

# **EXPERIENCES ON RIVER BASIN MANAGEMENT IN INDONESIAN'S RBO**

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## **Abstract**

Indonesian Archipelago is situated in a tropical zone with high rate precipitation but varied in time and location. In western part the precipitation depth is about 3,000 mm and in eastern part is about 2,500 mm per annum. There are two seasons every year, wet season mostly takes place from October to March and dry season from April to September. During the wet season about 70% of precipitation is occurred and only 30% during the dry season.

Rapid population growth and economic development stressed in Java leads water scarcity tends to increase, because of (1) water quality has deteriorated, (2) larger discrepancy of base-flow and peak-flow, and (3) rising water demand. Besides, water resources infrastructures development is very limited caused unbalance between supply and demand create conflict of interest among beneficiaries.

Up to present there are 90 river basins in Indonesia. Seventeen river basins of those considered strategic and have a national economic value are managed by Central Government. There are two types of RBO, i.e., Jasa Tirta Public Corporation (JTPTC) and Basin Water Resources Management Unit (BWRMU). JTPTC is established in the river basin that has high potential of economic value and able to manage independently while the budget used for water resources management are collected from beneficiaries. Otherwise BWRMU is performed by the Government.

JTPC is established based on Government Regulation while BWRMU based on Local Government Decree. Various Central and Local Government organizations involved in the basin contributes to an institutional problem in sharing roles and responsibilities characterized by overlapping mandates. That is why synergy between public sector, private sector, and communities has not been developed appropriately. Tariffs of products and services are very low due to the Central Government decision considering public services which cause inadequate O&M expenditures. The aforementioned problems lead to improper IWRM implementation.

Every river basin has its own characteristics particularly in economic value of water resources and local culture, cause some of them are less-developed compare to the others. Networking is needed to strengthen the RBOs in the way of improving database management, human resources development, and research and development.

Keywords: scarcity, integrated, legal, institutional, financial, networking.

## 1. INTRODUCTION

Indonesian Archipelago is situated in a tropical zone with high rate precipitation but varied in time and location. In western part the precipitation depth is about 3,000 mm and in eastern part is about 2,500 mm per annum. There are two seasons every year, wet season mostly takes place from October to March and dry season from April to September. During the wet season about 70% of precipitation is occurred and only 30% during the dry season.

Rapid population growth and economic development stressed in Java leads water scarcity tends to increase, because of (1) water quality has deteriorated, (2) larger discrepancy of base-flow and peak-flow, and (3) rising water demand. Besides, water resources infrastructures development is very limited caused unbalance between supply and demand create conflict of interest among beneficiaries.

Based on Ministry of Public Work Regulation No. 48 of 1989 there are 90 river basins in Indonesia. Seventeen river basins of those considered strategic and have a national economic value are managed by Central Government, the rest are entrusted to Local Government. Up to present the seventeen basins can be grouped in: (1) ten basins are in developing stages, (2) four basins under preparation of establishing river basin institution, and three other basins are managed by RBO in the form of Public Corporations. There are two types of RBO, i.e., Jasa Tirta Public Corporation (JTPC) and Basin Water Resources Management Unit (BWRMU). JTPC is established in the river basin that has high potential of economic value and able to manage the basins independently, while the budget used for water resources management are collected from beneficiaries. JTPC is responsible to provide water for multipurpose socially and commercially basis. On the other hand BWRMU is a river basin organizational in provincial level set up by the Government as implementation unit of Provincial Water Resources Management Agency.

The Constituent of 1945 said that the earth, water, and every riches contained in them are controlled by the State for maximum welfare of the people. This principle is the basis of all legislation for water resources management, i.e. Law No. 11 of 1974 on Water Resources, and Government Regulation No. 22 of 1982 on Water Resources Development. The principle of water use prioritization is given clearly in the Government Regulation No. 22 of 1982 are as follows: (1) domestic and municipality, (2) irrigation, plantation, and fishery, (3) industries, and (4) hydro-power generation.

Even the Law No. 11 is launched in 1974, the water resources development and management on the basis of river basin has been carried out since 1970 when GOI established Jatiluhur Authority Public Corporation (JAPC). The JAPC was established upon the completion Jatiluhur Multipurpose Project in Citarum river basin for optimizing the benefit of the output of the Project. The JAPC is a State own Company managing water resources in Citarum river basin based on GR No. 20 of 1970.

After the Presidential Decree No. 7 of 1981 the JAPC has been legally collecting contribution from beneficiaries to perform its operational and maintenance tasks.

Brantas River Basin Development Project has shown significant economic potential output therefore the GOI established Jasa Tirta Public Corporation (JTPC) based on GR No. 5 of 1990 for Brantas River Basin Management. The JTPC is responsible for maintaining the output function of the development in the basin to achieve maximum benefit and its sustainability. In the year of 2000, the working area of JTPC is added with Bengawan Solo River Basin. To strengthen water resource management in less-developed basins, the GOI was setting up basin level organizations called Basin Water Resources Management Unit (BWRMU) based on Ministry of Home Affairs (MOHA) Decree in 1997. The GOI is also preparing four other JTPCs to establish financially sustainable and autonomous organizations in keeping with the tenets of the national reform, i.e. Seputih-Sekampung, Jratunseluna, Jeneberang, dan Serayu-Bowogonto river basins.

Up to now the RBOs are facing various problems regarding with legal, institutional, and financial aspects therefore since 1998 the GOI has been undertaking a water resources sector reformation program to improve national policy and institution framework for water resources development and management.

Every river basin has its own characteristics particularly in economic value of water resources and local culture, cause some of them are less-developed compare to the others. Networking is needed to strengthen the RBOs in the way of improving database management, human resources development, and research and development; furthermore to find the most appropriate legal, institutional and financial conditions.

This paper presents a synthesis of implementation on water resources management by RBOs in Indonesia derived from three different institutions managing water resources in three different river basins, i.e., Jasa Tirta I Public Corporation of Brantas and Bengawan Solo, Jasa Tirta II Public Corporation of Citarum, and Basin Water Resources Management Unit of Jragung-Tuntang. This paper is a step in disseminating, understanding, and stimulating fundamental changes to avoid water resources damages by raising awareness on better management of water resources. The main aim of this paper is to inform the paramount importance implementation of integrated water resources management (IWRM) to sustain its resources benefits and avoid potential degradation by analyzing present situation and progress of RBOs.

## **2. PRESENT SITUATION**

### **2.1. National Water Resources Policy**

To support water resources development and management, the GOI is reviewing current policies and procedures in water resources management and formulate a National Water Resources Management Policy framework (NWRMP) that is able to support and guide the development and conservation efforts of all government and private entities as well as communities. The NWRMP would include:

- Introduction of a water rights framework for water allocation and utilization conducive to economic and social development and environmental sustainability
- Improving the efficiency in utilization of water, particularly for irrigation
- Attaining regional surface and ground water quality levels that are compatible with both socio-economic development and environmental sustainability
- Developing participatory institutions for prioritized, integrated river basin planning process, based on participatory of stakeholder representatives in water resources and irrigation decision-making and activities, establishing an enabling mechanisms for community management and financing of irrigation networks;
- Establishing a sustainable planning, programming, and budgeting system for water resources development and management under a framework for regional autonomy and government decentralization
- Creating a national and regional water resources management structure to support and implement integrated river basin management
- Improving coordination between forestry, agriculture, and water resources sector activities in watershed management, and
- Establishing a specific integrated policy for environmentally sustainable wetland and swampland development

The implementation of NWRMP reformation divides into four objectives: 1) improving institutional policy framework for water resources development, 2) improving river basin organizations framework, 3) improving institutional quality water resources management and its implementation, and 4) improving policy, institution, and regulation of irrigation management.

The implementation of NWRMP reformation regarding with river basin organization was the alternation of Government Regulation No. 93 of 1999 for Jasa Tirta I Public Corporation (Brantas river basin), GR No. 94 of 1999 for Jasa Tirta II Public Corporation (Citatum river basin), and Presidential Decree No. 129 of 2000 for additional working area of Jasa Tirta I Public Corporation with Bengawan Solo river basin. BWRMU of Jragung-Tuntang was established in 2002 based on the Provincial Regulation No. 1 of 2002.

The objective, proposed reform and monitorable indicator are presented in Table 1.

## **2.2. Physical Characteristic of the Basins**

### **2.2.1. Brantas River Basin**

The Brantas river located in East Java Province has a watershed of 12.000-square km and stretches 320-km from its spring at Mount Arjuno to the point where it branches into two rivers, Surabaya River and Porong River – that both ends into the Madura Strait. Brantas flows clockwise with Mount Arjuno and Kelud as its center. Along the main flow there are many tributaries; the important among others are: Lahor, Konto, Ngrowo and Widas River.

Average precipitation in the basin is about 2.000 mm/year and available surface water is approximately 12 Billions  $m^3$  / year but less than 25% of this amount is controllable – annual manageable water availability is about 3 billion  $m^3$ . The water balance for Brantas river basin which is calculated based on Surabaya and surrounding area is presented in **Table 2**.

Population in the basin is quite dense, closing to 15.2 million people in the year 2000. This counts for 43% of East Java population. As well as the population, the Regional Gross Domestic Product (RGDP) for the basin is quite high, valuing approximately Rp 89 trillion in 1999 that is 58% of the RGDP for East Java. The basin inhabitants enjoy higher RGDP per-capita, more than 134% then the average RGDP for East Java. Thus it is evident that the Brantas River Basin is a prosperous and wealthy area compared to other parts in East Java. This prosperity is supported among others by the water availability related to the infrastructures in the basin. Water resources infrastructures managed by Jasa Tirta I Public Corporation (JTPI) and physical characteristics of Brantas river basin resumed in **Table 3**.

#### **2.2.2. Citarum River Basin**

Citarum River Basin is located in West Java Province while the service area covering two provincial administrative, i.e. West Java and DKI Jakarta. Annual precipitation depth is 3,000 mm per year in the mountainous range and 2,500 in the lowland. Relative humidity is 80% and daily temperature of 25°C in the lowland and of 18°C in the mountainous area.

There are nine rivers traversing the area from mountainous range in the south to the north and terminated in Java Sea. Citarum River is the biggest one connected with four rivers to the West namely Cibeet, Cikarang, Bekasi, and Ciliwung, and four rivers to the East namely Ciherang, Cilamaya, Ciasem, and Cipunegara by manmade canals namely West Tarum Canal (WTC) and East Tarum Canal (ETC) respectively formed a unit hydrological boundary of Citarum integrated basin of 12,000 sq-km.

Average annual flow of water in the basin is 12.95 billions  $m^3$  and using the existing water resources infrastructures water that could be regulated is about 7.65 billions  $m^3$  annually. Up to present the potential of water is still enough to cope with demands in the basin. However other measures should be taken into consideration to fulfill the demand beyond 2025 (presented in **Table 2**). Water resources infrastructures managed by JTPI II and physical characteristic of Citarum river basin is resumed in **Table 3**.

#### **2.2.3. Jragung-Tuntang River Basin**

Jragung-Tuntang River Basin is located in Central Java Province covering six districts and two municipalities. The watershed covers 4,300 square-km with total length of river is about 620 km. Irrigation system supplied by water resources in the basin is about 31,083 ha. Annual precipitation depth is 3,000 mm per year in the mountainous range and 2,500 mm in the lowland.

Land use in the basin is 32.6% for rice field, 23.0% for dry land, 21.7% for forest, 15.3% for housing and 7.4% for others. Average annual flow in the basin is 5.62 billions cubic meter, 1.72 billions cubic meters is used for agriculture, 0.05 billions cubic meter is used for Domestic-Municipal –Industries, and the rest are wasted to the sea. Potential flooded area is 50,500 ha while rate of sedimentation up to 80 ton/ha/year.

### **2.3. Progress of Jasa Tirta I Public Corporation**

Development in the basin resulted into 7 (seven) reservoirs (Sengguruh, Sutami, Lahor, Wlingi, Selorejo, Bening and Wonorejo), four river-improvement-schemes, four barrages, and three rubber dams. Total investment in water resources infrastructure is priced Rp 7.38 billion based on the year 2000 price level (equivalent to US\$ 738 million, whereas 1 US\$ equals Rp 10,000).

After construction period it is necessary to maintain function of the completed infrastructures in order to ensure maximum benefit to achieve the designated technical life span and to achieve sustainable development. Adequate operation and maintenance activities are necessary to be conducted by a permanent institution, with professional staff and adequate budget. However, after most of the water resources infrastructures in the Brantas River Basin were completed, some specific problems were encountered i.e. institution, funding, and water resources degradation.

As an effort to solve the aforementioned problems, by developing a corporation system pilot in managing river basin based on “one river, one plan, one integrated management” in 1990 the Government established a public corporation, namely Jasa Tirta Public Corporation, as a State Owned Company (BUMN) to perform the Brantas River basin management. In 1999 the name of Perum Jasa Tirta was then changed into Jasa Tirta I Public Corporation.

The purpose of establishing this organization as stated in the legislation for the establishment, the Government Regulation No. 5 of 1990 on Perum Jasa Tirta, is for organizing general utilization of water resources in a good quality and properly for fulfilling people’s need, as well as for carrying out certain tasks from the Government in managing river basin.

By the development scheme in this basin, it could be seen that various sectors in the basin enjoys benefit from the infrastructures. Comparison of situation prior to the development (1960) and as recent as before Jasa Tirta I Public Corporation is assigned to manage the infrastructures (1990) could be seen in **Table 4**.

Evidently, about 60.000 ha of area are secured from annual inundation as flood control in the mainstream is established with a designated capability to control 50-years return period flood. Hydroelectric power generation in the basin also increases from a small amount of 170 kWh that is generated by two hydroelectric generation units from the Dutch-period, to a lump amount of 910 million kWh annually that is generated by eight units. Also, related to that, development of water resources infrastructures has secured water supply for irrigation, domestic and industrial purposes. As seen, the agricultural cropping intensity in the basin has increased twice since the 1960’s.

Jasa Tirta I Public Corporation was established to solve managerial, personnel and financial problems that come over the completed water resources infrastructure in the Brantas River Basin. This task was achieved, not in a perfect sense, but as a role model for other river basins in Indonesia this corporate body is an example of what proper management can do to extend the development benefits to its beneficiaries. After 10 years management by the corporate body, it was found that the following benefits could be extended to the beneficiaries.

As it could be seen, flood control in the mainstream is maintained with a designated capability to control 50-years return period flood. Higher than before, hydroelectric power generation in the basin is optimized from 910 kWh annually to an amount of 1,200 million kWh annually. Agricultural cropping intensity in the basin has increases from 1.8 to 2.2 per year. In matter of water quality, the average water quality in the basin is approaching to designated standards eventually it has not yet fully achieved its target. Comparison of condition before and after managed by Jasa Tirta I Public Corporation can be seen in **Table 5**. Furthermore, in management aspect, Jasa Tirta I Public Corporation has internationally acknowledge on quality management system of Brantas water resources management presented by ISO 9001 certificate from SGS International Certification Service in May 1997 and renew by ISO 9001:2000 in the year of 2003.

#### **2.4. Progress of Jasa Tirta II Public Corporation**

After the proclamation of independence (1945) the GOI prepared a program of self-supporting of national staple food of rice. The program was culminated in 1956 when Ir. H. Djuanda, the late Prime Minister of Indonesia declared the commencement of Jatiluhur Multipurpose Project. The project is in fact an integrated water resources development in north plain of West Java Province, utilizing nine rivers traversing the area from south to north terminating to Java Sea.

There were two main activities in the project the first one was the construction of Jatiluhur Dam across Citarum River about 80 kms from its estuary and reservoir behind the dam with impounding capacity of 3 billions cubic meters. Besides hydro-electric power station was also built in the dam with installed capacity of 150 MW. The second one was development of technically irrigation system of 240,000 hectares as commended area of the Jatiluhur Dam. The dam and the power station was completed in 1967, since then renamed as Ir. H. Djuanda Dam and Power Station dedicated to one of the Best Son of the Nation.

Upon the completion of the project benefits revealed among others:

- a. Flood which annually inundated and endangered the fertile area of about 20,000 hectares in the plain could be minimized
- b. Technically irrigated area of 240,000 ha of paddy field with two crops per year
- c. Raw water supply for domestics, municipalities and industries, especially for Jakarta the Capital City of Indonesia
- d. Hydro-electric Power Plant with installed capacity of 150 MW and annual power production of 850,000 million kWh

- e. Freshwater as well as brackish water fisheries along north coastal area potentially 20,000 ha
- f. Beautiful scenery surrounding the dam as tourism area and water sports

With regard to optimize the output of the project and to maintain its sustainability, in 1970 the GOI established river basin organization in the form of public corporation and named Jatiluhur Authority. The main task of the Corporation is conducting operation and maintenance of post project water resources system besides to mobilize contribution from the beneficiaries of water. The Corporation is only an operator of the system and does not have public rights since the regulator remain to the government. In 1999 the name of Jatiluhur Authority Public Corporation is changed to Jasa Tirta II Public Corporation through the Government Regulation No. 94 of 1999.

Water resources development in the basin was continued by constructing two other dams in Citarum River upstream of Ir. H. Djuanda namely Saguling (1984) and Cirata (1988) both for electric power generation of 700 MW and 1,000 MW successively. Reservoirs were formed behind the dams have impounding capacity of 900 millions m<sup>3</sup> and 1,200 millions m<sup>3</sup> respectively. The dam constructions as well as operation and maintenances are conducted by the State Electricity Enterprise. Comparison condition between before and after management of Jasa Tirta II Public Corporation can be seen in Table 5.

## **2.5. Progress of Jragung-Tuntang BWRMU**

Water resources development project in Jragung-Tuntang river basin has begun since 1970. In the beginning of the Project until 1985, the project was largely focusing on rehabilitation of irrigation system and construction of water resources infrastructure in the basin. In the period of 1985 to 1989, even though water resources infrastructure was still going on but the project development is shifted to operation and maintenance especially for irrigation system.

In 1996, the Implementation Unit of Water Resources Management in Jragung Tuntang River Basin (Satgas PSDA Jragung Tuntang) as a preparation unit to operate water resources management in the basin was set up. In 1999, based on Provincial Regulation No. 7 of 1999, the Local Government established seven BWRMU including BWRMU Jragung-Tuntang. BWRMU of Jragung-Tuntang is treated as pilot project to operate an integrated water resources management in the basin.

Hydrology, GIS, and River Infrastructure Management Database has been developed to support the management activities. A simple laboratory has been established and able to analyze thirteen water parameters. Regular coordination meeting among stakeholders plays a big role for integrated water resources management in the Jragung-Tuntang River Basin.

## **2.6. Constraints and Challenges**

### **2.6.1. Technical Issues**

- 1) Watershed degradation is affected by natural phenomenon as well as human interference alternating the hydrograph unit and enhances sedimentation due to erosion that shortens economic life of dams and reduces river capacity.

To overcome the constraints, some measures should be considered both structurally and non-structurally, with regard to pursue:

- Optimal soil stability and productivity
- Sustainable and optimal forest resources management in accordance with their natural, social and economic functions
- Sustainable and environmentally considered land use

- 2) Limited water availability in most basins due to infrastructure degradation, limited of water resources infrastructure development, while rapid increase of water demand that cause unbalance between supply and demand lead to conflict of interest among beneficiaries.

Some measures should be considered to avoid conflict of interest:

- Improve of water demand management, i.e., increasing irrigation efficiency as the biggest water user.
- Conducting rehabilitation and development of water resources infrastructure to improve supply capacity of water.
- Conjunctive use of groundwater and surface-water.

- 3) Water quality degradation occurs due to erosion in the upstream area besides pollution from domestic, industrial, and agricultural waste. Those affect reduce water resources usability and reveal water-born disease.

To improve water quality in appropriate level measures should be taken:

- Converging industrial activity in industrial estate to make it easier for controlling and monitoring of industrial waste
- Introducing centralized waste water treatment plant in scattered industrial zone
- Applying tariff of waste water discharge (polluter's pays principle)

- 4) Flood hazard is occurred due to decreasing of conserve capacity in the upstream area besides inconsistency of spatial planning implementation, slack of micro-drainage, and diminishing of flood-plain. The aforementioned conditions lead to lost of life and property.

To treat flood hazard actions can be conducted are as follow:

- Implementing the designated spatial planning
- Dissemination of flood hazard mitigation and develop flood early warning system.

- 5) Threatened river environment is an accumulation of riverbed degradation and improper in-stream river management converged with water quality degradation due to lack the authority to control off-stream sources of pollution, those threats the ecosystem, bio-diversity, and human welfare as well.

Some measures should be taken into consideration:

- Maintain stable and diverse riverbanks function in accordance with prevailing rules and regulation

- Preserve river functions, water resource infrastructures and river based ecology
- 6) Water resource infrastructures degradation due to lack of proper operation and maintenance could hazard water resources management in the river basin.

Some measures should be taken into consideration:

- Improving operation and maintenance activities supported by professional management and adequate financial that contributes from water beneficiaries.

#### **2.6.2. Institutional and Legal Issue**

IWRM is a process which promotes the coordinated development and management of water, land, and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystem. PJT I, PJT II, and BWRMU were established by the Government for managing water resources limited in-stream of river acted as operator of water resources in the basin.

However various Central and Local Government organizations involved in WRM contributes to an institutional problem in sharing roles and responsibilities characterized by overlapping mandates. These mandates are based on a blend of structural, advisory, geographic and technical responsibilities, some of which are carry-overs from long-standing WRM units while others are newly established. Therefore integrated management between public sector, private sector and community has not been established yet. Meanwhile integration between management of land, water, and related resources has not been established as well.

Shift of paradigms are one of the impacts in the Southeast Asia post crisis condition economic advent. Social economic development has given path to shifts of paradigms on water resources. Water that has always been regarded as a social good has transformed into an economic good with social function. This has also affects the Government role, which shifts from being a provider towards enabler, from a centralized towards a more decentralized approach, from a single purpose towards multi-sector approach, from a less towards broader public-private-participation.

The GOI has launched Water Resources Sector Reformation Program since 1998 covering: (1) national institutional framework for water resources development and management, (2) improving organizational and administrative framework for river basin management, (3) improve regional water quality management regulatory, institution, and implementation, and (4) improve irrigation management policy, institution, and regulation.

#### **2.6.3. Financial Issues**

- 1) Financial support for sustainable water resources management should be collected from beneficiaries.

Measures should be taken:

- Stakeholders' participation especially beneficiaries with appropriate tariff to use for operation and maintenance as well as capital cost recovery.

- Financial accountability
- 2) Funding of water resources management for the people welfare safety and environment conservation is only possible whether the government is willingly to take part (contribute) its shares.

Measures should be taken:

- Improve of funding to achieve the RBOs strategy goals.
- Implementation of Government Obligation for Public Service
- 3) Community awareness, education, and participation become important since people play significant role in utilization & conservation of water resources environment.

Measures should be considered:

- Improving community capability and willingness for being active and constructive participation in the conservation (in broad sense) of natural resources in the RBOs.
- 4) Decentralization in regard to this nation-wide policy, all natural resources are owned by the respective Local (Regencies / Municipal) Government.

Measures:

- An acceptance is needed from all stakeholders considering water is a flowing resource that encompasses both administrative and economic boundaries that could not be treated as the other natural resources.
- Role sharing and water resources prioritization (national, regional and local levels).

### **3. PROPOSED NARBO'S ACTION PLAN**

As a follow-up the NARBO General Meeting, Jasa Tirta I Public Corporation and Jasa Tirta II Public Corporation and BWRMUs as well propose a regional cooperation at bilateral as well as multilateral levels with the objective to support networking and sharing of experiences and ideas in the region. These endeavors focus especially on creating a common vision of integrated water resources management.

The proposed activities are as follows:

1. Advocacy and Raising awareness for IWRM among RBOs and related sector  
Community development: improved and maintain the sustainability of conservation capacity.
2. Sharing of information, good practices, and lesson learned for IWRM among the participating organizations by training, exchange of expertise, etc.

For example:

- Watershed management: use of geographical information system (GIS) tools, such satellite images and its documentation system for watershed monitoring and evaluation, hydrological database standardization.
- Flood management: advance flood forecasting capability, improve early warning system

- Water quantity management: implementation of water use efficiency by implementation of Water Use Right (WUR) and transferable WUR as non structural measures, use of GIS tools for monitoring, and technical/structural measures
- Water quality management: improve technology for wastewater treatment plant, implementation of polluters pay principle
- Water resources management: sharing information on the implementation of Quality System ISO 9001 for IWRM (PJT I had been certified since 1997 and renew to ISO 9001:2000 since 2003, meanwhile PJT II has been certified since 1999 using ISO 9001:1997 and improved to ISO 9001:2000 since 2003). PJT II has also been certified for National Standard Certificate SNI 19-17025-2000 since 2003 related to water quality laboratory.
- Financial support and funding: calculation for water use tariff and pollution fee tariff.

#### **4. CONCLUSION AND RECOMMENDATION**

- Recent social economic development has also given path to shift of paradigms on water resources, which also affects the Government role, which shifts from being a provider towards enabler, from a centralized towards a more decentralized approach, from a single purpose towards multi sector approach, from a less towards broader participation.
- The implementation of the reform agenda of the GOI on water resources sector would lead to the changes in water resources management implementation.
- The RBO's was established to solve managerial, personnel and financial problems that loom over the completed water resources infrastructure in the River Basins. This task was achieved, not in a perfect sense, but as a role model for other river basins in Indonesia this corporate body is an example of what proper management can do to extend the development benefits to the beneficiaries.
- During the implementation of IWRM in river basin, the RBO's faced some constraint and some key issues have been identified.
- As a follow-up the NARBO General Meeting, Indonesian RBO's propose a regional cooperation at bilateral as well as multilateral levels with the objective to support networking and sharing of experiences and ideas in the region such as staff exchange, regional workshop, joint activities, etc.

**Table 1** Improving Organizational and Administrative Framework for River Basin Management -

<b>OBJECTIVE</b>	<b>PROPOSED REFORM</b>	<b>MONITORABLE INDICATOR</b>
1. Improving Provincial Regulatory Management of River Basin and Aquiver	<ul style="list-style-type: none"> <li>a. Implement regulatory arrangements for water allocation and wastewater discharge, drought management, conjunctive use of groundwater and surface water, water quality monitoring and integrated watershed management.</li> <li>b. Formation of fully functioning Provincial River Basin Management Units (Balai PSDA) in key basin in about 8 provinces.</li> </ul>	<ul style="list-style-type: none"> <li>(i) Issuance of amended related Ministerial Decree, Administrative Technical Pedoman.</li> <li>(i) Issuance of Regional Government Perda, and Balai PSDA established in key basins in about 8 provinces.</li> </ul>
2. Develop Sustainable Corporate Framework for management of Strategic River Basin	<ul style="list-style-type: none"> <li>a. Established the organizational, financial, and management framework for self-financing river basin water management corporations compatible with regional autonomy legislation.</li> <li>b. Strengthen arrangements for corporate financing from bulk water supplies service fees and wastewater discharge fees.</li> <li>c. Revise legal basis for PJT Brantas and Perum Otorita Jatiluhur (called PJT II since 1999) to strengthen financial management and provincial rules and functions in governance of the corporations.</li> <li>d. Formation of four River Basin</li> </ul>	<ul style="list-style-type: none"> <li>(i) Issuance of generic Government Regulation for river basin corporations as BUMN or BUMD.</li> <li>(ii) Issuance of Ministerial Regulation / Pedoman for Regional Government establishment of river basin corporations.</li> <li>(i) Issuance of Ministerial Decree or other appropriate regulation to implement financing of river basin water management corporations and River Basin Management Units.</li> <li>(i) Issuance of revised PP 93/99 for PJT Brantas and PP 94/99 for PJT II.</li> <li>(i) Issuance of Presidential</li> </ul>

OBJECTIVE	PROPOSED REFORM	MONITORABLE INDICATOR
	Corporation (Bengawan Solo, Jeneberang, Jratunseluna, and Serayu-Bogowonto River Basin).	Decree and/or Regional Government Perda for four basin corporations and entities in process of being established.
3. Introduce Secure, Equitable, and Efficient Water Allocation.	a. Establish National Framework for an enforceable water rights system for surface and groundwater allocation.	(i) Inclusion of enabling framework in amended UU 11/74, issuance of Government Regulation for Water User Rights, and amendment of existing MPW regulations. (ii) Issuance of Pedoman for revised Provincial water use licensing regulations and allocation of water use rights.

**Table 2 Water Balance**

**a. Brantas River Basin**

No	Description	1998 (m <sup>3</sup> /sec)	2010 (m <sup>3</sup> /sec)	2020 (m <sup>3</sup> /sec)
1	Demand	56,69	72,28	89,15
2	Supply (in 1998)	46,32	46,32	46,32
3	Balance (1)	- 13,37	- 25,96	- 42,83
4	Efficiency by water user	5,66	10,82	17,19
5	Balance (2)	- 7,71	- 15,14	- 25,64
6	Efficiency in management	3,60	3,20	2,80
7	Balance (3)	- 4,11	- 11,94	-22,84
8	Dam development		21,97	25,47
9	Balance (Final)	-4,11	10,03	2,63

**b. Citarum River Basin**

No.	DESCRIPTION	1990		2005		2025	
		m <sup>3</sup> /s	10 <sup>6</sup> m <sup>3</sup>	m <sup>3</sup> /s	10 <sup>6</sup> m <sup>3</sup>	m <sup>3</sup> /s	10 <sup>6</sup> m <sup>3</sup>
1.	SOURCES:						
	Citarum and its Reservoirs	182.33	5,750.00	182.33	5,750.00	182.33	5,750.00
	Other rivers	60.25	1,900.00	61.83	1,950.00	63.42	2,000.00
2.	DEMANDS:						
	Irrigation	177.30	5,591.71	175.00	5,518.80	168.00	5,298.05
	Industry	7.91	249.45	15.00	473.04	25.00	788.40
	Drinking water	9.77	308.11	21.30	671.72	45.00	1,419.12
	Fisheries	1.00	31.54	10.00	315.36	20.00	630.72
	Flushing	2.00	63.07	10.00	315.36	15.00	473.04
	Peak Load	9.51	300.00	3.17	100.00	0.00	0.00
3.	WATER BALANCE:						
	Sources	242.58	7,650.00	244.16	7,700.00	245.75	7,750.00
	Demands	207.49	6,543.88	234.47	7,394.28	273.00	8,609.33
	Water Balance	35.09	1,106.12	9.69	305.72	-27.25	-859.33

**Table 3** Physical Features and Present Social Figures of the Basins

		BRANTAS RIVER BASIN		CITARUM RIVER BASIN		JRATUN' RIVER BASIN	
A.	MAIN RIVER						
	Main river course and lenght	Brantas	320 km	Citarum	300 km	18 rivers	620 km
	Administrative location	Province of East Java	110°30' and 112°55' eastern longitude, 7°31' dan 8°15' southern latitude	Province of West Java and Jakarta Municipality	106°50' and 108°5' eastern longitude, 5°55' dan 7°10' southern latitude	Province of Central Java	108°30' and 111°30' eastern longitude, 5°40' and 8°30' southern latitude
B.	MAIN TRIBUTARIES AND OTHER RIVERS IN THE BASIN						
		▪ Lesti	• 625 sq-km	▪ Bekasi	• 393 sq-km	SUM =	4,300 sq-km
		▪ Konto	• 687 sq-km	▪ Cikarang	• 218 sq-km		
		▪ Widas	• 1,539 sq-km	▪ Cibeet	• 534 sq-km		
		▪ Brantas	• 6,718 sq-km	▪ Cikao	• 187 sq-km		
		▪ Ngrowo	• 1,600 sq-km	▪ Ciherang-Cilamaya	• 343 sq-km		
		▪ Surabaya	• 631 sq-km	▪ Cigadung	• 160 sq-km		
		SUM ≈	12,000 sq-km	▪ Cijengkol	• 195 sq-km		
				▪ Ciasem	• 246 sq-km		
				▪ Cipunegara	• 929 sq-km		
				SUM ≈	12,000 sq-km		
C.	MAIN RESERVOIRS	Sengguruh, Sutami, Lahor, Wlingi, Selorejo, Bening, and Wonorejo		Saguling, Cirata, and Jatiluhur. Note: The first two dams are developed and managed by the State Electricity Enterprise			
	▪ Gross storage (initial / present)	647 / 405 Mm³		3,000 / 2,400 Mm³ Note: Jatiluhur reservoir only.			
	▪ Effective storage (initial / present)	479 / 343 Mm³		2,400 / 1,900 Mm³ Note: Jatiluhur reservoir only.			
D.	SURFACE WATER AVAILABILITY						
	▪ Average precipitation	2,000 mm/year		3,000 mm/year		3,000 mm/year	
	▪ Surface runoff coefficient	0.5		0.8		0.6	
	▪ Surface water availability	12 Bm³		12.95 Bm³		5.62 Bm³	
E.	SURFACE WATER UTILIZATION						
	▪ Irrigation water	2,400 Mm³		5,262 Mm³		1,720 Mm³	
	▪ Domestic-residential supply	158 Mm³		544 Mm³		50 Mm³	
	▪ Industry bulk water	131 Mm³		208 Mm³			
	▪ Maintenance flow	204 Mm³					
	▪ Fisheries	41 Mm³					
	SUM ≈	2,9344 Mm³		5,915 Mm³			

**Table 3** Physical Features and Present Social Figures of the Basins (Continued)

F. SOCIO-ECONOMY CONDITION						
BRANTAS RIVER BASIN			CITARUM RIVER BASIN		JRATUN' RIVER BASIN	
▪ East Java population (1999)	• 35.2 million	▪ West Java and DKI Jakarta population (2000)	West Java: 35.7 millions Jakarta: 8.361 million	▪ Central Java population (2003)	31.6 million	
▪ Brantas River Basin population (1999)	• 15.2 million	▪ Citarum River Basin population (1999)		▪ Jragung Tuntang River Basin population (estimated 2003)	5.72 million	
▪ Milled rice production in the basin (1996)	• 2.3 million ton	▪ Milled rice production in the basin (1996)	4.076 million	▪ Milled rice production in the basin (1996)	319 million	
▪ Regional Gross Domestic Products (RGDP) East Java	• 152 trillion Rp	▪ Regional Gross Domestic Products (RGDP) West Java	142 trillion Rp.	▪ Regional Gross Domestic Products (RGDP) Central Java 2003	156 trillion Rp	
▪ RGDP of Brantas River Basin	• 89 trillion Rp	▪ RGDP of Citarum River Basin				
▪ Ratio of RGDP for the Brantas River Basin to East Java	• 58%	▪ Ratio of RGDP for the Citarum River Basin to West Java				
G. IRRIGATION AREA						
BRANTAS RIVER BASIN			CITARUM RIVER BASIN		JRATUN' RIVER BASIN	
			296,000 ha		31,083 ha	

Note: Jratun = Jragung-Tuntang

**Table 4** Comparison of the Pre and Post Development Area in the Basins

Items	Unit	BRANTAS		CITARUM		JRATUN	
		1960	1990	1956	1970	1970	2002
Flood control	Inundated areas	60.000 ha	None	20,000 (ha)	None		50,500
Irrigation	Cropping intensity	0,8/year	1,8/year	1.2/year	2.0/year		1.7/year
Hydropower	Million kWh/year	170	910	None	700		0.024
Raw water for domestic	Million m <sup>3</sup> /year	73	125	None	70		55
Raw water for Industries	Million m <sup>3</sup> /year	50	115	None	None		None

**Table 5** Management benefits of Jasa Tirta Public Corporation in the Basins

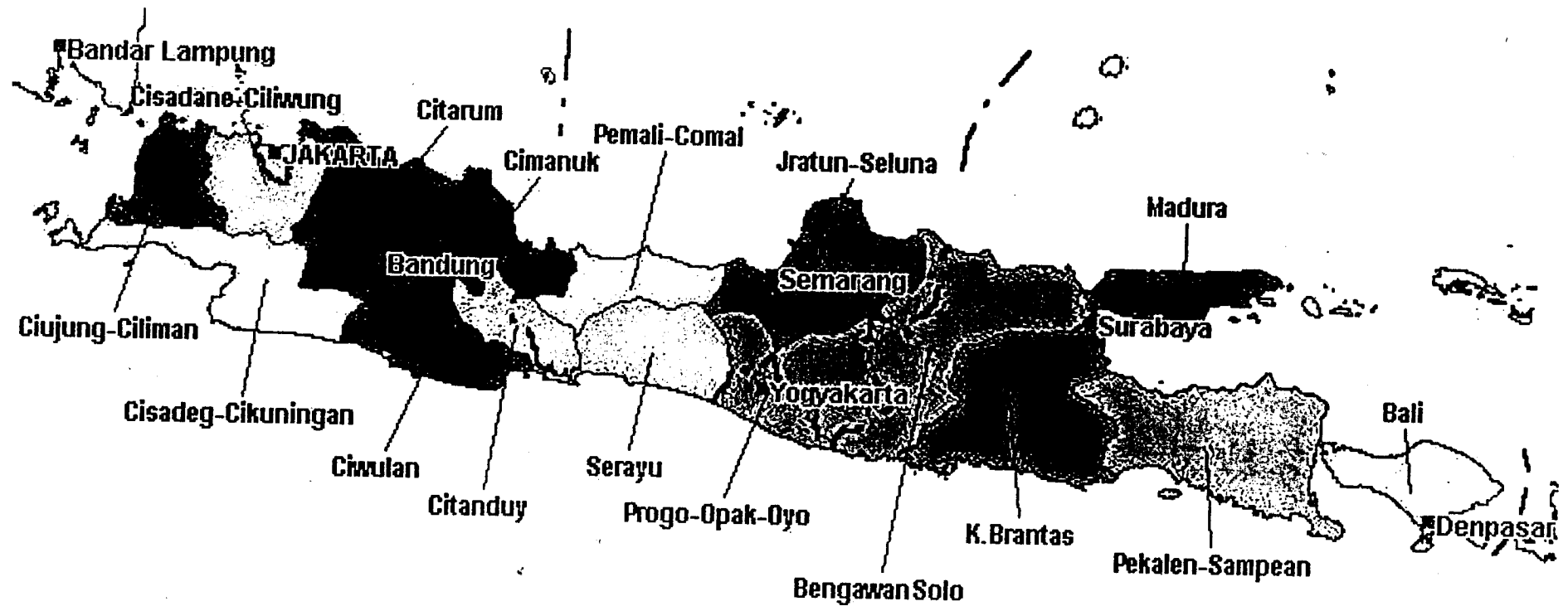
Beneficiaries	Unit	BRANTAS		CITARUM	
		1990	2000	1970	2003
Flood control	Inundated areas	None	None	None	None
Irrigation	Cropping intensity	1.8 / year	2.2 / year	2.0 / year	2.2 / year
Hydropower	Million kWh/year	910	1,200	700	850
Raw water for domestic	Million m3/year	125	206	70	544
Raw water for Industries	Million m3/year	115	129	None	208
Water quality	BOD average	12–16 mg/liter	4–9 mg/liter	4–20 mg/liter*	21–33 mg/liter*
Water resources infrastructures		Fair	Relatively Better	Good	Fair

Note: \* Based on average deviation of 25 points of sampling in Citarum River, year 1992 and 2002.

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# RIVER BASIN IN JAVA ISLAND



# CITARUM RIVER BASIN

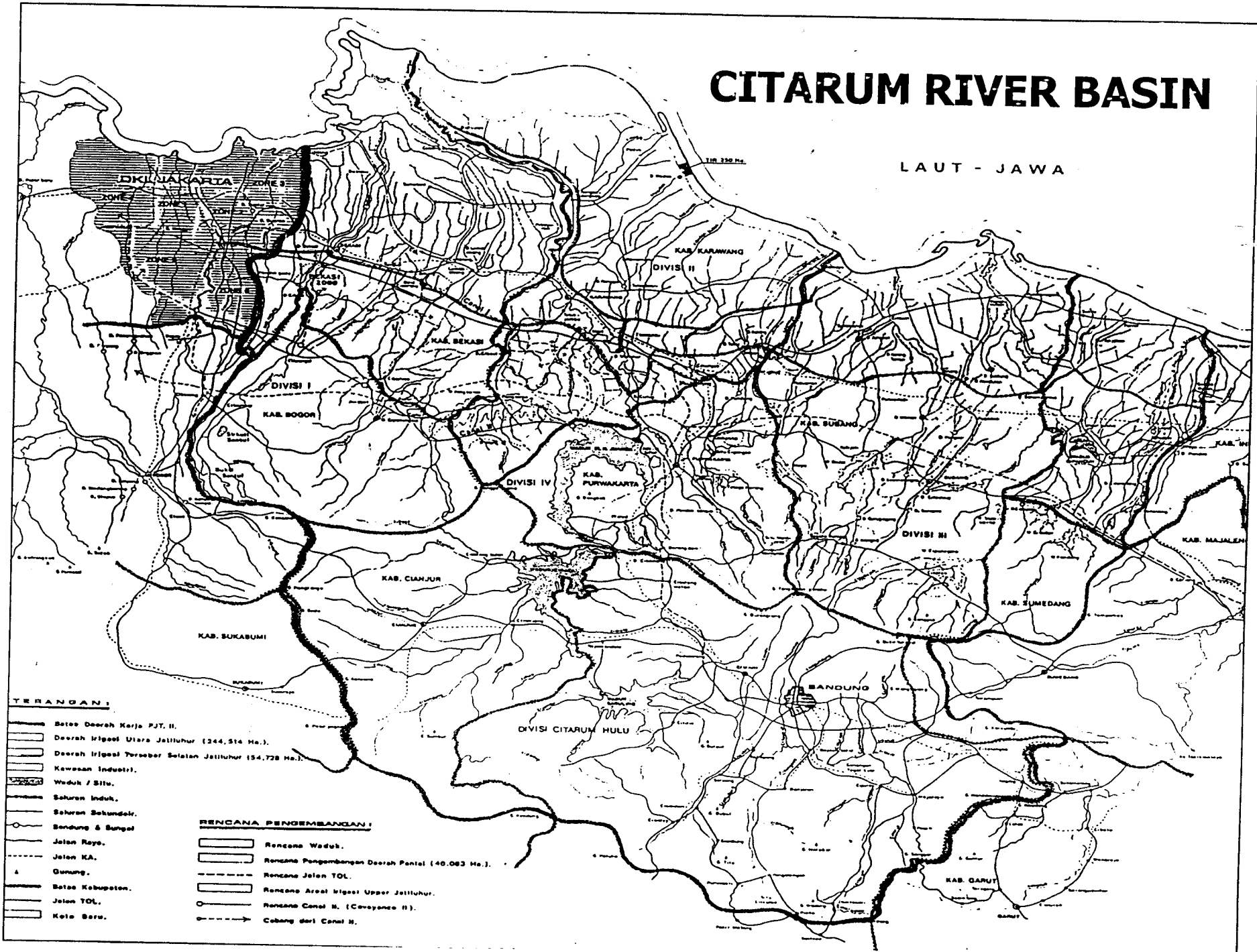
LAUT - JAWA

## TERANGAN:

- Batas Daerah Kerja P.J.T. II.
- Daerah Irigasi Utara Jatiluhur (244.514 Ha.).
- Daerah Irigasi Teraser Selatan Jatiluhur (54.728 Ha.).
- Kawasan Industri.
- Waduk / Situ.
- Saluran Induk.
- Saluran Sekunder.
- Bendung & Sungai.
- Jalan Raya.
- Jalan KA.
- Gunung.
- Batas Kabupaten.
- Jalan TOL.
- Kota Baru.

## RENCANA PENGEMBANGAN:

- Rencana Waduk.
- Rencana Pengembangan Daerah Pantar (40.083 Ha.).
- Rencana Jalan TOL.
- Rencana Area Irigasi Upper Jatiluhur.
- Rencana Canal II. (Covayana II).
- Cabang dari Canal II.





# Map of Brantas River Basin

