, mostly in the order of 0.26-0.50 hectare per family. The cropping pattern practiced varies somewhat depending on the degree of water availability. The river and irrigation canals are the main sources of water for irrigation. The ground water is found as an additional source of water. The farmers' source of income includes agricultural sector and non-agricultural sector which is composed of earnings from, for example, part time working outside from fields. It was observed that the farmers in the surveyed areas are inefficient in the use of irrigation water. It is found that there are Water Users Associations almost in every village in the Brantas river basin. However, the members are not active in joining their regular Water Users' Associations meetings. In some areas participation is demonstrated by farmers in the Brantas river basin in the form of involvement in rehabilitation works of the tertiary and quaternary canals.

#### a) Source of Water for Irrigation

Source of water for irrigation in the Brantas river basin is usually taken from irrigation canals. However, when there is a shortage of water supply from the irrigation canals, especially in the dry season, the ground water seems to be the source of the additional source of water for irrigation. Some farmers in the Warujayeng and Widas irrigation area have to use ground water as an additional water source for irrigation, while those who can not afford to buy the ground water tend to leave the land uncultivated. Details of the water sources are explained below.

Water Source	Source of water for Irrigation in the Surveyed Areas					
	Blobo	Lodoyo	Warujayeng	Widas	T. Tunggorono	B. Delta
Irrigation canals	100%	100%	100%	84%	83%	69%
Irrigation canals + Ground water	-	-	-	2%	10%	31%
Ground water	-	-	-	13%	5%	-
River water	-	-	-	1%	-	-
Rain fall	-	-	-	-	2%	-
Total	100%	100%	100%	100%	100%	100%

b) Problems in Irrigation Water Supply Systems

The problems of water unavailability and water shortage are observed in most of the Brantas river basin. Water is not available when it is needed and the water is not sufficient. These are main problems complained by most farmers as shown below. Majority of the farmers shares the same problem in the dry season.

Problem s	Problems in Irrigation Water Supply Systems					
	Blob o	Lodoyo	Warujayen g	Widas	Turi Tunggorono	B. Delta
-	50%	-	-	4%	-	-
1	-	-	4%	33%	16%	6%
2	-	34%	26%	44%	79%	67%
3	4%	-	-	-	-	-
4	-	-	1%	-	-	-
5	4%	-	-	-	-	-
6	-	-	-	1%	-	-
7	-	-	-	-	-	-
8	-	-	-	-	-	6%
1+2	2%	26%	63%	18%	5%	-
1+3	4%	-	1%	-	-	-
1+5	-	-	1%	-	-	-
1+7	-	-	-	-	-	3%
2+3	28%	40%	1%	-	-	3%
2+4	4%	-	-	-	-	-
2+5	-	-	2%	-	-	-
2+6	-	-	1%	-	-	-
2+7	-	-	-	-	-	21%
3+6	2%	-	-	-	-	-

0 = No problems

1 = No water in time

2 = No sufficient water

3 = Erosion in canal

5 = Low embankment

6 = No measuring devices

7 = Silted canal bottom

4 = Problems in check gate

8 = Others

c) Farmers' Income

Farmers' family income in the Brantas river basin may be classified into two categories, namely agricultural sector and non-agricultural sector. The table below shows a variation of farmers' income by irrigation areas. The agricultural sector contributes from 59% to 86% of the total family income of farmers in the surveyed area. The income derived from the agricultural sector is found still to be an important and higher than that of non-agricultural sector. It is found that the contribution of agricultural sector to the total income of the farmers in Warujayeng and Lodoyo irrigation area are the lowest among others, being only about 60%, while such sector contributes 86% of the farmers income in Widas

irrigation area. In Blobo, Turi Tunggorono and Brantas Delta irrigation areas, the agriculture sector contributes about 3/4 of the farmers' total income.

Irrigation Area	Farmers Income from Agriculture & Non-Agriculture Sector	
	Agriculture Sector	Non-Agriculture Sector
Blobo	74%	26%
Lodoyo	60%	40%
Warujayeng	59%	41%
Widas	86%	14%
Turi Tunggorono	77%	23%
Brantas Delta	76%	24%

The average of total farmers' family income from the agriculture and non-agriculture sector varies by irrigation areas in the surveyed area. As shown in table below, it is calculated that the average farmers' family income from both sectors Rp.22,062,500/family/year. From the agriculture sector farmers' average income Rp.15,575,000/family/year, while from non-agriculture sector only Rp.6,487,500/ family/year. This higher contribution indicates the degree of dependency of the farmer's family life to the agriculture sector. Therefore, to expect that the farmers with higher dependency to the agricultural sector pay a greater attention for their own interest, to participate in the comprehensive management plan for the water resources of the Brantas river basin.

Irrigation Area	Farmers' Family Income (Unit: Rp. 1000)		Total Income (Unit: Rp)
	Agriculture Sector	Non-Agriculture Sector	
Blobo	18,100	6,350	24,450
Lodoyo	14,200	9,400	23,600
Warujayeng	14,900	10,350	25,250
Widas	9,250	1,450	10,700
Turi Tunggorono	15,350	4,700	20,050
Brantas Delta	21,650	6,675	28,325

#### d) Farmers' Willingness to Participation

It was observed that farmers' willingness to participation in the water resources management systems, such as rehabilitation and operation & maintenance of irrigation canals with or without payment depend on the following issues;

- Level of agriculture sector derived income
- Availability of irrigation water in the dry season
- The degree of farmers' involvement at HIPPA activities

- ♦ Willingness to participate to overcome the water shortage problem
- ♦ Farmers realization of water service benefits from the Brantas river basin

It was identified that the farmers' participation for rehabilitation works of irrigation canals in the past was respectively high. This indicated in Blobo, Lodayo, Widas and Brantas Delta irrigation areas, where more than 80% of the farmers took part in such works, with some variation in participation frequency. Among them, farmers in Blobo area considered to be the most active one. In Warujayeng and Turi Tunggorono areas, however, farmers willingness to take in the rehabilitation works of irrigation canal was slightly less than 60% of total farmers.

(d-1) Willingness to Participate in Rehabilitation and Operation and Maintenance

Farmers' willingness to be involved in rehabilitation works of irrigation canal without payment varies by irrigation areas. The highest participation rate ((80-86%)) was represented by Blobo, Warujayeng and Brantas delta irrigation areas, and the lowest in Turi Tunggorono (20%) as shown in below. The lowest level of intention to participate indicates their less awareness about the good service they received. On the contrary, in the irrigation area where water supply is a problem in the dry season, the farmers showed their high interest to participate in the water resources management activities.

Farmers Willingness to Participate in Rehabilitation and Operation and Maintenance Works												
Willing to	BLB	LDY	WRJ	WDS	TURI	BRD	BLB	LDY	WRJ	WDS	TURI	BRD
Participate	Participation in Rehabilitation						Participation in Operation & Maintenance					
Yes	86%	52%	80%	64%	22%	84%	10%	-	46%	83%	17%	16%
No	10%	48%	20%	3%	20%	6%	90%	100%	54%	1%	77%	82%
Cannot reply	4%	-	-	33%	58%	10%	-	-	-	16%	6%	2%
Total	100	100	100	100	100	100	100	100	100	100	100	100

BLB: Blobo  
LDY: Lodayo  
WRJ: Warujayeng

WDS: Widas  
TURI: Turi Tunggorono  
BRD: Brantas Delta

(d-2) Willingness to Attend the HIPPA Meeting in the Future

The degree of farmers' participation in water resources management activities of the Brantas river basin in the future seems to correlate well with the degree of their involvement in the HIPPA meeting. The below table, may reflect the present role of HIPPA is satisfying the needs of its member. The farmers in the Blobo, Warujayeng and Brantas delta areas showed a consistent attitude towards water resources management activities, in the future, more than 55% farmers still willing to attend the HIPPA meeting. On the other hand, the intention of farmers to attend the HIPPA meeting in Lodoyo area seems to decrease sharply, as in the past their attendance to the meeting reached at the level of 92%. Similar trends are also observed in the Widas and Turi Tunggorono irrigation areas. The decrease in the interest of farmers to join the HIPPA meeting in the future reflect the present performance of the HIPPA in the fulfillment of the farmers' needs.

Irrigation Area	Willingness to Attend the HIPPA Meeting in the Future			
	Yes	No	Cannot reply	Total
Blobo	56%	22%	22%	100%
Lodoyo	36%	56%	8%	100%
Warujayeng	82%	18%	-	100%
Widas	17%	32%	51%	100%
Turi Tunggorono	27%	23%	50%	100%
B. Delta	64%	11%	25%	100%

(d-3) Willingness to Join the Water Resources Management Activities

For the farmers to join the water resources management activities of the Brantas river basin, the HIPPA is an official organization which can make a bridge through an interaction of 'top-down' and 'bottom' approaches between the water resources management agency and irrigation water users. A portion of the farmers have intention to participate in the comprehensive management plan for the water resources of the Brantas river basin with or without payment, although there is a variation by irrigation areas and the socioeconomic conditions of the farmers. Before implement the beneficiaries' participation in the water resources management plan, farmers motivation is necessary through education as well as increasing awareness. Because most of the farmers level of education at an elementary school, and the farmers are not well informed, not aware of their responsibilities and even they do not know how the management system works.



c) Beneficiary-Pay Concept

Beneficiary-pay-concept has been understood by most of the farmers in the Brantas river basin area. There are three kinds of payment by the farmers in the basin area; i.e. land tax, irrigation service fees (IPAIR) and IURAN (contribution in the form of paddy). It varies by areas of irrigation. It is found that HIPPA membership fee is also applied in some of the irrigation areas of the Brantas river basin.

(e-1) Payment for Irrigation Service Fee

In the surveyed irrigation areas most of the farmers pay the irrigation service fees through HIPPA. The payment varies by irrigation areas, as shown below.

Pay water Service	Payment for the Irrigation Water Service					
Respond	Blobo	Lodoyo	Warujayeng	Widas	Turi Tunggorono	Brantas Delta
Yes	94%	72%	97%	92%	92%	100%
No	6%	28%	3%	8%	8%	-
Total	100%	100%	100%	100%	100%	100%

Farmers' willingness is being shown by payment which is made for the irrigation water they use. There is a variation of amount paid for the water service fee is observed in the Lodoyo, Warujayeng and Brantas delta areas than in the other irrigation areas. The lowest rate seems to be in the Blobo and Brantas delta irrigation areas where farmers mostly pay less than Rp.25,000/ha/season. Some farmers even did not pay any irrigation service fees, as it is observed in all irrigation areas except the Warujayeng. It is shown in below, in the Warujayeng and Lodoyo areas, the implementation of beneficiary pay concept seems to be accepted by the farmers.

Amount Paid (Rp./ha/season) (Unit: 1000)	Amount of Money Paid for Irrigation Service Fee					
	Blob o	Lodoyo	Warujayeng	Widas	Turi Tunggorono	Brantas Delta
≤25	94%	4%	37%	72%	33%	97%
25-49	-	10%	34%	20%	59%	2%
50-100	-	58%	24%	-	-	1%
≥100	-	-	2%	-	-	-
Total	94%	72%	97%	92%	92%	100%

(e-2) Introduction of Beneficiary-Pay Concept

Most farmers in the Brantas river basin area seem to accept the beneficiary- pay concept, since 60% or more farmers recognized that such concept is reasonable in the surveyed areas. Still there is a small percentage of farmers who do not understand the concept in Blobo, Lodayo and Turi Tunggorono area, as shown in table below. The failure to understand the beneficiary- pay concept may be caused by the fact that most of the farmers still keep the old perception that the irrigation water service fee is included in the tax they pay and that it is the duty of the government to supply the water. Since the concept to some degree is already practiced, an introduction of beneficiaries pay-concept, which is based on the water actually used, may not be so difficult as long as the water supply service is also improved.

Perception to Beneficiary-Pay Concept			
Irrigation area	Reasonable	Not Reasonable	Can not Reply
Blobo	60%	8%	32%
Warujayeng	100%	-	-
Turi Tunggorono	60%	3%	37%
Lodayo	64%	14%	22%
Widas	94%	-	6%
Delta Brantas	78%	2%	20%

(2) Fishery Water Users

Brackish water fishpond aqua culture is presently consuming a considerable amount of water, which is mainly derived from the Brantas river. The most serious problems encountered are associated with water shortage in the dry season. The water problems and issues are dealt individually or discussed in a small group of fishpond farmers. It was observed that there is no organization like HIPPA for fishery water. It is identified that there is need for better water management system for the fishery water. The establishment of association based on "bottom up" mechanism might be fruitful. Improvement of water efficiency, both in quantity and quality, will be the entry point to introduce a beneficiary pay-concept.

a) Source of Water for Fish Farming

Water used for fish farming varies in origin in the Brantas river basin such as sea, river, irrigation canals, estuarine and rain fall water. However, the fishpond derived water, almost 70% from the adjacent river, either directly or indirectly through the irrigation canals. The details of source of water for the fishpond is shown below. The amount of water used, in general, has never been less than 20,000m<sup>3</sup>/ha/year. Some 50% of the farmers employ in the order of 25,000-

30,000m<sup>3</sup> of water/ha/year and another uses water more than 30,000m<sup>3</sup>/ha/year.

Source of Water for the Fishpond in the Brantas River Basin	
Name of Source	Percentage of Water
River water + Sea water	40%
River water + Rain water	10%
Rain fall	10%
From Irrigation canals	20%
Other (Estuarine)	20%

b) Income of the Fish Farmers

Almost 80% of the surveyed fishpond farmers have been in the fish cultivation for more than 5 years. This indicates that they have a lot of experience in running fish cultivation and are familiar with water issues. Gross incomes of the fishpond farmers vary somewhat depending mainly on the area being operated and the species of fish in cultivation. As shown below, most of them (80%) earn between 2 to 8 million Rp./ha/year. One half of them spend less than 1 million Rp./ha/year and only 10% of them pay more than 2.8 million Rp./ha/year for the operation and maintenance of the fishpond. However, none of them make any payment for the fishery water they use for fish farming.

Income Range (Million Rp./ha/year)	Fishpond Owners Gross Income and O&M Cost		
	Gross Income	Operational Cost (Million Rp./ha/year)	Operation and Maintenance Cost
2-4.99	40%	0.40-0.99	50%
5-7.99	40%	1.00-1.59	20%
8-10.99	10%	1.60-2.20	10%
≥11 Million	10%	2.20-2.79	10%
-	-	≥2.80	10%

c) Fishery Water Users' Associations

Presently, there is no fishery water users' association in the Brantas river basin. However, the fish farmers discuss problems of water quality and shortage in a small group. Some of the fish farmers seems to be less interested in to establishing of an association. Possible explanation is that they are still not sure whether such an association will be helpful since their experience with the

existing formal agencies do not function as they are expect them to.

d) **Fish Farmers' Willingness to Participation**

All of the surveyed fish farmers expressed that to obtain adequate water for the fish farming is within their own responsibilities. Most of the fish farmers (80%) stated that they want to participate in the rehabilitation works of the fishery water canal. However, all fish farmers stated that they had never paid for the operation and maintenance of the canals. The reasons of fish farmers' desire to participate in the water resources management system of the Brantas river basin are as shown below.

The Reasons of Fish Farmers' Desire to Participate		Fish Farmers
1	To overcome water shortage problem	50%
2	To improve water quality	17%
3	To increase production	33%

e) **Beneficiary-Pay Concept**

According to the survey results, almost 80% of irrigation farmers in the surveyed area are paying irrigation service fees. However, the fish farmers are not used to pay for the fishery water. For decades, there is a perception among the fish farmers that since they already pay for the land and income taxes, it is the obligation of the government to supply water for fish farming. In order to overcome these problems, it is necessary to introduce the beneficiary-pay concept in relation to water service to the fish farmers. It is likely that the above mentioned problems, especially water shortage and the decline of water quality, may be an entry point to make a closer contact with the fish farmers.

(3) **Industrial Water Users**

Industries that are considered as extensive water users and that discharge the waste water into the Brantas river are selected to be respondents. A total of 30 individual industries selected for the survey, mostly located in the Brantas river basin area.

a) **Source of Water for Industries**

The following figure shows that the majority of industries in the Brantas river basin area use the water from the river for their operation. One third of industries depend solely on the river as the main source of water required for the operation of their industries, while about one fifth rely only on the ground water. Another one fifth use a combined source of water, namely the river and

the ground water. The remaining industries employ a single or mixed source of water like PDAM, rain fall and ground water.

<b>Water Source for Industries in the Brantas River Basin</b>	
<b>Type of Water Source</b>	<b>Industrial Water</b>
PDAM	5%
Ground Water	23%
River Water	34%
Rain Water	-
PDAM + Ground Water	9%
PDAM + Ground Water + Rain Water	5%
Ground Water + River Water	24%

b) **Industry Associations and Issues Discussed**

The majority (56%) of the industries state that they are already participants in the water resources management activities through respective industry association meetings. The problems frequently discussed in those association meetings include the water quality, water tariff, water shortage and wastewater. According to the JICA survey, 24% of the industries claim that the quality of water is not as good as expected. Among those who complain about the water quality, 50% of them state that it is due to pollutant, and the remaining 26% express it results from sedimentation. Thus result indicates that a comprehensive actively needs be carried out to improve the environmental conditions of the Brantas river.

c) **Willingness of Industries for Participation in the Water Resources Management**

When the industrial water users are questioned whether they want to "participate more actively in the water resource management of the Brantas river basin", 76% of industries state they are willing to do so. Among those industries ready to participate more actively, according to the survey results, most of them hope to make closer contacts with government agencies concerned through umbrella organizations. It can be concluded that in general the industrial water users actually are ready to participate in those activities in order to establish the appropriate water resources management systems.

d) **Beneficiary-Pay Concept**

All surveyed industries pays for water. However, it seems that most of them are reluctant to pay higher water tariff. 20% of the industries are willing to pay up to 20% increase of the current water tariff, while about 4% of them mentioned

that they do not accept any increment. The remaining 76% do not respond to the question. Any attempt to incur a higher water tariff in the future must be followed by the improvement in water supply services. Among those industries experienced in discussing water related issues with government agencies (64% of total industries surveyed), a quarter of them are not satisfied with water supply services. The reasons cited include no solution to problems discussed and the high water tariff.

**REPORT  
ON  
COMMUNITY AND BENEFICIARIES'  
PARTICIPATION SURVEY**

## TABLE OF CONTENTS

	Page
<b>CHAPTER I</b>	
Introduction .....	1
1.1. Background .....	1
1.2. Objective .....	2
<b>CHAPTER II</b>	
Methodology .....	3
2.1. Location and Time .....	3
2.2. Method .....	3
1) Farmers .....	3
2) Fish pond Owners .....	5
3) Industrial Water Users .....	6
2.3. Data Analysis .....	7
<b>CHAPTER III</b>	
Results and Discussion .....	8
3.1. Farmers .....	8
3.1.1. Farmers Income .....	8
3.1.2. Agriculture Information .....	11
3.1.2.1 Area of the Cultivated Land and Tenure Status .....	11
3.1.2.2 Cropping Pattern .....	14
3.1.3 Information on Water Supply .....	17
3.1.3.1 Source of Water for Irrigation .....	17
3.1.3.2 Problems in Irrigation System .....	18
3.1.3.3 Water Applied for Irrigation .....	19
3.1.3.4 Water Supply Scheduling .....	22
3.1.3.5 Respond of Farmers in Case of Water Shortage .....	25
3.1.4 The Need of Water Management .....	27
3.1.4.1 Attendance on HIPPA Meeting ..	27
3.1.4.2 Participation in the Management Activities of Brantas River .....	29
3.1.4.3 Willingness to Join in the Management Activities of the Brantas River .....	32
3.1.5 Water Users Association .....	38
3.1.6 Beneficiaries Pay-Concept .....	41
3.1.7 Domestic Water .....	44
3.1.8 General Findings .....	44



	<b>Page</b>
<b>3.2. Fish pond Owners.....</b>	<b>47</b>
3.2.1. Fish Culture Information.....	47
3.2.2. Water Issues Related to Fish Cultivation	51
3.2.3. Fish pond Owners Association and Participation .....	56
3.2.4. General Findings.....	59
<b>3.3. Industrial Water Users.....</b>	<b>60</b>
3.3.1. Number of Staff .....	60
3.3.2. Source and Use of Water for Industries..	61
3.3.3. Expenditure on Water .....	67
3.3.4. Participation of Industrial Companies in the Water Resource Management.....	69
3.3.5. Willingness to participate in the Water Resources Management in the Future ....	71
3.3.6. Willingness to Pay Industrial Water and Its Elasticity .....	73
3.3.7. General Findings.....	73
<b>CHAPTER IV. Conclusions.....</b>	<b>75</b>

## LIST OF TABLES

Table	Page
2.1. Distribution of Respondents in the Survey Areas .....	4
2.2. Surveyed Villages in the Respective Irrigation Areas .....	5
2.3. Distribution of Respondent in Survey Area .....	6
2.4. Selected Respondents for Industrial Water Users.....	6
3.1.1. Contribution of Agricultural Sector and Non Agricultural Sector to the Income of Farmer in the Brantas River Basin .....	8
3.1.2. Family Income of Farmer in Brantas River Basin .....	9
3.1.3. Income Distribution Derived from the Agriculture and Non Agricultural Sector.....	10
3.1.4. Area of Cultivated Land .....	12
3.1.5. Tenure Status of Farming Operating .....	13
3.1.6. Cropping Pattern in Brantas River Basin .....	15
3.1.7. Main Source of Water for Irrigation.....	17
3.1.8. Problems of Irrigation System and Facilities.....	18
3.1.9. Water Applied for Irrigation.....	21
3.1.10. Schedule of Water Supplied from Irrigation Canals During the Dry Season .....	23
3.1.11. Response on Farming Practice in Case of Water Shortage.....	26
3.1.12. Attendance of Farmers in the HIPPA Meeting .....	27
3.1.13. Reason for Not to Attend HIPPA Meeting.....	28
3.1.14. Labour Service without Payment for Rehabilitation Work of Irrigation Canal and Operation of Water Intake Gate .....	29
3.1.15. Degree of Farmers Participation for Rehabilitation of Irrigation Canals as Influenced by Level of Agriculture-derived Income..	31
3.1.16. Farmers' Participation in Any Other Management Activities of the Brantas River .....	32
3.1.17. Willingness to Attend the HIPPA Meeting in Future .....	33
3.1.18. Willingness to Participate in The Rehabilitation Work and Operation of Water Intake Check Gate.....	34
3.1.19. Idea Proposed to Improve the Water Resources Management	35

3.1.20 Responsibility for the Operation and Maintenance of Irrigation Canals .....	36
3.1.21. The Need of Improvement of the Water Resources management System.....	37
3.1.22. Membership HIPPA .....	38
3.1.23. Reason to Join the HIPPA.....	39
3.1.24. Decision Process to Join HIPPA.....	39
3.1.25. The Perception to the HIPPA Role .....	40
3.1.26. Degree of Satisfaction with Water Management System.....	40
3.1.27. Payment of the Irrigation Water Service.....	41
3.1.28. Amount of Money paid for Irrigation Water Service Fee.....	42
3.1.29. Perception to "Beneficiaries Pay-Concept".....	43
3.1.30. Source of Water for Domestic Use .....	44
3.2.1. The Expected Amount of Additional Water for Fish Cultivation	53
3.2.2. Expected Source of Additional Water Fish Cultivation .....	54
3.3.1 Number of Staff in the Various Types of Industries .....	60
3.3.2 Water Source for Industries .....	62
3.3.3 Type of Product and Average Distance from the River.....	62
3.3.4 Level of Water Consumption of Company Water Users .....	64
3.3.5 Response to the Quality of Water Currently Supplied .....	66
3.3.6 Comment in the Quality of Water Currently Supplied .....	67
3.3.7 The Expenditure of Water.....	67
3.3.8 Involvement of Industries in the Discussion within the Industrial Companies' Association .....	69
3.3.9 Willingness to Participate in the Water Resources Management .....	72
3.3.10 Willingness to Share Responsibility in the Water Resources Management.....	72

## LIST OF PIE CHART

Pie Chart	Page
3.2.1. Tenure Status of Fish Farming in the Brantas Delta Irrigation Area.....	47
3.2.2. Fish pond Area Operated in the Brantas Delta Irrigation Area .	48
3.2.3. Fish pond Operator Gross Income.....	48
3.2.4. Cost of Operation and Maintenance .....	49
3.2.5. Common Fish Species Cultivated.....	50
3.2.6. Source of Water for Fish Cultivation.....	51
3.2.7. The Volume of Water Used for Fish Cultivation.....	52
3.2.8. Frequency of Water Changing for Fish pond.....	52
3.2.9. Quality of the Existing Water Compared to that 10 years ago..	55
3.2.10. Problems Associated with Fish Cultivation.....	55
3.2.11. Participation in the Water Resource Management of the Brantas River .....	57
3.2.12. Participation in the Rehabilitation of Water Canals.....	58

## **List of Appendices**

<b>Appendix</b>	<b>Page</b>
1. Map of survey location	77
2. Questionnaires (Farmers, Fish pond, Industry)	78
3. Some snapshots on farming system	103
4. Documented pictures of the surveyed fish pond	106
5. Water treatment unit some industry respondents	109

## CHAPTER I

### INTRODUCTION

#### 1.1. Background

The problem of scarcity of water, as it is needed for many aspects of human life, has become a great issue in the last 10 years and it has drew so much efforts from governments and private agencies concerned world wide. A similar problem has arised in Java, the most densely populated and industrialised island in the Indonesian archipelago.

In Java, water supply system is predominantly derived from the surface water, especially that comes from the river. In addition to domestic use, the water from the river has been mostly used for irrigation of the intensive farming system in the area for decades. Such water is also used for the fast growing brackish water pond aquaculture in the northern coastal area as well as various types of industries of the island.

The Brantas River is the second largest river in Java with its catchment area about 11,800 Km<sup>2</sup> and total length of 320 km. It originates in the southern flank of the Arjuno volcanic mountain, flows westward around, turns its direction to north near Tulungagung and finally debauches in the Madura strait after bifurcating in the Porong River and the Surabaya River at Mojokerto. Main tributaries of the Brantas River are the Lesti River, the Ngrowo River, the Konto River and the Widas River.

Average slope of the Brantas River is 1/200 in the most upstream reaches, 1/1,000 in upstream reaches, 1/2,000 in middle stream reaches, and 1/2,500 in downstream reaches, respectively. Average annual basin rainfall is approximately 2,000 mm and annual surface runoff is 12 billion m<sup>3</sup>. Average runoff observed at Mojokerto is 250 m<sup>3</sup>/s.

Problems to be faced in water supply, for agriculture, fisheries, industry and domestic purposes, covers among others the following :

1. The increase of population rate and its growth is 2.5 to 3.0% per annum. The population in the Brantas River basin including that of Surabaya, the second largest city in Indonesia, was 13,72 million as of 1990. The population density in the basin is as high as 1,163 persons/km<sup>2</sup>, compared with 678 persons/km<sup>2</sup> of the average value in East Java Province. Population increase showed a marked rate of 1.82% a year over a period of 1971 to 1980, and 1.35% for the next decade up to the year 1990.
2. Land use in upstream areas seems to ignore an environmental conservation. The increase of land use without taking into account land conformity, causes negative impacts. It is shown by the increase in the soil erosion rate that results in higher level sedimentation in the dams, rivers and the irrigation systems, flood and other unexpected impacts, which in turn results in the reduction of agricultural production in the irrigated area.
3. The sharp increase in water use is also due the with the rapid growth of industrial sector in the area.

To date, some of the water users, if not all, have never been placed in the water management system of the Brantas river basin. Therefore, the need for such effort is a must in order to utilise the water resources in a sustainable manner.

## 1.2. Objectives

The study is emphasised on the concept of the community and beneficiaries' participation in the comprehensive management plan for the water resources of the Brantas River basin. Therefore, the objectives of the study are an understanding of the community and beneficiaries consciousness about water resources, efficient utilisation and their socio-economic conditions in the Brantas river basin.

## CHAPTER II

### METHODOLOGY

#### 2.1. Location and Time

The study is carried out in the Brantas River basin in the middle of dry season, from the end of July until end of September 1997. The study covers some selected water service beneficiary groups of the Brantas River basin i.e. irrigation water users (farmers), fishery water users (fishpond owners) and industrial water users in the pre-determined location (see Appendix 1).

#### 2.2. Method

The study is performed using a survey method based on direct, face to face interview with the target groups employing questionnaires.

Irrespective of the target groups, the main issues covered in the questionnaires are as follow :

- a. Production activity
- b. Present condition and issues of water supply for production
- c. Involvement in water resources management activities and expectation in participating in water resource management
- d. Beneficiaries pay-concept
- e. The consciousness for efficient use of water.

The description of the surveyed area, sampling technique and sample size of the respective target groups is presented below :

##### (1) Farmers

The survey is carried out in the middle of dry season, from 29<sup>th</sup> of July to 10<sup>th</sup> of August 1997. A total of 500 farmer respondents are



interviewed. The distribution of respondents in the surveyed areas is presented in the following table.

**Table 2.1. Distribution of respondent in the survey area**

No.	Irrigation Area	Interview	Responded
01	Brantas Delta	100	100
02	Turi-Tunggorono	100	100
03	Warujayeng	100	100
04	Widas	100	100
05	Lodoyo T. Agung	100	100
Total		500	500

The interview is carried out by a group consisting of two interviewers for each irrigation area, so that each group of interviewers covers 100 respondents, respectively.

Tertiary irrigation blocks located in four to six villages in the corresponding irrigation area are determined as the area of survey. Therefore, the number of respondents interviewed in the village ranges from 15 to 25.

An observation along the tertiary irrigation canals is carried out prior to sampling. A systematic sampling technique is then applied in such a way so respondents taken are those practising cultivation in the land located along the tertiary irrigation canals. Thus it will cater any variability in water management issues in the corresponding irrigation area. Details of villages in the respective irrigation area surveyed is presented in Table 2.2.

## **(2) Fish pond owners**

The survey area is the low land of the Brantas Delta, in Sidoarjo regency. The area is characterised by a complex system of sustainable tambak (brackish water pond aquaculture) and wetland agriculture. A very

thin mangrove fringe remains in the area, but the land is mostly converted to tambak.

Tambak operators interviewed are whose ponds located in the Sidoarjo regency. A total of 10 respondents operating tambak in the area are selected as a sample. They are situated in 5 different village (desa), namely Desa Sawohan in the district (Kecamatan)of Buduran, Desa Kalanganyar Kecamatan Sedati, Desa Rangkah Kecamatan Sidoarjo, Desa Gebang in Kecamatan Gebang and desa Tambak Kalisogo in Kecamatan Jabon (Table 2.3). A randomised sampling technique is then applied to determine respondents in the respective village.

**Table 2.2. Surveyed Villages in the Respective Irrigation Areas**

No	Irrigation Area	District	Village
01	Brantas delta	a. Tanggulangin b. Buduran  c. Krembung d. Sukodono	1. Kalisampurno 2. Banjar Kemantren 3. Sidokepong 4. Kepper 5. Kelopo Sepuluh
02	Turi-Tunggorono	a. Perak  b. Megaluh  c. Tembelang	1. Sukorejo 2. Kalang Semanding 3. Megaluh 4. Turi Pinggir 5. Gabus Banaran
03	Warujayeng	a. Prambon	1. Gondanglegi 2. Mojoagung 3. Baleturi 4. Sanggrahan 5. Tanjungsari 6. Bandung
04	Widas	a. Nganjuk  b. Sukomoro	1. Ringin Anom 2. Begadung 3. Ngrenget 4. Putren
05	Lodoyo T. Agung	a. Kademangan  b. Kepanjen	1. Kademangan 2. Rejowinangun 3. Jenggolo 4. Sengguruh

Table 2.3. Distribution of Respondent in the Survey Area

No.	Village/District	Interview	Responded
01	Sawohan/Buduran	2	2
02	Kalanganyar/Sedati	2	2
03	Rangkah/Sidoarjo	2	2
04	Gebang/Gebang	2	2
05	Tambak Kalisogo/Jabon	2	2
Total		10	10

### (3) Industrial water users

Industries that are considered as extensive water users and that discharge the waste water into the Brantas River are selected to be respondents. A purposive sampling technique is therefore employed in the study. The list of the selected industries is presented in Table 2.4. A total of 30 individual industries, mostly located in or closed to the Brantas delta irrigation area, are surveyed.

Table 2.4 Selected Respondents for Industrial Water Users

No.	Name of Company	Address	Type of Product or Processing	Water Use (m <sup>3</sup> /year)
01	Sumber Makmur	Dampit, Malang	Tapioca	255,500
02	Sumber Tani Abadi	Dampit, Malang	Tapioca	255,500
03	BMI	Kab. Malang	Packaged shrimp	-
04	Kebalen Timur	Kodya Malang	Tanning	25,550
05	Dinas Pemotongan Hewan	Kodya Malang	Slaughter House	-
06	PT. Tjiwi Kimia	Tarik, Sidoarjo	Paper	12,648,96
07	PT. Ekamas Fortuna	Kepanjen, Malang	Paper (industrial)	2,887,706
08	PT. Surabaya Agung Ind.	Driyorejo, Gresik	Paper	7,179,540
09	PT. Surabaya Meka Box	Driyorejo, Gresik	Paper (industrial)	2,173,757
10	PT. Pakerin I	Pungging, Mojokerto	Paper/pulp	1,826,640
11	PT. Suparma	Karangpilang, Surabaya	Paper	1,897,344
12	PT. Jaya Kertas	Kertosono Nganjuk	Paper	
13	PT. Adi Prima	Wringin Anom, Gresik	Paper	1,250
14	PT. Ajinomoto Indonesia	Jetis, Mojokerto	MSG	6,505,700
15	PT. Ajinex International	Jetis, Mojokerto	Cane molasses	5,278,900

Table 2.1. Selected Respondents for Industrial Water Users (continued)

No.	Name of Company	Address	Type of Product or Processing	Water Use (m <sup>3</sup> /year)
16	Aneka Kimia	Wates, Mojokerto	Alcohols	876,000
17	PG. Gempolkerep	Gedeg, Mojokerto	Cane sugar	8,823,985
18	PG. Kebon Agung	Pakisaji, Malang	Cane sugar	1,131,610
19	PG. Kribet Baru	Kepanjen, Malang	Cane sugar	8,377,560
20	PG. Mrican	Mrican, Kediri	Cane sugar	7,300,800
21	PT. Petro Kimia Gresik	Jl. A. Yani, Gresik	Fertilizer	4,928,139
22	PT. Semen Gresik	Jl. Veteran, Gresik	Cement	1,638,558
23	Mertex	Kec. Puri, Mojokerto	Textile	1,825,000
24	PT. Gudang Garam	Semampir, Kediri	Cigarette	949,000
25	Timur Megah Steel	Driyorejo, Gresik	Electroplating	54,750
26	CV. Nasional	Kodya Malang	Rubber	
27	Persh Tahu Halim Jaya	Jl. Mastrip, Surabaya	Tofu (tahu)	182,500
28	Bintang Apollo	Jl. Jambangan, Surabaya	Coloring of thread	18,250
29	PT. Surya Indo Algae	Purboyo	Agar	
30	PT. Hanil Daya Metal work	Afv. Buntang	Metal works	

The first visit to an individual of the above-mentioned industries is intended to distribute the questionnaire and to explain the details to complete it. In the second visit, upon the collection of the completed questionnaire, discussion is carried out to verify the data filled in the questionnaire. A total of three industries do not give any respond. The details of responded industries is presented in Appendix 2.

### 2.3. Data Analysis

The collected data is then tabulated and analysed. An Excel 7 is used for data tabulation and calculation. Finally, a descriptive method of analysis is employed to draw conclusions.

## CHAPTER III

### RESULTS AND DISCUSSION

#### 3.1. FARMERS

##### 3.1.1. Farmers Income

Based on its source, farmers' income may be classified into two groups, namely from the agricultural sector and from non-agricultural one. Although it shows some degree of variation by areas, the agricultural sector contributes from 59% to 86% of the total income of farmers in the Brantas River Basin. The distribution of farmers income is presented in Table 3.1.1. It indicates that agricultural sector is still the main source of the farmers' income and any damage in this sector may result in a serious impact on their family lives.

**Table 3.1.1. Contribution of Agricultural Sector and Non Agricultural Sector to the Income of Farmers in the Brantas River Basin**

Irrigation Area	Income Contribution (%)	
	Agriculture Sector	Non Agriculture Sector
Blobo	74	26
Lodoyo	60	40
Warujayeng	59	41
Widas	86	14
Turi Tunggorono	77	23
Brantas Delta	76	24

Note :% is percentage from the total income

It is found that the contribution of agricultural sector to the total income of the farmers in Lodoyo and Warujayeng irrigation areas are the lowest among others, being only about 60%, while such sector contributes around 85% of the total income of the farmers in the Widas irrigation area.

In Blobo, Turi Tunggorono and Brantas Delta irrigation areas, the agricultural sector contributes about 3/4 of the farmers' total income.

The difference in the family income derived from the agricultural sector is related to the land area and types of crop being cultivated, the productivity and the status of operation. Such a difference also indicates the degree of dependency of the farmer's family life to this sector. The higher the contribution of this sector in the total family income the greater the dependency to be hence the damage in the sector results in more serious effects. It is reasonable, therefore, to expect that the farmers with higher dependency to the agricultural sector pay a greater attention to this sector.

The average of total farmers' family income, however, vary considerably with areas, as shown in Table 3.1.2. The total income of farmers in the Widas irrigation area ranges from Rp. 36.000,00 to Rp. 140.000,00/family/month, being the lowest among farmers in the Brantas River basin. On the other hand, the level of total income of farmers in the Brantas delta area is the highest one, ranging from Rp. 260.000,00 to Rp. 444.000,00/family/month.

Table 3.1.2. Family Income of Farmers in Brantas River Basin

Irrigation Area	Income (10 <sup>3</sup> Rupiah))		Total income (10 <sup>3</sup> Rupiah)
	Agriculture Sector	Non Agriculture Sector	
Blobo	181,00 ± 50,60	63,50 ± 75,44	300,00 ± 126,80
Lodoyo	142,00 ± 66,04	94,00 ± 72,98	258,00 ± 138,33
Warujayeng	149,00 ± 56,34	103,50 ± 59,99	276,00 ± 113,60
Widas	92,50 ± 31,92	14,50 ± 21,91	89,00 ± 52,72
Turi Tunggorono	153,50 ± 20,07	47,00 ± 48,02	245,00 ± 121,14
Brantas Delta	216,50 ± 20,07	66,75 ± 75,95	352,00 ± 92,71

Note : ± is the value of standard deviation

Table 3.1.3 shows that only about 40% farmers in the Blobo, Widas and Brantas delta areas are involved in the non agricultural sector income generating activity, while slightly above 50% farmers of Lodoyo and Turi Tunggorono areas do such an activity.

The low figure shown in the family income derived from the non agricultural activity of farmers in the Widas area is likely results from the low percentage of farmers, only 36%, involved in the sector. Moreover, the level of wage is also low, i.e. less than Rp. 50.000,00 per family per month and thus contributes only as low as 14% of the total income. Although the number of farmers performing off-farm activity is comparable to that of Widas, the income generated from this sector is found to be higher for farmers in the Brantas delta. It is mainly because of the higher level of wage, ranging from Rp.150.000,00 to more than Rp. 200.000,00/family/month, observed in the latter area.

**Table 3.1.3. Income Distribution Derived from the Agriculture and Non Agricultural Sectors**

Range Income (x 1000 Rupiah)	Irrigation Area											
	Agriculture Sector (%)						Non Agriculture Sector (%)					
	BLB	LDY	WRJ	WDS	TURI	BRD	BLB	LDY	WRJ	WDS	TURI	BRD
≤ 50	0	6	1	6	5	0	6	4	8	26	8	0
50-99	10	26	23	56	21	0	8	4	28	9	30	5
100-149	16	28	28	35	24	1	4	14	22	1	7	3
150-199	26	8	23	3	12	15	6	8	11	0	4	12
≥ 200	48	32	25	0	38	84	18	26	15	0	3	17
TOTAL	100	100	100	100	100	100	42	56	84	36	52	37

Note : % : Percentage of Farmers

BLB : Blobo

WDS : Widas

LDY : Lodoyo

TURI : Turi Tunggorono

WRJ : Warujayeng

BRD : Brantas Delta

Several home and small scale industries found in the Lodoyo irrigation area are likely to be the work place for farmers in the area. On the other hand, farmers in other areas are found to do a more variable jobs for their off-farm activities, like laborer and part-time merchant.

However, a high figure of farmers working in the sector alone does not necessarily result in a significant increase to the farmers total income, as it is shown in the Warujayeng area. The figure as high as 84% farmers in Warujayeng area are involved in the non-agricultural sector and it contributes 41% of the total income of farmers (Table 3.1.1) The value is comparable with that of Lodoyo where only 56% farmers working in the non-agricultural sector. It may results from the significant difference in the level of wage, as shown in Table 3.1.2. Similar results is also observed in the Lodoyo, Turi Tunggorono and Brantas delta areas where the non-agricultural sector contributes around 25% of the total farmers' family income, although the number of farmers working in the sector in the respective areas is difference.

### **3.1.2. Agriculture Information**

#### **3.1.2.1 Area of the Cultivated Land and Tenure Status**

The average area of land operated by most farmers in the Brantas River Basin are less than 0.5 ha per family, but in the Widas and Turi Tunggorono irrigation areas. Moreover, in Blobo, Lodoyo and Warujayeng irrigation areas nearly half of the farmers operate in the order of 0.25 ha or less per family. Details of land area cultivated by farmers in the Brantas River Basin is shown in Table 3.1.4.



Table 3.1.4. Area of Cultivated Land

Area (ha)	Irrigation Area					
	Biobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi-Tunggorono (%)	Brantas Delta (%)
≤ 0.25	42	50	49	21	24	25
0.26-0.50	22	24	33	37	32	66
0.51-0.75	12	14	11	19	13	5
0.76-1.00	18	4	1	13	13	3
≥ 1.01	6	8	6	10	18	1
Mean	0.44	0.37	0.33	0.51	0.55	0.35
S <sub>x</sub>	0.33	0.31	0.27	0.31	0.36	0.18

Note : (%) is a percentage of farmers

On the other hand, in the Brantas Delta area, most farmers (66%) operate on 0.26–0.50 ha/family. In general, only a few number of farmers operates on more than 1.0 ha per family. It is also observed that in Lodoyo and Warujayeng irrigation areas, the contribution of agriculture to the total income is relatively low. A quite large number of farmers also works in non-agricultural sectors and earn a comparable amount of money to that obtained from the agricultural sector.

In respect to the operation status, in general, most farmer on the Brantas River Basin are owner-operator (58 - 92%) and only a small number operate as tenant, share tenant and leasee, but the Widas irrigation area, the level of non-owner operator is up to 42% of the farmers (Table 3.1.5).

Table 3.1.5. Tenure Status of Farming Operation

Tenure Status	Irrigation Area					
	Biobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi- Tunggorono (%)	Brantas Delta (%)
Owner operator	92	88	67	58	76	88
Tenant	4	2	1	22	2	1
Share tenant	0	4	3	3	0	3
Leasee	4	6	29	17	22	8
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

In the Blobo irrigation area, 92% of the farmers are owner-operator, while tenant and share tenant is 4% respectively. Total owner-operator in Lodoyo irrigated area is 88% farmers, and tenant and share tenant as well as leasee makes up of another 12%. In the Brantas Middle stream area, the number of owner-operator is generally lower in comparison to that of the Brantas Upper and Downstream Irrigation areas.

In the Warujayeng irrigation area, the farmers with a status of owner-operator is 67%, while the level of leasee is 29%, the highest level found in the Brantas River Basin. In Widas Irrigation area, the number of farmers with a status as owner-operator is found to be the lowest in the Brantas River Basin (58%), owing to the high number of farmers as tenant and share tenant reaches a level of 22% and 17% respectively. Total owner operator in Turi Tunggorono irrigation area is 76% and followed by leasee, 22%. On the other hand, in the Brantas Delta Irrigation area almost 90% of farmers is owner operator. The figures indicate that the land is still considered as one of the most valuable resources for farmer and the farmers survive not to sell the land for

housing, even if it is situated closed to area where the housing project grows very rapidly, as it is shown in the Brantas della area. It may reflect that the ownership of land is important to their social status.

The above figures suggest that the family income of farmers depends not only on the area of land operated, but the status of operation as well. Despite the higher average area of land operated in the Widas irrigation area, the farmers' family income is lower than that in the other areas, mainly due to a relatively higher percentage of farmers (42%) with a status of non-owner operator. It is evidenced by farmers in the Turi Tunggorono area where the average area of land operated per farmer family is comparable to that of Widas, but the ones with a status as owner operator as high as 76%, compared to only 58% with the same status found in the Widas area.

### 3.1.2.2 Cropping Pattern

In the Brantas River Basin, 8 (eight) respective cropping patterns (Table 3.1.6) are observed i.e. (1) paddy-paddy-paddy, (2) paddy-paddy-horticulture (3), paddy - paddy - palawija (4) paddy - paddy - bero (5) paddy - palawija - palawija, (6) paddy - palawija - bero, (7) Palawija - palawija - palawija (8) palawija - palawija - bero. In wet season, most farmers in the Brantas River Basin grow paddy commencing in September and October.

Table 3.1.6 Cropping Pattern Found in the Brantas River Basin

Cropping Pattern	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Paddy-Paddy-Paddy	38	4	14	2	5	0
Paddy-Paddy-Horticulture-1	0	0	5	35	11	33
Paddy-Paddy-"Palawija"	40	52	80	63	70	16
Paddy-Paddy-"Bero"	0	0	0	0	0	51
Paddy - Palawija"-Palawija	2	20	0	0	0	0
Paddy - "Palawija"- "Bero"	0	22	0	0	0	0
"Palawija"- "Palawija"- "Palawija"	10	0	1	0	14	0
"Palawija"- "Palawija"- "Bero"	0	2	0	0	0	0
Horticulture-2	10	0	0	0	0	0
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

"Bero" means there is no cultivation

"Palawija " is secondary crops include maize, soybean, peanut etc.

Horticulture-1 : Onion, Chilly, Melon etc.

Horticulture-2 : mandarin, orange

Underlined is the crop cultivated in the dry season

In the Blobo irrigation area, almost 40% of farmers practice a cropping pattern of paddy - paddy - palawija and is then followed by paddy - paddy - paddy (38%). More than half (52%) of farmer in Lodoyo irrigation area practice cropping pattern of paddy - paddy - palawija, a pattern of paddy - paddy - paddy (22%) and followed by paddy - palawija - palawija (about 20%).

In the Brantas Middle stream area, the cropping patterns practiced are paddy - palawija - palawija (63 - 80%). The same pattern is practiced by a large number of farmers (80%) in Warujayeng irrigation area.

In Brantas Delta irrigation area, farmers that are practising paddy - paddy - palawija cropping pattern is the lowest (16%) among others, and the majority (51%) applying palawija - palawija - bero and the remaining 33% is paddy - palawija - palawija.

The different in family income of farmers seems to be also affected by the cropping pattern practiced. The comparison may be made for farmers from the Lodayo and Brantas delta areas, in which the level of farmer with a status of owner operator about the same i.e. 88% and a comparable of average area of land cultivated, about 0.36 ha/family, but the cropping pattern applied is different. In Lodayo area in the dry season, the percentages of farmers cultivate paddy, horticulture, palawija and "bero" are 4%, 0%, 72%, and 24% respectively (derived from Table 3.1.6). In the same season in the Brantas delta area, the respective figures are : 0%, 33%, 16% and 51%. Despite the higher level of land uncultivated ("bero") found in the Brantas delta, the average income of farmers derived from the agricultural sector in the Brantas delta area is higher than that of the Lodayo area. It is likely the results of horticulture cultivation.

Similar comparison may be applied for the farmers in the Brantas delta area with the ones from Blobo area. In spite of higher level of farmers being owner operator and operating at a wider land area, the farmers in the area earns less income compared with the ones in the Brantas delta area. Although the income of farmers from the agricultural sector in the Blobo is considered to be high. It is partly due to a cultivation of citrus crops. It once again shows that the horticulture cultivation makes a significant contribution to income derived from the agricultural sector.

Horticultural crops are generally considered to be more susceptible to pests than palawija and paddy crops are and that makes them to be more tedious to cultivate. Therefore, only a limited number of farmers equipped with a better technology can cultivate such crops successfully.

The consecutive figures of farmers cultivate horticultural crops in the Blobo, Lodoyo, Warujayeng, Widas, Turi Tunggorono and Brantas delta areas are : 10%, 0%, 5%, 35%, 11% and 33%.

### 3.1.3 Information on Water Supply

#### 3.1.3.1 Source of Water for Irrigation

Table 3.1.7. shows that the main source of water is basically the irrigation canals. In the Blobo, Lodoyo and Warujayeng areas, 100% farmers depend on the supply of water from the irrigation canals, while the figure for other areas varies. The number of farmers using other source of water other than the irrigation canals is very limited. Ground water is being the second largest source of water, as shown in the Widas and Turi Tunggorono irrigation areas. In these areas, the respective percentage of farmers rely solely on ground water for irrigation is 13% and 5 %. Some farmers (10%) in the Turi Tunggorono area also use ground water as an additional water in case of water shortage, while in the Brantas delta area the figure is somewhat higher i.e. 31%. In Turi Tunggorono area. 2% farmers use only rain water for irrigation.

Table 3.1.7. Main Source of Water for Irrigation

Water Source	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi- Tunggorono (%)	Brantas Delta (%)
Irrigation Canals	100	100	100	84	83	69
Irrigation Canals + Ground Water	0	0	0	2	10	31
Ground Water	0	0	0	13	5	0
River	0	0	0	1	0	0
Rain Fall	0	0	0	0	2	0
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

### 3.1.3.2 Problems in Irrigation System

The problems of water unavailability and water shortage are observed in most of the Brantas River Basin. No water is available when it is needed and the water is not sufficient are the main problems complained by most farmers in the Brantas River Basin. This is the case in the dry season in which more than 90% of the farmers shares the same problems (Table 3.1.8).

**Table 3.1.8. Problems of Irrigation System and Facilities**

Problems *)	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
0	50	0	0	4	0	0
1	0	0	4	33	16	6
2	0	34	26	44	79	67
3	4	0	0	0	0	0
4	0	0	1	0	0	0
6	4	0	0	0	0	0
7	0	0	0	1	0	0
8	2	0	0	0	0	0
1+2	2	26	63	18	5	0
1+3	4	0	1	0	0	0
1+5	0	0	1	0	0	0
1+7	0	0	0	0	0	3
2+3	28	40	1	0	0	3
2+4	4	0	0	0	0	0
2+5	0	0	2	0	0	0
2+6	0	0	1	0	0	0
2+7	0	0	0	0	0	21
3+6	2	0	0	0	0	0

\*) 0 = No Problems

1 = No Water in Time

2 = Not Sufficient Water

3 = Erosion in Canal

4 = Problems in Check Gate

5 = Low Embankment

6 = No Measuring Devices

7 = Silted Canal Bottom

8 = Others

The statement of farmers that the problems are related to unavailability or insufficiency of water may be interpreted differently. In most areas, it is not necessarily reflect the actual situation. Rather a reflection of unsatisfied feeling with the current service of water for irrigation. The problems most probably lie on the inappropriate application of the irrigation method. Traditionally, the farmers apply an irrigation method of what so called continuous flooding and continuous flowing in which water is applied in an excessive amount. This will be further discussed in the next sections.

In the Brantas delta area, however, the case of water insufficiency and unavailability is truly a real problem since in the dry season 51% farmers leave the land to be "bero".

The second largest problem, observed in the Blobo and Lodoyo areas, is an erosion of the irrigation canals. It may be due to a high slope in the most upper stream combined with inappropriate control of water flow in the check gate that makes the velocity of running water in the irrigation canals is considerably high resulting in the erosion of such canals. On the other hand, a silted canal bottom in the Down stream area, as observed in the Brantas delta area may indicate of improper land use in the upper stream area.

Less than 10% of farmers report the problem of irrigation system and facilities is associated with the check gate and unavailability of measuring devices. It indicate that maintenance dan repairs of such facilities is necessary for the improvement of water resources management.

### **3.1.3.3 Water Applied for Irrigation**

In the rainy season, the supply of water is not such a problem for most irrigation area in the Brantas River Basin, since the water applied for



the irrigation is mostly more than 6,000 m<sup>3</sup>, except in some parts of the Widas irrigation area. About one third of farmers in Widas area apply water only at a level of 2,000 m<sup>3</sup> during the season (Table 3.1.9). The figure conforms the cropping pattern found in the respective areas, as shown previously in Table 3.1.6.

It is considered that the ideal amount of water for irrigation is between 6,000 to 8,000 m<sup>3</sup> for paddy crop and is about 1,500 m<sup>3</sup> for palawija or horticultural crops. Therefore, in most cases, the amount of water applied by farmers in the Brantas River Basin for an irrigation purpose during the rainy season is excessive i.e. 10,000 m<sup>3</sup> or more. It is the case in all irrigation areas in the Brantas River basin, but Widas and Brantas delta areas. Even more, in the Warujayeng and Turi Tunggorono areas the figure reaches up to 14,000 m<sup>3</sup>.

The number of farmers inefficiently use of water in the rainy season varies with areas. The respective figure of farmers considered as inefficient water user is 94% in Blobo, 54% in Lodayo, 99% in Warujayeng and 92% in Turi Tunggorono. Furthermore, during the dry season a similar practice is still demonstrated in the Blobo (28% farmers) and Turi Tunggorono (12% farmers) areas.

During the dry season, most farmers in the Brantas River basin tend to cultivate palawija and or horticultural crops (see Table 3.1.6). The lowest amount of water applied for irrigation is in the Brantas delta area where 81% farmers only apply water for irrigation as much as 250 m<sup>3</sup> of water, while the remaining 19% farmers apply water at a level of 750 m<sup>3</sup>. It is likely that in this area, the problem of water shortage in the dry season seems to be the most severe one. To meet with the need of the crop, some farmers (about 30%) take an additional water from the ground (see Table 3.1.7). The percentage of 'bero' (uncultivated land) during the dry season is the highest in the Brantas River basin (see Table 3.1.6).

Table 3.1.9 Water Applied for Irrigation

Water Applied (m <sup>3</sup> /ha)	Rainy Season					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
2,000	0	0	0	29	0	0
6,000	0	46	1	70	8	100
10,000	94	54	50	1	15	0
14,000	4	0	49	0	77	0
Total	100	100	100	100	100	100

Water Applied (m <sup>3</sup> /ha/season)	Dry Season					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
250	0	0	0	0	0	81
750	0	0	0	0	0	19
1,250	0	0	0	0	0	0
1,750	0	0	0	0	0	0
2,000	0	82	86	97	34	0
6,000	72	18	14	3	54	0
10,000	28	0	0	0	12	0
14,000	0	0	0	0	0	0
Total	100	100	100	100	100	100

Note : % = percentage of farmer

On the other hand, in other areas within the Brantas River basin, the water applied for irrigation during the dry season is a little bit excessive for the type of crops being cultivated. As it was mentioned previously that an ideal amount of water for palawija and horticultural crops is in the order of 1,500 m<sup>3</sup>. It can be observe from Table 3.1.9 that the amount of water applied for such crops is mostly 2,000 m<sup>3</sup>. Even more, in some cases the amount of water applied is 6,000 m<sup>3</sup> or more, as indicated especially in the Blobo and Turi Tunggorono areas. In Blobo, 100% farmers apply between 6,000 and 10,000 m<sup>3</sup> of water, while only 38% of them cultivate paddy. In Turi Tunggorono, the situation is even

worst since 66% farmers apply at the same level, but none of them cultivate paddy. Therefore, farmers in the area may be considered as the most inefficient in the use of water for irrigation.

Therefore, it confirms that in general the water supplied from the irrigation canals is inefficiently used by farmers in the Brantas River basin, except in the Brantas delta.

Inefficient use of water for irrigation demonstrated by most farmers in the Brantas River basin may results, among others, from several reasons. First, an application of improper method of irrigation. It is common to see the application of an irrigation method of what so called a continuous flooding and a continuous flowing for paddy cultivation. In this case, the cultivated land is covered with water continuously. Secondly, it is possibly due to no devices installed in the tertiary canals to measure and to distribute water at an exact amount for a certain blocks of land area. Thirdly, a lack of knowledge of person in charge for such task, i.e. water distribution. The last but not least, it is associated with the lack of knowledge of farmers for mastering an optimal irrigation technique, i.e. the amount of water applied should be adjusted with the type of the crop being cultivated and to the stage of the plant growth. It appears that a technology for a better irrigation method needs to be introduced so that the farmers are more efficient in the use of water for optimal crops production. This may be carried out by the extension services of the Department of Agriculture.

#### **3.1.3.4 Water Supply Scheduling**

As previously described, during the rainy season, the water is relatively adequate and is available in all irrigation canal system in the surveyed area. Thus, scheduling of water supply is not necessary in the

season. The contrary is true during the dry season when the water is limited.

During the dry season, the water supply in almost all irrigation areas is scheduled according to the availability of water. The schedule varies between areas, as it is demonstrated in Table 3.1.10.

**Table 3.1.10. Schedule of Water Supplied from Irrigation Canals During the Dry Season**

Scheduling	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Everyday	6	-	-	-	-	-
Once in 2-4 days	28	-	7	-	34	46*
Once in 5-7 day	6	-	11	80	-	54*
Once in 8-10 day	2	62	18	-	-	-
Once in more than 10 days	58	12	64	-	66	-
None	-	26	-	20	-	-
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

\* the amount of water from the irrigation canals is very limited

It shows that farmers in the Blobo, Warujayeng and Turi Tunggorono areas are getting much less of water for irrigation, while in other fewer cases no water is available like in the Lodoyo and Widas areas. As can be seen from Table 3.1.6, in the dry season in the Lodoyo area about one fourth farmers leave the land uncultivated due to water is unavailable. In the Widas area, however, such a practice had never been found in the previous time. Only at the time of survey the condition is so severe that makes farmers decide not to cultivate any crop during the season. Therefore, 20% farmers at that time leave the land uncultivated (Table 3.1.10) claiming that the water is not available. The above data

also suggests that the supply of water for irrigation is limited in the dry season and thus conforms with the cropping pattern data (Table 3.1.6).

In the Brantas delta area, the schedule of water supply is relatively good since farmers can get access to water for irrigation at least once a week, but the amount of water available is too little that makes about 50% farmers leave the land uncultivated. Some additional water for irrigation is taken from the ground. On the other hand, the schedule of water supply for irrigation vary somewhat in the Blobo, Warujayeng and Turi Tunggorono areas, ranging from everyday or once in 2-4 days to once in more than 10 days. It may result from three reasons. First, the degree of water loss in the irrigation is high. The second reason is associated with the plot-to-plot irrigation technique usually applied by farmers that makes the blocks closer to the irrigation canals get more water than the far end blocks. Third, it may indicate that the water is not fairly distributed.

Sometimes, the water supply schedule made is not practicable since the water from the irrigation canals is very limited. Therefore, some farmers try to get an additional water from the ground, as it was observed in the Widas, Warujayeng and Brantas delta. The ground water supply service may be run by a private farmers or that is organised by HIPPA. The farmers has to pay the ground water on their own expenses, i.e. is not inclusive in the water service fee collected by HIPPA. However, a special case is demonstrated by one of the HIPPA in the Warujayeng irrigation area. The HIPPA organises not only the supply of water from the irrigation canals, but to get ground water as well. In case the water from the canal does not reach the block of land owned by its member, the HIPPA will organise to find the substituted water from the ground without any additional fee. This may be considered as an good example of well managed HIPPA.

However, in a rare case the water is illegally taken from the canals that make the distribution of water in the corresponding area disturbed. This is reported to occur in the Widas and Lodayo irrigation areas. Such a practice is disadvantageous to the efforts of introducing a comprehensive water management system. Any illegal and or misconduct practice need to be dealt favorably.

#### **3.1.3.5 Response of Farmers in Case of Water Shortage**

Table 3.1.11 presents the variation of responses demonstrated by farmers in the Brantas River basin in the case of water shortage. The response may be classified into three categories. First, the majority farmers give up paddy cultivation and then cultivate palawija, as represented by farmers in the irrigation area of Blobo (78% farmers), Lodayo (92% farmers), Turi Tunggorono (74% farmers) and Brantas delta (49% farmers). Secondly, changing the crop from paddy to palawija accompanied with seeking other source of water, usually ground water, as it is observed in the Warujayeng, Widas and Turi Tunggorono areas. The third response is leaving the land uncultivated ("bero") since no water is possibly taken from other sources, including the ground water. It is shown by farmers in the irrigation areas of Brantas delta (51% farmers), Widas (38% farmers) and Blobo (22% farmers). It is interesting to note that most farmers (85%) in the Warujayeng area tend not to let the land to be "bero" by seeking other source of water.

Some conclusions may be made from the facts found in the above sections :

- a. The water from the irrigation canals is inefficiently used by farmers
- b. The presence of a silted canal bottom of inappropriate land use in the Brantas River upper stream area

- b. The presence of a silted canal bottom of inappropriate land use in the Brantas River upper stream area
- c. The presence of erosion in the canals may be associated with improper control of water flow in the check gate
- d. There is an evidence of improper distribution of water for irrigation

Table 3.1.11. Response on Farming Practice in Case of Water Shortage

Response *)	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi-Tunggorono (%)	Brantas Delta (%)
1	78	92	0	14	74	49
2	0	0	0	0	3	0
4	0	0	14	6	0	0
5	22	0	0	38	0	51
1+2	0	8	0	0	3	0
1+4	0	0	86	11	19	0
1+5	0	0	0	20	0	0
2+4	0	0	0	1	0	0
4+5	0	0	0	10	0	0
1+3+4	0	0	0	0	1	0
Total	100	100	100	100	100	100

Note: % is a percentage of farmers

1 = Give up paddy cultivation and cultivate palawija

2 = Reduce cropping area

3 = Reduce cropping intensity

4 = To find out other water resources

5 = Do nothing and lost harvest

### 3.1.4 The Need of Water Management

#### 3.1.4.1 Attendance on HIPPA Meeting

Table 3.1.12. shows the degree of farmers' willingness to attend the Water Users Association (HIPPA) meeting. The highest participation is represented by farmers in the Blobo and Lodooyo irrigation areas where 90-92% farmers attend the HIPPA meeting, while in the Warujayeng and Widas areas, the figure is 74-76%. The lowest figure is observed in the Brantas Delta and Turi Tunggorono irrigation areas where only 65-68% farmers attend such a meeting.

**Table 3.1.12. Attendance of Farmers in the HIPPA Meeting**

Attendance	Blobo (%)	Lodooyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Many times	66	30	20	12	18	18
Few times	24	62	54	64	50	47
Never	10	8	26	24	32	35
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

A better participation to the HIPPA meeting is demonstrated by farmers in the Blobo area based on the meeting frequency they attend, while in the other areas the majority of farmers attend such meeting in a lower frequency. Furthermore, the number of farmers in the Brantas River Basin who did not attend the HIPPA meeting is different from one area to another, ranging from 8% to 35%. Farmers in the Brantas delta and Turi Tunggorono areas show the lowest interest, since as high as 32-35% farmers has never attended such a meeting, while only 8-10% farmers in the Blobo and Lodooyo areas found to be absent from the HIPPA meeting.

Reasons for not actively attend the HIPPA meeting vary considerably with areas. In the Warujayeng and Turi Tunggorono areas



about 50% of those not participating in the HIPPA meeting claims that they are not interested to such activity, while the figure is only about 30% in the Brantas delta area where another 30% of them also claims that no effect results from the meeting (Table 3.1.13). It seems to reflect a looser binding community in the Brantas River down stream areas which is typical to suburban community, influence the interest of farmers to any social organisation like HIPPA. Apart from that, the involvement of farmers in the off-farm activities affect their interest to the HIPPA meeting. The high figure of farmers having no interest to the HIPPA meeting is probably an indication of insufficient quality of service offered by the HIPPA to its community.

**Table 3.1.13. Reason for Not to Attend the HIPPA Meeting**

	Irrigation Area					
Reasons	Globo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Have no interest	2	0	12	7	17	11
Not invited	2	2	8	8	9	3
No effect to attend	0	2	6	0	5	9
Others	6	4	0	9	1	12
Total	10	8	26	24	32	35

Note : % is a percentage of farmers

The results suggest that the response to the HIPPA activities shown by farmers partly depends on how active the HIPPA is and whether the organisation is able to fulfil the needs of the farmers in relation to water supply. This fact has to be put into consideration when introducing a

more comprehensive water management system of the Brantas River basin.

### 3.1.4.2 Participation In the Management Activities of the Brantas River

It was identified that farmer participation for rehabilitation works of irrigation canals in the past was relatively high. This is indicated in Blobo, Lodayo, Widas and Brantas Delta irrigation areas, where more than 80% of the farmers took part in such an activity, with some variation in participation frequency. Among them, farmers in the Blobo area considered to be the most active one. In Warujayeng and Turi Tunggorono areas, however, farmers' willingness to take part in the rehabilitation works of irrigation canal was slightly less than 60% of total farmers ( Table 3.1.14).

**Table 3.1.14. Labour Service Without Payment for Rehabilitation Works of Irrigation Canal and the Operation of Water Intake Gate**

Labour Service Offered	Rehabilitation						Operation					
	BLB	LDY	WRJ	WDS	TURI	BRD	BLB	LDY	WRJ	WDS	TURI	BRD
	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Many times	68	34	40	24	4	39	16	2	12	1	3	21
Few times	18	46	19	60	47	50	16	4	29	31	32	33
Never	14	20	40	15	49	11	68	94	59	68	65	46
No answer	0	0	1	1	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100	100	100	100	100

Note : % : Percentage of farmers

BLB : Blobo

LDY : Lodayo

WRJ : Warujayeng

WDS : Widas

TURI : Turi Tunggorono

BRD : Brantas Delta

The degree of participation in the rehabilitation works of irrigation canal seems to correlate well with the degree of their involvement in the HIPPA meeting, except for farmers in the Brantas delta area. As can be seen from the previous data that the Brantas delta area is the most suffered area in relation to water supply, especially in the dry season. A high degree of participation in the rehabilitation works of the irrigation canal may be motivated by an expectation of the improvement of water supply service, or at least maintaining the current condition for not getting worse. Unlike attending in the HIPPA meeting, the rehabilitation works of the irrigation canal is seen as a real effort and it directly affects the supply of water.

Table 3.1.15 shows that the income generated from agricultural sector to some extent influenced the degree of farmers' participation to rehabilitation of water canals. In general, the higher the income obtained from the agricultural sector, the better the degree of participation. However, it seems that such tendency does not apply for farmers in the Lodoyo and Turi Tunggorono areas.

On the other hand, the participation of farmers for the operation of the water intake check gate is relatively low. The highest participation to such work is shown by farmers in the Brantas delta area (56% farmers), followed consecutively by farmers in the Warujayeng, Turi Tunggorono, Blobo and Widas areas. The lowest degree of participation for the operation of the water intake check gate is demonstrated by farmers from the Lodoyo area since only 6% of the farmers participate for such works. Most farmers consider that the operation of the water intake check gate at the tertiary canals is mainly the responsibility of the what so-called "ulu-ulu", the government apparatus at a village level.

**Table 3.1.15. Degree of Farmers Participation for Rehabilitation of Irrigation Canals as Influenced by Level of Agriculture-derived Income**

Agriculture-derived Income (Rp/family/month)	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Waru jayeng (%)	Widas (%)	Turi Tunggo rono (%)	Brantas Delta (%)
< 50.000 Rupiah/month	-	3	-	5	2	-
50.000- 99.000 Rupiah/month	2	13	8	46	13	-
100.000- 149.000 Rupiah/month	11	11	15	32	7	1
150.000- 199.000 Rupiah/month	24	2	16	2	5	11
> 200.000 Rupiah/month		11	20	-	24	78
Total	24	11	20	-	24	78

Note : % is a percentage of farmers

The data presented in Table 3.1.16. shows that less than 1/3 of the total farmers participated in other form of management activities of the Brantas River. It once again shows an inadequate role of farmers in the management of water resources they depend on.

This indicates that the management of the water resources system at a village is still not integrative among the parties concern and therefore there is a need to improve the situation.

**Table 3.1.16 Farmers' Participation in Any Other Management Activities of the Brantas River**

Respond	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Yes	26	18	4	16	7	3
No	74	82	96	80	91	95
Can not reply	0	0	0	4	2	2
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

### **3.1.4.3 Willingness to Join the Management Activities of the Brantas River in the Future**

#### **a. Attending HIPPA Meeting in the Future**

Water Users Association (HIPPA) is an organisation that link the interest of the water resources management agency, usually government, with the irrigation water users (farmers). Such an organisation expected to take part in the management of water resources at a village level, so that the water is fairly distributed and is efficiently used.

Table 3.1.17 may reflect whether the current role of HIPPA is satisfying the needs of its member. The farmers in the Blobo, Warujayeng and Brantas delta areas seem to show a consistent attitude towards water resources management activities since more than 55% farmers in the future are still willing to attend the HIPPA meeting. On the other hand, the intention of farmers to attend the HIPPA meeting in Lodoyo area seems to decrease sharply, as in the past their attendance to the meeting reaches the level of 92%. Similar trends are also observed for farmers in the Widas and Turi Tunggorono areas.

Table 3.1.17 Willingness to Attend the HIPPA Meeting in the Future

	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Yes	56	36	82	17	27	64
No	22	56	18	32	23	11
Can not reply	22	8	0	51	50	25
Total	100	100	100	100	100	100

The decrease in the interest of farmers to join the HIPPA meeting in the future reflect the current performance of the organisation in the fulfilment of the consumers' needs. Such a decrease has to be deeply observed and put into consideration in the planning for a better water resources management plan.

**b. Intention to Participate in the Rehabilitation of the Irrigation Canals and Operation of the Water Intake Check Gate**

Farmer's willingness to be involved in rehabilitation works of irrigation canal without payment varies between areas. The highest participation rate (80-85%) was represented by Blobo, Warujayeng and Brantas Delta irrigation area, and the lowest in Turi Tunggorono (20%) as shown in Table 3.1.18.

The rehabilitation work of the irrigation canal was incidental and not requiring a long period of time. Therefore, most farmers did not object to involve in such activities. Farmer absence in taking part in such activity will influence their communication with the community where they belong to.

**Table 3.1.18 Willingness to Participate in The Rehabilitation Work and Operation of Water Intake Check Gate**

Willing to Participate	BLB	LDY	WRJ	WDS	TURI	BRD	BLB	LDY	WRJ	WDS	TURI	BRD
	Rehabilitation (%)						Operation (%)					
yes	86	52	80	64	22	84	10	0	46	83	17	16
no	10	48	20	3	20	6	90	100	54	1	77	82
can not reply	4	0	0	33	58	10	0	0	0	16	6	2
Total	100	100	100	100	100	100	100	100	100	100	100	100

**Note :** % : Percentage of farmers

BLB : Blobo

WDS : Widas

LDY : Lodoyo

TURI : Turi Tunggorono

WRJ : Warujayeng

BRD : Brantas Delta

The lowest level of intention to participate in the rehabilitation works of irrigation canal is observed in Turi Tunggorono irrigation area where water supply is abundant. It indicate of low of sense of responsibility regardless the good service they have received. This is also represented by their low degree of participation on similar activities in the past. On the contrary, in the area where water supply is a problem in the dry season, the farmers show their high interest to participate in the activity.

It seems that an operation of the water intake check gate is not an interesting task for farmers. The highest level of willingness to do this job is found in Widas irrigation area (more than 80%), while in Blobo, Turi Tunggorono and Brantas Delta irrigation area the figure is less than 20%, even in Lodoyo irrigation area none of them is interested to do such work. It is assumed that an operation of water gate is such a job that requires a tight schedule of time and no social negative impacts suffered for not doing such an operation. This is supported by data of previous experience of farmers' involvement.

Except for check gate operation, further participation of farmers in the form of labour service and to some extent in the form of cash money may be expected from the farmers, provided it gives benefit and as a mean of social communication with other farmers. However, it is hard to expect that they will come with new ideas for a better water management. It is therefore, a better role may be sought from the HIPPA committee or organiser.

It is identified that farmers idea to make an improvement in water management system is relatively insufficient. This is true for all irrigation areas in the Brantas River Basin. The highest is recorded in Blobo irrigation area (20%), while other irrigation areas are less than 10% (Table 3.1.19).

**Table 3.1.19 Idea Proposed to Improve the Water Resources Management**

Respond	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Yes	20	6	6	5	5	6
No	60	88	84	42	33	64
Can not reply	20	6	10	53	62	30
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

It may result from several reasons. First, it is associated with the level of education of farmers, mostly only at a level of an Elementary school. Such condition commonly creates an inferiority that inhibit them to get access to any governmental agency to propose a new idea. Second, the farmers are not informed or are not aware of how the management system works. Third, the experience shows that the idea of improvement 'always' comes from the government side. It demonstrates that



stakeholders' involvement is not encouraged since the beginning when the water resources management plan was set up.

### c. Responsibility for Operation and Maintenance of Irrigation Canals

The majority of farmers (more than 74%) regard that the HIPPA is the one responsible for the operation and maintenance of irrigation canals, while some of them (less than 26%) expecting that it is the responsibility of the Irrigation service agency/staff (Table 3.1.20)

**Table 3.1.20 Responsibility for the Operation and Maintenance of Irrigation Canals**

Respond	Irrigation Area					
	Biobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Irrigation Service	6	0	11	26	1	1
HIPPA	86	88	82	74	89	88
Farmers	2	12	5	0	8	10
Do not know	6	0	2	0	2	1
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

The above data indicates two things. First, most farmers expect the improvement role of HIPPA in order to fulfil their need of water for irrigation. Second, only a few of them realise that such works is also their responsibility. In other words it is a reflection of lack of sense of responsibility.

#### d. The Need of Improvement of the Water Resources Management System

In the Turi Tunggorono area, the majority of farmers do not want an improvement of the water resources management system mainly because they already enjoy an excessive supply of water for irrigation (Table 3.1.21).

**Table 3.1.21 The Need of Improvement of the Water Resources Management System**

Need of Improvement	Irrigation Area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Yes	52	98	75	31	39	38
No	34	2	25	50	7	6
Can not reply	14	0	0	19	54	56
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

However, almost all farmers in the Lodoyo area seek an improvement of the management system, while at a lesser extend it is also expected by farmers in the Warujayeng, Blobo areas. It is interesting to note that only about 30% farmers in the Widas and Brantas delta areas give a similar response, despite their problem related with water supply for irrigation, especially in the dry season. It appears that about 50% farmers in these two areas is reluctant to answer such a question. It is due to uncertain feeling whether such an improvement is possible to be made since they have experienced such condition for a long time.

### 3.1.5. Water Users Association

In general, farmers in the Brantas River Basin have become members of HIPPA, representing about 80% of total farmers (Table 3.1.22). The reason to join the organisation is mainly motivated from the need of getting sufficient water supply. The reason is indicated by the majority of farmers in all irrigation areas in the Brantas River Basin, even in Lodoyo irrigation area 92% of farmers agree with the reason. Apart from that, the motive of joining HIPPA is simply for socialising (30%), and improvement of income (10%) and to explore a new technology or knowledge (10%).

Table. 3.1.22 Membership of HIPPA

Member	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Yes	100	100	94	80	87	89
No	0	0	6	19	10	11
Can not reply	0	0	0	1	3	0
Total	100	100	100	100	100	100

Note : % is a percentage of farmer

It is clear that fulfilment of the amount of water required for the crop is the main reason (Table 3.1.23). It does make sense since water is a main input for the growth of plants. Limited supply of the necessity water will certainly reduce the crop yield.

Table 3.1.23 Reasons to Join the HIPPA

Reason	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Unity of Community	28	8	18	3	17	41
Increase income	6	0	0	14	6	4
New Technology	0	0	0	0	2	3
Need of water	66	92	76	63	62	41
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

It is observed that the role of formal and informal leaders in the respective area are of great influence in the decision making process to be a HIPPA member. This is shown by the fact that more than 60% of total farmers become HIPPA member by "persuasion" of the above leaders (Table 3.1.24). It may be related to the fact that HIPPA is a government made organisation.

Table 3.1.24 Decision Process to Join the HIPPA

Decision	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
own decision	28	8	18	3	17	41
family decision	6	0	0	14	6	4
motivated by neighbour	0	0	0	0	2	3
motivated by the other	66	92	76	63	62	41
Total	100	100	100	100	100	100

Note : % is a percentage of farmer .

In the Turi Tunggorono, Blobo, Warujayeng and Widas areas, most farmers consider that the HIPPA is in active condition, while in Lodoyo

and Brantas delta the majority of farmers claim that the HIPPA is not active (Table 3.1.25).

**Table. 3.1.25 The Perception to the HIPPA Role**

HIPPA Role	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Active	80	32	71	68	89	22
Not Active	20	68	23	25	9	69
Can not reply	0	0	6	7	2	9
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

The Brantas delta and Lodoyo is the two areas that suffers most during the dry season since the water is hard to get. Farmers appear to feel that the condition is a results of the HIPPA being not active. It agrees with the data presented in Table 3.1.26.

**Table 3.1.26 Degree of Satisfaction with Water Management System**

Degree of Satisfaction	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
very much satisfied	10	0	0	2	2	0
satisfied	64	4	4	59	27	39
slightly satisfied	12	36	36	28	58	40
not satisfied	14	60	60	10	12	21
can not reply	0	0	0	1	1	0
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

It is clearly shown that most farmers in the Blobo and Widas irrigation areas are satisfied with the HIPPA service. The remaining claims that they are still not happy with the service HIPPA has given. The reason behind of unsatisfied feeling is mostly associated with the unavailability of water in the dry season.

### 3.1.6. Beneficiaries Pay-Concept

It is likely that beneficiaries' pay-concept is still not fully understood by farmers in the Brantas River Basin, although it shows some degrees of variation (Table 3.1.27).

**Table 3.1.27 Payment of the Irrigation Water Service**

Pay Water Service	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
Yes	94	72	97	92	92	100
No	6	28	3	8	8	0
Total	100	100	100	100	100	100

Note : % is a percentage of farmers

Most farmers pay the water service fee through the HIPPA. The payment, however, is usually not based on the amount of water they use, but on the yield of the successful crop. The payment may be in the form of harvested crop or cash money, or both. It varies by areas of irrigation (Table 3.1.28).

More variation of amount of money paid for the water service fee is observed in the Lodoyo, Warujayeng and Brantas delta areas than in the other areas. The lowest rate seems to be in the Blobo irrigation area where farmers mostly pay less than Rp 25,000.0, despite the variation in land area being cultivated. Some farmers even did not pay any fee, as it is observed in Lodoyo and Turi Tunggorono area. In Lodoyo area, 24%

farmers are not receiving any water for irrigation during the dry season and leave the land uncultivated. Similar but at a lesser degree is observed in Turi Tunggorono area.

**Table 3.1.28 Amount of Money Paid for Irrigation Water Service Fee**

Amount Paid (Rp/ha/season)	Irrigation Area					
	Blobo	Lodoyo	Warujayeng	Widas	Turi Tunggorono	Brantas Delta
	(%)	(%)	(%)	(%)	(%)	(%)
< 25,000	94	4	37	72	33	97
25,000-49,000	0	10	34	20	59	2
50,000-100,000	0	58	24	0	0	1
> 100,000	0	0	2	0	0	0
TOTAL	94	72	97	92	92	100

Note : % is a percentage of farmers

It is obvious that in the Warujayeng and Lodoyo areas, the implementation of beneficiaries-pay concept seems to be better implemented. To a lesser degree such a practice is demonstrated in Brantas delta. It may be concluded that in fact the beneficiaries concept is not fully implemented by farmers in the Brantas River basin.

Most farmers in the Brantas River basin area seems to accept the beneficiaries-pay concept, as 60% or more farmers say that such concept is reasonable (Table 3.1.29).

However, the number of farmers who do not understand the concept in Blobo, Lodoyo and Turi Tunggorono area is relatively high (about 40% farmers). At a lesser extend it is also observed in the Brantas delta area.

Table 3.1.29 Perceptions to "Beneficiaries Pay-Concept"

Perception to the concept	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi Tunggorono (%)	Brantas Delta (%)
reasonable	60	64	100	94	60	78
not reasonable	8	14	0	0	3	2
can not reply	32	22	0	6	37	20
Total	100	100	100	100	100	100

Note : % a percentage of farmers

In general the failure to understand the beneficiaries-pay concept may result from several reasons. First, there has never been any specific and rationale charge imposed for water used for irrigation. Therefore, most farmers still keep the old perception that the charge of water used is included in the tax they pay and it is the duty of the government to supply the water. Second, the water tariff is determined through a community meeting in the village and it is usually based on the area of land operated and the crops being cultivated. Such mechanism is imposed by the Department of Internal Affair. It is not clear what is the basis of the tariff. The difficulty to charge the use of water based on its volume is associated with insufficient control of water distribution due to unavailability of measuring devices at the tertiary canals and lack of skilled person to carry such work. Third, fair distribution of water is hard to achieve with the current method of irrigation, i.e. plot-to plot irrigation in which the land closed to the canals will receive more water.

It indicates that in the effort to improve the management system, the role of HIPPA need to be improved that is able to act as an intermediary body to introduce and to socialise the concept. Since the concept to some degree is already practised, an introduction of new payment scheme, which is based on the amount of water used, may not be so difficult as long as the service is also improved.



### 3.1.7 Domestic Water

The sources of water for domestic use somewhat vary. In some irrigation areas like in Warujayeng, Widas and Turi Tunggorono, water for domestic use is from the irrigation canals, while in Blobo, Lodoyo and Brantas Delta areas, most farmer use their own wells. In some parts of Blobo irrigation area, the water for domestic use is available from the public water supply system (PDAM). The service only caters to 10% of farmer households (Table. 3.1.30).

**Table. 3.1.30 Source of Water for Domestic Use**

Source of Water	Irrigation area					
	Blobo (%)	Lodoyo (%)	Warujayeng (%)	Widas (%)	Turi-Tunggorono (%)	Brantas Delta (%)
Irrigation Canal	0	0	0	0	0	0
Public water source	4	0	0	0	0	0
Own well	60	100	100	95	100	99
River	4	0	0	0	0	0
Water vendor	0	0	0	0	0	0
Rain Water	0	0	0	0	0	0
public water + own well	10	0	0	5	0	0
own well + River	22	0	0	0	0	0
own well + water vendor	0	0	0	0	0	1
<b>TOTAL</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Note : % Percentage of Farmer

### 3.1.8. General findings

The results show that the educational background level of most of farmers in the Brantas River Basin is relatively low (elementary school). Although the area of the land operated by farmers is relatively small,

mostly in the order of 0.26-0.50 Ha per family, the main source of income is still from the agricultural sector. The family income from the sector is, among others, affected by the area of land operated, the cropping pattern applied and the status of operation. Some farmers are engaged in non-farm income generating activities that possibly in part limits their participation in the management activities of the Brantas River basin.

The cropping pattern practised varies somewhat depending on the degree of water availability. Paddy is the most popular crop to cultivate when water is abundantly available. A high portion of contribution to the farmers' income seems to be derived from cultivating horticultural crops.

The Brantas River and its irrigation canals are the main sources of water for irrigation. A limited amount of ground water is found to be the source for an additional water for certain areas. The amount of water applied for irrigation is in excess for the type of crops being cultivated. It is true for most irrigation areas in the Brantas River basin, both in the rainy and dry seasons. It is therefore, the farmers in the Brantas River basin may be considered as inefficient water users. This is partly due to an application of improper method of irrigation, lack of control of water volume distributed. As a consequent, the water is not fairly distributed.

The main problem complained during the dry season is insufficient amount of water supplied for irrigation. Other problems, at a lesser degree, in the decreasing order is an erosion of the irrigation canal in the Brantas River upper stream reaches, a silted canal bottom in the Brantas delta area and unavailability of water control devices, especially at the tertiary canal level. Farmers tend to give up paddy and cultivate palawija or horticultural crops in the case of water shortage.

The degree of farmers participation in the management activities of the Brantas River basin is influenced by many factors like the type of activity, the irrigation areas, the quality of HIPPA service, the level of

income generated from the agricultural sector, and the degree of their involvement in off-farm income generating activities.

The quality of service currently offered by the HIPPA seems to affect the willingness of farmers to join the organisation activities in the future. However, in general, the farmers are still willing to be involved in the water resources management activities of the Brantas River in order to get a better service of water for irrigation, except for the operation of water intake check gate. The farmers considered that the role and service of HIPPA should be improved to take a better responsibility in the operation and maintenance of the irrigation system and providing a better service to its member.

The top-down approach in developing a better system for water resources management plan need to be evaluated. More community involvement since the beginning of plan being set up has to be encouraged to develop sense of belonging to the programs of the plan.

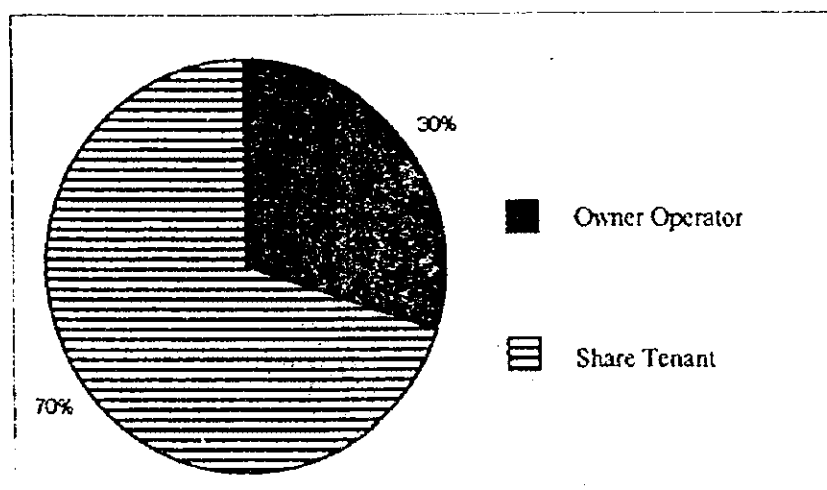
The beneficiaries pay-concept seems to be not fully understood nor implemented. However, an introduction of a new payment scheme, which is based on the amount of water, may not be difficult provided the water supply service is also improved. An improvement of the quality of HIPPA service may make the organisation to act as an intermediary body in introducing and implementation of such concept.

Brantas River and its derived irrigation canals are still an important source of water, both for an irrigation purpose and domestic use. Therefore, further participation to the management activities of the Brantas River may be sought from farmers since they are so dependent on water supplied from the river.

### 3.2. FISHPOND OWNERS

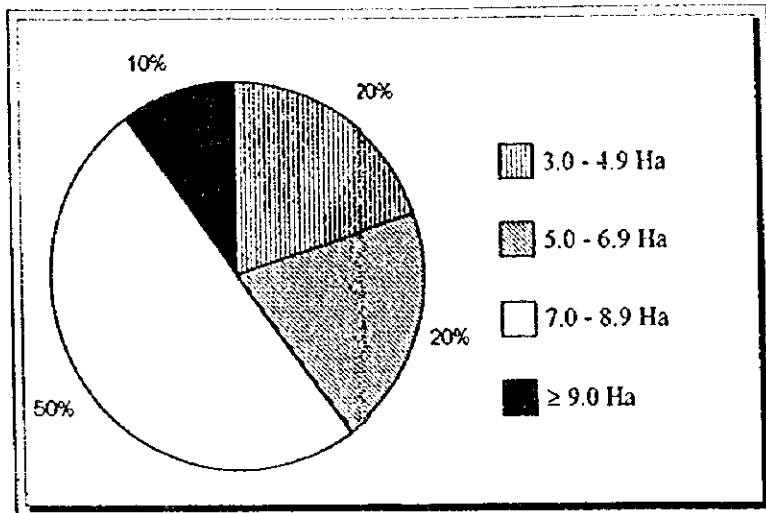
#### 3.2.1. Fish Culture Information

Fishponds surveyed falls into a type of brackish water pond aquaculture which is mostly known as tambak. They are run mostly (70%) by share tenant and the remaining are operated by the owners themselves (Pie Chart 3.2.1). Fish farming has been their main job for many years.



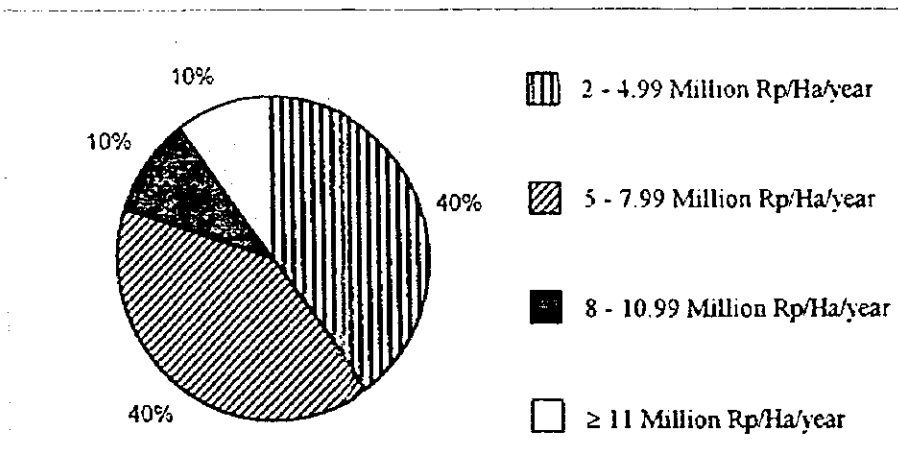
Pie Chart 3.2.1 Tenure status of fish farming in the Brantas delta irrigation area

The area of the tambak may be classified into four groups, i.e. 3.0-4.9 Ha, 5.0-6.9 Ha, 7.0-8.9 Ha and more than 9.0 Ha respectively. The majority of the tambak area operated falls into the third group, as it is shown in Pie Chart 3.2.2. The fish farmers mostly (80%) have been in the business for more than 5 years. This indicates that they have a lot of experience in running the business and are familiar with water issues. It is, therefore, they are good source of information necessary in the study.



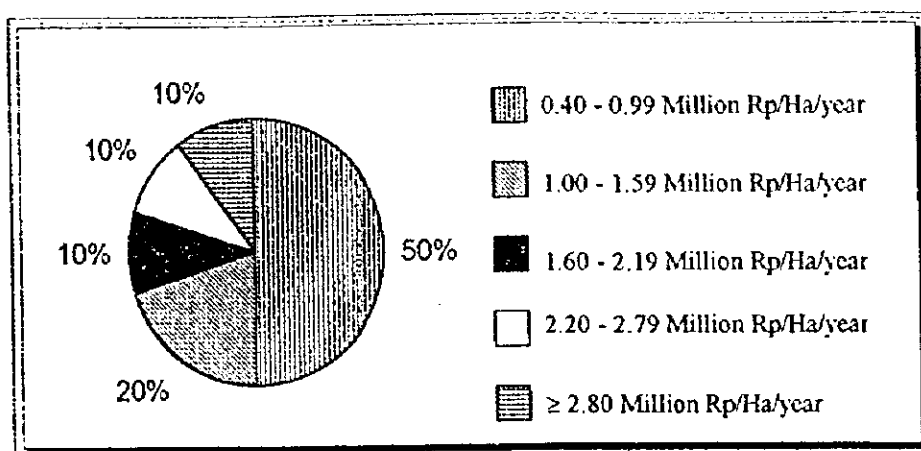
Pie Chart 3.2.2. Fishpond area operated in the Brantas Delta Irrigation Area

Most fishpond farmers (80%) earn a gross income ranging from 2 to Million Rupiah/ha/year, and only 20% of them earn more than 8 Million Rupiah/ha/year (Pie Chart 3.2.3). It is considered to be much higher than that obtained from the paddy cultivation. It is likely that the gross incomes of the tambak operators mainly depend on the area being operated, status of operation, the species of fish in cultivation and the system of farming employed. Despite the large area of tambak being operated, 70% of the farmers is in the status of share tenant. It is, therefore, only 20% of them earn more than 8 Million Rupiah/ha/year.



Pie Chart 3.2.3. Fishpond operator gross income

The fish farming business is mostly run in a traditional way as it is partly indicated by the low cost of operation and maintenance of tambak. A half of the tambak farmers spend less than 1.0 Million Rupiah/ha/year, and only 10% of them pay more than 2.8 Million rupiahs/ha/year for the operation and maintenance of the tambak. Pie Chart 3.2.4. show the distribution of the operation and maintenance cost of the tambak farming.

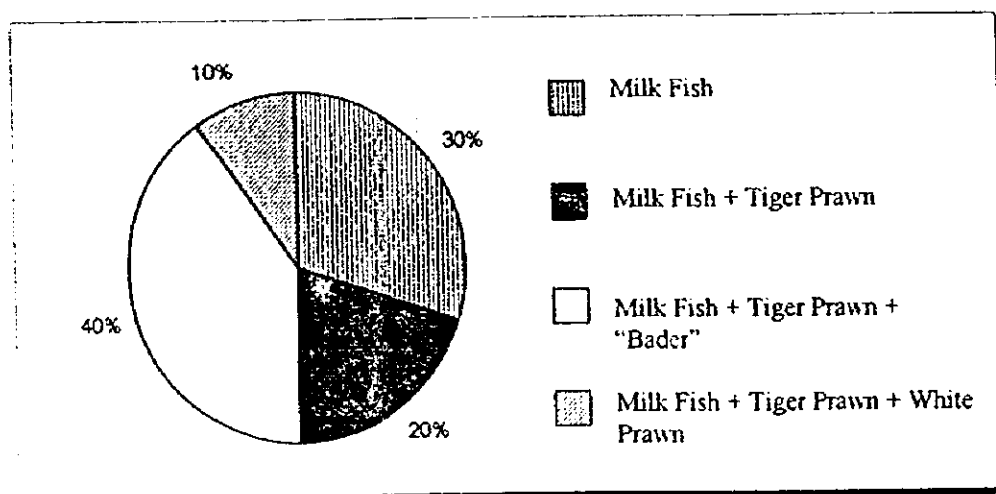


Pie Chart 3.2.4. Cost of operation and maintenance of fish farming

The traditional way of operation may also be indicated the absence use of a mechanical aeration device to help increase the level of dissolved oxygen commonly found in the intensive way of tambak operation. Other indication of such operation is shown by lack of control of water salinity. Only about one third of the farmers perform the measurement of the level of water salinity, while another 30% of the farmers realises the importance of such parameter, but do not carry out such measurement. Moreover, 40% of them are even ignorant of the water salinity level.

Furthermore, it is also indicated by the species of fish cultivated. Long before an intensive method of farming, i.e. tiger prawn cultivation booming, the area has long been known as milk fish producers. As can be seen from the Pie Chart 3.2.5 that the milk fish is found as the most

favourite species of fish to be cultivated, either in a monoculture basis (30% farmers) or in a mixed culture with other fish species (70% farmers). The second largest species to be cultivated in the mixed culture system is tiger prawn. A fresh water fish species with a local name of ikan bader is sometimes found in the pond. However, no single farmer cultivates tiger prawn in a monoculture system. This is possibly one way of avoiding damage results from infectious diseases that has occurred in the area in the last few years. The results show that the farmers tend to diversify the species of fish they cultivate, and to select milk fish, the species they have been familiar with.



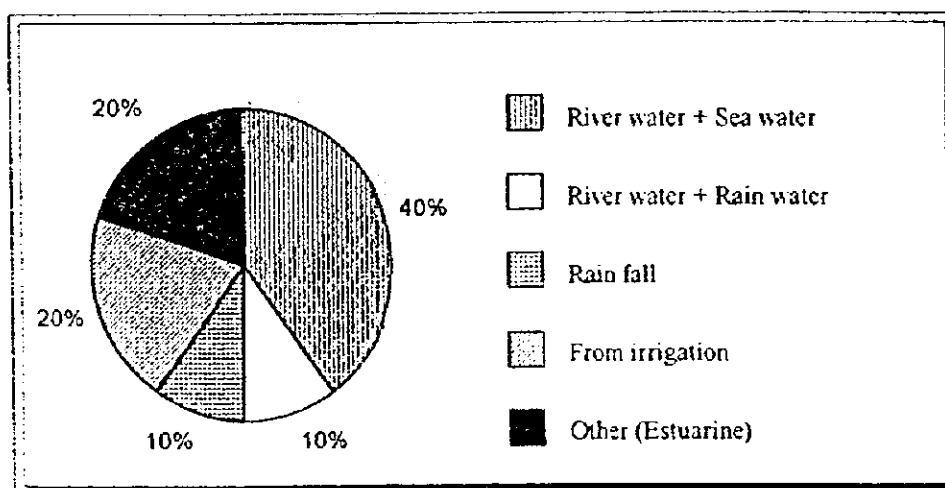
Pie Chart 3.2.5. Common fish species to be cultivated

The fact shows that the farming system is run mainly in the basis of experience rather than in a modern manner. It is probably related to the level of education that is generally low. Surprisingly, they have still survived in the business for years.

### 3.2.2. Water Issues Related to Fish Cultivation

Water used for fish culture varies in origin, but most farmers (50%) use the nearby river as a source of water for fish farming, another 20% take the water from an irrigation canal. The details of source of water for the tambak is shown in Pie Chart 3.2.6.

As can be seen that 50% farmers directly pump the water from the river. Such a method seems to be a common practice in the tambak operation. It may results from a number of reason. First, the irrigation canals is not available or the canal system is not as good as in the wet land cultivation. Second, the amount of water consumed is relatively high. Thus it will take a long time to deliver it into the tambak plot through the irrigation canal. Third, no organisation like HIPPA that helps organising the distribution of water among the tambak operators.

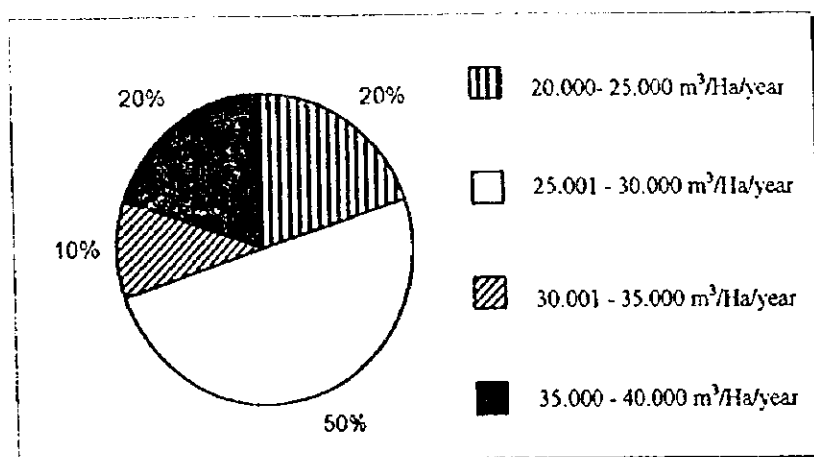


Pie Chart 3.2.6. Source of water for fish cultivation

As it is presented in Pie Chart 3.2.7 that the amount of water used, in general, has never been less than 20,000 m<sup>3</sup>/Ha/year. Some 50% of the farmers employ in the order of 25,000-30,000 m<sup>3</sup> water/Ha/year and another 30% uses water more than 30,000 m<sup>3</sup>/Ha/year. Such amount is

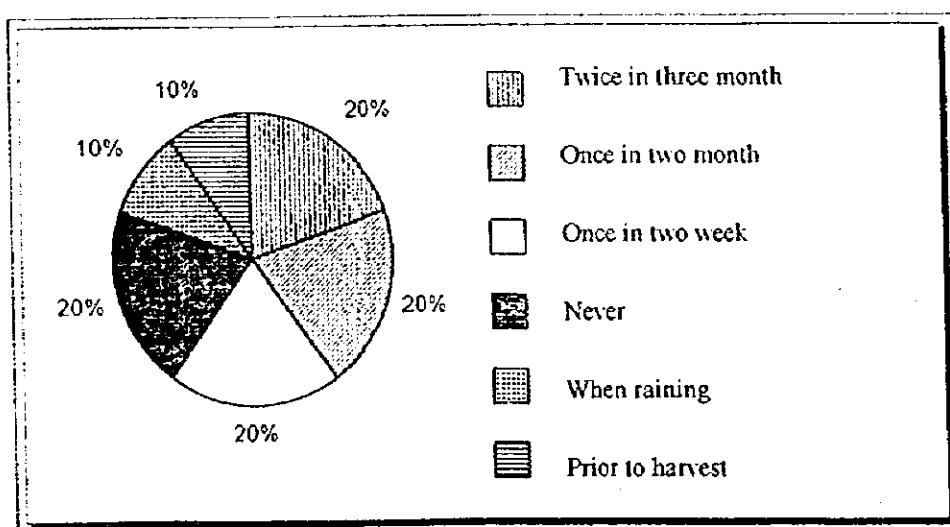


only to fill the tambak to start the fish cultivation. Some water is commonly added to maintain the water height at a certain level.



**Pie Chart 3.2.7 The volume of water apply to start the fish cultivation**

It is a common practice to replace the water from the fishpond and to put some additional water to it during the cultivation of fish to replace the loss of water through evaporation and seepage. The data shows, however, that the frequency of water replacement is relatively low (Pie Chart 3.2.8) since only 20% of them carry out such practice once two weeks, 40 % of the farmers have done it once six or more weeks.



**Pie Chart 3.2.8 Frequency of water changing for fishpond**

The low frequency of water changing is possibly associated with :  
 (i) a shortage of water, (ii) non-intensive tambak operation. In the traditional way of tambak operation, it is a common practice not to change the water very often since the population of the fish cultivated is not very high and the species of fish such as milk fish is relatively more tolerant to such situation.

The farmers, however, feel that they need some more additional water to run the tambak properly. Most farmers (70%) expect that there should be at least 12,000 M<sup>3</sup>/ha/year more water to be added for the fish cultivation. Details of the distribution of farmers expecting an additional amount of water for the cultivation of fish is presented in Table 3.2.1.

**Table 3.2.1 The Expected Amount of Additional Water for Fish Cultivation**

Volume of Additional Water (M <sup>3</sup> /ha/season)	% Farmers
< 12,000	20
12,000 - 15,000	10
15,000 - 18,000	30
> 18,000	30

The above figures show that in general the fish farming system they employed uses much higher amount of water, i.e. 1.5 - 2.0 times the amount of water needed for three consecutive paddy cultivation. Therefore, tambak farming is considered as a large volume water users.

Table 3.2.2 shows the distribution of source of the expected additional water for the fish cultivation. Most farmers (90%) expect that the additional fresh water they expected should come from the river or irrigation canals. It means that the role of river as a source of water in the tambak system is very important.

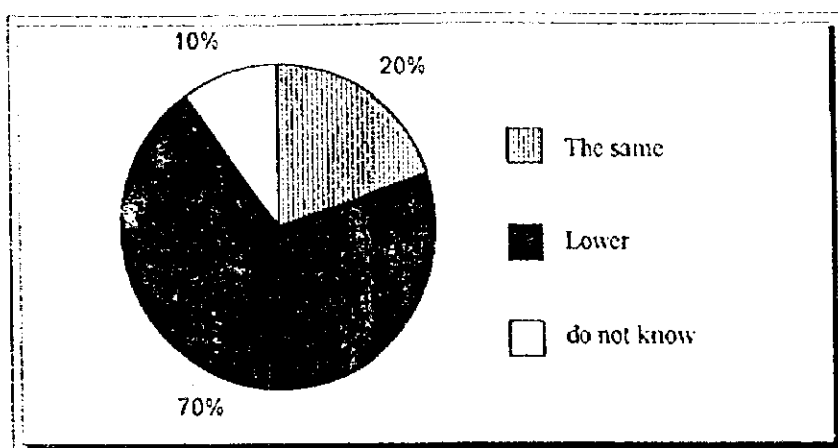
Table 3.2.2 Expected Source of Additional Water for Fish Cultivation

Expected Source of Water	% Farmers
River	30
Sea + River	40
Irrigation	20
Rain Fall	10

It is true that 80% of the farmers pay for the rehabilitation works of the canals. However, none of them make any payment for the water they use for fish cultivation. Most of the fish farmers see not to realize that water is becoming

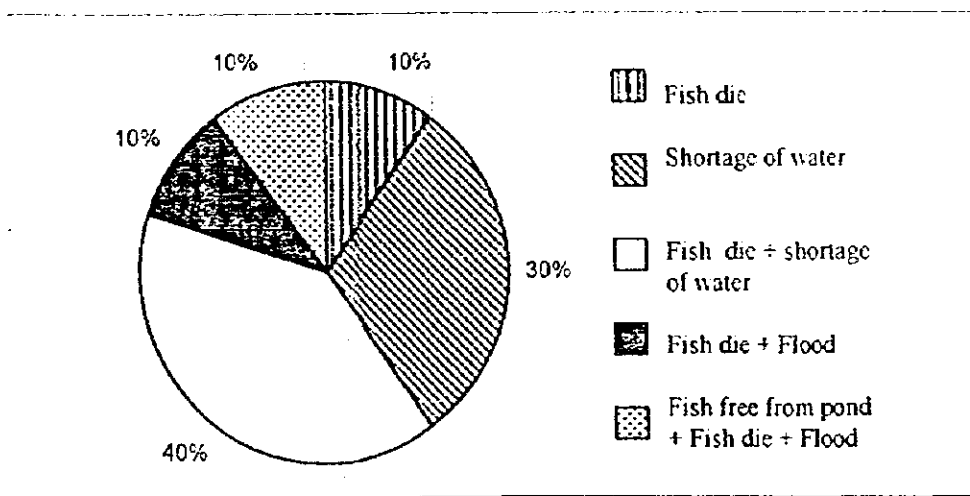
a limited resource, and therefore there is no need to pay for it nor for the water supply service. Such a perception may have been accepted among the fish farmers for decades. From the economic point of view, the reason is clear, the operation cost will increase as they have to pay for the water they use. Other possible explanations are : (i) the fish farmers consider that such a service is the obligation of the government. They might think that the payment for the used water is included in the income tax, and (ii) whether the payment of such service will improve the supply of water in sufficient amount and quality.

If compared with condition in 10 years ago, only 50% of fish farmers stated that the amount of water currently supplied is still sufficient, although the majority of the farmers (70%) feels that the water quality is declining. However, a few of them (10%) do not really aware of such problem (Pie Chart 3.2.9). The problems related to water shortage and the decrease in the water quality is likely well understood by most of the fish farmers.



**Pie Chart 3.2.9. Quality of the existing water compared to that of 10 years ago**

The problem encountered in relation to fish farming (Pie Chart 3.2.10) support such statement. In dry reason, when the water in the river reaches its lowest level, industrial pollutant is considerate to be the cause in increasing fish mortality. Some additional water is usually needed to replace the losses through evaporation's, infiltration and percolation. River is normally the source of additionally water. In other words, the river plays a very important role since any damage associated fish farming river will directly affect the fish farming system.



**Pie Chart 3.2.10. Problem associated with fish cultivation**

In the rainy season, on the other hand, the problem is usually related to flood. The water supply is adequate, but sometime an excessive run-off water result in flood in the low land of Brantas delta area. Instead of the increase in fish mortality occurs in dry season, the problem is simply losses of fish due to the flood.

It is identified that the water shortage problem is overcome by taking some additional water from the closest river. In other words, the river still plays an important role in the tambak system since none of them trying to seek any other sources of water, including ground water, to overcome the problem.

It is likely that the above mentioned problems, especially water shortage and the decline of water quality, may be used as an entry point to make a closer contact with the fishpond owners to improve and encourage their participation in water management activities of the Brantas River basin.

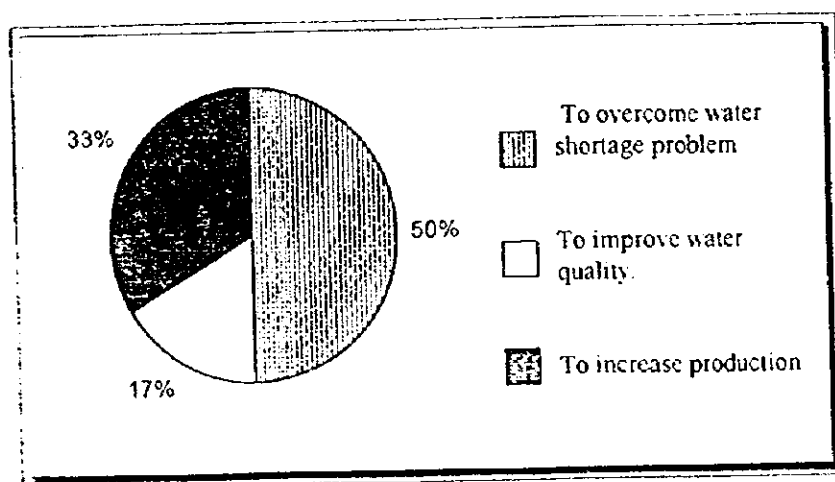
### **3.2.3. Fishpond Owners Association And Participation**

An idea of an establishment of an organisation such as fishpond owner's association seems to be not accepted overwhelmingly. 40% of the farmers responds that such an idea needs to be consulted with other fishpond owners. It may be assumed that the existence of such an organisation may be disadvantageous to their business. Another possible explanation is that they are still not sure whether such an organisation will be fruitful since from their experience with the existing formal agencies do not function as they are expected. This will be discussed in the section related to fishpond owners participation.

Those who are willing to accept and join the organisation to be established expects that such organisation will be responsive to the water supply problems. Most of these farmers stated that the existence of the

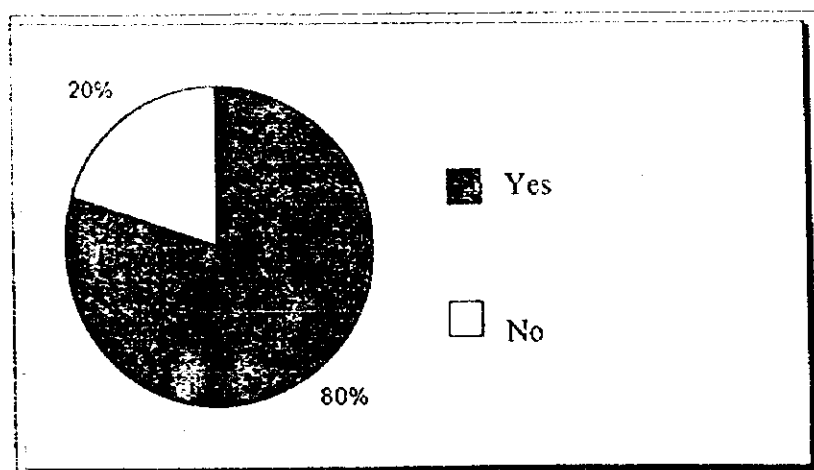
organisations can be used as means to increase knowledge and to overcome problem related to fish farming (Pie Chart 3.2.11). All of them expressed that to obtain an adequate amount of water for their pond is their own responsibility.

Most fish farmers (70%) has already involved in the meeting to deal with the water issue, and the topic mostly discussed is the shortage of water and the quality of water. The results also indicate that all fishpond farmers have never discussed water issues with the fishery officer. The reason include : 40% of the farmers feels that the fishery service staff never gave any attention to help solving the problems related to water supply and 60% of farmers considers that such staff has never provided any information related to fish farming.



Pie Chart 3.2.11. Participation in the water resources management of the Brantas river

Most fish farmer (80%) stated they want to participate in the rehabilitation works of the irrigation canal. They also have paid for irrigation canal (Pie Chart 3.2.12.).



**Pie Chart 3.2.12 Participation in the rehabilitation of water canals**

However, all fish farmers stated they never paid for operation and maintenance of irrigation canal. About 60% stated that, in general, they have participated actively in the management activities of the Brantas River Basin, while the remaining stated they did not know whether they participated actively. The results also indicate that who are currently active in the rehabilitation of canals are willing to be involved more actively in such activities in the future. They believe that it will improve the water supply and water quality. Some also believe that it may also increase the fish production.

The majority of fish farmers (60%) also stated they want to participate more actively in the management activity by means of communication with the Governmental Organisation concerned through an umbrella organisation such as fishpond owner's association. Another 20% of them want to participate in the form direct communication with the government and non-government bodies concerned, although not in regular basis. The remaining 20% is mostly concerned to work directly in the rehabilitation of canals.

### 3.2.4 General findings

The tambak operation is mostly run in a traditional way in which milk fish is being the most popular fish species being cultivated. It consumes a considerable amount of water, which is mainly derived from the Brantas River. The amount of water used may be 1.5 - 2.0 times as much water used for three consecutive paddy cultivation. The problems associated with water issues are usually dealt individually or discussed in a small group of farmers. No such an organisation like HIPPA is observed. However, the majority of fish farmers expect that an establishment of such organisation is enable to overcome problems related to water supply.

In the dry season, insufficient amount of water available at a reasonable quality is a problem for most tambak operators. A n introduction of a better irrigation system in the are seems to be necessary.

In relation to water use, the beneficiaries pay-concept is not understood nor implemented in the tambak operation. It appears that the establishment of an umbrella organisation like fishpond owner's association will help to introduce as well as to implement such concept. The implementation of such concept may not be successful unless provided the water supply service improved.

As it was previously stated that the fishpond owners show a basic requirement expected to be more involved and to actively participate in the water resources management of the Brantas River Basin.

In general, it is identified that there is a need for a better water management system for the tambak system.