

Restoration of the Bojongsoang Lake Oxbow Function in Citarum River

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Abstract--- *Citarum River as an infrastructure has a function to distribute water has several limitations, one of which is the ability of the river to accommodate rainwater that occurs in the watershed. River alignment activities undertaken by the government in the 80's, produced an abundant oxbow lake in the Citarum river. And based on data from Balai Besar Wilayah Sungai Citarum, it is estimated that 1.5 million m³ of water can be accommodated by oxbow lake or equivalent to the construction of 1 dam. Lack of maintenance and concern of stakeholders resulted in the oxbow lake not being able to function as expected. The objective of this paper is to present the results of oxbow lake dredging activities as an effort to reduce the impact of floods in Upper Citarum and utilization of oxbow lake for various purposes, such as education, recreation, protection of state assets and conservation.*

Keywords--- *Conservation, Citarum, Water resources, Oxbow Lake*

I. INTRODUCTION

It is estimated that for the period 1990-2025 there will be water scarcity problems in 118 countries. About 1 billion people face absolute water scarcity because they live in areas where there are enough sources of water. Another 348 million people face severe water scarcity because they live in areas where existing water sources require the development of high cost water acquisitions such as dams, wells, reservoirs and waterways to exploit their potential (Bruins 2000). Many countries have successfully conducted research on water resources management, and have produced several findings published in international meetings.

In Indonesia, in general the problem of Water Resources is classified into 2 major parts namely water quantity and quality (Prasetya and Yudianto, 2017; Saudi 2018). Several water quantity studies have successfully addressed flood and drought problems. The government is intensively doing infrastructure development Water resources such as the construction of reservoirs scattered throughout the territory of Indonesia and or normalization of rivers in several major cities to cope with floods and droughts. One of which is the normalization of the Citarum River.

Citarum River is the longest river in West Java Province and the river is also the main river that becomes the source of water for the urban community especially for the raw water source of Bandung as the capital city in west Java Province and Perum Jasa Tirta II has duty from government to management the water resources in the river. Oxbow lake is an object that can be used as an alternative retention pool so that it can reduce the impact of flooding in the area around the oxbow lake itself. In addition to being used as a retention pool, oxbow lake is expected to be a part to reduce the potential source of disease for the surrounding area. One of the problems in Oxbow lakes is the lack of maintenance of oxbow lakes that result in loss of government assets due to land acquisition and land misuse as waste disposal.

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In 2017 Perum Jasa Tirta II make a cooperation agreement with Balai Besar Wilayah Sungai Citarum to conduct the Citarum Bestari program and the activity is the dredging of mud in Oxbow lake. One of the problems that occurred when the oxbow mud dredging in the upper reaches of the Citarum River was the occurrence of flood and piles of garbage in the river body. The problem caused by the combination of mud and garbage makes oxbow lake has the potential to be an obstacle to the oxbow structuring process.

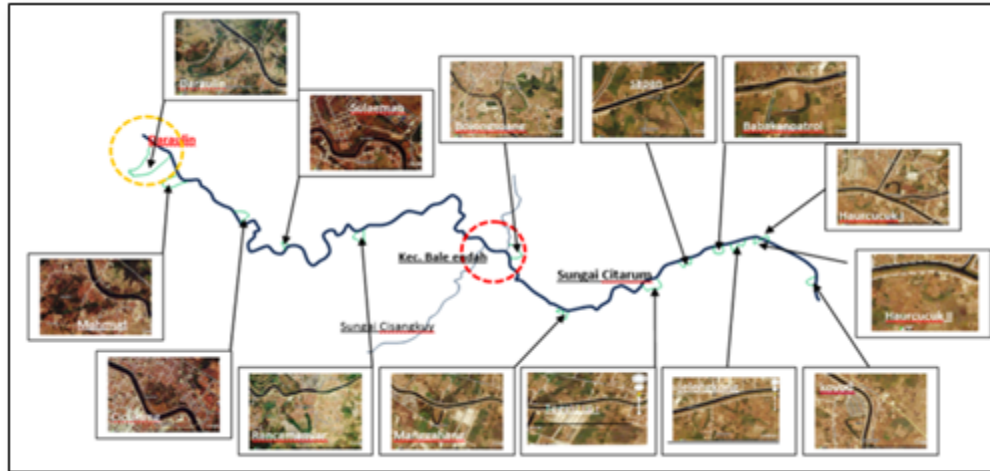


Figure-1: Oxbow lake location on upstream of Citarum river

II. BASIC TEORY

II.I. River Morphology

Meander base on name rivers in turkey, it is a river body that winds regularly with the direction of turns reaching half a circle. The turns are sometimes separated by the river as the flow returns straight through. The bend is called a horseshoe or also called oxbow lake. Meander is formed by erosion that occurs on the banks of the river.

The water on a river never flows in a straight line even shown in a seemingly straight line. The flow of water passing through rocks or other obstructions creates a slower and faster water movement area. Slower areas are found in deep rivers and are full of sediments. In the meantime, faster areas were found in the shallow part of the river and around the rock. Then, the river flows on the sides of the river that is still relatively straight. After that, a faster flow of water will move in opposite directions from the river over time so that it will form the meander.

Oxbow lake is a U shaped body of water that forms when a wide meander from the main stem of a river is cut off, creating a free-standing body of water. This landform is so named for its distinctive curved shape, resembling the bow pin of an oxbow. In Indonesia, oxbow lake called Kali Mati.

II.II. Oxbow Lake in Upstream Citarum River

Base on information and data from Balai Besar Wilayah Sungai Citarum (BBWSC)-Ministry Public Work of Republic Indonesia, there are more than 14 (fourteen) Oxbow lake in upstream Citarum River. But only 14 oxbow lakes have been identification, the namely is: Koyod, Haur Cucuk 1, Haur Cucuk 2, Babakan Patrol, Sapan, Tegal Luar, Jelegong, Mangguh, Bojongsoang, Rancamanyar, Suleman, Daraulin, Mahmud and Cicukang.

Today, all of oxbow have different characteristic and function, along with population growth in the southern Bandung area, some oxbows have shifted functions into rice fields, landfills and fish ponds, some of which are left untapped. This condition causes the environment to be disrupted and the function of oxbow as a temporary place (water parking lot) during the rainy season cannot be optimal, causing flooding in some areas in South Bandung.

Tabel 1: *Oxbow lake technical data (base date from BBWSC)*

Name of oxbow	Tecnical data				
	Location	Long (m)	Wide (m)/ depth (m)	Cross- Section Area	Volume
Koyod	Ds. Sumpersari	450	25/4	11,250	45,000
Babakan Patrol	Ds. Bojong	1,200	25/4	30,000	120,000
Sapan	Ds. Sumpersari	1,300	25/4	32,500	130,000
Haurcucuk 1	Ds. Sumpersari	1,100	25/4	27,500	110,000
Haur cucuk 2	Ds. Sumpersari	860	25/4	21,500	86,000
Tegal Luar	Ds. Tegal Luar	825	25/4	20,625	82,500
Jelekong	Ds. Jelengkong	760	25/4	19,000	76,000
Manggahang	Ds. Manggahang	930	25/4	23,250	93,000
BojongSoang	Ds. Bojongsoang	950	25/4	23,700	95,000
Rancamanyar	Ds. Rancamanyar	2,600	25/4	65,000	260,000
Sulaiman	Ds. Sulaeman	317	25/4	7,925	31,700
Cicukang	Ds. Cicukang	950	25/4	23,750	95,000
Mahmud	Ds. Mekar Rahayu	317	25/4	7,925	31,700
Daraulin	Ds. Daraulin	2,90	25/4	72,500	290,00
	Total	15,459		386,475	1,545,900

III. METHODOLOGY

The method carried out in this study follows the following stages (see figure 2): (1) identifying oxbow problems, (2) conducting literature studies on oxbows in the southern Bandung region, to choosing conservation methods, (3) conducting field studies to find locations oxbow, including determining the location of the oxbow to be done as a basis for determining the mud dredging method that is suitable for use when oxbow restoration is carried out, (4) collecting field data, such as measuring river cross sections (cross section), previous oxbow maps and boundaries land boundaries with surrounding communities, (5) undertaking work planning using the services of a planning consultant (6) Work Procsesing, carrying out the dredging process of mud at the oxbow location, (7) Evaluation result of work processing, carrying out oxbow conservation according to the designation.

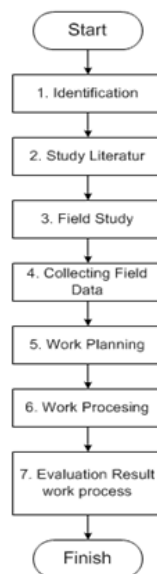


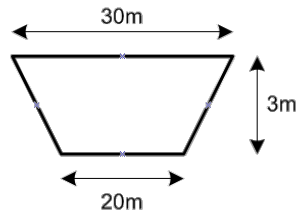
Figure 2: *Flow chart Methodology*

IV. RESULT AND DISCUSSION

Based on data from Balai Besar Wilayah Sungai Citarum (BBWSC), it is estimated that 1.5 million m³ of water can be accommodated by oxbow lake or equivalent to the construction of 1 dam. Lack of maintenance and concern of stakeholders resulted in the oxbow lake not being able to function as expected. The objective of this paper is to present the results of oxbow lake dredging activities as an effort to reduce the impact of floods in Upper Citarum and utilization of oxbow lake for various purposes, such as education, recreation, protection of state assets and conservation.

The structuring work was carried out in 2017-2018 by Perum Jasa Tirta II together with BBWSC, the project has been a success full restoration of several oxbow lakes function, namely: Bojongsoang lakes, Manggahan lakes, Rancamanyar lakes, Sapan lakes, Jelengkong lakes, Sulaiman lakes, Tegal Luar lakes, and Babakan Patrol lakes, with a storage volume of 1,545,900. m³. during the rainy season in 2019, oxbow has become temporary water parking, Based on calculations and estimates on the oxbow lake structuring plan, flood discharge can be parked in all oxbow with full oxbow filling time for 64.41 minutes, so that it can provide an early warning and give time to the community to conduct an early evacuation before the flood disaster occurs.

Typical planning of oxbow cross section



Length Oxbow (1)	: 15,459 m
Width Oxbow (2)	: 25 m
Cross-section area Oxbow (3)	: 386,475 m ²
Depth (4)	: 4 m
Volume of Oxbow lake (5)	: 1,545,900 m ³

Average flood debit Citarum river:
400 m³/sec.

Time Charging for full oxbow lake:
3,864.75 sec. (64.41minutes)

Temporary water reservoirs, such as Oxbow Lake, when floods hit the district of Bandung and can reduce the water level in the Citarum River. In addition, the location of Oxbow Bojongsoang has become one of the fishing locations and recreation areas for the surrounding community as shown in Figure 3 [7]. In addition to Oxbow Bojongsoang, Oxbow Manggahang has become a fish planting location by the Ministry of the Environment, and is expected with the assistance of a steak holder, such as BUMN and local government can change the face of dirty and dirty oxides into city parks and / or city forests that provide more benefits to the community and the environment.



Figure 3: *Oxbow Bojongsoang conditions before Restoration*

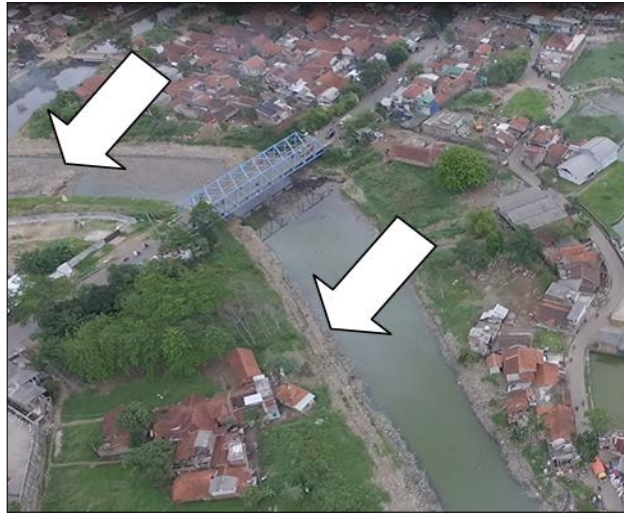


Figure 3: *Oxbow Bojongsorang conditions Afer Restoration*



Figure 4: *The community fishing at oxbow bojongsorang*

V. CONCLUSION

It can be concluded, that the structuring work of oxbow lakes in several locations in Bandung district, gives 64, 41 minutes to evacuate when the maximum water discharge (400 m³/s), in addition to functioning environmentally, in fact, the project can improve the economy of the surrounding community by planting fish for public consumption, green open space, water catchment locations, and a means of recreation for the community.

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