DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

IJES
Indonesian Journal of Environmental Sustainability

Published by :
Center For Environmental Studies
UIN Ar-Raniry Banda Aceh

THE EFFECTIVENESS OF ONLIMO UTILIZATION FOR WATER QUALITY MONITORING OF POLLUTION IN THE DOWNSTREAM AREA OF JANGKOK RIVER, MATARAM CITY

Janu Andina Aryanti[1*], Pramudya Bagas Utama[1], Maitsa Fikri Nabila[1]
Faculty of Environmental and Mineral Technology, Sumbawa University of Technology, Sumbawa, Indonesia

**Email Correspondence*: *januandina@gmail.com*

Received: 14 February 2025 Accepted: 04 June 2025 Published: 30 June 2025

ABSTRACT

The Jangkok River in Mataram City, Nusa Tenggara Barat, experiences severe pollution due to domestic and industrial waste. To monitor water quality in real-time, the Online Monitoring (ONLIMO) system has been implemented. This study aims to evaluate the effectiveness of ONLIMO compared to laboratory analysis in terms of accuracy, time, and cost. Physical and chemical parameters such as BOD, COD, DO, Nitrite, Nitrate, pH, TDS, and turbidity were analyzed using the Pollution Index (IP) method based on the Decree of the Minister of Environment No. 115 of 2003. The results showed an average Ci/Lij value of 1.70 with a maximum IP of 115.97 from ONLIMO, while the laboratory analysis produced an IP of 98.26 with a maximum Ci/Lij of 138.9. Nitrite (11.15–14.35) and turbidity (6.55–9.74) were identified as dominant contributors to pollution. In terms of efficiency, ONLIMO proved faster, with real-time monitoring and lower operational costs compared to laboratory methods, which require sample collection and manual analysis. However, ONLIMO has limitations in detecting certain parameters such as BOD. Overall, ONLIMO is considered efficient and effective for monitoring the water quality of Jangkok River, with potential improvements through the integration of additional methods for more accurate and comprehensive results.

Keywords: ONLIMO, Pollution Index, Jangkok River, water quality, efficiency.

ABSTRAK

Sungai Jangkok di Kota Mataram, Nusa Tenggara Barat, menghadapi pencemaran berat akibat limbah domestik dan industri. Untuk memantau kualitas air secara real-time, diterapkan sistem Online Monitoring (ONLIMO). Penelitian ini bertujuan mengevaluasi efektivitas ONLIMO dibandingkan analisis laboratorium dalam aspek akurasi, waktu, dan biaya. Parameter fisika dan kimia seperti BOD, COD, DO, Nitrit, Nitrat, pH, TDS, dan kekeruhan dianalisis menggunakan metode Indeks Pencemaran (IP) berdasarkan Keputusan Menteri Negara Lingkungan Hidup Nomor 115 Tahun 2003. Hasil menunjukkan rata-rata nilai Ci/Lij pada ONLIMO sebesar 1,70 dengan IP maksimum 115,97, sedangkan analisis laboratorium menghasilkan IP sebesar 98,26 dengan Ci/Lij maksimum 138,9. Parameter nitrit (11,15–14,35) dan kekeruhan (6,55–9,74) menjadi penyebab dominan pencemaran. Dari segi efisiensi, ONLIMO terbukti lebih cepat dengan pemantauan real-time dan biaya operasional lebih rendah dibandingkan laboratorium, yang membutuhkan proses pengambilan sampel dan analisis manual. Meski demikian, ONLIMO memiliki keterbatasan dalam mendeteksi parameter tertentu seperti BOD. Sistem ONLIMO dinilai efisien dan efektif untuk memantau kualitas air Sungai Jangkok, dengan potensi peningkatan melalui integrasi metode tambahan untuk hasil yang lebih akurat dan komprehensif.

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

***Kata Kunci**: ONLIMO, Indeks Pencemaran, Sungai Jangkok, kualitas air, efisiensi*

Introduction

Clean water is one of the most essential needs for human life and is a critical natural resource. It is used daily to support a sustainable livelihood (Dawud, 2016). According to the Regulation of the Minister of Public Works and Public Housing No. 09/PRT/M/2015, water encompasses all sources above and below ground level. Rivers, as one of these water sources, play a vital role in sustaining life. However, increasing population and uncontrolled industrial development contribute to a rise in environmental pollution. In Nusa Tenggara Barat, the population reached 5,646,000 in 2024, which has contributed to the deterioration of river water quality due to industrial waste and domestic activities. According to data from the Indonesian Central Bureau of Statistics in 2022, approximately 46% of rivers in Indonesia are heavily polluted, including Jangkok River in Mataram City. Its water quality is significantly influenced by biological parameters such as *Escherichia coli* and total coliform bacteria. To address this issue, continuous monitoring and control of water quality are essential. One such system that has been implemented is Online Monitoring (ONLIMO), which allows real-time tracking of water quality in the downstream section of Jangkok River. This study aims to evaluate the effectiveness of ONLIMO in monitoring water pollution by comparing the results with laboratory tests using a T-test. The study was conducted in the Ampenan Sub-district of Mataram City using ONLIMO data collected over four months. The results are expected to inform policy development, increase public awareness regarding the importance of water quality, and support scientific advancements by students and researchers in the field of environmental monitoring. Additionally, the study compares cost efficiency before and after the implementation of ONLIMO to assess its impact on water resource management.

Method

This study aims to evaluate the effectiveness of the ONLIMO system in monitoring real-time water pollution in Jangkok River. A literature review was conducted to establish a theoretical foundation for water quality monitoring and the applied technologies. Data collection involved both secondary data from government reports and prior studies, and primary data through direct measurements using ONLIMO and laboratory analysis of water samples. The research procedure included site preparation, ONLIMO operation, sampling, and data analysis. The results assessed ONLIMO's capability to detect water quality changes, contributing to improved pollution monitoring and mitigation strategies.

Data Collection

Data collection for this study comprised:

1. Primary data: Obtained through field observations and interviews with communities surrounding Jangkok River. Additionally, laboratory testing of water samples was carried out to analyze physical, chemical, and biological parameters. Operational evaluation of the ONLIMO system was also conducted at the Ampenan station.

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

2. Secondary Data: Sourced from relevant institutions, including real-time data from the ONLIMO system and laboratory test results. These were analyzed using the Pollution Index (IP) method to assess Jangkok River's water quality according to applicable standards.

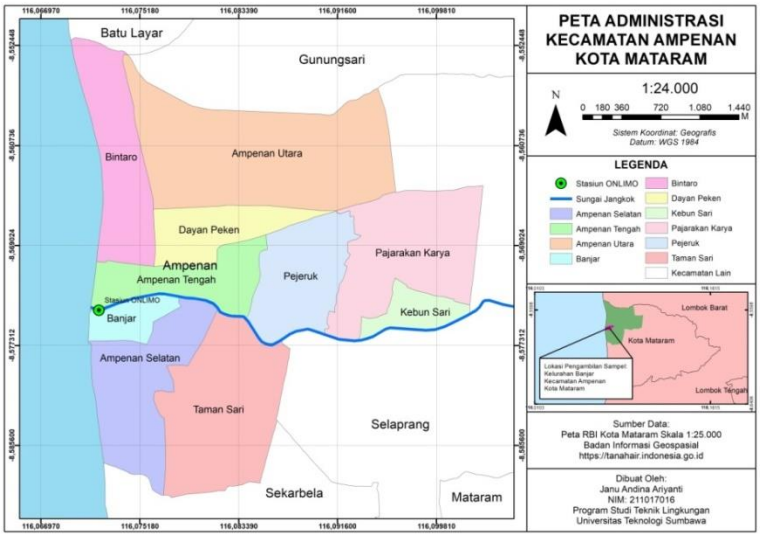

Figure 1. Administrative Map of Ampenan Sub-district, Mataram City, Nusa Tenggara Barat

Research Implementation

Time and Place

The research was conducted in Ampenan Sub-district, Lombok Barat, focusing on the ONLIMO station in the downstream area of Jangkok River. Data collection occurred over a three-month period, from October to December 2024.

Figure 2. Physical condition of the river

Figure 3. ONLIMO Station

Existing Conditions

Existing conditions indicate heavy pollution in the lower Jangkok River due to direct domestic waste discharge. This pollution has resulted in health issues and economic impacts

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

for local communities. Interviews with 25 respondents emphasized the urgent need for systematic and continuous water quality monitoring.

Research Mechanism

1. Tools and Materials: The study employed sterile sample bottles, water quality instruments (COD, BOD, DO meters), ONLIMO units, and laboratory equipment to ensure precise results.
2. Sampling Technique: A simple random sampling method was used to collect samples from the upstream, midstream, and downstream parts of the river over four months to ensure representativeness.
3. Research Methods: The approach combined field surveys, laboratory testing, and ONLIMO data analysis. Laboratory samples were collected at three monitoring points (upstream, midstream, downstream) to compare with ONLIMO measurements.
4. Data Analysis Technique: The Pollution Index (IP) method was used to determine the river's water quality status based on national quality standards.

Projected Research Results

The study is expected to provide comprehensive data on the effectiveness of ONLIMO in monitoring water quality in Jangkok River. Key outcomes include:

a. Evaluation of pollutant parameters in Jangkok River.
b. Assessment of ONLIMO's effectiveness for water quality monitoring.
c. Recommendations for technological applications in pollution mitigation of Jangkok River.

Results and Discussion

This research was conducted in Banjar Village, Ampenan Sub-district, located on the western coast of Lombok Island. The study site was Jangkok River, one of the main rivers in Lombok, spanning 47.1 kilometers and flowing through urban areas that are vulnerable to pollution from domestic, industrial, and agricultural waste.The regional boundaries of the study area are as follows:

a. The northern part bordered by Lombok Barat Regency.
b. The eastern part bordered by Selaparang Sub-district.
c. The southern part bordered by Kecamatan Sekarbela and part of Kecamatan Selaparang.
d. The western part bordered by the Lombok Strait

Interview and Observation Results

Field observations and interviews with 25 local residents of various occupations revealed that most participants were unaware of the ONLIMO system used for water quality monitoring in Jangkok River. In-depth interviews explored the participants' knowledge of ONLIMO, household waste disposal habits, and the effects of river pollution on their daily lives.

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

The interviews conducted in Banjar Village, Ampenan Subdistrict with 25 informants, involved 8 female and 17 male informants aged between 20 and 60. Most of the respondents were long-term residents of Jangkok River Basin area, with varying educational levels from elementary school, junior high school, high school, Diploma 3, to Bachelor's degree. Most male respondents were fishermen, while the majority of female respondents were housewives.

Table 1. Summary of in-depth interviews on community understanding of ONLIMO, waste management practices, and river pollution impacts on their daily lives.

nformants	Age	Gender	Education	Occupation
1	20	Female	Senior HS	Housewife
2	20	Male	Senior HS	Fisherman
3	21	Male	Junior HS	Fisherman
4	23	Male	Junior HS	Laborer
5	25	Female	Senior HS	Housewife
6	32	Female	Elementary School	Housewife
7	35	Male	Senior HS	Trader
8	37	Male	Senior HS	Fisherman
9	38	Male	Senior HS	Driver
10	40	Male	Senior HS	Fisherman
11	42	Female	Elementary School	Trader
12	42	Female	Senior HS	Housewife
13	42	Female	Elementary School	Housewife
14	44	Male	Junior HS	Fisherman
15	48	Female	Senior HS	Housewife
16	51	Female	Senior HS	Trader
17	53	Male	Diploma 3	Urban Village Office Staff
18	55	Male	Senior HS	Livestock Farmer
19	57	Male	Bachelor	Environmental Agency Staff
20	57	Male	Senior HS	Fisherman
21	58	Male	Senior HS	Fisherman
22	59	Male	Elementary School	Fisherman
23	59	Male	Junior HS	Merchant
24	60	Male	Senior HS	Fisherman
25	60	Male	Senior HS	Fisherman

Table 2. Characteristics of the results of interviews conducted in Banjar Village, Ampenan Subdistrict

No.	Questions	Agree	Disagree
	Variable X		
1.	Do residents accept the presence of the Online Monitoring system?	25	0
2.	Is ONLIMO considered important in monitoring water quality?	25	0
3.	Do residents receive sufficient information about water pollution levels through ONLIMO?	22	3
4.	Are residents satisfied with the performance of ONLIMO?	19	6

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

No.	Questions	Agree	Disagree
5.	Do you feel any changes related to ONLIMO on the water quality of Jangkok River?	3	22
	Variable Y		
6.	Does pollution in Jangkok River negatively impact the surrounding community?	23	2
7.	Do residents perceive the river as polluted?	22	3
8.	Is there a negative impact of the pollution of Jangkok River on the surrounding community?	23	2
9.	Does water pollution affect publich health?	24	1
10.	Are residents aware of river pollution countermeasures?	17	8
11.	Does watwr pollution affect the river ecosystem?	17	8

These findings reflect a generally positive public perception of ONLIMO as a technological tool for water quality monitoring. All 25 respondents agreed that ONLIMO plays an important role. While 22 respondents reported receiving adequate information, 3 expressed a lack of information. Nineteen respondents were satisfied with ONLIMO, whereas 6 were not. Notably, only 3 respondents observed a noticeable improvement in water quality, likely due to ONLIMO's relatively recent implementation since June, which may not have had sufficient time to generate visible environmental outcomes.

Table 3. Variable X

No.	Agreement Percentage	Disagreement Percentage	Cumulative Agreement Percentages	Cumulative Disagreement Percentages
1.	100.0	0	100.0	0
2.	100.0	0	100.0	0
3.	84.0	16.0	100.0	16.0
4.	76.0	24.0	100.0	24.0
5.	16.0	84.0	100.0	84.0

Analysis of interviews with the community of Banjar Village, Ampenan Sub-district on the utilization of ONLIMO showed that all respondents accepted and considered this technology important in monitoring water quality. A total of 88% of respondents felt that they were sufficiently informed about the level of water pollution, while 12% felt that they were not. As many as 76% of respondents were satisfied with the presence of ONLIMO, while 24% felt that it was not enough. However, only 16% felt a real change in water quality, while 84% did not. Nevertheless, the ONLIMO system has increased public awareness of the importance of maintaining water quality, reduced the risk of disease, and supported water-dependent professions such as fishermen and fish traders. In addition, the system helps the government make more

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

effective policies and increases public trust through data transparency, so overall ONLIMO contributes to a cleaner environment and healthier lives.

Table 4. Variable Y

No.	Agreement Percentage	Disagreement Percentage	Cumulative Agreement Percentages	Cumulative Disagreement Percentages
6.	92.0	8.0	100.0	8.0
7.	88.0	12.0	100.0	12.0
8.	96.0	4.0	100.0	4.0
9.	76.0	24.0	100.0	24.0
10.	68.0	32.0	100.0	32.0

Based on the SPSS analysis of interview data, the majority of respondents believed that pollution in the Jangkok River has a negative impact on the surrounding community (92%), and 88% perceived the river as polluted. Furthermore, 96% stated that water pollution affects public health, while 76% believed it negatively influences the river ecosystem. In terms of public awareness of pollution mitigation efforts, 68% of respondents indicated sufficient awareness, whereas 32% felt such awareness was still lacking.

Table 5. ONLIMO and Laboratory System Testing Results

No.	Parameter	Cij (ONLIMO result)	Lij (class 2)	Ci/Lij	Ci/Lij new
1	BOD	0.000	3	0	0
2	COD	6.43	25	0.26	0.26
3	Debit	0.6	-		
4	DO	0.5	4	1.61	2.03
5	Nitrogen	3. 58	15	0.43	0.43
6	Nitrit	2.96	0.06	107.17	11.15
7	Nitrat	11.8	10	0.64	0.64
8	Oxidation-reduction potential (ORP)	160.78	-		
9	pH	7.09	06 s/d 9	0.95	0.95
10	Temperature	26.8	Deviasi 3		
11	TSS	16.11	50	0.13	0.13
12	Turbidity	1.12	0.5	12.86	6.55
13	TDS	164	1000	0.01	0.01
Ci/Lij Avg	1.70				
Ci/Lij Max	164.00				
IP	115.97				

The pollution index (IP) calculations using data from the ONLIMO system indicated that the downstream segment of the Jangkok River was significantly polluted, with an IP value of 115.97. While COD (0.26), nitrogen (0.43), and nitrate (0.64) were within acceptable Class II water quality standards, nitrite exhibited a critical value (Cij

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

= 107.17, adjusted to 11.15), signifying major pollution. Dissolved oxygen (DO) increased slightly from 1.61 to 2.03, yet remained below optimal levels. Other parameters such as oxidation-reduction potential (ORP = 160.78), pH (0.95), temperature (26.8°C), total suspended solids (TSS = 0.13), and total dissolved solids (TDS = 0.01) were within safe thresholds. However, turbidity (6.55) remained high, indicating substantial suspended particulate matter in the water. These results confirm that the river water quality is compromised and necessitates immediate remedial action.

Table 6. Laboratory Test Results

No.	Parameter	Cij (lab result)	Lij (class 2)	Ci/Lij	Ci/Lij new
1	BOD	28.00	50	0.56	0.56
2	COD	7.44	06 s/d 9	3.73	3.86
3	Debit	2.07	3	9.33	5.85
4	DO	32.73	3	9.33	5.85
5	Nitrogen	2.65	4	0.66	0.66
6	Nitrit	0.023	0.06	466.67	14.35
7	Nitrat	1.2	10	2.80	3.24
8	Oxidation-reduction potential (ORP)	-	-		
9	pH	28.25	Deviasi 3		
10	Temperature	6.15	0.5	56.00	9.74
11	TSS	138.9	1000	0.03	0.028
Ci/Lij Avg		4.01			
Ci/Lij Max		138.9			
IP					

The laboratory analysis further confirmed that the downstream Jangkok River was heavily polluted, with a calculated Pollution Index (IP) of 98.26, reflecting poor water quality. Parameters such as low pH (3.86), elevated BOD and COD (5.85), and extremely low DO (0.66) highlighted serious organic contamination. Nitrite (14.35) and nitrate (3.24) values also exceeded typical thresholds, and turbidity (9.74) was considerably high. With an average Ci/Lij value of 4.01 and a maximum of 138.9, the findings emphasize the urgent need for environmental intervention to safeguard both the aquatic ecosystem and public health.

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

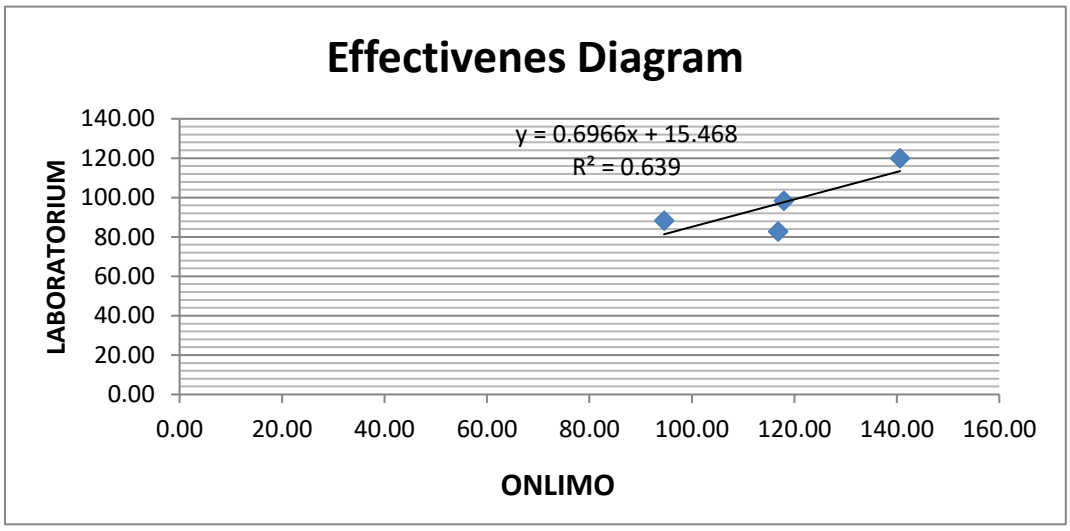

Figure 4. ONLIMO and Laboratory System Effectiveness Measurement

The linear regression analysis between water quality measurement results obtained through ONLIMO (x) and laboratory testing (y) demonstrated a positive correlation, represented by the equation y = 0.6966x + 15.468 with a coefficient of determination $R^2 = 0.639$. This indicates that approximately 63.9% of the variability in laboratory results can be explained by ONLIMO data. Although ONLIMO cannot fully substitute laboratory analysis in terms of accuracy and comprehensiveness, it offers significant advantages in terms of time and cost efficiency. ONLIMO enables real-time monitoring without delays, whereas laboratory-based assessments typically require 2–3 months from sample collection to result delivery. From a cost perspective, ONLIMO involves high initial installation expenses, however, its long-term maintenance costs are relatively low compared to laboratory operations, which entail recurring expenditures for reagents, trained personnel, and logistics. Therefore, ONLIMO proves to be a more efficient solution for continuous water quality monitoring, while laboratory testing remains essential for precise and detailed environmental assessments.

Table 7. Results of Jangkok River Water Quality Status Based on T Test

No.	Results	F	Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
1.	Equal variances assumed	0,00	0,991	1,635	6	0,153	20,28750	12,41035	-10,07954	50,65454
2.	Equal variances not assumed	-	-	1,635	5,904	0, 154	20,28750	12,41035	-10,19959	50,77459

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

The Independent Samples t-test revealed no statistically significant difference between the two groups tested (Sig. 0.145 > 0.05). Levene's test showed Sig. 0.991, indicating that the variance between groups is considered equal. Assuming equal variance, t = 1.635, df = 6, and Sig. (2-tailed) = 0.153, which is still greater than 0.05, so the null hypothesis cannot be rejected. The mean difference between the groups was 20.28750 with a standard error of 12.41035, and the 95% confidence interval included a value of 0, further confirming that the difference between the groups was not significant. A similar result was observed under the assumption of unequal variances (Sig. = 0.154).

Conclusion

Water quality analysis of the downstream segment of Jangkok River reveals a significant level of pollution. ONLIMO monitoring indicated an average Pollution Index (Ci/Lij) of 1.70 and a maximum IP of 115.97, with nitrite and turbidity identified as the dominant pollutants. Laboratory analysis supported these findings, producing an IP of 98.26 with elevated levels of nitrite, turbidity, and organic matter (BOD and COD). These results highlight the urgent need for pollution mitigation strategies to protect ecosystems and public health.

The effectiveness test of the ONLIMO system demonstrated a strong correlation with laboratory data, evidenced by a coefficient of determination (R^2) of 0.639. This suggests that ONLIMO can account for approximately 63.9% of the variation observed in laboratory measurements. Furthermore, ONLIMO offers advantages in operational efficiency due to its real-time capabilities and lower long-term costs. In contrast, laboratory analysis requires more time and higher costs due to sampling, chemical processing, and personnel involvement.

Independent Samples T-Test results revealed no statistically significant difference between ONLIMO and laboratory measurements (Sig. > 0.05). Levene's Test indicated equal variance (F = 0.000, Sig. = 0.991), with t = 1.635, df = 6, and a Sig. (2-tailed) of 0.153. The confidence interval for the mean difference (–10.08 to 50.65) included zero, further confirming that ONLIMO measurements are statistically comparable to laboratory results. Therefore, ONLIMO is a reliable and efficient alternative for continuous river water quality monitoring.

References

Agustiningsih, (2023). Analisis Kualitas Air di Sungai Sekanak Lambidaro Palembang. *In Prosiding Seminar Nasional Biologi 3(1)*, 253–261.

Alwansyah, A. F. (2024). Implementasi Internet Of Things (Iot) Untuk Sistem Monitoring Kualitas Air Shrimp Farming Vaname Pada Aplikasi Berbasis Android . *Jurnal Ilmiah Teknologi dan Rekayasa Volume 29 No. 1 April 2024, Volume 29 No. 1*, 72-85.

Dawud, M. I. (2016). Analisis Sistem Pengendalian Pencemaran Air Sungai Cisadane Kota Tangerang Berbasis Masyarakat. *Semnastek, 6*, 1-8.

Dimas Alif Rachmatulloh, K. E. (2023). Efektivitas Strategi Mengatasi Pencemaran Sungai. *Societas: Jurnal Ilmu Administrasi dan Sosial Vol. 12 No 2 November*

DOI: 10.22373/ijes.v3i1.6822
ISSN 3046-885X

2023, 256-264.

Effendi, F. D. (2019). Pengembangan Sistem Pelaporan Pemeliharaan Stasiun ONLIMO (*Online Monitoring*) Milik BPPT (Badan Pengkajian dan Penerapan Teknologi) Berbasis Android. *Jurnal Pengembangan Teknologi Informasi Dan Ilmu Komputer*, 2160–2166.

Hendrawan, D. (2005). Kualitas Air Sungai dan Situ di DKI Jakarta. *Makara Journal of Technology. 9 (1) 2005*, 13-19.

Hertika, A. M. (2022). Kualitas Air dan Pengelolaannya. *Universitas Brawijaya Press*.