Proceeding

The 4th ETMC 2011

"Present and Future Challenges in Environmental Sustainability"

2011
ENVIRONMENTAL TECHNOLOGY AND MANAGEMENT CONFERENCE

November 3 – 4, 2011
Bandung, Indonesia

ISBN 978-979-98278-3-8

Published by
Faculty of Civil and Environmental Engineering
Institut Teknologi Bandung - Indonesia

Please cite any paper(s) in this proceeding by including following information:

[Name of author(s)], *[Title of paper]*, Proceeding The 4th Environmental Technology and Management Conference: "Present and Future Challenges in Environmental Sustainability", Indonesia, 2011.

PREFACE

Sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs should be implemented in all countries. The implementation is of importance especially with the presence of alarming local to global scale anthropogenic environmental problems and how the countries are connected through the earth's natural system. It is thus imperative that countries collaboratively working together to tackle and prevent the problems in order to warrant the successful implementation of sustainable development in the countries.

It is under the above mentioned spirit that the Environmental Technology and Management Conference (ETMC) was initiated. Held every 4 years since 1997 and with growing numbers of participant and expertise, the ETMC brings together policy makers, scientists, engineers, industries, and field expertise in environmental technology and management to discuss current and future local, regional, and global environmental issues. The ETMC is aimed to provide a forum to discuss and disseminate advances in research, technologies, and management, for improving the quality of the environment. Past participants of the conference include researchers, academic staffs, students, industries, public, and government officials.

With theme "Present and Future Challenges in Environmental Sustainability", the 4th ETMC is a global momentum for sustainable development that will lead to practical applications of the engineering and science of sustainability. Participating industries, academics, and governmental bodies will acquire information on the state of the art in environmental technology and management.

Plenary sessions of the 4th ETMC include presentations by:

- **Prof. Toshihiro Kitada**
  Toyohashi University of Technology, Japan
- **Prof. (Hon) Rachmat Witoelar**
  President's Special Envoy for Climate Change Indonesia.

There are invited international distinguished speakers:

- **Prof. Yen Peng Ting**
  National University of Singapore, Singapore
- **Prof. Rudy Sayoga**
  Institut Teknologi Bandung, Indonesia
- **Prof. Naoyoki Funamizu**
  Hokkaido University, Japan
- **Prof. Michael Sturm**
  FH Köln, Germany
- **Prof. Kim Oanh**
  Asian Institute of Technology, Thailand
- **Prof. Takeshi Fujiwara**
  Okayama University, Japan

- **Ir. H. Mulyadi Afmar**
  PT. Benefita, Indonesia
- **Moekti Handajani Soejachmoen**
  Special Assistant to the President's Special Envoy for Climate Change Indonesia
- **Dr. Setiawan Wangsaatmadja**
  Environmental Management Agencyof West Java, Indonesia
- **Dr. Indra Budiman Syawmil**
  Institut Teknologi Bandung, Indonesia

Contributed oral (114 contributions) and poster (26 contributions) presentations are divided into 6 major sessions:

A. Eco-industries
B. Natural Resources Management
C. Water Resources Management
D. Environmental Engineering and Technology
E. Green Cities
F. Climate Change and Air Pollution

Finally, the Organizing Committee wishes that this conference is able to provide beneficial scientific information to the participants and other concerned readers.

Bandung, November 2011

Ir. Edwan Kardena, PhD
Chair of Organizing Committee

LIST OF COMMITTEES

ORGANIZING COMMITTEE

Chairman	: Dr. Ir. Edwan Kardena
Vice Chairman	: Emenda Sembiring, ST, MT, M.EngSc, Ph.D
Secretary	: Ir. Arief Sudradjat, MIS, Ph.D
Sponsorship	: Dr. Benno Rahardyan, ST, MT Dr. Asep Sofyan, ST, MT
Publication	: Dr. Mochammad Chaerul, ST, MT
Treasurer	: Dr. Ir. Dwina Roosmini, MS Dr. Kania Dewi, ST, MT
Program	: Herto Dwi Ariesyady, ST, MT, Ph.D Dr. Ir. Katharina Oginawati, MS Dr. Ing Marisa Handajani, ST, MT Dr. Sukandar, S.Si, MT
Logistic	: Dr. Qomarudin Helmy, ST, MT
Website	: Rofiq Iqbal, ST, M.Eng, Ph.D

SCIENTIFIC COMMITTEE

Chairman	: Prof. Dr. Ir. Wisjnuprapto
Secretary	: Prof. Dr. Ing. Ir. Prayatni Soewondo, MS
Members	: Prof. Dr. Ir. Enri Damanhuri Prof. Dr. Ir. Arwin Sabar, MS Dr. Ir. Tri Padmi Damanhuri Prof. Ir. Suprihanto N, Ph.D Ir. Pudji Lestari, Ph.D Dr. Sri H. Suhardi Ir. R. Driejana, MSCE, Ph.D Dr. Ir. Mindriany Syafila, MS Dr. Ir. Priana Sudjono, MS, Dipl.Eng Idris Maxdoni Kamil, M.Sc, Ph.D Dra. Barti Setiani Muntalif, Ph.D Ir. Agus Jatnika Effendi, Ph.D

CONTENTS

PLENARY LECTURES

INVITED SPEAKERS

ORAL SESSION SPEAKERS

Session A – Eco industries

Session B – Natural Resources Management

Session C – Water Resources Management

Session D – Environmental Engineering and Technology

Session E – Green Cities

Session F – Climate Change and Air Pollution

POSTER SESSIONS

PLENARY LECTURES

Analysis of Hydrological Regime as Instrument Control Land Use Watershed (Case Study Cimanuk Watershed Upstream of West Java Province)

Erwin, Arwin, Iwan K. Hadihardaja, dan Herto Dwi Ariesyady.

Faculty of Civil and Environmental Engineering
Institut Teknologi Bandung, Indonesia
Jl. Ganesha N0. 10 Bandung 40132, West Java, Indonesia
r_win_bpd@yahoo.com

Abstract. The river is part of the environment where poor water quality due to pollution will affect human health and reduce the wealth of natural resources (natural resources depletion) as well as having economic value due to the recovery of contaminated water conditions require that the cost may be greater than the value benefits from its activities. Damage and pollution of rivers accelerated by changes in land use of green open space to be built such as agriculture, residential, industrial and population growth due to the economic development of the upper-middle-downstream watershed (DAS). Cimanuk Upstream watershed area of 152,982.67 ha with Cimanuk River as the main river from upstream to downstream along the 84 km, is part of the Center of Watershed Management-Citanduy Cimanuk administratively located in the District of Garut and Sumedang regency of West Java Province. Current conditions there has been a trend of change in land use that encourages an increase in erosion and sedimentation that affect the river water pollution. To that end, this study aims to find out changes in the hydrological regime with a coefficient of river regime and the pollution index as an instrument of control of watershed land use. The method used is the Coefficient of River Regime (CRR) to analyze the flow regime of the river (river discharge) and the Pollution Index (IP) to analyze the quality of water quality with 11 parameters (Total Dissolved Solid, Total Suspended Solid, pH, BOD, COD, DO, Total phosphate, Nitrate, Sulphate, Total Coliform and Detergent) Cimanuk river water quality measurement results for a moment in April and August in 2006-2008 in the Upper-Bayongbong Cimanuk river (the Upper river) and river-Copong Cimanuk Hulu (middle) and Cimanuk Hulu-Wado (Downstream) in August 2011. The results showed that (1) hydrologic regime conditions (water discharge ekstrimintas) Cimanuk River upstream generally in good condition (low ektrimitas) is characterized by CRR value <50 for 23 years from 29 years or by 79.31%, and the condition of being with CRR 50-120 value for 5 years from 29 years or by 17.24% and in poor condition with CRR value> 120 only a year or 3.45% of the year 2008. While the trend CRR increasing trend toward being, although still in a good standard, (2) Condition of hydrological regime (water quality ekstrimintas) Cimanuk River Upstream in general in the polluted condition of mild to severe (high ektrimitas) than upstream (bayongbong) - middle (copong) - downstream (Wado) indicated by the value of IP> 1 in April (rainy season) and August (dry season) Year 2006-2008. Trend pencermaran both in April (rainy season) and August (dry season) decreased although still

above the standard (IP (> 1), (3) Pursuant to CRR and IP analysis indicates the need to control the utilization of space in reducing pollution of river water upstream to downstream settlements mainly from domestic sewage and industrial and agricultural land erosion and sedimentation.

Keywords: *Hydrology Regime, Coefficient of River Regime. Pollution Index, Land Use, Cimanuk Watershed Upstream.*

1 Introduction

Law of the Republic of Indonesia Number 7 Year 2004 regarding Water Resources Water states that water as a source of community life is dynamic existence naturally flow to a lower place without knowing the administrative boundaries. The presence of water follows the hydrological cycle is closely related to the weather conditions in an area that causes uneven water availability in every time and every region. Climate change affects the changes in rainfall, water reservoirs, agricultural and forestry land management (Ministry of Environment Republic of Indonesia, 2007).

According to Arwin (2009) Source of water is a natural resource that can be updated through the hydrologic cycle depending on the climate and weather be affected by cosmic factors, regional and local (watershed land conversion) form the hydrological regime. Where is the main component of the hydrological cycle of rainfall is input in the watershed system (DAS) and the output is the discharge and the quality of surface water (river water) and groundwater reserves. The second component is characterized by random variables and stochastic as well as water drainage to the sea is a deterministic phenomenon (Arwin, 2009). Uncertainties of climate and weather triggered by global warming from greenhouse gas emissions in the atmosphere result in temperature increases the earth (Arwin, 2009).

Conditions impact of climate change and land conversion may have occurred in the Cimanuk River Basin which is part of the Watershed Management Institute Cimanuk Citanduy, as the main water source rivers Jadigede Reservoir which is currently under construction and expected to finish by the end of 2013 so that the required discharge and quality of water entering the reservoir as needed and ongoing. Cimanuk Watershed Upstream including 15 super-priority watersheds in Java than 58 super-priority watersheds in Indonesia (Siregar et al., 2004). The threat of

increased degradation of the hydrological regime of river water as the influence of climate change and land use watershed that would affect the degradation of utility functions in downstream reservoirs. For that purpose the study was to determine changes in the hydrological regime with a coefficient of river regime and the pollution index as an instrument of control of watershed land use.

2 Methodology

2.1 Location and Time Research.

Research conducted in the Cimanuk Upper River watershed. Cimanuk River from upstream to downstream ± 84 km with a water drainage conditions throughout the year. The number of tributaries Cimanuk as many as 14 rivers namely River Cimanuk Hulu, Cibodas, Cipeujeuh, Cikamiri, Ciroyom, Cibeureum, Cisangkan, Cipari, Citameng, Cimuara, Cipancar, Cianten, Cicajur, Cipedes, Cigaruguy and Cibunilarang. Sub watershed Upper Cimanuk covering 152,982.67 ha ± (1529.82 km2) is part of the Watershed Management Institute Cimanuk-Citanduy (BP Cimanuk Watershed Upstream Citanduy, 2003 and 2009). Located upstream in District Cikajang and Bayongbong Garut and downstream in the subdistrict of Wado, Jatinunggal and Jatigede Sumedang District of West Java Province. Astronomically Sub watershed Upper Cimanuk lies between 107 ° 42'16 "-108 ° 10'54" East Longitude (BT) and 06 ° 45'00 "-07 ° 24'36" South Latitude (LS). Analysis of river water flow hydrologic regimes based on time series data flow of the river for 29 years the years 1998-2008 from the water discharge stasiun of Cimanuk-Wado. While the analysis of hydrological regime of river water quality data based on the results of measuring the quality of river water which is located in the Upper River watershed Cimanuk-Bayongbong and Cimanuk-Copong Garut City held in April (rainy season) and August (dry season) 2006 -2008 inundated by the Environmental Laboratory, Research Center for Water Resources Research and Development Agency for the Public Works Department of Public Works and Cimanuk-Wado location in August 2011 by the ITB Laboratory of Water.

2.2 Hydrological Regime Analysis Method

Hydrologic flow regime analysis method to determine the development of river water flow quantity of river water using one of the criteria and

performance indicators of watershed that is the water system with indicators of river water discharge and Coefficient of River Regime (CRR) is the maximum discharge ratio (Q max) with a minimum discharge (Qmin) as contained in the Decree of the Minister of Forestry No. 52/Kpts-I/2001 About Guidelines for Implementation of Watershed Management.

$$\mathbf{KRS} = \frac{Qmax}{Qmin}$$

Evaluation standard is CRR <50 good, CRR = 50-120 moderate, CRR> 120 bad. Condition of the water system is good if the magnitude of the CRR number is equal to or smaller than 50. Methods for the analysis of hydrological regime of river water quality to determine the development of river water quality through water quality status approach to the method of Pollution Index (PI) as stated in the Decree of the Minister of Environment of the Republic of Indonesia Number 115 Year 2003 on Guidelines for Determination of Status of Water Quality. While the status of water quality criteria based on water quality (Quality Standard) based on the class designation of water contained in the Government Regulation Number 82 Year 2001 on the Management of Water Quality and Water Pollution Control. Parameters to be measured and counted as many as 11 parameters of Physics (Dissolved Residues, Residue Suspended), Inorganic Chemistry (pH, BOD, COD, DO, Total Phosphate, Nitrate, Sulphate), Microbiology (Total Coliform) and Organic Chemicals (Detergent). Pollution index calculation as follows :

$$PIj = \frac{\sqrt{\left(\frac{Ci}{Lij}\right)_M^2 + \left(\frac{Ci}{Lij}\right)_R^2}}{2}$$

Where: PIj = pollution index for the allotment of j which is a function of Ci / LIJ;

Ci = concentration of water quality parameters (i);

LIJ = i the concentration of water quality parameters specified in the standard allotment of water pollution) of water j;

$(Ci / LIJ)_M$ = maximum value of Ci / LIJ;

$(Ci / LIJ)_R$ = the average value of Ci / LIJ.

Standard evaluation of PIj is meeting quality standards or good condition (G) 0 <PIj <1.0; Contaminated Light (CR) 1.0 <PIj <50; Contaminated Medium (CM) 5.0 <PIj <10; and Contaminated weight (CW) PIj> 10.0. Condition of river water quality is good (to meet the quality standard) if the magnitude of the numbers if 0 <PIj <1.0

3 Results and Discussion

3.1 Watershed Hydrological Regime Cimanuk River Watershed Upstream from water discharge stasiun of Cimanuk-Wado for 29 Years (Years 1998-2008) as presented in Figure 1

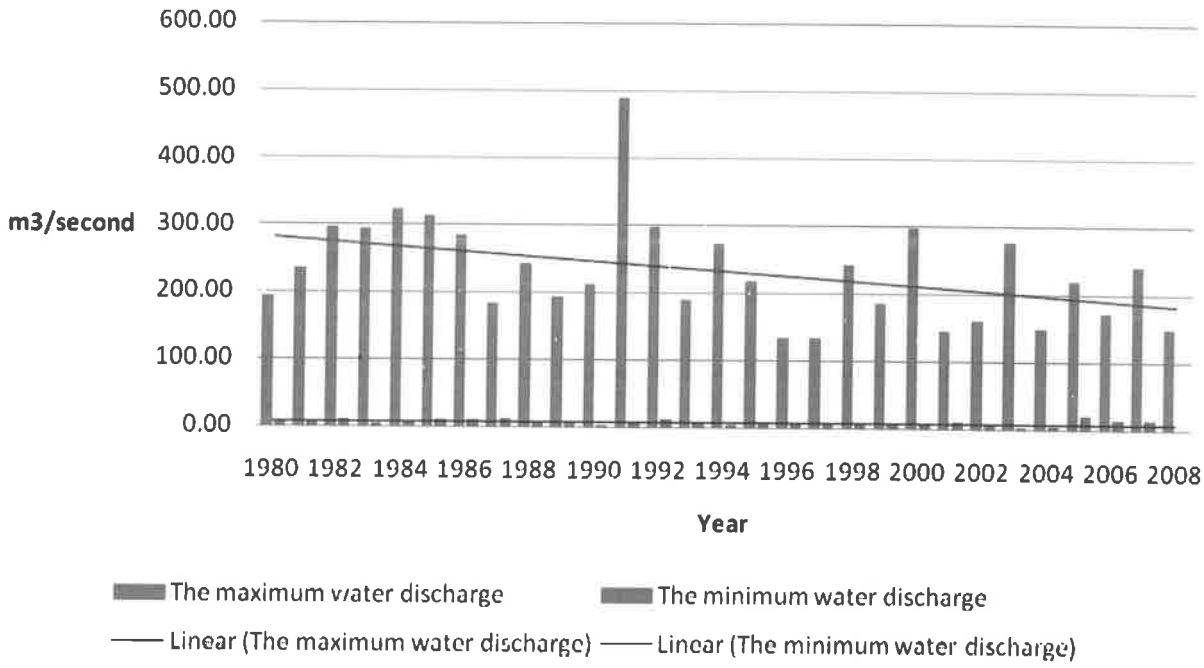

Figure 1 Maximum and Minimum Annual discharge from water discharge stasiun of Cimanuk River-Wado Over 29 Years (Years 1980-2008).

Figure 1. showed that both maximum and minimum discharge fluctuations during the year 1998-2008. Maximum discharge is greatest in 1991 amounting to 489.50 m3/dt and smallest in 1996 amounting to

191.50 m3/dt deebit average and maximum of 291.39 m3/dt While most of the minimum discharge in 1985 for 18.81 m3/dt and smallest in the year 2008 amounted to 0.00 m3/dt and maximum average flow of 7.54 m3/dt. The maximum discharge trend indicating a downward trend while the trend of increasing minimum discharge.

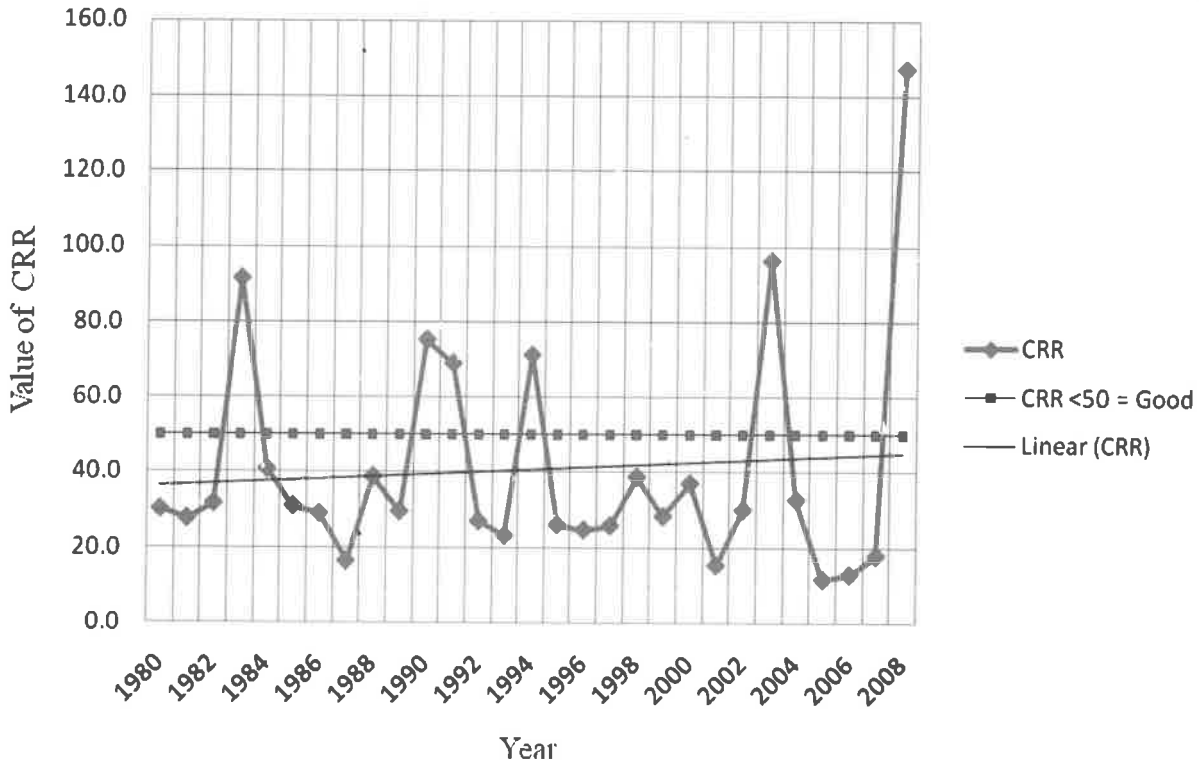

Figure 2 Development of Annual CRR Cimanuk-Wado Over 29 Years (1980-2008).

Based on calculations CRR as presented in Figure.2 with reference to the evaluation standards set forth in CRR Forestry Ministerial Decree No. 52/Kpts-I/2001 About Guidelines for Implementation of Watershed Management. Shows that the general condition Cimanuk River drainage in good condition characterized by CRR value <50 for 23 years from 29 years or by 79.31%, and the condition of being with the CRR 50-120 for 5 years from 29 years of age or at 17, 24% and in poor condition with CRR

value> 120 only a year or 3.45% of the year 2008. While the trend CRR increasing trend toward being, although still in a good standard.

The occurrence of the maximum fluctuation and drink berkaita with climate (rainfall). According to Avia and Berliana (2006) rainfall during the period 1900-2000, the amount of annual rainfall showed a positive and significant trend in Jakarta with a regression equation y = 1.0083 x +1755.5 while in Padang reverse the negative trend in the regression y = -0.2604 x +3371.7. In line with Adidarma (2009) the impact of climate change on the magnitude of precipitation in the region where rainfall Cirebon wet season 43.5% decline in the post before the year 1982 to 27.5% after 1982 (1982-2002) while rain fell in 18 dry season, 8% of the post before the year 1982 and changed to 42% post after 1982 so that annual precipitation decreased by 37% the post before and after the year 1982.

Synergistic with ektrimitas rainfall is suksesisf land conversion has significantly increased the frequency and intensity of floods. Recorded between 1981 and 1999 has been an increase in settlement area for the Upper Ciliwung by 100% with the impact of increased flooding in Katulampa discharge by 68%, and 24% in Depok, (Pawitan, 2003), while according to the Prime and Sudjono (2006) magnitude erosion along the catchment Cisanti between 0.15 x10-3 tons /ha/year to 2.05 x10-3 tons/ha/year. Simulation of changes in land use, if the forest turned into mixed farms and plantations found an increase in erosion between 0.22 x10-3 tons / ha / year to 31.07 x10-3 tons/ha/year, while the plantation land use of 0.3 x10-3 tonnes/ha/year to 41.43 x10-3 tons/ha/year. sedimentation of rivers in China during the years 1952-1990 for 150x108, 200x108 m3 (Yang et al., (2007).

In the period 1990-2002 a reduction in area of about 7.27% mixed farms and forests by 2.35% and an increase in residential area of about 5.11%. In addition, significant changes occurred in the proportion of surface flow component increased by 20.42%, while the basic flow and lateral flow decreased respectively 4.50% and 1.28%. Land use based on the suitability of land can create a better hydrological conditions (Ardiansyah et al., 2005).

Changes in land cover from 1996 to 2005, agricultural land cover is generally a constant that is 22.8%, and the land woke up from 4.5% to 4.9%, and natural land cover decreased from 72.7% to 72.3% (Riitters et al., (2009). the existence of spatial correlation (land-use change) is significant in the succession of vegetation in wetlands (Zhao et al. 2009). From the aspect of soil chemistry, soil structure changes due to erosion lowers the concentration of total C, N and P in the topsoil (Silvera et al., 2009) variability of phosphorus indicator (IP) is high (Castoldi, 2009).

3.2 Hydrological Regime of Cimanuk Watershed Upstream Water Quality

The measurement results of Cimanuk Watershed Upstream water quality in three locations: Upper section (Bayongbong), middle (Copong-Garut City) of West Java Province held in April (rainy season) and August (dry season) year 2006-2008 by the Environmental Laboratory inundated, Research and Development Center of Water Resources Research and Development Agency for the Public Works Department of Public Works as presented in Table 1, Table 2, and location Cimanuk-Wado in August 2011 by laboratories water are presented in Table 3 ITB as well as a standard Quality Standards contained in Government Regulation No. 82 of 2001 on water Quality Management and Control of Water Pollution in Table 4.

Table 1 Water Quality Conditions of Cimanuk River- Bayongbong in April and August of 2006-2008

Parameters	Unit	April			August		
		2006	2007	2008	2006	2007	2008
I. Physics							
1. Total Dissolved Solid	Mg/L	97,00	148,00	158,00	140,00	149,00	163,00
2. Total Suspended Solid	Mg/L	20,00	454,00	82,00	8,00	44,00	38,00
II. Organic Chemistry							
3. pH		6,60	7,20	6,50	7,60	7,20	7,90
4. BOD	Mg/L	5,30	4,51	3,90	2,40	4,40	1,80
5. COD	Mg/L	15,00	10,30	14,00	5,80	8,70	5,00
6. DO	Mg/L	7,60	7,30	6,30	6,60	5,90	8,10
7. Total Phosfat-P	Mg/L	0,02	0,05	0,06	0,08	0,25	0,32
8. Nitrat-N (NO_3-N)	Mg/L	0,23	1,71	1,50	0,78	1,00	2,34

9. Sulfat	Mg/L	12,00	26,00	67,00	33,60	9,20	61,70
III. Microbiology							
10. Total Coliform	Jml/100 Ml	30.000	3.800	12.000	120.000	450.000	1.200
IV. Inorganic Chemistry							
11. Detergen (MBAS)	Mg/L	0,031	0,028	0,116	0,052	0,081	0,034

Sources: Environmental Laboratory inundated, Research and Development Center of Water Resources
Research and Development Agency for the Public Works Department of Public Works (2010).

Table 2 Water Quality Conditions of Cimanuk River- Copong in April and August of 2006-2008

Parameters	Satuan	Bulan April			Bulan Agustus		
		2006	2007	2008	2006	2007	2008
I. Physics							
1. Total Dissolved Solid	Mg/L	105,00	166,00	142,00	178,00	192,00	212,00
2. Total Suspended Solid	Mg/L	20,00	840,00	78,00	8,00	28,00	42,00
II. Organic Chemistry							
3. pH		7,10	7,60	6,70	7,50	7,10	8,30
4. BOD	Mg/L	5,70	5,45	4,60	2,80	4,60	4,70
5. COD	Mg/L	15,00	14,60	16,00	7,70	6,90	12,80
6. DO	Mg/L	7,00	7,10	6,50	5,60	4,70	5,10
7. Total Phosfat-P	Mg/L	0,03	0,07	0,13	0,17	0,08	0,10
8. Nitrat-N (NO_3-N)	Mg/L	1,32	1,54	1,55	1,24	1,00	0,99
9. Sulfat	Mg/L	13,00	30,00	38,00	26,80	29,30	48,70
III. Microbiology							
10. Total Coliform	Jml/100 Ml	200.000	7.200	18.000	180000	8.000.000	7.800
IV. Inorganic Chemistry							
11. Detergen (MBAS)	Mg/L	0,022	0,095	0,327	0,022	0,084	0,066

Sources: Environmental Laboratory inundated, Research and Development Center of Water Resources
Research and Development Agency for the Public Works Department of Public Works (2010).

Table 3 Water Quality Conditions of Cimanuk River- Wado
August 2011

Parameters	Unit	Result
I. Physics		
1. Total Dissolved Solid	Mg/L	246
2. Total Suspended Solid	Mg/L	16
II. Organic Chemistry		
3. pH		8,66
4. BOD	Mg/L	8
5. COD	Mg/L	12
6. DO	Mg/L	7
7. Total Phosfat-P	Mg/L	0,0781
8. Nitrat-N (NO_3-N)	Mg/L	1,115
9. Sulfat	Mg/L	32,25
III. Microbiology		
10. Total Coliform	Jml/100 ml	2.400
IV. Inorganic Chemistry		
11. Detergen (MBAS)	mg/L	0,083

Sources: ITB Laboratory of Water (2011).

Table 4 Water Quality Standard Class

Parameter	class water quality standards *			
	I	II	III	IV
I. Physics				
1. Total Dissolved Solid	1.000	1.000	1000	2000
2. Total Suspended Solid	50	50	400	400
II. Organic Chemistry				
3. pH	6-9	6-9	6-9	5-9
4. BOD	2	3	6	12
5. COD	10	25	50	100
6. DO	6	4	3	0
7. Total Phosfat-P	0,2	0,2	1	5
8. Nitrat-N (NO_3-N)	10	10	20	20
9. Sulfat	400	0	0	0

III. Microbiology				
10. Total Coliform	1.000	5.000	10000	10000
IV. Inorganic Chemistry				
11. Detergen (MBAS)	200	200	200	0

Sources ; Government Regulation Number 82 Year 2001 on the Management of Water Quality and Water Pollution Control.

Table 1 seen that the parameter residue suspended in 2007 and DO and Total Coliform in 2006, 2007 and 2008 exceeded the water quality standard class both class I, II, III and IV contained in Government Regulation No. 82 of 2001 on Management of Water Quality and Water Pollution Control. Meanwhile, in August of parameters that exceed the quality standard is exceeded pH, Sulfate and Total Coliform.

Based on the analysis with the method of Pollution Index Cimanuk development of river water quality as presented in Figure3, 4, 5, 6 and 7.

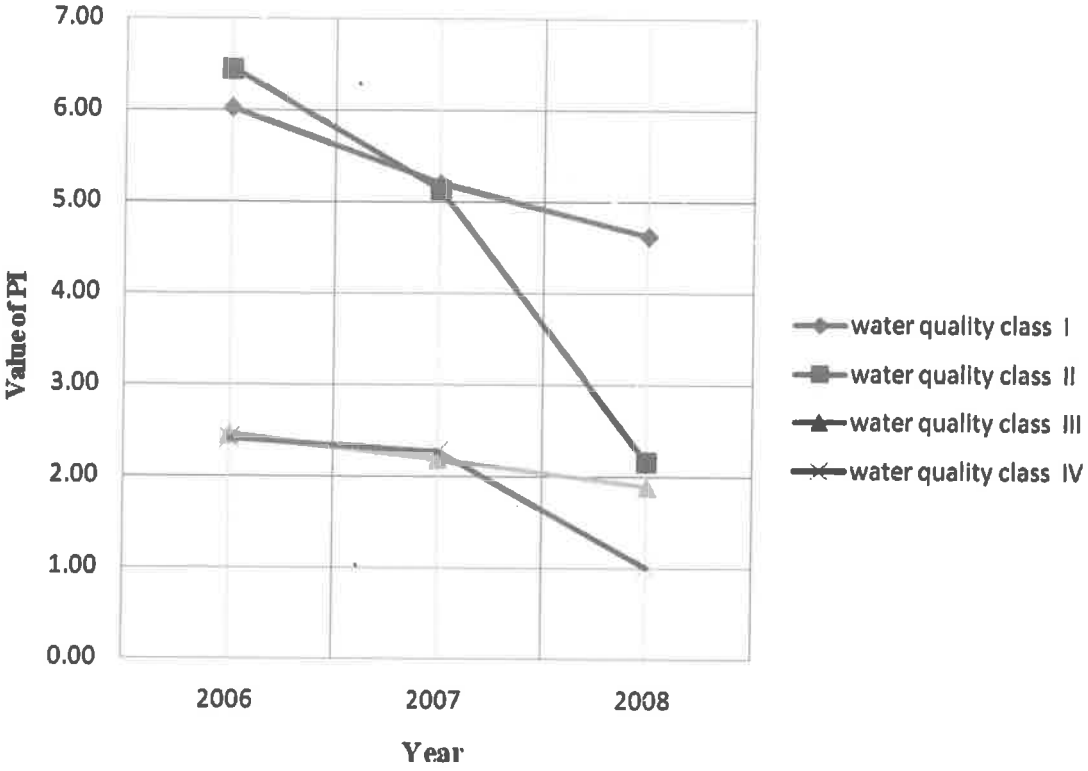

Figure 3 Developments of Rezim Water Quality of Cimanuk-Bayongbong Based Pollution Index in April 2006-2008.

Figure 3 shows that water quality-Bayongbong Cimanuk River (Upper River Section) in April (Dry Season) for 3 years (2006-2008) had experienced either contamination of water quality class I, II, III and IV are marked with the value of IP> 1. Water quality class I and II, whereas the light polluted water quality class III and IV light polluted. Pollution trend decreased for all classes of water quality.

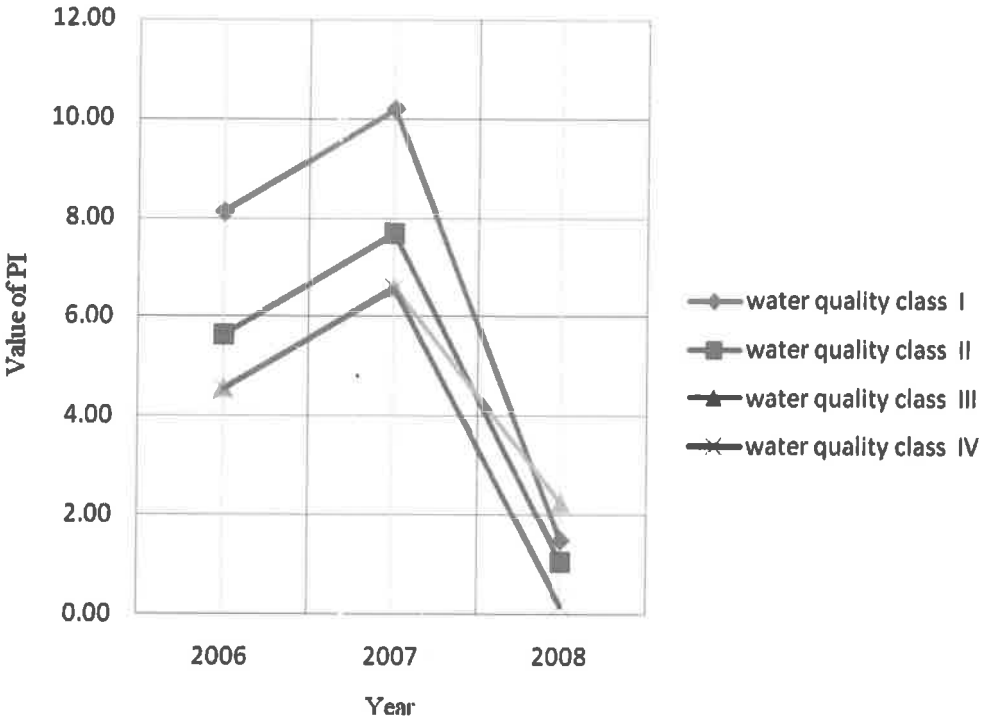

Figure 4 Developments of Rezim Water Quality Cimanuk-Bayongbong Based Pollution Index in August 2006-2008.

Figure 4 shows that water quality-Bayongbong Cimanuk River (Upper River Section) in August (Dry Season) for 3 years (2006-2008) has suffered a mild contamination, both moderate and severe water quality class I, II, III and IV are characterized by IP values> 1. Trend of pollution in 2007 increased compared to 2006 and declined again in 2008 but still above water quality standards except for class IV.

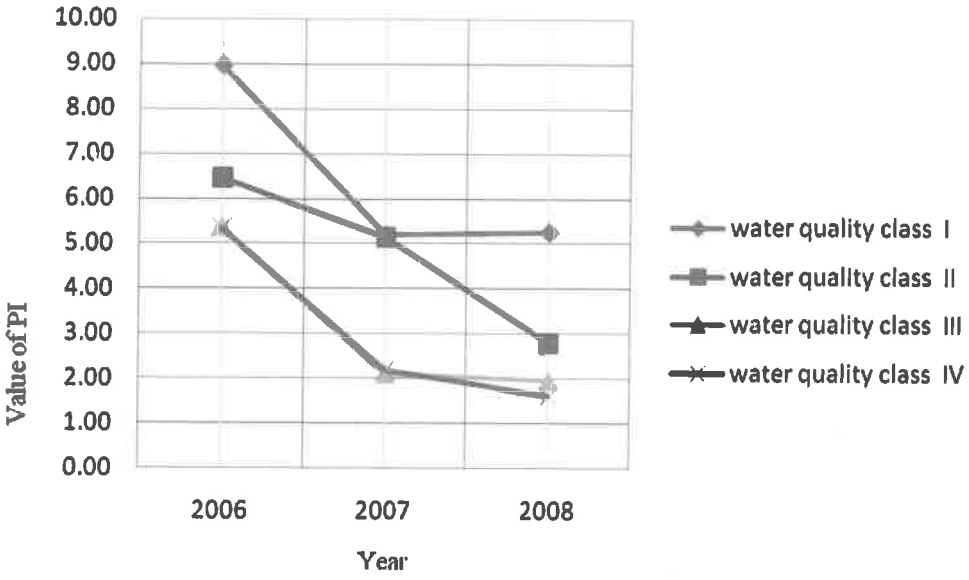

Figure 5 Developments of Rezim Water Quality of Cimanuk-Copong Based Pollution Index in April 2006-2008.

Figure 5 shows that water quality-Copong Cimanuk River (River Middle Section) in April (Dry Season) for 3 years (2006-2008) have experienced mild to moderate pollution of both water quality class I, II, III and IV is characterized by IP values> 1. Trend of pollution decreased but still above the standard.

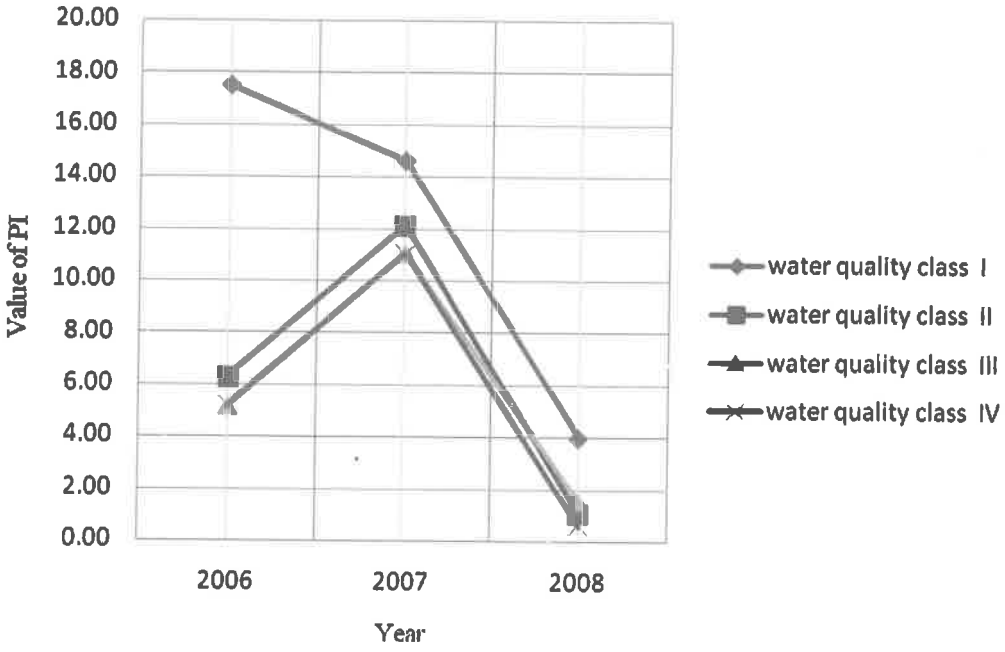

Figure 6 Developments of Rezim Water Quality of Cimanuk-Copong Based Pollution Index in Agustus 2006-2008.

Figure 6 shows that water quality-Copong Cimanuk River (River Middle Section) in April (Dry Season)'for 3 years (2006-2008) has suffered a mild contamination, both moderate and severe water quality class I, II, III and IV are characterized by IP values> 1. Trend of pollution decreased but still above the standard.

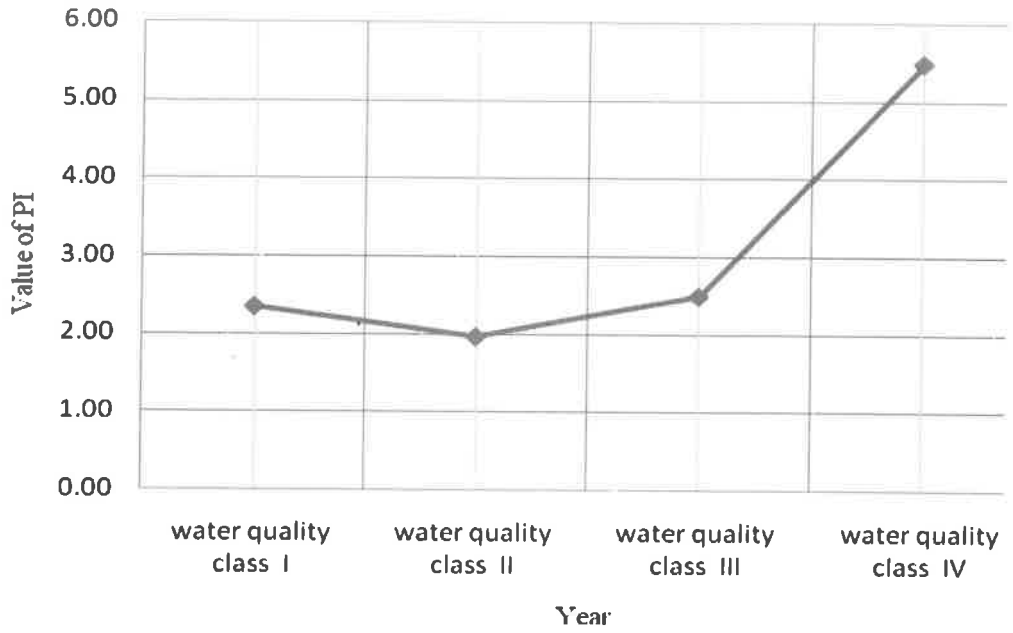

Figure 7 River Water Quality of Cimanuk-Wado Based Pollution Index In August 2011.

Figure 7 shows that water quality-Wado Cimanuk River (Lower River Section) on the Moon Agustusl (Dry Season) in 2011 have experienced mild to moderate pollution of both water quality class I, II, III and IV are characterized by the value of IP > 1.

River pollution conditions occur also in other rivers in Indonesia such as river pollution Tapung Left Kampar regency Pollution Index Value (Pij) in the rainy season, at 3.52 and ST1 stations ST3 and ST4 station is equal 3.71 and 4.27 ST5 station. River pollution levels that are on the Left Tapung contaminant level light pollution on the basis of criteria (Kep-MENLH/115/2003) (Azwir, 2006.

Likewise, according to Maria, et al. (2007) from upstream to downstream Sekonyer River City District West Central Kalimantan K. polluted conditions due to heavy metals (zinc, cadmium, copper and mercury). In the upstream experiencing mild defiled, after going through the heavily

polluted mining puya. From the confluence with the River Sekonyer Simpang Kanan until the mid Rimba Orangutan Eco Lodge with estuaries S. Sekonyer lightly polluted, while at the confluence of the Ulin Sekonyer with ungai is being defiled, and in heavily polluted estuary Sekonyer. Ledok river pollution levels classified as moderate. IP value is higher than the control. Contribution of pollution from the waste water of textile industry (Susanti Pudji Hastutit and Andrew Alfonds Maramis, 2008.

In general, the river and there in Jakarta has undergone changes in water quality. River Water Quality Index in situ mupun in Jakarta showed poor to moderate values, but these waters are used for a variety of human purposes. Adverse effects that occur in waters in the river and there in Jakarta can have negative feedback in the form of the emergence of various seedling diseases (Diana Hendrawan, 2005). In the dry season is relatively higher levels of pollution due to discharge of river water is smaller than in the rainy season so that erosion and sedimentation into the lower river. In contrast the conditions in the rainy season.

The level of river water pollution caused by several factors closely related to erosion and sedimentation, including land use change from green open spaces to be built, public awareness not to throw waste into the river, upstream-downstream watershed conservation including the application on agricultural land terracing system and reduced pesticide use.

Respect to the occurrence of river water pollution Upper Cimanuk, on the other side of the water will be used as the inflow of water reservoirs will be needed to control pollution in water catchments and water bodies. According Asdak (2007) relation to the conservation of watershed characteristics of slope, soil type and rainfall are classified and given a score. Score $\geq$ 175 protected areas, areas penyangga125-174, cultivation of perennial crops $\leq$ 124.

Various control measures such as conservation of the upstream-downstream watershed with the implementation of land use of protected areas and aquaculture areas as the Law of the Republic of Indonesia Number 26 Year 2007 on Spatial Planning, the Law of the Republic of Indonesia Number 7 Year 2004 regarding Water Resources Act Republic of Indonesia Number 32 Year 2009 on the Protection and Environmental

Management, and Government Regulation Number 82 Year 2001 on the Management of Water Quality and Water Pollution Control, Joint Decree of the Minister of Home Affairs, Minister of Forestry and the Minister of Public Works No.. 19 In 1984, No. No. 059/Kpts-II/1984-. 124/Kpts/1984 on the Handling of Land Conservation Priorities in the framework of Security DAS, Regulation of the Minister of Forestry of the Republic of Indonesia Number P.39/Menhut-II/2009 on Guidelines for Management Planning of Integrated Watershed, as well as other technical regulations and adjusted to include (a) The management plan comes with a pattern of operation of the dam reservoir dry year, normal year and in wet years, (b) the pattern of reservoir operations must be reviewed and evaluated at least 1 (one) times within 5 (five) years, (6) the results of the review and evaluation of a basic change in the pattern of dam operation as stated in Article 45 of Government Regulation Republic of Indonesia Number 37 Year 2010 regarding dams.

4 Conclusion

1. Hydrologic regime conditions (water discharge ekstrimintas) River Upstream Cimanuk generally in good condition (low ektrimitas) is characterized by CRR value <50 for 23 years from 29 years or by 79.31%, and the condition of being with the CRR 50-120 for 5 years of 29 years or by 17.24% and in poor condition with CRR value> 120 only a year or 3.45% of the year 2008. While the trend CRR increasing trend toward being, although still in a good standard.

2. Hydrological regime conditions (water quality ekstrimintas) Cimanuk River Upstream in general in the polluted condition of mild to severe (high ektrimitas) than upstream (Bayongbong) - middle (Copong) - downstream (Wado) indicated by the value of IP> 1 in April (Dry Season) and August (Dry Season) Year 2006-2008. Trend pencermaran both in April (rainy season) and August (Dry Season) decreased although still above the standard (IP (> 1).

3. Based on CRR and PI analysis indicates that the limb hydrological regime of water quality is more extreme than the quantity (water discharge). So that should control utilization of space in reducing pollution of river water from upstream to downstream settlements

mainly from domestic sewage and industrial and agricultural land erosion and sedimentation.

5 References

[1] Adidarma. (2009): Identification of the Impacts of Climate Change Data Series Rain in Java, Journal of Water Resources, 5, 1, ISSN.1907-0276.

[2] Ardiansyah, Syriac, E., Tarigan, SD, and Agus, F., (2005): Optimization of Land Use Planning with the Help of GIS and SWAT, a watershed study in West Java Cijalupang, Department of Soil Science and Land Resources, Faculty of Agriculture, Institute Bogor agriculture.

[3] Arwin. (2009): Climate Change, Land Conversion, and the Threat of Flooding and Drought in the Area Built, Professor of Speech Science Council of Professors of ITB, ITB, Bandung Senatama-Wikarya.

[4] Asdak. (2007): Hydrology and Watershed Management. Gadjah Mada University Press.

[5] Azwir. (2006): Analysis of Left Tapung River Water Pollution by Industrial Waste Kampar Regency Palm. Diponegoro University, Semarang.

[6] Diana Hendrawan. (2005): Rivers and Water Quality in Jakarta Jakarta.Makara Situ Technology Volume 9, Number. 1, 13-19 Decree of the Minister of Environment of the Republic of Indonesia Number 115 Year 2003 on Guidelines for Determination of Status of Water Quality.

[7] Mary, Mahendra1 and Arthana1. (2007): Analysis of Levels of Heavy Metals in River Water District Sekonyer K. City of West Kalimantan. Journal Ecotrophic. Volume 2 No.

[8] Minister of Environment of the Republic of Indonesia. (2007): Indonesia Country Report, Climate Variability and Climate Changes and Their Implication.

[9] Goverment Regulation of the Republic of Indonesia Number 37 Year 2010 regarding dams.

[10] Government Regulation Number 82 Year 2001 on the Management of Water Quality and Water Pollution Control. Government Regulation Number 35 Year 1991 on the River.

[11] Prime and Sudjono. (2006): Influence of Land Use on Erosion Rate in Cisanti Reservoir Catchment Area, Special Issue of Journal of Environmental Engineering in August 2009.
[12] Regulation of the Minister of Forestry of the Republic of Indonesia Number P.39/Menhut-II/2009 on Guidelines for Management Planning of Integrated Watershed
[13] Pawitan. (2003): Changes in Land Use and Its Effect on Watershed Hydrology, hydrometeorology laboratory FMIPA-IPB, Bogor.
[14] Riitters, Wickham and Wade. (2009): An Indicator of Forest Dynamics Using a Shifting Mosaic Landscape, Study in the Southern United State), Journal of Elsevier, from 9.107 to 117.
[15] Silvera, ML, Comeford NB, Reddy KR, Prenger, J and DeBusk, WF (2009): Soil properties as indicators of Disturbance in Forest Ecosystems of Georgia, USA, Elsevier Journal, 9, 740-747.
[16] Siregar, Djajadiningrat, Hezekiah, Syamsi, Idayanti and Widyarani (2004): Technology Road Map. Watershed Monitoring and Wastewater Treatment. Indonesia Institute for Sciences, Electronics and Telecommunications Research Centre, Jakarta.
[17] Joint Decree of the Minister of Home Affairs, Minister of Forestry and the Minister of Public Works No.. 19 In 1984, No. No. 059/Kpts-II/1984-. 124/Kpts/1984 on the Handling of Land Conservation Priorities in the framework of Security DAS.Susanti.
[18] Pudji Hastutit and Andrew Alfonds Maramis. (2008): The status of pollution and Heavy Metals in River Sedimentation Ledok (Quezon City-Central Java) As a result of Textile Waste Water Plant Waste. Formas Journal, Volume 2 No. 1, 74-80, ISSN 1978-8452.
[19] Law of the Republic of Indonesia Number 26 Year 2007 on Spatial Planning.
[20] Law of the Republic of Indonesia Number 32 Year 2009 on the Protection and Environmental Management.
[21] Law of the Republic of Indonesia Number 7 Year 2004 regarding Water Resources.
[22] Zhao, Yaner Yan, Guo Haiqiang, Meimei He, Yongjian Gu and Bo Ling. (2009): Rapid Monitoring Vegetation Succession in Estuarine Wetland Using MODIS Time Series-Based Indicators, an Application in the Yangtze River Delta Area, Elsevier Journal, 9, 346-356.