

3.3. Industrial Water Users

Two sets of data from industrial users, i.e. PT Petrokimia and PT Cheil Jedang Indonesia, are not included in the analysis. PT Petrokimia did not present data on the fertilizer plant unit (as it is expected), but on water processing plant unit. The second company at the moment is not in operation yet, so that the data presented is only a plan.

3.3.1. Number of Staff

The number of staff varies with industry (Table 3.3.1). Some of the industries are being labour intensive like the paper, cigarette and cement industries.

Table 3.3.1. Number of Staff in the Various Types of Industries

No.	Name of Company	Type of Product	Number of Staff (Person)
1	PT. SUMBER TIMUR	Tapioca flour	83
2	PT. SUMBER TANI ABADI	Tapioca flour	10
3	PG. KEBON AGUNG	Sugar Cane	40
4	PG. GULA 'GEMPOLKREP'	Sugar Cane	30
5	PG. MERITJAN - KEDIRI	Sugar Cane	44
6	PT. RAJAWALI I UNIT PG. KREBET BARU	Sugar Cane	82
7	PT. SUPARMA	Paper	92
8	PT. SURABAYA MEKA BOX LTD.	Paper	789
9	PT. PABRIK KERTAS TJWI KIMIA	Paper	7,540
10	PT. EKAMAS FORTUNA	Paper	729
11	PT. ADIPRIMA SURAPRINTA	Paper	227
12	PT. SURABAYA AGUNG INDUSTRI PULP & KERTAS.	Paper	1,436
13	PT. JAYA KERTAS	Paper	33
14	PT. AJINOMOTO INDONESIA	MSG, Flavouring Agent	51
15	PT. AJI NEX INTERNATIONAL	MSG, Flavouring Agent	10
16	PT. PERUSAHAAN ROKOK TJAP GUDANG GARAM	Cigarette Kretek	2,518
17	PD. PEMBANTAIAN KODYA DATI II MALANG	Slaughter House	51
18	UNIT PABRIK ETANOL PD. ANEKA KIMIA (BUMD)	Ethanol	216

Table 3.3.1. Number of Staff in the Various Types of Industries (continued)

No.	Name of Company	Type of Product	Number of Staff (Person)
19	PT. KEBALEN TIMUR	Tanned Leather	70
20	PT. BUMI MENARA INTERNUSA II	Prawn Cold Storage	45
21	PT. MERTEX INDONESIA	Textile	32
22	PERUSAHAAN TAHU HALIM JAYA	Tofu	-
23	PT. TIMUR MEGAH STEEL	Steel	93
24	PT. HANIL JAYA METAL WORKS	Steel, Wire rod, Billex	775
25	PT. SEMEN GRESIK (PERSERO)	Portland Cement	2,480
26	PT. PETRO KIMIA *)	WATER	
27	PT. CHEIL JEDANG INDONESIA *)	MSG/Flavouring agent	

Note : *) Not included in the analysis

3.3.2. Source and Use of Water for Industries

The majority of industries use the water from the river for their operation. One third of industries depends solely on the river as the main source of water required for the operation of the industry, while about one fifth rely only on the ground water. Another one fifth uses 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, ground water. The data is presented in Table 3.3.2. The number of industries, which depends on the river as the source of water is comparable to that of the ground water. It is also indicated that only a very limited number of industries uses PDAM as the source of water. Apart from the price consideration, the water needed for the operation is not always in such a quality as it is produced by PDAM. It is likely that the PDAM water is the source of water for domestic use only. In other words, the water from the river is more economical and practical to use for some industries.

Table 3.3.2 Water Source for Industries

Type of Water Source	% of Companies
PDAM	0
Ground Water	28
River	40
Rain Water	0
PDAM + Ground Water	8
PDAM + Ground Water + Rain Water	4
Ground Water + River	20

The industries that employ the river as a water source are mostly situated along or closed to the river where they are taking the water from, as indicated by the distance (Table 3.3.3). The closest distance of the industry to the river is 5 m and the furthest is 1,000 m, respectively.

Table 3.3.3. Type of Product and Average Distance from the River

No	Name of Company	Type of Product	Average Distance (meter)
1	PT. SUMBER TIMUR	Tapioca flour	5
2	PT. SUMBER TANI ABADI	Tapioca flour	5
3	PG. KEBON AGUNG	Sugar Cane	10**
4	PG. GEMPOL KEREP	Sugar Cane	100**
5	PG. MERITJAN - KEDIRI	Sugar Cane	50**
6	PT. RAJAWALI I UNIT PG. KREBET BARU	Sugar Cane	500**
7	PT. SUPARMA	Paper	10**
8	PT. SURABAYA MEKA BOX LTD.	Paper	300**
9	PT. PABRIK KERTAS TJIWI KIMIA	Paper	1000**
10	PT. EKAMAS FORTUNA	Paper	100**
11	PT. ADIPRIMA SURAPRINTA	Paper	100**
12	PT. SURABAYA AGUNG INDUSTRI PULP & KERTAS.	Paper	600**

Table 3.3.3. Type of Product and Average Distance from the River (continued)

N0	Name of Company	Type of Product	Average Distance (meter)
13	PT. JAYA KERTAS	Paper	-
14	PT. AJINOMOTO INDONESIA	MSG, Flavouring Agent	20**
15	PT. AJI NEX INTERNATIONAL	MSG, Flavouring Agent	20**
16	PT. PERUSAHAAN ROKOK TJAP GUDANG GARAM	Cigarette	-
17	PD. PEMBANTAIAN KODYA DATI II MALANG	Slaughter House	-
18	UNIT PABRIK ETHANOL PD.ANEKA KIMIA (BUMD)	Ethanol	5**
19	PT. KEBALEN TIMUR	Tanned Leather	-
20	PT. BUMI MENARA INTERNUSA II	Prawn Cold Storage	-
21	PT. MERTEX INDONESIA	Textile	-
22	PERUSAHAAN TAHU HALIM JAYA	Tofu	-
23	PT. TIMUR MEGAH STEEL	Steel	-
24	PT. HANIL JAYA METAL WORKS	Steel, Wire rod, Billex	300**
25	PT. SEMEN GRESIK (PERSERO)	Portland Cement	100**
26	PT. PETROKIMIA GRESIK *)	Water	100
27	PT. CHEIL JEDANG INDONESIA *)	MSG, Flavouring Agent	40

Note : *) Not included in the analysis

**) Represents industry that use, wholly or partly, river as water source

It is identified that 15 out of 25 industries (60%) using river as the source of water are located less than 1000 m from the river. Those include industries that produce sugar cane, industrial paper, ethanol and flavouring agents. It is more convenient to locate the industry closed to the river as to reduce the cost of pumping the water into the industrial area.

The level of water use in the dry and wet seasons for several types of industries such as pulp, shrimp freezing, are nearly the same, while the level is different between seasons for cassava flour, sugar, cigarettes,

ethanol and textiles. The amount of water used in the dry season is higher than in the rainy season. Probably, the industries use a considerable amount of rain water for the production activity during the rainy season.

In regards to the amount of water, all industries are satisfied with the present condition of water supply. The level of water used varies considerably with industries and the capacity. The highest level of water consumption is demonstrated by one of the Sugar cane industries, more 21,000 m³ water/day and the lowest one is observed for the soybean curd (tofu) industry, i.e. 3 m³/day (Table 3.3.4). Compared with other industries, the sugar cane, paper and the leather tanning industries are considered as consuming a high level of water. The amount of water consumed is more than 15,000 m³/day.

Table 3.3.4 Level of Water Consumption of Company Water Users

No	Name of Company	Type of Product	Amount of water used (m ³ /day)	Water Used in Production (m ³ /ton product)
1.	PT. SUMBER TIMUR	Tapioca flour	1,397.67	115.94
2.	PT. SUMBER TANI ASADI	Tapioca flour	38.04	4.63
3.	PG. KEBON AGUNG	Sugar Cane	5,292.00	49.02
4.	PG. GEMPOL KEREK	Sugar Cane	-	-
5.	PG. MERITJAN - KEDIRI	Sugar Cane	21,945.60	25.91
6.	PG. RAJAWALI UNIT PG. KREBET BARU	Sugar Cane	18,226.71	100.95
7.	PT. SUPARMA	Paper	5,668.67	17.24
8.	PT. SURABAYA MEKA BOX LTD.	Paper	4,833.33	31.03
9.	PT. PABRIK KERTAS TJWI KIMA	Paper	16,541.67	98.17

Table 3.3.4 Level of Water Consumption of Company Water Users
(continued)

No	Name of Company	Type of Product	Amount of water used (m ³ /day)	Water Used in Production (m ³ /ton product)
10	PT. EKAMAS FORTUNA	Paper	-	-**
11	PT. ADIPRIMA SURAPRINTA	Paper	-	-**
12	PT. SURABAYA AGUNG INDUSTRI PULP & KERTAS.	Paper	12,195.80	25.96
13	PT. JAYA KERTAS	Paper	10,000.00	202.78
14	PT. AJINOMOTO INDONESIA	MSG, Flavouring Agent	28.36	0.04
15	PT. AJINEX INTERNATIONAL	MSG, Flavouring Agent	23.07	0.47
16	PT. PERUSAHAAN ROKOK TJAP GUDANG GARAM	Cigarette	2,205.95	-**
17	PD. PEMBANTAIAN KODYA DATI II MALANG	Slaughter House	-	-**
18	UNIT PABRIK ETANOL PD ANEKA KIMIA (BUMD)	Ethanol	1,372.23	38.55
19	PT. KEBALEN TIMUR	Tanned Leather	28.50	173.38
20	PT. BUMI MENARA INTERNUSA II	Prawn Cold Storage	70.00	31.94
21	PT. MERTEX INDONESIA	Textile	516.67	-**
22	PERUSAHAAN TAHU HALIM JAYA	Tofu	3.33	-**
23	PT. TIMUR MEGAH STEEL	Steel	-	-**
24	PT. HANIL JAYA METAL WORKS	Steel, Wire rod, Billex	1,000.00	1.11
25	PT. SEMEN GRESIK (PERSERO)	Portland Cement	2,490.78	0.23
26	PT. PETROKIMA GRESIK *	Water	7,315.67	0.47
27	PT. CHEIL JEDANG INDONESIA *	MSG, Flavouring Agent	-	-**

Note : *) Not included in the analysis

***) Production volume data is not available

Since one third of industries surveyed did not respond to the question related to production volume, the comparison of the relative amount of water consumed per ton of product will be based on the available data. The relative amount of water consumed varies considerably with the industry. The high figure is shown by paper

producers, i.e. more than 200 m³/ton of product, while the lowest level is shown by the MSG/Flavouring agent (PT Ajinomoto Indonesia), i.e. less than 0.04 m³/ton of product.

Variation of the relative amount of water consumed is also demonstrated among similar industries. Between the two tapioca flour producers, PT Sumber Tani Abadi is considered to be much more efficient in the use of water than PT Sumber Timur is. The same does apply between the sugar cane industries. It shows that PG Mrican Kediri is much more efficient in relation to water use compared with the PG Kebon Agung and PG Kribet. For the paper industries, PT Suparma is the most efficient one as compared with the other paper industries in the relation to water use, assuming that the type of product is the same.

Although all industries are satisfied with the amount of water currently supplied, about 24% of them claim that the quality of water is not as good as they are expected (Table 3.3.5).

Table 3.3.5 Response to the Quality of Water Currently Supplied

Quality of water	% Companies
Good	76
Bad	24

Among those who are complaint about the water quality, 50% of them states that it is due to pollutant and the remaining 16.6% express it results from sedimentation (Table 3.3.6).

The results indicates that a more comprehensive activity needs to be carried out to reduce the level of pollutant introduced to the Brantas River and also to improve in the environmental condition in the upper stream area.

Table 3.3.6 Problems associated with the Water Quality

Problem	% of companies
Polluted	50.00
Sedimentation	16.60
pH level is out of range	16.60
Others	16.60

3.3.3. Expenditure on Water

The highest level of expenditure on water is observed on paper industry, i.e. PT Tjiwi Kimia, and the lowest is in the tanning industry (Table 3.3.7). However, the relative cost of water consumed, i.e. amount of money spent for water per ton of product, also vary considerably. The highest is observed in the paper industry and the lowest is found in the cement industry.

It is also interesting to note that the cost is much lower for cement industry than that of the leather tanning industry. There are three reasons to explain this phenomenon. First, the production volume of the tanning industry is relatively small in comparison with that of the cement industry, which has a various type of products with much larger production volume. Secondly, the price of water per m³ obtained from the wells (ground water) seems to be higher than that from the river. Thirdly, in the cement industry a water saving technology is already applied.

Table 3.3.7 The Expenditure On Water

No.	Name of Company	Type of Product	Monthly Expenditure on Water (Rp./Ton of Product)	Total Expenditure on Water (Rupiah)
1	PT. SUMBER TIMUR	Tapioca flour	578.78	212,220.00
2	PT. SUMBER TANI ABADI	Tapioca flour	148.50	445,500.00
3	PG. KEBON AGUNG	Sugar Cane	805.77	31,750,000.00
4	PG. GEMPOL KEREK	Sugar Cane	128.25	112,235,456.00

Table 3.3.7 The Expenditure On Water (continued)

No.	Name of Company	Type of Product	Monthly Expenditure on Water (Rp./Ton of Product)	Total Expenditure on Water (Rupiah)
5	PG. MERITJAN - KEDIRI	Sugar Cane	188.43	58,248,000.00
6	PG. RAJAWALI I UNIT PG. KREBET BARU	Sugar Cane	1,470.53	96,913,800.00
7	PT. SUPARMA	Paper	125.00	15,000,000.00
8	PT. SURABAYA MEKA BOX LTD.	Paper	211.06	12,000,000.00
9	PT. PABRIK KERTAS TJIWI KIMIA	Paper	2,813.01	173,000,000.00
10	PT. AJINOMOTO INDONESIA	MSG, Flavouring Agent	550.19	127,000,000.00
11	PT. AJI NEX INTERNATIONAL	MSG, Flavouring Agent	5,461.11	98,300,000.00
12	PT. PERUSAHAAN ROKOK TJAP GUDANG GARAM	Cigarette	-	11,948,655.00
13	PD. PEMBANTAIAN KODYA DATI II MALANG	Slaughter House	-	507,730.00
14	UNIT PABRIK ETANOL PD.ANEKA KIMIA (BUMD)	Ethanol	508.04	6,600,000.00
15	PT. KEBALEN TIMUR	Tanned Leather	1,083.33	65,000.00
16	PT. BUMI MENARA INTERNUSA II	Prawn Cold Storage	375.00	300,000.00
17	PT. MERTEX INDONESIA	Textile	-	38,000,000.00
18	PERUSAHAAN TAHU HALIM JAYA	Tofu	-	750,000.00
19	PT. TIMUR MEGAH STEEL	Steel	-	1,986,000.00
20	PT. SEMEN GRESIK (PERSERO)	Portland Cement	24.42	95,000,000.00
21	PT. EKAMAS FORTUNA	Paper	1,410.00	14,100,000.00
22	PT. ADIPRIMA SURAPRINTA	Paper	6,000.00	15,000,000.00
23	PT. SURABAYA AGUNG INDUSTRI PULP & KERTAS.	Paper	1,555.45	22,230,000.00
24	PT. JAYA KERTAS	Paper	4,666.67	7,000,000.00
25	PT. HANIL JAYA METAL WORKS	Steel, Wire rod, Billex	98.18	2,700,000.00
26	PT. PETROKIMIA GRESIK *	Water	3.23	18,432,738.00
27	PT. CHEIL JEDANG INDONESIA *	MSG./Flavou ring Agent	-	-

Note : *) Not included in the analysis

- Data of water consumption is not available

The expenditure on water of the PT Sumber Tani Abadi (tapioca flour) is higher than that of the similar industry. This is mainly due to the PT Sumber Tani Abadi is less efficient in the use of water. Similar results may be shown is the sugar industries. The same does apply for the paper industries.

The investment needed for the installation of water facilities vary considerably depending on the type of product, capacity, and the water requirement of the industry. The investment ranges from 1 million rupiahs to more than 4 billion rupiahs, which is reported by one of the biggest paper industry surveyed. The industry uses river as the water source. More over, the operation and maintenance costs of one industry is also different from the other for a similar reason. The highest cost is recorded for the sugar cane industry.

3.3.4 Participation of Industrial Companies in the Water Resources Management

The majority of industrial companies (56%) states that they already participate in the water resources management activities by means of discussing water issues in the respective industry association meeting (Table 3.3.8). The problems discussed in the decreasing order are about water tariff, water availability and water quality.

Table 3.3.8. Involvement of Industries in the Discussion within the Industrial Companies' Association

Involvement	% Companies
Yes	56
No	40
No. Respond	4

It was stated that the current water supply is not a problem, it appears that the respond does not reflect the actual condition since they

frequently discussed the topic in the meeting of industrial association. It is clear that the three main water issues mentioned above need to be put into consideration in the establishing the better water resources management plan.

Most of industrial companies have also discussed the problems with the government agencies concerned. It is noted that 64% of the industry has done so. However, the remaining industries express that they do not know how to make a closer contact with such agencies.

Among those who have discussed the water issues with the governmental agencies, about 68.8% company express their satisfaction, but a quarter of them are not satisfied. Several issues that makes industrial people are not satisfied with the governmental service are related to the increase of water tariff and no solution to problems discussed, and a bureaucratic problem. These may suggest that a more intensive contact and improvement of the governmental service need to be performed.

Moreover, about 40% of the industrial companies has never involved to discuss about water issues with non-government agencies. The figure is comparable to that of those involved in such activity. Discussions with the non-governmental agencies are usually made in the seminars and similar meetings covering the topics of water resources management, environment and aspects of waste water treatment. The remaining 20% of them do not give any answer to the question whether they already discussed about water issues with non-governmental agencies. It may result from a number of reasons. The industry people are trying not to expose the problem they faced as it may damage the reputation, or they are sceptical of not getting solution by doing so. Overall, more than 50% industrial companies feel that they already participate in the water resources management activities of the Brantas River.

The above mentioned facts suggest that the degree of participation of the industrial water users in the water resources management of the Brantas River basin varies considerably. As it was shown that not all of the industrial water users participated in the activities of water resources management of the Brantas river. There are some main water issues identified that make the industrial water users are not happy, namely the water tariff, water availability and water quality. These three aspects need to be considered favourably in seeking participation of industrial water users in the water resources management system of the river.

3.3.5. Willingness to Participate in the Water Resources Management in the Future

In order to develop a water management system, the participation of water users in Brantas River Basin in the future should be encouraged including thus of the industrial water users.

When the industrial water users are questioned whether they want to more actively participate in the water resources management, 76% of the industrial companies (Table 3.3.9) are willing to participate because of a number of reasons, namely : (1) the river water is consumed by other people, (2) to conserve water resources and environment, (3) they use the water themselves, (4) the water is getting scarce, (5) to keep a good quality of water and (6) it is also their responsibility to conserve the resources.

Among those who are willing to participate, they want to be involved in the following activities, in the decreasing order. First, they want to communicate with the agencies through an 'umbrella' organisation. Second, they expect to make a closer contact not in a regular basis, with the agencies concerned. Third, they want to have regular meetings with the industrial people and the governmental agencies concerned.

Table 3.3.9. Willingness to Participate in the Water Resources Management

Participation	% companies
Willing to Participate	76
Not Willing to Participate	4
Do not Know	12
No Respond	8

The figures show that an establishment of an integrated plan that binds the parties concern with the water resources management is necessary. More consultative contact is also expected to deal with such issues.

It is likely that most industrial water users (64%) prepares to share a responsibility in dealing with water issues in the water resources management of the Brantas River basin for the benefit of all community (Table 3.3.10). Only a small number (4%) of industrial water users do not want to do one and another 12% of them can not decide what to do. Some industrial companies (20%) do not make any respond to the matter.

Table 3.3.10 Willingness to Share Responsibility in the Water Resources Management

Share responsibility	%
Willing to Share	64
Not Willing to Share	4
Do not know	12
No Respond	20

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 system, but it should be followed by the improvement of the service of the governmental and other agencies concerned.

3.3.6. Willingness to Pay Industrial Water and Its Elasticity

In the response to the improvement of water service, it is identified that only a small number of industries (about 20%) are willing to pay up to 20% increase from the current water tariff, while about 4% of them does not accept any increase in water tariff. The remaining (about 75%) of them refuses to answer such a question. The reason seems to lie on the economical aspect. It is true that the increase in water tariff certainly increases the cost of production and makes the product becomes less competitive or reduces the profit, but they do not realise that through the improvement of water quality, for example, the quality of the product may be also improved. It is clear that the beneficiaries' pay-concept is only well understood and accepted by a small number of industrial water users.

In relation to the elasticity of the level of water consumption with any change in tariff, all industries refuse to answer the question. It is probably due to a level of water used for production is a fixed value which is related to the design of processes and activities in producing pre-determined types and volumes of products.

3.3.7. General Findings

1. River is still the main source of most industries in the Brantas River basin and the industries located not longer than 1,000 m tends to use the river as the main source of water since river water is relatively cheap as compared with the ground water.
2. Some industries that produce tapioca flour, sugar cane and paper are considered as inefficient in the use of water. The level of water consumed by the sugar cane and paper industries is considerably high.
3. Three main issues need to be dealt favourably are related to water tariff, scarcity, water availability and water quality.

4. Most industries already participate in the discussion with a similar company and the governmental agencies concerned about the water issues. A more pro-active role of the governmental agencies concerned is necessary
5. All industries pay for the water they use, but vary in degree depending on the source of water. However, they mostly seem not to be willing to pay a higher water tariff even if the water supply service is improved.
6. Since the level of water needed for the process is a fixed value, based on the design, the level of water consumed will not be changed in case of any alteration in water tariff.
7. There is a need to develop a more comprehensive plan of the water resources management of the Brantas River involving all the stakeholders in order to make a sustainable utilization of the water resources.

CHAPTER IV

CONCLUSION

Based on the finding result from the survey, it may be concluded that :

1. Agricultural sector remains to be the main source of income for farmers and fishpond operators and the land area operated is 0.4ha and 8.0 ha respectively. Despite the area of the land operated by farmers is relatively small, mostly in the order of 0.26-0.50 ha/family, and some farmers are engaged in non-farm income generating activities, 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. The income of the fishpond farmers is much higher than that of the land farmers since the average land area operated is much higher.
2. The cropping pattern practised varies depending on the degree of water availability and paddy being the most popular crop to cultivate when water is abundantly available, although a high portion of contribution to the farmers' income seems to be derived from cultivating horticultural crops. The tambak operation is mostly run in a traditional way in which milk fish is being the most popular fish species being cultivated. The system 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. On the other hand, most industries requires much higher river water for production.
3. 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. Similarly is true for fish farming system and the industries.

4. In general the majority of the three beneficiary groups are inefficient users of water
5. In the dry season, water shortage seems to be a problem in some area of land farming. Similar condition is also the case for fish farming and the industries. Moreover, the decline of water quality is complained by fish farmers and the industries.
6. To some extent, the participation in the water resources management activities have been shown by farmers, industrial water users, but fish farmers. The role of the association of the respective groups in the water resources management system may need to be improved.
7. It seems that the beneficiaries pay-concept is not fully understood nor implemented by most farmers, fish farmers and the industrial water users.
8. There is a need to introduce a better water resources management system that encourages more participation from the beneficiaries groups of the Brantas River.

Questionnaire for Survey of Farmers in the Brantas River Basin Areas

The main purpose of this questionnaire is to study the possibility for farmers to participate in the water resources management of the Brantas River Basin. For this purpose, this questionnaire survey include such questions such as the present status of farming, irrigation water supply, problems to meet the demand, farmer's consciousness of water scarcity and others.

1. On Interview

1.1 Interviewer name:

1.2 Interview : PlaceDateTime

2. Respondent Information

2.1 NameAge (1) Male (2) Female

2.2 Village/Town:P.O.District

2.3 Name of Cabang Dinas Pengairan:

2.4 Name of Cabang Seksi Pengairan:

2.5 Name of Daerah Irigasi (DPK):

2.6 Total family members: () persons

2.7 Educational background of Respondent: (1) No schooling (2) Primary education

(3) Secondary education (4) Vocational education (5) Higher education

2.8 What is the average monthly income of your household? Please answer by source of income.

() Rupiah per month by agriculture activity

() Rupiah per month by other activity ()

() Rupiah per month in total

3. Farming Information

3.1 Tenure status: (1) Owner operator (2) Tenant (3) Share tenant (4) Lessee

3.2 How many hectares of land are you cultivating now? () hectares

3.3 What kinds of crops do you mainly cultivate in rainy season?

(1) Paddy (2) Maize (3) Sugar cane (4) Potato (5) Vegetables (6) Tobacco

(7) Other, please mention ()

3.4 What kinds of crops do you mainly cultivate in dry season?

(1) Paddy (2) Maize (3) Sugar cane (4) Potato (5) Vegetables (6) Tobacco

(7) Other, please mention ()

4. Irrigation Water Supply

4.1 What is the main water source (s) that you are using for cultivation?

(1) Irrigation canals (2) Taking water from river directly (please write name of river) (3) Ground water (4) Pond/Lake (5) Other

4.2 Are there any problems in the irrigation system and facilities managed by your water user's association? You can select more than two answers.

(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 (please specify) ()

4.3 Do you know how much water you are using per/ha in rainy season?

(1) Yes,m³/ha/year (2) Do not know

4.4 Do you know how much water you are using per/ha in dry season?

(1) Yes,m³/ha/year (2) Do not know

- 4.5 Do you receive irrigation water everyday or intermittently? Please answer in rainy season and dry season separately.

In rainy season (1) Everyday (2) 1 day indays

In dry season (1) Everyday (2) 1 day in days

(3) If you receive the irrigation water in very limited hours, please specify how many hours?

- 4.6 In the drought year, if the irrigation water is limited, how do you use this scarce water? (You can choose more than two answers from below)

(1) Give up paddy cultivation and cultivate polowijo (please specify the name of crop)

()

(2) Reduce cropping area (please specify which crop will be reduced)

()

(3) Do nothing and you loose all harvest in the season

(4) To find out other water resources

- 4.7 If your answer to Q4.6 is (4), please specify the water source

(1) Shallow well (2) Deep well (3) Pond/lake (4) Other source (please specify)

5. Need of Water Management

- 5.1 Have you ever joined to any management activities of the Brantas River in the past? Please answer the following questions regarding your participation in the past.

5.1.1 Have you ever attended any meeting of HIPPA?

(1) Yes, many times (2) Yes, but few times only (3) Never

5.1.2 If your answer to Q5.1.1 was (3) Never, what was the reason?

(1) Have no interest (2) Not invited (3) No effect to attend (4) Others

5.1.3 Have you ever offered your labor service with no pay to any rehabilitation works of irrigation canals?

(1) Yes, many times (2) Yes, but few times only (3) Never

5.1.4 Have you ever offered your labor service with no pay to the operation of water intake gate of irrigation water?

(1) Yes, many times (2) Yes, but few times (3) Never

5.1.5 Are there any other participation of yours to the management activities of the Brantas River Basin?

(1) Yes: () (2) No

5.2 Do you have an intention to join the management activities of the Brantas River?
Please answer the following?

5.2.1 Do you want to attend HIPPA meeting to present your opinion and /or request toward HIPPA activities?

(1) Yes (2) No. (3) Cannot reply

5.2.2 Are you willing to offer labor service with no pay for rehabilitation works of irrigation canals if requested?

(1) Yes (2) No. (3) Cannot reply

5.2.3 Are you willing to offer your labor service with no pay for handling intake gate of irrigation canals if requested?

(1) Yes (2) No. (3) Cannot reply

5.2.4 Have you any other ideas of participation to the management activities of the Brantas River basin than the items mentioned above?

(1) Yes: () (2) No (3) Cannot reply

5.3 Who is responsible for operation and maintenance of your irrigation canals?

(1) Irrigation office (2) HIPPA (3) Yourselves (4) Do not know

5.4 Do you feel you need more improved irrigation water management system?

(1) Yes (2) No (2) Cannot reply

6. Water Users' Associations

6.1 Do you have a membership in the water users' association?

(1) Yes (2) No

6.2 Why have you decided to be a member of water users' association?

(1) Unity of community (2) To improve level of incomes (3) For new technology

(4) To get water for irrigation

6.3 How did you become a member of the water users' association?

(1) Own decision (2) Family decided (3) Motivated by neighbor (4) Motivated by other

6.4 Is your water users' association active?

(1) Yes (2) No

6.5 If you answer to Q6.4 is No, please explain why your water users' association is not active? ()

6.6 Are you satisfied with water management system of water users' association?

(1) Very much satisfied (2) Satisfied (3) Slightly satisfied (4) Not satisfied

6.7 If you answer to Q6.6 is (4) "Not satisfied", please explain why you are not satisfied.

()

7. On Beneficiaries' Pay-Concept

7.1 Are you paying irrigation service fees?

(1) Yes (2) No

7.2 If your answer to Q7.1 is No, please explain why you are not paying irrigation fees?

()

7.3 If your answer to Q7.1 is Yes, how much do you pay for irrigation service fees per/ha/year? () Rp./ha/year

7.4 On "Beneficiaries-pay concept"

Water will become increasingly scarce in the Brantas River Basin Area in the future as a result of an increase in population and the expansion of agriculture and industrial activities. Under these circumstances, the government goal is to secure sufficient volume of water with good quality for people in the area. However, the cost for developing new water supply facilities and introducing new technology for better water resources management for achieving this goal would be enormous. In this regard, there is an opinion that a part of these costs should be born by each beneficiary if the beneficiary can be identified.

For example, the cost of supplying public piped water should be born by the water consumers including domestic and industrial water users through paying water charge according to the consumption volume of each consumer. This reasoning is referred to as "beneficiaries-pay concept". This concept is also supported from the point of view of avoiding an imbalance of cost bearing among beneficiaries and non-beneficiaries, because if the beneficiaries don't pay, then the non-beneficiaries as tax payers are forced to pay.

7.4.1 Do you think that this idea of "beneficiaries-pay concept" is reasonable?

(1) Yes (2) No (3) Cannot reply

Please tell us your opinion toward the beneficiaries-pay concept, if you have any.
()

8. Domestic Water

8.1 From where do you get water for domestic purpose (cooking, toilet, bathing etc.)

(you can select more than two, if any)

(1) Irrigation canals (2) Public water supply service (3) Your own well

(4) River: name of the river () (5) Water vender

(6) Rain water (7) Other: mention ()

8.2 What is the amount of domestic water your household consumes per day? Please answer by source of water and for minimum case (drought time, when you experienced limited water supply etc.) and maximum case (when water is abundant or when there is no restriction on water use).

Water volume	Source			
	1. Irrigation canal	2. Public water supply system	3	Total
minimum				
maximum				
average				

If you can not give the amount in liter, please tell the interviewer any information that might indicate the amount of water you use. (size of container you use for carrying water, frequency of visiting river for getting domestic water etc.)

8.3 What is the average monthly expenditure for domestic water for your household?

Please answer by source of water.

(1) Public water supply system: () Rupiah per month per household

(2) Other: (): () Rupiah per month per household

(): () Rupiah per month per household

Total: () Rupiah per month per household

- 8.4 (For responding getting domestic water from public water supply system) Assuming a situation in which public water supply service will be improved in the future both in terms of quantity and quality or in which deterioration of public water supply services be prevented, up to what level of public water tariff would you accept to pay? Please answer "Yes" or "No" to the values the interviewer will give you.*

Present level ()*	Rupiah per month:	Yes	No
10% up ()**	Rupiah per month:	Yes	No
20% up ()**	Rupiah per month:	Yes	No
30% up ()**	Rupiah per month:	Yes	No
40% up ()**	Rupiah per month:	Yes	No
50% up ()**	Rupiah per month:	Yes	No
60% up ()**	Rupiah per month:	Yes	No
70% up ()**	Rupiah per month:	Yes	No
80% up ()**	Rupiah per month:	Yes	No
90% up ()**	Rupiah per month:	Yes	No
100% up ()**	Rupiah per month:	Yes	No

For interviewers:

* Please put the figure you heard in Q9.4, (1) Public water supply system.

** Please calculate the expense values corresponding to each % values based on the present payment amount you have just heard from the respondent and put them in ().

Example: Present level (1,000) Rp./month

10% up (1,100) Rp./month

20% up (1,200) Rp./month

- 8.5 Please assume situations in which public water supply system tariff be changed, increased or decreased, due to unavoidable reason such as inflation, change in government pricing policy and so on. How would you change the amount of water your household uses in increase to the price changes?

Rate of change in
domestic water tariff

Rate of change in the amount
of water used

Present expenses on water

Present amount

() Rp./month*

() m³/month**

50% up:

() Rp./month***

() % down

100% up (double):

() Rp./month***

() % down

50% down (half):

() Rp./month***

() % up

To the interviewer:

* Please put the figure (1) of Q10.4 for public water supply system.

** Please put the figure for public water supply system in Q10.3

*** Please calculate the monthly expenses and put them in ().

Example:

Present expense on water

Present amount of water

(4,000) Rp./month

(30) m³/month/family

50% up

(6,000) Rp./month

() % down

100% up

(8,000) Rp./month

() % down

50% down

(2,000) Rp./month

() % up

Questionnaire for Survey of Fishpond owners' in the Brantas River Basin Area

The purpose of this questionnaire survey is to study the possibilities for fishpond owners to participate in the water resources management of the Brantas River basin. For this purpose, this questionnaire survey include questions such as the present status of water supply, current problems, and other related points to the fishpond culture.

1. On Interview

1.1 Interviewer name:

1.2 Interview : PlaceDateTime

2. Respondent Information:

2.1 NameAge(1) Male (2) Female

2.2 Village/Town:P.O.District.....

2.3 Name of Cabang Dinas Pengairan:

2.4 Name of Cabang Seksi Pengairan:

2.5 Total family members: () persons

2.6 Educational background of the respondent: (1) No schooling (2) Primary education
(3) Secondary education (4) Vocational education (5) Higher education

3. Fish Culture Information

3.1 Tenure status: (1) Owner operator (2) Tenant (3) Share tenant (4) Lessee

3.2 Is fish farming main job in your family?

(1) Yes (2) No

3.3 If your answer to Q3.2 is No, what is your main job?

3.4 How much yearly gross income do you get from other sources than fishpond culture?
() Rupiah

3.5 How many hectares of land you are using now for fish culture? Please answer by type of fishpond.

(1) Tambak -----ha. (2) Sawah tambak -----ha. (3) Kolam ---- ha.

(4) Mina padi ----ha. (5) Others

3.6 What kinds of fish do you usually cultivate in your fishpond in the dry season?

(1) Tiger Prawn (2) White Prawn (3) Milk Fish (4) Mujair (5) Red Nila

(6) Others

3.7 What kinds of fish do you usually cultivate in your fishpond in the rainy season?

(1) Tiger Prawn (2) White Prawn (3) Milk Fish (4) Mujair (5) Red Nila

(6) Others

3.8 Do you apply aeration for fish cultivating at your fishpond?

(1) Yes (2) No

3.9 Since how many years ago you are cultivating fish?

(1) Three years (2) Four years (3) Five years (4) More than five years

3.10 What is the range of salinity percentage for optimum fish production? Please explain.

From% To% ()

3.11 What is annual operation and maintenance cost and method at present?

Please give a brief explanation. ()

4. Related to water for fish culture

4.1 What kinds of water resource (s) are you using for your fishpond? You can choose more than two answers.

(1) River water (2) Sea water (3) Rain fall (4) Drainage water (5) From irrigation canal (6) Other

4.2 Do you pay the water service fees for your fishpond?

(1) Yes (2) No

4.3 If your answer to Q4.2 is Yes, how much do you pay for one m³ of water? ()Rp.

4.4 How many times are you changing fresh water and sea water in a week for fish cultivation?

(1) Once a week (2) Twice a week (3) Thrice a week (4) Everyday

4.5 Do you know how much fresh water you are using in cultivating fish per year?

(1)m³/ha/year (2) Do not know

4.6 Do you think there is shortage of water supply to your fishpond?

(1) Yes (2) No (3) Cannot reply

4.7 If your answer to Q4.6 is Yes, please clarify how much do you need more? Please write the name of water source?

(1).....m³/ha/year (2) Sea water (2) River water (3) Lake water (4) Rain water

4.8 Do you think you are using water efficiently and effectively?

(1) Yes (2) No (3) Cannot reply

4.9 If your answer to Q4.8 is No, please specify the reason. ()

4.10 Do you think the quality of water is adequate for fish culture when compared with those in the 10 years ago? (1) Yes (2) No (3) Cannot reply

4.11 If your answer to Q4.10 is No, what kind of problem you have on water quality.

(1) Too much fertilizer (2) Pesticide in the water (3) Salinity (4) Other pollution

4.12 What kind of damage have you experienced in the past on your fishpond culture?

(1) Fish flee from pond (2) Fish die (3) Shortage of water (4) Flood (5) Other

4.13 Do you feel that the source of water supply you are using now is appropriate?⁸⁹

(1) Yes (2) No (3) Cannot reply

4.14 If you need more fresh water, how will you get it?

(1) Shallow well (2) Deep well (3) River (4) Buy from some agency (5) Others

4.15 If your answer to Q4.14 is (4), how much you will pay for one m³? () Rupiah

5. On Fishpond Owners' Associations

5.1 If the fishpond owners' association were established, do you want to be a member?

(1) Yes (2) No (3) Cannot reply

5.2 If your answer to Q5.1 is Yes, why you want to be a member of fishpond owners' association? please explain ()

5.3 If your answer to Q5.1 is No, why you do not want to be a member of fishpond owners' association? please explain ()

5.4 Who is responsible for water supply to your fishpond?

(1) Fishery office (2) Irrigation office (3) Yourselfs (4) Cannot reply (5) Others

6. On Participation

6.1 Have you ever discussed the water issue with other fishpond owners?

(1) Yes (2) No (3) Never

6.2 If your answer to Q6.1 is Yes, what way have you discussed the water issue?

(1) In the meeting of fishpond owners (2) In an formal manner
(3) Other way, please mentioned ()

6.3 If your answer to Q6.1 is Yes, what was the topic of the discussion?

(1) Scarcity of water (2) Limited availability of water (no water available when needed)
(3) Bad water quality (4) Price of water (too expensive) (5) Other

6.4 If your answer to Q6.1 is Never, what was the reason?

(1) Have no interest (2) Not invited (3) No effect to attend (4) Others

6.5 Have you ever discussed the water issue with fishery department people?

(1) Yes (2) No

6.6 Was the response of the fishery department people toward your concerned issues satisfactory?

(1) Yes (2) No

- 6.7 If your answer to Q6.6 is No, in what point were you not satisfied with their response? Please explain briefly ()
- 6.8 Have you ever offered a labor service with no pay for rehabilitation of water canals?
(1) Yes (2) No
- 6.9 Have you ever paid to any rehabilitation works of water canals?
(1) Yes (2) No
- 6.10 Have you ever paid for the operation and maintenance of water canals?
(1) Yes (2) No
- 6.11 Overall do you think you are actively participating in the management activities of the Brantas River Basin such as mentioned above.
(1) Yes (2) No (3) Do not know
- 6.12 Do you wish to participate more actively in the water resources management of the Brantas River?
(1) Yes (2) No (3) Do not know
- 6.13 If you answer to Q6.12 is Yes, what makes you wish to participate more actively in the water resources management of the Brantas River Basin?
Please explain briefly ()
- 6.14 If your answer to Q6.12 is No, why do you not wish to participate more actively in the water resources management of the Brantas River Basin?
(1) Already actively participating (2) Having no water problem now
(3) Find no necessity to participate (4) No opportunity available (5) Other, please mentioned ()
- 6.15 In what form would you like to participate in the management activities?
(1) Regular meetings between fishpond owners and the government agencies concerned.
(2) Closer and direct communication with the government agencies concerned authority and others, not necessarily on a regular basis.
(3) Communication with the governmental organization concerned through umbrella organizations (example; fishpond owners, community groups etc.).
(4) Other ()

JICA Study Team

The Comprehensive Management Plan for
the Water Resources of the Brantas River
Basin in the Republic of Indonesia

Questionnaire for Factories in the Brantas River Basin Area

The following questions are asked to you to collect information for " the Study on Comprehensive Master Plan for the Water Resources of the Brantas River Basin " being conducted by the Japan International Cooperation Agency study team. The information collected will be used for finding out an appropriate beneficiaries participation program, making a forecast of industrial water demand and planning an appropriate water quality control plan for the Brantas River Basin. The information collected from you will be used anonymously and exclusively for the study purpose and will not be released. We highly appreciate your kind cooperation.

1. Respondent Information

- 1.1 Name of the factory : ()
- 1.2 Name of the respondent (), position ()
- 1.3 Address of the factory : ()
- 1.4 Year of establishment : ()
- 1.5 Number of staff :
 - Manager : ()
 - office workers : ()
 - factory workers : ()^{1/1}
 - total : ()
- 1.6 Land area of the factory : () m²

2. Factory production

- 2.1 Type of products : ()
* Describe as specifically as possible.
- 2.2 Annual production amount : () in 1996 (or _____)
- 2.3 Annual sales : () Rupiah in 1996 (or _____)

3. Industrial water

3.1 What is the source of water used for production ?

- a. public water supply system
- b. ground water with your own facilities
- c. river water directly abstracted from the river with your own facilities : name of the river : ()
distance from river : () meter
- d. rain water
- e. other : Mention. ()

3.2 What are the minimum amount (drought period/year, dry season, when public water supply is limited etc.) and maximum amount (e.g. rainy season/when no restriction is imposed) of water supplied from these sources for production under the present production capacity ? Please gives us either monthly figures or daily figures, whichever easier to process and more reliable.

Water volume	Source			
	1	2	3	Total
(m ³ /month)				
minimum				
maximum				
average				
(m ³ /day)				
minimum				
maximum				
average				

3.3 Is the amount of water you get sufficient ?

Yes

No

If " no ", how much water do you actually need ?

() m³/month

3.4 Is the quality of water that you get satisfactory ?

Yes

No

If "no", what is the problem with water quality ?

()

3.5 What is the major purpose of the industrial water ? How much percentage does it account for the total amount of industrial water you use ?

- a. boiler
- b. raw materials
- c. manufacture and/or washing
- d. cooling
- e. thermostatic control
- f. miscellaneous use
- g. others

() %

3.6 Have you been practicing recycling of water for production ? : (Water once used for production is reused for production.)

Yes

No

If " Yes ", what is the amount of water recycled per month ?

() m³ per month

3.7 Do you apply less water consuming production technology ?

Yes

No

If " Yes ":

- In what year did you start using that machine ? year ()
- Why do you apply water saving technology ? ()
- What is the amount of water saved compared with alternative machines ? : () m³ per month
- How did you get information about the water saving machine ? ()

If " No ":

- Why did you not apply less water consuming production technology ?
 A
 a. interested, but no information available
 b. interested, but expensive and not affordable
 c. interested, but no technology available
 d. not interested
 d. other. Mention ()
- In renewing your machines in the future, would you be interested in applying less water consuming production technology ?

Yes

No

3.8 Assuming your factory introduces a new production process requiring smaller amount of water or water recycling facility, to what extent do you think you can save the industrial water need?

10%	Yes	No
20%	Yes	No
30%	Yes	No
40%	Yes	No
50%	Yes	No
60%	Yes	No
70%	Yes	No
80%	Yes	No
90%	Yes	No
100%	Yes	No

3.9 What is the monthly expenditure for using water mentioned in 3.1 ?

source (): expenditure () Rupiah per month
 source (): expenditure () Rupiah per month
 source (): expenditure () Rupiah per month
 Total expenditure : () Rupiah per month

3.10 (For factories abstracting water directly from the river or own well)
 What are the investment cost of your own water intaking facilities and their operation and maintenance cost ?

- investment cost : () Rupiah
 installed in year : ()
 - operation and maintenance cost () Rupiah per month

4. Willingness-to-pay for industrial water

- 4.1 Our judgment so far is that water will become increasingly scarce in the Brantas River Basin Area in the future. It would cost for developing new water supply facilities and introducing new technology for better water resources management. The government goal is to secure sufficient volume of water with good quality for people in the area under these circumstances. Assuming that water supply condition be improved in the future both in terms of quantity (sufficient amount available) and quality (better quality water available), or in which deterioration of water supply condition be prevented (at least present level maintained), up to what level of total expenditure on water for production purpose would you accept to pay ? Please answer "yes " or "no " to the value the interviewer will give you.

Present level	(	*)	Rupiah per month :	Yes	No
20% up	(	**)	Rupiah per month :	Yes	No
40% up	(	**)	Rupiah per month :	Yes	No
60% up	(	**)	Rupiah per month :	Yes	No
80% up	(	**)	Rupiah per month :	Yes	No
100% up	(	**)	Rupiah per month :	Yes	No
200% up or more :	Yes	(	)	Rupiah per month :	
	No				

For interviewers :

* Please put the total figure in 3.8.

** Please calculate the expense value corresponding to each % value based on the present payment amount you have just heard from the respondent and put them in ().

- 4.2 Please assume situations in which your expenditure on industrial water be changed, increased or decreased, due to unavoidable reasons such as inflation and change in government pricing policy. How would you change the amount of water your factory uses in response to water cost changes ?

Rate of change in water cost _____	Rate of change in the amount of water used _____
present expense on water ()Rupiah/month*	present amount ()m ³ /day*
50% up : ()Rupiah/month**	()% up/down
100% up (double) ()Rupiah/month**	()% up/down
50% down (half) : ()Rupiah/month**	()% up/down

To the interviewer :

* Please put the same figures as you have heard in question "3.2 (average total figure)" and "3.8".

** Please calculate the monthly expense and put them in ().

Example :

present expense on water (20,000)Rupiah/month*	present amount (10)m ³ /day*
50% up : (30,000)Rupiah/month**	()% down
100% up (double) (40,000)Rupiah/month**	()% down
50% down (half) : (10,000)Rupiah/month**	()% up/down

5. Water Resources Management and participation

5.1 Have you ever joined to any management activities of the Brantas River Basin in the past ? Please answer the following questions regarding your participation in the past.

5.1.1 Have you ever discussed the water issue with other industrial people ?

- a. Yes
- b. No
- c. No knowledge

5.1.2 If " Yes ", what was the topic of the discussion ?

- a. scarcity of water
- b. limited availability of water (no water available when needed)
- c. bad water quality
- d. price of water (too expensive)
- e. other

5.1.3 Have you ever discussed the issues above in 5.1.2 with government people ?

- a. Yes
- b. No
- c. No knowledge

5.1.4 Was the response of the government people toward your concerned issue satisfactory ?

- a. Yes
- b. No
- c. Do not know

If " No ", in what sense were you not satisfied with their response ?

()

5.1.5 Have you ever had an opportunity to discuss the water issue in any other form than mentioned above in 5.2.1 through 5.1.4 ?

- a. Yes
- b. No

If " Yes ", in what form did you have that opportunity ?

()

5.1.6 Overall do you think you are actively participating in the management activities of the Brantas River Basin such as mentioned above (5.1.1 through 5.1.5) ?

- a. Yes
- b. No
- c. Do not know

5.2 We would like to ask you about your intention to join to the management activities of the Brantas River Basin.

5.2.1 Do you wish to participate more actively in the water resources management of the Brantas River Basin ?

- a. Yes
- b. No
- c. Do not know

If "Yes", why do you wish to participate more actively in the water resources management of the Brantas River Basin ?

()

5.2.2 In what form would you like to participate in the management activities ?

- a. regular meetings between industries and government organizations
- b. closer and direct communication with government organizations, not necessarily on a regular basis
- c. communication with government organizations through umbrella organizations (example : industrial association of Malang or whatever)
- d. other way : ()

5.2.3 Water will become increasingly scarce in the Brantas River Basin Area in the future. It would cost for developing new water supply facilities and introduce new technology for better water resources management. The government goal is to secure sufficient volume of water with good quality for the people in the area. This necessitates closer coordination in water allocation among all the parties concerned. An increased sense of participation (e.g. more opportunities for discussing water allocation issue) and obligation sharing (e.g. increase in water charge, obligation for installing water recycling facilities etc.) will be required on the part of beneficiaries to achieve fair and efficient utilization of the limited water resources.

Considering this prospect, would you be ready to share the responsibility of the management of the Brantas River Basin with all those concerned including PJT, irrigation departments, farmers association, fishpond operators and PDAMs ?

- a. Yes
- b. No
- c. Do not know

If " No", please tell us why.

()

6. Industrial waste water

6.1 Total volume of waste water (m^3/day)

1992	(	)	m ³ /day
1993	(	)	m ³ /day
1994	(	)	m ³ /day
1995	(	)	m ³ /day
1996	(	)	m ³ /day

6.2 Discharge point of waste water

1. River (Name : _____ / Address of outlet : _____)
2. Sewage drain _____
3. Other _____

6.3 Waste water treatment facility

1. We do not have a treatment facility.
2. We have a treatment facility, but we do not operate it.
(Reason : _____)
3. We have a treatment facility, and we operate it for treating waste water.

6.4 Treatment cost for waste water, if any (Rupiah/year)

1992	(	)	Rupiah/year
1993	(	)	Rupiah/year
1994	(	)	Rupiah/year
1995	(	)	Rupiah/year
1996	(	)	Rupiah/year

6.5 Quality of waste water in 1996

Items	Raw waste water (before treatment)	Treated waste water (after treatment)
pH		
BOD	mg/l	mg/l
COD	mg/l	mg/l
SS	mg/l	mg/l
other ()		
other ()		

7. Industrial sludge7.1 Total volume of sludge produced by waste water treatment
(ton/day, wet base)

1992 () m³/day, wet base
 1993 () m³/day, wet base
 1994 () m³/day, wet base
 1995 () m³/day, wet base
 1996 () m³/day, wet base

7.2 Sludge treatment facility

1. We do not have a treatment facility.
2. We have a treatment facility, but we do not operate it.
(Reason :)
3. We have a treatment facility, and we operate it for treating sludge.

7.3 treatment cost for sludge, if any (Rupiah/year)

1992 () Rupiah/year
 1993 () Rupiah/year
 1994 () Rupiah/year
 1995 () Rupiah/year
 1996 () Rupiah/year

7.4 Sludge disposal site
Name and address ()

Appendix 3. Some snapshots on farming system



A tertiary irrigation canal in the Brantas Delta area



A typical irrigation canal in a dry season



Ground water is taken as an additional water in the dry season



Farmers respondent interviewer in action

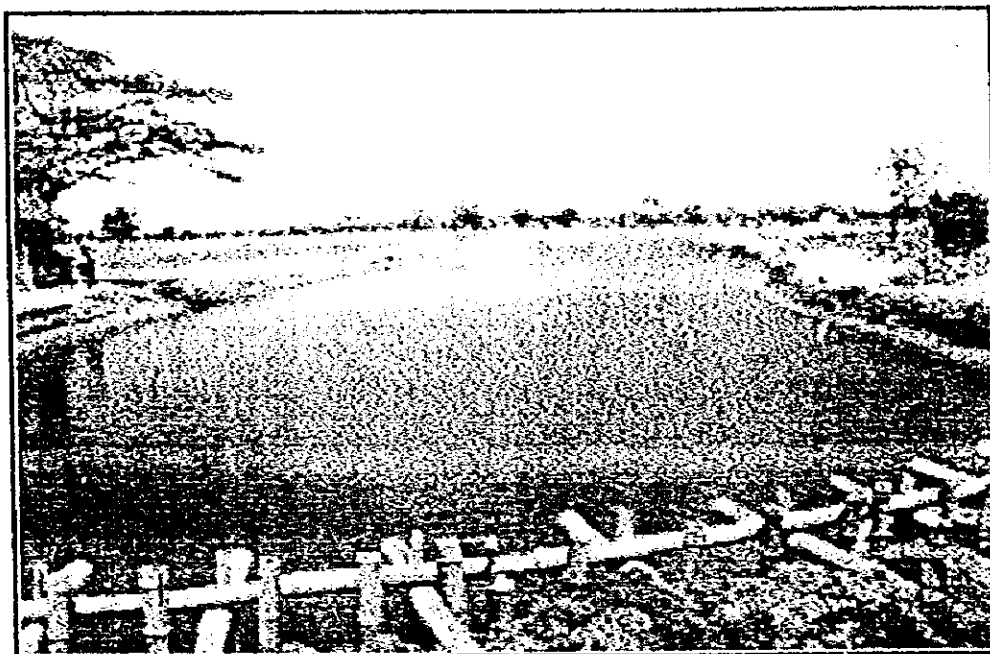


Intake water check gate



Water melon farming

APPENDIX 4. Documented pictures of the surveyed fishpond



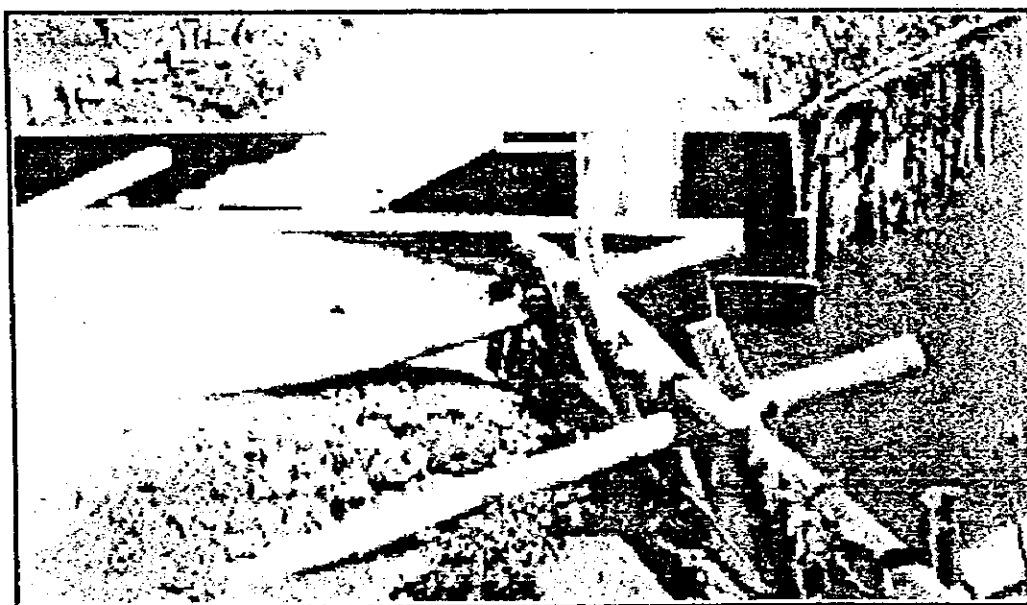
A typical of brackish water pond in Sidoarjo East Java, Province



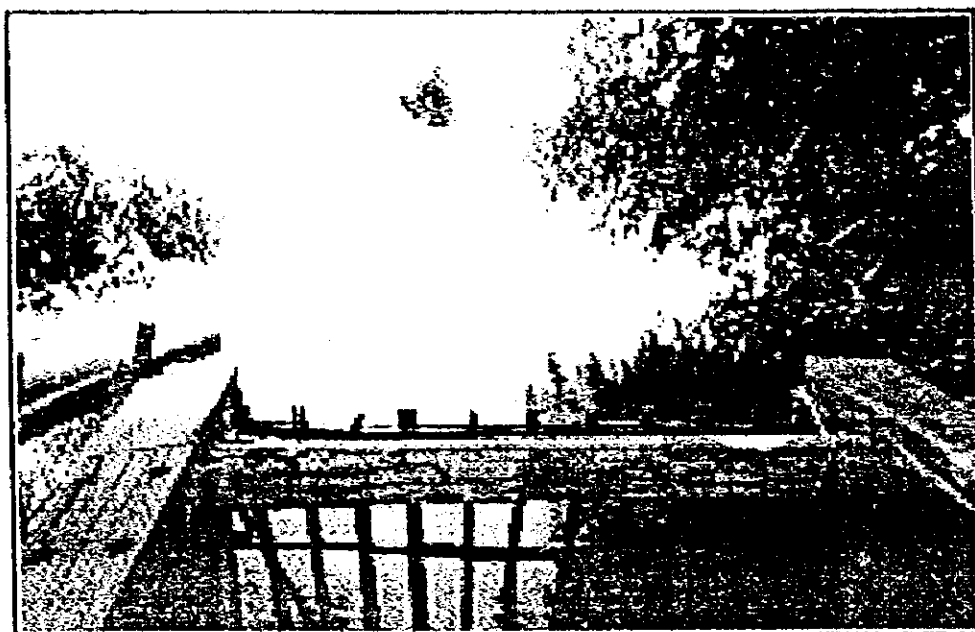
River adjacent to Tambak



Water pump being operated to fill the fishpond



Intake water check gate in the brackish water pond (tambak)

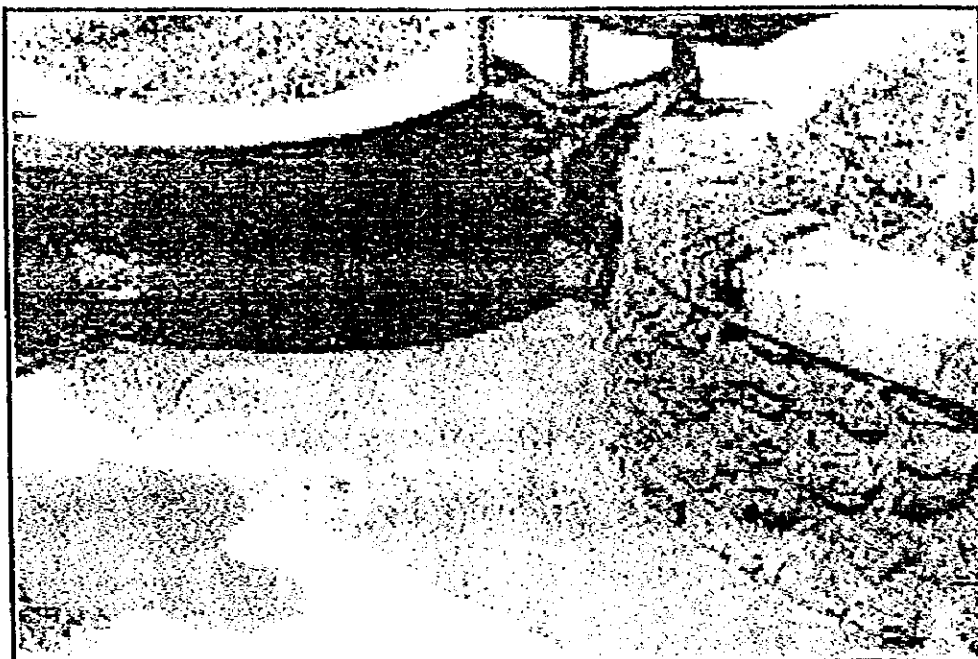


Wooden made trap gate installed in the fishpond (tambak)

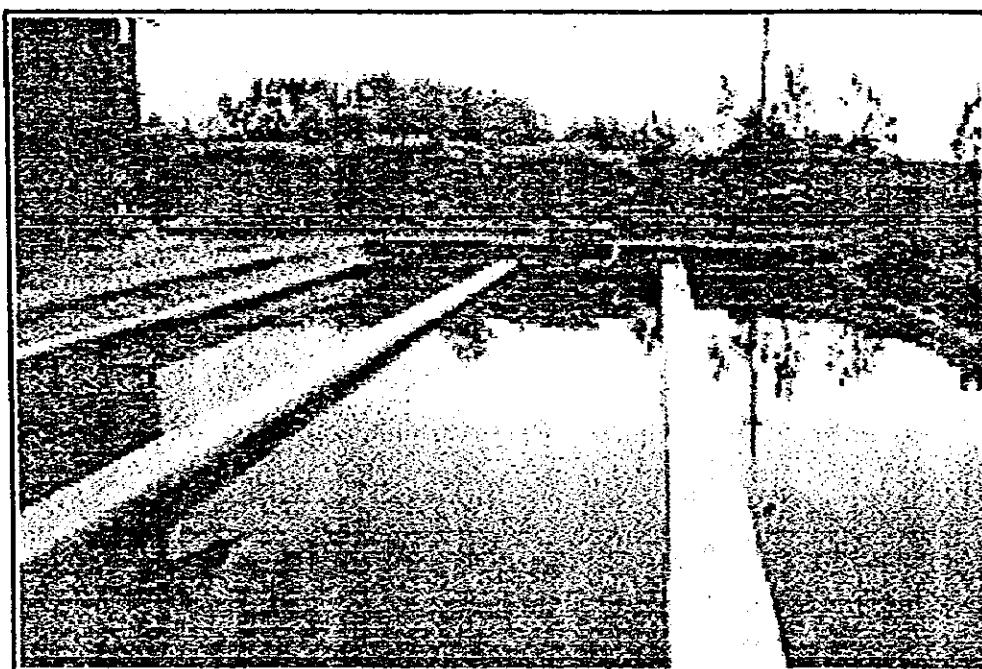


Tambak operators and the interviewer

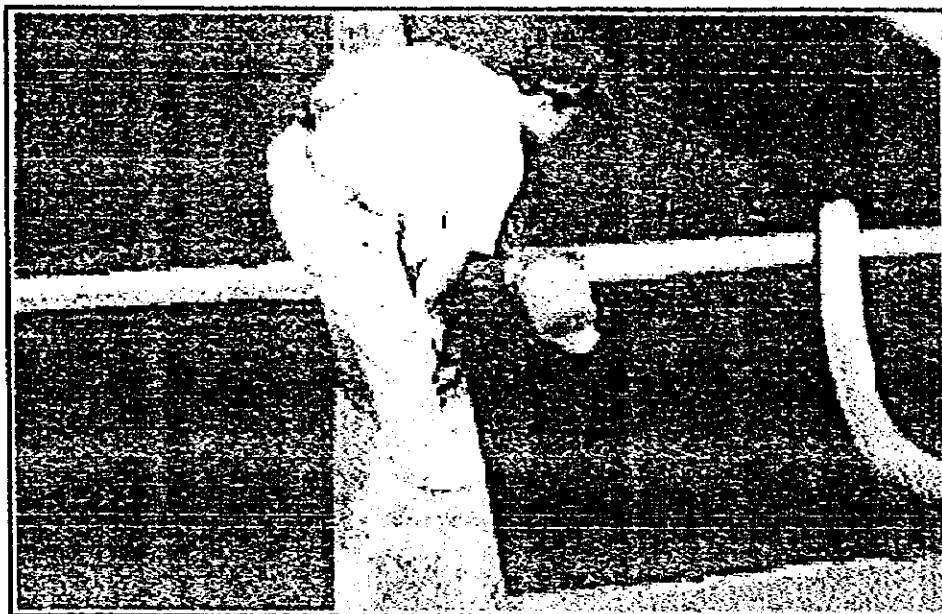
Appendix 5. Water treatment unit of some industrial respondents



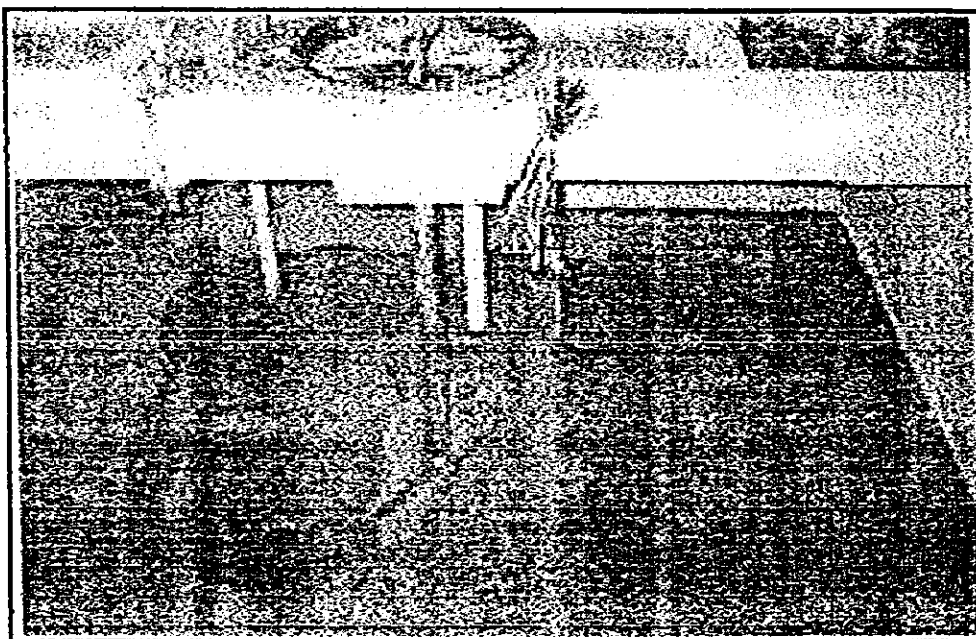
Oil separation gate of the waste water treatment unit in
the sugar cane factory



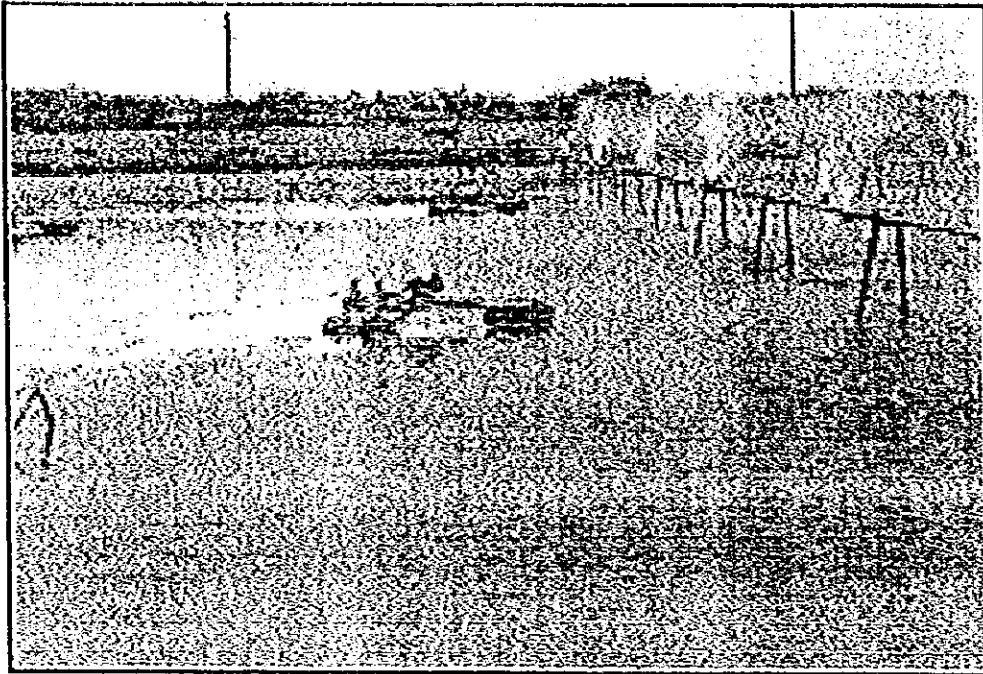
Waste water treatment :
Sedimentation pond of the sugar cane industry



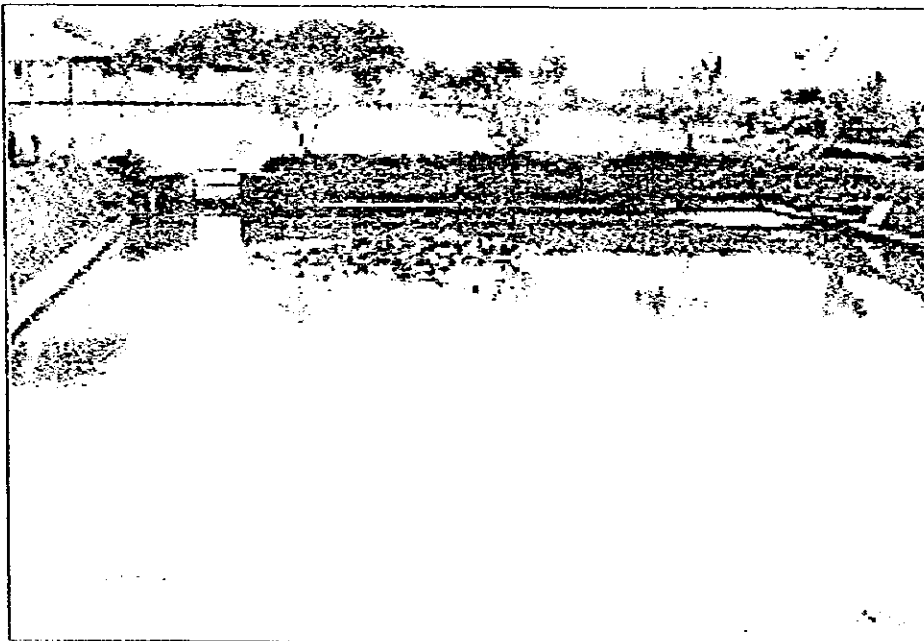
Water sample is being taken from the sedimentation pond of the sugar cane Industry



Shrimp cold storage : Flocculation tank



Mechanical aerator operated for waste water treatment
in a sugar cane factory



Treated water pond

BI
BIODIVERSITY INVENTORY SURVEY

BIODIVERSITY INVENTORY SURVEY OF THE BRANTAS RIVER

**The study on Comprehensive Management Plan for the water resources of
the Brantas River Basin in the Republic of Indonesia**

**Yenny Risjani Y.,
Sri Sudaryanti, Djati Batoro,
Endang Yuli H, Muhammad Musa,
Diana Arfiati, Yuniarta**

**FACULTY OF FISHERIES
BRAWIJAYA UNIVERSITY
MALANG**

January, 1998

CONTENT

	Page
ACKNOWLEDGEMENTS	i
CONTENT	ii
LIST OF TABLE	iv
LIST OF FIGURE	v
INTRODUCTION	
A. The Background.....	1
B. The Objective.....	1
C. Problems Formulation.....	6
D. Site Location of the survey.....	7
E. Writing Framework.....	7
METHODOLOGY	
Sampling methods.....	9
Fishes.....	9
Macroinvertebrates.....	10
Plankton and periphyton.....	10
Terrestrial and aquatic plant.....	11
Mangrove forest.....	11
Other fauna.....	11
Ecological characteristics.....	11
Time of schedule.....	12
SITE DESCRIPTION	
Physical characteristics.....	14
Chemical characteristics.....	28
FISHES COMMUNITIES	
Historical data of fishes caught in the Brantas river.....	34
Present status :.....	38
The existed species.....	38
The distribution.....	40
Dry and rainy season catchment.....	41
Indicator species.....	45
Keystone species and endangered species.....	46
Problems and targets of fish biodiversity.....	48
BENTHIC MACROINVERTEBRATE COMMUNITIES	
Present status : the abundance.....	53
The role of macroinvertebrate communities.....	57
The problems and the solutions.....	58
Target : Macroinvertebrate communities as a tool of aquatic ressources management.....	59

PLANKTON AND PERIPHYTON COMMUNITIES

The abundance and the distribution.....	61
Plankton.....	61
Periphyton.....	64
Diversity index of plankton and periphyton.....	66
Indicator species.....	70
The role of plankton and periphyton in biodiversity and their economic aspects.....	71
Problems and solutions.....	72

PLANT COMMUNITIES

The important of vegetation.....	77
The existed species and the family composition in the Brantas river.....	78
Zonation of Macrophyte along the Brantas river.....	81
Terrestrial plants.....	81
Aquatic plants.....	82
Mangroves.....	82
Indicator species.....	83
Mangrove and fisheries in the Brantas delta.....	85
The problems and the solutions.....	87

OTHER FAUNA.....	90
------------------	----

GENERAL CONCLUSION.....	91
-------------------------	----

ANNEXES

LIST OF TABLE

Table 1.	Sampling location and equipments used to catch fishes..	9
Table 2.	Ecological factors.....	12
Table 3.	Time of schedule for each activity.....	13
Table 4.	Site description and physical conditions.....	23
Table 5.	Indigenous Fishes of the Brantas River	34
Table 6.	Fishes caught from the Brantas watershed (exp. Selorejo area) in 1970.....	36
Table 7.	The existed species of the Brantas river in 1997.....	38
Table 8a.	Fishes distribution in the Brantas river in 1997.....	42
Table 8b.	Fishes distribution in the Brantas river in 1997.....	43
Table 8c.	Fishes distribution in the Brantas river in 1997.....	44
Table 9.	The important value of the indigenous and the non indigenous fishes of the Brantas river.....	47
Table 10.	Plankton of the Brantas River in the dry season.....	62
Table 11.	Plankton of the Brantas river in the rainy season.....	63
Table 12.	Periphyton of the Brantas river in the dry season.....	65
Table 13.	Periphyton of the Brantas river in the rainy season...	66
Table 14.	The plant family composition along the Brantas river..	80

LIST OF FIGURE

Figure 1.	The Brantas River and the sampling sites.....	15
Figure 2.	Water source in Sumber Brantas at Arjuno Mount. From this site springs the water of the Brantas River.....	16
Figure 3.	Sampling site at the head water of the Brantas River in Junggo.....	17
Figure 4.	Sampling locations at Malang Regency: Sengkaling (a) and Malang (b).....	18
Figure 5.	Study area at Sengguruh(a)and Karangkates Reservoir (b).....	19
Figure 6.	Sampling sites in Kademangan (a) and Canggu (b).....	25
Figure 7.	Sampling sites in Lengkong (a) and Petekan, Surabaya estuary (b).....	26
Figure 8.	Sampling sites in Wonokromo estuary (a) and in the Brackishwater ponds in Wonokromo estuary (b).....	27
Figure 9.	Dissolved oxygen and Biological Oxygen Demand (BOD) along the Brantas river in the dry and rainy season 1997.....	30
Figure 10.	The concentration of Nitrate and phosphate of each site in the dry and rainy season 1997.....	31
Figure 11.	The value of pH of each site in the Brantas river during the dry and rainy season 1997.....	33
Figure 12.	Some of the indigenous fishes of the Brantas River in 1997. (a). <i>Barbodes gonionatus</i> (<i>P. javanicus</i> , 'tawes'; (b). <i>M. gulis</i> , 'baung' (c). <i>Monopterus albus</i> , (d). <i>M. micracanthus</i> 'keting'.....	50
Figure 13.	Some of the indicator species: <i>Cyprinus carpio</i> (A) a clean water species and <i>Clarias batrachus</i> (B) a polluted water species.....	51
Figure 14.	<i>Pangasius micronemus</i> (a), is the keystone and the indigenous species of the Brantas River; <i>Nemacheilus fasciatus</i> (b) is one of the indigenous species which has an important value.....	52

Figure 15. The number of taxa of macroinvertebrate in the Brantas River during dry and the rainy season 1997.....	56
Figure 16. Some example of macroinvertebrate species commonly found in clean water (a & b) and in polluted water (c)	60
Figure 17. Diversity index of plankton and periphyton in the dry and rainy season of the different sites of the Brantas River.....	69
Figure 18. Domination of a species in Karangates reservoir by Chorchormidium (a). Closed view of Chorchormidium (b).....	74
Figure 19. Some of phytoplankton genera commonly found in the water surface of the Brantas River. A. <i>Microcystis</i> , B. <i>Scenedesmus</i> , C. <i>Spirulina</i> , D. <i>Pediastrum</i>	75
Figure 20. Some of periphyton commonly attached in the stones of the Brantas River. A. <i>Anomoeneis</i> , B. <i>Cymbella</i> , C. <i>Tabellaria</i> , D. <i>Synedra</i>	76
Figure 21. Some of mangrove species which inhabit in many quantity at the Brantas delta. A. The sapling of <i>Acanthus</i> B. <i>Exoecaria</i>	84
Figure 22. Aquatic plant, the water hyacinth <i>Eichornia crassipes</i> in Porong during the dry season, August 1997 (A). The species covers approximately 100 % of the total area in the beginning of rainy season December 1997 (B)....	89
Figure 23. Some of aquatic birds of the Brantas river.....	90
Figure 24. The interrelated problems of the Brantas river in the connection with biological diversity.....	94



INTRODUCTION

A. THE BACKGROUND

One of the national resources of the province of East Java, the function of waters, either on the land (on the bottom and on its land surface), or on the sea are very important. The potency of waters, wether in the past or in the present time, are not fully functioned yet optimally. This writing will be limited to, firstly about the Brantas river and secondly about its biodiversity that is occupied.

The Brantas river has a long history of high civilization sustained by irrigated farming on fertile volcanic soils. Most natural forests in this area were reduced to fragments centuries ago. The river comprises of ecosystems, which range from alpine meadows to moist lowland forests, from lakes and reservoirs to shallow swamps and mangroves.

The legacy of development around the basin has included conversion of natural forest, plantation development, small-scale encroachment and urban development. It also has included the degradation of wet-lands and coastal ecosystems from industry, agriculture, sedimentation, drainage and rampant building of aquaculture ponds (tambak).

The length of the Brantas river is 320 km from the springriver at Arjuno Mount in the regency of Malang to theirs mouths in the coastal region at the Strait of Madura and the width of the river flowstream basin is about 12.000 km² or 25% the width of East Java.

The population amount is about 14 millions or about 43% of the East Java inhabitant in 1990 (Usman, 1997), and the Brantas river flows through the cities, which becomes the prominent zones : Malang, Blitar, Kediri, Mojokerto, and Surabaya.

For the people of East Java, the Brantas river has a very important role in the socio-economic aspects for supplying of freshwater necessities, whether domestic or industry, irrigation, electricity energy, recreation infrastructure, transportation and other necessities

The Brantas river facing many problems since the past time such as the flood in the rainy season, the dryness in the dry season, its sediment, the conflict of human necessity, the water pollution, fully with *Eichhornia crassipes* (eceng gondok), etc.

The population growth increased rapidly and the population densities of the region along the Brantas river basin inhabited uncertainly, it caused directly or indirectly the burdens and the problems of the Brantas river. Because of those problems, the Government cq. the Public Works then handled the Brantas river by exploiting the waters resources. It has been occurred since the era of Dutch Government until the Government of Republic of Indonesia.

The waters resources development have been done through the Five Year Development Plan. The Programmes and its realization, from the First Main Plan (1961) to the Fourth Main (1997) had been resulted. For increasing the performance of the water resources management, the Public Enterprise of Jasa Tirta (Perum Jasa Tirta) - the Water Resources Management, was then founded by P.P. No. 5/1990 (the Government Regulation Number: 5/1990), with the mission: giving service for public benefits of water and water resources and all at once to get profit based on the Enterprise management principles.

The Water Resources Management can be divided into two group activities :

a. Operational Activities: the water quantity management (liscence, allocation, patron, distribution, monitoring, carrying capacities, monitoring, flood control and the dryness) and the water quality

management (licence, quality control, carrying capacities, monitoring, water quality control and water pollution).

b. Maintainable Activities: the waters infrastructures of the dam, embankment, checkdams; revetment, dredging and repairs of the river, basin, reservoirs; the upper watershed, terracing, replanting, reforestation.

What is the content of the Brantas river ? Or what is inside of the Brantas river ?

The Brantas river occupies on its water and substratum such as: sand, stone, tuff, gravels, cobbles, rocky ground, soil, mud and their biodiversity.

According to the topic, the writing will be focused to the freshwater biodiversity of the Brantas river. Biological diversity is the variability among living organisms from where they live and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Some notes on the results of this biological diversity of the Brantas river are focused as: Fisheries; Macroinvertebrates, Plankton; Periphyton; Aquatic and terrestrial plant, Plant vegetation, and Mangrove forest.

The structure and function of rivers in general are influenced by both the natural environment and human activity, which may affect the quality of river ecosystem. This has a considerable effect on the water quality of the river which in turn influence their living community. Flora and fauna which inhabit in this river are depending on the quality of its environment.

Some studies of fish variety collected from the Brantas river have been achieved long time ago. Weber and de Beaufort had collected fishes data of the Brantas River between 1916 to 1962. Some data of fishes of Selorejo area in 1970 had been noted by Wardoyo and Sukimin. Recently Susilo et al. (1994), invented the variety of the indigenous fishes in the Brantas river. Those survey

had found 39 fishes and among these species, 10 species were indigenous fishes. While, from our survey on the dry and the rainy season 1997 has been identified about 50 fishes types included 18 indigenous species. Thus, from 1962 to present a number of the indigenous fishes of the Brantas river decreased.

Macroinvertebrates are also exist in the Brantas river. Studies of these communities in the Brantas river have been reported by some authors (Sutini, et al, 1987; Van den Brink, 1991). Macroinvertebrates are commonly used as bioindicator or biological assesment of water quality. Several studies (Sudaryanti, 1993; Murtiningsih, 1995; Ernawan 1997; Pramono, 1997) have been done to use this animal to asses stream water quality.

Other biotas existence which is present in the river are plankton (zooplankton and phytoplankton). Zooplankton includes small animal and Phytoplankton consist of single or multi-celled plants that are between 1 millimeter and 0.1 micrometers in size. Plankton are commonly exist abudantly in the reservoir and in the downstream part of the river where the current velocity is slow. Most of these types live as periphyton in the river. Some species have ecological adaptation to their environments, such as population growing on reservoir walls, the other live as clean and polluted algae.

Mangrove forest is one of the most important vegetation types in the coastal zone of Java and occurs on muddy flats or fine textured soils in deltas, estuaries, coastal belts and along coastal islands. Avicenniaceae, Rhizophoraceae, Sonneratiaceae and Meliaceae are the four families which is found commonly in Java. The mangrove forest of Brantas deltas represent an important natural resource. It offers indirect but beneficial ecological services, as a land-building and land-protective agent. It provides suitable and fertile areas for breeding and spawning grounds of many commercially valuable marine species.

Biodiversity of flora and fauna in the Brantas river play an important role in supporting ecological condition. The condition of this resources has a direct relation to characteristics of various types of land use along the river. Not many information of the richness of the natural resources in the Brantas river, therefore, the inventory survey of flora and fauna of the river from its source to the estuary is a valuable information for the sake of the river management in the future.

Biodiversity has an important role and can be indicated for water pollution. So, it can be used for the water resources quality control, which it is one of the operational activities of Perum Jasa Tirta.

The dynamic of biodiversity is depends on the river water condition as the good or damaged habitat for the living organisms. A good habitat can contribute productivity which reflected on their natural distribution; the density; and the movement of the life and the cycles of biodiversity soundly. And on the contrary, damaged environment may influence the condition of biodiversity such as the reduction of their abundance, type, activities, health and diversities. A damaged habitat can be caused by human factors, e.g. the uncontrollable sand and stone mining from the river can influence or damage the biodiversity. The mangrove forest clearance can influence the decay of the ecosystem. The disturbance of the habitat and ecosystem caused the decay of the biodiversity. The decay of the biodiversity means the poorly of the natural resources.

B. THE OBJECTIVES

The river environment study as a part of the comprehensive Management plan will bring forward the awareness of and attention to freshwater biodiversity issues. It is important to collect current data, to make the appropriate environmental decisions.

The objectives of this report, are:

1. To analyse data of the major aquatic ecosystems, fauna and flora of the watershed and habitat types, for appropriate environmental decision making;
2. To consider biodiversity categories as indicator species of environmental condition, keystone species or specific species and endangered species. It will provide base level scientific data for future environmental assessments in the Brantas river Basin;
3. To give input the biodiversity inventory for the study on the Comprehensive Management Plan for the Water Resources of the Brantas river Basin in the Province of East Java - the Republic of Indonesia.

C. PROBLEMS FORMULATION

The field work results are formulated as the present status of biological diversity condition. Their roles in the Brantas river are also cited in this report. Some biological data are selected from the field for the consideration of environmental indicator species. The problems faced by the Brantas river are formulated as follow:

1. Physical environmental Brantas river basin problems:
Water pollution and waste disposal; The decrease of self purification capacity; The water intrusion, especially at the coastal area.
2. Fishery Problems:
The decrease of the indigenous species; Uncontrollable and careless of fish catchment; The reservoir function in the Brantas river basin nowadays are still not be used yet for the fish culture; The Dam building without an ecological consideration for biodiversity.
3. Benthic Macroinvertebrate community problems:
The changing of the original habitat and river banks; Sand digging (mining).
4. Plankton and Periphyton Communities Problems:
The lower diversities of communities in some sites which indicate the instability of habitat; The eutrophication of water.

5. Plant Communities Problems:

Forest loss; Mangrove conversion to other land use; Lack of silvofishery management; uncontrollable sand mining; The disturbance of *Eichhornia crassipes* (eceng gondok) in the slow river water stream; The rise of CO₂ in the water by aquatic plants during the night.

Those problems can be formulated and can be seen on the Fig. 24.

D. SITES LOCATION OF THE SURVEY

The sampling survey were taken generally and globally, on the 18 sites which located, started from the upper part of the Brantas river to the estuaries at the Strait of Madura, e.g. : Sumber Brantas, Junggo, Sengkaling, Malang, Sengguruh, Karangates reservoir, Kademangan, Ngunut, Papar, Ploso, Padangan, Porong river, Porong estuary, Canggu, Gunugsari, Petekan, Wonokromo river and Wonokromo estuary. Those sites are located at the 14 Regencies and Municipalities in the Province of East Java. Each sampling site is considered based on the different habitat of living communities, so each communities may has a different site to the other.

E. WRITING FRAMEWORKS

This writing can be organized systematically into 8 chapters, which are completed with 14 Tables and 23 Figures. Those chapters can be seen as follows.

Chapters I Introduction tells about the background, formulation problems, objectives, sites location of the survey and writing frameworks.

Methodology of the survey can be seen on Chapter II, which consists of: Sampling Methods and Time Schedule. Sampling methods that to be used for : Fishes, Macroinvertebrates, Plankton and Periphyton, Aquatic and terrestrial plants, Mangrove forest, other fauna, and Ecological characteristics.

Chapter III cites the Site Description which consists of Physical characteristics of the sites and Chemical characteristics

(Dissolved oxygen, Biological Oxygen Demand, Nitrate and Phosphate, and PH).

Fish community can be seen on chapter IV, which consists of Historical data of fishes caught in the Brantas river; Present status, which are written about the existed species, and the distribution, the dry and the rainy season catchment, indicator species, keystone species and endangered species, Problems and target of fish biodiversity.

Chapter V cites Benthic Macroinvertebrate Communities. It explain about the present status include their abundance along the Brantas river, the role of macroinvertebrate communities at the Brantas river ecosystem, the problems and threaten at the Brantas river; and the target of macroinvertebrate communities as a tool of aquatic resources management.

Plankton and periphyton communities are written on the Chapter VI, which explain the abundance and the distribution of plankton and periphyton; diversity index of plankton and periphyton; indicator species; the role of plankton and periphyton in biodiversity and their economic aspects and also problems and solutions of these communities in the Brantas river.

Chapter VII Plant vegetation explains about the important of vegetation, the existed species and the family composition in the Brantas river; Zonation of macrophytes along the Brantas river which including terrestrial plants, aquatic plants and mangroves; Indicator species; Mangrove and fisheries in the Brantas delta; the Problems and the solutions.

This observation is not focused to inventaire the terrestrial animals, in spite of that some other animals which was seen during the survey is also taken into the note. The last Chapter consists of General Conclusion of this final report. There are also annexes which are attached in this writing.