

***JASA TIRTA***

# WATER QUALITY MONITORING SYSTEM AND RIVER MANAGEMENT INFORMATION SYSTEM (MIS) IN BRANTAS RIVER BASIN



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# Description of Brantas River Basin



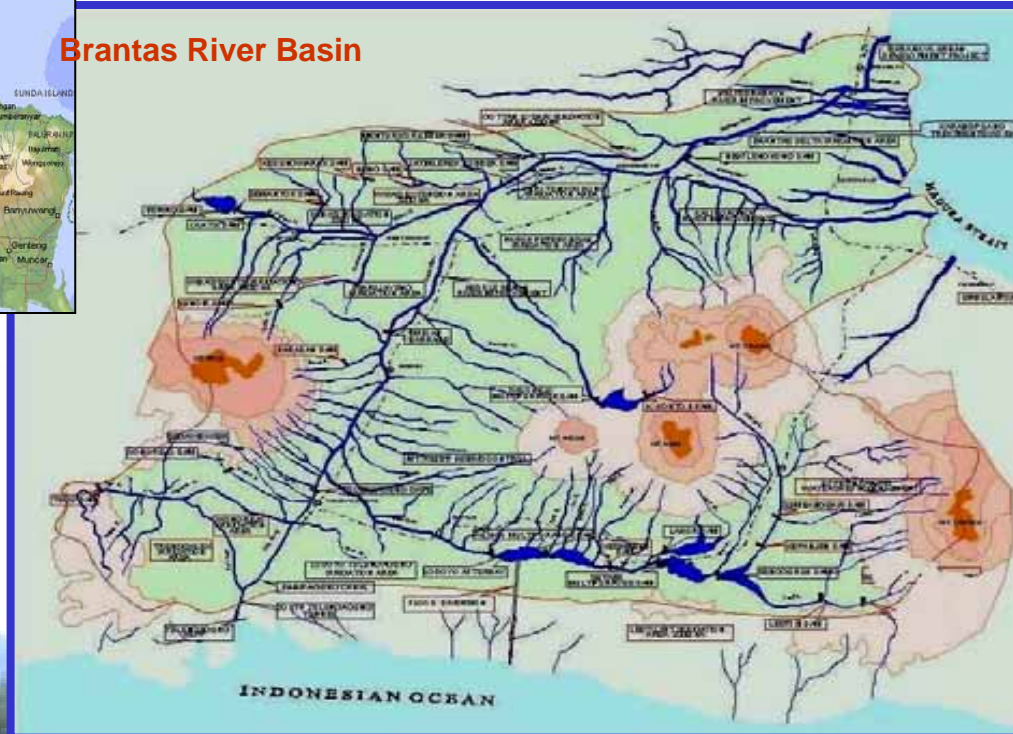
East Java



Brantas River Basin

- Basin Area : 11,800 km<sup>2</sup> (25% of E. Java)
- Population (2003) : 15.5 million (43% of E. Java)
- Average Rainfall : 2,000 mm/year
- Water Potentials : 12 billion m<sup>3</sup>/year
- River Length : 320 km

## Brantas River Basin



- Active volcanoes: Mt. Kelud & Mt. Semeru
- Land Use (2004) :
 

- paddy field	39.0%
- dry land	12.0%
- plantation	22.0%
- forest	11.0%
- settlements	12.0%
- others	4.0%

# MAIN TASK AND BASIC PRINCIPLES OF COMPANY

## MAIN TASK

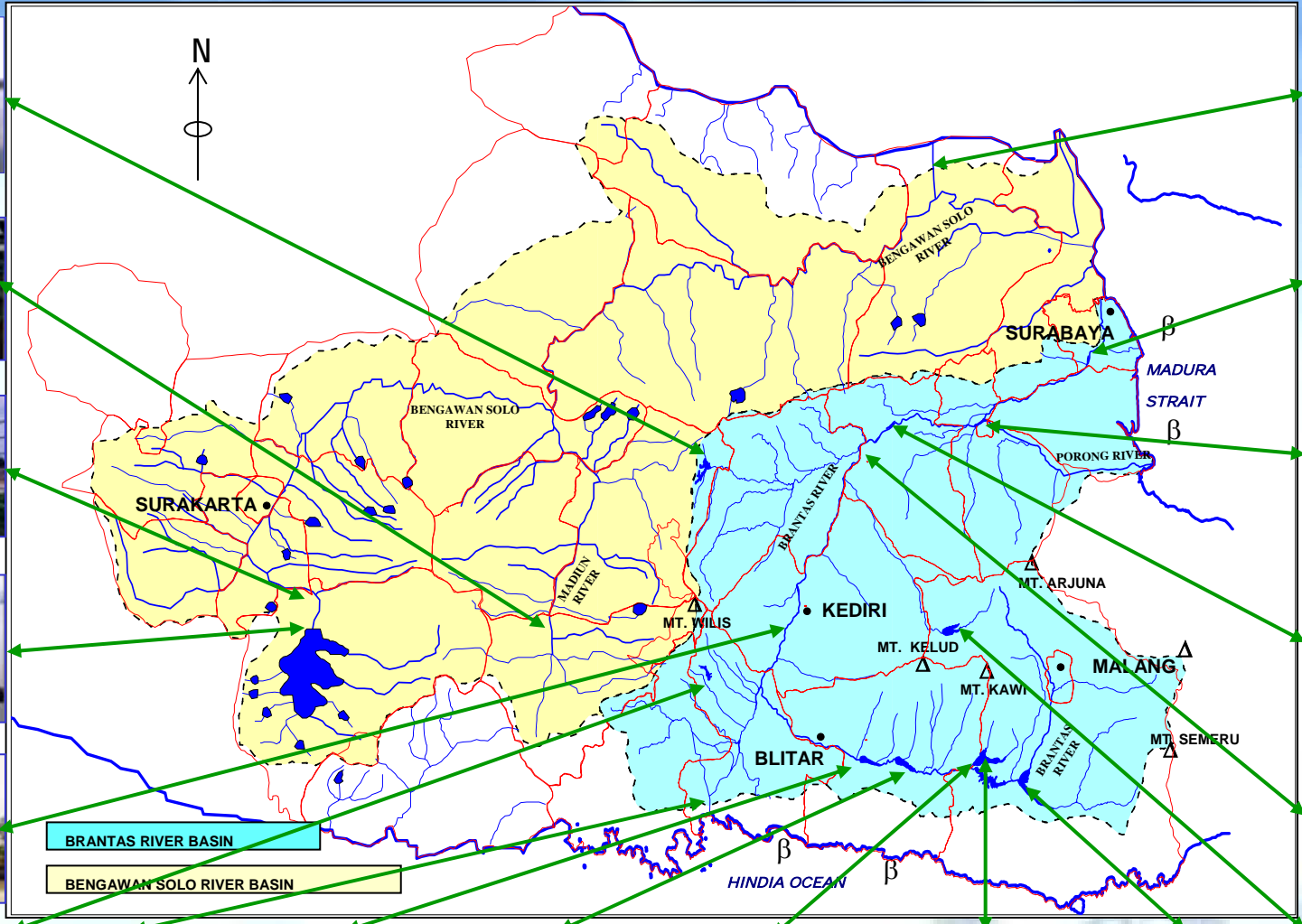
- Operation and maintenance of water resources infrastructures,
- Dealing with water and water resources,
- River basin management such as conservation, development and utilization of water as well as water
- Rehabilitation of water resources infrastructures

## BASIC PRICIPLES

1. Water resources management covers the development, conservation, utilization and control.
2. Based on the principles of conservation, utilization, fairness, self sufficiency and accountability.
3. Planned and implemented interestedly, comprehensively, sustainable, based on environmental considerations with the river basin as the management unit.
4. The management scope:
  - Watershed Management,
  - Water Quantity Management,
  - Water Quality Management,
  - Flood Control Management,
  - River Environment Management,
  - Water Resources Infrastructure Management.



# WORKING AREA OF JASA TIRTA I PUBLIC CORPORATION



Bening Dam



Jati Rubber Dam



Colo Barrage



Wongiri Dam



Mrican Barrage



Wonorejo Dam



T. Agung Coastal Hydro Electric Power



Ledoyo Barrage



Wlingi Barrage



Sutami Dam



Lahor Dam



Sengguruh Dam



Selorejo Dam



Floodway Sedayulawas



Gunungsari Barrage



New Lengkonng Barrage



Menturus Rubber Dam



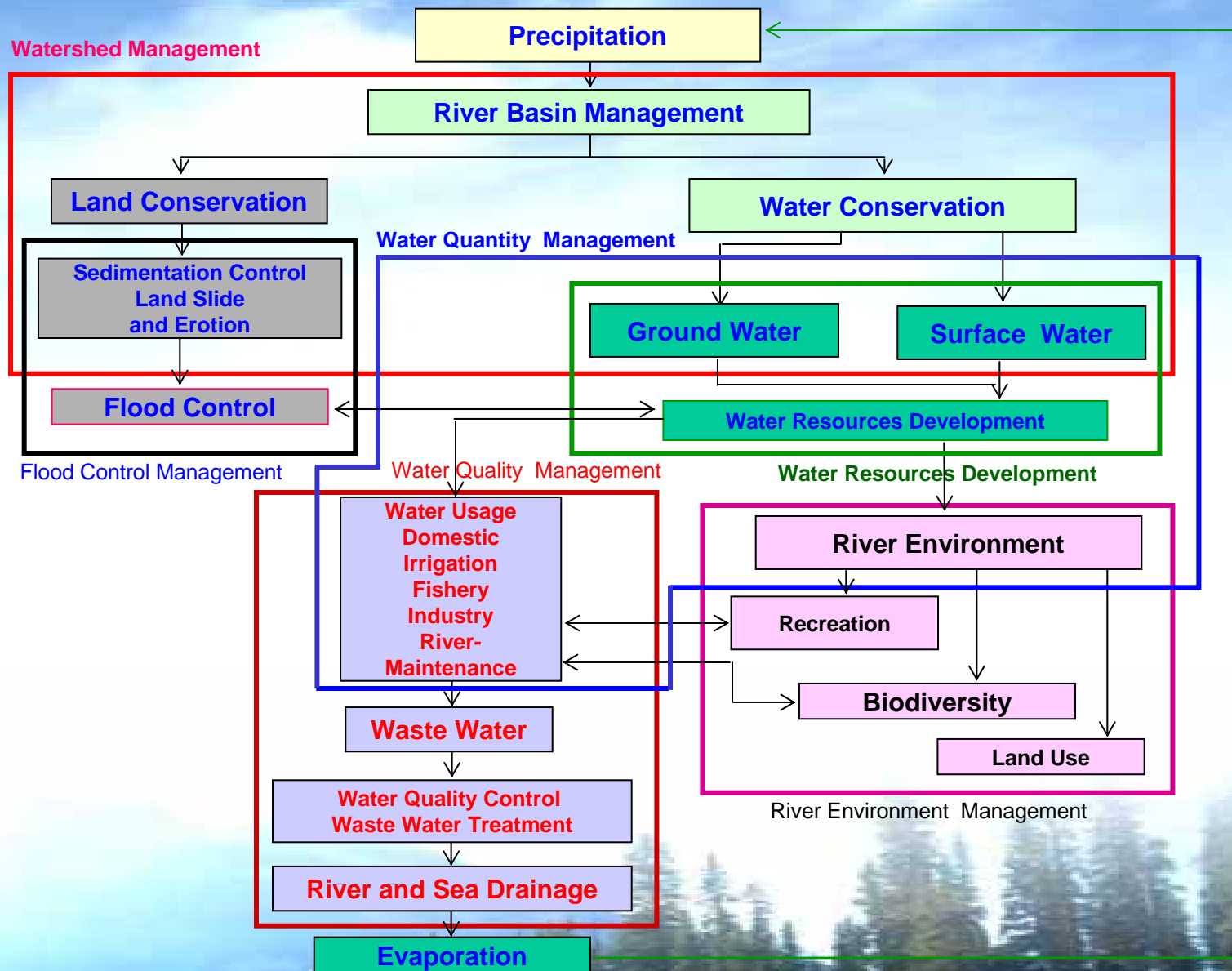
Jatimlerek Rubber Dam

# Facts about Brantas River Basin

- One of the largest river systems in Indonesia
- Functions as the most important source of water supply in East Java Province
- Support regional and national development benefits: GRDP Brantas Rp. 150,630 billion – approx. US\$ 17.66 billion – 59% GRDP E. Java – 8% GRDP National



# Water Resources Management Scope of Work





# Background (main problems)

- a. The growth of population and economic development increases pollution, and causes water quality degradation.

The main source of pollution are :

- Industry ;
- Domestic (households) ;
- Agriculture.

- b. Less of environmental awareness by :

- Industries : waste water treatment plant not functioning correctly, industries have no treatment plant,
- Domestic : disposing of waste water and rubbish directly to the river,
- Agriculture : excessive consumptions of fertilizer and pesticide,



# Background (main problems)

- c. In effective institutional arrangement for water quality management :
  - Less of coordination between concerned agencies,
  - Lack of funding.
  
- d. Incomplete regulations and ineffective of law enforcement :
  - Command and control approach treats polluters as objects,
  - Sanction which have been applied have not been effective.

# Relevant Technical Issues in the Basin



**Waste discharge**



**Waste domestic**



**Reservoir Eutrophication**



**Waste industries**



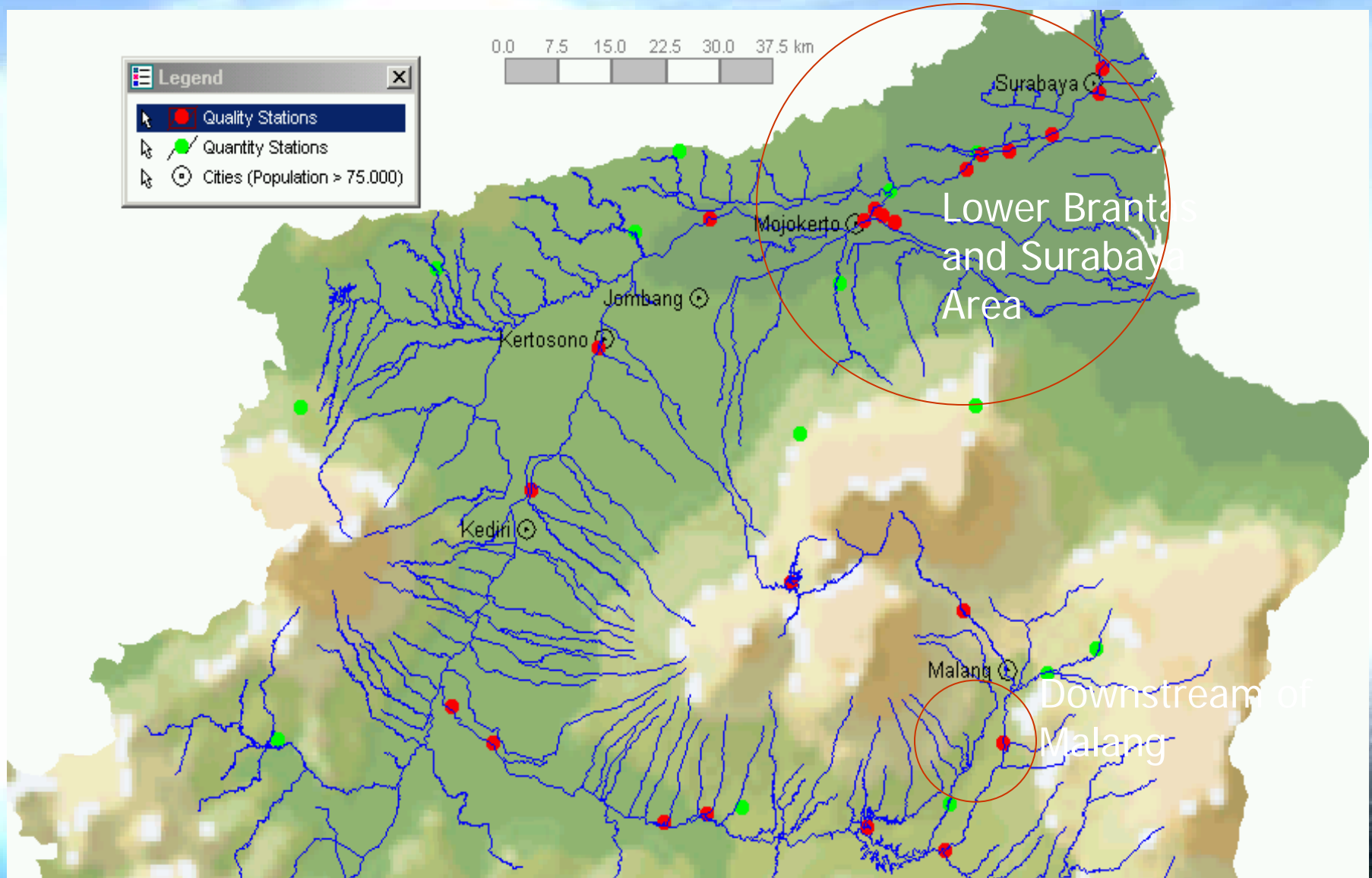
**River polluted**



**Died Fish**

- **pollution from domestic, industrial and agricultural sources has polluted the river and the reservoir**
  - ⇒ **creates a span with the designated standards**

# Zones of Poor Water Quality in Brantas Basin



# **WATER QUALITY MANAGEMENT**

**Jasa Tirta I Public Corporation participates in seeking to create the Brantas River water quality condition as it should be by carrying out water quality monitoring and licensing waste water disposal, cooperating with the agencies concerned.**

**As one of the pollution control efforts, Jasa Tirta I Public Corporation cooperates with the Indonesian Science Institute in constructing a telemetry system for water quality monitoring in the Brantas River basin and a Water Quality Laboratory in Malang, and improving the Water Quality Laboratory in Mojokerto.**



**The activities of the Water Quality Management of Jasa Tirta I Public Corporation are as follow :**

- 1. Real time water quality monitoring taken from 23 Water Quality Monitoring stations.**
- 2. Routine monitoring:**
  - a. Monitoring of river water body of the Brantas River and its tributaries at 60 locations.**
  - b. Monitoring of industrial waste water quality at 57 locations.**
  - c. Monitoring of hospital waste water quality at 11 locations.**
- 3. Public Service.**

# Monitoring System - Manual

## Monitoring location :

Routinely quality monitoring activity in body river executed in 51 dot location watch with period 2 weekly in 5 location, monthly in 29 location and 3 monthly in 17 location.

For monitoring waste industries and waste domestic executed in 3 period per **month at 56 location monitoring point waste industries** and **11 location monitoring point waste domestic (5 hospitals, 4 hotels, 2 locations at public sanitation canal)**.

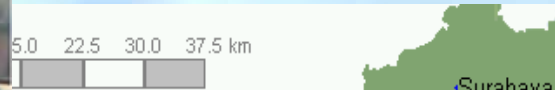
## Purpose and Objective:

the Monitoring activity intended to get quality picture or information of Brantas river totally. Pursuant to conditions rule arranged with Governor Decision and from the monitoring result hence can be evaluated its quality eligibility storey level so that can be searched by the operation effort which require to be executed by a Government Province of East Java and Regency Government and/ Town with On duty/ Related/Relevant Institution. With this effort is expected will create clean water source environment and make healthy.

# Water Quality Monitoring Infrastructures and Equipment (Manual)



Mobile Laboratories



Intake Pengambilan Air PDAM Karangpilang

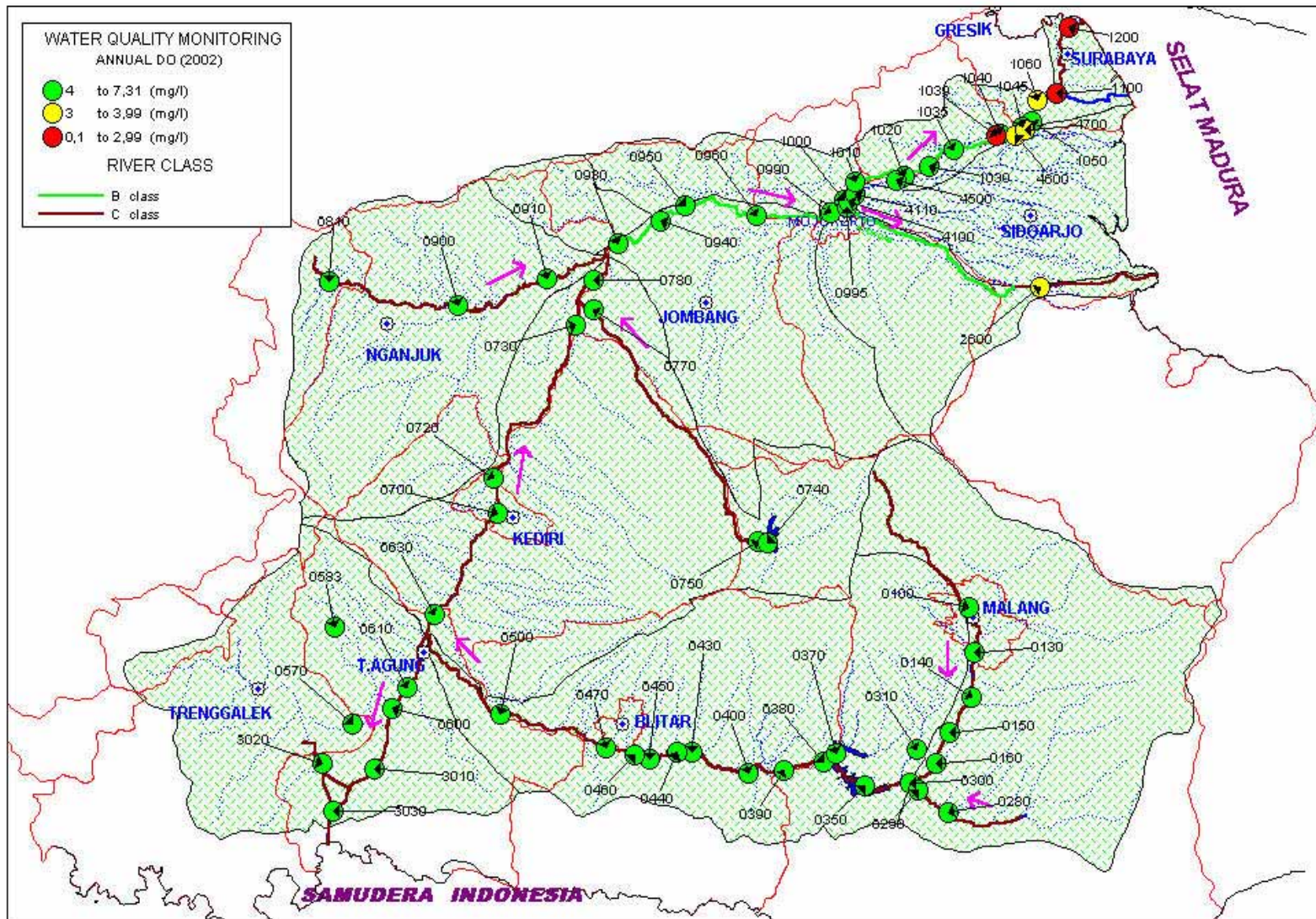


LKA Mojokerto

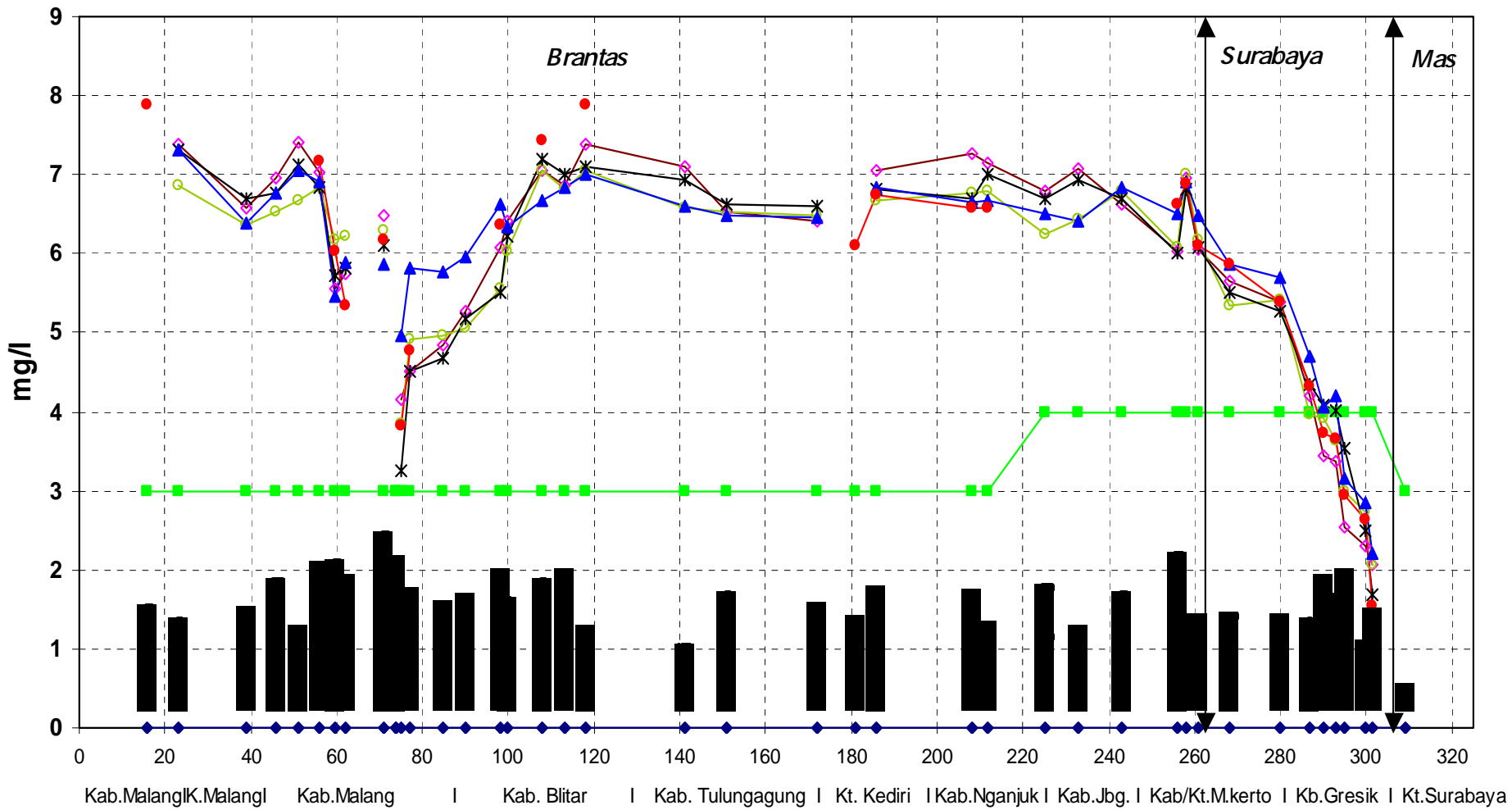








# WATER QUALITY MONITORING ANNUAL DO (Dissolved Oxygen) ALONG BRANTAS, SURABAYA & MAS RIVER



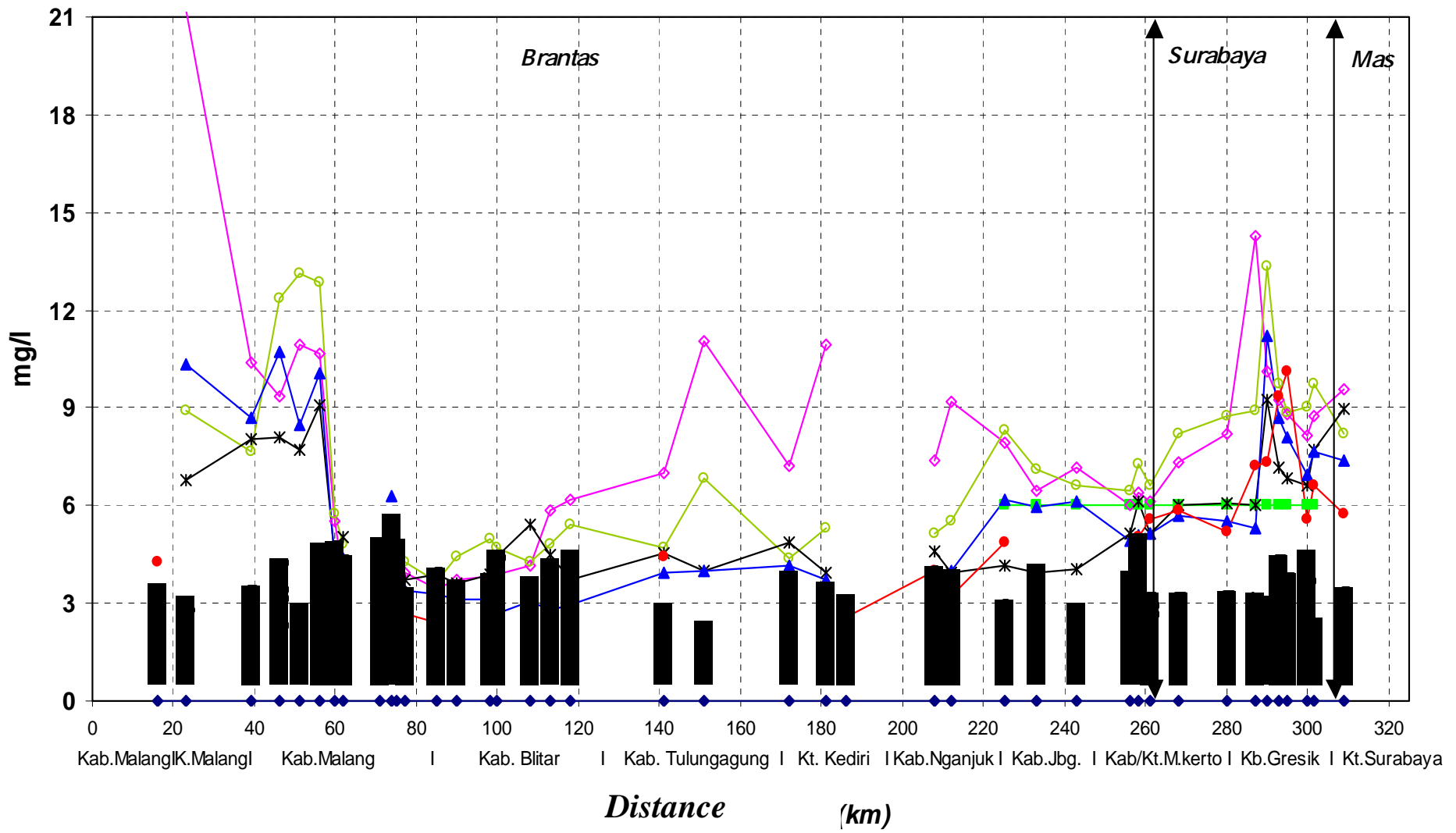
*Distance (km)*

- ◆ Location
- Standart Min.
- ◇ Year : 1999
- Year : 2000
- \* Year : 2001
- ▲ Year : 2002
- Year : 2003

# WATER QUALITY MONITORING

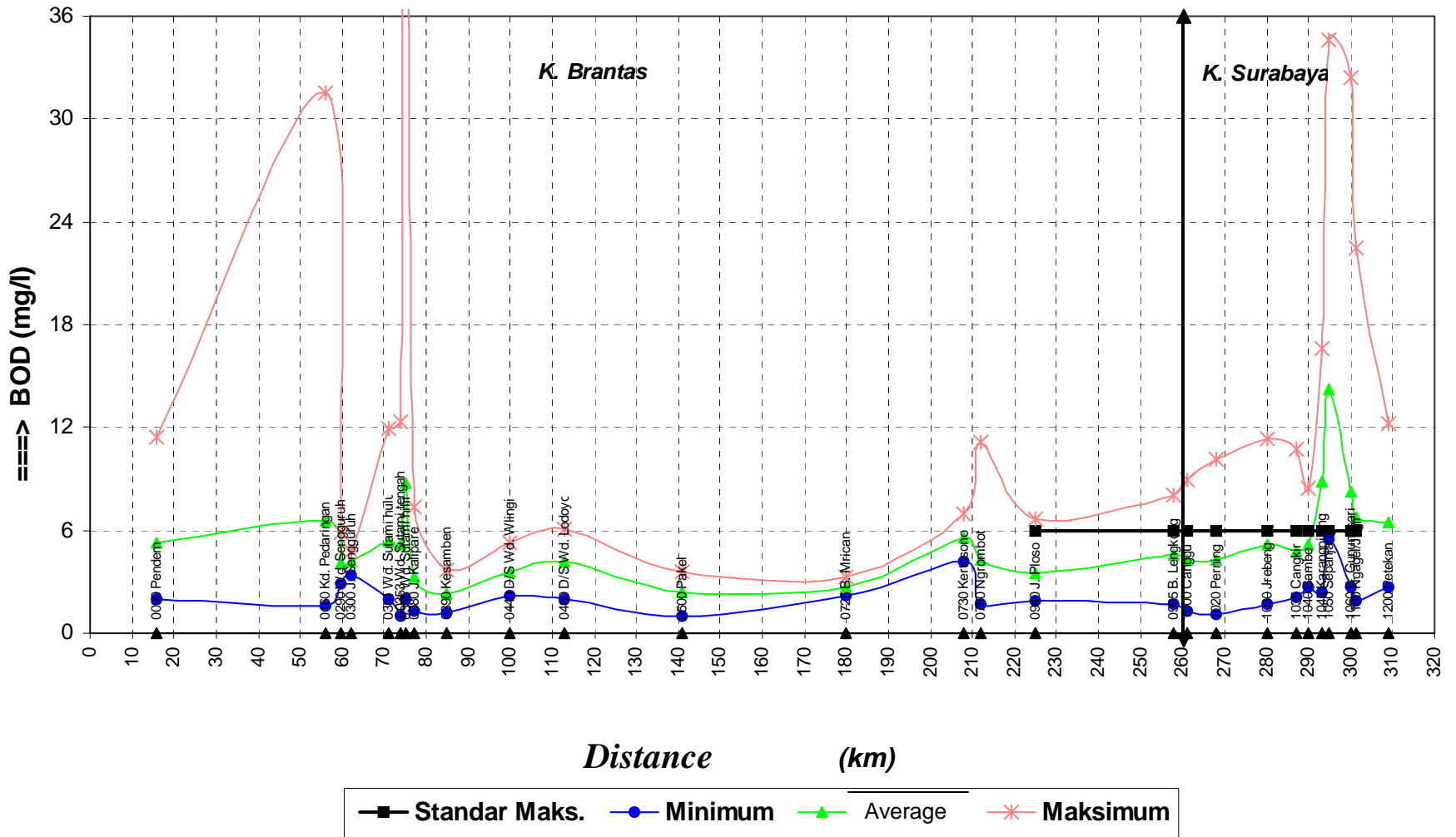
## ANNUAL BOD (Biological Oxygen Demand)

### ALONG BRANTAS, SURABAYA & MAS RIVER



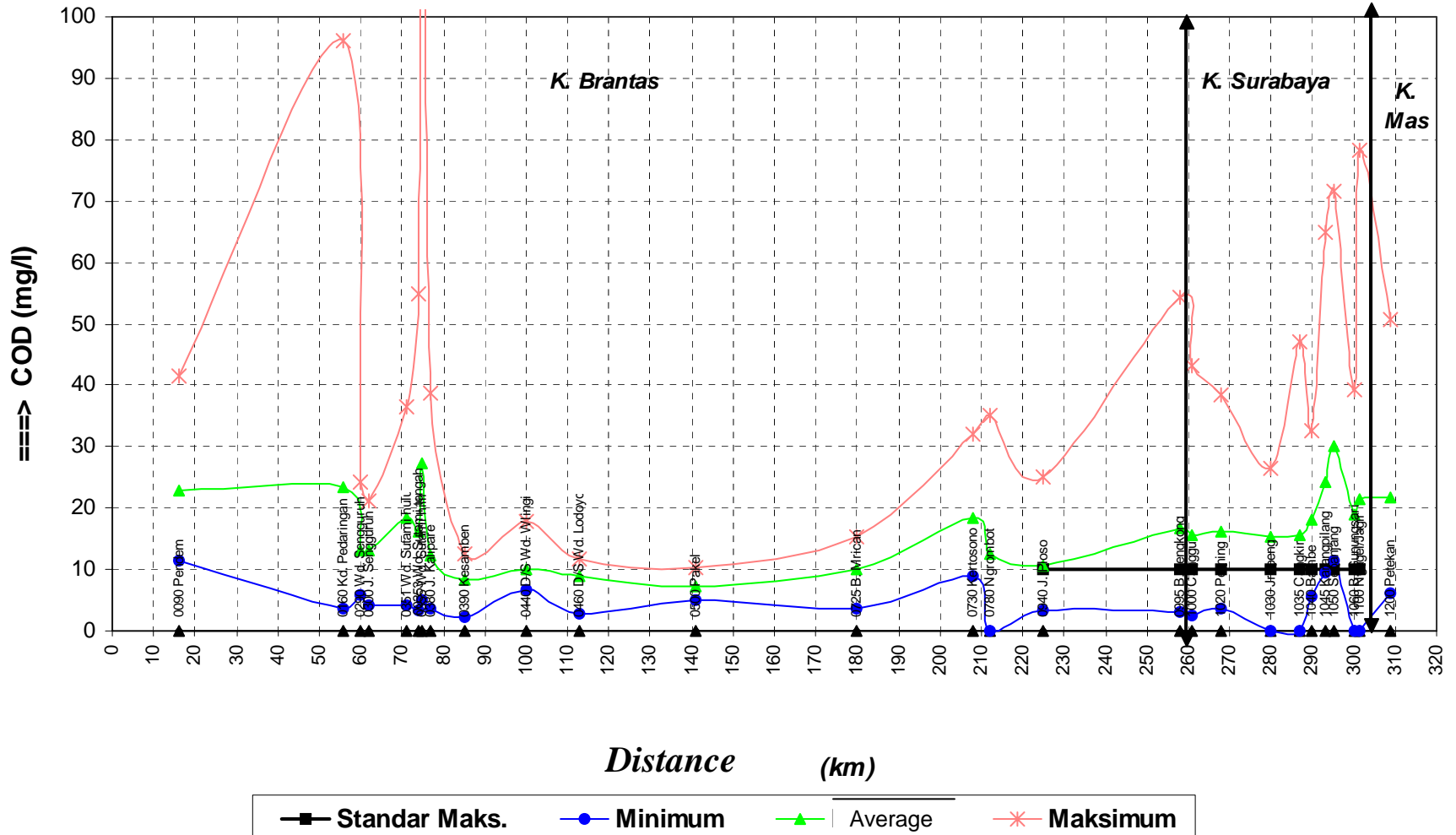
◆ Location   
 —■— Standart Max.   
 ◇ Year : 1999   
 ○ Year : 2000   
 \* Year : 2001   
 ▲ Year : 2002   
 ● Year : 2003

# Water Quality Monitoring Result Along Brantas River, Surabaya River & Mas River Periode : Year 2004 Biochemical Oxygen Demand (BOD)

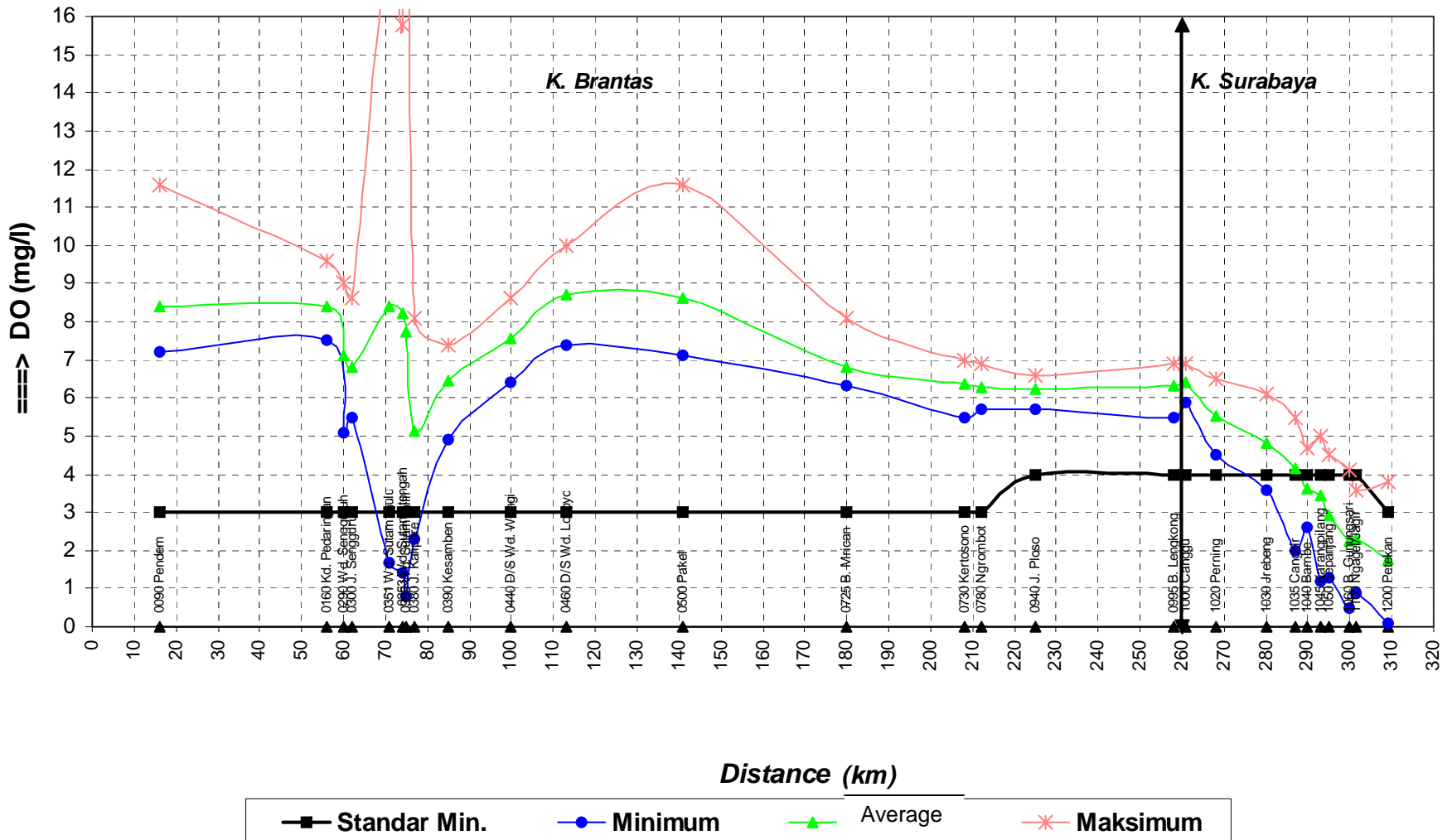




## Water Quality Monitoring Result Along Brantas River, Surabaya River & Mas River Periode : Year 2004 Chemical Oxygen Demand (COD)



# Water Quality Monitoring Result Along Brantas River, Surabaya River & Mas River Periode : Year 2004 Dissolved Oxygen



# **Brantas River Water Quality and Pollution Management System ( BRWQPMS )**

## **Monitoring System – On line**

### **Purpose:**

- 1. Water Quality Monitoring implementation directly,**
- 2. Implementation of Pilot of installation of liquid waste processing,**
- 3. New water quality Laboratory development and existing and to upgrade water quality laboratory ( water quality monitoring implementation by off-line/ manual,**
- 4. Additional implementation of equipments for the amount monitoring water quantity ( rainfall condition and high water level) directly**
- 5. Development of data processing system for decision making ( decision support system/ DSS)**
- 6. Program training to operation and maintenance.**

# Brantas River Water Quality and Pollution Management System ( BRWQPMS )

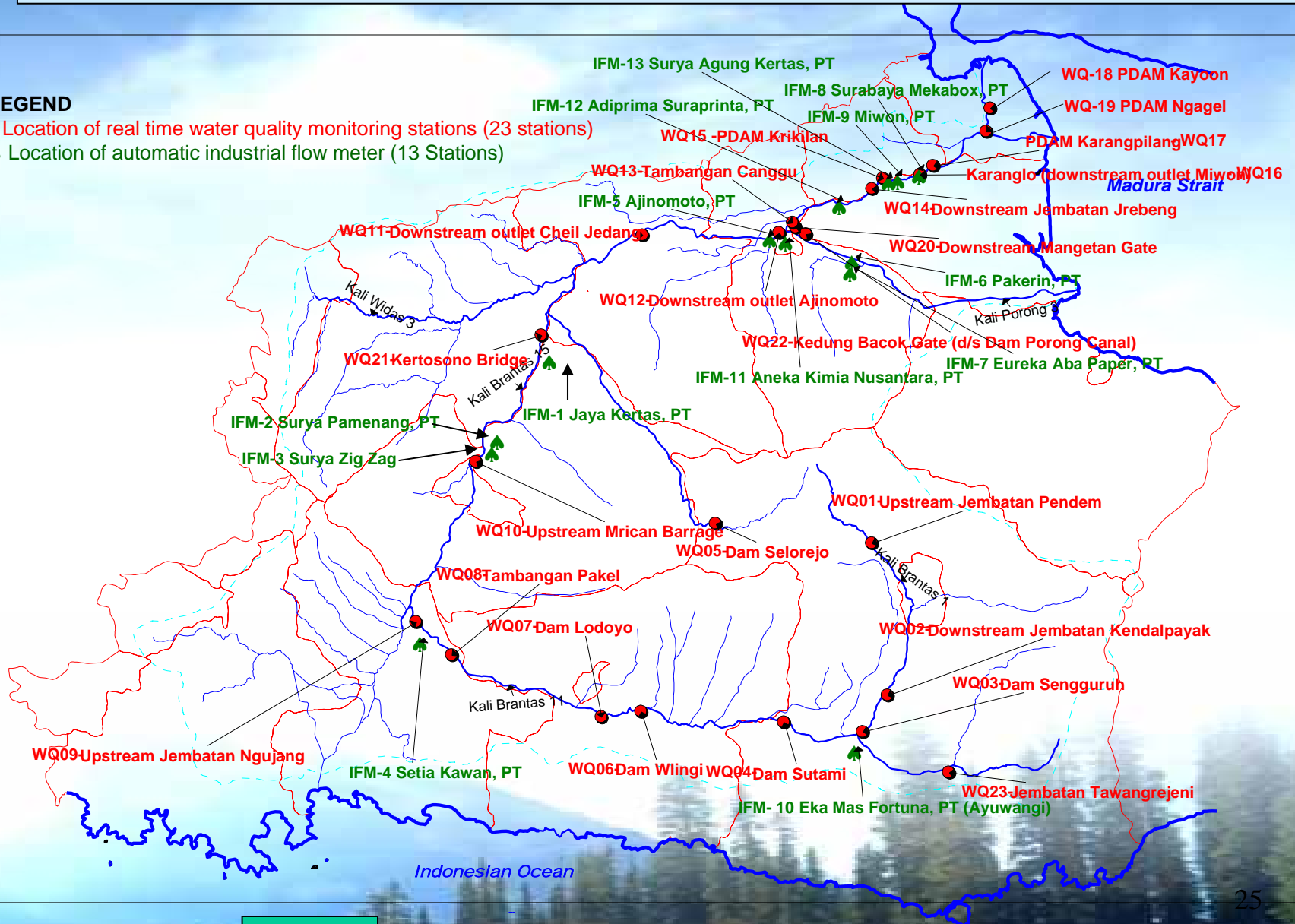
- 23 station of water quality monitoring ( telemetry/ on-line),
- 7 station watcher rain fall & 7 sty. watcher water level ( for FFWS),
- Development water quality laboratory in Malang and upgrade  
Water quality laboratory in Mojokerto,
- Information Technology ( IT) : BHIS ( data base , DSS, Internet,
- 12 st. industrial disposal watcher ( IFM),
- 3 liquid waste processor Installation ( 2 industry, 1 domestic),
- Management from BRWQPMS during 3 year. ( inclusive of education and program training).



# LOCATION OF ONLINE WATER QUALITY MONITORING STATIONS AND AUTOMATIC INDUSTRIAL FLOW METER

## LEGEND

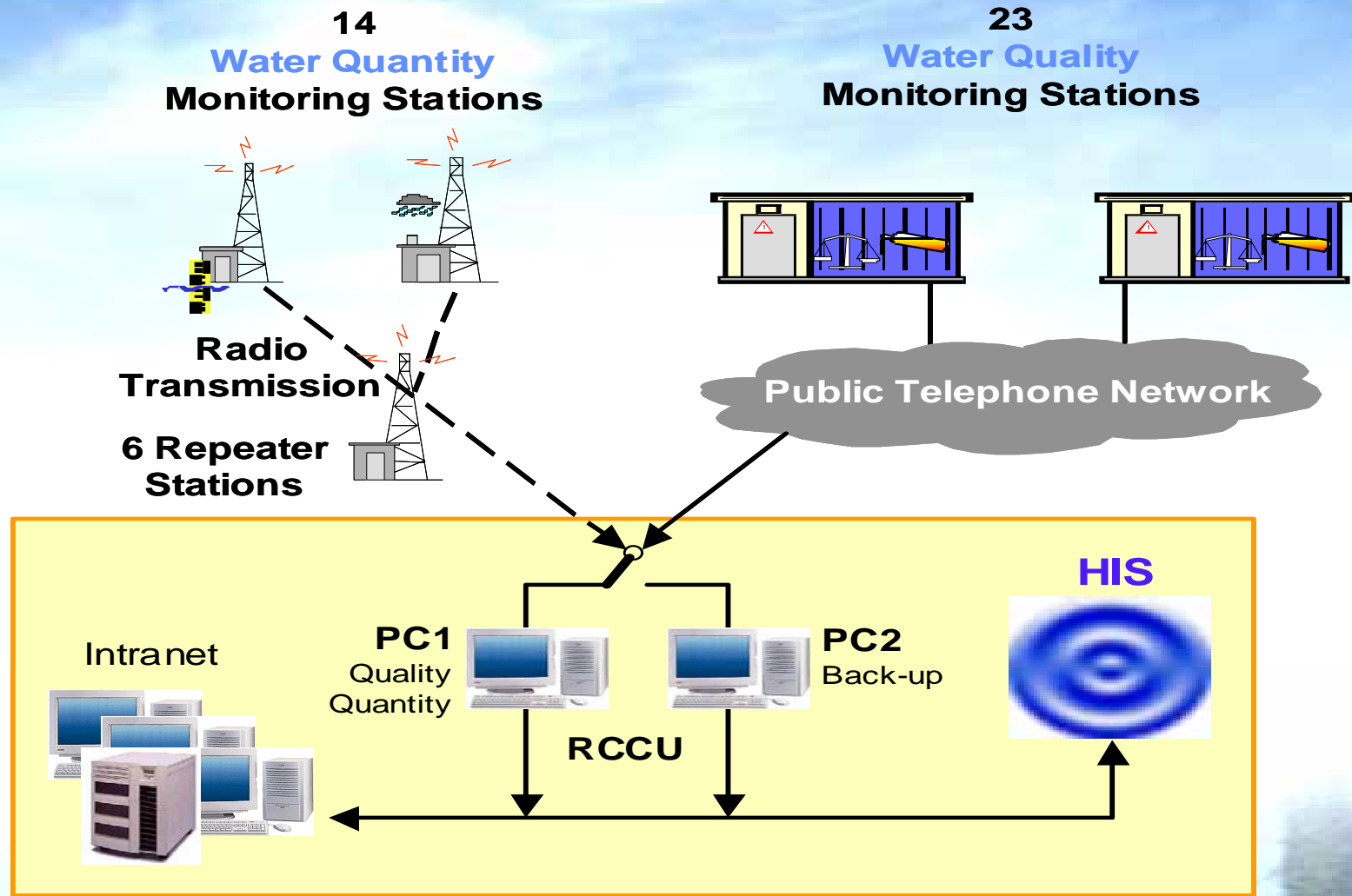
- Location of real time water quality monitoring stations (23 stations)
- ▲ Location of automatic industrial flow meter (13 Stations)



Equipment

# Water Quality and Quantity Station

(Data Real-Time transfer to RCCU via Radio and / or Telephone Transmission)



**RCCU** Remote Central Control Unit  
**HIS** Hydrological Information System

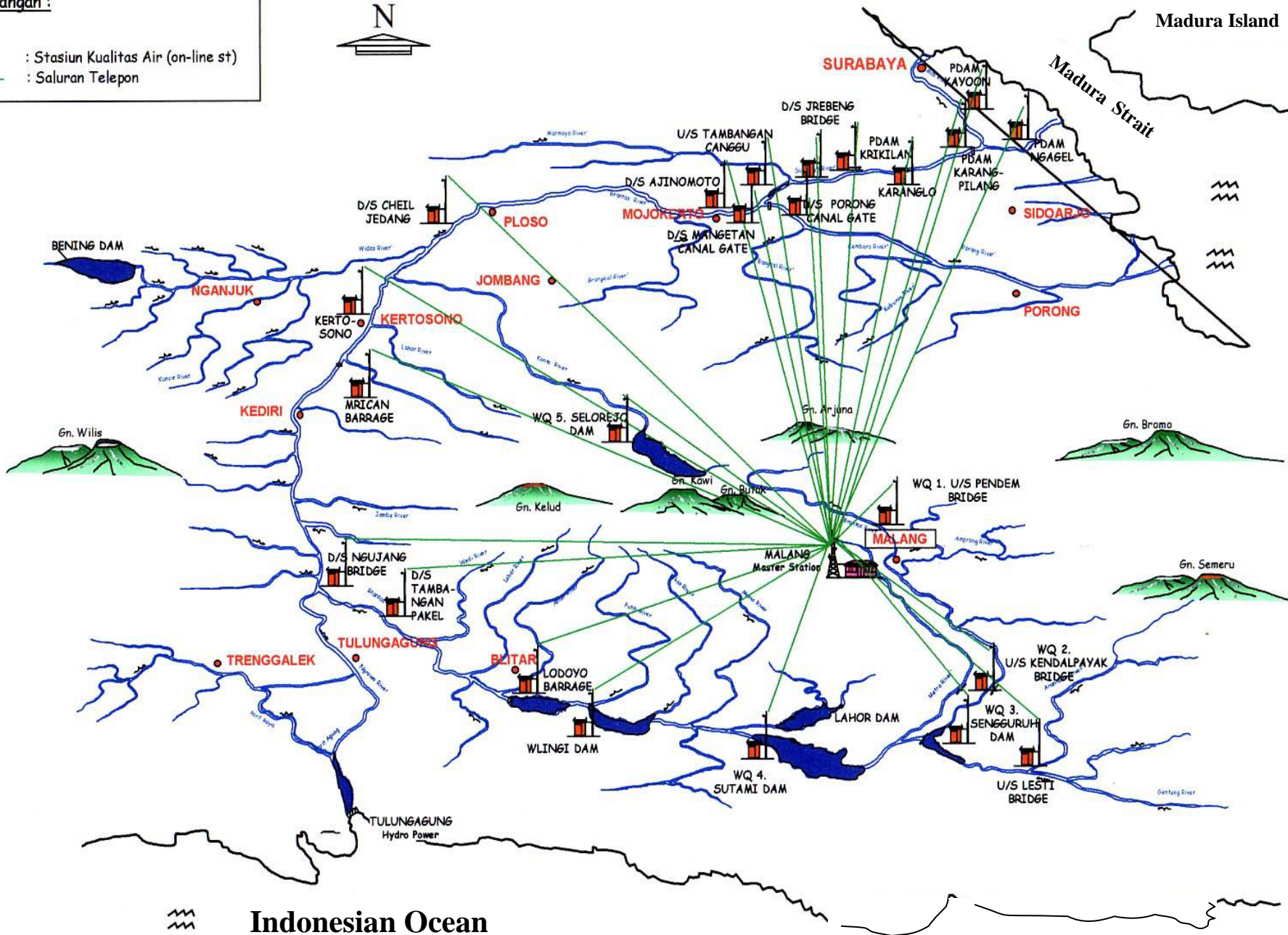
**Keterangan :**



: Stasiun Kualitas Air (on-line st)



: Saluran Telepon



**Indonesian Ocean**

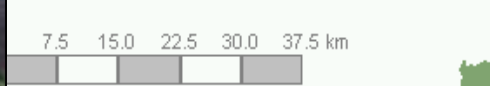




# Water Quality Monitoring Infrastructures and Equipment (On line)



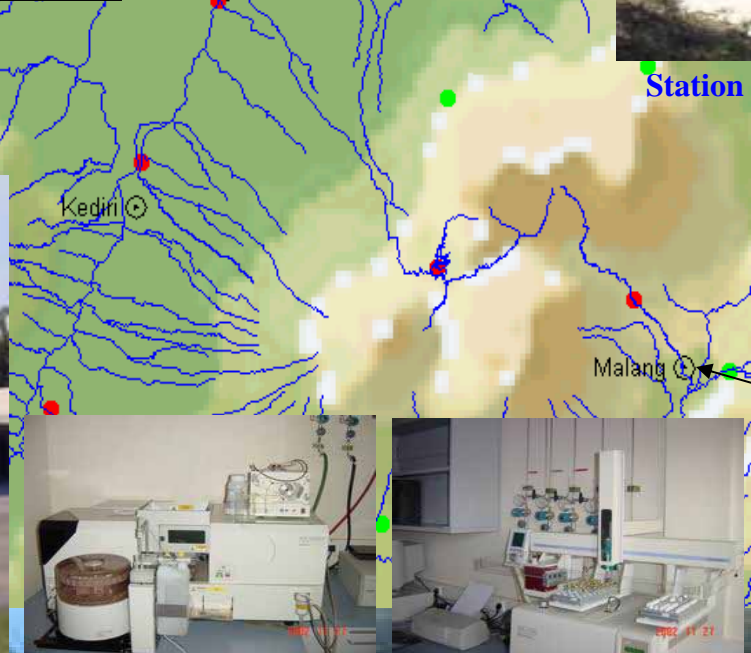
Laboratorium Mobile



Station of water quality monitor (on-Line)



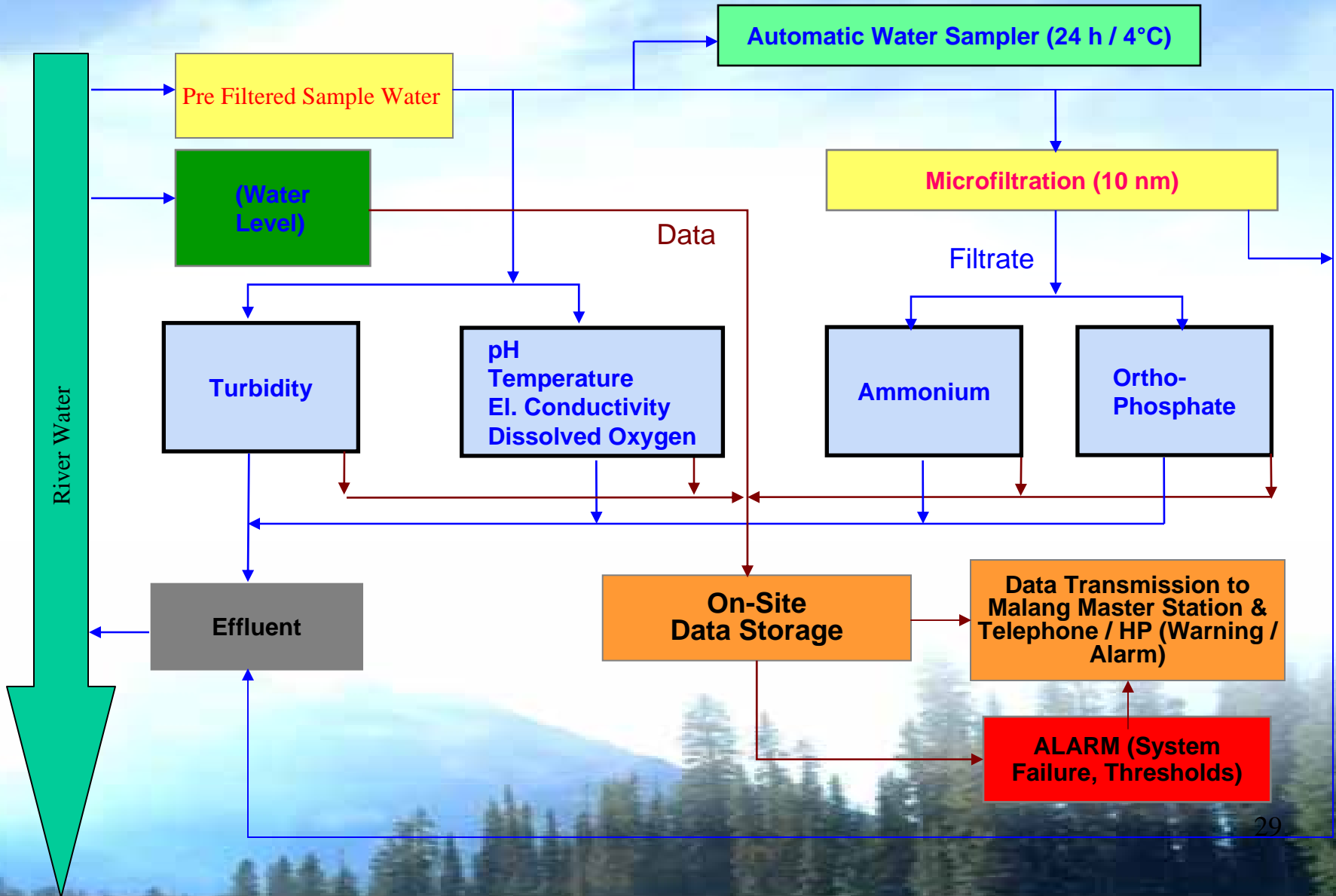
Mojokerto Laboratory



Malang Laboratory

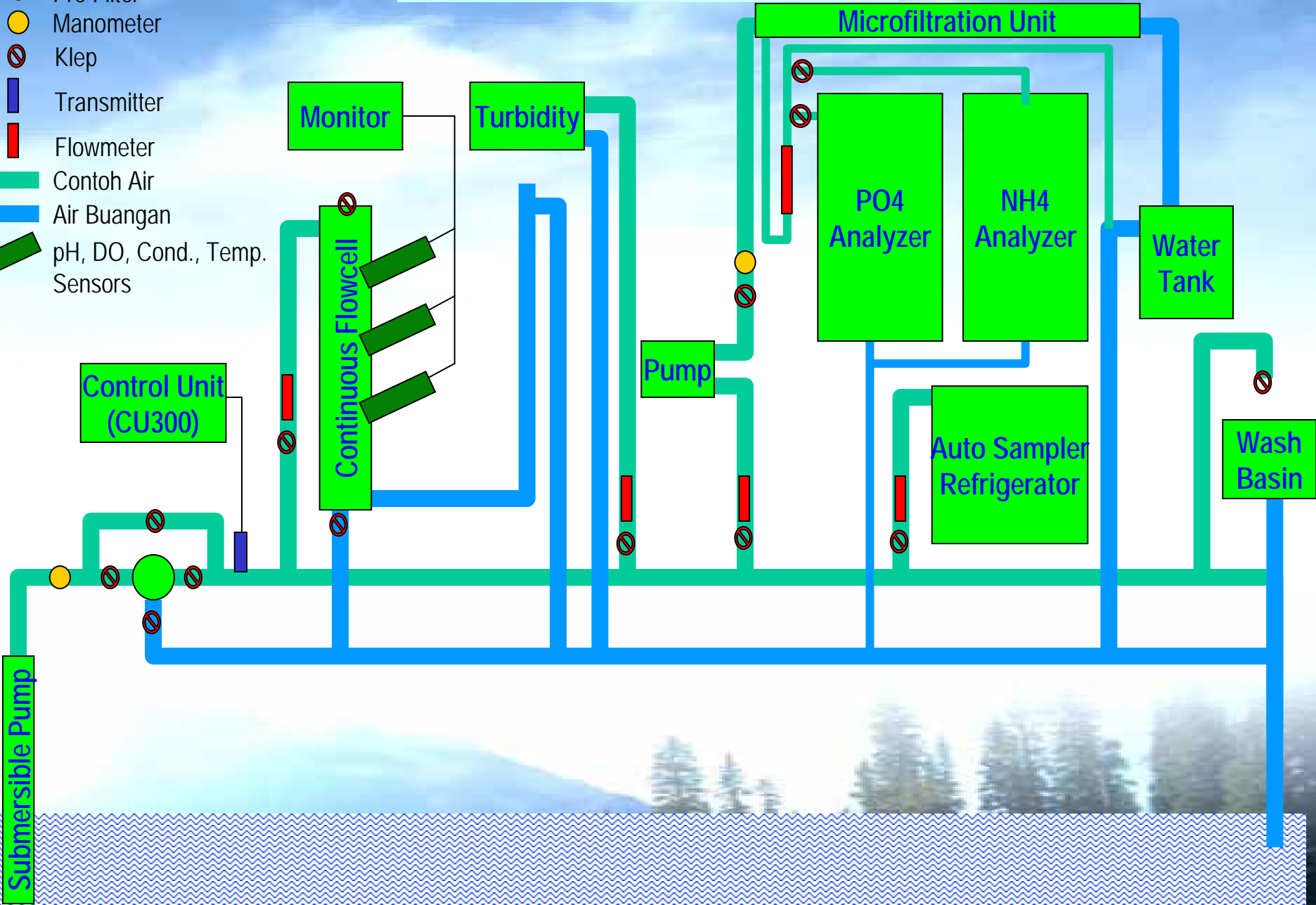


# Water Quality Monitoring Station (Lay out)



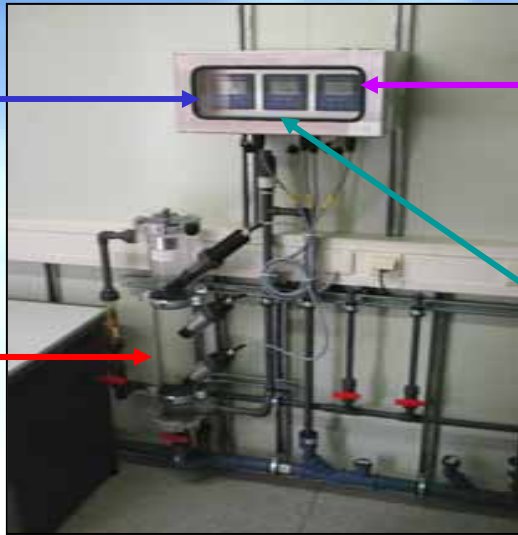
# FLOW SYSTEM OF SAMPLE

- Pre Filter
- Manometer
- ⊘ Klep
- ▬ Transmitter
- ▬ Flowmeter
- ▬ Contoh Air
- ▬ Air Buangan
- ▬ pH, DO, Cond., Temp. Sensors



# EQUIPMENT SYSTEM OF WATER QUALITY MONITORING

PH & TEMP



CONDUCTIVITY

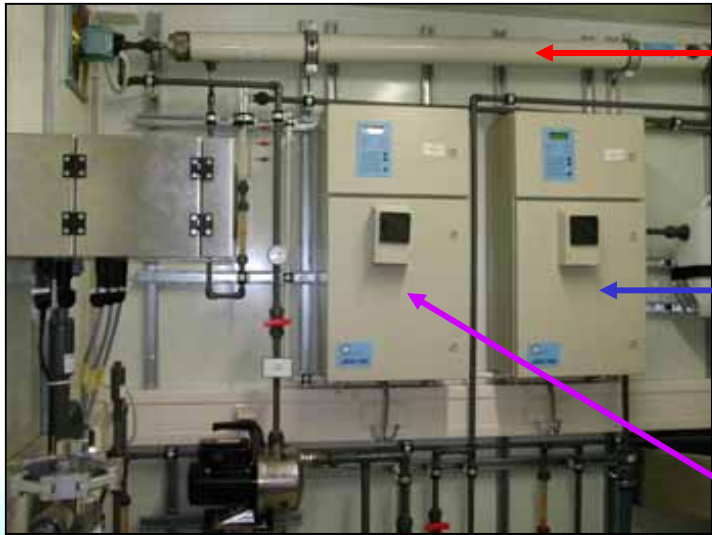
FLOW CELL

DO

PH, TEMPERATURE, CONDUCTIVITY, DISSOLVED OXYGEN



TURBIDITY METER



MICRO FILTRASI

NH4

PO4

AMMONIA DAN ORTHOPHOSPHATE (NUTRIENS)



SAMPEL OTOMATIS (AUTOSAMPLER)

# Water waste processor Installation & Industrial Flow Metering



Treatment Plan of Domestic waste (Tlogo Mas)



Treatment plan of Domestic waste



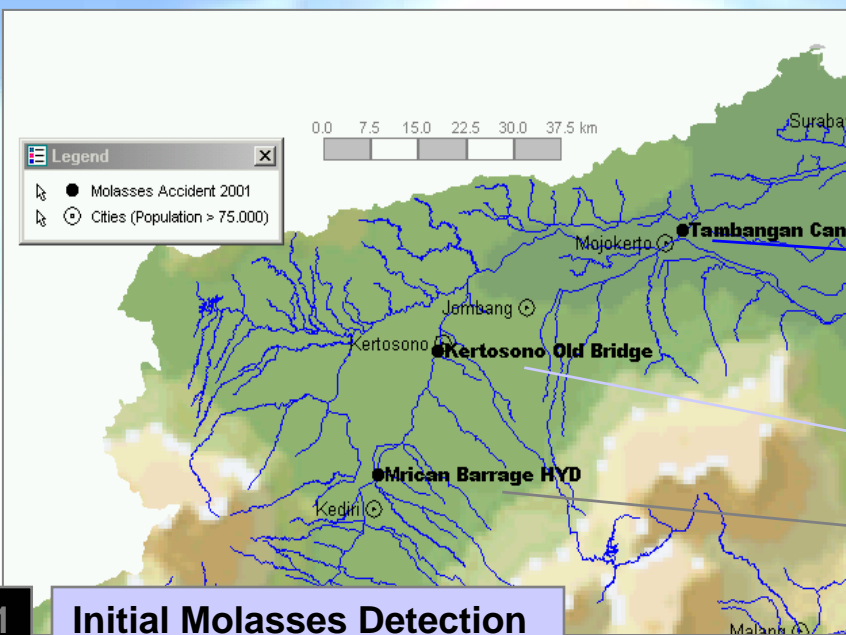
Treatment Plan of Industries waste (PT. Kasin)



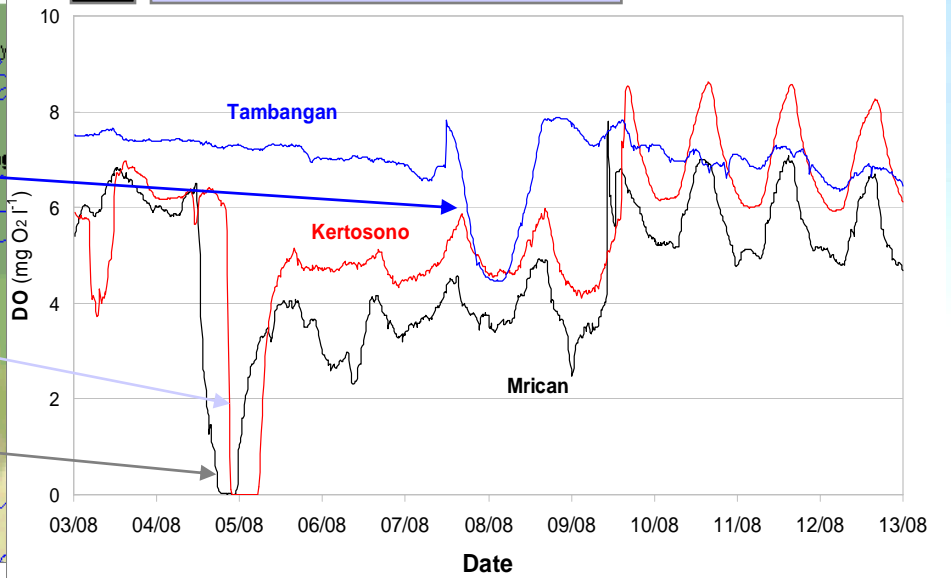
Industrial Flow Metering (IFM)



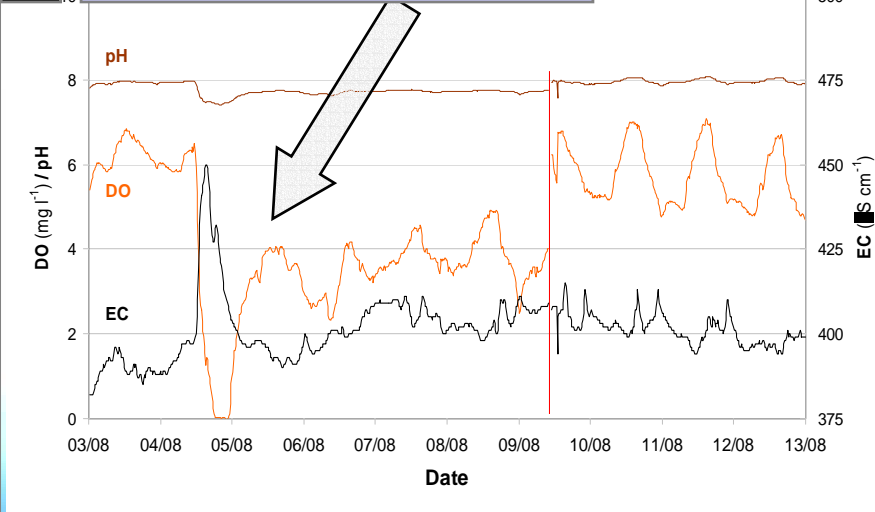
# Water Quality Monitoring (Release of Industry Effluent into Brantas River)



## 2 Molasses Propagation



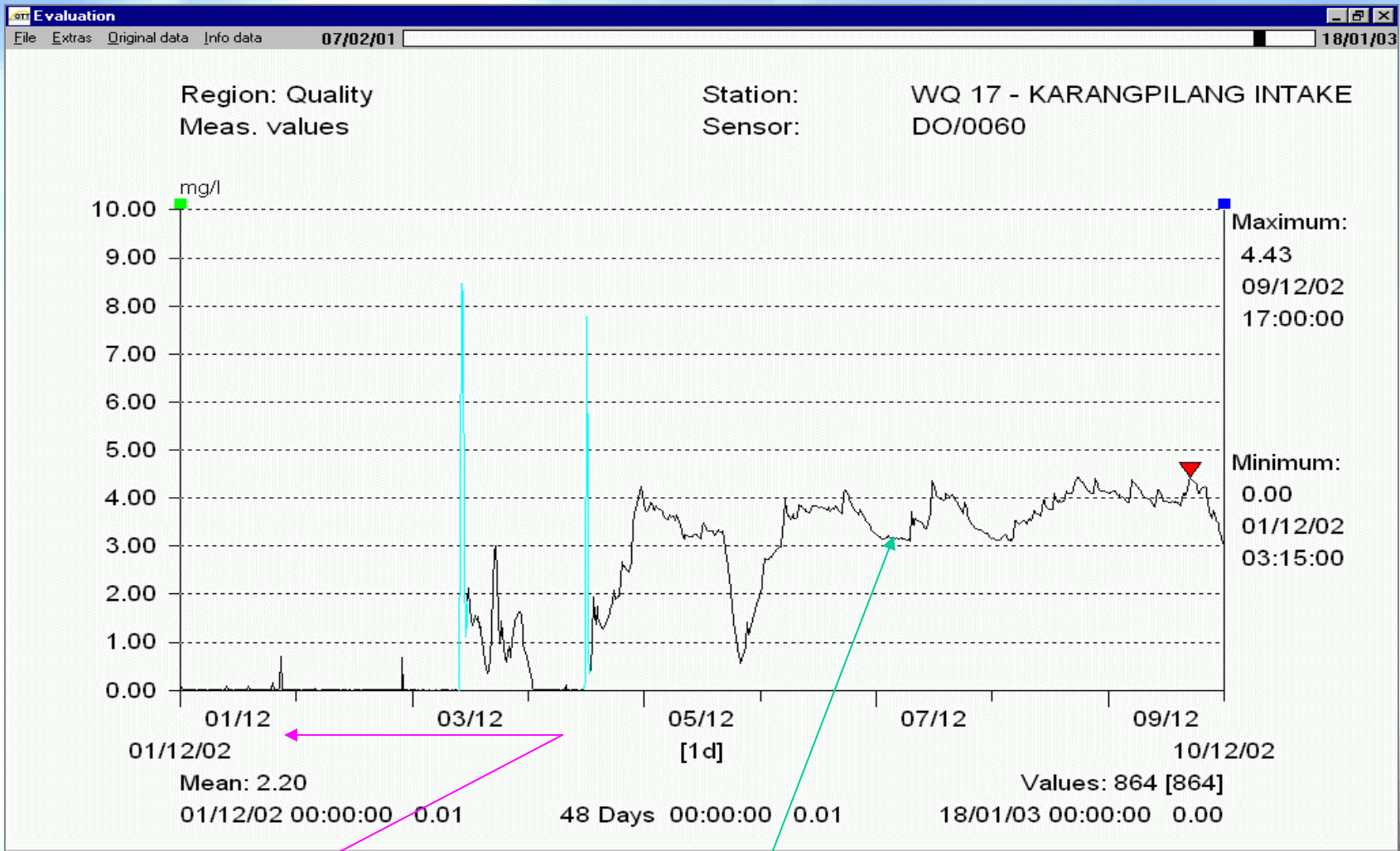
## 1 Initial Molasses Detection



## Molasses Accident August 2003

- 1 Sharp drop of dissolved-oxygen concentration (DO) and pH  
Sharp rise of el. conductivity (EC)
- 2 Sharp drop of dissolved-oxygen levels at three consecutive monitoring stations

# Water quality condition in Surabaya river at Station Karangpilang (holliday periode, December 2004)

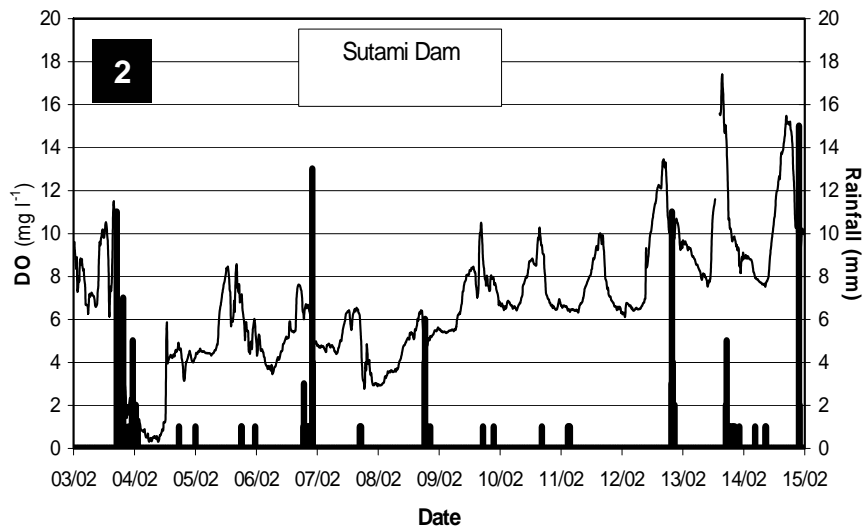
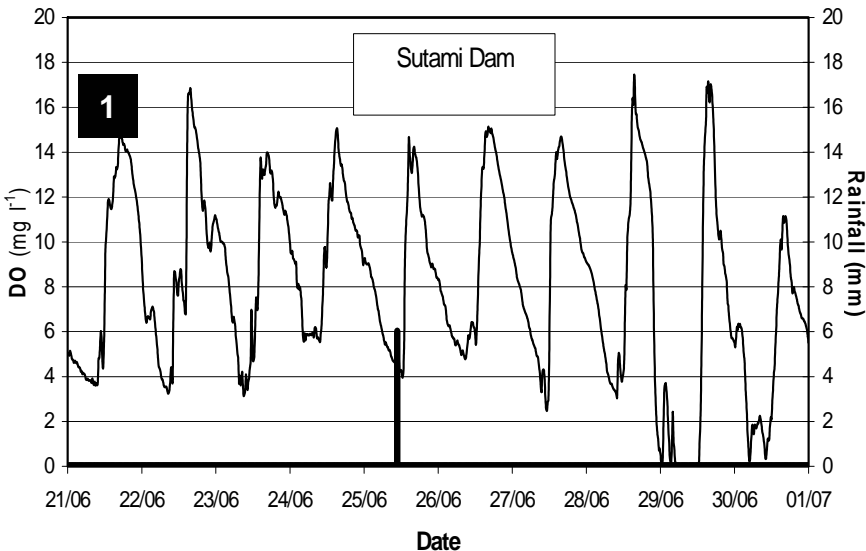


Before week end and/ or holliday result measurement was not excelent and satisfaction

After weekend and / or holliday result measurement was excelent and satisfaction

# Sutami Dam Water Quality Characteristic

## Dissolved Oxygen (DO) and Rainfall at a Station Located at a Dam



1 Dry Season

2 Rainy Season

During the dry season a much higher amplitude for diurnal pattern in DO can be observed, which is caused by autotrophic organisms.

At water temperatures between 28 and 32°C DO concentrations in the dry season exhibit very high variations with differences of more than 10mg/l during the day. Excessive algae oxygen production leads to over-saturation of more than 200% in the afternoon, whereas in the night even anoxic conditions occur. In the rainy season maximum variations of DO at water temperatures between 27 and 29°C usually are less pronounced than in the dry season.

# Problems in maintenance equipments



location pump- station



dirty water



mud sediment



mud sediment- eq.timeworn



Equipments full of mud



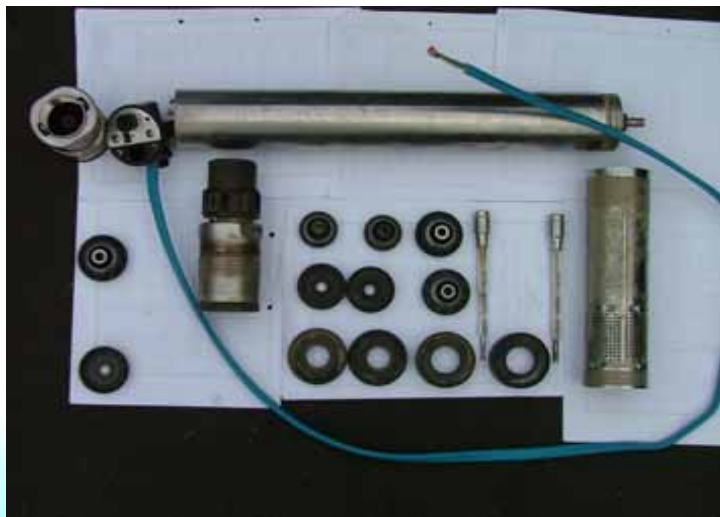
# Problems in maintenance equipments



maintenance equipments



Equipments timeworn



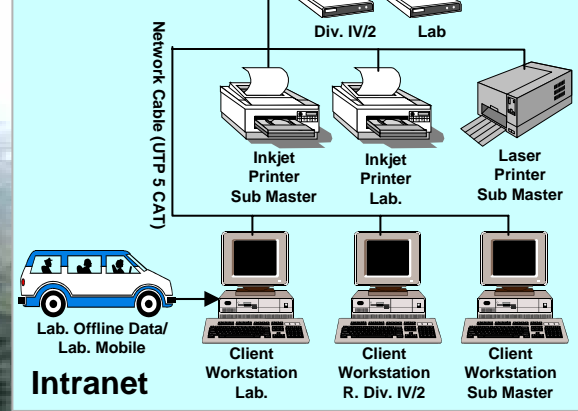
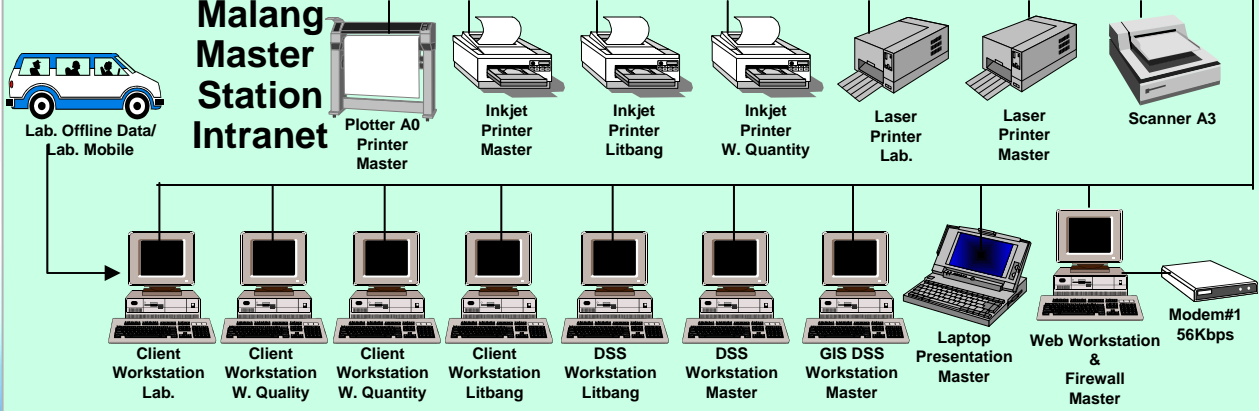
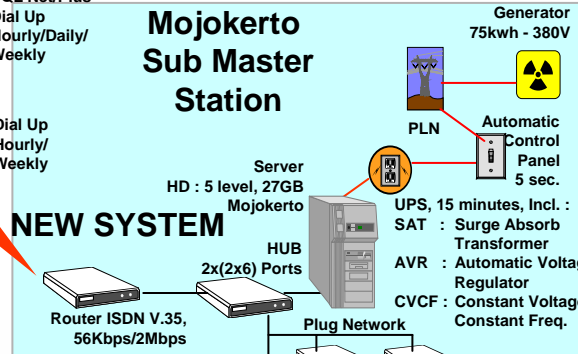
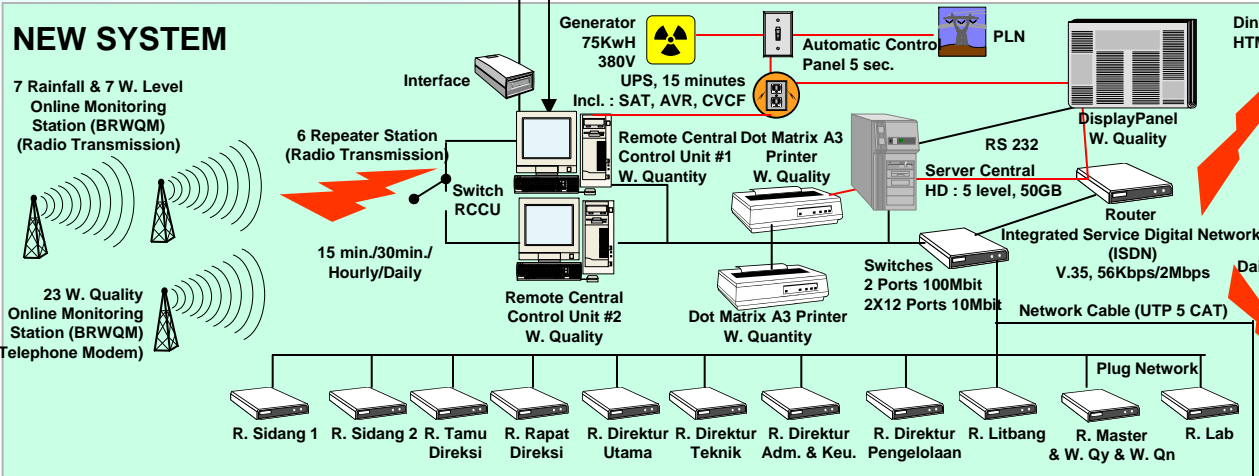
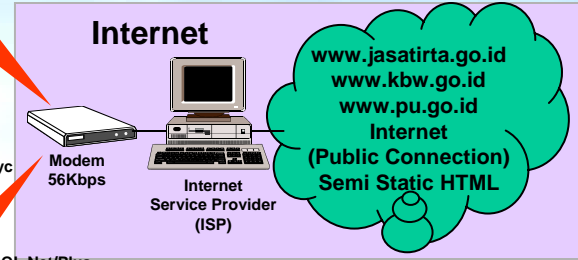
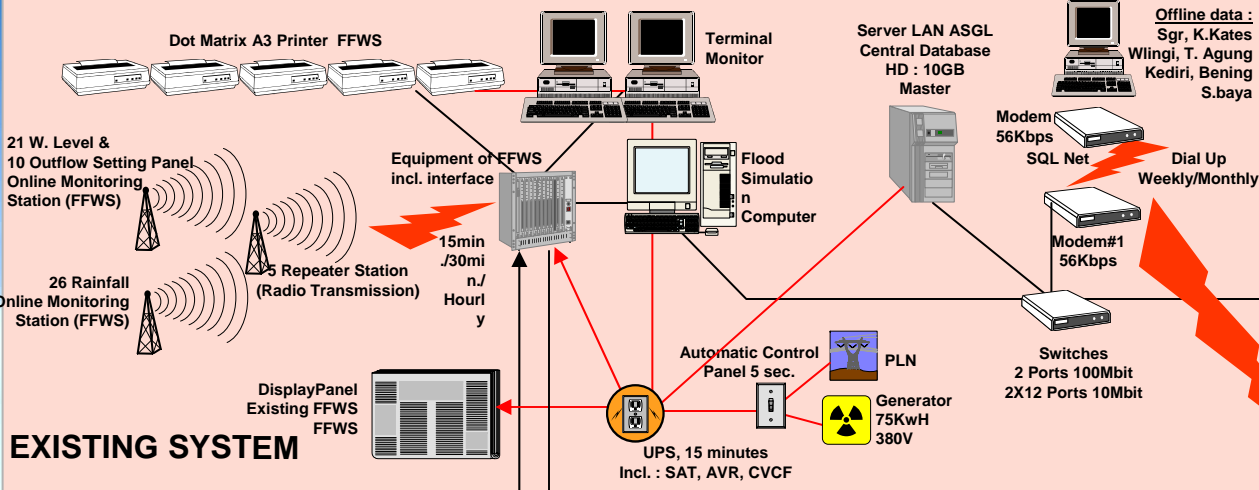
Runed spare part



Replacement of spare part

# PERUSAHAAN UMUM JASA TIRTA

## INFORMATION OF TECHNOLOGY DIAGRAM (MANAGEMENT INFORMATION SYSTEM)



# MANAGEMENT INFORMASI SYSTEM (MIS)

## Software :

### a. Operating System

- Windows NT 4 Server
- Windows BackOffice Server
- Windows 2000 Server

### b. Programmer Language

- Ms. Access Visual Basic
- Delphi Borland

BHIS, TimeSeriesServer  
Hydras, Logotronic, Mermaid

### c. Programme System

- Fontpage
- Microsoft Office
- Norton Utilities
- Microsoft Exchange
- GeoMedia Professional
- Read Win
- Oracle
- Structure Query Language

Pembuatan Web Page  
Dokumentasi  
Keamanan Virus  
Mail Server  
Sistem Geografi  
Industrial Flow Meter  
Manajemen Database  
Pemrograman Database

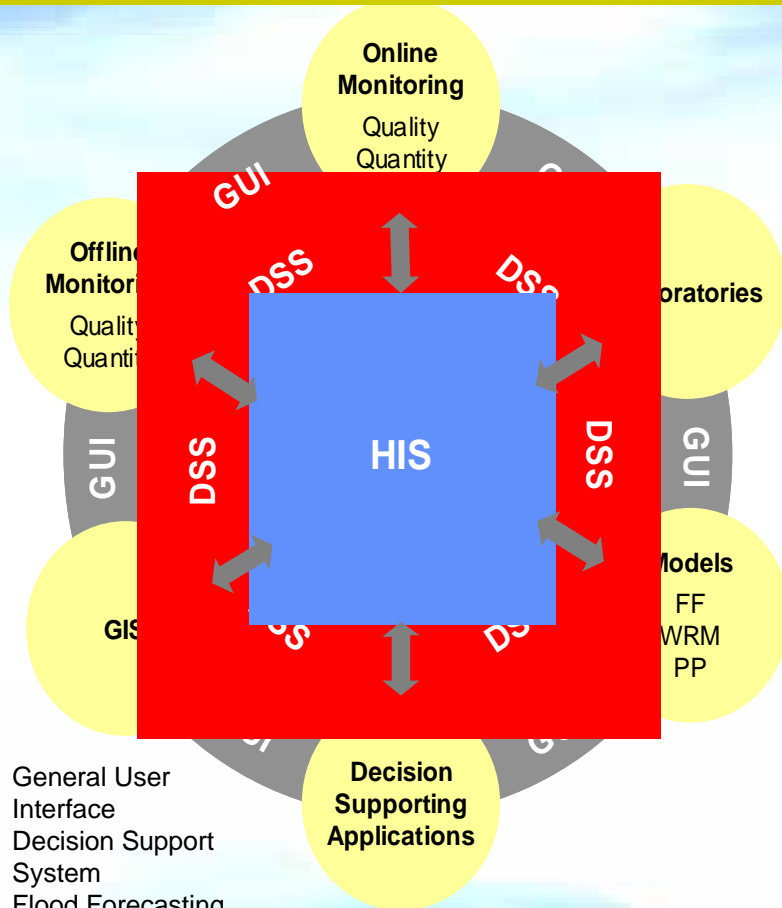
### d. Decision Support System

- Hydrology Remote Access System
- Logotronic
- Brantas Hydrology Information System
- HEC HMS
- Nopolu
- Dam Safety
- TimeSeriesServer
- Profile Sedimen
- Flood Forecasting Warning System (FFWS)
- Climate Data
- Bio Assesment
- Water Resources Management Model (WRMM)
- Mermaid

Pemantauan Kualitas Air  
Pemantauan Banjir  
Pusat Database  
Simulasi Banjir  
Simulasi Polusi Kualitas Air  
Pemantauan Keamanan Tubuh Bendungan  
Interface FFWS & BHIS  
Pemantauan Sedimen Sungai & Waduk  
Pemantauan Banjir  
Simulasi Klimatology  
Pemantauan Microbiology  
Pemantauan Alokasi Air Sungai  
Pemantauan Kualitas Air Kali Surabaya

# Information Technology

(The Online-Monitoring Data Integrates with the Brantas Hydrological Information System / BHIS  
Based on a Central Database)



- GUI** General User Interface
- DSS** Decision Support System
- FF** Flood Forecasting
- WRM** Water Resource Management
- PP** Pollution Propagation
- GIS** Geographical Information System

## Central Database

Management of all chemical, physical, biological, hydraulic as well as environment and climate-related data for a comprehensive assessment of water quality and quantity in the river basin.

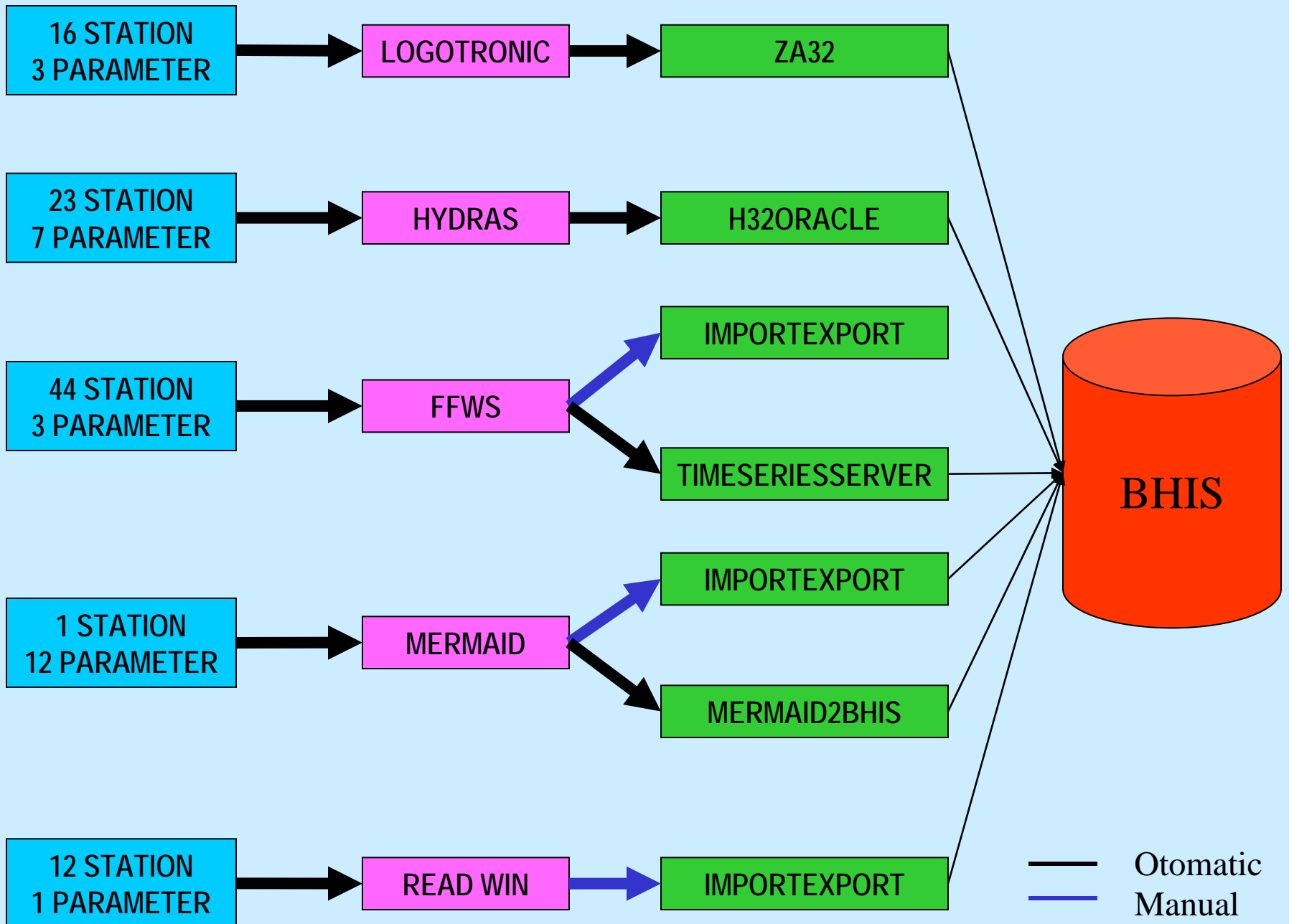
## General User Interface for Data of ...

- 1 Online Monitoring Systems**
- 2 Simulation Applications**
- 3 Water Quality Laboratories**
- 4 Decision Supporting Applications**
- 5 Offline Monitoring Systems**
- 6 Geographical Information System**

**The Brantas HIS Forms a Powerful Decision Support System**



# DATA COMMUNICATION SCHEME



# BRANTAS HYDROLOGICAL INFORMATION SYSTEM

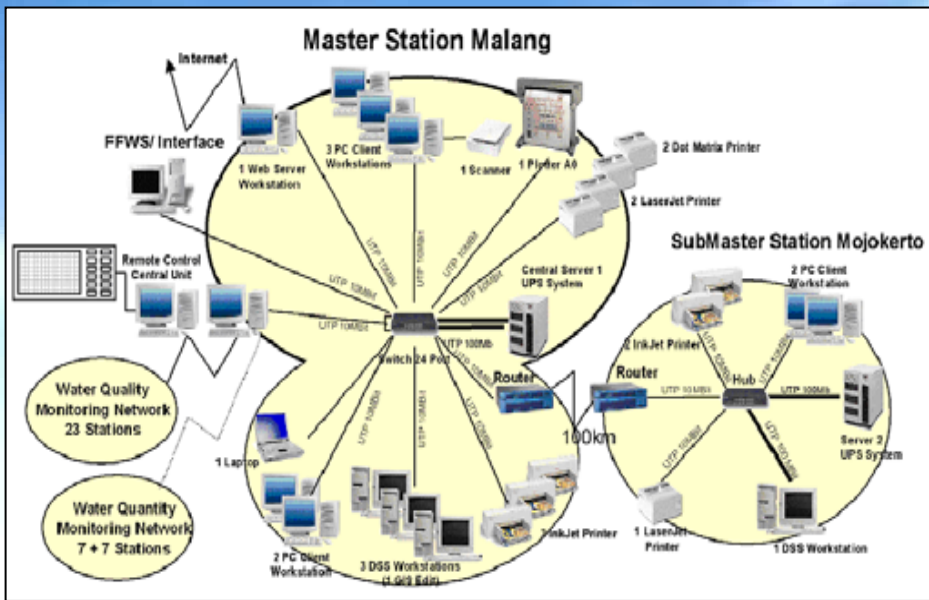


Figure 1. Schematic overview HW Equipment Master Submaster Station

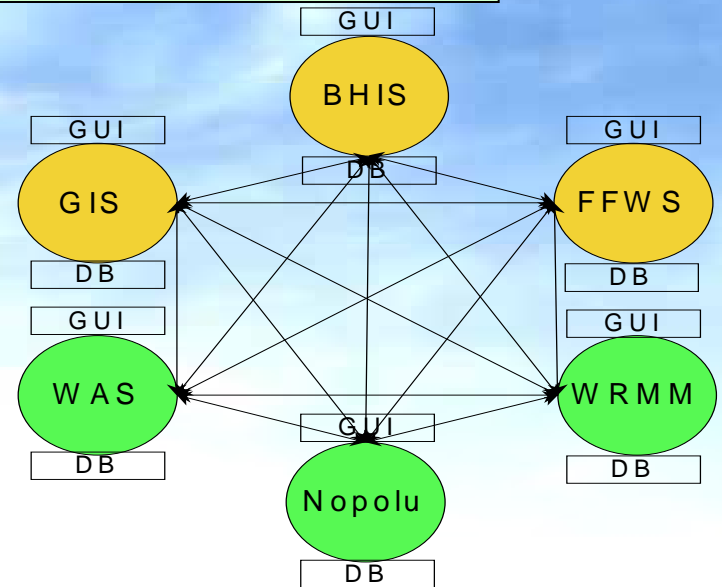


Figure 2. Stand-alone Solution: Each Application communicates to the others through a complex, deregulated Data Transfer Network

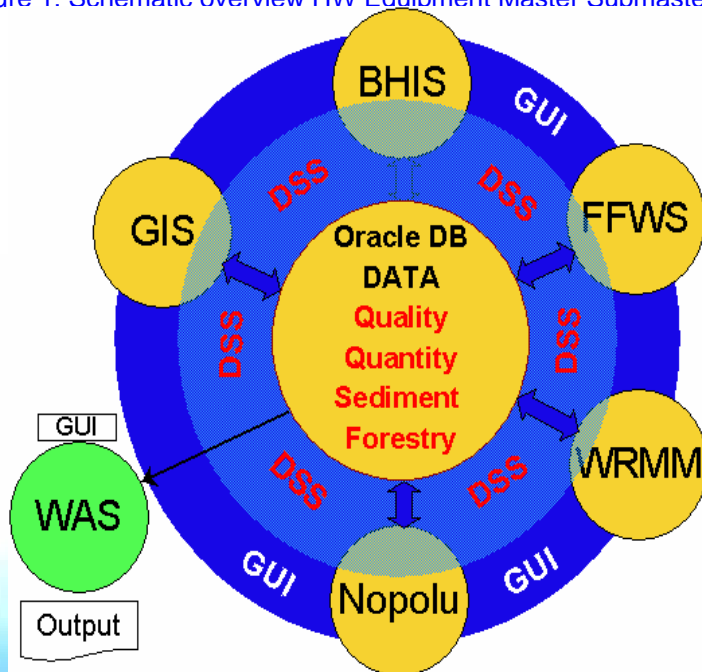


Figure 3. Integration Concept

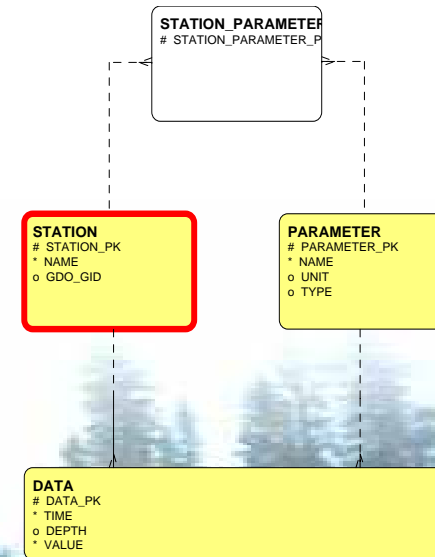


Figure 4. Example of Tables and their Relations

# BRANTAS HYDROLOGICAL INFORMATION SYSTEM

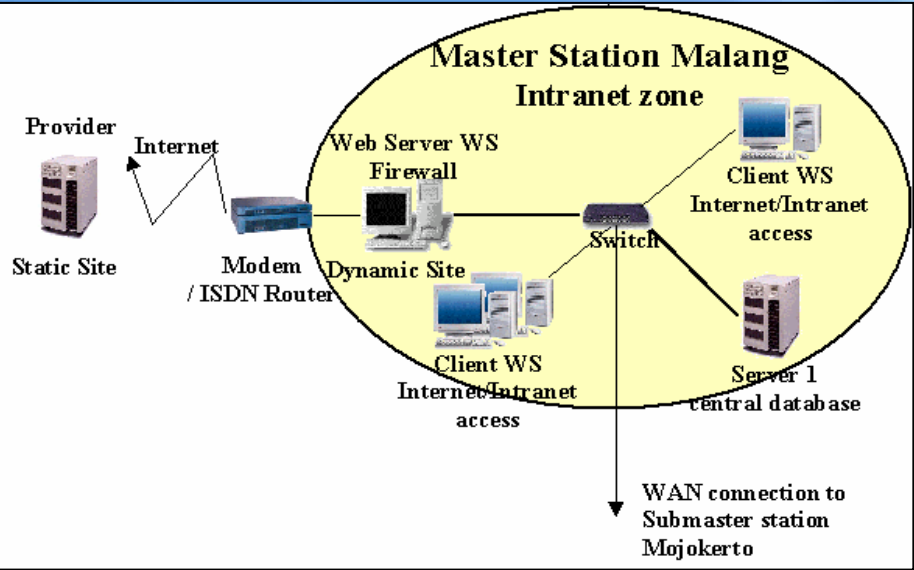
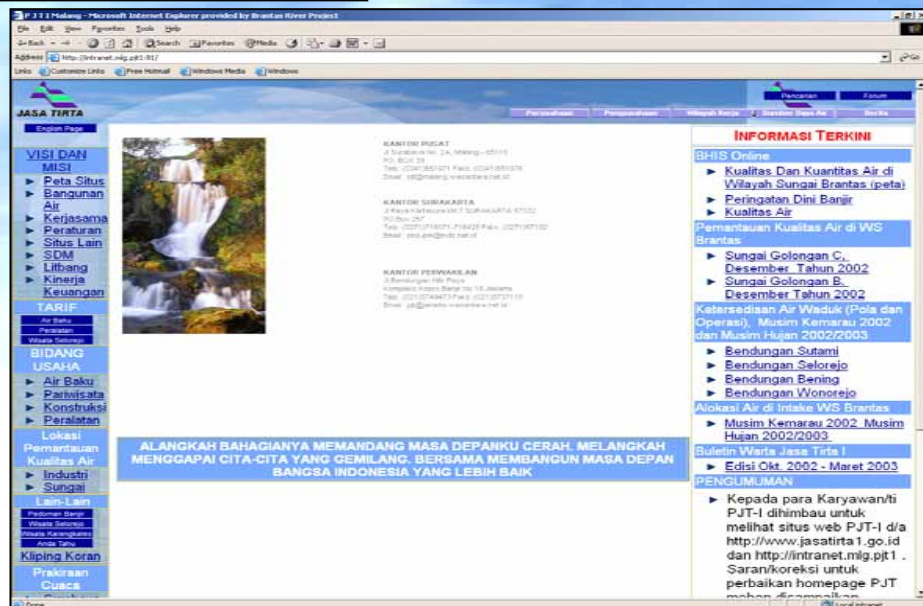


Figure 9 Schematic Brantas Home Page Intranet/Internet



Brantas Home Page - Main Page

Number	Controll (m)	Station	Time	Water Level	Other Parameter	Previous Data	Status
4-1	318.10	319.05	320.10	Tawangrejeni	June 27, 2003 6:0	314.07 m	Valid
6-2	292.80	292.90	293.00	Sengguruh	June 27, 2003 6:0	292.18 m	Valid
8-3	272.80	273.50	275.50	Sutami Dam JRC	June 27, 2003 6:0	272.26 m	Valid
9-4	273.00	274.20	275.50	Lahor Dam JRC	June 27, 2003 6:0	272.48 m	Valid
15-8	163.75	164.00	164.25	Wilingi Dam JRC	June 27, 2003 6:0	163.26 m	Valid
17-6	136.25	136.50	136.75	Lodoyo BRG	June 27, 2003 6:0	136.80 m	Valid
18-7	78.00	78.10	78.35	Jeli	June 27, 2003 6:0	75.60 m	Valid
21-8	61.80	62.05	62.25	Kediri WL.	June 27, 2003 6:0	59.63 m	Valid
22-9	57.50	57.75	58.00	Mrican BRG	June 27, 2003 6:0	57.28 m	Valid
23-10	41.30	41.65	42.00	Kertosono	June 27, 2003 6:0	36.94 m	Valid
24-11	29.50	30.05	30.55	Ploso	June 27, 2003 6:0	25.89 m	Valid
26-12	18.00	18.25	18.50	New Lengkong	June 27, 2003 6:0	17.73 m	Valid
27-13	5.95	6.35	6.85	Porong	June 27, 2003 6:0	0.57 m	Valid
28-14	10.00	10.50	11.00	Perning	June 27, 2003 6:0	8.02 m	Valid
30-15	622.20	622.60	623.00	Selorejo Dam JRC	June 27, 2003 6:0	620.86 m	Valid
33-16	109.00	109.10	109.20	Bening Dam JRC	June 27, 2003 6:0	105.34 m	Valid
34-17	40.70	41.00	41.30	Lengkong	June 27, 2003 6:0	36.08 m	Valid
36-18	91.30	91.85	92.40	Bendo	June 27, 2003 6:0	87.06 m	Valid
37-19	79.00	79.50	80.00	Inlet Gate	June 27, 2003 6:0	78.19 m	Valid
38-20	4.73	4.75	4.80	Gunung Sari	June 27, 2003 6:0	4.72 m	Valid
22403-21	436.88	438.88	440.88	Madyopuro	June 27, 2003 6:0	433.20 m	Valid
22405-22	436.88	438.88	440.88	Selopuru	June 27, 2003 6:0	0.00 m	Valid
22407-23	436.88	438.88	440.88	Sooko	June 27, 2003 6:0	28.07 m	Valid
22409-24	54.22	56.22	58.22	Gebang Bunder	June 27, 2003 6:0	41.82 m	Valid
22411-25	11.24	13.24	15.24	Jetis	June 27, 2003 6:0	7.94 m	Valid
22413-26	289.40	290.40	292.40	Metro	June 27, 2003 6:0	285.06 m	Valid
22415-27	102.22	104.22	106.22	Trenggalek	June 27, 2003 6:0	102.91 m	Valid

Brantas Home Page - Water Quantity On-Line Viewing

Num.	Station	Time (mm/dd/yy hh:mm:ss)	Dissolved Oxygen	Other Parameters	Previous Data	Status
1	Pendem Bridge	24-Juni-2003 4:45	8.22 mg/l	Click	Click	Invalid
2	Kendalpayak Bridge	24-Juni-2003 4:45	7.22 mg/l	Click	Click	Invalid
3	Sengguruh Dam HYD	24-Juni-2003 4:45	6.33 mg/l	Click	Click	Invalid
4	Wilingi Dam HYD	24-Juni-2003 4:45	6.47 mg/l	Click	Click	Valid
5	Lodoyo Dam	24-Juni-2003 4:45	5.73 mg/l	Click	Click	Valid
6	Tambangan Pakel	24-Juni-2003 4:45	5.78 mg/l	Click	Click	Invalid
7	Ngujangan Bridge	24-Juni-2003 4:45	9.75 mg/l	Click	Click	Invalid
8	Mrican Barrage HYD	24-Juni-2003 4:45	3.80 mg/l	Click	Click	Valid
9	Cheil Jedang	24-Juni-2003 4:45	7.02 mg/l	Click	Click	Valid
10	Ajinomoto	24-Juni-2003 4:45	5.43 mg/l	Click	Click	Valid
11	Tambangan Canggung	24-Juni-2003 4:45	7.07 mg/l	Click	Click	Valid
12	Karanglo	24-Juni-2003 4:45	4.18 mg/l	Click	Click	Valid
13	PDAM Karangpilang	24-Juni-2003 4:45	4.11 mg/l	Click	Click	Invalid
14	PDAM Kayoon	24-Juni-2003 4:45	0.08 mg/l	Click	Click	Valid
15	Mangetan Gate	24-Juni-2003 4:45	6.96 mg/l	Click	Click	Valid

Brantas Home Page - Water Quality On-Line Viewing

# CONCLUSION

1. Water to represent life source. In availability limited by need of existence of arrangement of water which is made available become water resources of adequate and certifiable water for accomplishment to meet the public living requirements,
2. System of monitoring Equipments in Brantas river basin will assist to recognize characteristic from each the ecosystem, to be the require to strive to take care of permanence from the infrastructures,
3. The water quality network for the Brantas River system consists of the following main component: on-line water quality monitoring stations, off-line water quality monitoring stations, water analyses laboratories, water quality surveillance program, data collection, processing, interpretation possibilities as well as management through a decision support system.
4. System of Job which is concerning people of a lot of will succeed if all related/relevant party follow to participate active in the activity



A scenic landscape featuring a calm lake in the foreground. On the right side, a concrete-lined embankment slopes down towards the water, with a large, vibrant bush of pink flowers in the immediate foreground. In the middle ground, a grassy hillside is dotted with several houses, including a prominent white house with a dark, steep gabled roof. Tall, slender pine trees are scattered across the hillside. In the background, misty mountains rise under a blue sky with light clouds. The text "Thank you very much" is written in a bright yellow, sans-serif font across the center of the image.

Thank you very much