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Development of Ecotourism Scenario Based on Seawater Quality Evaluation

La Harudu[1*], La Ode Nursalam[1], Nurlansi[2], Agus Sugiarto[3], Ahmad Tarmizi Abdul Karim[4], Fahrudi Ahwan Ikhsan[5], Andri Estining Sejati[6], Masri Ridwan[7], Liyushiana[8], dan Feri Fadlin[9]

[1]Geography Education Department, Universitas Halu Oleo, Kendari, Indonesia; email: harudu9@gmail.com
[2]Chemistry Education Department, Universitas Halu Oleo, Kendari, Indonesia
[3]Geography Education Department, Universitas Tanjungpura, Pontianak, Indonesia
[4]Civil Engineering and Built Environment Faculty, Universiti Tun Hussein Onn Malaysia, Johor, Malaysia
[5]Geography Education Department, Universitas Jember, Jember, Indonesia
[6]Geography Education Study Program, Universitas Sembilanbelas November Kolaka, Kolaka, Indonesia
[7]Destination Tourism Study Program, Politeknik Pariwisata Makassar, Indonesia
[8]Destination Tourism Study Program, Politeknik Pariwisata Medan, Indonesia
[9]Politeknik Pertanian Negeri Samarinda, Indonesia

ABSTRAK

Terdapat berbagai aktivitas di kawasan pemandian kali biru pulau Bungkutoko oleh PT. Pelindo Nusantara dan pemukiman masyarakat tanpa disadari dapat berdampak pada kualitas lingkungan air. Tujuan penelitian ini untuk mengetahui kualitas air laut pada kawasan pemandian Kali Biru dan mengembangkan konsep rekayasa lingkungan berbasis pariwisata berkelanjutan. Metode penelitian ini menggunakan survey dan analisis laboratorium. Pemeriksaan sampel air dilakukan secara langsung. Analisis data kualitas air laut dari hasil uji kualitas air pada laboratorium uji yang tingkat kelayakannya ditetapkan berdasarkan PP RI Nomor 22 Tahun 2012. Hasil penelitian menunjukkan ada tiga unsur yang memiliki nilai uji laboratorium melampaui nilai ambang batas yaitu: nitrit (N02-N), sulfat (SO4), dan besi (Fe) yang seharusnya kosong akan tetapi, saat penelitian sudah ada nilai nitrit (N02-N) sebesar 0,12, 0,006, dan 0,0006, sulfat (SO4) sebesar 2.3, 1.4, dan 4.8 dan besi (Fe) sebesar 0.0012, 0.0019, dan 0.001 sedang enam unsur yang lain mulai dari dari pH (derajat keasamaan), salinitas (%), nitrat (N03-N), minyak lemak, arsen (As), dan total coliform berada dalam ambang batas kualitas kawasan pariwisata air laut. Skenario pengembangan kegiatan pariwisata melalui kegiatan ekowisata.

Kata Kunci: Analisis Air, Biota Laut, Wisata

ABSTRACT

There were various activities in the Bungkutoko Island Kali Biru Bathing area by PT. Pelindo Nusantara and community settlements can unwittingly impact the quality of the water environment. This study aimed to determine the quality of seawater in the Kali Biru bathing area and develop a sustainable tourism-based environmental engineering concept. This research method uses surveys and laboratory analysis. Examination of water samples is carried out directly. Seawater analysis is descriptive with quality data from the results of water quality tests in testing laboratories whose feasibility levels were determined based on Indonesia's government rule number 22 of 2012. The results showed that three elements had laboratory test values exceeding the threshold value, namely: nitrite (NO2-N), sulfate (SO4), and iron (Fe), which should not be present, but during the study, there were already values for nitrite (NO2-N) of 0.12, 0.006, and 0.0006, sulfate (SO4) of 2.3, 1.4, and 4.8 and iron (Fe) of 0.0012, 0.0019, and 0.001 while the other six elements starting from pH (degree of acidity), salinity (%), nitrate (NO3-N), oil and grease, arsenic (As), and total coliform were within the regional quality threshold sea tourism. Scenarios for developing tourism activities through ecotourism activities.

Keywords: Environmental, Seawater Analysis, Ecotourism

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1. INTRODUCTION

Awareness of environmental impacts to deal with the development of beaches and seas for tourist areas to accommodate the visits of tourists ranging from local, national and international must maintain the sustainability of the quality of the environment and or tropical tourism natural resources. One of the environmental impacts that can affect the preservation of environmental quality is waste. Various types of waste, such as household waste, industrial waste, and agricultural waste. However, household waste has a more significant impact on environmental quality. Three types of household waste cause polluted water: garbage, wastewater from bathing and washing activities, and human-produced waste (Ramadhiani & Suharyanto, 2021). Wastes, if not managed properly like the go green program, have a high potential to pollute the environment (Biswas & Tortajada, 2019).

The living environment that is often affected by pollution is water. Water was one of the natural resources that had an important role and got special attention. Water is the main parameter of the ecological system which is the main requirement for various domestic needs, irrigation, industry, tourism and other economic sectors (Damhuri et al., 2018; Widodo et al., 2019). Various cases of pollution in Indonesia have resulted in a clean water crisis caused by weak government oversight and proper law enforcement, resulting in many areas of the water being polluted (Salman, 2021).

The environment affected by pollution can affect environmental quality. There are findings in previous research that environmental quality influences tourism development (Baloch et al., 2023). The existence of waste in water bodies results in a decrease in environmental quality caused by human activities on land (Panggabean et al., 2016). Coastal conditions are closely related to rivers, estuaries and the sea in these areas, such as the Kali Biru bathing tourism area. Changes in rivers due to human activities will affect water quality and the coastal water environment. Environmental pollution in fishermen and industry is caused by the entry of household and industrial waste containing chemicals which will cause changes to their ecological conditions (Angriani et al., 2018; Roosmini et al., 2006). The hectic activity of marine waters due to inter-island transportation, such as diving tours and other activities in the waters, creates physical, chemical, and microbiologic pressure (Laapo et al., 2012). There is a need for priority actions that governments, industry and society can implement at the sources and dumps of pollution, over the next decade to reduce ocean pollution and steer us towards a More Sustainable Future (Willis et al., 2022).

A sustainable tourism development approach can be pursued by generating environmental quality-based promotional content. (Folgado-Fernández et al., 2019) suggests that there is still little research aimed at promoting sustainable air management in the tourism industry. Sustainability discourse should be more implicit in marketing and promotional activities (Hanna et al., 2018). This means that dissemination of information about environmental commitment to destinations is real through the use of images or videos. (Garcés-Ordóñez et al., 2020) Conservation of coastal ecosystems with a working group that acts as a coast guard to protect waste disposal into the sea and prevent the creation of a society of garbage into the sea. Ecotourism can be a development strategy in areas exposed to wastewater pollution (Koens et al., 2009). Ecotourism projection scenario taking into account the potential, role of local communities, availability of tourism facilities and institutions (Sánchez-Prieto et al., 2021).

Kali Biru is one of the tourist attractions for the local community, and even tourists from outside Southeast Sulawesi Province take advantage of the abundant natural potential. The Kali Biru tour is located on Bungkutoko Island and takes about 20 km from Kendari City or takes 30 minutes by using a 4-wheeled or 2-wheeled vehicle. The position of this area is at coordinates S003059.530 and E0122637.0450. The location, which was close to Kendari City, was a favourite of the people to visit the Kali Biru tourism area to enjoy attractions such as the appearance of mountains and hills, the appearance of flora, the appearance of blue water and the appearance of small islands.

Kali Biru tourism has abundant natural resource potential and belongs to PT. Pelindo Nusantara, the Bungkutoko port area, as well as community settlements. Communities intentionally or unintentionally produce household waste, which increases from day to day and never decreases along with the increase in population and city development (Yang et al., 2023). Preliminary observations show that the baths are located close to the construction of facilities and infrastructure of PT. Pelindo Nusantara circulation of ebb and flow water only rotates in this area, never in the high seas area.

Based on the observations above, the researchers wanted to see seawater quality parameters used in the Kali Biru tourism area. The parameters were question range from pH, salinity (%), nitrate (NO3-N), nitrite (NO2-N), sulfate (SO4), fatty oil, arsenic (As), iron (Fe), and total coliform. These parameters enable researchers to analyze water quality standards for bathing in marine areas, especially coral, pelagic, estuary, and lake waters.

Changes in environmental quality can be seen in the level of water pollution. One of the analytical methods used was the analysis of pollution levels (Rahmawan et al., 2017). Pollution through water media is the cause of disease outbreaks and is a major threat to public health (Levallois & Villanueva, 2019). Environmental quality, especially water pollution, was very important for considering policy directions for compiling monitoring and recovery programs for environmental components that experience quality as

part of risk management (Dunca, 2018; A E Sejati et al., 2019).

Research on water quality is widely carried out. The water quality of the Genjreng river in Boyolali Regency, Indonesia (Widodo et al., 2019). Research links water quality with pollutants used for the safety purposes of agricultural crop irrigation. The water quality parameters used are based on government regulation 82 of 2001, which regulates water quality management and pollution control. Parameters include pH, TDS, TSS, BOD, COD, Phosphate, Cadmium, Chromium, Plumbum, and Total Coliform. The results show that the water quality can still be used for irrigation. However, it was necessary to carry out periodic checks, especially during the dry season when there are many pollutants from dumping waste.

Water quality and pollutants in rivers from Banat, Romania (Dunca, 2018). Research on water quality was used for many purposes that utilize the river, such as drinking for local people, household water needs, irrigation, watering plants, transportation, tourism, and other economic activities that require water. Water quality parameters use the Water Quality Index (WQI), which consists of DO, pH, BODS, temperature, total P, N-NO2, and turbidity. The results show that the Timis and Bega rivers have experienced water quality degradation.

Water quality in agricultural wells in Tembalang, Semarang, Indonesia (Prabowo et al., 2021). Research on water quality used for irrigation purposes and recommendations for community drinking needs. Water quality parameters using the WQI include turbidity, nitrite, temperature, TDS, iron, cadmium, hardness, chloride, magnesium, nitrate, pH, sulfate, and lead. The results show that dug and drilled wells are feasible for consumption and agricultural irrigation.

The water quality in the Al-Graffaf river in Southern Iraq (Ewaid & Abed, 2017). Research on water quality for recommendations for community drinking needs. Water quality parameters used WQI consisting of BOD, TDS, pH, DO, Tur., PO4, NO3, Cl-, TH, EC, and alkalinity. The results show that of the five samples, one is suitable for drinking, three is bad, and one is very bad.

The water quality of the Code River, Yogyakarta, Indonesia (Saraswati et al., 2019). Research links water quality with pollutants used for quality monitoring purposes. The water quality parameters used are based on the WQI, which consists of 19 parameters. The results show that the water quality is good during the rainy season. However, it is necessary to conduct investigations during the dry season when there are many pollutants due to decreased currents.

Water quality in the Upper Citarum River, West Java, Indonesia (Ramadhiani & Suharyanto, 2021). Research links water quality with pollutants used for household, agricultural, and industrial purposes. The water quality parameters used are based on government regulation 82 of 2001 with BOD, TSS, DO, COD, pH, and temperature. The results show that water quality is in category II, and some pollutants must be monitored.

There are many more similar studies that have been carried out in rivers. The six studies above differ from this study, where most locations are in groundwater, while this study is in seawater. The second difference lies in its designation, mostly for agriculture and household and industrial needs. At the same time, this research focuses on tourism and marine life's sustainability. Third, the analysis used to assess water quality is mostly WQI. Two studies use government regulation number 82 of 2001. This study uses the government regulation of the Republic of Indonesia number 22 of 2021, which was more updated in Indonesia. WQI and other analyzes were used as comparisons in several research discussions. The purpose of this study was to determine the quality of seawater in the Kali Biru bathing area and develop a sustainable tourism-based environmental engineering concept. It is urgent to research the quality of seawater in the Kali Biru bathing area to assess seawater based on its quality. This is a reference for determining whether or not it is suitable to be used as a tourist attraction. Apart from that, the urgency of further research is to develop ecotourism scenarios to plan ecotourism activities in the Kali Biru.

2. RESEARCH METHODOLOGY

This research method used surveys and laboratory analysis. The research location was in the bathing area of Kali Biru, Bungkutoko Beach, Abeli District, Kendari City, which the community has used as a tourism area. The research was carried out from May to June 30, 2022. The tools and materials used were; Garmin GPS/Glonass, Current meter, Soil Thermometer, Meter, Geological Compass, stationery, 250 ml glass/sterile bottle, pH meter, thermometer, and salinometer.

The data in this study are primary and secondary. Primary data was seawater data taken at 3 points. The three location points are on the Bungkutoko Coast. The first Geographic coordinate point was found at 122^0 37' 8.479" E Longitude (X) and 3^0 59' 19.104" S Longitude (Y). The second Geographic coordinate point is found at 122^0 37' 7.581" E Longitude (X) and 3^0 59' 26.018" S Longitude (Y). The third Geographic coordinate point is found at 122^0 37' 2.001" E Longitude (X) and 3^0 59' 31.244" S Longitude (Y). Secondary data was taken at BMKG (wind speed, air temperature, humidity, rainfall). The research location map is shown in Figure 1.

Water saples were examined directly at the measurement location, and then the preserved water quality parameters were examined at the UHO MIPA.

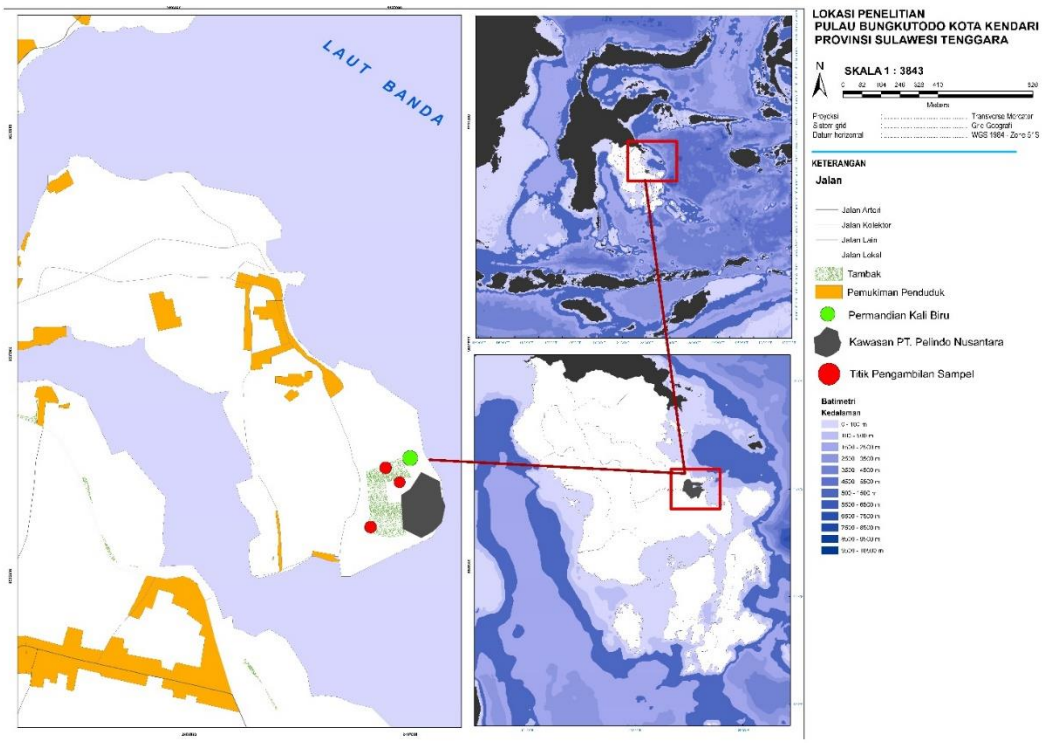


Figure 1. Locations of Kali Biru

Table 1. Analysis Parameters, Methods, and Test Equipment

No	Parameter Test	Unit	Quality Standart		Test Equipment
			Tourism	Marine Biota	
1	pH (degree of acidity)	-	7-8,5	7-8,5	pH meter
2	Salinity	%	Alami	s/d. 34	Handrefraetometer
3	nitrate (NO_3-N)	mg/l	0,06	0,06	Spectrophotometry
4	nitrite (NO_2-N)	mg/l	-	-	Spectrophotometry
5	sulphate (SO_4)	mg/l	-	-	Gravimeter
6	Oil and grease	mg/l	1	1	Gravimeter
7	Arsenic (As)	mg/l	0,025	0,012	AAS
8	Iron (Fe)	mg/l	-	-	AAS
9	Total coliform	Ju/100ml	100	100	MPN

Sumber: (PP-22, 2021)

Seawater quality data were analyzed from the results of water quality tests in a testing laboratory whose eligibility level was determined based on Government Biomolecular and Environmental Laboratory in June 2022. Regulation of the Republic of Indonesia Number 22 of 2021 concerning environmental protection and management violations.

Ecotourism is engineering process using visualizes alternative plans (Kim et al., 2015). This method creates alternatives quickly, emits various metrics, and visualizes alternative plans before actual construction; mainly focus on design. Visualization design supports stakeholders in making timely and informed decisions.

The process of refining the design based on the results of observations, laboratory findings, and applied results will be presented and discussed through visualization (Moosa et al., 2020). Relevant and appropriate aspects of this understanding have informed the spatial and functional relationships of the design proposal (London & Ostwald, 2004). Literature study on site design concepts (Setiadi et al., 2022).

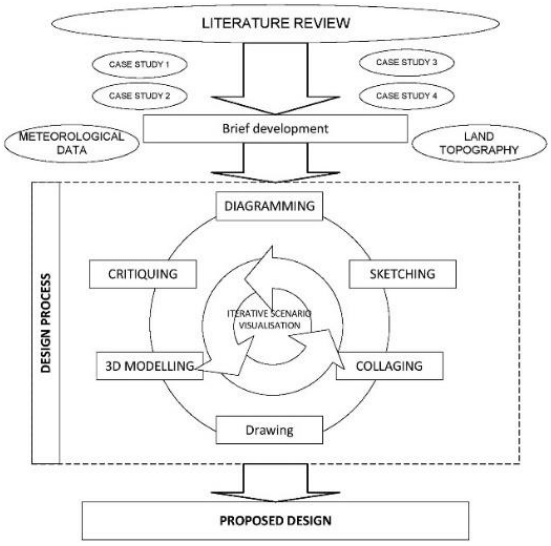


Figure 2. The Site Design Process is Based on Literature Review
(Moosa Et Al., 2020)

3. RESULTS AND DISCUSSION

The results of an analysis of seawater quality in the Kali Biru bathing tour, Bungkutoko beach, Abeli District, Kendari City, from May to June 30, 2022, were presented in Table 2.

Visualization of water quality maps lies in assessing its usefulness so as to facilitate the development of ecotourism areas. Thematic maps produced using GIS, present various spatial distributions of water quality parameters. This study area is located in the Kali Biru bathing tour area, Bungkutoko beach, Abeli District, Kendari City buffer 14 km from the City Center, Kendari Centre. Variations in physicochemical parameters (water quality) are as follows.

At measurement locations 1 and 2, the pH is close to the threshold for environmental quality standards, 8.12 and 8.32, from a maximum of 8.5. These results already indicate a wet pH in the sense that the ability of water to bind or release H ions is alkaline. The pH at location 3 is also slightly alkaline but closer to neutral, with the lowest value among the three locations. The overall pH is still within the environmental quality standards for tourism and marine life, but vigilance is needed for the first and second locations. pH that is not by quality standards will cause a nitrification process affecting water oxygen (Le et al., 2019) . If the pH is less than 7, it indicates acidic water; if it is more than 7, it indicates a wet atmosphere (Le et al., 2019).

The salinity (%) per mil unit comprises seven main ions starting from sodium, potassium, potassium, magnesium, chloride, sulfate, and bicarbonate (Zaman et al., 2018). There are three categories of water salinity values, namely: the range of 0 to 5 ppt fresh water; 6-29 ppt brackish waters; 30 to 40 ppt marine waters (Akib et al., 2015). If the salinity is too high, the concentration ratio will be higher, so continuous water circulation is needed. Salinity in waters affects the balance of body osmoregulation with energetic processes that affect growth. Aquatic organisms must expend great energy adjusting to salinity far below or above normal for their life (Bhateria & Jain, 2016).

The salinity at the three measurement locations was the same, namely around 32. These results indicated that the salinity value was two digits less than the threshold. Salinity is still worthy of being used as a bathing tourism area as well as the life of marine life. High salinity can affect marine life; the highest category is brine (Ali et al., 2016; Bhateria & Jain, 2016).

Nitrate (NO3-N) and nitrite (NO2-N) are produced from the oxidation of nitrogen in water by the oxidation of ammonia to nitrite and nitrate under aerobic conditions carried out by Nitrosomonas bacteria. In contrast, nitrite becomes nitrate by the process of Nitrobacter bacteria. Both bacteria are chemotherapy bacteria, which were the nitrogen in the water. The three measurement locations seen from nitrate are still within the threshold because they are below 0.06. The three locations already contain nitrite values, so they are no longer suitable tourist areas because they should not contain nitrite. Nitrite that exceeds the threshold is dangerous for humans and marine biota (Duan et al., 2022).

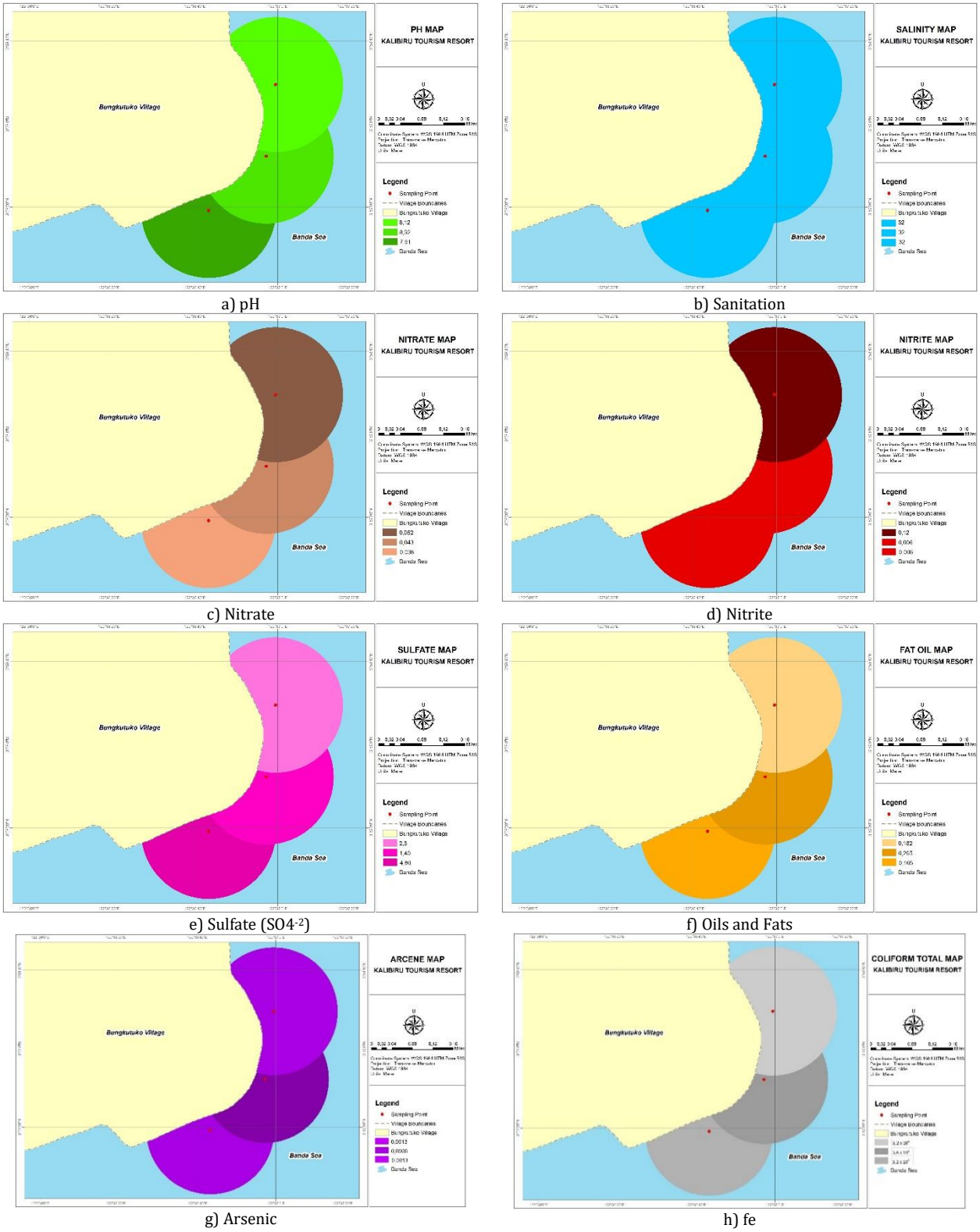
In nitrate (NO3-N) and nitrite (NO2-N), it is known that nitrate levels for drinking water needs should not exceed ten mg/l (Effendi, 2003). Large amounts of nitrate in the intestine tend to turn into nitrites (NO2-N) which can interact directly with hemoglobin in the oxygen circulation in the body. The maximum concentration standard allowed for nitrate (NO3-N) is 20.0 mg/l based on the Indonesian Ministry of Health, while according to WHO international standards, the accepted concentration is 5.5 mg/l.

Sulfate (SO4) at the three measurement locations showed that the three locations contained content. The highest content is in the third location, located behind the PT Pelindo Nusantara building, namely 4.80. Water quality standards for tourism and good marine life related to sulfate (SO4) should not exist. The presence of sulfate in the three locations shows that it is not suitable to be used as a bathing tourism area. Sulfate should not be in good water content (Zaman et al., 2018).

Table 2. Analysis of Seawater Quality in Kali Biru

No	Parameter Test	Unit	Test Result			Quality Standard	
			Loc. 1	Loc. 2	Loc. 3	Tourism	Marine Biota
1	pH (degree of acidity)	-	8.12	8.32	7.91	7-8,5	7-8.5
2	Salinity	%	32	32	32	Alami	s/d. 34
3	Nitrate ($N0_3$-N)	mg/l	0.052	0.043	0.038	0.06	0.06
4	Nitrite (NO_2-N)	mg/l	0.12	0.006	0.006	-	-
5	Sulphate (SO_4)	mg/l	2.3	1.40	4.80	-	-
6	Oil and grease	mg/l	0.182	0.265	0.165	1	1
7	Arsenic (As)	mg/l	0.0013	0.0006	0.0013	0.025	0.012
8	Iron (Fe)	mg/l	0.0012	0.0019	0.001	-	-
9	Total coliform	Ju/100ml	3.2×10^2	3.6×10^2	3.2×10^2	1000	1000

Source: Lab. Biomolekuler and Environment Test, 2022



a) pH b) Sanitation

c) Nitrate d) Nitrite

e) Sulfate ($SO4^{-2}$) f) Oils and Fats

g) Arsenic h) fe

Figure 3. Spatial Maps for Water Quality Parameters.

Sulfate (SO4), the maximum standard concentration set by the Ministry of Health of the Republic of Indonesia for sulfate in water, was a minimum of 200-400 mg/l. Reduction of sulfate anions into hydrogen sulfide under anaerobic conditions in the decomposition process of organic matter will cause an unpleasant odor and increase the corrosivity of metals and the reduction process of heterotrophic bacteria on the seabed (Effendi, 2003).

Oil and grease at the three measurement locations were within the threshold for the bathing area, which is below one mg/l. This condition was supported by the circulation of seawater alternating with the high seas. Oil and grease are compounds that can cause pollution in water, so the concentration must be limited. High oil and grease harm humans and biota, such as in river water measured in Tasikmalaya (Salman, 2021). Oils and fats are organic materials

that are permanent and difficult to decompose by bacteria (Chapman, 2021).

Arsenic (As), usually, there is arsenic in waters due to volcanic eruptions and human activities in various activities, for example, the use of pesticides on land and the accumulation of household and industrial waste that enters the waters. The quality standard for heavy metal Arsenic (As) in water is 0.05 mg/l based on Government Regulation 28 of 2001. Arsenic (As) at the three measurement locations shows that it was at the threshold for tourism and marine biota's health. The value of 0.0013 must be watched for in the next ten years. Arsenic can arise from industrial activities. The arsenic threshold in several studies was consistent at a maximum of 0.01 and some 0.05 (Ali et al., 2016; M & Saputra, 2017; Paul, 2017).

Iron (Fe) at the three measurement locations was no longer suitable for a tourist area. The presence of iron is due to the weathering of the host rock, and the Southeast Sulawesi region was known as a nickel mining area. The Kali Biru, a bathing tourism area, is close to nickel ports in South Konawe (Tanjung Tiram, Cempeda, Morosi, Lainea) and the Konawe Islands. Iron in water should not be present because it harms health (Kachroud et al., 2019; Prabowo et al., 2021).

Iron (Fe) in water; Iron was the result of rock weathering, commonly found in public waters. Iron compounds in water were ferrous salts or ferrous salts with a valence of 2. The iron content can cause the water to turn reddish-brown, give rise to a fishy odor, and form an oil-like coating. High levels of iron in water correlate with high organic matter or high levels of iron found in water originating from deep groundwater with an anaerobic atmosphere or from the bottom layer of waters which no longer contain oxygen .(Effendi, 2003; Paul, 2017)

The total coliform at the three locations was at the threshold because the measurement results were still below 1000. These results were caused by tidal circulation, which affects the brightness and beauty supported by the seabed's steep topography. Coliform bacteria carry disease at high levels (Divya & Solomon, 2016).

Total coliform was usually found in bodies of water such as lakes, rivers, and seas, as well as water for community needs such as baths and drinking water. Processes like this originate from human processes and warm-blooded animals and waters contaminated with organic waste (Divya & Solomon, 2016). Ecoliform, as a group of bacteria, was characterized as rod-shaped bacteria. Gram-negative, does not form spores, aerobic and facultative anaerobic, which ferment lactose by producing acid, which was characterized by the formation of gas in a tube that has been incubated on media that is traversed (Waluyo, 2012).

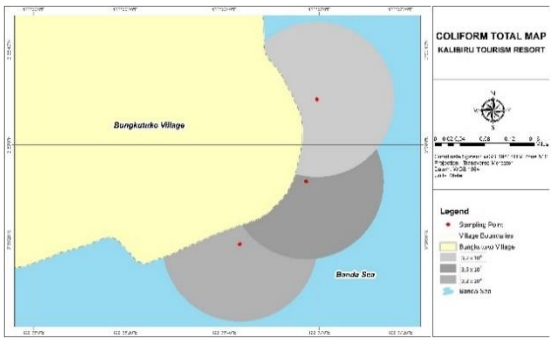


Figure 4. Spatial Maps for Coliform Total

The overall results show that the parameters still determined by the quality standards for water quality for tourism and marine biota are pH, salinity, nitrate, fatty oil, arsenic, and coliform. Of the six test parameters, the two to watch out for are pH and arsenic. Parameters indicated location incompatibility with water quality standards for nitrite, sulfate, and iron. These three ingredients endanger humans in traveling and marine biota. These results were an important note not to be careful so as to swallow sea water while bathing the tourism.

Secondary data that support primary data are presented in Table 3.

Secondary data shows that the wind speed at the Kali Biru bathing tourist site is 1.5-4 km/hour in the wind speed range. This range was included in the Beaufort 1 classification whose characteristics can be seen, namely, the wind direction can be seen in the smoke but not in the wind direction pointer. This wind was entered at a weak strength, so it was suitable for tourist areas. Coastal and sea breezes are attractions in Tourism (HL et al., 2022).

The combination of temperature and humidity at the Kali Biru bathing tourist site indicates that the temperature was always above 31oC and 60%. This data indicates that both were above the comfortable, warm threshold. This condition was reasonable because the coast closer to sea level, based on the adiabatic law, will have hot temperatures. Hot temperatures must be given lots of plants and gazebo facilities for shelter (Murtini et al., 2018). Consideration of tourism by minimizing the number of disasters, including extreme heat or other extreme weather (Andri Estining Sejati et al., 2020; UNDP, 2020).

Table 3. Environment Parameter

Parameter	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed (km/h)	3.6	3.6	4.1	4.1	4.1	3.1	4.1	4.6	4.1	4.1	4.1	4.1
Temperature (^{0}C)	34.6	34.2	33.6	34.6	32.1	31.9	32.1	31.3	32.2	34.8	34.3	34.8
Humidity (kg/m^3)	92	91	91.8	90	92	95.3	93.8	87.5	85.3	85.8	87.5	88.3
Rainfall (mm)	67.1	127.8	272.6	121.7	107.6	171.3	135.7	46.1	12	0	34.6	238.6

Sumber: BMKG Kota Kendari (2023)

Based on Schmith Ferguson's classification, rainfall above 100 mm/month indicates a wet month. The data shows that the Kali Biru baths experience seven wet months at the tourist location. This condition needs to be known by the public so that they prepare equipment such as raincoats or umbrellas when entering the month, especially when it is wet. Wet months provide potential contamination in water (Rahayu et al., 2018). Rainwater also makes seawater cloudy. The brightness and cleanliness of seawater are also a consideration in developing coastal tourism (Amaluddin et al., 2019).

3.1. Ecotourism Activities

Planning for Ecotourism Activities Tourism development in Kali Biru has environmental weaknesses in four environmental parameters. For the first and second locations the nitrification process is predicted to accelerate the waste degradation process (Ma et al., 2021). The third location already contains nitrite values so that it is no longer suitable to be used as a tourist spot because it should not be contains nitrites. Sulfate (SO4) at the three measurement locations shows that the third location has a content, Sulfate should not be present in good water content (Zaman et al., 2018). Iron (Fe) at the three measurement locations is no longer suitable as a tourist spot. Iron in the air should not be present because it is detrimental to health.

The results of this research provide better insight for the planning and projection of ecotourism development for PT. Pelindo Nusantara as the owner of the Kali Biru Area. The Kali Biru were future development direction was through ecotourism implementation. Ecotourism, a concept for recreational and tourism purposes, can promote habitat conservation and wise management in areas exposed to toxic waste (Burger, 2000) . According to (Putri et al., 2019) sea tourism activities, including swimming, sunbathing, fishing, snorkeling, diving, boating, and surfing, were components of sea water tourism activities. However, due to the high nitrile content, water-based tourist activities such as swimming, sunbathing, and diving are not recommended in Kali Biru. Instead, the local community can utilize Kali Biru for fishing, mariculture, and tourism education, such as planting seagrass and mangrove plants. The presence of nitrate and phosphate in the water supports the fertility and quality of plants, such as seagrass beds (Silvi et al., 2022) .

The application of environmentally oriented tourism can improve the image of PT Pelindo Nusantara. Tips that can be taken by 1) Prioritizing ecotourism activities as an environmental policy in the short, medium and long term: PT. Pelindo Nusantara, as the owner of the Kali Biru area, has a social responsibility to ensure the continuity of the community around the port area. Kali Biru, which was located in the PT Pelindo area, was like two currencies, on the one hand it has an economic role for local communities through the sale of tourist tickets, parking, pavilion rentals and tyre rentals, and on the other hand it has an impact on the health of visitors. Therefore, the future of Kali Biru requires development that benefits both parties, namely the establishment of an ecotourism area. Ecotourism facilities focus on providing educational support services so that they can build trust and serve as a basis for work between one party and another (Lee, 2021) . In this research, ecotourism in Kali Biru can be a door to cooperation between local communities, local government and PT Management Pelindo Nusantara. 2) Create a zoning plan for management of the use of water resources, land and priority scale to minimize degradation (Eryani et al., 2021): Zoning is conducted to establish the structure and spatial pattern of the Kali Biru area. This includes planning for permissible activities, activities that require permission, tourist management, and the roles and responsibilities of local communities in the tourist area of Kali Biru. 3) Involve the local community in institutional governance of the Kali Biru Area destination in maintaining ecosystem sustainability. The main causes of the waste problem in the Kali Biru area are weak enforcement of regulations, lack of organization and scientific knowledge by local people, and poor infrastructure. (Garcés-Ordóñez et al., 2020) ecosystem conservation with a working group that acts as a custodian of the Area to protect waste disposal into the sea and prevent people from dumping waste into the sea. Ecotourism can be a development strategy in areas exposed to waste water pollution (Koens et al., 2009) 4) To improve the quality of sanitation according to the threshold required biofilter media in the form of mangroves. Mangrove plants accumulate heavy metals highest in the roots (Kariada et al., 2014) However as well as other factors such as mobility and solubility metals also affect the accumulation of metals weight in plants. Then cultivation is needed mangroves along the Kali Biru area. The results of monitoring and interviews in the field show that mangrove habitat is degraded due to conflicts of interest between residents, companies and the government. The existence of mangroves can be used as educational activities. Path creation Mangrove tracking is recommended at along the mangrove area of the *Kali Biru* area, Bungkutoko Island. Mangroves have the potential for educational activities (Brown et al., 2014; Surjanti et al., 2020). Ecotourism as a learning tool for sustainable development (Mondino & Beery, 2019). Babana Beach in Pesisir Luwu Regency was developed through mangrove ecotourism by involving the community in it; The human resource development program is carried out by increasing understanding of the surrounding community's environment, improving aspects of tourism facilities, cleanliness and safety of mangrove ecotourism; as well as optimizing promotion and environmental interpretation for

visitors (Wahyuti et al., 2023). With good governance, in the end the tourist area of the Kali Biru area as fostered by PT. Pelindo Nusantara can be a catalyst by being a learning tool for all ages, and for locals as well as visitors. 5) As an initial step in the development of ecotourism ecotourism was created site planning for the layout of tourism activities in accordance with the results of the environmental evaluation.

Figure 5. Design the Regional Space as a Destination

Figure 5 is the management plan for the Kali Biru bathing tourist area, Bungkutoko Beach, Abeli District, Kendari City. This model is expected to be able to overcome the problem of seawater waste pollution through massive planting of mangrove forests. Community settlements around PT Pelindo are regularly regulated, waste channels are integrated with the principle of Reduce, Reuse, Recycle (3R). Thus, the development of a sustainable tourism area.

4. CONCLUSION

There are three elements that cross the threshold of environmental quality standards in coastal tourism areas, namely; nitrite (N02-N) at the three sampling points indicated that the quality value had exceeded the threshold. The test results have reached 0.006 to 0.12. Sulfate (SO4) test results at three consecutive points of 1.40, 2.3, to 4.8 should not exist for tourist areas. Iron (Fe) at three points each has an index value (0.0012, 0.0019, and 0.001) and should not exist. Three elements are no longer suitable to be used as a tourist area and 6 elements are declared still suitable to be used as a tourist area. Action is needed to protect the Kali Biru tourist area and the local government immediately warns the importance of tourism areas to industry and society to avoid adding pollution through the development of ecotourism-based areas. The environmental scenario is carried out by making tourism a priority program of PT. Pelindo Nusantara through the implementation of ecotourism, create a zoning plan for management of the use of water resources, land and priority scale to minimize degradation and involve local communities in institutional governance of the Kali Biru Area destination in maintaining ecosystem sustainability. Further researchers need to monitor the condition of the area in the next 6 months.

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