www.bircu-journal.com/index.php/birci
Budapest International Research and Critics Institute-Journal (BIRCI-Journal)
Humanities and Social Sciences
ISSN 2615-3076 Online)
ISSN 2615-1715 (Print)
Budapest Institute

Conservation of Protected Forests in Catchment Areas of Reservoirs in Barelang, Riau Islands

Muhammad Dahari[1], Suwindar Agung Sutianto[2], Yuanita FD Sidabutar[3]
[1,2,3]*Universitas Batam, Indonesia*
yuanita.fd@univbatam.ac.id

Abstract

Barelang is an abbreviation of Batam Rempang and Galang. Areas with rapid economic growth by utilizing a strategic location, namely international shipping lanes. The development of the city which has the issue of the availability of raw water sources is a special concern for the central government in developing this area later in the future. Sources of water that come from rainwater feds are then accommodated in reservoirs that have been built in several areas. BP batam's efforts in building this infrastructure are still continuing by collaborating with the central and regional governments, namely the Batam city government so that this problem can be solved together for the sake of the progress of barrelang in the future. The indicators that measure the availability of raw water in the Barelang Region are reservoirs that have been built by the government until 2022, including: Baloi Reservoir, Sei Harapan Reservoir, Muka Kuning Reservoir, Duriangkang Reservoir, Tembesi Reservoir, Sei Ladi Reservoir, Monggak Reservoir and Sei Gong Reservoir. Although these reservoirs are already available, the need for water for the survival of the city is still not sufficient. BP Batam's strategy to address the need for clean water takes the following steps: Normalization of Existing Reservoirs, Construction of new reservoirs, Seawater Desalination, Recycle domestic waste treatment, Supply of raw water from surrounding areas namely Bintan Island, Lingga Island, Siak River and Kampar River.

Keywords
conservation; forest; crisis; raw water; reservoir

I. Introduction

Batam Island first inhabited by peopleMalaywith the title of the Straits since the year 231 AD. The island which was once the battlefield of Admiral Hang Nadim's struggle against the invaders was used by the government in the 1960s as a base for petroleum logistics in Indonesia, Sambu Island.

Batam is one of the islands in the Riau Archipelago group and is an island among 329 islands located between Malacca Straitand Singapore which as a whole make up the Batam area. The scarcity of written records about this island, where there is only one literature that mentions Batam's name, namely the London Treaty which regulates the division of power between Dutchand English. However, according to cruisers fromChinaThis island has been inhabited since 231 AD when Singapore was still called Pulau Ujung.

Before receiving special attention from the central government, Batam was an empty island in the form of a wilderness that was almost devoid of life. However, there are several groups of people who first inhabited this island. They work as fishing and farming. They are not at all involved in changing the physical form of this island which is a stretch of wilderness.

In the 1970s, Batam began to be developed as a logistics and operational base for the oil and gas industry by Pertamina. with the initial aim of making Batam a Singapore Indonesia, then based on Presidential Decree (Keppres) No. 41/1973, the development of Batam was supported and entrusted to a government agency called the Batam Island Industrial Development Authority or now known as the Batam Island Industrial Area Development Authority. Batam Concession Agency (BP Batam) as a driving force for Batam's development

Batam is an island that is included in the Riau Archipelago Province. Its strategic location is facing the State of Singapore which is an international trade route. The rapid economic growth of Batam Island is influenced by four sectors, namely industry, ship conversion, manufacturing and tourism.

Economic growth is still an important goal in a country's economy (Magdalena and Suhatman, 2020). Batam's rapid economic growth makes Batam lack of land to meet the needs of investors who will enter the island. So from this period BJ Habibie developed the balloon theory which aims to divide areas that have been filled with activities that can be forwarded to surrounding areas which will later become centers of new economic growth. In 1992-1998 infrastructure was built connecting Batam with the surrounding islands. The islands connected by this bridge are Batam-Nipah-Setokok-Rempang-Galang-Galang Baru Island. With this infrastructure development, Batam is increasingly famous for the construction of bridge infrastructure using sophisticated modern technology.

In 2016 the population of Batam City was recorded at 1,037,227 inhabitants. Furthermore, in 2017 the population of the city of Batam increased, which was recorded at 1,055,040 people, which increased by 1.72% compared to the previous year. In 2018 the addition of the population in Batam City increased significantly to 1,329,763 people with a growth rate of 26.04% compared to the previous year. The highest increase in population is in Batam City compared to other sub-districts. However, in 2019 the population of Batam City actually experienced a significant decrease, namely by 16.71% compared to 2018. Furthermore, during the pandemic period, namely 2020, the population of Batam City actually increased even though this increase was not as large as the previous year. The increase in population growth in Batam City in 2020 is 8.02% so that the population of Batam City in 2020 reaches 1,196,396 people. During the last five years the population of Batam City has experienced a fluctuating upward trend from year to year. This trend that tends to increase needs attention because the increase in population needs to be followed by the quantity and quality of basic public services.

When viewed from the population distribution in 2020, the population of Batam City is still more dominant in the mainland sub-district, namely Sagulung District (17.50%) and Batam City (16.60%), while the lowest is in the hinterland district, namely Bulang (0.89%) and Galang (1.42%) Districts

Increasing economic growth has made Batam an opportunity for Indonesians to try their luck there. The rapid development of infrastructure aims to make it easier for investors to carry out their trade transactions around the world. The complete infrastructure in Batam does not coincide with available natural potential sources, especially raw water sources.

Barelang (Batam, Rempang, Galang) is an island that relies on rainwater storage after it is channeled to available reservoirs. The existence of the reservoir is still not sufficient for the needs of clean water in barrelang. BP Batam's strategy to address the need for clean water is carried out as follows: Normalization of Existing Reservoirs, Construction of new reservoirs, Seawater desalination, recycling of domestic waste

treatment, supply of raw water from the surrounding area namely Bintan Island, Lingga Island, Siak River and Kampar River.

According to Law no. 41 of 1999 concerning Forestry further details conservation forest areas into 3 (three) areas, namely:

1. KSA Nature Reserve Forest Area (KSA)is a state forest area with certain characteristics.
2. Natural Conservation Forest Area (KPA) KPA is a state forest area with certain characteristics that have the main function of protecting life support systems, preserving plant and animal species diversity, and sustainable use of biological natural resources and their ecosystems. Nature conservation areas according to Law No. 5 of 1990 are defined as areas with certain characteristics both on land and in waters.
3. Hunting Park Hunting park is a state forest area designated as a hunting tourism spot, this forest serves to accommodate activities related to hunting and hobbies for the community. The number of conservation forests is only a few and the area is not as wide as other forest types. In some countries, hunting parks are used as traditional locations for hunting recreation. Therefore, conservation forest types can be used as a profitable tourism sector

From the above understanding, forest conservation in Barelang is included in the category of Forest Conservation Areas. This forest area is able to maintain the availability of raw water sources to be processed into clean water sources for the Barelang Community and its surroundings.

The purpose of this paper is to protect the existing reservoirs from sedimentation or siltation as a result of forest encroachment by the community, illegal settlements, and the conversion of illegal logging land functions. The seriousness of the security forces and the government in maintaining forest conservation around the reservoir as a catchment area and providing strict legal action to create a deterrent effect for those who violate so that forest sustainability is always maintained Second: knowing data from reservoirs operating in the barrelang area and their production capacity. The catchment of the reservoir area is the center of attention because this is the place that functions to maintain the capacity of the raw water source in the reservoir.

The problems faced in the reservoir at this time are:

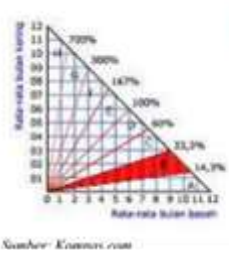
1. Reservoir sedimentation
2. The presence of water hyacinth plants in the reservoir
3. Damage to catchment area
4. Encroachment around the catchment area
5. There are cages around the reservoir
6. Licensing in the catchment area
7. Long drought

II. Review of Literature

Regional morphology is basically a landscape description based on hue, general slope, and elevation. Related to this morphology, in the Batam area, there are land and hill morphology units. The land morphology unit here refers to the shape of the landscape which is dominated by relatively flat or slightly wavy land. In the Batam area, the morphology of the land is lowlands and wavy plains. As for the hilly morphological unit, it refers to the landscape that shows both smooth and rough relief, forming hills with varying slopes.

In general, Batam City is an area with a wet tropical climate. During the dry season, the average rainfall reaches more than 55 mm. Based on Figure 4.28 below, it is known that the largest wet month occurred in 2017 which amounted to 12 which indicates that there is a high possibility of water availability this year, then in 2018, the dry month in Batam City was 2 and the wet month was 10 which is a lower number than the previous year. Therefore, it is very important to note that the large wet month must be used to maintain the availability of water so that there is an adequate water reserve.

In addition, according to the Schimdt-Ferguson climate classification, the rainfall in Batam City is included in the B climate type category with a Q value of 14.3-33.3% and a wet climate. According to information from BP Batam, Batam City is a tropical area with average temperatures ranging from 24 to 35 degrees Celsius (77 to 95 degrees Fahrenheit). Humidity in this region ranges from 73% to 96%. In general, the rainy season starts from November to April, while the dry season starts from May to October. Average annual precipitation inBatam City is about 2,600 mm per year.



Tipe Iklim	Nilai Q (%)	Keadaan Iklim
A	< 14,3	Sangat Basah
B	14,3 – 33,3	Basah
C	33,3 – 60,0	Agak Basah
D	60,0 – 100,0	Sedang
E	100,0 – 167,0	Agak Kering
F	167,0 – 300,0	Kering
G	300,0 – 700,0	Sangat Kering
H	> 700,0	Luar Biasa Kering

Figure 1. *Schmidt-Ferguson climate classification*

Rain Catchment Area, Watershed, an area in the form of a basin bounded by a topographic barrier in the form of ridges in which there is a river network, where rain that falls into this area is released through one outlet (Linsley et al, 1975).

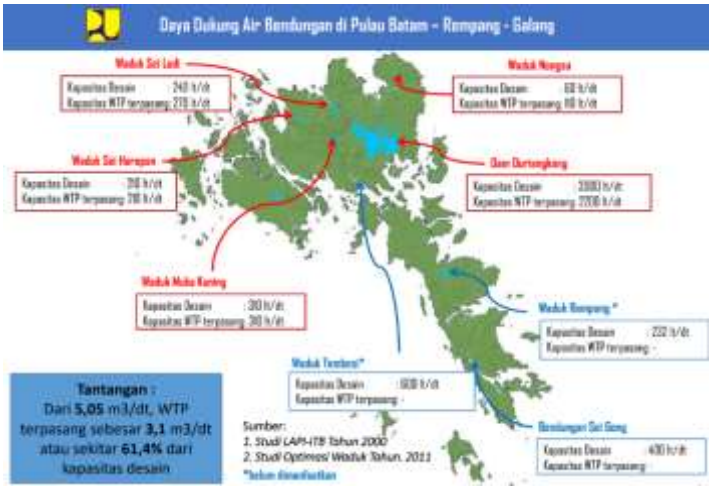
Water catchment area (DTA) is an area that functions as a water catchment area that has important benefits for maintaining the sustainability of the function of water sources in the area.

According to Law Number 41 of 1999 concerning Forestry, conservation forest is a forest area with certain characteristics that have the main function of preserving the diversity of plants and animals and their ecosystems. This type of forest tends to be formed from natural forests that have various types of plants. The high diversity of plant species will help the forest maintain its ecological balance. The concept of "conservation" was put forward by Theodore Roosevelt, who was the first American to suggest this term. The definition of conservation is the wise use of natural resources. Conservation can also be viewed from an economic and ecological perspective. Conservation activities from an economic point of view mean trying to allocate natural resources to meet current needs. (source:*https://protectihutan.com/blog/hutan-konservasi-pengertian-type-function/*)

2.1 Map of the Distribution of Barelang Clean Water Supply

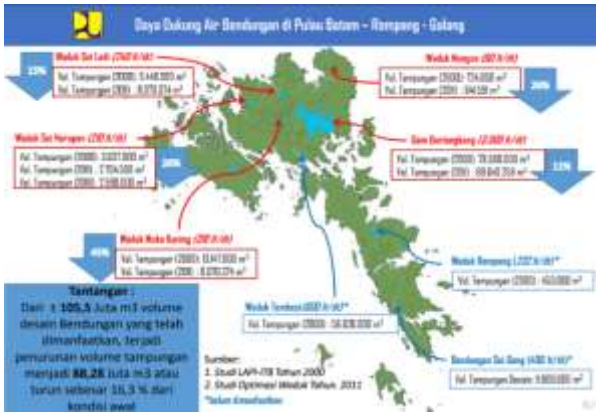
(MAP.1- Barelang Clean Water Supply Distribution Map, FGD Strategy for Handling Raw Water Availability Crisis in Barelang, Riau Archipelago Province, 2019)

2.2 Map of Barelang Dam Water Supporting Capacity



(MAP.2- Barelang Dam Water Carrying Capacity Map, BWWS IV, Strategic Issues for Batam City, Riau Islands 2019 2019)

2.3 Map of Barelang Dam Water Supporting Capacity



(Map 3. Barelang Water Dam Bearing Capacity Map, - BWWS IV, Strategic Issues for Batam City, Riau Islands 2019)

Management System
Clean Water in Barelang

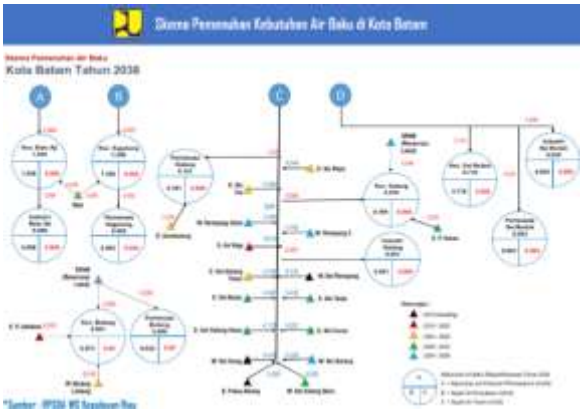
1. Fully managed by BP Batam
2. BP Batam cooperates with private parties
   - Fully Managed by Private Parties
   - Managed partially (partially) by a Private Party

2.4 Projection of Barelang Water Need

(Graph 1. Projection of barrelang water needs, BWWS IV-Strategic Issues for Batam City, Riau Islands 2019)

2.5 Barelang Water Needs Fulfillment Plan

2.6 Scheme of Fulfillment of Barelang Water Needs



(scheme 1. Scheme for Fulfilling Raw Water Needs in Batam City BWWS IV, Strategic Issues for Batam City, Riau Islands, 2019)

III. Research Method

The research method according to Sugiyono states that the research method is as follows: "Research method is basically a scientific way to obtain valid data with the aim of being able to find, prove, and develop knowledge so that in turn it can be used to understand, solve and anticipate problems". (2008:5) The method used by the author is a descriptive method with a quantitative approach, according to Burhan Bungin are: "Quantitative research with a descriptive format aims to explain, summarize various conditions, various situations, or various variables that arise in society to become objects 30 research is based on what happened. Then raise the surface of the character or description of the condition of the situation between these variables. (2009:36)

Qualitative research methods. is a research procedure that produces descriptive data in the form of written or spoken words from people and observed behavior (Bodgan and Taylor in Barowi and Suwandi, 2009: 21), while the purpose of qualitative research according to Sulistyo-Basuki (2010: 78) The purpose of this research is to obtain a complete picture of a matter according to the view of the human being studied. Qualitative research deals with the ideas, perceptions, opinions, or beliefs of the people being studied,

all of which cannot be measured by numbers. Meanwhile, according to Prastowo (2012: 45) qualitative research emphasizes inductive analysis, not deductive analysis. The data collected is not intended to support or reject hypotheses that have been prepared before the study begins, but abstractions are structured as specifics that have been collected and grouped together through a carefully carried out data collection process. In this study, researchers develop concepts and collect facts, but do not test hypotheses through numerical calculations.

Quantitative method will be used in this study aimed to determine the reservoirs that have occurred sedimentation as a result of the weak supervision of the conservation of protected forests.

The first step of research is using quantitative methods by determining the variables.

Variables are phenomena that vary in form, quality, quantity and standard. From this understanding, the variable is a (changing) phenomenon, thus there may not be an event in nature that cannot be called a variable, depending on the quality of the variable, namely how the variation of the phenomenon forms. According to the form, the variables consist of independent variables and dependent/dependent variables (Burhan Bungin 2004:70).

The independent variable is a variable that determines a certain direction or change in the dependent variable, while the independent variable is in a position that is free from the "influence" of the dependent variable. Thus the dependent/bound variable is a variable that is influenced by the independent variable (Burhan Bungin 2004:72).

According to chablullah wibisono Variable is a concept that can be measured & the measurement results vary.

Based on the distinguished function:

1. Variable cause
2. Connecting variable
3. Dependent variable

Because	Between	Consequence
Free variable		
Moderator variables	Variable between	Variable depends
Control variables		
random variable		

Variable Classification

In this study the independent variable is marked with the letter X, the intermediate variable is marked with the letter Y and the dependent variable is marked with the letter Z. So the independent variables of this study are Forest Conservation (X1), Law enforcement security apparatus (X2) Reservoirs in Barelang (Y) While the dependent variable / dependent on the Future (Z).

IV. Results and Discussion

Protected Forest Conservation to protect the Cathment of the Reservoir Area very needed to maintain the raw water capacity. Strict supervision and cooperation with various stakeholders are needed.

Data collection of reservoirs where sedimentation has occurred must be carried out immediately. The reservoirs that have been scattered in the Barelang Region include: 1. Baloi Reservoir, 2. Sei Harapan Reservoir, 3. Muka Kuning Reservoir, 4. Duriangkang Reservoir, 5. Tembesi Reservoir. 6. Sei Ladi Reservoir, 7. Monggak Reservoir and 8. Sei Gong Reservoir. Among the existing reservoirs above is one that is no longer functioning, namely the Balaoi reservoir. The Baloi Reservoir has stopped operating because it has been converted into a squatter settlement.

After collecting data from the 8 reservoirs that have been scattered in the Barlang area. Created a description table, among others:

Tabel Exisitng Waduk-Waduk di Barelang

No.	Nama Waduk	Sedimentasi Waduk	Keberadaan Tumbuhan Eceng Gondok	Kerusakan pada Catchment area	Penambahan di sekitar catchment area	Keramba di sekitar Waduk	Perizinan didalam Catchment Area
1	Waduk Baloi	50%	85 %	100%	100%	20%	0%
2	Waduk Sei Harapan	20%	0%	35%	0%	0%	0%
3	Waduk Muka Kuning	10%	10 %	10%	5%	5%	0%
4	Waduk Duriandkang	10%	3%	20%	30%	2%	0%
5	Waduk Tembesi	35%	35 %	40%	40%	15%	0%
6	Waduk Sei Ladi	3%	0%	0 %	0%	0%	0%
7	Waduk Monggak , Rempang	5%	2%	30%	35%	0%	0%
8	Waduk Sei Gong, anlang	10%	0%	15%	10%	0%	0%

From the table above, a government management plan can be made with a period of 25 years. If it is not taken seriously, it is feared that the funds needed to revitalize these dams will be very expensive in the future. The supervision of the conservation of this protected forest must involve security forces, including: 1. TNI, 2. POLICE, AND 3. PROVINCE HIGH PROSECUTORS.

Supervision from the security related parties is expected to be able to maintainConservation Forest Preservation for the sake of maintaining the availability of raw water that has been accommodated by the reservoirs in the Barelang Area

Indicator Analysis has an effect on maintaining the availability of raw water in the Barelang Region

Influential indicators are value factors that become in achieving the Goals. Indicator X1 will occur if the supervision of indicator X2 is carried out in accordance with Government Regulations. When these values occur according to the existing legal corridors, the achievement of future Raw Water Needs will be realized. Although the X1 indicator does not change the Water Availability Crisis in the Barelang Region, the X1 indicator can still minimize the Raw Water Demand Crisis in the Region.

V. Conclusion

Barelang (Batam-Rempang-Galang) is one of the regions in Indonesia with rapid economic growth. Economic growth that occurs in the region can affect national economic growth. Rapid population growth, increasing industrial growth are new problems in this region, especially the availability of raw water to meet their needs. The issue of the raw water crisis is of particular concern to the central government, so that future plans are made to deal with the crisis.

Protected Forest Conservation is one of the indicators in maintaining the availability of raw water. If this is not taken seriously and handled seriously, the costs to be incurred will gradually become more expensive and it is possible that the current reservoirs can change their function as happened in the Baloi Reservoir. Cooperation between stakeholders is a legal force for the maintenance of forest conservation and raw water supplies in the Barelang area

References

Badan Pengusahaan Batam Batam Integrated Total Water Management (BITWM) Fgd Strategi Penanganan Krisis Ketersediaan Air Baku Di Barelang, Provinsi Kepulauan Riau.

Badan Pusat Statistik Kota Batam. Kecamatan Belakang Padang Dalam angka Tahun 2021, Badan Pusat Statistik Kota Batam.

Balai Wilayah Sungai Sumatera IV Direktorat Jenderal Sumber Daya Air Kementerian Pekerjaan Umum dan Perumahan Rakyat.

Bungin. 2019. Metodologi Penelitian kuantitatif

Ciriajasa E.C PT kso Multi Karadiguna Jasa, Laporan Akhir Penyusunan Program Pembangunan Infrastrusktur Kota batam

Citra Persada1, Santun R.P. Sitorus2, Marimin3, Ruchyat Deni Djakapermana4.

https://lindungihutan.com/blog/hutan-konservasi-pengertian-jenis-fungsi/)

https://www.tribunnews.com/pendidikan/2021/11/17/apa-itu-daerah-tangkapan-air-dan-daerah-aliran-sungai-berikut-penjelasannya.

Isu Strategis Kota Batam Prov. Kepulauan Riau.

Kementerian Koordinator Bidang Perekonomian. FGD Penyusunan Strategi Penyediaan Air Baku untuk Kawasan Batam-Bintan-Karimun-Tanjungpinang di Provinsi Kepulauan Riau

Magdalena, S., Suhatman, R. (2020). The Effect of Government Expenditures, Domestic Invesment, Foreign Invesment to the Economic Growth of Primary Sector in Central Kalimantan. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*. Volume 3, No 3, Page: 1692-1703.

Mustika Erwin 1990-1992. Sistem Penyedian Air minum dan Lingkungan

Penentuan Status Keberlanjutan Infrastruktur Perkotaaan(Studi Kasus : Kota Bandarlampung)

Sejarah Kota Batam https://id.wikipedia.org/wiki/Kota_Batam

Sidabutar Yuanita FD, “Ilmu Perencanaan Wilayah Untuk membangun kepulauan Riau”, http://Batampos.id/2021/03/08/ilmu-perencanaan-wilayah-untuk-membangun-kepulauan-riau/)

Sidabutar Yuanita FD, 2020, “The effect of building quality and environmental conditions on community participation in medan city historical buildings”, Vol 5 NO 1 (2020): JURNAL IDEALOG (https://doi.org/10.25124/idealog.v5i1.28)

Sidabutar Yuanita FD, 2021, “Dasar-dasar perencanaan wilayah”, PT Tiga Saudara Husada, ISBN 978-623-98846-0-4, cetakan pertama , November 2021.

Sidabutar Yuanita FD, 2021, “Ilmu Perencanaan Wilayah untuk Membangun Kepulauan Riau”, https://batampos.id/2021/03/08/ilmu-perencanaan-wilayah-untuk-membangun-kepulauan-riau/)

Sidabutar Yuanita FD, 2021, “Kearifan Lokal Dalam Perencanaan Wilayah”, https://keprisatu.com/kearifan-lokal-dalam-perencanaan-wilayah/)

Sidabutar Yuanita FD, E. Indera , 2021, “ Maritime Potential Phenomenon in improving the Welfare of the Riau Island Community”, E3S Web of Conferences 324 (MaCIFIC 2021), 08001

Sidabutar Yuanita FD, J Danuwidjojo, F Iood, 2021, “Kearifan lokal melayu sebagai identitas Kota Batam” Jurnal Potensi 1 (2), 22-28

Sugiyono. 2019. Metode Penelitian kuantitatif,kualitatif dan R & D

Wibisono,cablullah 2022. Metpen kuantitatif