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Performance Assessment and Actual Operational Maintenance Needs (AKNOP) of Situ Ranca Gede Kawao, Serang Regency

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ABSTRACT

The increasing population in Indonesia demands sufficient food availability to achieve national food security. Food security is a strategic policy involving social, economic, cultural, environmental, and political aspects, with its success indicators determined by adequate food access. Addressing food security issues requires factors such as infrastructure, sustainable technology, and land availability. Effective agricultural land management, supported by water resources, is crucial for improving agricultural productivity. Situ (water reservoirs) play a significant role in supporting agricultural productivity, particularly in Serang Regency, and make a notable contribution to rice production. Ensuring proper management of the situ through technical evaluation and maintenance audits is essential to enhance operational efficiency and support food security goals. Performance assessment and AKNOP preparation are critical for identifying areas of improvement and optimal resource allocation. This activity aims to provide information on components that require attention and serves as a guideline for budget preparation. The performance assessment indicated that Situ Ranca Gede Kawao received a score of 57.17, categorized as sufficient. Components that need improvement include operational guidelines, supporting documents, staff competency, and community involvement. Field identification revealed minor damages that impact water retention, requiring attention to ensure optimal functionality. The results of the AKNOP preparation for Situ Ranca Gede Kawao include operational and maintenance costs totaling IDR 250,905,325. Technical audits, including operational and maintenance cost calculations, provide a foundation for targeted actions to improve the situ's performance and maintain agricultural productivity. A proactive management strategy is key to ensuring the operational efficiency and maintenance of Situ Ranca Gede Kawao, thereby contributing to national food security efforts.

1. Introduction

The population of Indonesia tends to increase annually, with an average growth rate of 1.16% per year [1]. This population growth must be accompanied by adequate food availability to achieve national food security. Security itself is a system that aims to maintain structure from disruptions. The actors in the planting system include farmers, processing, distribution processes, consumers, the types of food required, and the components of the food chain. Food security is a strategic policy formulated by the government to meet food needs. Food security comprises several important

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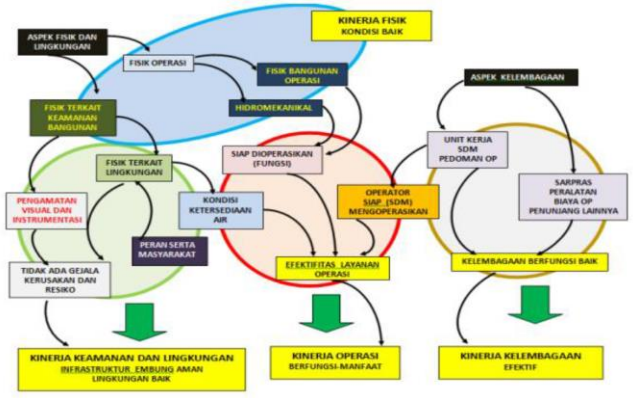
aspects, including social, economic, cultural, environmental, and political dimensions [2]. The success indicator of food security is when access to food needs is adequately met [3]. Addressing food security challenges involves various factors, such as existing infrastructure, renewable technology, and land availability.

Appropriate availability of agricultural land can increase agricultural productivity. In this context, the integration of land availability, human resources, and supporting technology is crucial for realizing food security. Optimizing existing agricultural land must be supported by sufficient water resources. Adequate water supply for existing agricultural land can enhance agricultural productivity, necessitating efforts to preserve water resources. One of the government's initiatives to maintain water resource sustainability is the construction of water storage structures such as reservoirs, situ, or ponds. Situ are depressions used to store water sourced from rainfall, rivers, and springs. The utilization of situ includes raw water supply, clean water, agricultural irrigation, and other needs. However, situ can pose risks if proper maintenance efforts are not conducted [4]. Such neglect can be hazardous for agricultural land or downstream settlements. The role of situ is critical in realizing food security by ensuring sufficient water availability, which in turn increases agricultural productivity.

Situ are widely distributed in the western part of Java Island. The province of Banten has approximately 53 situ, consisting of 45 managed by the central authority under the Cidanau Ciujung Cidurian River Basin Authority and 8 managed by the Public Works and Housing Agency (PUPR) of Banten Province. Most of the situ in Banten Province are utilized for irrigation. Serang Regency has 20 situ under the Cidanau Ciujung Cidurian River Basin Authority, or approximately 37% of the total situ in Banten Province. These situ structures support the efforts of the Serang Regency Government to become one of the rice barns in Banten Province, contributing to maintaining the stability of national food security. According to [1], in 2023, rice production in Banten Province reached 1.68 million tons, with 27% contributed by Serang Regency.

Situ Ranca Gede Kawao is one of the situ with a storage capacity of 11,500 m^3 and an irrigation service area of 200 hectares. Besides serving agricultural needs, the situ also supplies raw water for local communities. However, the primary issue faced by Situ Ranca Gede Kawao is the inadequate provision of clean water services. This is due to the suboptimal routine and periodic maintenance, with the last maintenance carried out in 2019. Therefore, a technical study and audit of the situ structure, which has experienced functional decline, as well as repair activities, are necessary [5].



KINERJA FISIK KONDISI BAIK **Physical Performance in Good Condition**	SUMBER DAYA MANUSIA TERSEDIA **Available Human Resources**
ASPEK FISIK DAN LINGKUNGAN **Physical and Environmental Aspects**	SUMBER DAYA MANUSIA TERSIAPKAN **Prepared Human Resources**
ASPEK KELEMBAGAAN **Institutional Aspects**	PERAN SERTA MASYARAKAT **Community Participation**
FISIK OPERASI **Operational Physical Conditions**	SOP DIOPERASIKAN **Standard Operating Procedures (SOP) are Operated**
FISIK TERKAIT KEAMANAN DAN LINGKUNGAN **Physical Aspects Related to Safety and Environment**	KOORDINASI KETERSEDIAAN AIR **Water Availability Coordination**
PERMASALAHAN VISUAL INFRASTRUKTUR **Visual Issues in Infrastructure**	EFEKTIFITAS LAYANAN OPERASI **Effectiveness of Operational Services**
FISIK BANGUNAN OPERASIONAL **Operational Building Conditions**	OPERATOR (SDM) MENGOPERASIKAN **Operators (Human Resources) Operate**
HIDROMEKANIKAL **Hydromechanical**	UNIT KERJA SESUAI PEDOMAN OP **Work Units in Accordance with Operational Guidelines**
TIDAK ADA GEJALA KERUSAKAN AIR DAN TANAH **No Signs of Water and Soil Damage**	SAMPAH (RECYCLE) PENANGANAN, DRAINASE, DAN PENUMBUHAN LAPISNYA **Waste (Recycling) Management, Drainage, and Layer Regeneration**
KINERJA OPERASI BERFUNGSI MAKSIMAL **Operational Performance Functioning Maximally**	KINERJA KELEMBAGAAN BERFUNGSI BAIK **Institutional Performance Functioning Well**
KINERJA KELEMBAGAAN EFEKTIF **Effective Institutional Performance**	

Fig. 1. Conceptual Framework for Situ/Pond Performance Analysis

A technical audit or performance assessment is conducted to determine the condition and functionality of the situ. The Actual Operational and Maintenance Needs (AKNOP) is an activity involving the planning of routine and periodic maintenance based on the current condition of the infrastructure, with its output serving as a reference for funding future operation and maintenance activities [6]. According to [7], there are four aspects evaluated in the performance assessment of situ: physical condition assessment, operational and service assessment, structural and

environmental safety assessment, and institutional quality assessment. All these aspects are interconnected.

Each performance assessment aspect has sub-aspects with predetermined weightings. A more detailed explanation is provided in Table 1 below.

Table 1. Situ Performance Assessment Aspects and Weightings

Assessment Aspect	Sub-Assessment Aspect	Weight (%)
Physical Performance	1. Main Structure	40
	2. Spillway Structure	15
	3. Water Intake Structure	25
	4. Supporting Structures	10
Operational and Service Performance	1. Operations	60
	2. Services	40
Safety and Environmental Performance	1. Structural Safety	50
	2. Environment	50
Institutional Performance	1. Management	25
	2. Human Resources	25
	3. Operational Guidelines (OP) Documents	25
	4. Facilities and Infrastructure for OP	25

Table 2. Performance Scores and Categories for Situ Operations and Maintenance

Score	Performance Category
80 – 100	Good Performance
55 - < 80	Sufficient Performance
<55	Poor Performance

The Actual Operational and Maintenance Needs (AKNOP) are calculated based on damage data reviewed directly in the field. The AKNOP data is obtained by summing up the product of volume, frequency, and unit price of work for each operational activity, routine maintenance, and periodic maintenance. The AKNOP calculation is formulated as follows:

$$AKNOP = \Sigma\ V\ x\ F\ x\ HSP \quad (1)$$

Note:

V = Volume of Situ operation and maintenance activities
F = Frequency of activities
HSP = Unit price of work

2. Method

2.1. Research Location

This research was conducted at Situ Ranca Gede Kawao, located in Binuang District, Serang Regency. The location of Situ Ranca Gede Kawao can be seen in Figure 2 below.

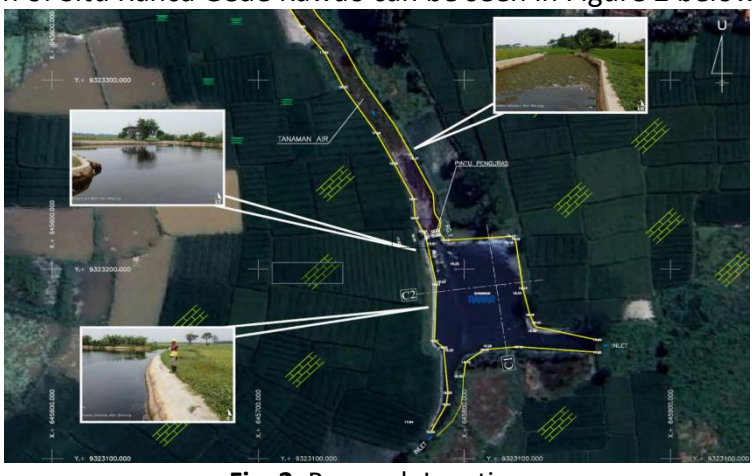


Fig. 2. Research Location

2.2. Implementation Procedure

The implementation of the Performance Assessment and the Preparation of the Actual Operational and Maintenance Needs (AKNOP) includes preparation activities, data inventory, situ performance assessment, calculations, and the preparation of AKNOP.

2.3. Data Collection Technique

Data for the Performance Assessment and Preparation of AKNOP were obtained through two methods: primary data and secondary data. Primary data were collected through field observations, including direct observation and interviews with situ personnel. Secondary data were gathered from previous reports, situ operation and maintenance (OP) manuals, drawings, and supporting documents.

2.4. Data Inventory and Performance Assessment

The activities began with the collection of secondary data, followed by field visits to gather the required information. The inventoried data were then rechecked in the field through direct observation and assessed using pre-determined forms. Field observation activities were accompanied by measurements of structural damages in the situ, which serve as the basis for the preparation of AKNOP.

2.5. Preparation of AKNOP

The Actual Operational and Maintenance Needs (AKNOP) were derived from the damage findings observed in the field. The follow-up to the preparation of AKNOP includes costs for routine operations, routine maintenance, and periodic maintenance. Routine operations cover: situ operation personnel, field equipment, and documents and reports. Routine maintenance activities include grass cutting, dense weed removal, dry weed cleaning, painting, and gate lubrication. Periodic maintenance is determined based on the direct damage findings from the field observations.

2.6. Determination of Priority Scale for Actions

The results of the performance assessment and the AKNOP preparation are used to determine a priority scale as a reference for operations and maintenance in the following year. Factors influencing the priority scale include the level of need and the availability of supporting facilities and infrastructure.

3. Results and Discussion

3.1. Results

3.1.1. Performance Assessment of Situ Ranca Gede Kawao

The performance assessment of Situ Ranca Gede Kawao was conducted through observations of both physical and non-physical aspects of the situ. The results of the physical performance assessment are presented in Table 3.

Table 3. Physical Performance Assessment of Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Physical Performance Score
Main Structure	40	69.00	62.66
Spillway Structure	25	72.00	
Intake Structure	25	39.68	
Complementary Structures	10	71.40	

Based on Table 4, it shows that, in general, the physical performance of Situ Ranca Gede Kawao is in a fairly good condition. Field observations indicate that the infrastructure of the structures is still functioning well but requires repairs, particularly the spillway structure, which has minor cracks, and the intake structure, which has silt buildup and needs restoration. Components in good

condition need regular maintenance to ensure the reliability of the structures. The performance assessment further includes non-physical performance related to operations, services, safety, and environmental quality. The performance assessment results for Situ Ranca Gede Kawao are shown in Tables 3–5 below.

Table 4. Performance Assessment of Operations and Services at Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Operations and Services Score
Situ Operations	50	36.00	40.50
Situ Services	50	45.00	

Based on Table 3, the operations and services performance of Situ Ranca Gede Kawao is in poor condition. This is caused by a lack of situ operational guidelines/manuals and a limited number of staff. These factors hinder the operations and services performance, such as insufficient water availability to meet community needs. In addition, water quality and distribution from Situ Ranca Gede Kawao are not yet optimal. Excessive sedimentation in the situ base and outlet channels also negatively impacts irrigation flow. A more comprehensive and detailed operational manual is required to resolve this issue.

Table 5. Performance Assessment of Situ Structure Safety and Environment at Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Safety and Environmental Score
Structure Safety	60	65.80	71.30
Environment Quality	40	79.55	

Based on Table 4, the safety performance of the structure and the environmental condition of Situ Ranca Gede Kawao are in fairly good condition. Observations and field inspections indicate that the structural safety is in good condition, and visually, there are no issues that disrupt the performance of the situ. Structural safety is also supported by routine reports from personnel, which are conducted every six months. Several aspects need to be improved to enhance the safety of the situ, such as installing monitoring instruments like CCTV. The environmental aspect of the situ performance assessment also shows fairly good results. Field observations indicate that the surrounding area, such as buffer zones and water inundation areas, are still well maintained. However, community participation in maintaining the situ needs to be improved. So far, the maintenance of the situ has been mainly focused on the situ operational personnel. Agricultural activities around the situ also need to be controlled as they can cause sedimentation. There is a need for socialization regarding proper planting methods and types of crops that can reduce the rate of sedimentation in this area.

Tabel 6. Performance Assessment of Institutional Aspects of Situ Ranca Gede Kawao

Component	Weight (%)	Component Score	Institutional Performance Score
Situ Manager	25	100.00	58.75
Human Resources	25	50.00	
Operational Document	25	24.00	
Infrastructure	25	61.00	

Based on Table 5, it shows that the institutional performance of Situ Ranca Gede Kawao is in poor condition. The limited number of personnel has become an issue, and the management structure is not yet established, which is one of the causes of the poor institutional performance at Situ Ranca Gede Kawao. The lack of supporting infrastructure such as office facilities, operational vehicles, and necessary documents has not been fulfilled. The observations indicate that the available infrastructure does not meet the guidelines for institutional performance assessment. From the data in the table, it can be concluded that the performance of Situ Ranca Gede Kawao falls into the "adequate" category. Several supporting aspects, such as the provision of supporting documents and infrastructure, must be completed to enhance its performance. A recap of Situ Ranca Gede Kawao's performance assessment can be seen in Table 6 and Figure 3.

Table 7. Recapitulation of Situ Ranca Gede Kawao Performance Assessment

Assessment Item	Optimal Weight (%)	Maximum Weight (%)	Final Weight (%)
Physical Performance	20.13	35.00	21.93
Operations and Services	17.25	30.00	12.15
Safety and Environment	11.50	20.00	14.26
Institutional Performance	8.63	15.00	8.81
Total		57.15	Adequate Performance

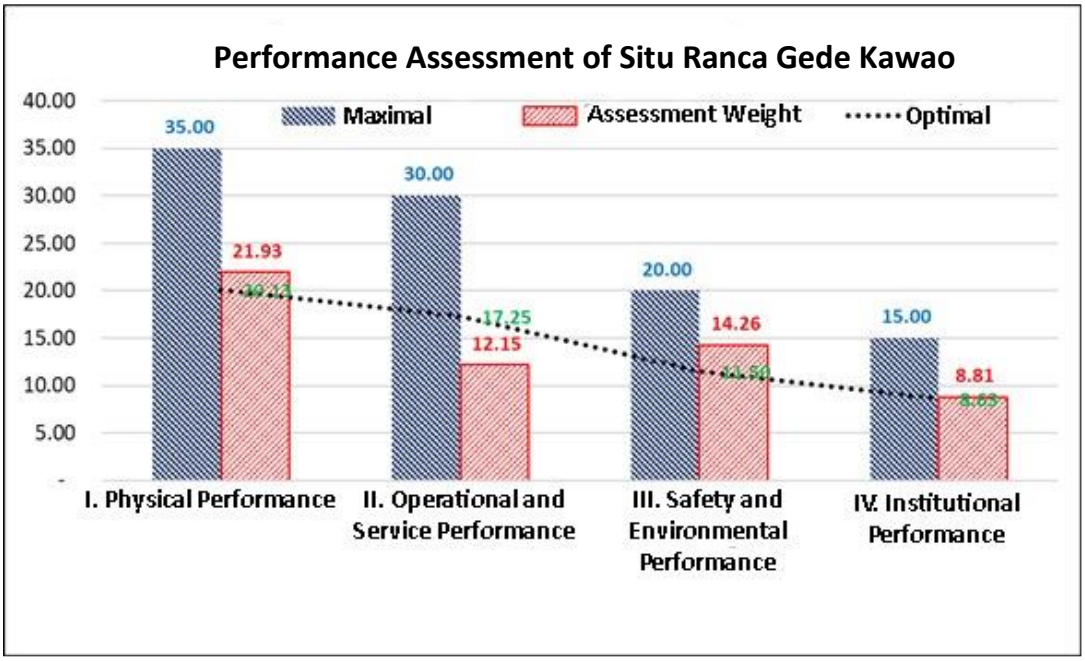


Fig. 3. Recapitulation of Situ Ranca Gede Kawao Performance Assessment

3.1.2. Preparation of Actual Performance Figures for Operation and Maintenance

The Actual Performance Figures for Operation and Maintenance (AKNOP) are prepared based on the identification of damages observed in the field. The AKNOP for the reservoir is compiled to determine the budget allocation for operation and maintenance activities for the following fiscal year. The purpose of preparing the AKNOP is to ensure that the allocated budget is targeted accurately according to existing needs while guaranteeing transparency, efficiency, effectiveness, and accountability. The preparation of the Actual Performance Figures for Operation and Maintenance (AKNOP) for Situ Ranca Gede Kawao consists of three components, which include: Routine operations, Routine maintenance, and Periodic maintenance. The costs for routine operations at Situ Ranca Gede Kawao are presented in Table 6.

Table 8. Operation Costs of Ranca Gede Kawao for Fiscal Year 2025

Component	Amount (Rp)
Documentation and Reporting	5,341,350
Operations	78,000,000
Field Equipment	1,620,000
Total Cost	84,961,350

The planned operation costs are based on the results of the field needs identification. The procurement of field equipment such as boots, helmets, vests, masks, and other necessary items has also been carried out. This is intended to support the performance of the Situ OP staff. Other AKNOP aspects, such as routine maintenance and periodic maintenance, are based on the results of field identification and damage measurements. The routine maintenance costs are calculated based on field identification. The majority of the routine maintenance at Situ Ranca Gede Kawao involves

weed cleaning. The components and costs of routine maintenance are presented in Table 7 and Figures 4-5.

Table 9. Routine Maintenance Costs of Situ Ranca Gede Kawao

Component	Unit	Volume	Unit Price (Rp)	Total Cost (Rp)
Tree Cutting (Clearing)	m^2	1002	9,853	9,872,706
Grass Cutting	m^2	253	883	223,457
Solid Weed Cleaning	m^3	315	98,530	31,036,950
Painting	m^2	13.50	59,253	799,924
Door Lubrication	Unit	12	26,156	313,880
			Total Cost	42,246,918

Source: SHBJ Provinsi Banten 2024, SE Bina Konstruksi 2023

Fig. 4. Location of Routine Maintenance for Tree Cutting and Grass Cutting

Fig. 5. Solid Weed Cleaning

In general, the physical infrastructure of Situ Ranca Gede Kawao is in good condition. Sedimentation remains the primary issue for the site. Minor damages also occurred to the situ lining over a 100-meter stretch (Figure 6) and the washing staircase over 3 meters (Figure 7). The damage to the lining has caused leaks, resulting in reduced water supply for agricultural land. The periodic maintenance costs have been prioritized for the repair of the situ lining, as this is a critical component of the site.

Fig. 6. Damage to Situ Lining

Fig. 7. Damage to Washing Staircase

3.2. Discussion

Food security is a major challenge for Indonesia in maintaining the stability of agricultural production. A good agricultural system supported by enabling technology can meet the desired productivity levels [8]. Water availability is crucial for supporting the success of increasing agricultural productivity. Water and food security are two major challenges faced by the world. One of the connections between the two is agricultural irrigation, with more than 70% of total water being used for agriculture or food production [9]. Therefore, it is important to maintain the sustainability of water sources. The government has made efforts to preserve water sources by

building water reservoirs such as lakes (situ). Situ also plays a role in sustaining rural life by providing water through proper management via operation and maintenance regulation [10].

As one of the rice granaries in Banten Province, Serang Regency continues to optimize water resources such as situ. Situ Ranca Gede Kawao is one of the lakes in Serang Regency relied upon to support agricultural productivity. In this regard, the government under the authority of the Cidanau Ciujung Cidurian River Basin Organization has conducted a technical audit in the form of Performance Assessment and the preparation of AKNOP (Real Operational and Maintenance Performance Number), intended to assess the feasibility of Situ Ranca Gede Kawao's function. This activity aims to ensure that Situ Ranca Gede Kawao can function optimally. The performance assessment shows that the physical and non-physical condition of Situ Ranca Gede Kawao is categorized as quite good, with a score of 57.17, as detailed in Tables 2 to 5. Problems at Situ Ranca Gede Kawao include significant sedimentation and aquatic weeds, which reduce the reservoir volume. If the sedimentation rate exceeds the plan, the lake's operational performance will decline, and the water volume will decrease, making operations ineffective [11]. Changes in volume need to be evaluated to assess the lake's ability to meet water needs [12]. Uncontrolled weed growth is another issue that must be addressed immediately. Weeds can result in water loss from the reservoir. Evapotranspiration from the weeds reduces the lake's water level and causes sedimentation [13]. Another factor affecting the performance of Situ Ranca Gede Kawao is non-physical factors such as operational manuals, supporting documents (as-built drawings, operational history documents, planning documents), staff competence, and community involvement. Based on the performance assessment, the number and competence of staff are not well-implemented. The absence of an institutional management structure for the lake could lead to a decline in the lake's function. The current staff at Situ Ranca Gede Kawao often have multiple roles, as there is no clear division of tasks and functions. There is a need for an increase in the number of staff and capacity building through technical guidance. According to research [14], the better the quality of human resources, the higher the institutional performance, thus improving the operation and maintenance of infrastructure. Successful management is determined by the integration of physical and non-physical performance, ensuring reliable water resource provision [15].

The calculation of the Real Operational and Maintenance Performance Number (AKNOP) is carried out based on field identification and measurements. The AKNOP budget consists of routine operations, routine maintenance, and periodic maintenance. The calculations show that the maintenance priorities at Situ Ranca Gede Kawao are sediment excavation and weed cleaning. These activities are essential to maintain the water storage volume so it can support surface irrigation in the Binuang District, Serang Regency. Minor damage such as cracks in the walls is also considered in the preparation of AKNOP for the 2025 budget. Small repairs are made to prevent larger damages. Preparing the operational costs for the OP staff is equally important, as these staff members are crucial for conducting the operations and maintenance of Situ Ranca Gede Kawao. The operational costs include not only staff salaries but also equipment and documents that support their tasks.

The results of the Performance Assessment and the calculation of the Real Operational and Maintenance Performance Number (AKNOP) provide a foundation or recommendation for the relevant authorities to take appropriate actions so that Situ Ranca Gede Kawao can contribute to the success of Serang Regency as the rice granary of Banten Province in ensuring national food security stability.

4. Conclusions

Based on the results of the Performance Assessment and the calculation of the Real Operational and Maintenance Performance Number (AKNOP), it is evident that the operation and maintenance

activities of the situ structure are crucial for the continuity of Situ Ranca Gede Kawao's service functions. The performance assessment serves as the first step in providing information on which components need improvement and enhancement, so future efforts to improve the lake's performance will be more efficient and effective. The calculated operation and maintenance costs will serve as a basis for the 2025 budget preparation, ensuring that damages at Situ Ranca Gede Kawao are promptly addressed. The recapitalized AKNOP cost for Situ Ranca Gede Kawao is Rp 250,905,325, with a performance assessment in the "adequate" category.

Conflict of interest

The authors declare no conflict of interest.

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