SENJOp
http://senjop.ppj.unp.ac.id/index.php/senjop
Science and Environmental Journals for Postgraduate
Vol. 5 No. 1 (pp. 35-39) December 2022
p_ISSN 2655-5085
e_ISSN 2655-5239

Environmental Ecology of the Palembayan Watershed – Agam Regency

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Received: 12 Jul. 2022, Revised: 01 Nov. 2022, Accepted: 01 Des. 2022

ABSTRACT

The Palembayan Watershed as an object of study, in the 2011 RTRW of the Agam Regency, is one of the watersheds in the Agam Regency, an area that must maintain the authenticity of its environmental ecology, from studies and research the raw water quantity can be calculated and potential, very high quality raw water needs to be maintained , starting from upstream to downstream in the Landian watershed, it is necessary to carry out guidance, integrated conservation of all sectors so that it is maintained according to its function.

Keywords: Ecology, Environmental, Watershed, Palemayan Agam.

INTRODUCTION

In the RTRW document for Agam Regency No. 13/2011 clause 18 points 3, it is stated that the watersheds located within Agam Regency include: 1) Palembayan; 2) Masang; and 3) Gaung (Septian et al., 2020). This literature review study describes the environmental ecology of the Palembayan watershed. Watersheds are ecosystems, where elements of organisms and the biophysical environment as well as chemical elements interact dynamically and within them, there is a balance of inflow and outflow of materials and energy. The importance of the position of the watershed as an integral management unit is a logical consequence of maintaining the sustainable use of forest, soil, and water resources. Within the Palembayan watershed ecosystem area is one of the studies as a source of raw water for Regional SPAM Agam Regency and Bukittinggi City, which is located in Jorong Ranah Nagari Sungai Landia located at an altitude of 1,147 MAS (Firdaus et al., 2022).

Ecologically, this is related to the catchment ecosystem which is a series of natural processes of the hydrological cycle. Therefore, in regional SPAM planning as part of the Palembayan Watershed, the land use should pay attention to the watershed ecological system, namely by considering the capacity and carrying capacity of the environment where the watershed or watershed is an expanse bounded by ridges of hills or mountains in the upper reaches of the river downstream valley direction. The watershed is therefore a unitary land resource where humans move to benefit from it. For watershed benefits to be obtained optimally and sustainably, watershed management must be planned and implemented as well as possible. This paper briefly presents the main points of view on watershed ecological systems and philosophies to achieve sustainable and profitable watershed management.

FINDING (LITERATURE REVIEWS)

2.1 Raw water quantity

The results of the analysis of the quantity of raw water in the Palembayan watershed found that 1) The minimum water availability for the Palembayan watershed during wet conditions (Q.20) is 38.23 m³/s, normal conditions (Q.50) is 26.76 m³/s and dry conditions (Q.80) is 19.97 m³/s. While the maximum discharge for wet conditions (Q.20) is 78.26 m³/s, normal conditions (Q.50) is 59.35 m³/s, and dry conditions (Q.80) is 41.91 m³/s; 2) Utilization of surface water in the Palembayan watershed is 14.82 m³/s, consisting of 0.18 m³/s domestic needs, 14.63 m³/s irrigation needs, and 0.01 m³/s industrial water needs; and 3) Based on the results of a comparison between the use and availability of water (water balance) in the Palembayan watershed, the minimum water availability is still able to meet the needs and during dry conditions (Q.80) there is still a water reserve of 1.92 m³/s. but for each of the sub-watersheds and river nodes/sections, there are still several segments that lack water.

The water source used in planning the Regional SPAM is the Landia River which is included in the Jorong Ranah Nagari Balingka District IV Koto Agam which is included in the Palebayan Watershed, from secondary data on rainfall from rainfall post points obtained from the SDA BK office of West Sumatra Province. From these data it can be compared with the water distribution balance scheme for the use of discharge quantities along the Landia river as follows, the minimum discharge Q90 at the source is 310 l/s with a withdrawal of 0.22 m/s, for irrigation fulfillment Q 0.01 m³/s with the remaining Q is 0.08 m³/s, with the addition of several sumps so that the remaining water downstream of 1.019 l/s enters the Sianok stem, as can be seen in Fig 1 below.

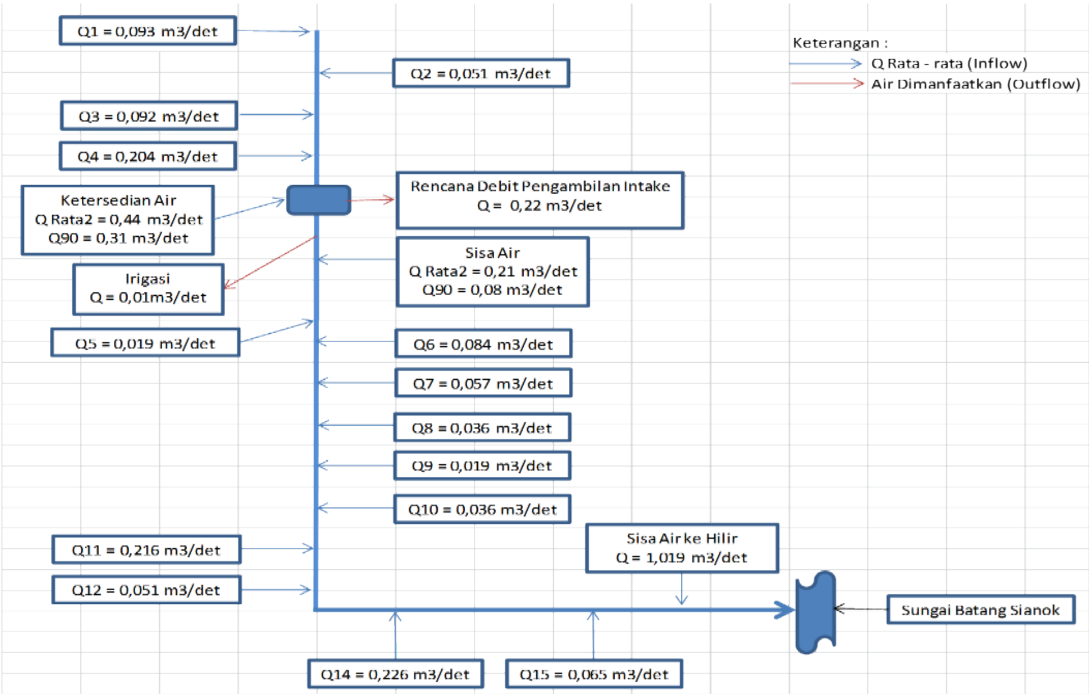

Figure 1. The water balance is included in the Palembayan watershed (In Indonesia).

2. Raw Water Quality

The quality that we do lies in the Palembang Watershed which will be used as a source of raw water for Regional SPAMs. The quality in this study refers to the standard standards set by the government through drinking water standard standards in the Minister of Health regulation number 492/Menkes/per/IV/2010 concerning requirements for drinking water quality and PP No. 22/2021. Safe drinking water for health meets the requirements of physics and chemistry. Good water quality should meet the requirements for physical parameter tests, including odorless, tasteless (fresh), colorless, clear or not cloudy, normal temperature, and does not contain solids or Total Dissolve Solid, low TDS. The results of testing the physical parameters in the form of smell and taste of water showed that 100% of the water samples tested met the standard set by the government. Laboratory test results for the physical parameters in Table 1, namely odor, turbidity, taste, temperature, color, and TDS show that from 6 water samples taken at different reservoir locations, the result is that all samples have met the standards for consumption by customers or publics. This indicates that the water is clean and not contaminated by substances that may endanger health.

Table 1. Water physics parameters

No	Parameter	Unit	Sample	Sample	Sample	Quality standards
1	Smell	-	Odorless	Odorless	Odorless	Odorless
2	Color	TCU	<0.379	9.08	6.99	15
3	Total Substance In Dissolved	mg/L	53.38	50.5		500
4	Turbidity	NTU	0.11	0.49	<6	5
5	Taste	-	Tasteless	Tasteless	Tasteless	Tasteless
6	Temperature	-		22.4	27.5	Air +/- 3C

The odor and taste parameter test was carried out by observing the sense of smell and taste using the organoleptic method. Organoleptic/sensory testing, namely testing using the human senses as the main tool for assessing the quality of a food/beverage product. Assessment using this sensory tool includes quality specifications for appearance, smell, taste, and consistency/texture as well as several other factors needed to assess the product (SNI 01-2346-2006). Changes in smell and taste in water can be caused by the presence of decomposing organic materials, chemical compounds, and the presence of algae, and other aquatic plants and animals that enter as contaminants in water samples. The results of the color parameter test are measured using the True Color Unit (TCU) scale, with water quality standards for clean water at a maximum of 50 TCU and drinking water at 5 TCU using the visual method or direct comparison of color appearance, where the results show that 3 times the water sampling at The raw water source for the Regional SPAM plan has very low turbidity levels of 0.11, 0.49 and less than 6 NTU with color parameters for all water samples fit for consumption by residents.

For other physical parameters such as turbidity and total dissolved substance (TDS), the results also show values that are below the set standards so that they are suitable for consumption by residents. Meanwhile, in the temperature parameter, it is shown in Table 1 that the water temperature has different variations. The water temperature should not be too hot and not too cold, good water must have the same temperature as the air temperature, which is around 28°C so that there is no dissolution of chemicals in the ducts or pipes that can endanger health, and inhibit biochemical reactions in the channels. or pipes and pathogenic microorganisms are not easy to grow.

Table 2. Water chemistry parameters

No	Parameter	Unit	Sample Number	Sample Number	Sample Number	Quality standards
1	Kadminum	mg/L	<0.003	<0.003	<0.003	0.003
2	Nitrit-NO2	mg/L	<0.002	<0.007	<0.002	3
3	Nitrat-NO3	mg/L	<0.089	<0.089	0.0296	50
4	Besi (Fe)	mg/L	<0.028	0.105	0.062	0.3
5	Khlorida	mg/L	3.36	0.83	1.26	250
6	Mangan	mg/L	<0.013	<0.013	<0.038	0.4
7	PH		6.24	7.5	7.7	6.5-8.5
8	Seng	mg/L	-	<0.01	<0.01	3
9	Sulfat	mg/L	6.76	22.4	<0.382	250
10	Tembaga	mg/L	<0.013	<0.032	<0.016	2
11	Amoniah NH3	mg/L	<0.012	0.023	<0.013	1.5
12	Zat Organik (KMnO4)	mg/L	0.68	-	-	10

In addition to testing the water quality using chemical parameters, water quality testing was also carried out on chemical parameters, namely the degree of acidity (pH), Aluminum (Al), Ammonia (NH3), Arsenic (As), Iron (Fe), Fluoride (F), Hardness (CaCo3), Chloride (Cl), Manganese (Mn), Nitrate (NO3), Nitrite (NO2), Zinc (Zn), Cyanide (CN), Sulfate (SO4), Copper (Cu), Organic substances (KMnO4), and Chromium (Cr). The results of the chemical parameter tests are shown in Table 2, where the concentration levels of several heavy metal contaminants analyzed in all water samples were still below the clean water quality standards set by the government through the minister of health regulation number 492/Menkes/per/IV/2010 concerning "Quality Requirements of Drinking Water". Based on the results of pH measurements carried out at the West Sumatra Provincial Health Laboratory, it was shown that the pH in the water samples in the study area was within the range of established water quality standards, namely 6.5 – 8.5. The pH yield is affected by the soil structure in the region where the water reservoir is located. So the six water reservoirs in the research area met the requirements for drinking water quality in terms of pH. According to Putra & Husrin (2017); Putra et al (2017) Water should be neither acidic nor alkaline (neutral) to prevent heavy metal dissolution and corrosion of the water distribution network. The recommended pH for clean water is a maximum of 6.5 – 8.5.

3. Upstream and Downstream Watershed

One of the problems in watershed management efforts in the regional context is the location of the upstream of the river which usually passes upstream to downstream, the upstream watershed has an important role, especially as a place to provide water to flow to the downstream. The upstream watershed has an important meaning, especially in terms of protecting the function of the water system, therefore any activity in the upstream area will have an impact on the downstream area in the form of changes in discharge fluctuations and transport of sediment and dissolved materials in the water flow system (Jahandideh-Tehrani et al., 2020; Gandri & Bana, 2021). Therefore, the upstream part of the watershed often experiences conflicts of interest in land use, especially for agricultural, tourism, mining, and settlement activities. Considering that the upstream watershed has limited capacity, any misuse will hurt the downstream. In principle, the upstream watershed can be conserved by covering aspects related to the water supply. In 2015 the Ministry of Environment and Forestry established a Medium-Term Development Plan (RPJM 2015-

2019) and prioritized the handling of critical watersheds which are a priority because of the damage caused occurs in the upstream area. The upstream area as a conservation area functions as a supplier of water and sediment for the areas below it. Besides that, it also functions as a water catchment area (recharge area) which ideally is an area with forest vegetation cover. However, in reality, there has been forest degradation, in the form of forest conversion to agricultural which is feared to reduce the hydrological function of the watershed.

Figure 2. Catchment Area of the Landia River as a source of raw water for regional SPAMs in the Palembayan watershed.

From Fig 2, one of the catchment areas in the Palembayan watershed can be seen in the upstream part, it has started to break down due to a change in forest function, this protected forest should be used by the Decree of the Minister of Forestry SK 35/Menhut-II/2013 and the map attached to the decision of the Minister of Environment and forestry SK 6599/men-LHK-PKTL/KUH/PLA/2/10 of 2021. According to Haeruman (1979), integrated management is the development of harmony of objectives between various systems of natural resource management. When an object is managed by many managers according to their relevance and importance to the object being managed. Haeruman (1979) further said that integration in the management of activities must be able to create: 1) coordinated managers of an object interrelated in a system to achieve a variety of goals; 2) integrate every effort to utilize arrangement, maintenance, supervision, and control as well as development based on the elements of the relationship or dependence of the object being managed. Meanwhile, Bailey & Copeland (1961) says that watershed management is an applied science for the protection, improvement, and management of watersheds, and the basic objective is to increase water supply, reduce the range of maximum and minimum flows, reduce sediment yields and improve water quality for various uses. . Notohadiprawiro (1985) argues that watershed management must be carried out in an integrated manner because 1) there is a relationship between various activities in the management of natural resources and the development of human activities in their use; 2) in terms of the type of science that underlies it, watershed management is characterized by multidisciplinary characteristics; and 3) the implementation of watershed management is cross-sectoral so that no agency has complete authority.

CONCLUSION

Based on the definition of the limitations above, it can be given the understanding that integrated watershed management is an integrated effort to manage natural resources, including actions to utilize, organize, maintain, monitor, control, restore and develop watersheds based on the preservation of harmonious and balanced environmental capabilities to support sustainable development. for the improvement of human welfare. Seen from the aspect of integrated management of forest, land, water, community, and others, these are targets or objects to be managed, thus it can be seen that there is a link between ecosystems, watersheds, and integrated management. Integrated watershed management must strive for the elements of the ecosystem structure such as forest, soil, water, community, and others to remain in balance and harmony.

ACKNOWLEDGEMENTS

Thanks are conveyed to the Agam Regency government, Lecturers of Aquatic Ecology Courses, Universitas Negeri Padang, Wife, and Parents who always give encouragement and encouragement and motivation to the author.

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