

BUKTI KORESPONDENSI ARTIKEL PROSIDING INTERNASIONAL

: Assessment of Water Quality in Downstream Watershed for The Realization of Integrated Coastal Zone Management

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2	revise abstract and submit your papers	29 Juni 2021
3	revise abstract and submit your papers	6 Juli 2021
4	Abstract has been accepted	6 Juli 2021
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Assessment of water quality in downstream watershed for the realization of integrated coastal zone management

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ABSTRACT

Watersheds, especially downstream areas, are very important areas for the life of aquatic ecosystems. This downstream area is a coastal area which is a transitional area between land and ocean ecosystems. Several previous studies have shown that this area is polluted from industrial waste and domestic waste, ~~furthermore, this research is very important to continue~~. This research was conducted in the downstream Garang watershed, Semarang City, Indonesia. ~~Sampling was carried out according to the regulation of the Governor of Central Java Indonesia No156/2010, which divided the Garang watershed into 7 segments according to their designation~~. Water quality analysis was carried out to assess the water quality in the downstream area. Samples for water quality analysis were taken in the downstream area of the river which is a coastal area. The results of the water quality analysis are compared with ~~PP 82/2001~~. The results showed that the concentration of TDS, Copper and Chromium exceeded the quality standard. This water quality analysis are then used to implement Integrated Coastal Zone Management (ICZM), furthermore that the quality of this downstream area can be maintained.

Keywords: water quality, watershed, downstream, Integrated Coastal Zone Management

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I. INTRODUCTION

Integrated Coastal Zone Management (ICZM) is a dynamic, sustainable process designed for sustainable management of the coastal zone. ICZM thematic policy areas are control of coastal water pollution by land use in catchment areas such as agro-environmental policy, industrial waste management, household waste treatment, sectoral analysis: integration of environmental principles per sector of land use, environmental responsibility to users [1]. The participation of all stakeholders is an important requirement of the ICZM process and should have priority in planning and reviewing coastal and marine management decisions and actions, in the formulation and implementation of coastal and marine strategies, plans, programs, or projects [2].

Watershed is an area that is very important to be preserved because it is very beneficial for the life of aquatic organisms. The watershed is a very complex area because it covers the upstream area in the mountainous area, the middle area is an urban area, and the downstream area is a coastal area, furthermore, the downstream area in this watershed needs to be managed using the ICZM process. This coastal area is also part of the watershed and water management must be carried out, so integration and cooperation with other institutions are required [3]. The purpose of using ICZM is to maintain sustainable high biodiversity and protect vital habitats. Various countries have considered using the ICZM method to solve problems of biodiversity, management of the marine environment, natural resources. In this ICZM process, biodiversity monitoring and conservation are carried out, one of which is carried out by monitoring water quality in coastal areas which are downstream of the watershed [4].

II. METHODS

2.1. Types of Research

The study was conducted using a quantitative descriptive approach. The descriptive method with a quantitative approach in this study was used to describe the condition of the Garang watershed Semarang Indonesia water quality from residential and industrial activities.

2.2. Sampling Locations

Seven segments of the Garang watershed (Fig. 1), water samples were taken in the downstream area of Garang Watershed that is in segment 7, and it is the coastal area of Java Sea. About 25% of the human population lives in the world's coastal zones [7]. Coastal areas are important areas for human survival and socio-economic development. Furthermore, it is very important to evaluate the ecological condition and environmental carrying capacity in the coastal zone [8]. The downstream of Garang Watershed is used for estuary, settlement, port fishery, and aquaculture area. The waste in this area comes from industry, domestic and thus affecting the water quality of the river [5]. The water quality parameters studied in the ICZM analysis were Salinity, pH, DO, COD, and heavy metals [4].

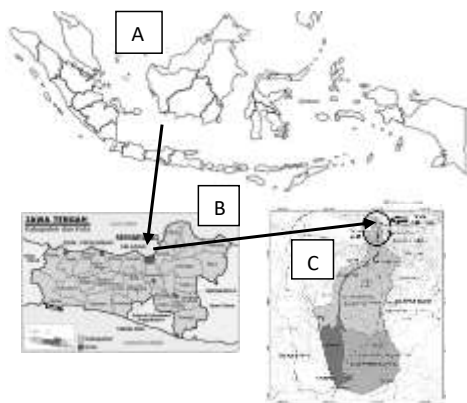


Figure 1. Study area: the map of the Indonesia (A), Central Java Province (B), Sampling Location: Downstream Area of Garang Watershed, Semarang, Indonesia (C)

III. RESULTS AND DISCUSSION

3.1. Land Use

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2.3 Water quality

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The largest land use at this location is a residential area of 179.962 Ha. Urban land use can affect flow regimes, water quality, and change river channels. Variations in river gradients (channel slopes) affect the response of fish assemblages to land use [9]. Land use management is central to government planning for sustainable development [10]. The relationship of land use variations with significant water quality in natural or semi-natural watersheds. Socio-economic activities in urban areas will affect the response of water quality to variations in land use. The proper development and expansion of cities have caused structural damage and functional degradation of river channels in urban areas. Some activities from urban areas that cause water pollution are industry, agriculture, aquaculture, and runoff. The existence of pollution that exceeds the carrying capacity of the river water environment can cause a decrease in water quality and a reduction in aquatic biodiversity. Pollution of urban rivers can affect sustainable economic and social development and threaten human health [11]. Land use and infrastructure parameters are used to provide a measure of anthropogenic changes that have an impact on river conditions and biota. Land use and infrastructure activities affect river health [16].

3.2. Water Quality

The water temperature at the research location ranged from 27.6-30°C. River temperature is important for cold-water-adapted fish species and affects their growth, survival, and demographic characteristics [12]. Sunlight, temperature, and Physico-chemical characteristics influence diatoms, this is related to the biodiversity in the watershed [13]. Temperature is an important parameter for the stability of aquatic ecology, affects types of aquatic life, affects dissolved oxygen in waters, and affects physical, chemical, and biological processes in waters [21].

Total dissolved solids (TDS) ranged from 183-4110 mg/l. TSS concentration in coastal sampling point, exceeds quality standards of 1000 mg/l. TDS includes all salts present in water and nonionic components. Dissolved organic compounds affect the TDS and can be measured by the total dissolved carbon content (TDC). The TDS content was taken by filtering the water sample, evaporating the filtrate, and measuring the dry weight of the remaining main solute. The total TDS content is used by geomorphologists interested in determining the effects of chemical erosion in different areas [14]. This high TDS may be due to agricultural runoff and soil erosion [15]. High levels of TSS downstream of the river may come from high surfactant particles ranging from detergents, cleaners, cleaning agents, and emulsifiers [16]. Total Suspended Solids (TSS), ranged from 89 – 217 mg/l. High concentrations of TSS are often used to indicate ecological health status or river pollution due to wastewater discharge [21]. The deposition of TSS in animals and plants can cause various types of damage such as blockage of gills and respiratory surfaces [24].

Biochemical oxygen demand (BOD), ranged from 17- 25 mg/l. High BOD concentration indicates low DO in the water, furthermore that it can cause death in fish due to low of oxygen. High BOD concentration can reduce fish populations in the waters [35]. BOD is the amount of dissolved oxygen needed by aquatic organisms to break the organic components available in a water sample at certain temperatures over a certain period. BOD is an approximate measure of the amount of biochemically degraded organic matter present in a water sample, BOD is determined by the amount of oxygen required by aquatic organisms in the waters to oxidize organic matter to a stable organic form [17]. Chemical oxygen demand (COD), ranged from 18.9-43.9 mg/l, and Dissolved Oxygen (DO), ranged from 5.6-12.2 mg/l, COD and DO represent the oxygen depletion parameter. Both of these parameters are important because oxygen is very important for the life of aquatic biota. COD is a measure of oxygen consumed during the decomposition of organic matter and oxidation of inorganic chemicals, while DO is known as the main indicator of river water quality [21]. The need for clean water in various countries continues to increase, but industry, agriculture, and increasingly intensive urbanization cause an increase in the amount of waste that causes pollution of the aquatic

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environment which causes a decrease in water quality, especially DO concentrations. This happens because the waste is discharged into the waters without sewage treatment [18].

Nitrates affect the nitrification and denitrification processes. Nitrate is an important element in the nitrogen cycle. The use of fertilizers containing nitrate can have the effect of increasing nitrate in the river. The location in the middle of the river is a large area of agriculture and plantations, so it can be polluted by fertilizers. Other factors that affect the amount of nitrate are sewage discharge, nitrogen fixation, and water runoff [22]. Nutrients, especially nitrate, show a significant increase in the rainy season due to fertilizer runoff from agricultural areas in the catchment area [18]. The condition of ammonia that continues to rise is very dangerous for aquatic biota. Ammonia is present in water in the form of ionized (NH_4^+) and ionized (NH_3) The content of ammonia that is safe for aquatic life is less than 0.1 mg/l to below 1.0 mg/l [23]. The increasing phosphate concentration will affect the eutrophication of waters [19]. Eutrophication in rivers occurs due to the presence of nutrients. The growth of algae and plankton increases (algal bloom) resulting in a reduction in oxygen in aquatic biota [20], if the water conditions are covered by algae, the intensity of light entering the water body will decrease. The community as river water users must be wise in disposing of their waste so that there is no closure in water bodies.

Chromium (Cr) concentration ranged from 0.024-0.025 mg/l. Cr is a heavy metal that can be harmful to humans even in small amounts [25]. The Cr content: 0.025 exceeds the Cr content that should exist in river waters: 0.0017 mg/l [26], furthermore that the Cr content in the coastal area is considered dangerous for aquatic biota. The negative impact caused by chromium for the aquatic environment, which can pollute waters, dissolve in water, settle to the bottom of the water, is corrosive, and toxic. Cr compounds are often found in polluted waters and have been known to be toxic, mutagenic, and have carcinogenic effects on biological systems even though Cr is an important element in the body [36].

Copper (Cu) concentration ranged from 0.11-0.15 mg/l. Cu concentration in coastal sampling point, exceeds quality standards of 0.02 mg/l. Chronic exposure to low concentrations of some metals can also have serious health effects [27]. Concentrations of Cu, Nitrate, and phosphate will contaminate surface water because it can have a negative impact on water supplies and ecosystems [28]. Manganese (Mn) concentration ranged from 0.248-0.562 mg/l. Mn can cause skeletal abnormalities and severe abnormalities in the reproductive system in fish [30]. Manganese is known to naturally occur in many surface water and groundwater sources, especially under anaerobic oxidation conditions or low oxidation conditions [31].

3.3. Integrated Coastal Zone Management (ICZM)

ICZM is a planned, integrated, coordinated, and comprehensive effort to provide environmental protection and sustainability of coastal areas. The development of the right area must be based on the suitability of the existing area. Environmental damage control and carrying capacity management are the next priority alternative management. Area conservation and environmental education are strategies that can directly attract communities to participate in protecting, maintaining, and renewing coastal resources. The next alternative strategy from an economic perspective is the improvement and addition of infrastructure [32]. The realization of ICZM is important because there are problems related to water quality and sanitation, watershed deforestation, solid waste, and ecosystem degradation [33].

Steps for the realization of ICZM in coastal areas [34]:

- 1) Integrated water resources management and waste management, environmentally sound and sustainable
- 2) The economy in coastal and maritime areas is adjusted to the nature of the coastal zone and marine resources must be protected from pollution;

- 3) Establish indicators for the development of economic activities to ensure sustainable use of the coastal zone and reduce pressures that exceed their carrying capacity

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Assessment of Water Quality in Downstream Watershed for The Realization of Integrated Coastal Zone Management

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