11 Management Organization

11.1 Organization

The present management approach to water quality is being made by many agencies. This tends to generate conflicting sectoral interests. The water quality management should be integrated and comprehensive for the whole basin. Thus, it is recommended that PJT has a responsibility for the water quality management as a water supplier. To put the assertion more concretely, overall management of the water quality in the Brantas river basin should be implemented under the responsibility of PJT. PJT should have a strong leadership of the water quality management and a line management responsibility will be required.

On the other hand, PJT can delegate its tasks to other agencies for implementation of the projects. Taking into consideration of the functions of BBLH which will be replaced by BAPEDALDA, execution of pollution control shall be done under the instructions and/or coordination of BBLH. In this manner, pollution control of each sector shall be undertaken by respective responsible agencies. All the related agencies shall report to PJT their requirements and the operation results with water quality data.

The recommended overall organization for the comprehensive water quality management in the Brantas river basin is illustrated in Figure A3-15.

11.2 Demarcation of Responsibilities

(1) Responsible agencies

(a) Water quality monitoring

Water quality monitoring should be supervised by PJT and coordinated by BBLH. Implementation of monitoring should be made by the following agencies.

- River water : PJT
- Domestic waste water : PJT, cooperated by DPU Cipta Karya and DKES
- Industrial waste water : PJT, cooperated by DPRIND
- Agricultural waste water : PJT, cooperated by DPERTA

All data monitored will be send to PJT in order to be compiled and evaluated. After compilation, the data will be reported to BBLH and related agencies, and the Basin Water resources Management Committee (hereinafter referred to as BWMC).

(b) Pollution control

Pollution control should be supervised by PJT as a secretary of BWMC. This means that PJT should prepare an overall pollution control plan in consideration of monitoring results and progress of countermeasures. PJT reports the plan and/or program to BBLH after the approval from upper organizations. Then, BBLH coordinates and instructs the implementation of pollution control activities to the responsible agencies.

It is noted that pollution load from major livestock houses has been controlled in the industrial sector under PROKASIH. Since agricultural pollution load have a great possibility of water quality deterioration, pollution control should be made by agriculture sector itself in order to implement that organically and effectively.

Therefore, pollution control activities should be conducted by the following agencies.

- Overall planning, programming : PJT as a secretary of BWMC
- Coordinating and instructions : BBLH (BAPEDALDA)
- Domestic pollution control : DPU Cipta Karya
- Industrial pollution control : DPRIND
- Agricultural pollution control : DPERTA
- Other pollution control : DKES

Above all, in order to enable implementation of activities (countermeasures), it is recommendable that domestic pollution control (sewerage systems including on-site systems) and other pollution control (sludge and solid waste disposal) are executed by local governments, sometimes public corporations. Implementation of sewerage systems and centralized treatment systems for the industries by "Built, Operate, and Transfer (BOT)" methods deserves full considerations. New PJT could have a possibility of BOT.

(2) Demarcation of responsibilities

Recommended demarcation of responsibility for management and implementation of the required activities is shown in Table A3-22.

12 Requirements of PJT

12.1 Organization

In order to implement the projects organizationally and effectively, an independent department for the Water Quality Management is necessary for the new institution of PJT with a planning and coordination section, an water quality monitoring section, a research and development section, and a laboratory included. Recommended department for the water quality management will be established together with the department of River Environment Management.

According to the functions, each of the section in the department of Water Quality Management will have the following main activities, including inter and inner institutional coordination and fundamental decision for management plan both in short-term and long-term ranges.

Sections	Main Activities
Planning and Coordination	- to prepare plans, programs and/or regulations of water quality management - to formulate countermeasures, to review them - to advice the related agencies about countermeasures - to issue a discharge license (as a secretary) - to arbitrate a dispute regarding water quality - to manage a subsidy, a loan and a bounty - to execute public relations (PR)
Water quality monitoring	- to execute the water quality monitoring (to prepare plans, programs) - to compile the data of results - to evaluate monitoring results - to make monthly and annual reports
Research and Development	- to execute simulation analysis - to execute inventory survey - to identify pollution loads and their magnitude of impacts - to research and development of proper countermeasures, new technique for evaluation of water quality
Laboratory	- to take samples (water, river bed sediment, etc.) - to analyze samples (water, river bed sediment, etc.) - to operate and maintain automatic water quality monitoring stations

Management of the river maintenance flow will be made as a part of low flow management. This matter will be within the jurisdiction of the Planning and Controlling Bureau of PJT. Management will be made in consideration of the information sent from the Water Quality Management Department.

To make a final decision of implementation of projects according to the plans and programs together with the policies, to make budget plans for the sections and to allocate them will be done by the upper department.

12.2 Manpower

For implementation of comprehensive water quality management, the following manpower will be needed in the Water Quality Management department of PJT. Environmental planner, water quality engineers, computer technicians and so on will be necessary.

Sections	Required Manpower	persons
Planning and Coordination	- manager	1
	- coordinator	1
	- environmental planner	1
	- other staff	4
Water quality monitoring	- coordinator	1
	- reporters (including water quality engineer)	1
	- recorders (including computer engineer)	2
	- other staff	2
Research and Development	- computer engineers	2
	- engineers specializing in water quality, sanitation, chemistry, biology or microbiology, and so on.	3
Laboratory (Malang and Mojokerto)	- analysts	10
	- sampling staff	4
	- technician for automatic water quality monitoring system	1
	- drivers	4

Note : 1) Administrators (2 staff) are required for all sections.
2) Figures in this table show required number of staff.

It will be necessary to have technical knowledge and/or know-how of specified fields of works, such as water quality management, evaluation of water quality, simulation study, analysis of water quality and so on. The practical knowledge and/or know-how of them could be trained by means of OJT and/or training organizations in and outside of the country. Recruitment of persons who have a related career and/or a background is required.

12.3 Facilities

For establishment of the recommended Water Quality Management Department in PJT, additional preparation of a new work office for the staff and related facilities would be necessary. This office will be located near the headquarters of PJT. Besides, the foundation of a new laboratory covering upstream area of the Brantas river basin is recommendable in addition to the existing laboratory in Mojokerto, in order to take and transport samples and to analyze them timely. A work office for the Research and Development section is recommendable to be founded in new laboratory in Malang.

For the sake of implementation of comprehensive water quality management by PJT,

following main facilities will be needed.

Sections	Main Facilities
Planning and Coordination	- work office - computer unit, office supplies
Water quality monitoring	- work office - computer unit, office supplies
Research and Development	- work office (including research laboratory) - computer unit, office supplies
Laboratory	- laboratories (two places) - sampling, field testing and transporting implements - analyzing instruments (including laboratory equipment) - automatic water quality monitoring system - mobiles (including mobile laboratories) - computer unit, office supplies

Note : 1) Analyzing instruments include those that can analyze harmful components and microbiological parameters.
2) Automatic water quality monitoring system will be installed by the Wonorejo Multipurpose Dam Construction Project.
3) Mobile laboratory means that with small laboratory consists of sampling, field testing and transporting implements.

12.4 Required Cost

Necessary cost for establishment of the Water Quality Management Department in PJT is that for its manpower and facilities. Investment cost for the facilities and O&M cost (direct cost and personnel expenses, not include depreciation of equipment) are estimated as follows.

Sections	Investment cost (million Rp.)	O&M cost (million Rp./year)	
		Direct cost	Personnel expenses
Planning and Coordination	100	10	45
Water quality monitoring	150	15	40
Research and Development	250	25	35
Laboratory (Mojokerto, Malang)	4,000	350	105
Total	4,500	400	225

Note : 1) Investment cost for laboratories include expansion and enhancement of existing laboratory, and foundation of new laboratory, not include cost for the automatic water quality monitoring system.
2) Research and Development section will use new laboratory.
3) Figures in this table are constant values as of 1996 (not include depreciation).

13 Project Implementation Program

13.1 Projects Identification

The final goal of the proposed projects is to comply with the target by 2020 in the Brantas river basin. In order to accomplish this target, it is clarified through the water quality prediction that all the proposed countermeasures for each source and direct purification should be implemented.

Most suitable and manageable countermeasures shall be applied, depending on commencement necessities based on magnitude of effects and technical and economical aspects, in principle. Thus, countermeasures shall focuse on pollution sources which can be specified at first. In addition, in order to put priority for implementation on the proposed countermeasures, institutional and/or legislative necessity shall be taken into consideration.

Table A3-23 shows countermeasures with priority positions which are divided into four groups, urgent projects, high, medium and low priorities.

13.2 Implementation Schedule

The required activities for the water quality management in the Brantas river basin fall under 10 categories. All these activities have to be prepared and implemented from now on in order to attain the target by 2020.

On the other hand, reconstituting the organizations and enhancement of legislation and/or regulation are required. Besides, the development schedule of PJT and establishment of new department for water quality management in PJT should be considered. Furthermore, affordability of inhabitants especially low income households should be taken into consideration. For step-wise improvement planning, the outline of schedule phases are as follows.

- First stage (1999 - 2004) : action plan
  - reconstitution of the organization
  - enhancement of legislation and/or regulation
  - implementation of model projects
  - masterplan (M/P) and feasibility study (F/S) on the selected urgent projects
- Second stage (2005 - 2009)
  - commencement of high priority projects
- Third stage (2010 - 2014)
  - commencement of medium priority projects
- Fourth stage (2015 - 2020)
  - commencement of low priority projects

Implementation schedule is showed in Table A3-24.

13.3 Responsible Organizations

The implementation of the water quality improvement activities is proposed to be managed and administered by PJT, assigning the cooperation of the works to BBLH (BAPEDALDA). The important matters for the water quality management are to make proper plans and programs with clarified responsibilities and their activities. Responsible organizations for projects implementation are summarized in Table A3-22.

13.4 Preliminary Project Cost

Preliminary project costs for each pollution control sector are described in Table A3-24.

14 Action plan

(1) Establishment of continuous water quality management system

This is especially noteworthy in the case of the water quality management, a feed back system of monitoring results for taking countermeasures for actual implementation and O&M of the projects should be required. That is to say, a cycle of "Plan-Do- See/Check - Review/Assess" that can be called "a continuous water quality management system" as shown on diagram of Figure A3-16 should be developed. Components of the system are as follows.

- Plan : target, plan initiatives, consolidate priorities, allocate responsibility
- Do : projects planning, implement actions, improve awareness
- See/Check : monitor, report progress
- Review/Assess : identify directions, achieve endorsement

(2) Strengthening of legislation and institutions

The present institutional and/or legislative framework is not enough to successfully carry out the recommended countermeasures. In particular, legal supports which shall be arranged by the combined efforts of the East Java province and agencies concerned will be needed. The following preparations are necessary for the water quality management:

- enhancement of legislation and/or regulation
  enactment of "Water quality management law", "Sewerage law (including the functions of private sewerage system law)".
  guidelines for specific activities
- institutional development of PJT
- reinforcement of staff in duty in PJT

In the course of the institutional development of PJT, enforcement of existing PJT laboratory should be necessary. In particular, its' staff training is required urgently as well as overhaul and calibration of existing facilities and installation new facilities concerning analysis of river bed sediment, harmful substances and microbiological parameters.

For the staff training, the Environmental Management Center in Jakarta can be used. Generally, the center accepts trainee for water quality analysis and harmful substance management at BAPEDAL expense. Even if its' budget is limited, training can be available with PJT expense. One week training for water quality analysis will require a fee of about one million Rupiah.(as of 1997).

(3) Preparation of waste water treatment map

If a public sewer system becomes available soon after the installation of on-site sanitation facilities, owners will be reluctant to abandon their on-site facilities because they have already paid for the installation. To avoid such twofold investment, foresighted zoning is required. In addition, it is necessary to designate "hot zone" where early countermeasures are required

because of high pollution loads flowing into the rivers.

In order to portray above zones, "waste water treatment map" contains the following zones and was prepared by the Study Team:

- areas planned to be provided with sewage systems
- areas planned to be provided with on-site treatment facility (CTPSTS)
- areas planned to be provided with sanitation facility
- hot zones

Based on the map as shown in Figure A3-17, establishment of adequate waste water treatment systems is recommended.

(4) Implementation of a model project of Gappei Johkaso

"Johkaso" is the term for privately owned excreta and/or domestic waste water treatment system common in Japan. It is a favored alternative used in individual houses, housing estates and public facilities where a public sewer system is not available. This kind of system is not still installed in Indonesia. There was only one experimentation for CTPSTS in Indonesia that was made by JICA in cooperated with Dept.PU. It goes without saying that examination of acceptability and training of experts of Johkaso systems are prerequisite for successful use of them.

To cope with this situation, implementation of a model project of CTPSTS is recommended. The installation of the systems as a module will be made to hotels, hospitals, large scale restaurants, collective housing areas or condominiums, public facilities or public toilets where water pollution control is crucial.

Considering affordability of inhabitants especially low income households, johkaso system seems to be expensive. Therefore, installation of CTPSTS to hotels, hospitals, large scale restaurants, collective housing areas or condominiums, public facilities, schools and public toilets where water pollution control is crucial, should be obliged at first. Next, the installation to a large income households should be obliged. Finally, most of domestic waste water should be treated.

(5) Implementation of M/P and F/S

Up to now, many studies concerning water quality have been made in the Brantas river basin, mainly focused on the Surabaya river. The Surabaya River Pollution Control Plan Study (Technical assistance from IBRD) is going on as well as the Surabaya Sewerage and Sanitation Development Program (PT INDULEXCO). However, attention has not been paid on Malang area. As mentioned in the previous section, water quality in Malang area is also deteriorated. No careful activities has not been tackled yet. Therefore, it is recommendable to implementation of M/P and F/S focusing on the river environment in Malang. In that plan, off-site and on-site domestic waste water treatment systems including Gappei Johkaso, sludge (septage) and solid waste management, related human resources development will be discussed.

15 Recommendations

(1) Pollution Charge System

The concept of "Polluter pays principle" has been adopted for a long time around the word. In general, this concept means that polluters have a responsibility for paying expenses to treat their pollution to prevent environmental degradation, and/or to retrieve previous environment if they polluted. In view of the concept, polluters like industries, in principle, should treat their waste water to attain the effluent standards on their own responsibility. Inhabitants who utilize a public sewerage system including waste water treatment plant shall pay a sewer user charge.

A pollution charge system as an economic approach of pollution control has been proposed by PJT together with the related agencies. This system, if established, should be one with a limited period of validity from a viewpoint of the principle. Besides, as the polluters can be specified, direct regulations against them are to ensure the decrease in pollution load.

Polluters of industry shall pay the charge before the effective waste water treatment system is established. Polluters charge will be used for establishing a fund in order to promote installation of waste water treatment facilities such as a subsidy, a loan and a bounty, and/or research and development. Finally, the system will be replaced to a regulation system not later than target year of 2020 (see Figure A3-18). In case of the regulation system, if the industries exceed the water quality standards which has been published by the East Java province, a penalty shall be imposed on them.

It should be also added that if the charge is lower than the cost of waste water treatment, there must be considerable doubt to promote installation of treatment facilities. Therefore, the charge should be set up in accordance with the treatment cost.

In addition, the charge can be focused on organic pollutants as represented by BOD and inorganic substances as represented by SS. In the Brantas river basin, most of industries can be categorized 2 main groups. One is the group of industries discharging organic waste water mainly, and the other is the group of industries discharging inorganic waste water mainly. Thus, BOD and SS can cover a wide range of industries. Most of other pollutants could be decreased in the treatment process for BOD and SS, if the process is of effective. If established, the maximum limits of pollution loads should be set up. As for harmful components such as heavy metals, exceeding discharge of them should be strictly prohibited and they are not proper to be accounted monetary values.

(2) Improvement of Kampung

As a result of field reconnaissance, a high densely populated area along the riversides can be seen, especially in Surabaya and Malang. It is often called "Kampung" area. Most of domestic waste water from these area enters into the rivers without purification. Sometimes, open-air defecation or over hang latrine can be seen in and around the rivers. To make matters worse, it is difficult to install pipe network for sewerage systems, mainly due to densely located houses. Therefore, improvement of Kampung areas is necessary to improve water quality as well as river environment.

(3) Cleaner Production

Minimization of pollution load from industries can be made by means of pre-process, in-process, end-of-pipe measurers and their combinations. Pre-process and in-process measurers are called waste minimization technology or cleaner production technology. Pre-process includes product changes, raw material substitution, in-process includes process changes, material handling improvements and recycling. Normally, production cost cloud be reduced by cleaner production technology. Therefore, adaptation of cleaner production is necessary.

(4) Others

For the implementation of the above water quality improvement plan, the following supporting tasks should be taken into consideration.

- Research and development for appropriate technology of pollution control
- Industrial audit (on-site industrial pollution inspection system)
- Implementation of Environment Impact Assessment
- Utilization of ISO 14000

Table A3-1 Present Water Quality Monitoring System in The Brantas River Basin

Organizations	Monitoring points	Monitoring items	Monitoring organizations	Purposes	O&M Cost
PJT	River water : 51	21 (physical and chemical items, not include heavy metal and microbiological items)	Sampling and Analysis : PJT laboratory Data compilation and Reporting : PJT	Water resource management	O&M: 75 million Rp./year Personal expense : 78 million Rp./year
	Industrial waste water : 41	13 (physical and chemical items, not include heavy metal and microbiological items)	ditto		
PROKASIH	River water : 29	BOD, COD, SS	Sampling : DPU Analysis : BTKL Data compilation and Reporting : Work team of PROKASIH	Clean river campaign in accordance with direction by BAPEDAL	385 million Rp./year (1996/97) *including staff training, supports for river cleaning activities and so on. *not all for the Brantas river basin
	Industrial waste water : 58	5-32 items (depend on type of industry). BOD, COD are reported by PROKASIH report	Sampling : DPRIND (Municipal Industrial Services) Analysis : BTKL, Laboratory of Kanwil PU, BPPI Data compilation and Reporting : Work team of PROKASIH		
Kanwil PU	River water : 12	About 60 *including heavy metals and microbiological items	Sampling : DPU Analysis, Data compilation and Reporting: Laboratory of Kanwil PU	Water resource management	3 million Rp./year (1996/97) *Analisis only

Sources : PJT, PROKASIH report, Laboratory of Kanwil PU.

Table A3-2 Monitoring Points of Water Quality in The Brantas River Basin by PJT

No.	Code	Location	Rivers	Class	Period	Remarks
1	100	Dinoyo Bridge	Brantas	C	Monthly	Upstream of Malang
2	130	Bumiayu Bridge	Brantas	C	Monthly	Downstream of Malang
3	140	Segenggeng Tambangan	Brantas	C	Monthly	Downstream of Malang
4	150	Blobo Bridge	Brantas	C	Monthly	Downstream of Malang
5	160	Kd.Pedaringan Bridge	Brantas	C	Monthly	Upstream of Sengguruh Dam
6	300	Sengguruh Bridge	Brantas	C	Monthly	Downstream of Sengguruh Dam
7	350	Sutami Dam	Brantas	C	Monthly	Sutami Dam reservoir
8	380	Kalipare Bridge	Brantas	C	Monthly	Downstream of Sutami Dam
9	390	Kesamben Tambangan	Brantas	C	Monthly	Downstream of Sutami Dam
10	400	Ngembul Bridge	Brantas	C	Monthly	Upstream of Wlingi Dam
11	430	Wlingi Dam-1	Brantas	C	Monthly	Wlingi Dam reservoir
12	440	Wlingi Dam-2	Brantas	C	Monthly	Downstream of Wlingi Dam
13	450	Lodoyo Bridge	Brantas	C	Monthly	Lodoyo Dam reservoir
14	460	Lodoyo Dam	Brantas	C	Monthly	Downstream of Lodoyo Dam
15	470	Demangan Bridge	Brantas	C	Monthly	In Blitar
16	500	Pakel Tambangan	Brantas	C	Monthly	Upstream of join the Ngrowo river
17	630	Jeli Bridge	Brantas	C	Monthly	Downstream of join the Ngrowo river
18	700	Ngronggo Tambangan	Brantas	C	Monthly	Upstream of Kediri
19	720	Jongbiru Bridge	Brantas	C	Monthly	Downstream of Kediri
20	730	Mekikis Bridge	Brantas	C	Monthly	Upstream of join the Konto river
21	780	Ngrombot Tambangan	Brantas	C	Monthly	Downstream of join the Konto river
22	940	Ploso Bridge	Brantas	B	Monthly	In Ploso
23	950	Jatigedong Tambangan	Brantas	B	Monthly	Downstream of Ploso
24	960	Betro Tambangan	Brantas	B	Monthly	Upstream of Mojokerto
25	990	Padangan Bridge	Brantas	B	Weekly	Mojokerto
26	1000	Canggu Tambangan	Surabaya	B	Weekly	Downstream of diverging to the Porong river
27	1020	Perning Bridge	Surabaya	B	Weekly	Along the industrial strip
28	1030	Jrebeng Bridge	Surabaya	B	Weekly	Along the industrial strip
29	1035	Cangkir	Surabaya	B	Weekly	Along the industrial strip
30	1040	Bambe Tambangan	Surabaya	B	Weekly	Along the industrial strip
31	1045	Karangpilang	Surabaya	B	Daily	Near intake of water supply treatment plant
32	1050	Sepanjang Bridge	Surabaya	B	Weekly	Upstream of Gununnsari Dam
33	1060	Gunungsari Dam	Surabaya	B	Weekly	Gunungsari Dam
34	1100	Ngagel Treatment	Surabaya	B	Daily	Near intake of water supply treatment plant
35	1200	Petekan Bridge	Mas	C	Monthly	Downstream of Surabaya
36	280	Wonokerto Bridge	Lesti	C	Monthly	Upstream of Sengguruh Dam
37	290	Sengguruh Dam	Lesti	C	Monthly	Sengguruh Dam reservoir
38	570	Bendo Gate	Ngasinan	C	Monthly	Downstream of the Ngasinan river
39	600	Lembu Peteng	Ngrowo	C	Monthly	Tulungagung
40	610	Plandaan Bridge	Ngrowo	C	Monthly	Between Tulungagung Gate and the Brantas river
41	3010	Campurdarat Bridge	Parit Agung	C	Monthly	Campurdarat
42	3020	Mergayu Bridge	Parit Raya	C	Monthly	Upstream of the Ngasinan river
43	3030	Kendal Bridge	Tunnel Entr.	C	Monthly	Downstream of joining Parit Agung and Parit Raya
44	750	Selorejo Dam	Konto	C	Monthly	Downstream of Selorego Dam reservoir
45	770	Kayen Bridge	Konto	C	Monthly	Upstream of joining the Brantas river
46	810	Bening Dam	Widas	C	Monthly	Bening Dam reservoir
47	900	Karangsemi Bridge	Widas	C	Monthly	Middle of the Widas river
48	910	Lengkong Bridge	Widas	C	Monthly	Upstream of joining the Brantas river
49	930	Beng Confluence	Beng	C	Monthly	Upstream of joining the Brantas river
50	1010	Jetis Bridge	Marmoyo	C	Weekly	Upstream of joining the Brantas river
51	2600	Porong Bridge	Porong	C	Monthly	In Porong

Source : PJT

Table A3-3 Industries Monitored by PJT and PROKASIH in The Brantas River Basin

NO.	Name of Industries	PJT	PROKASIH	Locations	Productions	Rivers	Water Quality (Annual Ave. 1996)					
							PJT			PROKASIH		
							Discharge (m3/day)	BOD (mg/l)	Pollution Load (kg/day)	Discharge (m3/day)	BOD (mg/l)	Pollution Load (kg/day)
1	PT.Timur Megah Steel	*	*	Gresik	Steel	Tengah River	3,372	149.2	503	7,068	0.4	3
2	PT.Huey Chie	*	*	Gresik	Textile'dycing	Surabaya River	14,400	170.4	2,453	14,400	72.3	1,041
3	PT.Surabaya Mekabox	*	*	Gresik	Carroon(paper)	Tengah River	120,000	237.7	28,534	106,999	50.4	5,393
4	PT.Miwon Indonesia	*	*	Gresik	MSG	Surabaya River	264,000	41.4	10,938	326,018	1,235.0	402,633
5	PT.Surya Agung K.	*	*	Gresik	Paper	Surabaya River	432,000	842.8	364,103	367,999	69.1	25,429
6	PT.Surya Sosro Kencono	*	*	Gresik	Tea	Tengah River	4,800	1,019.5	4,894	8,410	33.0	278
7	PG.Jombang Baru	*	*	Jombang	Sugar	Irrigation Canal	16,500	167.0	3,142	15,528	28.9	449
8	PG.Mrican	*	*	Kediri	Sugar	Irrigation Canal	3,600	533.5	1,921	7,169	201.8	1,447
9	PG.Ngadirejo	*	*	Kediri	Sugar	Irrigation Canal	39,600	678.5	26,868	128,448	56.6	7,270
10	UD.Sumbercejo	*		Kediri	Tapioca	Irrigation Canal	207,360	3,358.3	696,381	-	-	-
11	PT.Gudang Garam	*	*	Kediri	Cigarette	Irrigation Canal	60,688	133.5	8,126	43,872	36.4	1,597
12	PT.Surya Zig Zag	*	*	Kediri	Paper	Brantas River	58,920	117.8	6,940	55,270	38.5	2,128
13	DIN.Pemot.Hewan	*		Kediri	Slaughter-house	Brantas River	4,147	604.3	2,506	-	-	-
14	PT.Eureka Aba P	*	*	Mojokerto	Wrapping Paper	Porong River	60,000	1,364.8	81,890	130,999	836.8	109,620
15	PG.Gempol Kerep	*	*	Mojokerto	Sugar	Marmoyo River	23,040	30.1	694	22,433	66.8	1,499
16	PT.Ajinomoto	*	*	Mojokerto	MSG	Brantas River	250,400	25.8	5,951	223,601	58.1	12,991
17	PD.Aneka Kimia	*	*	Mojokerto	Alcohol	Brantas River	14,400	989.0	14,242	13,320	2,567.0	34,192
18	PT.Pakerin	*	*	Mojokerto	Paper	Porong River	432,000	617.1	266,566	435,001	82.8	36,101
19	PT.Penamas	*		Malang	Cigarette	Irrigation Canal	4,147	197.1	817	-	-	-
20	PG.Krebet Baru	*	*	Malang	Sugar	Irrigation Canal	154,848	158.0	24,461	17,993	17.8	320
21	PT.Intaf	*	*	Malang	Tapioca	Lesti River	23,624	1,503.9	41,655	11,717	90.3	1,058
22	PG.Kebon Agung	*	*	Malang	Sugar	Irrigation Canal	93,312	334.6	31,219	108,144	98.5	10,652
23	PET. Babi Jimbe	*		Blitar	Cattle Breeding	Brantas River	62,208	3,712.6	230,956	-	-	-
24	PT.Sumber Tani	*	*	Malang	Tapioca	Lesti River	23,246	1,766.3	41,061	47,395	963.0	45,642
25	PT.Sumber Timur	*	*	Malang	Tapioca	Lesti River	24,137	1,367.8	33,014	6,696	745.3	4,991
26	PT. Leces	*		Malang	Tapioca	Metro River	41,472	2,145.2	88,965	-	-	-
27	PT.Kebalen Timur	*	*	Malang	Tanned leather	Brantas River	912	193.2	176	1,174	55.4	65
28	Pem.Hewan Malang	*	*	Malang	Slaughter house	Brantas River	566	2,304.7	1,305	1,231	136.9	169
29	PG.Lestari	*	*	Nganjuk	Sugar	Irrigation Canal	3,686	252.9	932	28,800	197.8	5,695
30	PT.Jaya Kertas	*	*	Nganjuk	Paper	Widas River	67,200	400.8	26,932	275,016	155.8	42,847
31	PT.Tjiwi Kimia	*	*	Sidoarjo	Paper	Mangetan Canal	840,000	512.5	430,483	847,200	218.6	185,167
32	PT.Sido Makmur	*		Sidoarjo	Tofu	Surabaya River	1,560	2,112.0	3,295	-	-	-
33	PT.Supama	*	*	Surabaya	Paper	Surabaya River	134,472	140.7	18,913	111,962	23.4	2,620
34	PT. Tahu Purnomo	*	*	Surabaya	Tofu	Surabaya River	960	2,002.3	1,922	7,034	1,887.2	13,275
35	PT.Tahu Gunungsari (Legowo)	*	*	Surabaya	Tofu	Surabaya River	612	1,328.8	813	874	247.0	216
36	Pem.Hewan KMS	*	*	Surabaya	Slaughter-house	Surabaya River	365	1,069.7	390	480	378.1	181
37	PT.Setia Kawan	*	*	Turungagung	Wrapping paper	Brantas River	22,800	1,457.5	33,232	25,994	541.6	14,079
38	PG.Mojopanggung	*	*	Turungagung	Sugar	Irrigation Canal	72,000	83.0	5,979	137,866	190.3	26,236
39	PET.Babi Batoan	*		Turungagung	Cattle husbandary	Brantas River	1,920	1,222.4	2,347	-	-	-
40	PT.Surya Pamenang	*	*	Kediri	Paper	Brantas River	144,000	334.7	48,195	144,000	107.3	15,451
41	PT.Eka Mas Fortuna	*	*	Malang	Paper	Lesti River	192,000	461.6	88,627	41,160	260.0	10,702
42	Peternakan babi Gunawan		*	Mojokerto	Pig husbandary	Sadar River	-	-	-	20,100	276.8	5,564
43	PT.Jayantara Sakti		*	Mojokerto	Cartor	Sadar River	-	-	-	1,930	174.8	337
44	PT.Spindo		*	Surabaya	Steel pipe	Tengah River	-	-	-	3,372	1.1	4
45	PT. Wastra Indah		*	Malang	Textile	Brantas River	-	-	-	3,799	21.2	81
46	Peternakan Babi		*	Sidoarjo	Pig husbandary	Surabaya River	-	-	-	125	517.3	65
47	Peternakan Sapi		*	Sidoarjo	Cattle husbandary	Sumbaya River	-	-	-	120	238.7	29
48	PT.Java Paper Indo		*	Mojosari	Paper	Sadar River	-	-	-	19,500	265.3	5,173
49	PT.Gawe Rejo		*	Surabaya	Sock	Surabaya River	-	-	-	1,195	46.0	55
50	PT.Halim Jaya		*	Surabaya	Tofu	Surabaya River	-	-	-	2,376	735.7	1,748
51	PT.Bintang Apollo		*	Surabaya	Dyeing	Surabaya River	-	-	-	1,166	16.8	20
52	PT.Kedawung Setia		*	-	Cardboad Box	Surabaya River	-	-	-	681	28.2	19
53	PT.Kegaung Setia		*	-	Enamel	Surabaya River	-	-	-	2,116	1.0	2
54	PT.Sama Jaya		*	-	Ketchup	Surabaya River	-	-	-	225	229.4	52
55	PT.Mta Prima Canna		*	-	Leather	Surabaya River	-	-	-	-	-	-
56	PT.Sumber Baru		*	-	Dyeing	Surabaya River	-	-	-	-	-	-
57	PT.Sumber Agung		*	-	Dyeing	Surabaya River	-	-	-	117	238.7	28
58	PT.Wijaya Indonesia Makmur		*	-	Casting	Surabaya River	-	-	-	961	5.3	5
59	PT.Kasin		*	Malang	Tanning	Brantas River	-	-	-	1,440	166.8	240
60	PT.Usaha Loka		*	Malang	Leather	Brantas River	-	-	-	2,006	256.3	514
61	PT.Mertex		*	Mojokerto	Textile	Sada River	-	-	-	26,400	252.0	6,653
62	PT.Kuda Mas Indah		*	Kediri	Paper	Brantas River	-	-	-	-	-	-
63	PT.Pagina Cita		*	Malang	Leather	Brantas River	-	-	-	-	-	-
64	PT.Surya Kencana		*	-	Pig husbandary	Brantas River	-	-	-	1,354	643.4	871
65	PT.Nasional		*	-	Ruber	Brantas River	-	-	-	1,106	93.3	103
	Average						95,214	882.1	65,423	65,730	275.1	17,956
	Total	41	58				3,903,775	-	2,682,326	3,812,360	-	1,043,199

Source : PJT,PROKASIH Annual Report in 1996,1997

Note : 1) * Monitoring Factories

: 2) As of 1997, PET.Babi Batoan(NO.39) was closed.

Table A3-4 Foundation Of PROKASIH

Fiscal Year	BBLH (*10^3 Rp/year)	Sector Bureau (DPU Cipta karya) (*10^3 Rp/year)	Private (*10^3 Rp/year)	Local Government (*10^3 Rp/year)	Total (*10^3 Rp/year)
1989/90	-	-	-	-	0
1990/91	30,000	-	-	-	30,000
1991/92	54,000	613,198	250,000	-	917,198
1992/93	80,000	382,000	250,000	-	712,000
1993/94	100,000	400,000	250,000	-	750,000
1994/95	125,000	735,120	300,000	-	1,160,120
1995/96	148,000	2,270,000	300,000	-	2,718,000
1996/97	155,000	2,350,000	300,000	1,325,000	3,825,000

Source: PROKASIH annual report 1996/1997

Note: 1)The foundation are not all for the Brantas river basin.
2)The foundation includes the cost for administration, sampling of water, laboratory analysis, training of staff, data arrangement and examination, supports for river cleaning activities, river bank ordering and catchment area greening.
3) Private means PJT.

Table A3-5 Water Quality of The Reservoirs and The Rivers

Parameters	Units	Reservoirs													Rivers	
		Sengguruh Dam		Sutami Dam				Wlingi Dam	Lodoyo Dam		Lahor Dam		Selorejo Dam		Lahor River	Konto River
	Depth from the surface	1m	4m	1m	5m	10m	25m	1m	1m	5m	1m	20m	1m	5m	-	-
Date	-	1997/8/6	1997/8/6	1997/8/6	1997/8/6	1997/8/6	1997/8/6	1997/8/7	1997/8/7	1997/8/7	1997/8/6	1997/8/6	1997/8/7	1997/8/7	1997/8/6	1997/8/7
Time	-	9:15	9:30	13:30	13:45	14:00	14:20	10:45	11:30	12:00	14:30	14:45	15:55	16:15	16:00	17:30
Water Temp.	C	26.5	25.5	28.0	27.5	27.0	27.0	27.5	27.0	26.5	27.5	26.5	24.5	24.0	27.5	23.0
pH	-	7.0	7.0	8.3	8.3	8.1	7.9	7.2	8.2	7.3	8.4	8.0	8.2	7.3	7.8	7.6
EC	mbos/cm	382	373	340	341	338	331	326	263	253	211	222	263	253	286	203
BOD	mg/l	4.7	4.1	3.2	3.8	5.5	4.2	3.3	3.1	3.4	6.6	3.4	8.4	6.1	7.6	4.2
COD	mg/l	9.7 (4.0)	8.5 (3.5)	6.9	7.7	12.5	7.7	5.7	5.3	4.4	15.8 (5.0)	6.5	15.8 (5.0)	10.9	19.3	7.1
DO	mg/l	5.2	4.9	6.9	9.2	6.1	5.2	4.3	6.4	6.5	7.4	5.3	6.9	5.9	6.2	6.2
PV	mg/l	6.89	1.29	0.81	1.29	0.93	4.04	2.42	1.21	1.21	3.39	1.62	3.07	2.26	1.13	0.41
SS	mg/l	12	12	18	12	12	14	60	66	78	12	12	14	14	12	12
VSS	mg/l	10	8	16	10	10	12	22	28	34	10	8	8	12	14	10
T-HARD	mg/l	162	164	143	141	124	141	137	139	118	93	95	104	109	122	97
NH4-N	mg/l	0.05	0.03	0.07	0.05	0.05	0.05	0.11	0.11	0.15	0.07	0.05	0.03	0.09	0.03	0.09
NO3	mg/l	0.84	0.87	0.14	0.62	0.75	0.08	0.72	0.06	0.78	0.02	0.03	0.08	0.12	0.13	0.75
NO2	mg/l	0.12	0.28	0.02	0.02	0.02	0.02	0.17	0.02	0.27	0.02	0.02	0.04	0.04	0.03	0.03
T-N	mg/l	0.31	0.29	0.31	0.25	0.23	0.23	0.1	0.17	0.19	0.27	0.25	0.23	0.33	0.23	0.23
T-P	mg/l	0.186	0.093	0.049	0.082	0.047	0.052	0.146	0.148	0.208	0.047	0.067	0.075	0.072	0.06	0.024
PO4	mg/l	0.044 (0.18)	0.058 (0.24)	0.005 (<0.05)	0.005 (<0.05)	0.005	0.008	0.01 (0.15)	0.012 (0.5)	0.017	0.012 (<0.05)	0.008 (<0.05)	0.007 (<0.05)	0.007 (<0.05)	0.039 (0.25)	0.01 (0.25)
Transparency	m	1.0	-	1.5	-	-	-	0.5	0.5	-	0.5	-	1.0	-	-	-

Note : 1) ( ) of PO4 and COD were analyzed by using a handy instrument, the Kyoritsu Chemical-Check Lab.,Crop.
2) Water samplings were conducted on August 6th and 7th, 1997

Table A3-6 Results of Water Quality Survey in the Rivers and Canals by The Study Team with PJT

No.	Location	River or Canal	Date	WT (℃)	Color	Water Flow (m3/s)	pH (-)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	SS (mg/l)	T-N (mg/l)	T-P (mg/l)	EC	Remarks
B-1	Mojokert Kec.Magersari	Brantas river	8/16/97	-	Yellowish brown	60.0	7.8	6.6	4.9	8.1	12	0.31	0.143	449	Near Intake of PDAM
B-2	Mojokert Kec.Lengkong	Brantas river	8/16/97	-	Reddish brown	43.2	7.8	6.5	16.1	36.4	6	0.15	0.133	439	
V-1	Sidoardjo Kec.Mliriprowo	Voor canal I	8/16/97	-	Reddish brown	1.6	6.7	n.a.	45.5	78.1	12	0.61	0.122	491	
V-2	Sidoardjo Kec.Mliriprowo	Voor canal II	8/16/97	-	Reddish brown	1.9	7.8	6.4	4.5	9.4	10	0.23	0.132	444	
V-3	Sidoardjo Kec.Mliriprowo	Voor canal outlet	8/15/97	29.5	Reddish brown	3.5	7.8	3.6	10.6	21.4	8	0.33	0.126	446	
M-1	Sidoardjo Kec.Penambangan	Mangetan canal	8/15/97	29.0	Yellowish brown	2.4	7.3	0.7	17.4	45.7	16	0.89	0.126	708	
M-2	Sidoardjo Kec.Kemasan	Mangetan canal	8/15/97	30.0	Yellowish brown	1.9	7.3	1.9	7.6	15.0	10	0.80	0.120	701	
M-3	Sidoardjo Kec.Gedangan	Mangetan canal	8/16/97	31.5	Yellowish green	1.6	7.3	4.4	11.7	28.3	36	0.87	0.187	630	
R-1	Sidoardjo Kec.Sidomulyo	Pelayaran canal	8/15/97	31.5	Light green	1.1	7.3	2.3	12.4	26.7	48	0.57	0.122	752	
R-2	Sidoardjo Kec.Tawangsari	Pelayaran canal	8/15/97	29.0	Light green	0.9	7.2	1.8	12.9	27.5	10	0.84	0.160	704	Near Intake of PDAM
R-3	Sidoardjo Kec.Ngelon	Pelayaran canal	8/15/97	27.5	Light green	0.7	7.1	1.2	12.1	34.7	6	0.61	0.146	748	Near Siphon
P-1	Sidoardjo Kec.Tarik	Porong canal	8/16/97	29.5	Reddish brown	1.2	7.3	3.6	16.1	31.5	6	0.82	0.199	464	
P-2	Sidoardjo Kec.Prambon	Porong canal	8/16/97	31.0	Light green	0.9	7.5	3.8	5.0	17.0	12	0.44	0.190	474	
P-3	Sidoardjo Kec.Krembung	Porong canal	8/16/97	31.0	Yellowish brown	0.5	7.9	4.7	15.4	39.7	32	0.82	0.207	484	
P-4	Sidoardjo Kec.Mindi	Porong canal	8/16/97	31.5	Yellowish green	0.1	8.4	10.4	9.3	23.4	28	0.44	0.194	464	
T-1	Sidoardjo Kec. Tambak Sumur	Buntong canal	8/16/97	27.5	Grayish green	0.3	7.5	4.3	12.1	21.82	10	2.83	0.775	1,082	Nera Intake of PDAM
Q-1	Sidoardjo Kec. Pepe	Pepe canal	8/16/97	27.0	Yellowish green	0.01	7.1	1.7	17.6	37.17	36	5.43	0.653	1,202	Near Intake of PDAM
F-1	Sidoardjo Kec.Cemandi	Near fish ponds	8/6/97	-	Yellowish brown	1.8	7.6	-	9.3	12.1	254	0.66	0.735	-	Near Fish Pond
F-2	Sidoardjo Kec.Cemandi	In fish pond	8/6/97	-	Yellowish brown	-	8.1	-	14.3	28.2	118	1.19	0.449	-	In Fish Pond
K-1	Surabaya Kayoon	Mas river	8/15/97	29.5	Yellowish green	3.2	7.3	2.3	6.2	9.3	14	0.35	0.143	909	Near Intake of PDAM

Note: 1) Water flow is measured by means of float method by the Stady Team.
2) Water quality is analyzed by the labolatory of PJT.

Table A3-7 The Water Quality Standards of The East Java Province

Parameters			Unit	Water Quality Standards						
				Class A		Class B		Class C	Class D	Class E
				Maximum recommended	Maximum allowed	Maximum recommended	Maximum allowed	Maximum content	Maximum content	Maximum content
1.PHYSICS	1.	Temperature	C	Normal water temperature	Normal water temperature	Normal water temperature	Normal water temperature	Normal water temperature +-2C	Normal water temperature	Normal water temperature +-5C
	2.	Color	Pt.Co's Scales	5	50				1000-2500	
	3.	Smell	-	No smell	No smell					
	4.	Taste	-	No taste	No taste					
	5.	Turbidity	mg/l Sio2	5	25					
	6.	Amount of dissolved solid matter	mg/l	500	1.500	500	1.500	2.000	1000-2500	5.000
	7.	Electric conductivity	mhos/cm					150-400	1750-2250	
2.CHEMISTRY	1.	PH	-	6.5 8.5	6.5 8.5	6 8.5	6 8.5	6-9	6-9	6-9
	2.	Calcium (Ca)	mg/l	75	200					
	3.	Magnesium (Mg)	mg/l	30	150					
	4.	Barium (Ba)	mg/l	0	0.05	0	1			
	5.	Iron (Fe)	mg/l	0.1	1	1	5			10
	6.	Manganese (Mn)	mg/l	0.05	0.5	0.05	0.5		2	5
	7.	Copper (Cu)	mg/l	0	1	0	1	0.02	0.2	5
	8.	Zinc(Zn)	mg/l	0	5	0	55	0.02	5	15
	9.	Hexavalence Chromium(Cr)	mg/l	0	0.05	0	0.05	0.05	0.5	2
	10.	Silver (Ag)	mg/l					0.03		
	11.	Cadmium (Cd)	mg/l	0	0.01	0	0.01	0.01	0.01	0.1
	12.	Mercury (Hg)	mg/l	0.0005	0.001	0.0005	0.001	0.02	0.005	0.005
	13.	Lead (Pb)	mg/l	0	0.1	0.05	0.1	0.03	1	5
	14.	Arsenic (As)	mg/l	0	0.05	0	0.05	1	1	1
	15.	Selenium (Se)	mg/l	0	0.01	0	0.01	0.05	0.05	0.5
	16.	Cyanide (CN)	mg/l	0	0.05	0	0.05	0.02		1
	17.	Sulphide (S)	mg/l	nil	nil	nil	nil	0.002		1
	18.	Fluoride (F)	mg/l		1.5		1.5			15
	19.	Chloride (Cl)	mg/l	200	600	200	600			2.000
	20.	Sulphate (SO4)	mg/l	200	400	200	400			1.000
	21.	Ammonia (NH3)	mg/l	nil	nil	0.01	0.5	0.02		
	22.	Nitrate (NO3)	mg/l	5	10	5	10	10		
	23.	Nitrite (NO2)	mg/l	nil	nil	nil	nil	0.06		
	24.	Phosphate (PO4)	mg/l					0.5		
	25.	Free CO2	mg/l					12		
	26.	Fluoride	mg/l					1.5		
	27.	Free Chlorine (Cl2)	mg/l					0.003		
	28	Organic matter	mg/l KMnO4	0	10	0	10			
	29.	Dissolved oxygen (DO)	mg/l							>=2
	30.	Biochemical Oxygen Demand(BOD)	mg/l				6			
	31.	Chemical Oxygen Demand(COD)	mg/l				10			
	32.	Negatively ionized detergent	mg/l	0	0.5	0	0.5	0.2		
	33.	Fenrel	mg/l	0.001	0.002	0.001	0.002	0.001		
	34.	Oil and fat	mg/l	nil	nil	nil	nil	1		10
	35.	Extract of Chloroform Carbon	mg/l	0.04	0.5	0.04	0.5			
	36.	PCB	mg/l	nil	nil	nil	nil	nil		
	37.	Nickel (Ni)	mg/l	-					0.5	5
	38.	Cobalt (Co)	mg/l						0.2	
	39.	Boric (B)	mg/l						1	
	40.	% Na	% Sodium						60	
	41.	Sodium Absorption Ratio (SAR)	%						10-18	
	42.	Residual Sodium Carbonate(RSC)	mg/l						1.25-2.5	
3.MICROBIOLOGIC	1.	Coliform group	MPN/100ml	nil	nil		10.000	20.000		
	2.	Coliform feces	MPN/100ml				2.000	4.000		
	3.	Parasitic germ	-	nil	nil					
	4.	Pathogenic germ	-	nil	nil					
4.RADIOACTIVITY	1.	Total of Beta activity	pCi/l				100		1.000*	
	2.	Strontium-90	pCi/l				2		10	
	3.	Radium-226	pCi/l				1		3	
5.PESTICIDE	1.	Pesticide	mg/l			nil	nil		nil	

Source: THE DECREE OF THE GOVERNOR OF THE PROVINCE OF EAST JAVA NUMBER:413,YEAR 1987

Note : * Activity without SP-90 and Ra-226

Table A3-8 Summary of The Results of Survey on Industries by the Study Team

No.	Name of Industries	Products	Location	Date	Waste Water Treatment	Investment Cost (million Rp.)	Treatment Cost (Rp./day)	Discharge (m3/day)	Water Quality (mg/l) pH	BOD	COD	SS	T-N	T-P	Remarks
1	PT.Sumber Tani Abadi	Starch or sugar from tapioca	Malang	8/1/97	Screening and maturation pond				4.5	3,601	8,516	4,236	43.9	0.3	
									4.2	2,401	6,545	864	17.6	0.7	
2	PT.Sumber Timur	Starch or sugar from tapioca	Malang	8/1/97	Screening and maturation pond	40	6,800	600	4.3	3,376	7,151	632	48.1	0.6	*a)
									4.1	2,484	6,140	594	33.8	3.0	
									4.7	1,401	3,272	1,864	8.1	1.9	
3	PT.BMI	Package of Shrimp	Malang	8/1/97	Screening and settling process	8	16,000	100	7.2	461	1,091	266	96.3	4.5	
									6.8	537	1,252	55	114.2	5.1	
4	PT.Eka Mas Factory	Paper	Malang	8/1/97	Aeration pond				6.9	706	1,632	786	3.9	0.9	
									7.4	121	287	192	3.6	0.5	
5	PET.Babi Suraya Kencana	Pig breeding	Tulungagung	7/31/97	-		-	-	n.a	n.a	n.a	n.a	n.a	n.a	Closed
									n.a	n.a	n.a	n.a	n.a	n.a	
6	PT.Setia Kawan	Paper	Tulungagung	7/24/97	Sedimentation pond				-	1,101	3,232	2,612	3.8	0.8	
									-	781	1,632	160	1.9	0.4	
7	PG.Mrican	Sugar	Kediri	7/31/97	Sedimentation pond and aeration tank				7.2	130	307	162	0.7	0.9	*b)
									7.4	23	91	39	0.9	0.1	
									6.7	59	108	60	0.5	0.9	
									7.7	11	24	36	0.7	0.7	
8	PT.Suraya Pamenang	Paper	Kediri	7/24/97	Clalifier and biological treatment	7,590	1,000,000	10,800	-	85	188	38	0.5	0.2	
									-	11	25	12	0.6	0.1	
9	PT.Aneka Kimia	Alcohol distillery (molasses)	Mojokerto	8/6/97	Aeration pond				4.4	84,001	207,757	37,594	202.7	0.7	
									6.7	1,706	3,070	644	26.7	1.9	
10	PT.Eureka Aba Paper	Pulp and Paper	Mojokerto	7/25/97	Sedimentation pond and aeration tank	4,000	-	6,000	-	586	990	1,056	4.3	2.2	*c)
									-	1,505	3,272	478	8.1	2.8	
11	PT.Miwon Indonesia	Yeast and derivative	Gresik	7/25/97	Clalifier and aerated lagoon				-	436	889	188	215.3	0.5	
									-	64	129	38	31.3	0.2	
12	PT.Suparma	Paper	Surabaya	8/4/97	Clalifier and biological treatment		1,200,000	15,000	6.8	661	1,471	948	2.9	0.3	
									7.3	28	40	12	6.3	2.0	

Note : 1) Water samples are analyzed by the laboratory of PJT

2) In columns of water quality, upper lines show before treatment and lower lines show after treatment or discharge to the river directly.

3) *a) There are 2 outlets to the river in the industry. One is not by way of treatment plant.

*b) There are 2 inlets to the treatment plant and 2 outlets to the river.

*c) There is another waste water entering into the treated water. The sample was taken after mixture.

Table A3-9 Effluent Standards in the East Java Province

Type of industries	Parameters (Unit : mg/l except pH)															
	pH	BOD	COD	TSS	Oil & Grease	Phenol	Sulfide (H_2S)	CN	Cr (Total)	Cu	Zn	Ni	Pb	NH4-N	Others
Pulp and paper	6-9	50-100	120-300	60-100		0.01	0.64								10(T-P), 0.01(Chloroform), 17(AOX)
	6-9	100	250	100											
Paper	6-9	30-70	70-150	35-70											
	6-9	70	150	70											
Alcohol distillery (Ethanol)	6-9	100	300	100			0.5								
	6-9	150		300											
MSG	6-9	50	150	60										5	
	6-9	80	150	100										5	
Sugar cane	6-9	60	100	50	5		0.5								
	6-9	60	100	50	5		0.5								
Electroplating	6-9			20				0.2	0.5	0.6	1.0	1.0	0.1		0.1(Cr^{6+}), 0.05(Cd)
	6-9			20				0.2	0.5	0.6	1.0	1.0	0.1		0.1(Cr^{6+}), 0.05(Cd)
Leather tanning	6-9	40-50	100-110	50-60	3-5		0.5-0.8		0.3-0.5					5-10	
	6-9	75-100	200-250	75-100	3-5		0.5-0.8		0.3-0.5					5-10	
Caustic soda	6-9			25					0.5	1.0	1.0	1.2	0.8		0.5(Cl_2)
	6-9			25					0.5	1.0	1.0	1.2	0.8		0.5(Cl_2)
Rubber	6-9	100	200	100										10	
	6-9	100	200	100										10	
Textile	6-9	50	150	50	3.6	1.0	0.3		1.0					8	
	6-9	50	150	50	3.6	1.0	0.3		1.0					8	
Urea fertilizer	6-9		200	100	20									50	100(T-N)
	6-9	100	250	100	20									50	
Nitrogen fertilizer	6-9		200	200	20									100	150(T-N)
	6-9	100	250	200	20									100	
Accumulator (Wet)	6-9		30	6	4					0.6	0.4		0.14		1.0 (Fe), 0.2 (Sb)
	6-9		30	6	4					0.6	0.4		0.14		1.0 (Fe), 0.2 (Sb)
(Dry)	6-9			8	2				0.05		0.2	0.4			0.01(Hg), 0.3 (Mn)
	6-9			8	2				0.05		0.2	0.4			0.01(Hg), 0.3 (Mn)
Paint	6-9		80	50	10	0.2				0.8	1.0		0.3		0.2(Cr^{6+}), 0.01(Hg), 0.03(Cd), 0.4 (Te)
	6-9		80	50	10	0.2				0.8	1.0		0.3		0.2(Cr^{6+}), 0.01(Hg), 0.03(Cd), 0.4 (Te)
Pesticide	6-9	25	75	20		1.0		0.8		0.8				1	0.1(Benzene), 0.1(Toluene), 1(Active Material)
	6-8.5	25	75	20		1.0		0.8		0.8				1	0.1(Benzene), 0.1(Toluene), 1(Active Material)
Plywood	6-9	75	150	75	4	1.0								1	
	6-9	75	150	75		1.0								1	
Nitric acid	6-9	80	100	60											
	6-9	80	100	60											
Dairy and hog farm	6-9	100	200	100			0.06							1	
	6-9	100	200	100			0.06							1	
Slaughter House	6-9	100	250	100	25									25	
	6-9	100	250	100	25									25	
Palm oil	6-9	100	350	250	25									20	
	6-9	100	350	250	25									20	
Vegetable oil and	6-9	75	180	60	15										10 (PO_4^{3-}), 30 (MBAS)
Soap/Detergent	6-9	75	180	60	15										10 (PO_4^{3-}), 30 (MBAS)
Fish canning	6-9	100	150	30	6.5										
	6-9	100	150	30	6.5										
Cold storage	6-9	100	200	100	30										
	6-9	100	200	100	30										
Beer	6-9	40	120	40											
	6-9	40	120	40											
Milk	6-9	30	90	25											
	6-9	30	90	25											
Soft drink	6-9	50	100	30	6										
	6-9	50	100	30	6										
Coffee peeling, Candy	6-9	75	200	100	20										
Noodle	6-9	75	200	100	20										
Tofu, Soy sauce,	6-9	75	200	50											
Tempe	6-9	150	300	100											
Fruit and vegetable	6-9	75-85		60											
processing	6-9	75-85		60											
Tapioca starch	6-9	100	250	80				0.2							
	6-9	150	300	100				0.2							
Pharmacopoeia	6-9	100	300	100		1.0									30(T-N)
	6-9	150	500	130		5.0									45(T-N)
Oil refinery	6-9	60	160		15	0.4	0.5							5	

Note : 1) This table shows maximum concentration only.
2) Upper line of each industry is applicable to new industry (including expansion of industry), lower line is to existing industry.
Source : Goverment Decree No.136, 1994 in East Java Province

Table A3-10 Unit Pollution Load (BOD) of Domestic Waste Water

Items			Urban area	Semi-urban area	Rural area
1. Water consumption rate	(l/cap.day)	Present	190	120	100
		2020 forecast	200-250	150	120
2. Raw Pollution load	1) Gray water (g/cap.day)	Present	30	17	14
		2020 forecast	44	22	18
	2) Black water (g/cap.day)	Present	11	11	11
		2020 forecast	11	11	11
	3) Total (g/cap.day)	Present	41	28	25
		2020 forecast	55	33	29
3. Pollution load with sanitation	1) Gray water (g/cap.day)	Present	30	17	14
		2020 forecast	44	22	18
	2) Black water (g/cap.day)	Present	0	0	0
		2020 forecast	0	0	0
	3) Total (g/cap.day)	Present	30	17	14
		2020 forecast	44	22	18
4. Pollution load with Gappei Johkaso	1) Gray water (g/cap.day)	Present	-	-	-
		2020 forecast	9	4	4
	2) Black water (g/cap.day)	Present	-	-	-
		2020 forecast	3	3	3
	3) Total (g/cap.day)	Present	-	-	-
		2020 forecast	12	7	7

Note : 1) Increasing rates in pollution load of gray water are as follows
- 1.5% in urban area
- 1.0% in semi-urban and rural areas

2) Water consumption rates are in PDAM service areas.

Source : Brantas III Project (revised by the Study Team)

Table A3-11 (1) Industries (Major Producers) in Bumiyau Bridge Sub-basin

No.	Name of Industries	Products	Discharge Location	Present			2020 Frecast		
				Discharge (m³/day)	Water Quality (BOD mg/l)	Pollution Load (BOD kg/day)	Effluent Standard(mg/l)	Pollution Load* (BOD kg/day)	Amount of Decrease(kg/day)
1	PT. Kebalen Timur	Tanning	Branyas river	912	193.2	176	75	68	108
2	Pem. Hewan Malang	Slaughter house	Brantas river	566	2,304.7	1,304	100	57	1,248
3	PT.Wastra Indah	Textile	Brantas river	3,799	21.2	81	50	81	0
4	PT.Pagina Cita	Tanning	Brantas river	n.a.	n.a.	n.a.	75	n.a.	n.a.
Total				5,277		1,561		206	1,356

Note : Pollution load* is caluculated on the assumption that industries will attain the effuluent standards by 2020
Source : PJT

Table A3-11 (2) Industries (Major Producers) in Demangan Bridge Sub-basin

No.	Name of Industries	Products	Discharge Location	Present			2020 Frecast		
				Discharge (m³/day)	Water Quality (BOD mg/l)	Pollution Load (BOD kg/day)	Effluent Standard(mg/l)	Pollution Load* (BOD kg/day)	Amount of Decrease(kg/day)
1	Pet.Babi Jimbe	Cattle breeding	Brantus river	62,208	3,712.6	230,953	100	6,221	224,733
Total				62,208		230,953		6,221	224,733

Note : Pollution load* is caluculated on the assumption that industries will attain the effuluent standards by 2020
Source : PJT

Table A3-11 (3) Industries (Major Producers) in Jogbiru Bridge Sub-basin

No.	Name of Industries	Products	Discharge Location	Present			2020 Frecast		
				Discharge (m³/day)	Water Quality (BOD mg/l)	Pollution Load (BOD kg/day)	Effluent Standard(mg/l)	Pollution Load* (BOD kg/day)	Amount of Decrease(kg/day)
1	PT.Sumberrejo	Tapioca	Irrigation canal	207,360	3,358.3	696,377	150	31,104	665,273
2	PG.Ngadirejo	Sugar	Irrigation canal	39,600	678.5	26,869	60	2,376	24,493
3	PG.Mrican	Sugar	Irrigation canal	3,600	533.5	1,921	60	216	1,705
4	PT.Gudang Garam	Cigarettes	Irrigation canal	60,888	133.5	8,129	30	1,827	6,302
5	PT.Surya Zig Zag	Paper	Brantas river	58,920	117.8	6,941	100	5,892	1,049
6	PT.Surya Pamenang	Paper	Brantas river	144,000	334.7	48,197	100	14,400	33,797
7	PT.Kuda Mas Indah	Paper	Brantas river	n.a.	n.a.	n.a.	100	n.a.	n.a.
Total				514,368		788,432		55,815	732,618

Note : Pollution load* is caluculated on the assumption that industries will attain the effuluent standards by 2020
Source : PJT

Table A3-11 (4) Industries (Major Producers) in Canggu Bridge Sub-basin

No.	Name of Industries	Products	Discharge Location	Present			2020 Frecast		
				Discharge (m³/day)	Water Quality (BOD mg/l)	Pollution Load (BOD kg/day)	Effluent Standard(mg/l)	Pollution Load* (BOD kg/day)	Amount of Decrease(kg/day)
1	PT.Ajinomoto	MSG	Brantas river	230,400	25.8	5,944	80	5,944	0
2	PD.Aneka Kimia	Alcohol	Brantas river	14,400	989.0	14,242	150	2,160	12,082
3	Peternakan Babi	Pig husbangary	Surabaya river	125	517.3	65	100	13	52
4	Peternakan Sapi	Cattle husbandary	Surabaya river	120	238.7	29	100	12	17
Total				245,045		20,279		8,129	12,150

Note : Pollution load* is caluculated on the assumption that industries will attain the effuluent standards by 2020

Table A3-11 (5) Industries (Major Producers) in Karangpilang Sub-basin

No.	Name of Industries	Products	Discharge Location	Present			2020 Frecast		
				Discharge (m³/day)	Water Quality (BOD mg/l)	Pollution Load (BOD kg/day)	Effluent Standard(mg/l)	Pollution Load* (BOD kg/day)	Amount of Decrease(kg/day)
1	PT.Sido Makmur	Tofu	Surabaya river	1,560	2,112.0	3,295	150	234	3,061
2	PT.Huey Chie	Textile	Surabaya river	14,400	170.4	2,454	50	720	1,734
3	PT.Surya Agung Kertas	Paper	Surabaya river	120,000	237.7	28,524	100	12,000	16,524
4	PT.Miwon Indonesia	MSG	Suravaya river	264,000	41.4	10,930	80	10,930	0
5	PT.Surya Sosro Kencono	Tea	Tengah river	4,800	1,019.5	4,894	75	360	4,534
6	PT.Timur Megaha Steel	Steel, Electlic plating	Tengah river	3,372	149.2	503	30	101	402
7	PT.Wijaya Indonesian Makmur	Cating, Bicycles	Tengah river	961	5.3	5	30	5	0
8	PT.Surabaya Mekabox	Paper	Tengah river	120,000	237.7	28,524	100	12,000	16,524
9	PT.Spindo	Steel pipe	Tengah river	3,372	1.1	4	30	4	0
10	PT.Kegaurg Setia	Enamel	Surabaya river	2,116	1.0	2	30	2	0
11	PT.Suparma	Paper	Surabaya river	134,472	140.7	18,920	100	13,447	5,473
Total				669,053		98,054		49,803	48,251

Note : Pollution load* is caluculated on the assumption that industries will attain the effuluent standards by 2020
Source : PJT

Table A3-11 (6) Industries (Major Producers) in Ngagel Sub-basin

No.	Name of Industries	Products	Discharge Location	Present			2020 Frecast		
				Discharge (m³/day)	Water Quality (BOD mg/l)	Pollution Load (BOD kg/day)	Effluent Standard(mg/l)	Pollution Load* (BOD kg/day)	Amount of Decrease(kg/day)
1	PT.Tahu Purnomo	Tofu	Surabaya river	960	2,002.0	1,922	150	144	1,778
2	PT.Gawerejo	Socks	Surabaya river	1,195	46.0	55	30	36	19
3	PT.Bintang Apolo	Dyeing	Surabaya river	1,166	16.8	20	30	20	0
4	PD.Pemot.Hewan KMS	Slaughter house	Surabaya river	365	1,069.7	390	100	37	354
5	PT.Tahu Halim Java	Tofu	Surabaya river	2,376	735.7	1,748	150	356	1,392
6	PT.Tahu Gunungsari (Legowo)	Tofu	Surabaya river	612	1,328.8	813	150	92	721
Total				6,674		4,948		684	4,264

Note : Pollution load* is caluculated on the assumption that industries will attain the effuluent standards by 2020
Source : PJT

Table A3-11 (7) Industries (Major Producers) in Pelayaran Sub-basin

No.	Name of Industries	Products	Discharge Location	Present			2020 Frecast		
				Discharge (m³/day)	Water Quality (BOD mg/l)	Pollution Load (BOD kg/day)	Effluent Standard(mg/l)	Pollution Load* (BOD kg/day)	Amount of Decrease(kg/day)
1	PT.Tjiwi Kimia	Paper	Mangetan canal	840,000	512.5	430,500	100	84,000	346,500
Total				840,000		430,500		84,000	346,500

Note : Pollution load* is caluculated on the assumption that industries will attain the effuluent standards by 2020
Source : PJT

Table A3-12 (1) Number and Output Value of Industries in the East Java Province

Year	Large and Medium Scale Industries				
	Establishments	Density (units/km²)	Output Value (million Rp./yr)	Output Value per Establishment (million Rp./yr)	Output Value per Area (million Rp./km²/yr)
1994/95	9,000	0.2	15,744,890	1,749.4	355.1
1995/96	9,099	0.2	16,583,500	1,822.6	374.0
1996/97	9,988	0.2	18,064,241	1,808.6	407.4
1997/98	10,966	0.2	19,680,623	1,794.7	443.8

Source : Provincial Industry Service (DPRIND)

Year	Small Scale Industries				
	Establishments	Density (units/km²)	Output Value (million Rp./yr)	Output Value per Establishment (million Rp./yr)	Output Value per Area (million Rp./km²/yr)
1994/95	476,837	10.8	3,343,400	7.0	75.4
1995/96	480,207	10.8	3,515,300	7.3	79.3
1996/97	484,490	10.9	3,541,664	7.3	79.9
1997/98	488,124	11.0	3,679,733	7.5	83.0

Source : Provincial Industry Service (DPRIND)

Table A3-12 (2) Number and Output Value of Industries in Surabaya

Year	Large and Medium Scale Industries				
	Establishments	Density (units/km²)	Output Value (million Rp./yr)	Output value per Establishment (million Rp./yr)	Output value per Area (million Rp./km²/yr)
1980/81	824	3.0	280,025	340	1,022
1981/82	830	3.0	329,198	397	1,201
1982/83	874	3.2	396,623	454	1,447
1983/84	897	3.3	430,478	480	1,571
1984/85	899	3.3	547,018	608	1,996
1985/86	907	3.3	683,635	754	2,494
1986/87	919	3.4	765,574	833	2,793
1987/88	941	3.4	999,140	1,062	3,646
1988/89	1,018	3.7	1,538,725	1,512	5,615
1989/90	1,131	4.1	1,944,161	1,719	7,094
1990/91	755	2.8	2,154,091	2,853	7,860
1991/92	770	2.8	2,575,588	3,345	9,398
1992/93	783	2.9	2,934,848	3,748	10,709
1993/94	803	2.9	3,309,495	4,121	12,076
1994/95	817	3.0	4,463,294	5,463	16,286
1995/96	833	3.0	4,183,161	5,022	15,264

Source : Surabaya in Figures 1995

Year	Small Scale Industries				
	Establishments	Density (units/km²)	Output Value (million Rp./yr)	Output value per Establishment (million Rp./yr)	Output value per Area (million Rp./km²/yr)
1980/81	3,784	13.8	62,873	17	229
1981/82	4,594	16.8	95,801	21	350
1982/83	4,747	17.3	108,511	23	396
1983/84	4,954	18.1	123,772	25	452
1984/85	5,173	18.9	137,124	27	500
1985/86	5,434	19.8	158,439	29	578
1986/87	5,679	20.7	174,296	31	636
1987/88	6,033	22.0	186,420	31	680
1988/89	6,420	23.4	236,255	37	862
1989/90	6,841	25.0	240,645	35	878
1990/91	7,537	27.5	432,183	57	1,577
1991/92	7,758	28.3	522,649	67	1,907
1992/93	7,973	29.1	574,382	72	2,096
1993/94	8,326	30.4	702,283	84	2,563
1994/95	8,648	31.6	841,401	97	3,070
1995/96	9,845	35.9	908,713	92	3,316

Source : Surabaya in Figures 1995

Table A3-13 Unit Pollution Load (BOD) of Industrial Waste

ISIC	Sub Sector	Unit Waste Water Discharge (m^3/day/million Rp/yr.)	Waste Water Quality (BOD mg/l)	Unit Pollution Load (g/day/million Rp/yr.)
31	Food, Beverages, Tobacco	0.011	1,800	18.00
32	Textile, Garment, Leather	0.002	190	0.38
33	Wood industry	0.003	140	0.42
34	Paper, Printing and Publishing	0.003	960	2.88
35	Chemical, Oil, Rubber, Plastics	0.010	760	7.60
36	Non Metal Mining	0.027	280	7.56
37	Basic Metal	0.027	280	7.56
38	Metal, Machine and its Equipment	0.027	280	7.56
39	Other Manufactured industry	0.010	110	1.10
	Average (Weighted)	0.019	482	6.89

Note : 1) ISIC means International Standard Industrial Code
2) Avarage were weighted with following output values per establishment
Source : The Study on Urban Drainage and Wastewater Disposal Project in The City of Jakarta, JICA 1991

East Java Province (Large and Medium Scale Industries)

ISIC	Sub Sector	Establishments	Output Value (million Rp./yr)	Output Value per Establishment (million Rp./yr)
31	Food, Beverages, Tobacco	1,714	11,409,612	6,657
32	Textile, Garment, Leather	604	2,859,067	4,734
33	Wood industry	400	1,524,992	3,812
34	Paper, Printing and Publishing	161	1,956,619	12,153
35	Chemical, Oil, Rubber, Plastics	431	2,985,195	6,926
36	Non Metal Mining	328	920,336	2,806
37	Basic Metal	32	1,777,908	55,560
38	Metal, Machine and its Equipment	447	2,035,189	4,553
39	Other Manufactured industry	69	203,047	2,943
	Total (Average)	4,186	25,671,967	6,133

Note : ISIC means International Standard Industrial Code
Source : East Java in Figures 1995

Table A3-14 Population of Livestock and Pollution Load (BOD)

Area	(km2)	Population of Livestock (heads)							Polution Load from Livestock (BOD kg/day)							Pollution Load Unit	
		Horses	Cows	Dairy Cows	Carabaos	Goats	Sheep	Pigs	Horses	Cows	Dairy Cows	Carabaos	Goats	Sheep	Pigs	(kg/day)	(kg/day/km2)
(Regency)																	
Sidoarjo	592	195	19,634	1,411	6,826	19,512	19,601	1,886	43	12,566	903	4,369	1,951	1,960	377	22,169	37.4
Mojokerto	744	287	62,023	1,796	3,587	48,542	17,437	1,574	63	39,695	1,149	2,296	4,854	1,744	315	50,116	67.4
Malang	3,168	1,764	106,142	23,798	1,897	76,597	43,787	3,143	388	67,931	15,231	1,214	7,660	4,379	629	97,431	30.8
Blitar	1,156	216	62,784	1,777	4,663	54,275	26,246	2,675	48	40,182	1,137	2,984	5,428	2,625	535	52,938	45.8
Kediri	1,386	444	110,599	5,367	4,684	122,130	39,156	2,966	98	70,783	3,435	2,998	12,213	3,916	593	94,035	67.8
Nganjuk	1,183	306	136,806	2,539	6,662	96,672	64,495	1,541	67	87,556	1,625	4,264	9,667	6,450	308	109,937	92.9
Jombang	1,148	18	64,028	5,313	4,637	96,044	27,153	2,075	4	40,978	3,400	2,968	9,604	2,715	415	60,085	52.3
Tulungagung	844	120	63,540	3,671	1,763	47,644	11,942	15,610	26	40,666	2,349	1,128	4,764	1,194	3,122	53,250	63.1
Trenggalek	603	51	18,460	239	1,967	89,612	15,409	233	11	11,814	153	1,259	8,961	1,541	47	23,786	39.4
Gresik	136	47	8,525	39	85	8,486	4,534	1	10	5,456	25	54	849	453	0	6,848	50.4
Pasuruan	220	429	15,493	1,117	80	12,697	9,429	32	94	9,916	715	51	1,270	943	6	12,995	59.1
Sub-total	11,180	3,877	668,034	47,067	36,851	672,211	279,189	31,736	853	427,542	30,123	23,585	67,221	27,919	6,347	583,589	52.2
(Municipality)																	
Surabaya	197	36	2,105	1,274	319	5,279	1,747	0	8	1,347	815	204	528	175	0	3,077	15.6
Mojokerto	16	9	406	172	198	1,457	493	4,542	2	260	110	127	146	49	908	1,602	100.1
Malang	119	82	5,703	293	154	2,478	2,558	0	18	3,650	188	99	248	256	0	4,458	37.5
Kediri	63	23	6,922	249	293	4,023	1,791	0	5	4,430	159	188	402	179	0	5,363	85.1
Blitar	32	48	7,886	178	29	2,752	1,562	0	11	5,047	114	19	275	156	0	5,621	175.7
Sub-total	427	198	23,022	2,166	993	15,989	8,151	4,542	44	14,734	1,386	636	1,599	815	908	20,122	47.1
Grand Total	11,607	4,075	691,056	49,233	37,844	688,200	287,340	36,278	897	442,276	31,509	24,220	68,820	28,734	7,256	603,711	52.0

Source : Jawa Timur Dalam Angka 1990 and 1995, East Java Statistics Office

Note : Polution load units (BOD) are as follows :

Unit : BOD g/head/day

Horses	Cows	Dairy Cows	Carabaos	Goats	Sheep	Pigs
220	640	640	640	100	100	200

Table A3-15 Pollution Load (BOD) from Livestock at each Sub-catchment

No.	Name	Location	Subbasins	Surface				Pollution Unit (1994)			Livestock Pollution Load (1994)			
				Urban (km²)	Semi-urban (km²)	Rural (km²)	Total (km²)	Urban (kg/day/km²)	Semi-urban (kg/day/km²)	Rural (kg/day/km²)	Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)
1	Bumiayu Bridge	Malang	B000	0.0		71.0	71.0	37.6		30.8	0		2,187	2,187
			B001	6.3		59.9	66.2	37.6		30.8	236		1,845	2,081
			B020	10.3		287.9	298.3	37.6		30.8	388		8,869	9,257
			B021	25.9		159.6	185.5	37.6		30.8	974		4,916	5,890
			B022	10.9		0.0	10.9	37.6		30.8	409		0	409
	Subtotal			53.4		578.5	631.9				2,007		17,817	19,824
2	Demangan Bridge	Blitar	B142		7.8	51.2	59.0		173.7	45.8		1,362	2,343	3,705
			B150		6.7	87.1	93.8		173.7	45.8		1,171	3,989	5,160
			B153		0.0	52.3	52.3		173.7	45.8		0	2,393	2,393
	Subtotal				14.6	190.5	205.1					2,533	8,725	11,258
3	Jogbiru Bridge	Kediri	B310		10.7	86.6	97.3		84.6	67.8		904	5,873	6,776
			B311		21.7	48.5	70.2		84.6	67.8		1,838	3,286	5,125
			B312		3.0	0.5	3.5		84.6	67.8		255	34	289
			B313		4.5	0.0	4.5		84.6	67.8		381	0	381
			B314		3.1	0.5	3.6		84.6	67.8		266	34	300
			B315		13.2	27.9	41.1		84.6	67.8		1,120	1,890	3,010
			B316		1.5	3.2	4.7		84.6	67.8		124	220	344
			B317		1.2	125.5	126.8		84.6	67.8		103	8,511	8,614
	Subtotal				59.0	157.1	351.7					4,991	19,847	24,838
4	Padangan Bridge	Mojokert	B503			23.1	23.1			67.4			1,555	1,555
			B504			61.1	61.1			67.4			4,120	4,120
			B505			23.6	23.6			67.4			1,587	1,587
			B506			16.0	16.0			67.4			1,080	1,080
			B507			2.6	2.6			67.4			177	177
			B510			46.5	46.5			67.4			3,134	3,134
			B511			116.7	116.7			67.4			7,868	7,868
			B512			201.0	201.0			67.4			13,544	13,544
			B513			13.0	13.0			67.4			874	874
			B514			185.0	185.0			67.4			12,467	12,467
			B515	0.1		40.1	40.2	57.2		67.4	6		2,702	2,708
	Subtotal			0.1		728.6	728.7				6		49,108	49,114
5	Canggu Tambangan	Mojokert	B619			7.9	7.9			67.4			531	531
			B620			7.3	7.3			67.4			491	491
			B820			0.0	0.0			67.4			0	0
	Subtotal					15.2	15.2						1,022	1,022
6	Karangpilang	Surabaya	B621		12.0		12.0		50.2			602		602
			B622		38.5		38.5		50.2			1,933		1,933
			B623		15.5		15.5		50.2			778		778
			B624		6.2		6.2		50.2			309		309
			B630		39.7		39.7		50.2			1,994		1,994
			B631		6.1		6.1		50.2			308		308
			B632		20.1		20.1		50.2			1,009		1,009
	Subtotal				138.1		138.1					6,934		6,934
7	Ngagel	Surabaya	B640	2.6	6.4		9.0	15.6	50.2		41	322		363
			B641	0.0	17.8		17.8	15.6	50.2		0	895		895
			B642	3.3	7.2		10.5	15.6	50.2		51	360		411
			B643	17.1	2.7		19.8	15.6	50.2		267	135		401
			B644	8.3	0.1		8.4	15.6	50.2		130	3		132
	Subtotal			28.7	34.2		65.5				488	1,714		2,203
8	Kayon	Surabaya	B645	2.3			2.3	15.6			37			37
			B646	3.5			3.5	15.6			54			54
	Subtotal			5.8			5.8				91			91
9	Pelayaran	Sidoardjo	-		1.5		1.5		37.5			56		56
10	Porong	Sidoardjo	-		0.5		0.5		37.5			19		19

Table A3-16 Domestic Pollution Load (BOD) produced in each Sub-catchment (1994)

No.	Name	Location	Subbasins	Population (1994)				Produced Domestic Pollution Load (1994)				Served Population(1994)			Net Domestic Pollution Load (1994)			
				Urban	Semi-urban	Rural	Total	Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)	Urban (%)	Semi-urban (%)	Rural (%)	Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)
1	Bumiayu Bridge	Malang	B000	0		33,521	33,521	0		838	838	55		55	0		635	635
			B001	37,006		28,278	65,283	1,517		707	2,224	55		55	1,293		536	1,829
			B020	60,968		135,908	196,875	2,500		3,398	5,897	55		55	2,131		2,575	4,706
			B021	152,921		75,331	228,252	6,270		1,883	8,153	55		55	5,345		1,428	6,772
			B022	64,214		0	64,214	2,633		0	2,633	55		55	2,244		0	2,244
	Subtotal			315,108		273,038	588,146	12,919		6,826	19,745	55		55	11,013		5,174	16,187
2	Demangan Bridge	Blitar	B142			28,765	32,845	61,610		805	821	1,627		84	60		540	604	1,144
			B150			24,729	55,918	80,647		692	1,398	2,090		84	60		464	1,029	1,493
			B153			0	33,545	33,545		0	839	839		84	60		0	617	617
	Subtotal					53,494	122,307	175,801		1,498	3,058	4,556		84	60		1,004	2,250	3,254
3	Jogbiru Bridge	Kediri	B310			39,196	82,202	121,398		1,097	2,055	3,153		61	60		834	1,513	2,347
			B311			79,749	45,998	125,747		2,233	1,150	3,383		61	60		1,698	846	2,544
			B312			11,083	475	11,558		310	12	322		61	60		236	9	245
			B313			16,515	0	16,515		462	0	462		61	60		352	0	352
			B314			11,524	475	11,998		323	12	335		61	60		245	9	254
			B315			48,591	26,449	75,039		1,361	661	2,022		61	60		1,034	487	1,521
			B316			5,395	3,075	8,470		151	77	228		61	60		115	57	171
			B317			4,477	119,128	123,605		125	2,978	3,104		61	60		95	2,192	2,287
	Subtotal					216,530	277,801	494,331		6,063	6,945	13,008		61	60		4,610	5,112	9,721
4	Padangan Bridge	Mojokert	B503				22,839	22,839			571	571	88		60	0		420	420
			B504				60,519	60,519			1,513	1,513	88		60	0		1,114	1,114
			B505				23,315	23,315			583	583	88		60	0		429	429
			B506				15,870	15,870			397	397	88		60	0		292	292
			B507				2,594	2,594			65	65	88		60	0		48	48
			B510				46,035	46,035			1,151	1,151	88		60	0		847	847
			B511				115,563	115,563			2,889	2,889	88		60	0		2,126	2,126
			B512				198,941	198,941			4,974	4,974	88		60	0		3,661	3,661
			B513				12,840	12,840			321	321	88		60	0		236	236
			B514				183,120	183,120			4,578	4,578	88		60	0		3,369	3,369
			B515	620			39,689	40,309	25		992	1,018	88		60	19		730	750
	Subtotal			620			721,324	721,944	25		18,033	18,059	88		60	19		13,272	13,292
5	Canggu Tambangan	Mojokert	B619				7,801	7,801			195	195			60			144	144
			B620				7,207	7,207			180	180			60			133	133
	Subtotal						15,008	15,008			375	375			60			276	276
6	Karangpilang	Surabaya Gresik	B621			13,524		13,524		379	0	379		60			289		289
			B622			43,401		43,401		1,215	0	1,215		60			929		929
			B623			17,469		17,469		489	0	489		60			374		374
			B624			6,931		6,931		194	0	194		60			148		148
			B630			44,776		44,776		1,254	0	1,254		60			958		958
			B631			6,920		6,920		194	0	194		60			148		148
			B632			22,653		22,653		634	0	634		60			485		485
	Subtotal					155,673		155,673		4,359	0	4,359		60			3,331		3,331
7	Ngagel	Surabaya Gresik	B640	21,932	4,897			26,829	899	137	0	1,036	70	60	730	105			835
			B641	0	13,622			13,622	0	381	0	381	70	60	0	292			292
			B642	27,373	5,486			32,859	1,122	154	0	1,276	70	60	912	117			1,029
			B643	143,060	2,048			145,108	5,865	57	0	5,923	70	60	4,764	44			4,808
			B644	69,647	38			69,685	2,856	1	0	2,857	70	60	2,319	1			2,320
	Subtotal			262,012	26,091			288,103	10,743	731	0	11,473	70	60	8,725	558			9,283
8	Kayon	Surabaya	B645	19,588				19,588	803			803	70		652				652
			B646	29,215				29,215	1,198			1,198	70		973				973
	Subtotal			48,803				48,803	2,001			2,001	70		1,625				1,625
9	Pelayaran	Sidoardjo	-			2,738		2,738			77	77		60			59		59
10	Porong	Sidoardjo	-			913		913			26	26		60			20		20

Table A3-17 Estimated Pollution Load (BOD) produced in each Sub-catchment (2020 : Without Project)

No.	Name	Location	Subbasins	Population (2020)				Produced Domestic Pollution Load (2020)				Served Population(2020)			Net Domestic Pollution Load (2020)			
				Urban	Semi-urban	Rural	Total	Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)	Urban (%)	Semi-urban (%)	Rural (%)	Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)
1	Bumiayu Bridge	Malang	B000	0		42,754	42,754	0		1,240	1,240	63.6		72.8	0		897	897
			B001	62,249		36,066	98,314	3,424		1,046	4,470	63.6		72.8	2,988		757	3,745
			B020	102,556		173,340	275,896	5,641		5,027	10,667	63.6		72.8	4,923		3,639	8,562
			B021	257,234		96,079	353,314	14,148		2,786	16,934	63.6		72.8	12,348		2,017	14,365
			B022	108,017		0	108,017	5,941		0	5,941	63.6		72.8	5,185		0	5,185
	Subtotal			530,056		348,239	878,295	29,153		10,099	39,252	63.6		72.8	25,445		7,310	32,755
2	Demangan Bridge	Blitar	B142		33,602	36,017	69,619		1,109	1,044	2,153		85.5	82.8		793	716	1,509
			B150		28,888	61,318	90,206		953	1,778	2,732		85.5	82.8		682	1,220	1,901
			B153		0	36,784	36,784		0	1,067	1,067		85.5	82.8		0	732	732
	Subtotal				62,490	134,119	196,609		2,062	3,889	5,952		85.5	82.8		1,474	2,668	4,142
3	Jogbiru Bridge	Kediri	B310		39,196	97,014	136,210		1,293	2,813	4,107		81.8	80.3		941	1,956	2,897
			B311		79,749	54,286	134,036		2,632	1,574	4,206		81.8	80.3		1,914	1,095	3,009
			B312		11,083	560	11,643		366	16	382		81.8	80.3		266	11	277
			B313		16,515	0	16,515		545	0	545		81.8	80.3		396	0	396
			B314		11,524	560	12,084		380	16	397		81.8	80.3		277	11	288
			B315		48,591	31,214	79,805		1,603	905	2,509		81.8	80.3		1,166	630	1,796
			B316		5,395	3,629	9,024		178	105	283		81.8	80.3		129	73	203
			B317		4,477	140,594	145,071		148	4,077	4,225		81.8	80.3		107	2,835	2,943
	Subtotal				216,530	327,858	544,388		7,145	9,508	16,653		81.8	80.3		5,197	6,612	11,809
4	Padangan Bridge	Mojokert	B503			30,983	30,983			899	899	88.8		75.4	0		642	642
			B504			82,098	82,098			2,381	2,381	88.8		75.4	0		1,700	1,700
			B505			31,628	31,628			917	917	88.8		75.4	0		655	655
			B506			21,528	21,528			624	624	88.8		75.4	0		446	446
			B507			3,519	3,519			102	102	88.8		75.4	0		73	73
			B510			62,450	62,450			1,811	1,811	88.8		75.4	0		1,293	1,293
			B511			156,768	156,768			4,546	4,546	88.8		75.4	0		3,246	3,246
			B512			269,876	269,876			7,826	7,826	88.8		75.4	0		5,588	5,588
			B513			17,419	17,419			505	505	88.8		75.4	0		361	361
			B514			248,415	248,415			7,204	7,204	88.8		75.4	0		5,144	5,144
			B515	847		53,841	54,688	47		1,561	1,608	88.8		75.4	38		1,115	1,153
	Subtotal			847		978,523	979,370	47		28,377	28,424	88.8		75.4	38		20,261	20,300
5	Canggu Tambangan	Mojokert	B619			10,583	10,583			307	307			75.4			219	219
			B620			9,777	9,777			284	284			75.4			202	202
	Subtotal					20,360	20,360			590	590			75.4			422	422
6	Karangpilang	Surabaya Gresik	B621		19,872		19,872		656	0	656		78.2			485		485
			B622		63,773		63,773		2,104	0	2,104		78.2			1,556		1,556
			B623		25,668		25,668		847	0	847		78.2			626		626
			B624		10,184		10,184		336	0	336		78.2			248		248
			B630		65,793		65,793		2,171	0	2,171		78.2			1,605		1,605
			B631		10,168		10,168		336	0	336		78.2			248		248
			B632		33,286		33,286		1,098	0	1,098		78.2			812		812
	Subtotal				228,743		228,743		7,549	0	7,549		78.2			5,581		5,581
7	Ngagel	Surabaya Gresik	B640	28,409	6,134		34,543	1,562	202	0	1,765	65.5	72.3		1,358	154		1,511
			B641	0	17,063		17,063	0	563	0	563	65.5	72.3		0	427		427
			B642	35,457	6,871		42,328	1,950	227	0	2,177	65.5	72.3		1,695	172		1,867
			B643	185,307	2,565		187,872	10,192	85	0	10,277	65.5	72.3		8,857	64		8,921
			B644	90,214	48		90,262	4,962	2	0	4,963	65.5	72.3		4,312	1		4,313
	Subtotal			339,386	32,682		372,067	18,666	1,078	0	19,745	65.5	72.3		16,221	819		17,040
8	Kayon	Surabaya	B645	25,373			25,373	1,395			1,395	65.5			1,213			1,213
			B646	37,842			37,842	2,081			2,081	65.5			1,809			1,809
	Subtotal			63,215			63,215	3,477			3,477	65.5			3,021			3,021
9	Pelayaran	Sidoardjo	-			4,499	4,499			148	148			68.7			114	114
10	Porong	Sidoardjo	-			1,500	1,500			49	49			68.7			38	38

Table A3-18 Pollution Load (BOD) from Large and Medium Scale Industries at each Sub-catchment

No.	Name	Location	Subbasins	Output Value of Industries(1994) (million Rp./yr)				Pollution Load Unit (1994) (g/day/million Rp.)			Pollution Load from Industries(1994)				Estemated Pollution Load	
				Urban	Semi-urban	Rural	Total	Urban	Semi-urban	Rural	Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)	2020 Net (kg/day)	2020 80% (kg/day)
1	Bumiayu Bridge	Malang	B000	0		25,219	25,219	6.89		6.89	0		174	174		
			B001	102,113		21,274	123,387	6.89		6.89	704		147	850		
			B020	168,234		102,247	270,482	6.89		6.89	1,159		704	1,864		
			B021	421,970		56,674	478,644	6.89		6.89	2,907		390	3,298		
			B022	177,192		0	177,192	6.89		6.89	1,221		0	1,221		
	Subtotal			869,510		205,415	1,074,924				5,991		1,415	7,406	17,775	14,220
2	Demangan Bridge	Blitar	B142		77,762	18,167	95,929		6.89	6.89		536	125	661		
			B150		66,851	30,929	97,781		6.89	6.89		461	213	674		
			B153		0	18,554	18,554		6.89	6.89		0	128	128		
	Subtotal				144,613	67,650	212,263					996	466	1,462	3,510	2,808
3	Jogbiru Bridge	Kediri	B310		105,931	30,759	136,689		6.89	6.89		730	212	942		
			B311		215,531	17,212	232,743		6.89	6.89		1,485	119	1,604		
			B312		29,954	178	30,132		6.89	6.89		206	1	208		
			B313		44,634	0	44,634		6.89	6.89		308	0	308		
			B314		31,144	178	31,322		6.89	6.89		215	1	216		
			B315		131,322	9,897	141,219		6.89	6.89		905	68	973		
			B316		14,580	1,151	15,731		6.89	6.89		100	8	108		
			B317		12,101	44,576	56,676		6.89	6.89		83	307	391		
	Subtotal				585,197	103,948	689,146					4,032	716	4,748	4,748	3,799
4	Padangan Bridge	Mojokert	B503			8,192	8,192			6.89			56	56		
			B504			21,707	21,707			6.89			150	150		
			B505			8,363	8,363			6.89			58	58		
			B506			5,692	5,692			6.89			39	39		
			B507			930	930			6.89			6	6		
			B510			16,512	16,512			6.89			114	114		
			B511			41,451	41,451			6.89			286	286		
			B512			71,357	71,357			6.89			492	492		
			B513			4,606	4,606			6.89			32	32		
			B514			65,683	65,683			6.89			453	453		
			B515	1,629		14,236	15,865	6.89		6.89	11		98	109		
	Subtotal			1,629		258,729	260,358				11		1,783	1,794	4,843	3,875
5	Canggu Tambangan	Mojokert	B619			2,798	2,798			6.89			19	19		
			B620			2,585	2,585			6.89			18	18		
	Subtotal					5,383	5,383						37	37	100	80
6	Karangpilang	Surabaya	B621		119,023		119,023		6.89	6.89		820		820		
			B622		381,965		381,965		6.89	6.89		2,632		2,632		
			B623		153,738		153,738		6.89	6.89		1,059		1,059		
			B624		60,999		60,999		6.89	6.89		420		420		
			B630		394,066		394,066		6.89	6.89		2,715		2,715		
			B631		60,900		60,900		6.89	6.89		420		420		
			B632		199,364		199,364		6.89	6.89		1,374		1,374		
	Subtotal				1,370,056		1,370,056					9,440		9,440	41,535	33,228
7	Ngagel	Surabaya	B640	42,669	63,578		106,248	6.89	6.89	6.89	294	438		732		
			B641	0	176,849		176,849	6.89	6.89	6.89	0	1,218		1,218		
			B642	53,255	71,216		124,471	6.89	6.89	6.89	367	491		858		
			B643	278,328	26,582		304,910	6.89	6.89	6.89	1,918	183		2,101		
			B644	135,500	496		135,995	6.89	6.89	6.89	934	3		937		
	Subtotal			509,752	338,720		848,472				3,512	2,334		5,846	27,476	21,981
8	Kayon	Surabaya	B645	38,109			38,109	6.89			263			263		
			B646	56,838			56,838	6.89			392			392		
	Subtotal			94,947			94,947				654			654	3,075	2,460
9	Pelayaran	Sidoardjo	-		14,878		14,878		6.89			103		103	205	164
10	Porong	Sidoardjo	-		4,959		4,959		6.89			34		34	681	55

Table A3-19 Pollution Load (BOD) from Small Scale Industries at each Sub-catchment

No.	Name	Location	Subbasins	Output Value of Industries(1994) (million Rp./yr)				Pollution Load Unit (g/day/million Rp.)			Pollution Load from Industries(1994) (kg/day)				Estimated Pollution Load	
				Urban	Semi-urban	Rural	Total	Urban	Semi-urban	Rural	Urban	Semi-urban	Rural	Total	2020 Net (kg/day)	2020 80% (kg/day)
1	Bumiayu Bridge	Malang	B000	0		5,355	5,355	6.89		6.89	0		37	37		
			B001	19,249		4,517	23,766	6.89		6.89	133		31	164		
			B020	31,713		21,711	53,424	6.89		6.89	219		150	368		
			B021	79,544		12,034	91,578	6.89		6.89	548		83	631		
			B022	33,402		0	33,402	6.89		6.89	230		0	230		
	Subtotal			163,907		43,617	207,524				1,129		301	1,430	3,432	2,745
2	Demangan Bridge	Blitar	B142		12,330	3,857	16,187		6.89	6.89		85	27	112		
			B150		10,600	6,567	17,167		6.89	6.89		73	45	118		
			B153		0	3,940	3,940		6.89	6.89		0	27	27		
	Subtotal				22,930	14,364	37,294					158	99	257	617	493
3	Jogbiru Bridge	Kediri	B310		16,796	6,531	23,328		6.89	6.89		116	45	161		
			B311		34,175	3,655	37,829		6.89	6.89		235	25	261		
			B312		4,750	38	4,787		6.89	6.89		33	0	33		
			B313		7,077	0	7,077		6.89	6.89		49	0	49		
			B314		4,938	38	4,976		6.89	6.89		34	0	34		
			B315		20,823	2,101	22,924		6.89	6.89		143	14	158		
			B316		2,312	244	2,556		6.89	6.89		16	2	18		
			B317		1,919	9,465	11,384		6.89	6.89		13	65	78		
	Subtotal				92,789	22,072	114,861					639	152	791	791	633
4	Padangan Bridge	Mojokert	B503			1,739	1,739			6.89			12	12		
			B504			4,609	4,609			6.89			32	32		
			B505			1,776	1,776			6.89			12	12		
			B506			1,209	1,209			6.89			8	8		
			B507			198	198			6.89			1	1		
			B510			3,506	3,506			6.89			24	24		
			B511			8,801	8,801			6.89			61	61		
			B512			15,152	15,152			6.89			104	104		
			B513			978	978			6.89			7	7		
			B514			13,947	13,947			6.89			96	96		
			B515	307		3,023	3,330	6.89		6.89	2		21	23		
	Subtotal			307		54,937	55,244				2		379	381	1,028	822
5	Canggu Tambangan	Mojokert	B619			594	594			6.89			4	4		
			B620			549	549			6.89			4	4		
	Subtotal					1,143	1,143						8	8	21	17
6	Karangpilang	Surabaya Gresik	B621		18,872		18,872		6.89	6.89		130		130		
			B622		60,565		60,565		6.89	6.89		417		417		
			B623		24,377		24,377		6.89	6.89		168		168		
			B624		9,672		9,672		6.89	6.89		67		67		
			B630		62,483		62,483		6.89	6.89		431		431		
			B631		9,656		9,656		6.89	6.89		67		67		
			B632		31,611		31,611		6.89	6.89		218		218		
	Subtotal				217,237		217,237					1,497		1,497	6,586	5,269
7	Ngagel	Surabaya Gresik	B640	8,043	10,081		18,124	6.89	6.89	6.89	55	69		125		
			B641	0	28,041		28,041	6.89	6.89	6.89	0	193		193		
			B642	10,039	11,292		21,331	6.89	6.89	6.89	69	78		147		
			B643	52,466	4,215		56,681	6.89	6.89	6.89	361	29		391		
			B644	25,542	79		25,621	6.89	6.89	6.89	176	1		177		
	Subtotal			96,091	53,708		149,799				662	370		1,032	4,851	3,881
8	Kayon	Surabaya	B645	7,184			7,184	6.89			49			49		
			B646	10,714			10,714	6.89			74			74		
	Subtotal			17,898			17,898				123			123	580	464
9	Pelayaran	Sidoardjo	-		2,359		2,359		6.89			16		16	33	26
10	Porong	Sidoardjo	-		786		786		6.89			5		5	11	9

Table A3-20 Estimated Population with On Site Sanitation Facilities including Shared and Public Facilities

Unit : thousand

Area	Served Pop. 1994(%)	Population 1994	Served Pop. 1994	Targets 1998(%)	Population 1998	Served Pop. 1998	Increase in Number 94-'98	per year	in 26 years	Population 2020	Served Population 2020	(%)
(Regency)												
Sidoarjo	60	1,079	648	65	1,165	757	110	22	571	1,774	1,218	68.7
Mojokerto	60	818	491	65	858	558	66	13	346	1,110	837	75.4
Malang	55	2,232	1,227	60	2,317	1,390	163	33	846	2,846	2,073	72.8
Blitar	60	1,060	636	65	1,075	699	63	13	327	1,164	963	82.8
Kediri	60	1,316	789	65	1,350	877	88	18	457	1,553	1,246	80.3
Nganjuk	84	958	805	86	987	848	44	9	228	1,160	1,033	89.0
Jombang	35	1,065	373	40	1,107	443	70	14	363	1,365	736	53.9
Tulungagung	73	917	670	75	940	705	36	7	185	1,077	855	79.3
Trenggalek	71	641	455	75	661	496	41	8	211	783	667	85.2
Gresik	60	869	521	65	899	585	63	13	329	1,088	851	78.2
Pasuruan	60	1,140	684	65	1,180	767	83	17	432	1,415	1,116	78.9
Average	60.3	1,100	664	64.8	1,140	739	75	15	390	1,394	1,054	75.6
Subtotal	-	12,095	7,299	-	12,539	8,125	826	165	4,295	15,337	11,594	-
(Municipality)												
Surabaya	70	2,294	1,606	70	2,387	1,671	65	13	339	2,972	1,945	65.5
Mojokerto	88	102	90	90	107	96	7	1	34	140	124	88.8
Malang	55	700	385	60	758	455	70	14	364	1,177	749	63.6
Kediri	61	233	142	65	233	151	9	2	48	233	190	81.8
Blitar	84	119	100	85	122	103	4	1	19	139	119	85.5
Average	67.4	690	464	68.7	721	495	31	6	161	932	625	67.1
Subtotal	-	3,448	2,322	-	3,607	2,477	155	31	804	4,660	3,127	-
Grand Total	61.9	15,543	9,621	65.7	16,145	10,602	981	196	5,100	19,997	14,721	73.6

Note : Targets were set up based on REPELITA VI

Table A3-21 (1) Estimated Pollution Load (BOD) produced in each Sub-catchment (2020 : Case-1)

No.	Name	Location	Subbasins	Population (2020)				Served Population(2020)							Domestic Pollution Load (2020)			
				Urban	Semi-urban	Rural	Total	Urban (%)			Semi-urban (%)			Rural (%)	Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)
								Sewerage	Jokaso	Sanitation	Sewerage	Jokaso	Sanitation					
1	Bumiayu Bridge	Malang	B000	0		42,754	42,754			63.6				72.8	0		897	897
			B001	62,249		36,066	98,314	100		0				72.8	0		757	757
			B020	102,556		173,340	275,896			63.6				72.8	2,870		3,639	6,509
			B021	257,234		96,079	353,314			63.6				72.8	7,198		2,017	9,215
			B022	108,017		0	108,017	100		63.6				72.8	3,023		0	3,023
	Subtotal			530,056		348,239	878,295	32.1	0.0	56.1					13,091		7,310	20,401
2	Demangan Bridge	Blitar	B142		33,602	36,017	69,619				5.0		80.5	82.8		595	716	1,312
			B150		28,888	61,318	90,206				5.0		80.5	82.8		512	1,220	1,731
			B153		0	36,784	36,784							82.8		0	732	732
	Subtotal				62,490	134,119	196,609				5.0	0	80.5			1,107	2,668	3,775
3	Jogbiru Bridge	Kediri	B310		39,196	97,014	136,210						81.8	80.3		705	1,956	2,662
			B311		79,749	54,286	134,036						81.8	80.3		1,435	1,095	2,530
			B312		11,083	560	11,643						81.8	80.3		199	11	211
			B313		16,515	0	16,515							80.3		297	0	297
			B314		11,524	560	12,084				100			80.3		0	11	11
			B315		48,591	31,214	79,805						81.8	80.3		874	630	1,504
			B316		5,395	3,629	9,024						81.8	80.3		97	73	170
			B317		4,477	140,594	145,071						81.8	80.3		81	2,835	2,916
	Subtotal				216,530	327,858	544,388				5.3	0	77.4			3,689	6,612	10,301
4	Padangan Bridge	Mojokert	B503			30,983	30,983							75.4			942	642
			B504			82,098	82,098							75.4			1,700	1,700
			B505			31,628	31,628							75.4			655	655
			B506			21,528	21,528							75.4			446	446
			B507			3,519	3,519							75.4			73	73
			B510			62,450	62,450							75.4			1,293	1,293
			B511			156,768	156,768							75.4			3,246	3,246
			B512			269,876	269,876							75.4			5,588	5,588
			B513			17,419	17,419							75.4			361	361
			B514			248,415	248,415							75.4			5,144	5,144
			B515	847		53,841	54,688	100	0	0				75.4	0		1,115	1,115
	Subtotal			847		978,523	979,370	100	0	0					0		20,261	20,261
5	Canggu Tambangan	Mojokert	B619			10,583	10,583							75.4			219	219
			B620			9,777	9,777							75.4			202	202
	Subtotal					20,360	20,360										422	422
6	Karangpilang	Surabaya Gresik	B621		19,872		19,872							78.2		342		342
			B622		63,773		63,773							78.2		1,097		1,097
			B623		25,668		25,668							78.2		442		442
			B624		10,184		10,184							78.2		175		175
			B630		65,793		65,793							78.2		1,132		1,132
			B631		10,168		10,168							78.2		175		175
			B632		33,286		33,286							78.2		573		573
	Subtotal				228,743		228,743					0	0	78.2		3,935		3,935
7	Ngagel	Surabaya Gresik	B640	28,409	6,134		34,543			66.1				72.3	826	98		924
			B641	0	17,063		17,063			66.1				72.3	0	271		271
			B642	35,457	6,871		42,328			66.1				72.3	1,031	109		1,141
			B643	185,307	2,565		187,872			66.1				72.3	5,389	41		5,430
			B644	90,214	48		90,262			66.1				72.3	2,624	1		2,625
	Subtotal			339,386	32,682		372,067	0	0	66.1	0	0	72.3		9,871	520		10,391
8	Kayon	Surabaya	B645	25,373			25,373	100							0			0
			B646	37,842			37,842	100							0			0
	Subtotal			63,215			63,215	100							0			0
9	Pelayaran	Sidoardjo	-			4,499	4,499							68.7			68	68
10	Porong	Sidoardjo	-			1,500	1,500							68.7			23	23

Table A3-21 (2) Estimated Pollution Load (BOD) produced in each Sub-catchment (2020 : Case-II)

No.	Name	Location	Subbasins	Population (2020)				Served Population(2020)								Domestic Pollution Load (2020)			
								Urban (%)			Semi-urban (%)			Rural (%)					
				Urban	Semi-urban	Rural	Total	Sewerage	Jokaso	Sanitation	Sewerage	Jokaso	Sanitation			Urban (kg/day)	Semi-urban (kg/day)	Rural (kg/day)	Total (kg/day)
1	Bumiayu Bridge	Malang	B000	0		42,754	42,754			63.6					72.8	0		897	897
			B001	62,249		36,066	98,314	100		0					72.8	2,870		757	757
			B020	102,556		173,340	275,896			63.6					72.8	7,198		3,639	6,509
			B021	257,234		96,079	353,314			63.6					72.8	3,023		2,017	9,215
			B022	108,017		0	108,017	100		63.6					72.8	3,023		0	3,023
	Subtotal			530,056		348,239	878,295	32.1	0	56.1						13,091		7,310	20,401
2	Demangan Bridge	Blitar	B142		33,602	36,017	69,619				5.0		80.5	82.8			595	716	1,312
			B150		28,888	61,318	90,206				5.0		80.5	82.8			512	1,220	1,731
			B153		0	36,784	36,784							82.8			0	732	732
	Subtotal				62,490	134,119	196,609				5.0	0	80.5				1,107	2,668	3,775
3	Jogbiru Bridge	Kediri	B310		39,196	97,014	136,210						81.8	80.3			705	1,956	2,662
			B311		79,749	54,286	134,036						81.8	80.3			1,435	1,095	2,530
			B312		11,083	560	11,643						81.8	80.3			199	11	211
			B313		16,515	0	16,515						81.8	80.3			297	0	297
			B314		11,524	560	12,084				100			80.3			0	11	11
			B315		48,591	31,214	79,805						81.8	80.3			874	630	1,504
			B316		5,395	3,629	9,024						81.8	80.3			97	73	170
			B317		4,477	140,594	145,071						81.8	80.3			81	2,835	2,916
	Subtotal				216,530	327,858	544,388				5.3	0	77.4				3,689	6,612	10,301
4	Padangan Bridge	Mojokert	B503			30,983	30,983							75.4				642	642
			B504			82,098	82,098							75.4				1,700	1,700
			B505			31,628	31,628							75.4				655	655
			B506			21,528	21,528							75.4				446	446
			B507			3,519	3,519							75.4				73	73
			B510			62,450	62,450							75.4				1,293	1,293
			B511			156,768	156,768							75.4				3,246	3,246
			B512			269,876	269,876							75.4				5,588	5,588
			B513			17,419	17,419							75.4				361	361
			B514			248,415	248,415							75.4				5,144	5,144
			B515	847		53,841	54,688	100	0	0						0		1,115	1,115
	Subtotal			847		978,523	979,370	100	0	0						0		20,261	20,261
5	Canggu Tambangan	Mojokert	B619			10,583	10,583							75.4				219	219
			B620			9,777	9,777							75.4				202	202
	Subtotal					20,360	20,360											422	422
6	Karangpilang	Surabaya Gresik	B621		19,872		19,872						78.2				342		342
			B622		63,773		63,773						78.2				1,097		1,097
			B623		25,668		25,668				50.0		78.2				442		442
			B624		10,184		10,184						78.2				175		175
			B630		65,793		65,793						78.2				1,132		1,132
			B631		10,168		10,168				100		0				0		0
			B632		33,286		33,286				100		0				0		0
	Subtotal				228,743		228,743				24.6	0	63.3				3,188		3,188
7	Ngagel	Surabaya Gresik	B640	28,409	6,134		34,543			66.1			72.3			826	98		924
			B641	0	17,063		17,063			66.1			72.3			0	271		271
			B642	35,457	6,871		42,328			66.1			72.3			1,031	109		1,141
			B643	185,307	2,565		187,872			66.1			72.3			5,389	41		5,430
			B644	90,214	48		90,262			66.1			72.3			2,624	1		2,625
	Subtotal			339,386	32,682		372,067	0	0	66.1	0	0	72.3			9,871	520		10,391
8	Kayon	Surabaya	B645	25,373			25,373	100								0			0
			B646	37,842			37,842	100								0			0
	Subtotal			63,215			63,215	100								0			0
9	Pelayaran	Sidoardjo	-			4,499	4,499						68.7				68		68
10	Porong	Sidoardjo	-			1,500	1,500						68.7				23		23

Table A3-21 (3) Estimated Pollution Load (BOD) produced in each Sub-catchment (2020 : Case-III)

No.	Name	Location	Subbasins	Population (2020)				Served Population(2020)							Domestic Pollution Load (2020)			
				Urban	Semi-urban	Rural	Total	Urban (%)			Semi-urban (%)			Rural(%)	Urban	Semi-urban	Rural	Total
								Sewerage	Jokaso	Sanitation	Sewerage	Jokaso	Sanitation	Sanitation	(kg/day)	(kg/day)	(kg/day)	(kg/day)
1	Bumiayu Bridge	Malang	B000	0		42,754	42,754		48.6	15.0				72.8	0		897	897
			B001	62,249		36,066	98,314	100	0	0				72.8	0		757	757
			B020	102,556		173,340	275,896		48.6	15.0				72.8	1,225		3,639	4,864
			B021	257,234		96,079	353,314		48.6	15.0				72.8	3,073		2,017	5,090
			B022	108,017		0	108,017	100	0	0				72.8	0		0	0
	Subtotal			530,056		348,239	878,295	32.1	33.0	10.2				72.8	4,298		7,310	11,608
2	Demangan Bridge	Blitar	B142			33,602	36,017				5.0	15.9	64.6	82.8		513	716	1,229
			B150			28,888	61,318				5.0	15.9	64.6	82.8		441	1,220	1,661
			B153			0	36,784							82.8		0	732	732
	Subtotal					62,490	134,119				5.0	15.9	64.6	82.8		954	2,668	3,622
3	Jogbiru Bridge	Kediri	B310			39,196	97,014					25.0	56.8	80.3		554	1,956	2,511
			B311			79,749	54,286					25.0	56.8	80.3		1,128	1,095	2,223
			B312			11,083	560					25.0	56.8	80.3		157	11	168
			B313			16,515	0					25.0	56.8	80.3		234	0	234
			B314			11,524	560				100			80.3		0	11	11
			B315			48,591	31,214					25.0	56.8	80.3		687	630	1,317
			B316			5,395	3,629					25.0	56.8	80.3		76	73	150
			B317			4,477	140,594					25.0	56.8	80.3		63	2,835	2,899
	Subtotal					216,530	327,858				5.3	23.7	53.8	80.3		2,900	6,612	9,512
4	Padangan Bridge	Mojokert	B503				30,983							75.4			642	642
			B504				82,098							75.4			1,700	1,700
			B505				31,628							75.4			655	655
			B506				21,528							75.4			446	446
			B507				3,519							75.4			73	73
			B510				62,450							75.4			1,293	1,293
			B511				156,768							75.4			3,246	3,246
			B512				269,876							75.4			5,588	5,588
			B513				17,419							75.4			361	361
			B514				248,415							75.4			5,144	5,144
			B515	847			53,841	100	0	0				75.4	0		1,115	1,115
	Subtotal			847			978,523	100	0	0				75.4	0		20,261	20,261
5	Canggu Tambangan	Mojokert	B619				10,583							75.4			219	219
			B620				9,777							75.4			202	202
	Subtotal						20,360							75.4			422	422
6	Karangpilang	Surabaya Gresik	B621			19,872						30.3	47.9			249		249
			B622			63,773						30.3	47.9			800		800
			B623			25,668					50.0	30.3	47.9			322		322
			B624			10,184						30.3	47.9			128		128
			B630			65,793						30.3	47.9			825		825
			B631			10,168					100	0	0			0		0
			B632			33,286					100	0	0			0		0
	Subtotal					228,743					24.6	24.5	38.8			2,323		2,323
7	Ngagel	Surabaya Gresik	B640	28,409	6,134		34,543		17.4	48.1		38.6	33.7		656	61		717
			B641	0	17,063		17,063		17.4	48.1		38.6	33.7		0	170		170
			B642	35,457	6,871		42,328		17.4	48.1		38.6	33.7		818	68		887
			B643	185,307	2,565		187,872		17.4	48.1		38.6	33.7		4,277	26		4,302
			B644	90,214	48		90,262		17.4	48.1		38.6	33.7		2,082	0		2,082
	Subtotal			339,386	32,682		372,067	0	17.4	48.1	0	38.6	33.7		7,832	326		8,158
8	Kayon	Surabaya	B645	25,373			25,373	100							0			0
			B646	37,842			37,842	100							0			0
	Subtotal			63,215			63,215	100	0	0					0			0
9	Pelayaran	Sidoardjo	-			4,499	4,499					46.8	21.9			36		36
10	Porong	Sidoardjo	-			1,500	1,500					46.8	21.9			12		12

Table A3-22 Demarcation of Responsibilities on Water Quality Management in the Brantas River Basin

Management activities	Actions required		Responsible agencies	Implementation agencies
Overall plan, program and coordination	Establishment of "Water Quality Management Plan"	planning, programming	BWMC (PJT)	PJT/BBLH
	Coordination and instruction to related agencies	Coordinating	BWMC (PJT)	PJT/BBLH
Water quality monitoring	Monitoring of river water	O&M of WQMPCS	PJT	PJT
		O&M of automatic water quality monitoring systems	PJT	PJT
	Monitoring of river bed sediment	Sampling and analysis of river bed sediment	PJT	PJT
	Pollution sources inspection	Monitoring of domestic waste water (Business activities)	PJT	PJT/DKES
		Monitoring of domestic waste water (Dwellings)	PJT	PJT/DPU Cipta Karya
		Monitoring of industrial waste water	PJT	PJT/DPRIND
		Monitoring of agricultural waste water (livestock houses)	PJT	PJT/DPERTA
		Monitoring of other sources	PJT	PJT/DKES
	Preparation of inventory	Inventory survey	PJT	PJT
Domestic pollution control	On-site treatment facility (including semi-off-site treatment facility)	Combined type private sewage treatment facility	DPU Cipta Karya	Local government, etc.
		Sanitation facility (Septic tank, etc.)	DPU Cipta Karya	Local government
		Other methods (soil trench, etc.)	DPU Cipta Karya	Local government
	Off-site treatment facility	Sewerage systems (conventional, small-bore or shallow systems)	DPU Cipta Karya	Local government, etc.
Industrial pollution control	On-site treatment facility	Physical, chemical or biological treatment facilities	DPRIND	DPRIND
	Off-site treatment facility	Centralized treatment facility for industrial zone	DPRIND	DPRIND
		Centralized treatment facility for small scale industries	DPRIND	DPRIND
		Centralized treatment facility for densely industrialized zone	DPRIND	DPRIND
Agricultural pollution control	Waste water treatment (livestock houses)	Physical, chemical or biological treatment system	DPERTA	DPETEMA
	Agricultural chemicals uses control	Fertilizer and pesticides control	DPERTA	DPERTA
	Improvement of farming practices	Terracing, contouring, buffer strip cropping and mulching, etc.	DPERTA	DPEKEBU
Other pollution control	Sludge and septage management	Collection, treatment and disposal systems	DKES	Local government, etc.
	Solid waste (garbage) management	Collection, treatment and disposal systems	DKES	Local government, etc.
	Watershed management	Soil erosion control (afforestation, sediment control dam, etc.)	BRLKT	BRLKT
Direct purification	River maintenance flow	Optimum water allocation	PJT	PJT
		Water resource development	PJT	PJT
	Dredging or clearing	Dredging of rivers, clearing of ditches	PJT	PJT
	Utilization of Self-purification function	Soil treatment, plant treatment, etc.	PJT	PJT
Supporting activities	Assistance systems	Management of subsidy, loan and bounty	PJT	PJT/DPRIND
	License system	Issue or suspension of license for waste water discharge	PJT as a secretary	PJT/DPRIND
	Encouragement of environmental engineering industries	Technology development, financial assistance	MIT, DPRIND	BPPT, BPPI
	Human resource development	Analysts, environmental planner or engineer	BAPEDAL	EMC, BBLH
	Community participation	Promotion of campaign, financial assistance	PJT, BBLH	PJT, BBLH
	Environmental education	Promotion of campaign	BBLH	BBLH
Research and development	Pollution load identification	Simulation methods, magnitude of each pollution sources	PJT	PJT
	Domestic waste water treatment methods	Adequate treatment methods	DPU Cipta Karya	DPU Cipta Karya
	Industrial waste water treatment methods	Adequate treatment methods, cleaner production technology	MIT, DPRIND	BBPT, BPPI
	Direct purification methods	Soil treatment, plant treatment and other adequate methods	PJT	PJT
	Monitoring methods	Monitoring by aquatic life in the rivers	BBLH	BBLH
Legislation and/or Regulation	Enactment of related law and/or regulation	Water quality management, sewerage, etc.	BBLH as a secretary	BBLH
		Stringent of regulation or standards	BBLH as a secretary	BBLH

Table A3-23 Required Projects on Water Quality Management in the Brantas River Basin

Management activities	Actions (projects) required		Priority	Remarks
Overall plan, program and coordination	Establishment of Water Quality Management system		Urgent	
	Institutional development of PJT	Establishment of Water Quality Management Department in PJT	Urgent	
		Enhancement of existing laboratory	Urgent	Partly commencement
		Foundation of new laboratory in Malang	Medium	
Water quality monitoring	Monitoring of river water	Establishment new system of river water	Urgent	
		Sampling and analysis of harmful components	High	
		Installation of automatic water quality monitoring system	High	
	Monitoring of river bed sediment	Sampling and analysis of river bed sediment	Medium	
	Pollution sources inspection (monitoring)	Domestic waste water (Business activities)	High	
		Domestic waste water (Dwellings)	Medium	Partly commencement
		Industrial waste water (major producers)	Urgent	Already commencement
		Industrial waste water (remaining industries)	High	
		Industrial waste water (small scale industries)	High	
		Industrial waste water (harmful components)	High	
		Agricultural waste water (livestock houses)	Urgent	Partly commencement
		Other sources	Low	Partly commencement
	Preparation of inventory	Inventory survey	High	
Domestic pollution control	On-site treatment facilities	CTPSTS (Surabaya)	Urgent	As a model project
		CTPSTS (Malang)	Urgent	ditto
		CTPSTS (Crucial facilities in other cities)	Urgent	ditto
		CTPSTS (Others)	High-low	
	Sanitation facilities	Sanitation facilities (Septic tank, imhoff tank), Surabaya	High	Partly commencement
		Sanitation facilities (Septic tank, imhoff tank), Malang	High	ditto
		Sanitation facilities (Septic tank, imhoff tank), Others	Medium-low	ditto
	Off-site treatment facilities	Sewerage system (Surabaya, SSDP)	Urgent	Partly commencement
		Sewerage system (Malang)	Urgent	
		Sewerage systems (Other cities)	Medium-low	
Industrial pollution control	On-site treatment facilities	Waste water treatment facilities for major producers	Urgent	Partly commencement
		Waste water treatment facilities for remaining large and medium scale industrie	High	
		Waste water treatment facilities for small scale industries	Medium-low	
	Off-site treatment facility	Centralized treatment facility for hot zone	Urgent	
		Centralized treatment facilities for small scale industries	Medium	
		Centralized treatment facilities for industrial parks	-	Already commencement
Agricultural pollution control	Waste water treatment (livestock houses)	Waste water treatment facilities for major producers	Urgent	Partly commencement
		Waste water treatment facilities for remaining livestock houses	High-low	
	Agricultural chemicals uses control	Preparation of guidelines	High	
	Improvement of farming practices	Technical approaches	Medium-low	As a watershed management
		Vegetative approaches	Medium-low	ditto
Other pollution control	Solid waste (garbage) management	Domestic solid waste collection, treatment and disposal systems	High	Partly commencement
		Industrial solid waste collection, treatment and disposal systems	High	
	Septage and sludge management	Septage collection, treatment and disposal systems	High	Partly commencement
		Sludge collection and disposal systems	High	
	Watershed management	Soil erosion control (afforestation, sediment control dam, etc.)	High-low	As a watershed management
Direct purification	River maintenance flow	Optimum water allocation	High	
		Water resource development	-	Already commencement
	Dredging or cleaning	Dredging of rivers, clearing of ditches	High-low	As a river facilities management
	Utilization of Self-purification function	Soil treatment, plant treatment, etc.	Low	
Supporting activities	Assistance systems	Establishment of subsidy, low-interest loan and bounty	High	
	License system	Issue or suspension of license for waste water discharge	-	Already commencement
	Encouragement of environmental engineering indust	Technology development, financial assistance, tax privilege	High-low	Partly commencement
	Human resource development	Analysts, environmental planner or engineer	Urgent	
	Community participation	Promotion of campaign, financial assistance	High-low	Partly commencement
	Environmental education	Promotion of campaign	High	ditto
Research and development	Pollution load identification	Simulation methods, magnitude of each pollution sources	High	Already commencement
	Domestic waste water treatment methods	Adequate treatment methods	High	ditto
	Industrial waste water treatment methods	Adequate treatment methods, clenner production technology	High	ditto
	Direct purification methods	Soil treatment, plant treatment and other adequate methods	High	Partly commencement
	Monitoring methods	Monitoring by aquatic life in the rivers	Low	
Legislation and/or Regulation	Enactment of related law and/or regulation	Water quality management, sewerage, etc.	Urgent	Partly commencement
		Stringent of regulation or standards	High	Partly commencement

Table A3-24 (1) Implementation Schedule of Water Quality Monitoring

Actions (projects) required		Investment cost	1999	2000		2005		2010		2015		2020
Monitoring of river water	Establishment of new laboratory in PJT											
	(Establishment new monitoring system)	*1 4,500	500	500	3,500							
	Sampling and analysis of harmful components	Included in *1										
	Monitoring by automatic water quality monitoring system	Installed by Wonorejo Dam Project										
Monitoring of river bed sediment	Sampling and analysis of river bed sediment	Included in *1										
Pollution sources inspection (monitoring)	Domestic waste water (business activities)	Included in *1										
	Domestic waste water (dwellings)	Included in *1										
	Industrial waste water (major producers)	Included in *1										
	Industrial waste water (remaining industries)	Included in *1										
	Industrial waste water (small scale industries)	Included in *1										
	Industrial waste water (harmful components)	Included in *1										
	Agricultural waste water (livestock houses)	Included in *1										
	Other sources	Included in *1										
Preparation of inventory	Inventory survey	-										

Note : Figures in this table are constant values as of 1996 (unit : million Rp.)

Project implementation

Mnonitoring

Table A3-24 (2) Implementation Schedule of Domestic Waste Water Treatment

Actions (projects) required		Investment cost	1999	2000		2005		2010		2015		2020
On-site treatment facilities	CTPSTS (Surabaya)	100,000	4,500	4,500	18,000	4,500	18,000	4,500	18,000	4,500	18,000	5,500
	CTPSTS (Malang)	50,000			20,000	5,000	20,000	5,000	20,000	5,000	20,000	5,000
	CTPSTS (Crucial facilities in other cities)	30,000			12,000	3,000	12,000	3,000	12,000	3,000	12,000	3,000
	CTPSTS (Others)	20,000					5,200	1,300	5,200	1,300	5,200	1,800
Sanitation facilities	Septic tank, imhoff tank (Surabaya)	100,000	4,500	4,500	18,000	4,500	18,000	4,500	18,000	4,500	18,000	5,500
	Septic tank, imhoff tank (Malang)	100,000	4,500	4,500	18,000	4,500	18,000	4,500	18,000	4,500	18,000	5,500
	Septic tank, imhoff tank (Others citise)	300,000					80,000	20,000	80,000	20,000	80,000	20,000
Off-site treatment facilities	Sewerage system (Surabaya)	200,000	8,000	8,000	32,000	8,000	32,000	10,000	40,000	10,000	40,000	12,000
	Sewerage system (Malang)	100,000			16,000	4,000	16,000	4,000	24,000	6,000	24,000	6,000
	Sewerage systems (Other cities)	50,000							16,000	4,000	22,000	8,000

Note : Figures in this table are constant values as of 1996 (unit : million Rp.)
CTPSTS : Combined Type Private Sewage Treatment System

Table A3-24 (3) Implementation Schedule of Industrial Waste Water Treatment

Actions (projects) required		Investment cost	1999	2000		2005		2010		2015		2020
On-site treatment facilities	Waste water treatment facilities for major producers	1,000,000	45,000	45,000	180,000	45,000	180,000	45,000	180,000	45,000	180,000	55,000
	Waste water treatment facilities for remaining large and medium scale industries	400,000					100,000	25,000	100,000	25,000	100,000	50,000
	Waste water treatment facilities for small scale industries	80,000							32,000	8,000	32,000	8,000
Off-site treatment facility	Centralized treatment facility for hot zone	800,000			140,000	35,000	140,000	35,000	180,000	45,000	180,000	45,000
	Centralized treatment facilities for small scale industries	80,000							32,000	8,000	32,000	8,000
	Centralized treatment facilities for industrial parks	Alredy commenced										

Note : Figures in this table are constant values as of 1996.

Table A3-24 (4) Implementation Schedule of Agricultural Waste Water Treatment

Actions (projects) required		Investment cost	1999	2000		2005		2010		2015		2020
Waste water treatment (livestock houses)	Waste water treatment facilities for major producers	100,000	4,500	4,500	18,000	4,500	18,000	4,500	18,000	4,500	18,000	5,500
	Waste water treatment facilities for remaining livestock houses	60,000					16,000	4,000	16,000	4,000	16,000	16,000
Agricultural chemicals uses control	Preparation of guidelines	-										
Improvement of farming practices	Technical approaches	Included in water-shed management										
	Vegetative approaches	Included in water-shed management										

Note : Figures in this table are constant values as of 1996 (unit : million Rp.).

Table A3-24 (5) Implementation Schedule of Solid Waste and Septage Management

Actions (projects) required		Investment cost	1999	2000		2005		2010		2015		2020
Solid waste (garbage) management	Domestic and industrial waste collection, treatment and disposal systems	111,000	2,000	2,000	12,000	3,000	24,000	6,000	24,000	6,000	24,000	8,000
Septage and sludge management	Septage and sludge collection, treatment and disposal systems	222,000	4,000	4,000	24,000	6,000	48,000	12,000	48,000	12,000	48,000	16,000
Watershed management	Soil erosion control (afforestation, sediment control dam, etc.)	Included in watershed management										

Note : Figures in this table are constant values as of 1996 (unit : million Rp.).

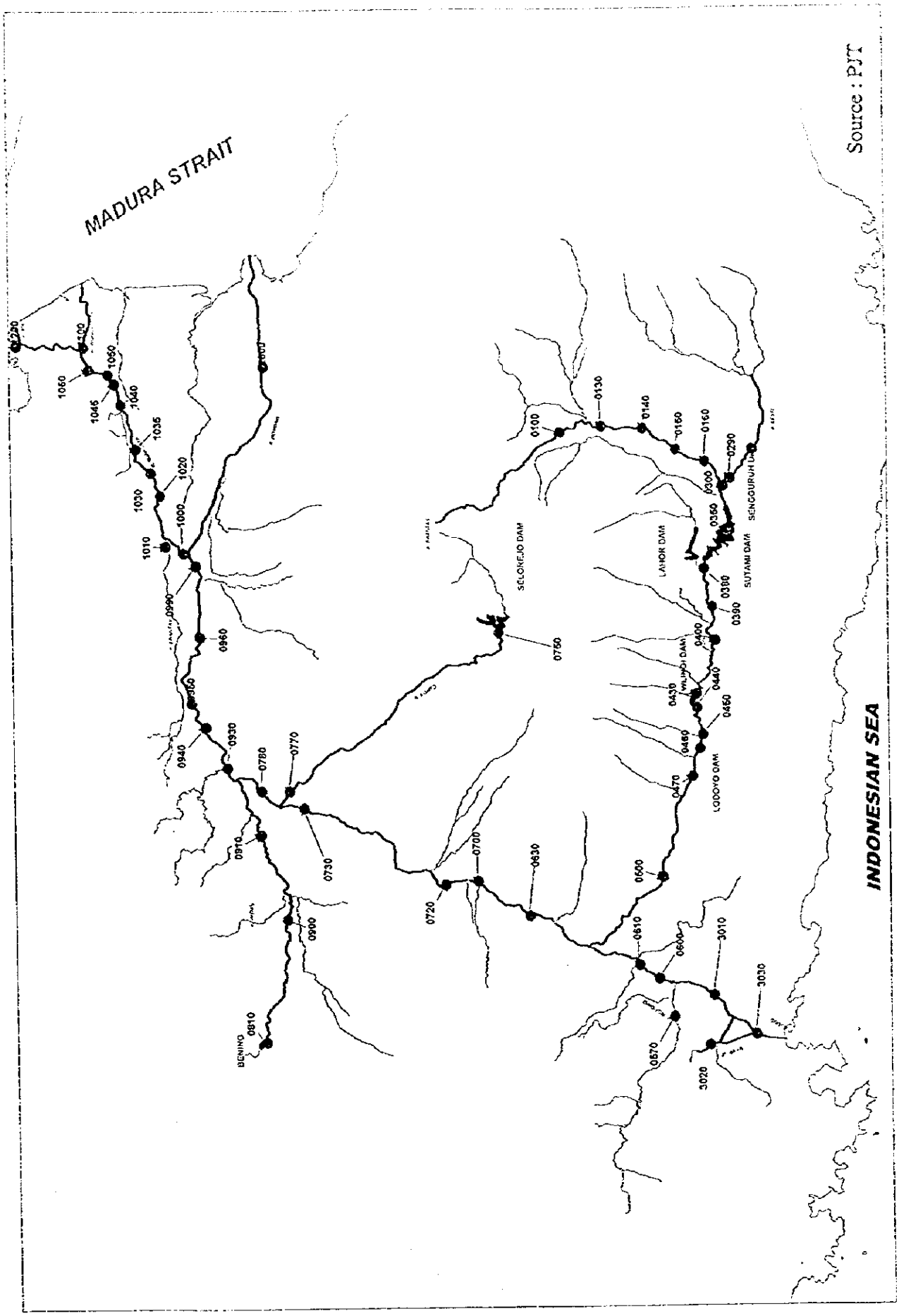


Figure A3-1 River Water Quality Monitoring Points by PJT

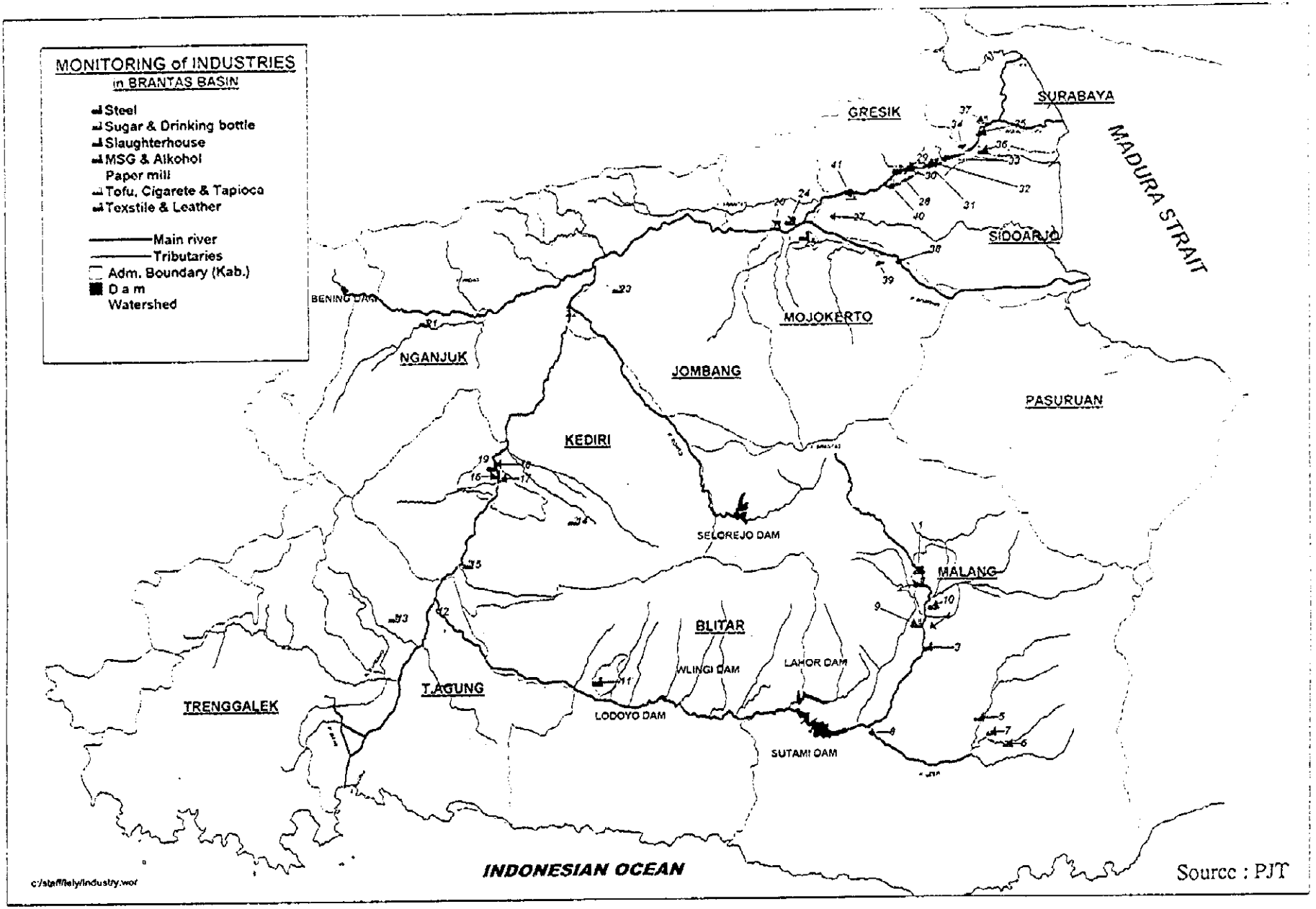
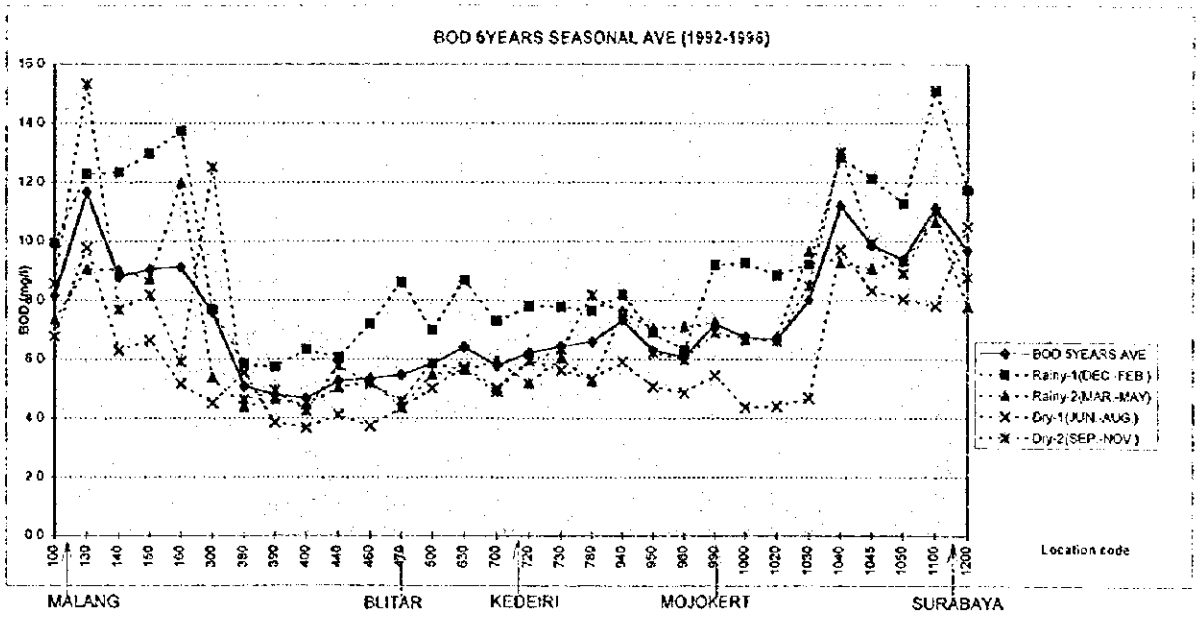


Figure A3-2 Location of Monitoring Industries by PJT



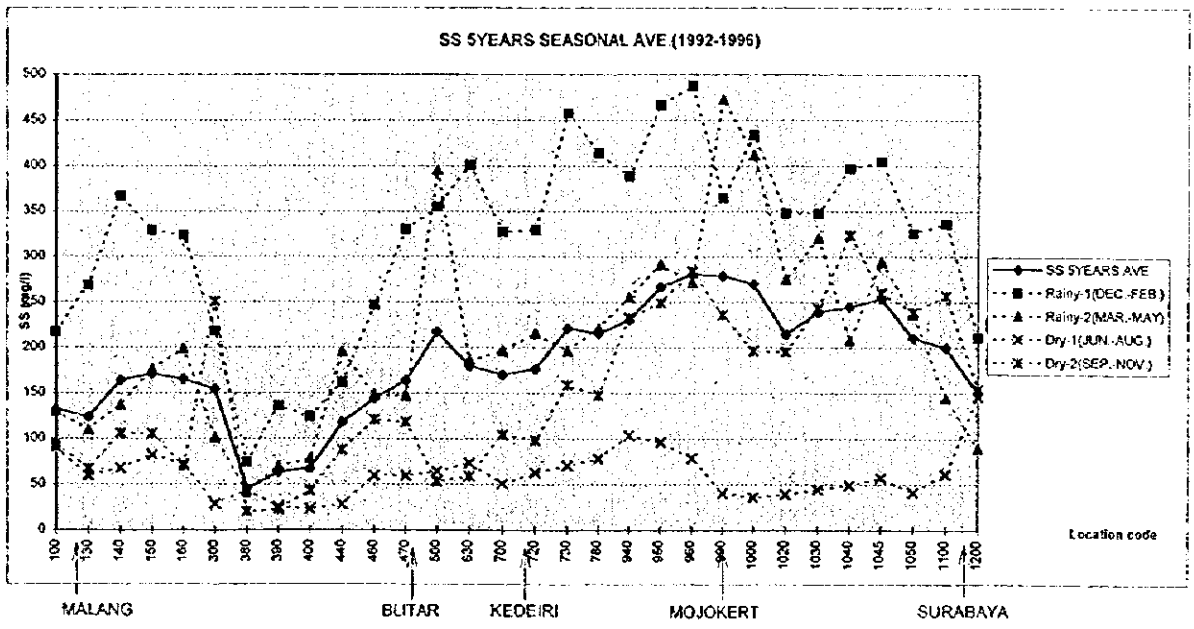
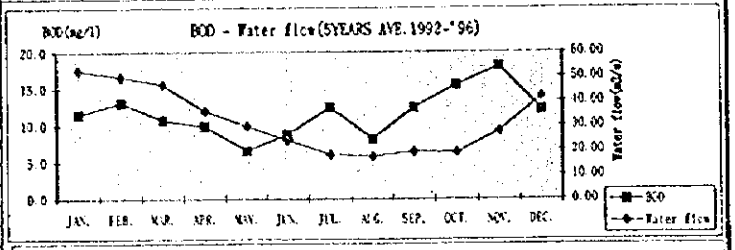
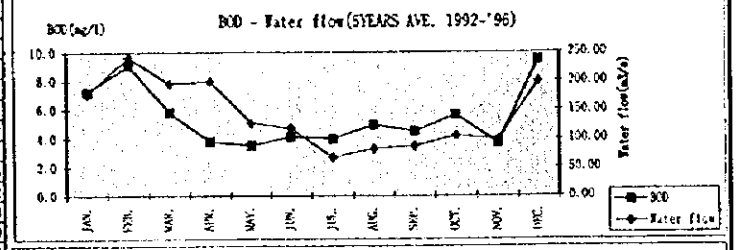


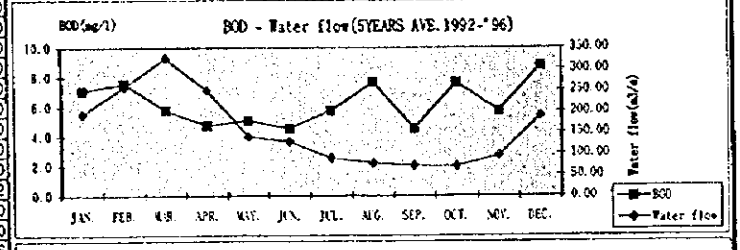
Figure A3-3 (1) Seasonal Variation and Geographical Distribution of BOD and SS in the Brantas, Surabaya and Mas Rivers

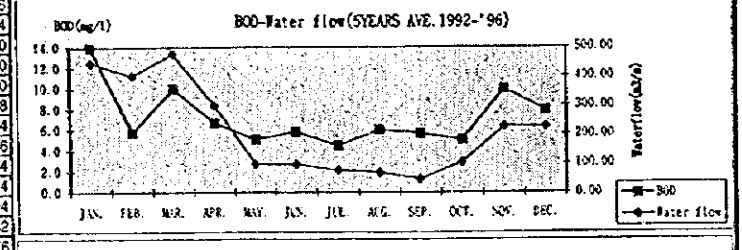
Source : PJT

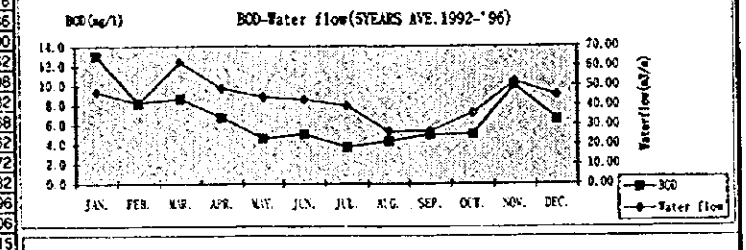
LOCATION	MONTH	BOD (mg/l)	Water flow (m3/s)
Bumiayu Bridge	JAN.	11.6	52.60
	FEB.	13.1	50.00
	MAR.	10.7	46.80
	APR.	9.9	36.00
	MAY.	6.6	29.70
	JUN.	8.7	24.00
	JUL.	12.5	18.20
	AUG.	8.2	17.40
	SEP.	12.5	19.40
	OCT.	15.5	19.00
	NOV.	18.0	27.80
	DEC.	12.2	41.75
Demangan Bridge	JAN.	7.3	177.89
	FEB.	9.1	241.67
	MAR.	5.8	195.42
	APR.	3.8	199.74
	MAY.	3.5	126.92
	JUN.	4.1	117.71
	JUL.	4.0	66.82
	AUG.	4.9	82.04
	SEP.	4.5	86.36
	OCT.	5.6	104.62
	NOV.	3.7	88.83
	DEC.	9.5	199.39
Jongbiru Bridge	JAN.	7.1	193.60
	FEB.	7.6	256.80
	MAR.	5.8	324.60
	APR.	4.7	248.80
	MAY.	5.1	139.60
	JUN.	4.5	128.40
	JUL.	5.6	88.40
	AUG.	7.7	77.20
	SEP.	4.5	70.60
	OCT.	7.6	69.32
	NOV.	5.7	95.00
	DEC.	8.8	188.80
Padangan Bridge	JAN.	13.9	446.96
	FEB.	5.8	401.84
	MAR.	10.0	476.70
	APR.	6.7	299.20
	MAY.	5.1	96.00
	JUN.	5.9	96.58
	JUL.	4.5	75.94
	AUG.	6.0	68.86
	SEP.	5.7	46.44
	OCT.	5.1	103.44
	NOV.	10.0	226.94
	DEC.	7.9	226.62
Canggu Tambangan	JAN.	13.0	46.76
	FEB.	8.2	40.85
	MAR.	8.6	62.00
	APR.	6.8	48.62
	MAY.	4.6	44.08
	JUN.	5.1	42.82
	JUL.	3.7	39.68
	AUG.	4.4	26.62
	SEP.	5.0	26.72
	OCT.	5.1	35.82
	NOV.	10.1	51.96
	DEC.	6.6	45.06
Karangpilang	JAN.	12.3	84.15
	FEB.	10.4	74.11
	MAR.	10.3	70.21
	APR.	8.4	55.39
	MAY.	8.6	50.61
	JUN.	8.4	37.91
	JUL.	8.5	31.97
	AUG.	8.2	21.34
	SEP.	9.6	25.11
	OCT.	6.9	34.03
	NOV.	13.4	77.49
	DEC.	13.7	55.69
Ngagel	JAN.	14.3	67.21
	FEB.	11.3	60.76
	MAR.	11.6	59.65
	APR.	11.4	48.68
	MAY.	9.0	39.24
	JUN.	10.4	26.28
	JUL.	6.8	32.71
	AUG.	6.2	17.25
	SEP.	8.8	23.66
	OCT.	8.9	26.03
	NOV.	15.4	64.30
	DEC.	19.7	46.15

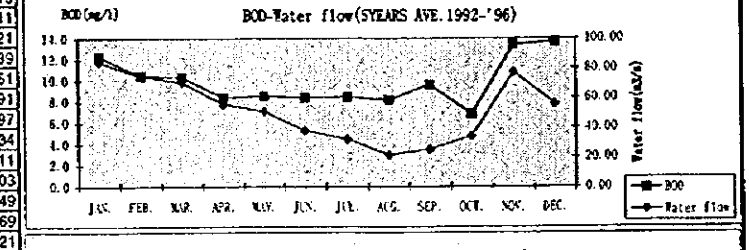












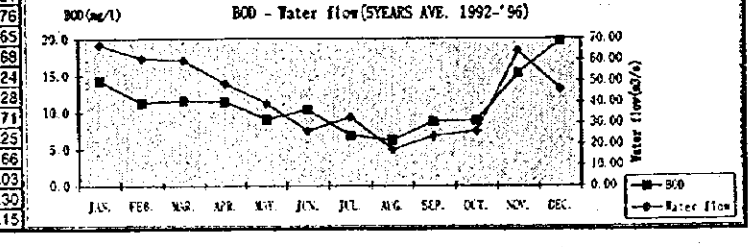
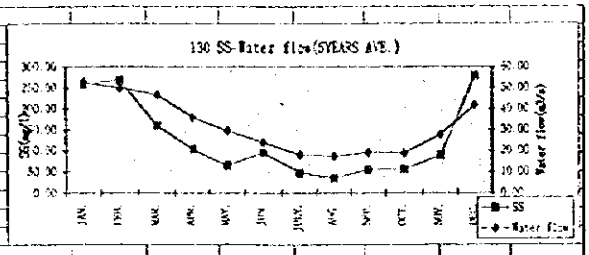


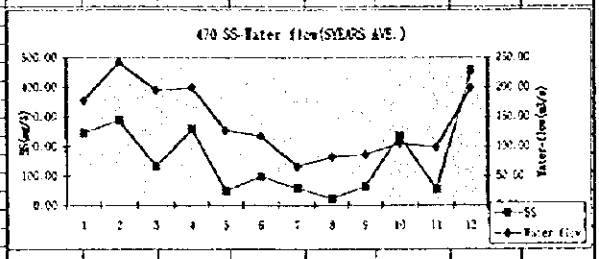
Figure A3-3 (2) Seasonal Variation and Geographical Distribution of BOD and SS in the Brantas, Surabaya and Mas Rivers

Source : PJT

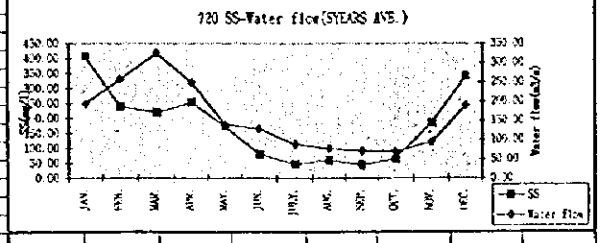
	MONTH	SS	Water flow
130	JAN.	258.20	52.60
	FEB.	268.24	50.00
	MAR.	160.72	45.80
	APR.	103.60	36.00
	MAY.	65.20	29.70
	JUN.	96.00	24.00
	JULY.	43.80	19.20
	AUG.	34.80	17.40
	SEP.	55.60	19.40
	OCT.	56.40	19.00
	NOV.	83.60	27.60
	DEC.	279.50	41.75



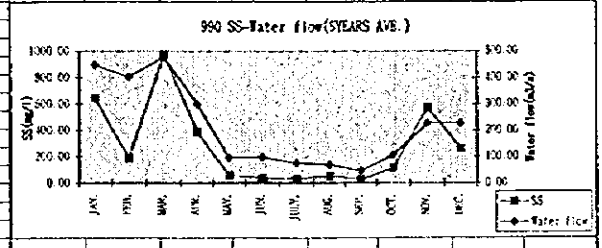
	MONTH	SS	Water flow
470	JAN.	246.00	177.89
	FEB.	288.40	241.67
	MAR.	133.60	195.42
	APR.	259.00	139.74
	MAY.	49.60	126.92
	JUN.	98.00	117.71
	JULY.	59.40	66.82
	AUG.	22.40	82.04
	SEP.	64.80	86.36
	OCT.	234.60	104.62
	NOV.	58.00	98.83
	DEC.	456.20	199.39



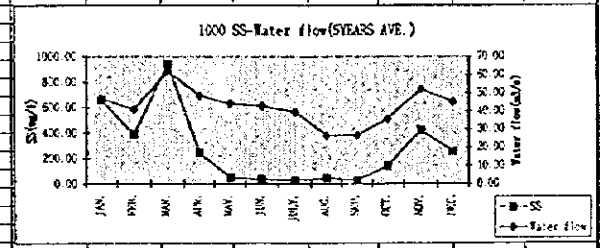
	MONTH	SS	Water flow
720	JAN.	406.80	193.60
	FEB.	239.92	256.80
	MAR.	219.08	324.60
	APR.	252.60	248.80
	MAY.	174.40	139.60
	JUN.	80.80	128.40
	JULY.	47.00	88.40
	AUG.	61.20	77.20
	SEP.	44.40	70.60
	OCT.	64.60	69.32
	NOV.	136.20	95.00
	DEC.	341.60	189.80



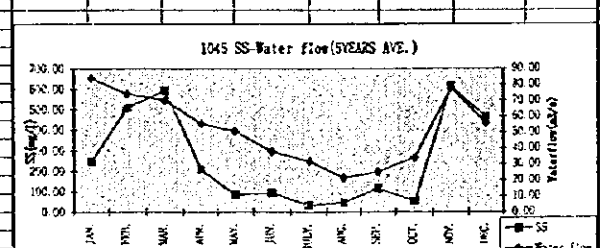
	MONTH	SS	Water flow
990	JAN.	644.40	446.96
	FEB.	190.40	401.84
	MAR.	971.20	476.70
	APR.	388.40	299.20
	MAY.	58.40	96.00
	JUN.	36.60	96.58
	JULY.	31.80	75.94
	AUG.	54.40	68.86
	SEP.	25.60	46.44
	OCT.	113.00	103.44
	NOV.	569.40	226.94
	DEC.	259.80	226.62



	MONTH	SS	Water flow
1000	JAN.	661.20	46.76
	FEB.	387.12	40.86
	MAR.	941.40	62.00
	APR.	245.00	48.62
	MAY.	50.60	44.08
	JUN.	34.00	42.82
	JULY.	29.20	39.68
	AUG.	45.00	26.62
	SEP.	29.20	26.72
	OCT.	138.40	35.82
	NOV.	421.60	51.96
	DEC.	254.60	45.06



	MONTH	SS	Water flow
1045	JAN.	245.60	64.15
	FEB.	508.20	74.11
	MAR.	592.20	70.21
	APR.	206.80	55.39
	MAY.	83.40	50.61
	JUN.	94.40	37.91
	JULY.	32.00	31.97
	AUG.	45.20	21.34
	SEP.	114.40	25.11
	OCT.	52.40	34.03
	NOV.	613.20	77.49
	DEC.	460.60	55.69



	MONTH	SS	Water flow
1100	JAN.	363.80	67.21
	FEB.	281.28	60.76
	MAR.	185.40	59.65
	APR.	136.20	48.68
	MAY.	112.60	39.24
	JUN.	120.20	26.28
	JULY.	26.60	32.71
	AUG.	36.40	17.25
	SEP.	52.00	23.66
	OCT.	86.80	26.03
	NOV.	631.60	64.30
	DEC.	363.80	46.15

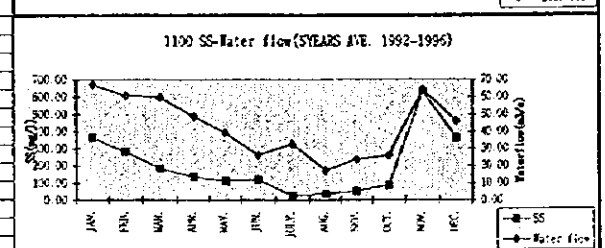


Figure A3-3 (3) Seasonal Variation and Geographical Distribution of BOD and SS in the Brantas, Surabaya and Mas Rivers

Source : PJT

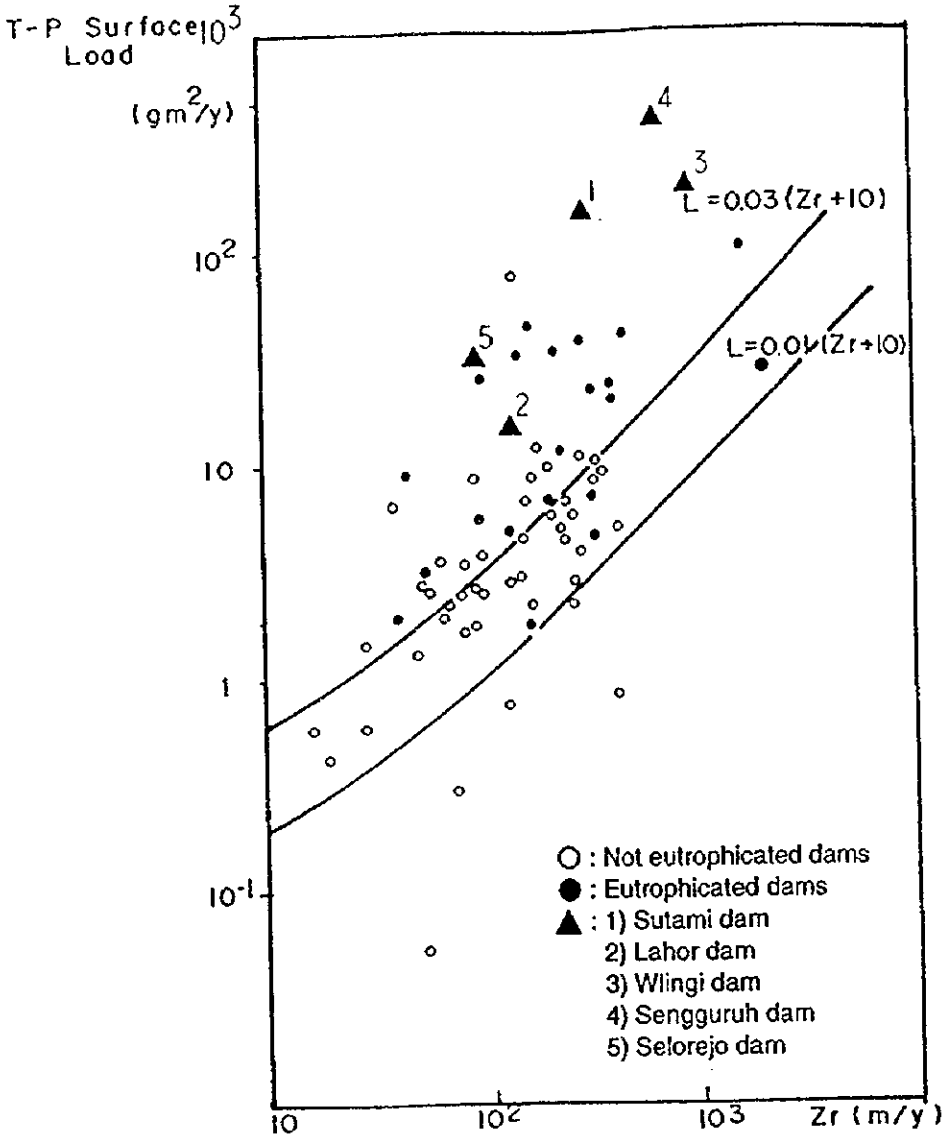


Figure A3-4 **Assessment of Eutrophication of the Reservoirs (Vollenweider Model)**

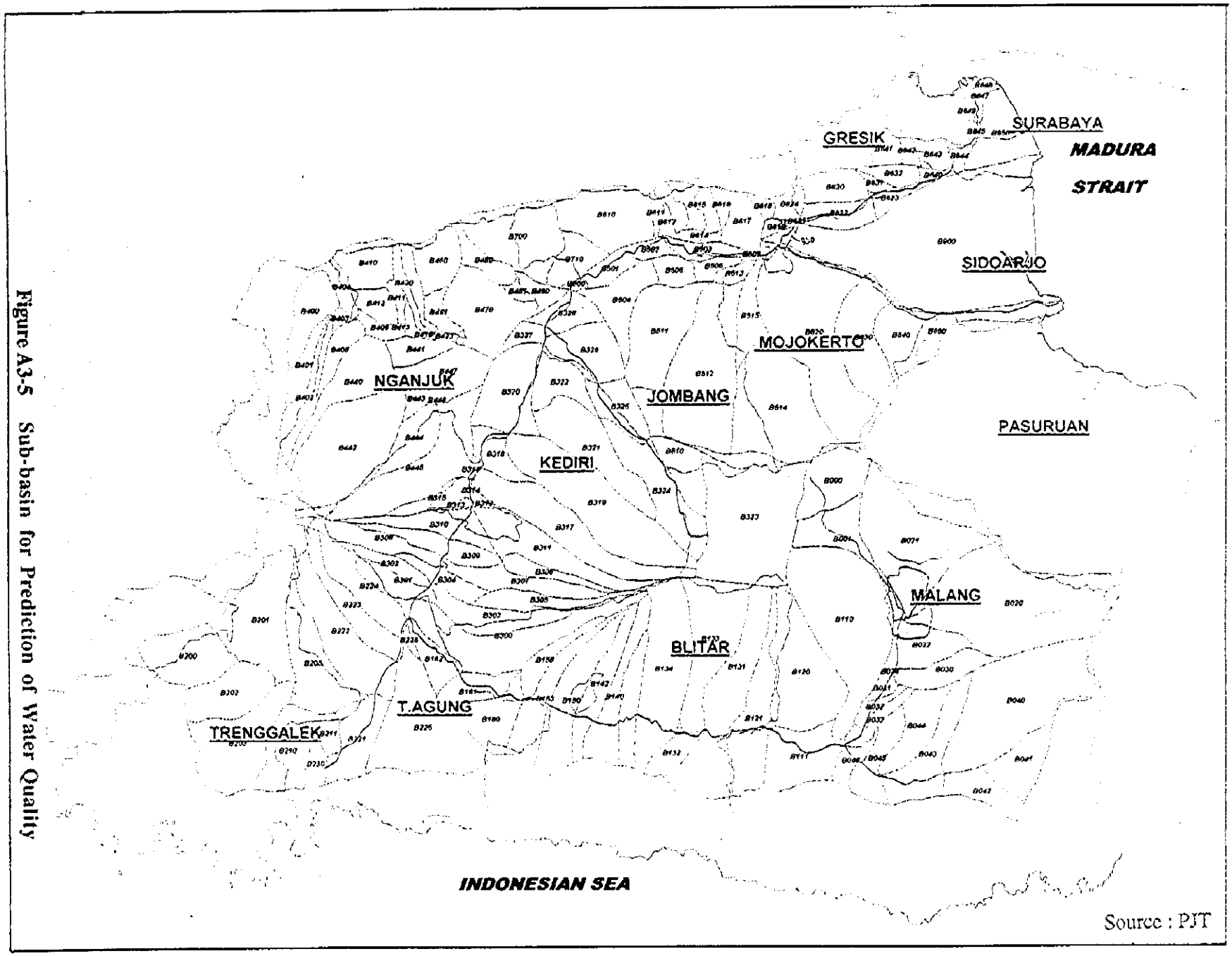
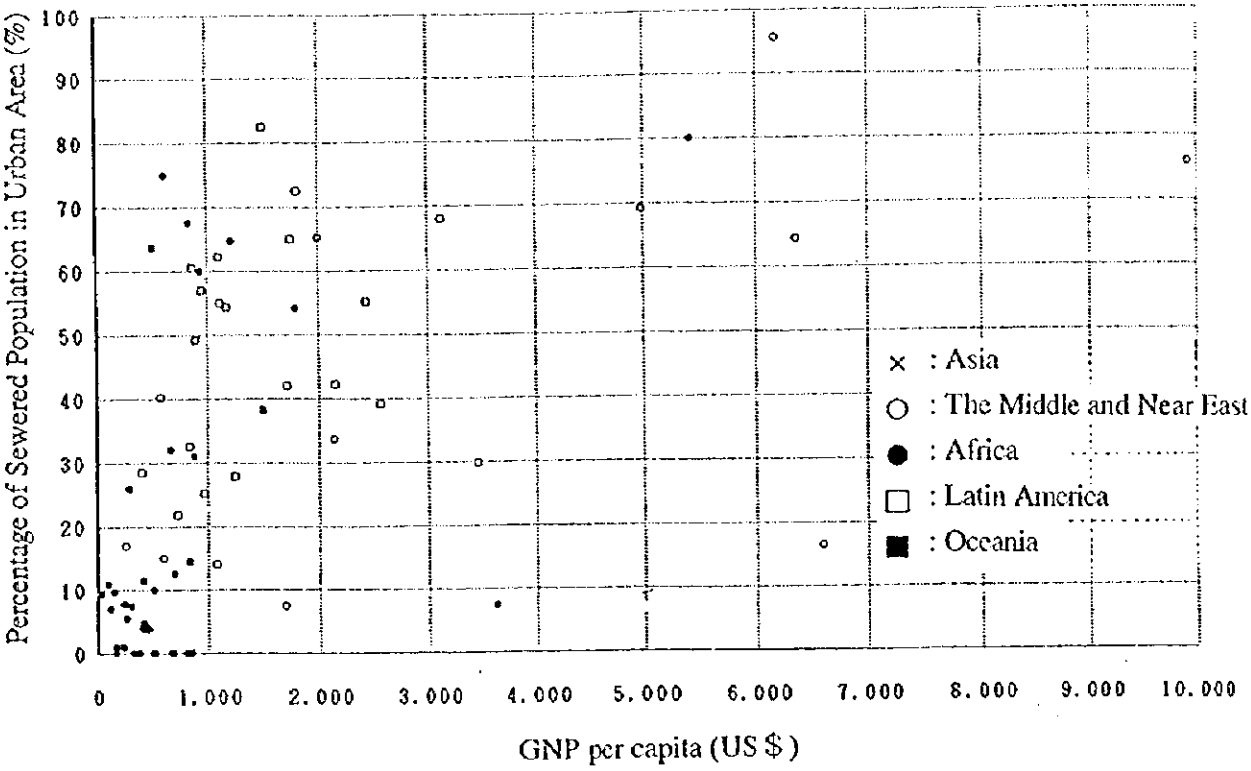


Figure A3-5 Sub-basin for Prediction of Water Quality



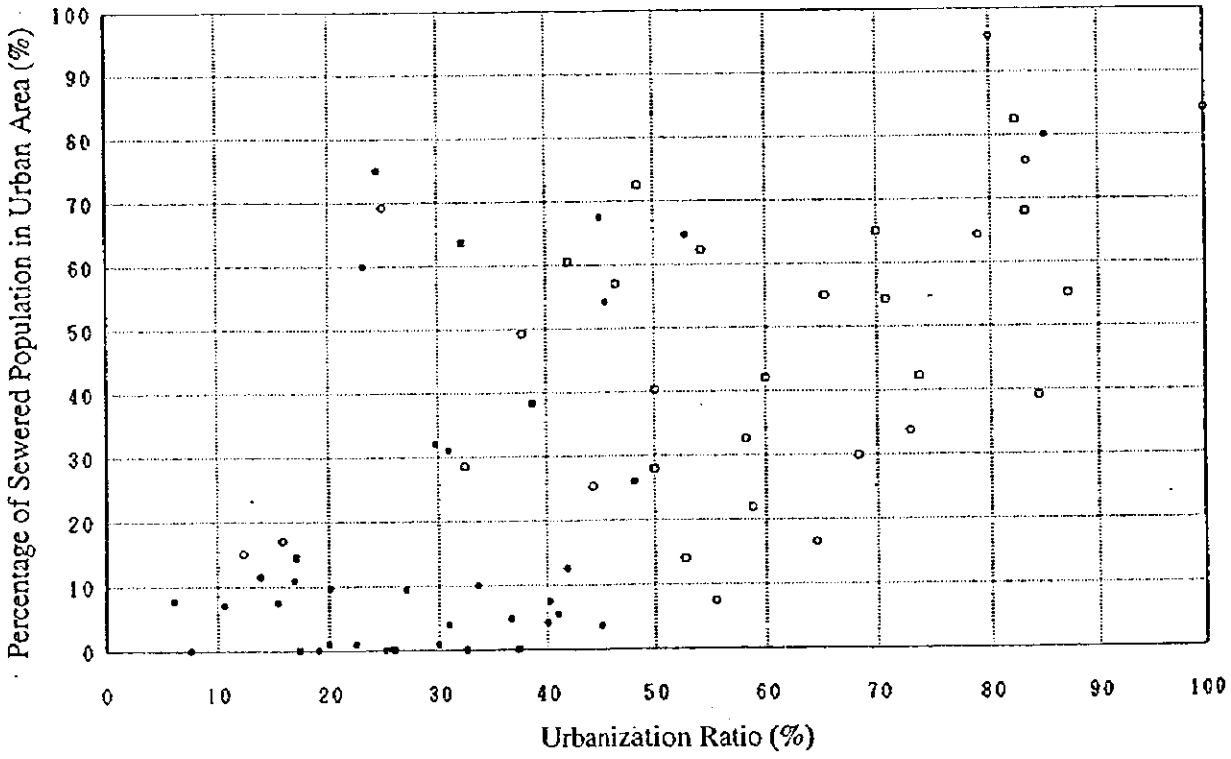


Figure A3-6 Relationship Between Percentage of Sewered Population in Urban Area and GNP per capita and Urbanization Ratio

Source : JICA

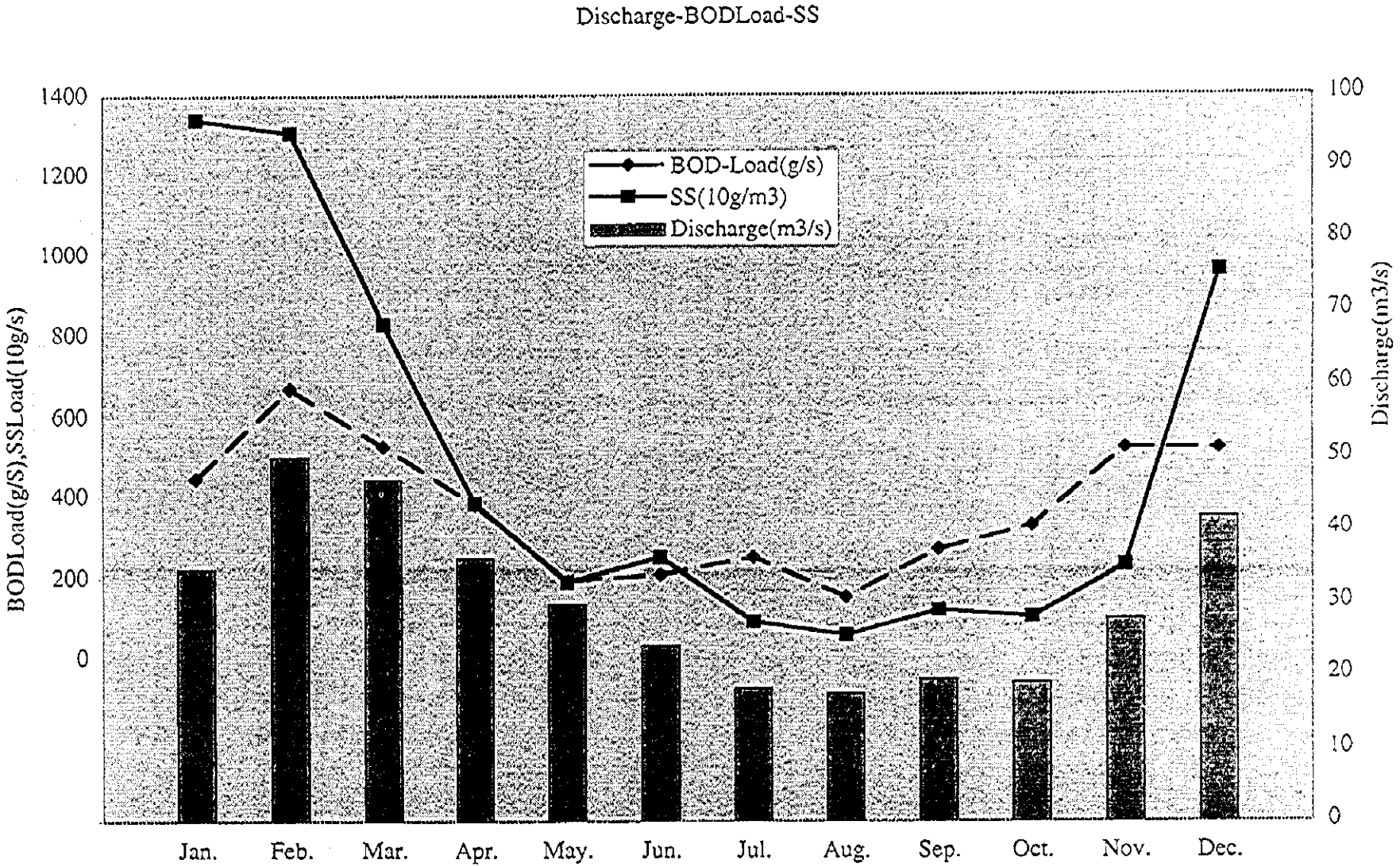


Figure A3-7 Run-off Pollution Load and Water Flow

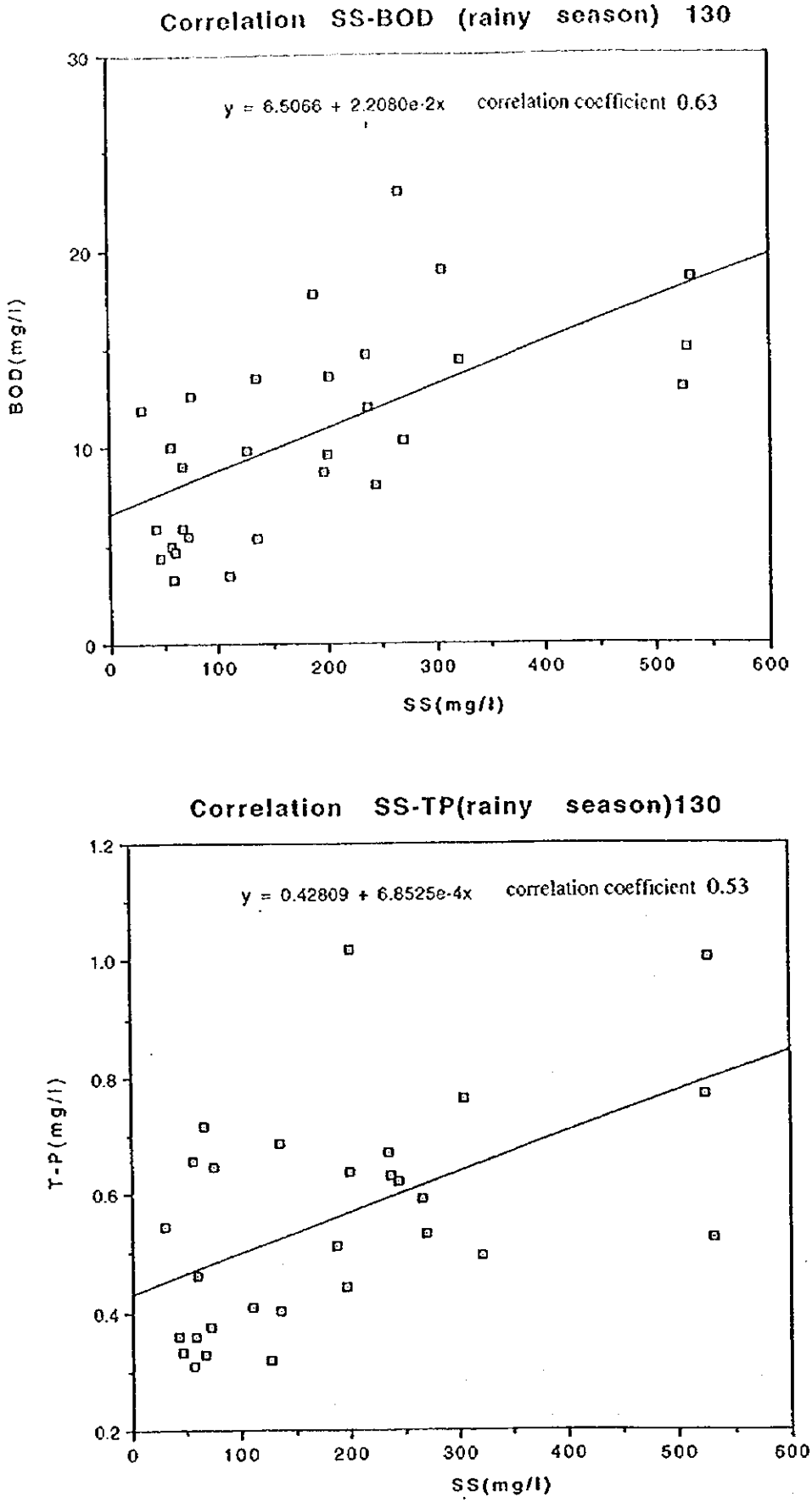


Figure A3-8 Correlation between BOD, T-P and SS

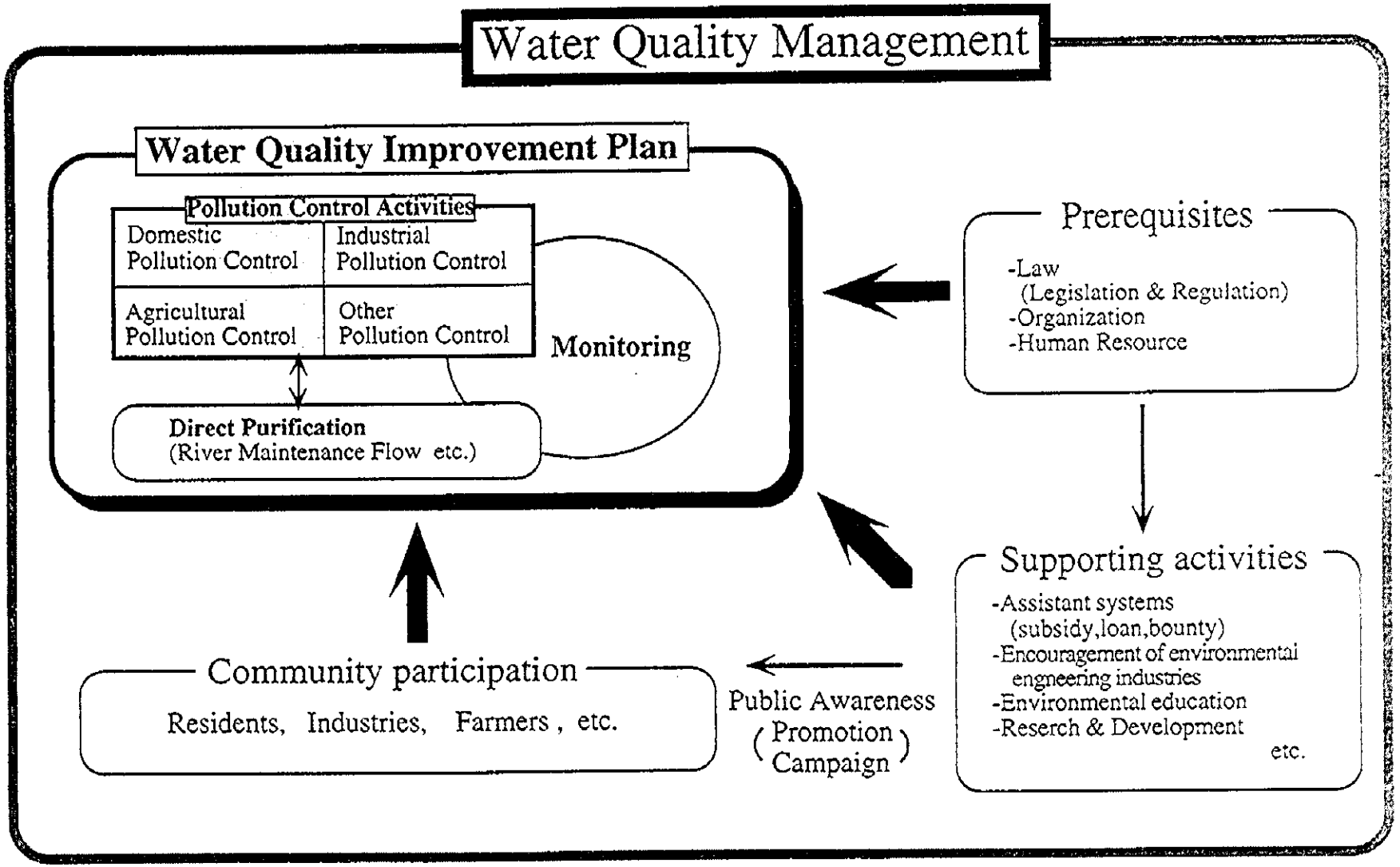


Figure A3-9 Proposed Framework of Water Quality Management

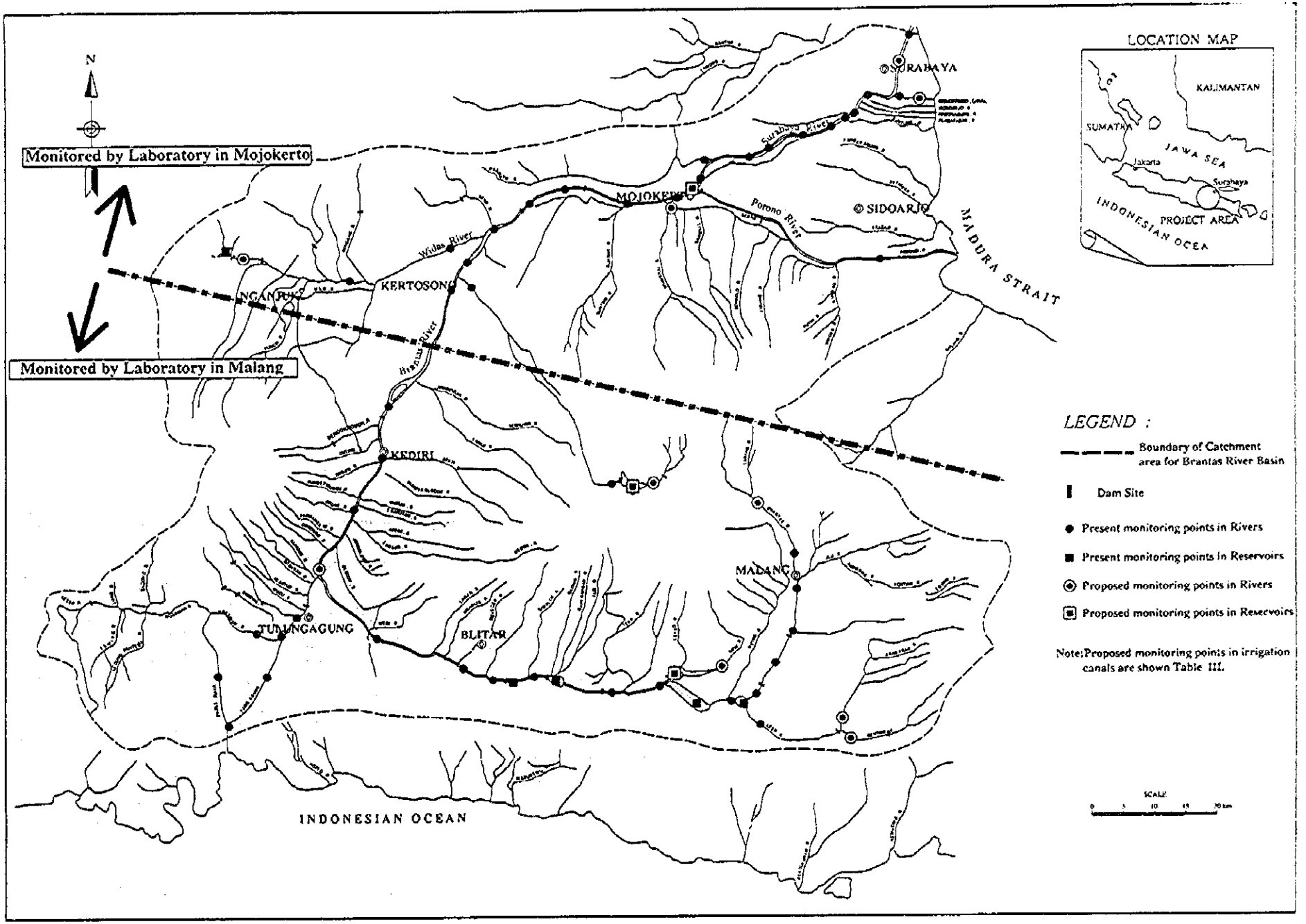
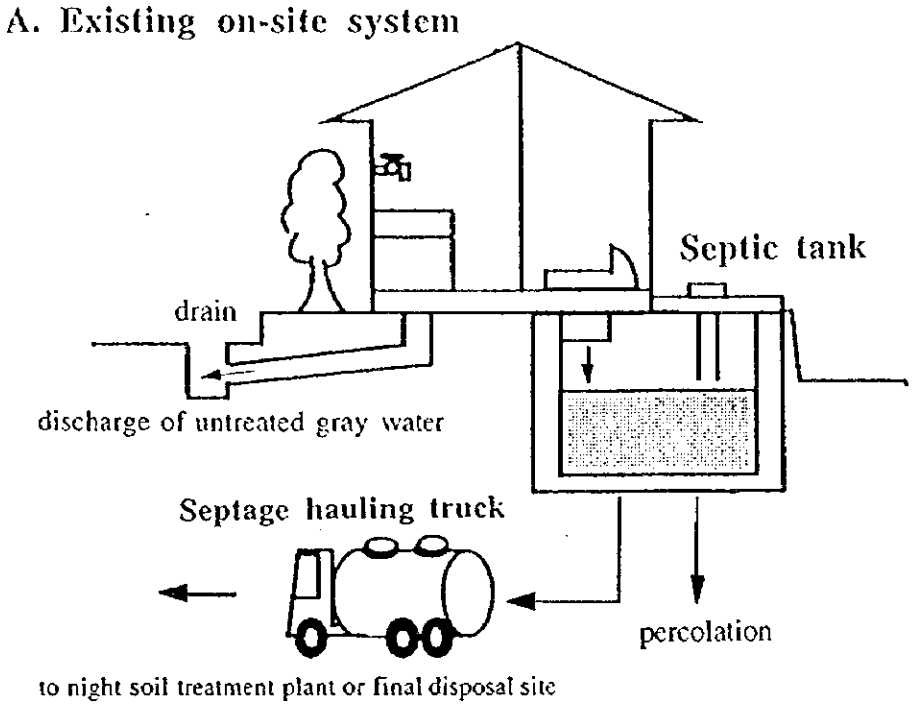


Figure A3-10 Proposed Monitoring Points in the Rivers and Reservoirs



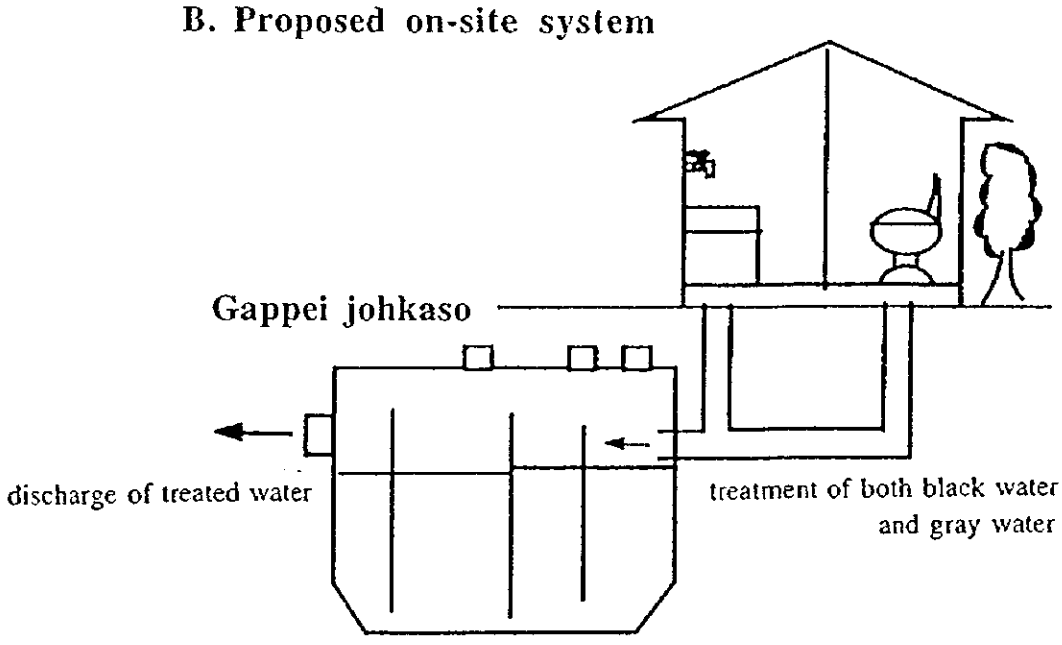


Figure A3-11 **Present and Proposed On-site Domestic Waste Water Treatment Systems**

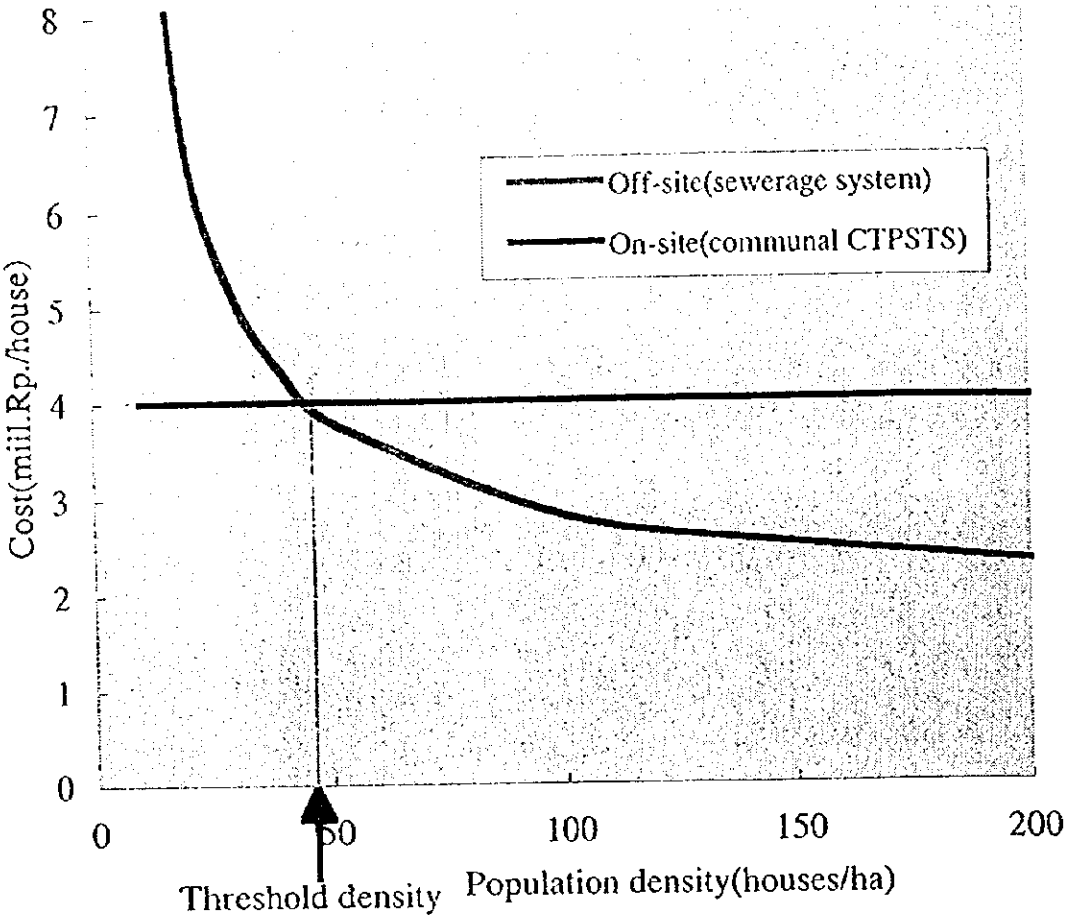


Figure A3-12 **Per House Cost Comparison Between Off-site and On-site Systems**

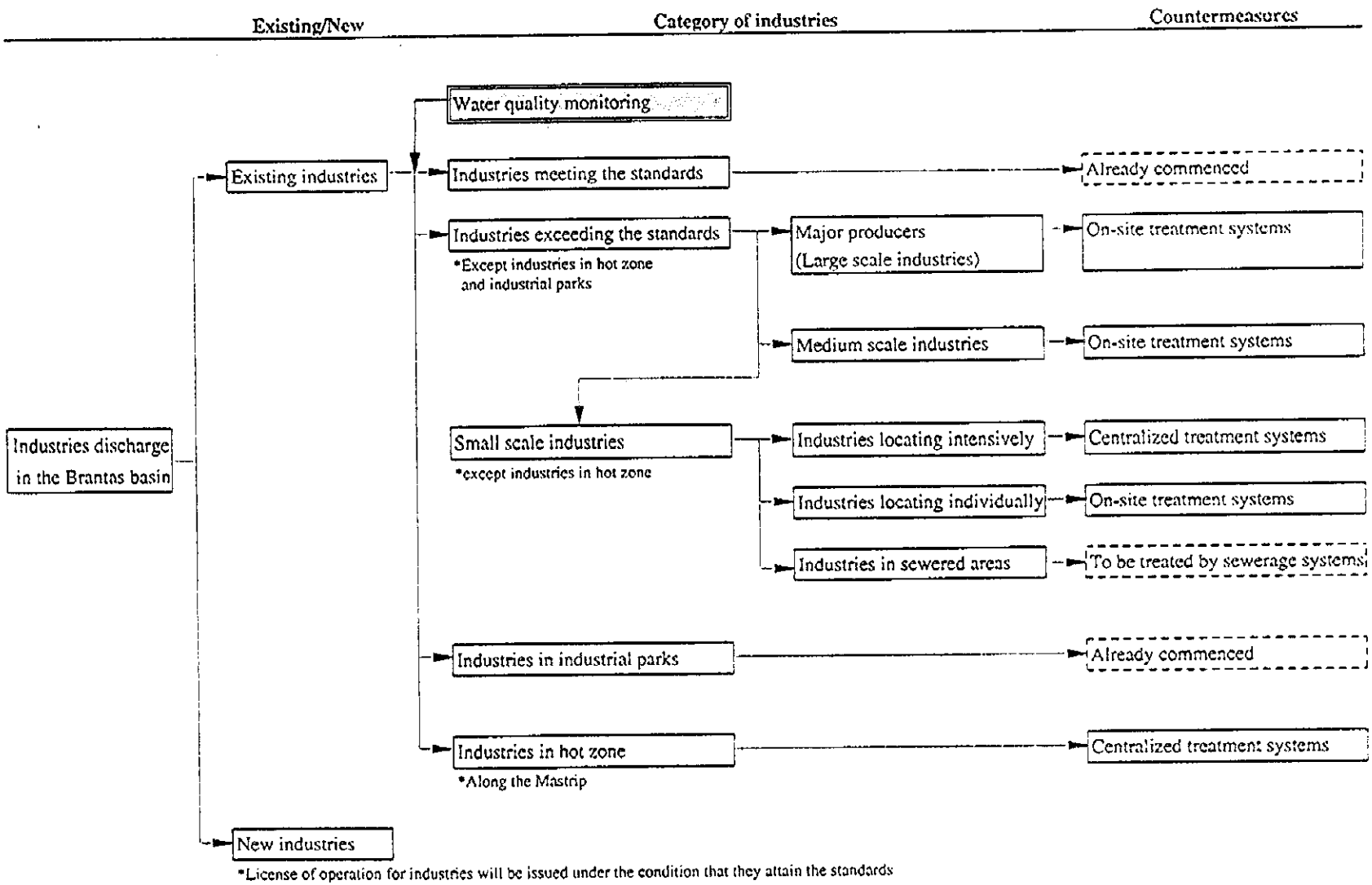


Figure A3-13 Basic Principal on Industrial Waste Water Treatment

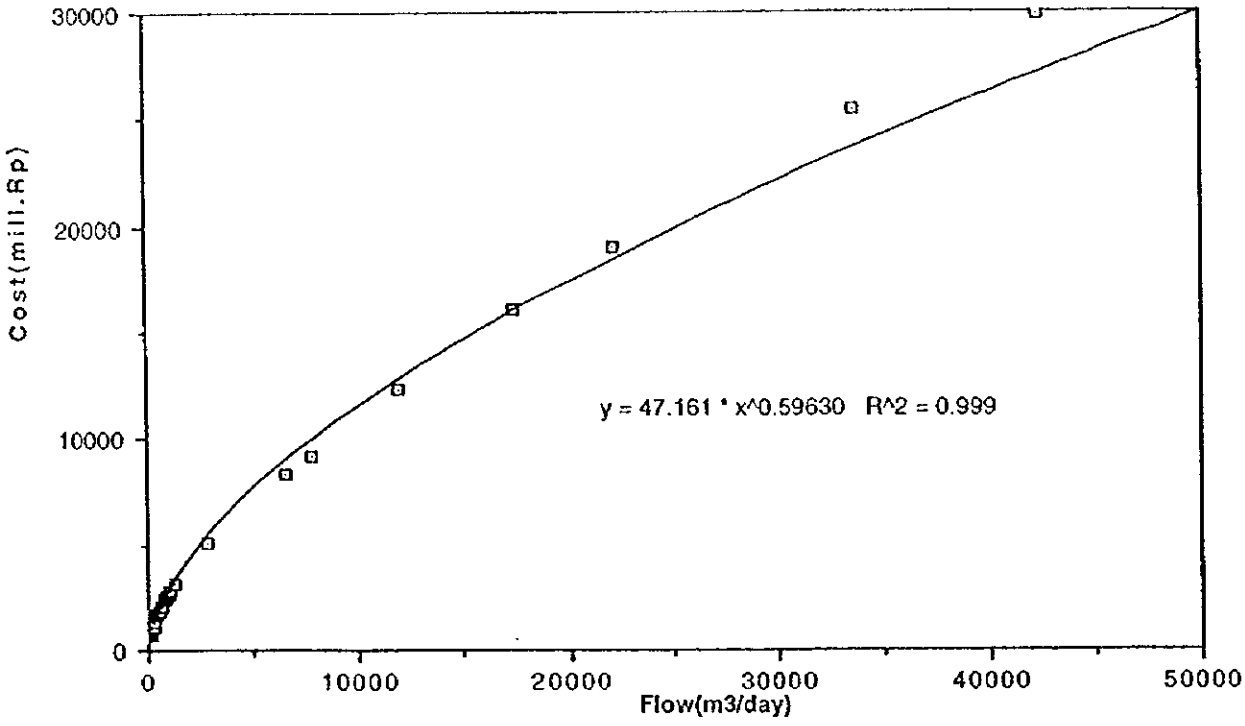


Figure A3-14 Secondary Treatment Cost

Source:Water quality management sector project, appendix,june 1990
(Agency for research and development ministry of public works)

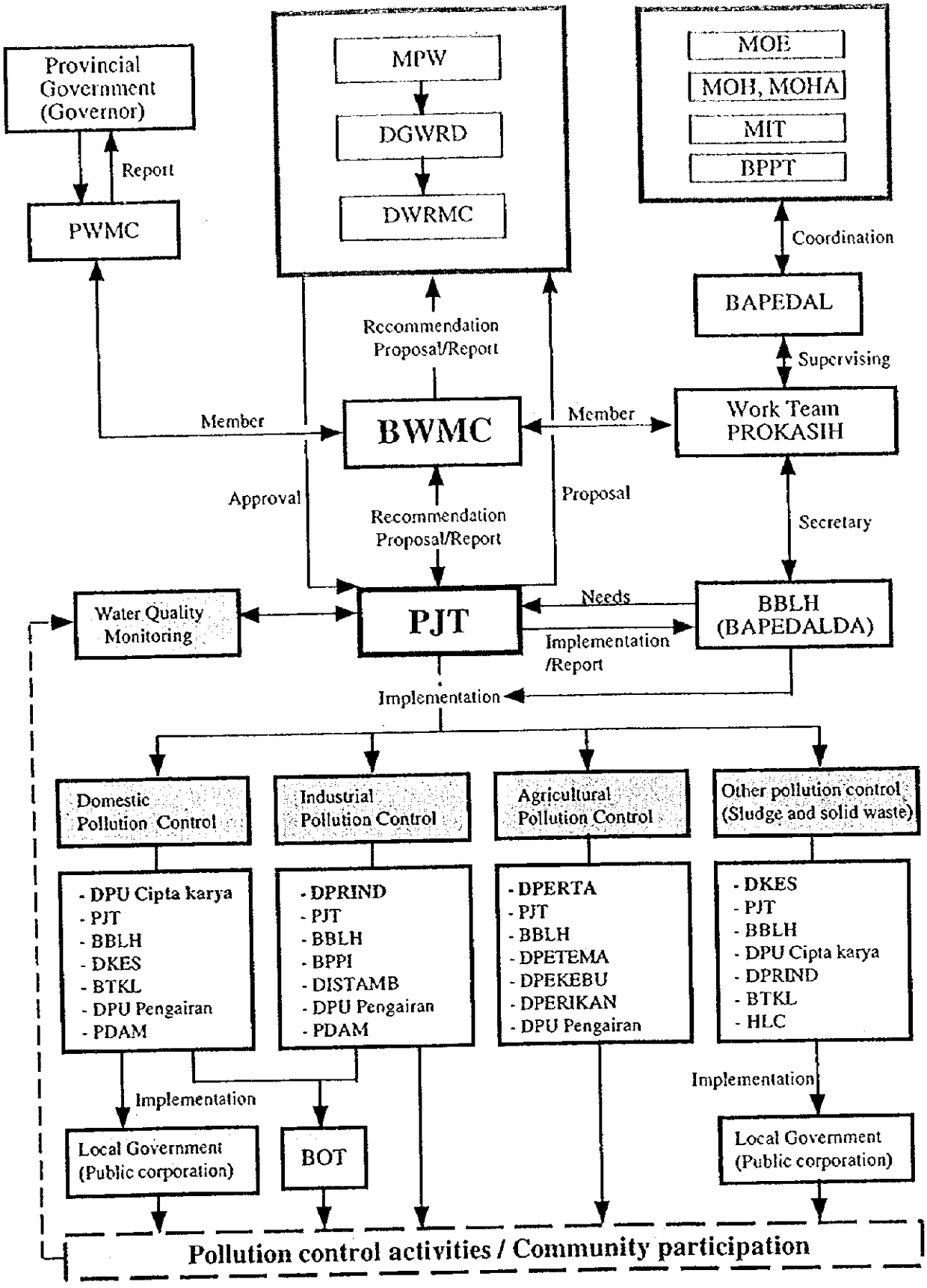


Figure A3-15 Proposed Organization of Water Quality Management

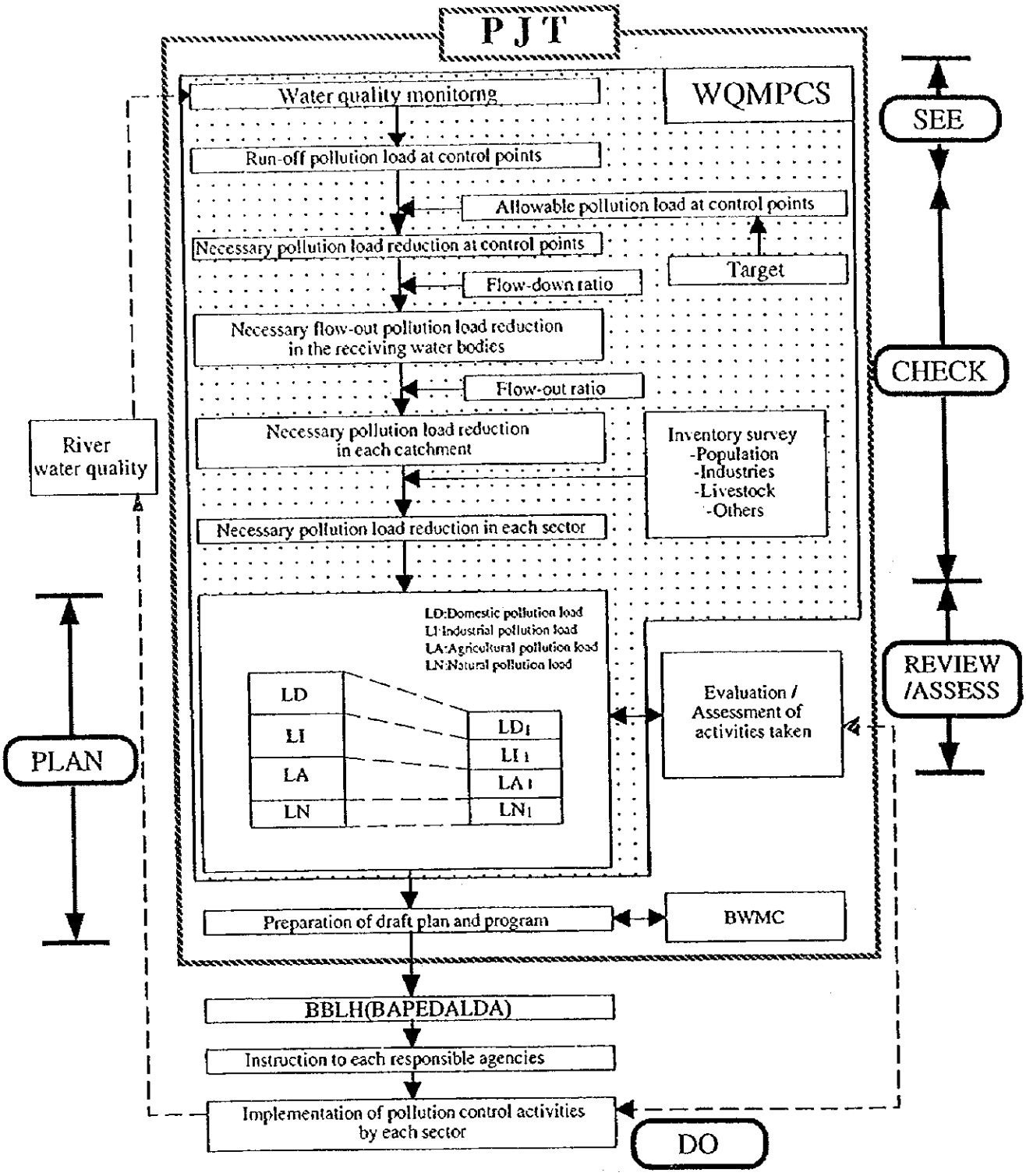


Figure A3-16 Continuous Water Quality Management System

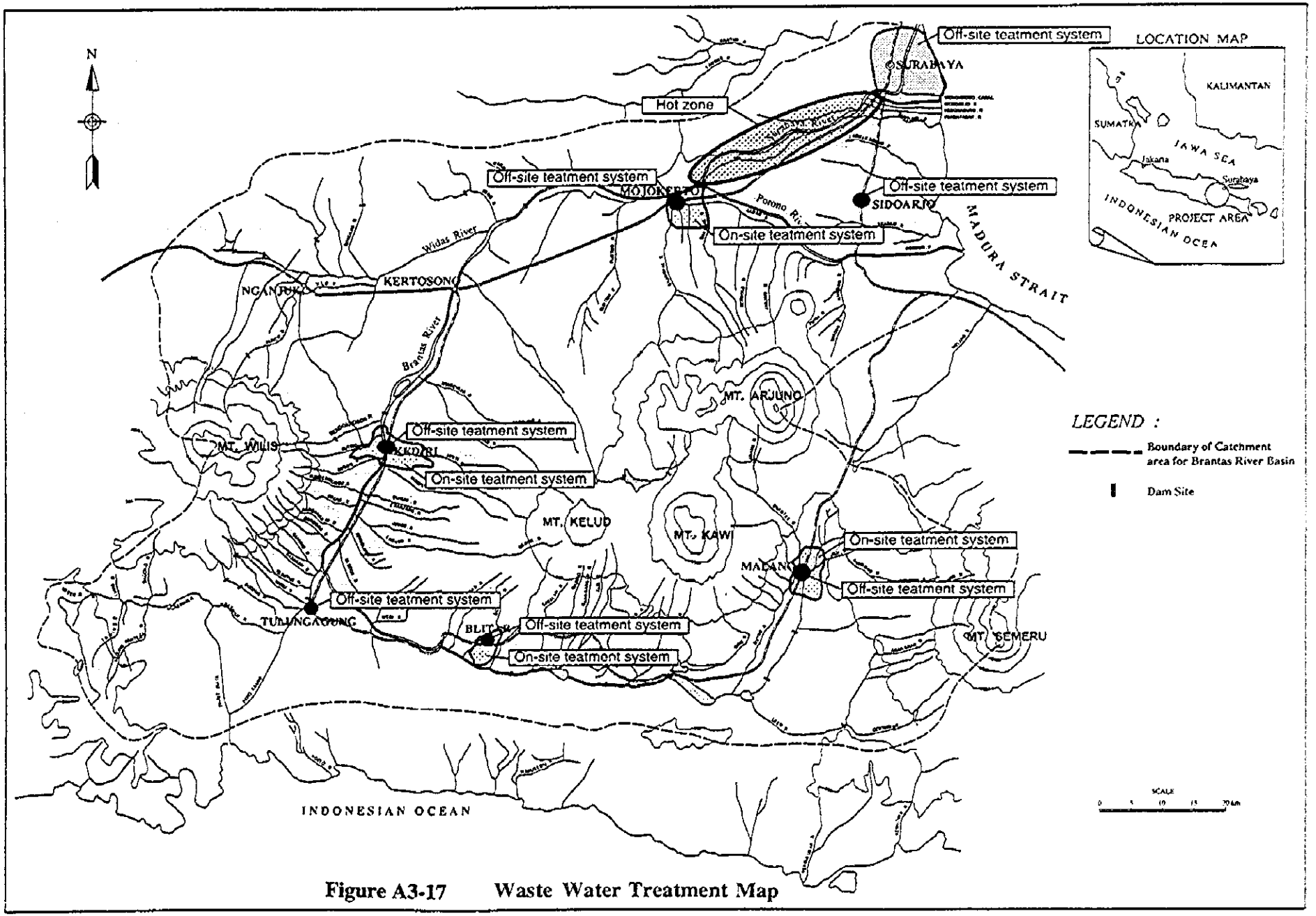


Figure A3-17 Waste Water Treatment Map

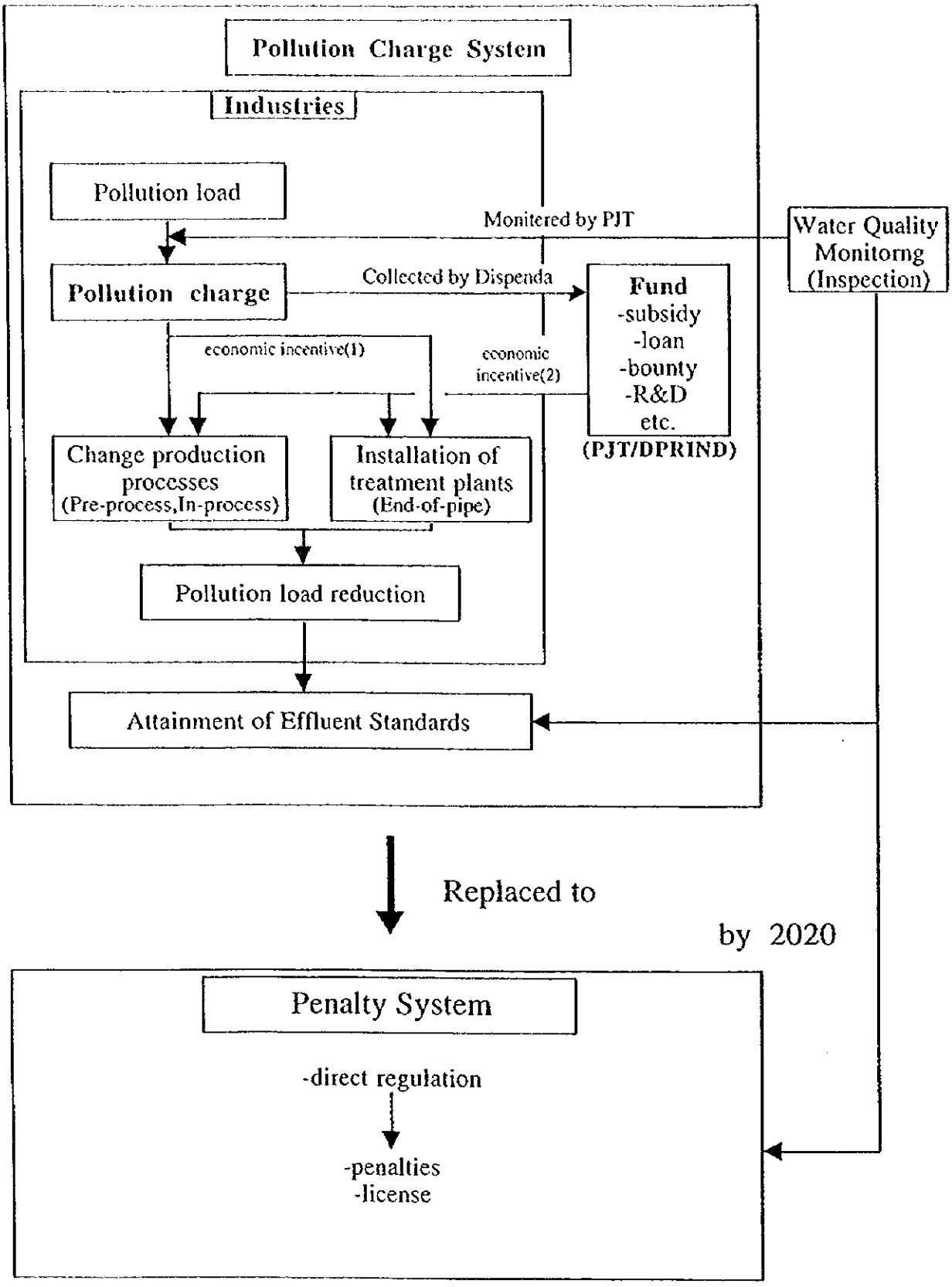


Figure A3-18 Recommended Pollution Charge System