

PROCEEDING INTERNATIONAL CONFERENCE ON INDONESIAN INLAND WATERS III

Palembang, November 8th, 2012



Theme :
**“Strengthening Sustainable Management
of Indonesian Inland Waters Biodiversity and Fisheries”**



The Agency for Marine and Fisheries Research and Development
Research Center for Fisheries Management and
Fish Resources Conservation
RESEARCH INSTITUTE FOR INLAND FISHERIES
2012

INTERNATIONAL CONFERENCE ON INDONESIAN INLAND WATERS III
PROCEEDING
Palembang, November 08th, 2012

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PROCEEDING INTERNATIONAL CONFERENCE ON INDONESIAN INLAND WATERS III

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PREFACE

Research Institute for Inland Fisheries (RIIF) of Research Center for Fisheries Management and Fish Resources Conservation (RCFMFRC) belong to Agency For Marine and Fisheries Research & Development under the Ministry of Marine Affairs and Fisheries of Republic Indonesia (MMAF-RI), has seriously considered the importance of inland waters for the people and strategic contribution of related science for proper management of inland waters more focusing in inland water biodiversity and fisheries. Since 2004, The Research Institute for Inland Fisheries (RIIF) of Research Center for Fisheries Management and Fish Resources Conservation (RCFMFRC) has annually convened Indonesian Forum on Inland Waters in Palembang, South Sumatra. This year is the third International Conference on Indonesian Inland Waters. The theme of the Conference is "*Strengthening Sustainable Management of Indonesian Inland Waters Biodiversity and Fisheries*".

The principal objectives of the conference are to strengthen international networking on inland fisheries and promote the sustainable management and conservation, including:

- Identification of the state of Indonesian inland waters biodiversity
- Determination of the role and impact of anthropogenic changes on aquatic biodiversity and fisheries
- Building the Indonesian awareness on inland waters biodiversity utilization and conservation
- Obtaining the suitable management measures for inland waters biodiversity and fisheries
- Strengthening international networking on inland fisheries
- Lessons learn of the Indonesian and ASEAN inland waters biodiversity and their research status.

In this conference, there is about 56 of supporting papers submitted by the authors. All papers reviewed by the editors and 49 of supporting papers selected and published as a special publication in Proceeding of International Conference on Indonesian Inland Waters. The selection of papers based on the content and quality of the papers.

I hope, some of the conclusion of the conference will be addressed by various stakeholders organization, and annually convened Indonesian Forum on Inland Waters in Palembang, South Sumatra.

Palembang, November 2012
Director of Research Institute for Inland Fisheries

Budi Iskandar Pri Santoso

ORGANIZING COMMITTEE'S REPORT

The honorable:

Prof. Dr. Ngurah Nyoman Wiadnyana, Head of the Center for Engineering and Technology Assessment of Marine and Fisheries - Agency for Marine and Fisheries Research & Development.

My great appreciation is expressed to Prof. David A. Bengston, Dr. Jun-ya Shibata and Dr. Chumnarn Pongsri who have accepted our request for delivering as keynote speaker in this conference.

Distinguished guests, Ladies and Gentlemen.

Assalamu'alaikum warohmatullahi wabarokatuh,
Good Morning.

First of all, let me state our welcome, and thank you to all of you to attend this International Conference on Indonesian Inland Waters III with the theme is "Strengthening sustainable management of Indonesian inland waters biodiversity and fisheries". This is one day conference.

This conference was initiated by Prof. Dr. Indroyono Susilo, the former chairman of Agency for Marine and Fisheries Research in 2004, with the objective to provide the opportunities for the Indonesian inland waters stakeholders to share any information, discuss issues and formulate problem solution in regard to the utilization and management of Indonesian inland waters, and to establish a close network of among the stakeholders.

Distinguished participants,

Our recent data show that 150 participants attend this conference from USA, Japan and Thailand as well as from Indonesia. Once again we really appreciate your present. In this meeting, there is about 52 papers, consisting of three papers of the keynote speakers, and 49 supporting papers as research outcome and review which will be presented by researcher, lecturer, and professional from various institution. At the end, it will be formulated into one comprehensive paper of policy recommendation.

Honorable Ladies and Gentlemen,

These all about the committee's report. We hope this conference will be running based on what we have planned. To all our distinguished guests, have a nice day while you are staying in beautiful Palembang city.

I kindly invite Mr. Ngurah N. Wiadnyana on behalf of The Chairman of Agency for Marine and Fisheries Research & Development to give welcoming remarks and officially open this conference.

Terima kasih. Thank you and success for us.

Billahi taufiq wal hidayah, wassalamu'alaikum warohmatullahi wabarokatuh.

Budi Iskandar Prisantoso

REMARKS
THE CHAIRMAN OF AGENCY FOR MARINE AND FISHERIES
RESEARCH & DEVELOPMENT

**Addressed by The Head of the Center for Engineering and Technology Assessment
of Marine and Fisheries**

The honorable :

Prof. David A. Bengston, The university of Rhode Island, USA

Dr. Jun-ya Shibata, Kyoto University, Japan

Dr. Chumnarn Pongsri, the secretary of South East Asian Fisheries development (SEAFDEC), Thailand

All chairman of the first and second echelon of the Ministry of Marine and Fisheries Affairs
Head of South Sumatra Fisheries and Marine Affairs Department

Distinguished Guest

Ladies and Gentlemen

Assalamualikum Wr.Wb

Good Morning

In this great opportunity, let me begin on behalf of The Chairman Of Agency For Marine And Fisheries Research & Development, extending welcome to our special guest Prof. David A. Bengston, Dr. Jun-ya Shibata and Dr. Chumnarn Pongsri to **the 3th International Conference of Indonesian Inland Waters**. I would like also to express my appreciation to representation from the Head of South Sumatra Fisheries and Marine Affairs Departement for his present today. To all our distinguished guest and participants let me express my warm welcome to all of you in this conference.

Distinguished participants,

The conference held at 8 November 2012. This is the 3rd international conference. The theme of this conference is: "Strengthening sustainable management of Indonesian inland waters biodiversity and fisheries". The significance of this theme is to strengthen international networking on inland fisheries and promote the sustainable management and conservation.

Indonesia has the biggest potential resources area and biodiversity of inland waters in Asia. The number of fish recorded in various areas is about 1,300 species. In every year new fish species are being described, these indicating that there are still many species that have not been discovered, identified and scientifically described.

The problem faced in Indonesia is not much different from countries in Southeast Asia. Indonesia is also significantly suffering from its rapid coastal erosion and loss of biodiversity. There are factors might influence the perturbation of its aquatic ecosystem including habitat fragmentation, water pollution, unfriendly aquaculture practices and over exploitation of economically important species, and also recording data that has not been good. The extinction of species is a major concern for the maintenance of ecosystem function as species diversity and functional ecosystem integrity drive functional redundancy (turnover of species in ecological niches) is an insurance against loss or regulatory function in the wild.

These inland water ecosystems provide a vital range of goods and services essential for sustaining human well-being, such as generating income, employment opportunity, and cheap protein source for the rural household. From official statistical data, inland capture fish production accounted for about 400,000 tons/year. However, the fish potential yield is estimated about more than 3,000,000 tons/year. This figure indicates there is opportunity and

challenge to increase fish production through management improvement including research and development and better recorded data systems.

To establish and strengthen regional networking for improving the fisheries management and fish conservation of inland waters, Indonesia proposed to establish the regional office for South East Asia Fisheries Development Center (SEAFDEC).

The Research Center for Fisheries Management and Conservation (RCFMC) belonging to the Agency for Marine and Fisheries Research and Development (AMFRD) under the Ministry of Marine Affairs and Fisheries of Republic Indonesia (MMAF-RI), has seriously considered the importance of inland waters for the people and strategic contribution of related sciences for proper management of Indonesia inland waters more focusing in inland water biodiversity and fisheries. Considering the above conditions and the Indonesian strategic advantages, the RIIF-CRFMFC is convening this conference.

The cooperation in this field of technology is also expected to continue braided to increase fish production, as well as cooperation in the field of conservation of fish resources. To that end, I invite ladies and gentlemen to the researchers, academics, practitioners, and bureaucrats as well as entirely to jointly work in accordance with the roles and functions of each one so that the public waters of Indonesia's land next to well-managed and utilized as much as possible for the prosperity Indonesian society. Through this forum we can share ideas and find solutions in developing appropriate strategies for fisheries management and conservation of fish resources in business management over the interests of the people.

Honorable Ladies and Gentlemen,

These all about that I can share today. At this moment, I stated to the International Conference on Indonesian Inland Waters III is officially opened. To all our distinguished guests have a nice day while you are staying in Palembang. Have a great conference and once again thank you for coming. I specially appreciate that. Thank you.

Palembang, 8 November 2012

On Behalf of The Chairman Of Agency For Marine And Fisheries Research and Development,
Head of the Center for Engineering and Technology Assessment of Marine and Fisheries,

Prof. Dr. Ngurah N. Wiadnyana, DEA

CLOSING REMARKS

Bismillahirrahmanirrahim.

Assalamu'alaikum Warahmatullahi Wabarakatuh.

Peace be upon you, and may Allah bless you all.

- Dr. Chumarn Pongsri, Secretary General of South East Asian Fisheries development (SEAFDEC)
- Prof. David A. Bengston, The University of Rhode Island, USA
- Dr. Jun-ya Shibata, Kyoto University, Japan
- Representation of the Chairman of Agency Marine and Fisheries Research and Development, Prof. Dr. Ngurah Wiadnyana, DEA

Distinguished Guests,
Ladies and Gentlemen,

First of all, I would like to thank to the committee of **3rd International Conference on Indonesian Inland Waters 2012** for inviting me to this wonderful event and also for giving me a great opportunity to deliver a speech in this closing ceremony.

I must add that it gives me an enormous sense of satisfaction to be here with all of you today because as you know, Inland Waters and Fisheries has always been something very important in Indonesia's research and development and on this particular today, I feel a special elation at *being able to share this moment with you all.*

Honorable Ladies and Gentlemen,

Once again, we would like to extend our gratitude to all of you for your selfless sharing of valuable information and hard in ensuring that this event is the success that it is. On that note it gives me great pleasure to officially close the **3rd International Conference on Indonesian Inland Waters 2012**. We wish you well in your travel home and we look forward to welcoming you again next 2 year.

Thank you.

Billahi taufiq wal hidayah, wassalamu'alaikum warohmatullahi wabarokatuh.

Budi Iskandar Prisantoso

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SEDIMENTATION RATE IN GAJAH MUNGKUR RESERVOIR CENTRAL JAVA, INDONESIA

Agus Djoko Utomo¹, M. Rasyid Ridho², Dinar DA Putranto³ and Edward Saleh⁴

ABSTRACT

Gajah Mungkur reservoir is a multipurpose reservoir with broadness of 8.800 ha. Its functions mainly for irrigation, hydroelectric power, source of drinking water, tourism, aquaculture and fisheries. Presently the sustainability of reservoir function is distressed by emerging of sedimentation. The sedimentation may be reduced water volume, create siltation, decrease carrying capacity, create rust and corrosion on the turbine engine. The aims of the research is to observe the sedimentation rate at Gajah Mungkur Reservoir as a base line study on the reservoir management model. The research has been conducted at Gajah Mungkur Reservoir, Central of Jawa during the period of February to Desember 2011. In order to estimate bathymetry of this reservoir the acoustic survey methods has been applied whilst the sediment traps is applied to estimate the sedimentation rate. The results of this research showed that maximum depth was 16 m, average depth was 6.07 m, average water volume was 428,912,270 m³. Compared to the situation when the reservoir was built in 1981/1982 the average depth was 9 m, average water volume was 630,000,000 m³. It is mean that after 28 years, there is a reduction of water volume about 201,088,000 m³ and reduction of water depth 2.93 m. The sedimentation rate was higher during the rainy season i.e. 0.96 m³/ha/day, whilst during the dry season i.e. 2.76m³/ha/day. The average sedimentation rate in one year was 6 cm / year, 593.71 m³/ha/year, 822.53 tons/ha/ year.

Keywords: Sedimentation, Water Volume, Siltation, Reservoir.

INTRODUCTION

Reservoir posses not only a strategic value but also multipurpose use for the economic activities (Sukimin, 2008). Gajah Mungkur reservoir is situated at the Solo River constructed during the period of 1981 to 1982 by drowning 51 villages and 67.157 people relocated out of Jawa through transmigration scheme. This reservoir is located in Wonogiri District Central Java, with water surface area 8.800 ha, 140 above sea level. Gajah mungkur reservoir is multipurpose reservoir initially, it functions was for irrigation, hydroelectric power, source of drinking water, however, it also attract for tourism, aquaculture and fisheries (Utomo et al., 2010). The problem encountered were sedimentation and eutrophication. Sedimentation derived from erosion of

rainwater runoff and erosion from the upper stream of the river. Eutrofication derived from anthropogenic factors such as agricultural, domestic and industrial wastes, as well aquaculture such as floating cage culture (Sukimin, 2008).

Currently, the sustainability of reservoir function is distressed by emerging of sedimentation. Sedimentation can reduce water volume, siltation, reduce carrying capacity, rust and corrosion on the engine turbine. When the reservoir was built in 1982, sediment thickness up to 3 mm / year. In 2000, sediment thickness reached 8.8 mm/year (Departemen Pekerjaan Umum Dirjen Pengairan, 1992; Direktorat Pengelolaan Bengawan Solo, 2003). Twenty four years later from the time when this reservoir began to operates in 1984, the volume of sediment

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by Dinar Da Putranto

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SEDIMENTATION RATE IN GAJAH MUNGKUR RESERVOIR CENTRAL JAVA, INDONESIA

Agus Djoko Utomo¹⁾, M. Rasyid Ridho²⁾, Dinar DA Putranto³⁾ and Edward Saleh⁴⁾

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Keywords : Sedimentation, Water Volume, Siltation, Reservoir.

INTRODUCTION

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Currently, the sustainability of reservoir function is distressed by emerging of sedimentation. Sedimentation can reduce water volume, siltation, reduce carrying capacity, rust and corrosion on the engine turbine. When the reservoir was built in 1982, sediment thickness up to 3 mm / year. In 2000, sediment thickness reached 8.8 mm/year (Departemen Pekerjaan Umum Dirjen Pengairan, 1992; Direktorat Pengetotaan Bengawan Solo, 2003). Twenty four years later from the time when this reservoir began to operates in 1984, the volume of sediment *entered the reservoir up to 168,719 million meters cubic*, which is the average of sedimentation rate per year was 7.03 million meters cubic, while the effective volume for irrigation remain 341 million meters cubic (Direktorat Pengelolaan Bengawan Solo, 2008; Jasa Tirta, 2008).

The volume of water in the reservoir has also been affected to the carrying capacity of fish culture. The large volume of water will be more carrying capacity of fish culture. Small volume of water that otherwise would be less carrying capacity of fish culture (Utomo *et al.*, 2011). In order to formulate the policy on the sustainable water resources development at Gajah Mungkur Reservoir for present and the future, the main problems and challenges should be taken into account. The key factor causing the above mentioned problems was the high volume of sediment entered into the reservoir. The aims of the research is to observe the sedimentation rate at Gajah Mungkur Reservoir as a base line study for reservoir management model.

MATERIAL AND METHODS

The study was conducted in 20/1, November 2011 and December 2011. The research methodology was direct observation to the field and laboratory analysis of materials samples

have been collected during that periods.

1. Acoustic Survey

In order to estimate the bathymetry of the reservoir, the acoustic survey using Simrad EY 60 was conducted in February 2011 (Table 1). The acoustic is placed on the right hand side of the 8 GT wooden boat. The placement of the equipment was to avoid the noise from the muffler of the boat. Since the reservoir is a closed area, therefore, the design of the transect to measure the depth was by zig-zag method. This method is to prevail the bathymetric from reservoir side to the centre in order to figure out of it contours (Figure 1) (FAO, 1980)

Reservoir bathymetry data were compared to data when the reservoir was built, subsequently we get the reduction of water volume as a result of sedimentation that entered into the reservoir (Jasa Tirta,2008; Fakultas Perikanan dan Ilmu Kelautan Universitas Riau,; Dirjen Sumberdaya Air dan Pusat Studi Ilmu Teknik Universitas Gajah Mada,2003).

Table 1. Acoustic Equipment

No	Equipment	Used
1	Acoustic: Portable Scientific Echosounder SIMRAD EY-60, transducer 120 KHz	The main equipment acoustic
2	One unit portable powe generator, 1000 Watt	Electricity power
3	Wooden boat 8 GT.	Transporting and installing acoustic equipment
4	Laptop with memory >2 GB, Hardisk >80 GB	Data acquisition
5	Personal Computer (PC). Memory >2 GB, Hardisk >80 GB	Post processing data
6	Software ER60	Processing data
7	Software SONAR-4	Processing data

2. Estimation of sedimentation rate by using sediment traps using the following formula

The study has been conducted at nine sites representing the type of water reservoir: (1) Middle Site

near the island; (2) Inlet of Wiroko Site; (3) Site near cage culture of PT. aqualam; 4) Cage Culture area Site; Inlet of Keduang Site; (6) Outlet site (7) Inlet of Bengawan Solo Site; (8) Inlet of Alang site; (9) Inlet of Wurantoro Site (Figure 2).

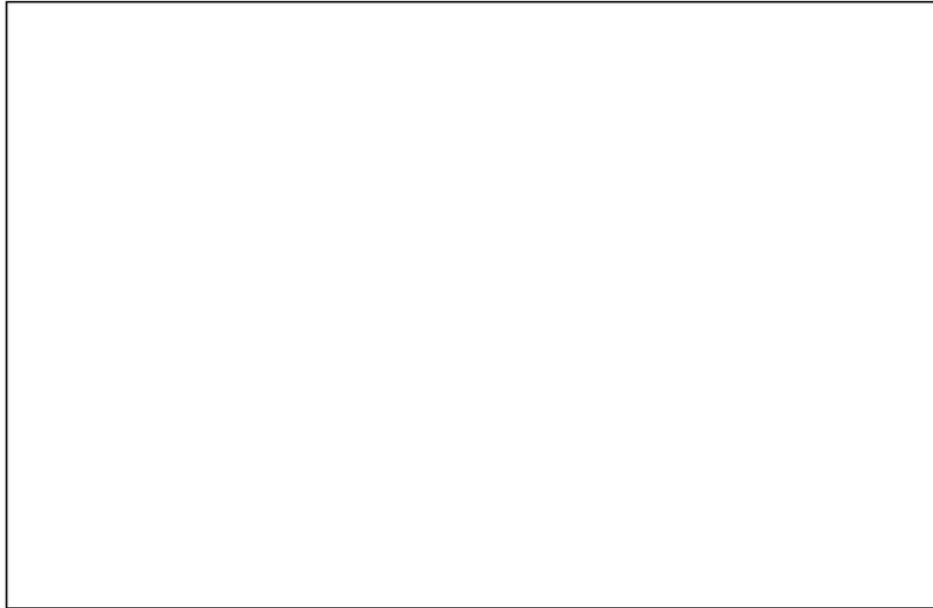


Figure 1. Acoustic transects design in Gajah Mungkur Reservoir.

Sediment traps was placed in the bottom waters for a few days. Sediment deposition in sediment traps were analyzed in the laboratory. The sedimentation rate was calculated. Estimation of sedimentation rate by using sediment traps using the following formula (APHA 1986; Morgan, 1979; Sulisty, 2000):

$$Ls = \frac{-W/A}{T}$$

Remarks:

- Ls = Sedimentation rate (ml/cm²/day, or gram/cm²/day)
- W = Sediment deposition (gram, or ml)
- A = Square of sediment traps
- A = r_i.r² (cm²)
r = radius circle of **sediment** traps (5.25 cm)
- T = Interval time (day)

RESULT AND DISCUSSION

Based on the acoustic survey (Table 2 and Figure 3); the result showed that maximum depth of Gajah Mungkur Reservoir was 16 m with the

average depth of 6.07 m and the average water volume was 428,912,270 m³. Compared to the reservoir when *was built in 1981 to 1982: the average depth was 9 m and average water volume was 630,000,000*. In other words, there is a reduction of water volume of 201,088,000 m³ and reduction of water depth 2.93 m in after 28 years later.

The reduction in the depth and water volume was due to the sedimentation entered into the reservoir. The catchments area around reservoir is 70% made up of yard, moor, and *dry* land. The forests may bear *up* erosion only 13.2%, the banks of the river into the reservoir often to grow crops (Wijarnako, 2010).

Based on the experimental of **sediment** traps (Table 3); the result showed that the average of siltation: (0.012 Cm/day + 0.010 cm/day + 0.028 Cm/day)/3 = 0,016 Cm/day, or 6 Cm/year. The average sedimentation rate in units of volume (ha) was (1.15 m³/ha/day + 0.96 m³/ha/day + 2.76 m³/ha/day)/3 = 1.63 m³/ha/day, or = 593.71 m³/ha/year. The average of sedimentation in units of weight (ton) was (1.48 ton/ha/day+1.69 ton/ha/day+3.59 ton/ha/day)/3 = 2.25 ton/ha/day, or 822.53 ton/ha/year.

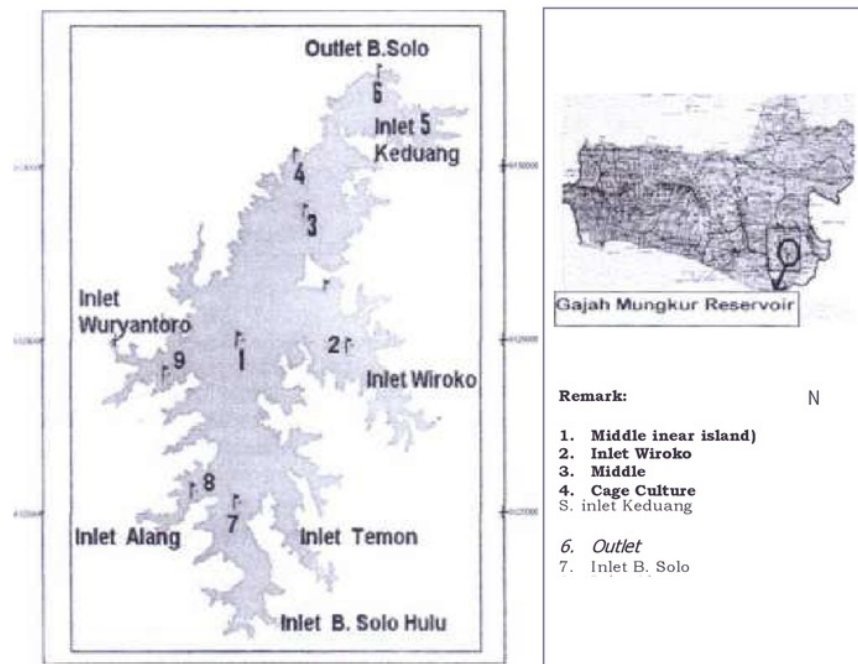


Figure 2. Location Site Map of Sediment Sampling

Tabel 2. Depht, vast and water volume of Gajah Mungkur Reservoir

Depth (m)	Vast (m ²)	Volume (m ³)
>0 -2	16.710.000	33.420.000
>2- 4	12.840.000	38.520.000
>4- 6	9.549.000	47.745.000
>6- 8	5.508.000	38.556.000
>8- 10	8.701.000	78.309.000
>10- 12	7.319.000	80.509.000
>12- 14	6.148.000	79.924.000
>14- 16	3.886.000	58.290.000
Average depth 6,07 m	70.661.000	Average Water Volume 428.912.270

The Sedimentation rate was larger during the rainy season ($0.96 \text{ m}^3/\text{ha}/\text{day}$) than during the dry season ($2.76 \text{ m}^3/\text{ha}/\text{day}$) due to the land affected by erosion entered into the reservoir, particularly land around the reservoir that used by the farm communities.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

- The sedimentation rate in Gajah Mungkur Reservoir was $593.71 \text{ m}^3/\text{ha}/\text{year}$ and it is considered to be very high.
- The reduction in the depth and water volume was caused by sedimentation process entered into the reservoir.

2. Recommendations

In order to recover the reservoir as was built, using land on the banks of the reservoir for agriculture is not allowed and it is highly recommended to lift the silt from reservoir.

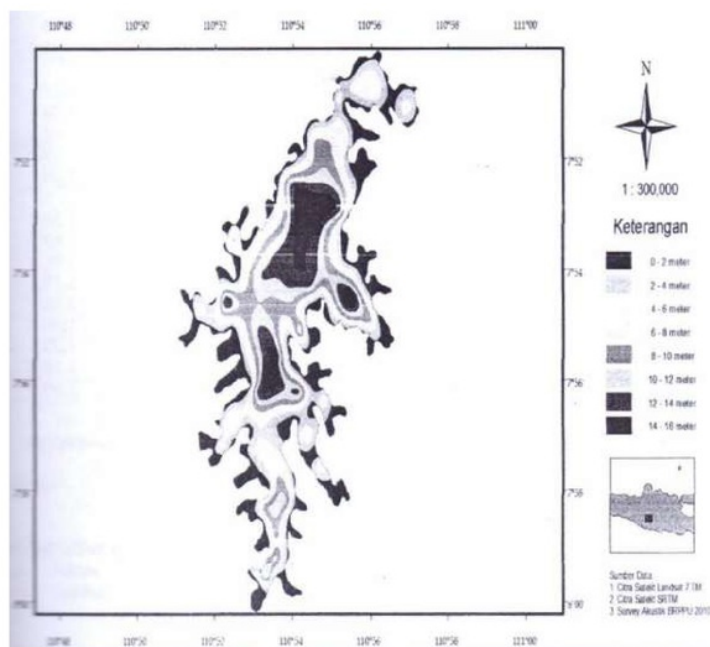


Figure 3. Bathymetry Map of Gajah Mungkur Reservoir

Tabel 3. Sedimentation Rate at Gajah Mungkur Reservoir

Location and Month		Sedimentation Rate		
		Cm/day	m3/ha/day	Ton/ha/day
A	November 2009			
1.	Inlet Wiroko	0.06	0.58	0.59
2.	Center 1	0.012	1.15	1.51
3.	KJA PT.Aquafarm	0.06	0.58	1.88
4.	KJA Masyarakat	0.012	1.15	0.74
5.	Outlet	0.023	2.31	2.68
Average		0.012	1.154	1.48
B	July 2010			
1	Center 1	0.012	1.18	2.27
2	KJA PT.Aquafarm	0.013	1.33	2.28
3	KJA Masyarakat	0.006	0.62	1.07
4	Outlet	0.007	0.72	1.14
Average		0.010	0.96	1.69
C	December 2011			
1.	Inlet Bengawan Solo	0.036	3.60	4.68
2.	Inlet Alang	0.030	2.98	3.87
3.	Inlet Wurantoro 1	0.026	2.62	3.41
4.	Inlet Wurantoro 2	0.040	3.99	5.19
5.	Inlet wiroko 1	0.045	4.48	5.83
6	Center 1	0.015	1.51	1.96
7	Inlet Keduang	0.013	1.33	1.73
8	Outlet	0.016	1.59	2.08
Average		0.028	2.76	3.59

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