

# Integrating Irrigation and Potable Water via a Pump-Fed Reservoir: Operational Scenarios and Economic Feasibility in Sukodono

Rahmah Dara Lufira<sup>1\*</sup>, Suwanto Marsudi<sup>1</sup>, Ussy Andawayanti<sup>1</sup>, M. Amar Sajali<sup>1</sup>, Rizki Tri Utami<sup>1</sup>, Santi Sari<sup>2</sup>, Rizki Ramadhani Pratama<sup>3</sup>

<sup>1</sup> Water Resources Engineering Department, Engineering Faculty, Universitas Brawijaya, Indonesia.

<sup>2</sup> Independence Consultant, Malang, Indonesia.

<sup>3</sup> Civil and Environmental Engineering Department, Nagoya University, Japan.

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Corresponding Author:

Rahmah Dara Lufira

[rahmahdara@ub.ac.id](mailto:rahmahdara@ub.ac.id)

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**Abstract:** The Sukodono Reservoir (Gresik, East Java, Indonesia) is a pump-fed, multi-compartment system integrating irrigation and potable supply. We assess scenario-based operations and an economic appraisal. Three vertical-turbine pumps are installed (3×150 L/s); routine operation uses two units at 81% efficiency, yielding 243 L/s for 12 h/day (10.498 m<sup>3</sup>/day), with the third unit as standby/peak. By 2039, the population is projected at 30.801, requiring 22 L/s, supplied by a 30 L/s WTP. Irrigation storage targets are 120.000 m<sup>3</sup> (250 ha core plantation), 270.000 m<sup>3</sup> (2.250 ha inter-cropping), and 546.750 m<sup>3</sup> (secondary crops). Six phased-expansion scenarios over six years were evaluated. Results show the designed operation reliably meets the 22 L/s potable demand while achieving the irrigation storage targets across scenarios. Base-case economics at a 5.50% discount rate (WACC) indicate IRR 18.50%, BCR ≈ 1.00 (break-even), and payback 7.10 years. We conclude that pump-fed reservoirs can integrate rural water supply and dryland irrigation effectively, although economic performance is marginal under the base case; viability improves with efficiency gains and prudent O&M/Fuel-Cost control.

**Keywords:** Economic appraisal; Integrated water supply; Irrigation; Pump-fed reservoir; Scenario-based operation

## Introduction

Water scarcity is widely recognized as a pressing global challenge that threatens food security, livelihoods, and economic growth. Although roughly 70% of Earth's surface is covered by water, only about 2.5% is freshwater and only a small portion is readily available for human use (Polomski & Wiatkowski, 2023). Agriculture consumes more than 70% of global freshwater withdrawals, making improvements in allocation efficiency and service reliability pivotal for sustainable production and socio-economic stability

(Pawitan, 2018). Within this context, reservoirs play a central role by regulating supplies for multiple purposes, including irrigation and domestic use (Guan et al., 2020; Polomski & Wiatkowski, 2023).

In northern Gresik, East Java, dry-season deficits and rising cross-sectoral demands motivated the construction of the Sukodono Reservoir (completed in 2020), a pump-fed, multi-compartment system intended to integrate dryland irrigation with potable water supply. The core operational challenge is to schedule energy-intensive pumping during the wet season and allocate storage across compartments so that dry-season

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irrigation and year-round domestic demands are met reliably (Beça, 2023).

Prior studies broadly examine gravity-fed or single-purpose reservoirs; few address pump-fed, multi-compartment systems in rural settings that must coordinate seasonal pumping, storage partitioning, and staged service expansion (Kangrang et al., 2023; Sriworamas et al., 2021). Optimization techniques enable reservoir operations to maximize benefits under defined constraints while improving service reliability (Ethteram et al., 2018).

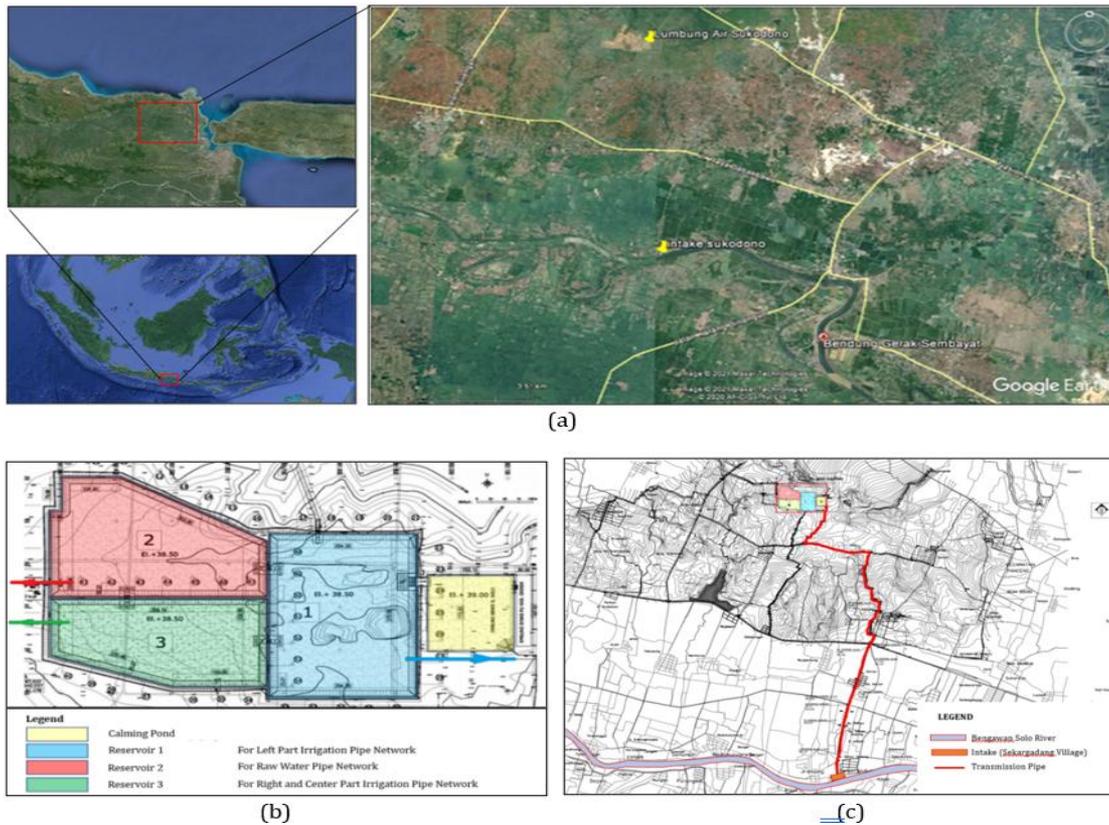
This study contributes a replicable decision framework that links scenario-based operating rules (seasonal pumping windows, cross-compartment storage allocation, phased expansion) with an economic feasibility appraisal targeted to public investment decisions in Indonesia. Rather than proposing a formal optimization model, we apply transparent scenario analysis consistent with the methods reported. We develop and evaluate scenario-based operating rules for the Sukodono Reservoir and appraise economic feasibility using IRR, BCR, and payback against an explicit discount rate, providing evidence to guide phased expansion, Operation and Maintenance (O&M) planning, and integrated irrigation-potable water provision.

*Materials*

*Study Area*

Geographically, the Gresik Regency area is located between 112–113° East Longitude and 7–80° South Latitude with an area of 1,191.25 km<sup>2</sup>. The area is lowland, with an average elevation of 2–12 meters above sea level, except for the mountainous areas on the north coast, which reach 46 meters above sea level. Regarding government administration, the Gresik Regency comprises 18 districts. Nearly a third of the Gresik Regency area is coastal along Kebomas District, parts of Gresik District, Manyar District, Bungah District, and Ujungpangkah District. Meanwhile, Sangkapura District and Tambak District are on Bawean Island.

The location of Sukodono Reservoir is administratively located in two different districts in Gresik Regency, known as Panceng District for the reservoir location and Dukun District for the intake location, with water taken from the Bengawan Solo River using a pump system to the reservoir. The location of the Sukodono Reservoir is shown in Figure 1a. The reservoir, which has a surface area of 30.92 ha and a total storage volume (calming pond, reservoir 1, reservoir 2, and reservoir 3 of 1.67 million m<sup>3</sup>, is planned to be able to meet water needs for dry land agriculture, providing raw water of 30 lt/sec for 9 villages (nine Public Hydrants) located in two districts. The reservoir layout is shown in Figure 1.



**Figure 1.** Sukodono reservoir layout plan: (a) the location of Sukodono reservoir; (b) the reservoir layout; (c) intake and reservoir

### *Reservoir Technical Data*

Effective reservoir operation requires a combination of robust design parameters and optimized management strategies. The Sukodono Reservoir, strategically located along the Bengawan Solo River, has been engineered to meet these demands through carefully designed technical specifications. With a crest elevation of 46.00 m above sea level (m.asl) and a bed elevation of 38.50 m.asl, the structure ensures adequate storage and controlled water regulation. The reservoir's three interconnected compartments Reservoir 1 (600,479.69 m<sup>3</sup>), Reservoir 2 (511,879.99 m<sup>3</sup>), and Reservoir 3 (413,584.85 m<sup>3</sup>) provide a cumulative capacity of 1,668,043.47 m<sup>3</sup>, complemented by a 142,098.94 m<sup>3</sup> calming pond for improved water stabilization. Reinforced levees with 1:2 slopes and Concrete Lining K225 enhance structural integrity, supporting long-term functionality.

Incorporating these design features into reservoir operation aligns with recommendations in the literature emphasizing multi-compartment storage systems for enhanced water allocation flexibility and risk mitigation (Lai V., 2022). Studies have shown that storage improves the ability to meet fluctuating agricultural and domestic demands, with optimization models, enabling efficient reservoir operation even under constrained inflows, ensuring a reliable water supply throughout the year (Ethteram et al., 2018).

### *Transmission Pipe Technical Data*

The transmission pipe system at the Sukodono water reservoir is designed to transport water from the intake to the reservoir efficiently. The transmission pipe is made of High-Density Polyethylene (HDPE) with a diameter of 630.00 mm and a total length of 8,160.00 m. The pipe is laid as a single unit, ensuring seamless water flow over its length. The intake ground surface elevation is +4.92 m.asl, while the reservoir surface elevation is +45.26 m.asl, providing the necessary gradient for water flow.

The transmission pipe system is supported by various utilities to ensure its stability and functionality. There are six road crossing pipes, along with bridge crossing pipes of different lengths and locations: two locations with a 6 m bridge crossing pipe, one with a 7 m bridge crossing pipe, one with an 8 m bridge crossing pipe, and one with a 13 m bridge crossing pipe. Additionally, there are five washout units and three check valves installed along the transmission pipe system to facilitate maintenance and prevent backflow (Marselina et al., 2018; Umakant et al., 2017).

The layout of the intake and reservoir, along with the transmission pipe system and supporting utilities, is illustrated in Figure 1c, highlighting the strategic placement and configuration of components to ensure

efficient and reliable water transmission within the Sukodono water reservoir system.

### *Intake and Pump Technical Data*

The intake and pump system at the Sukodono water reservoir is designed with precision to ensure efficient water extraction and distribution. The intake system comprises Galvanized Iron Pipes (GIP) with a diameter of 500 mm, each measuring 110.00 m in length, with a total of two units installed. The pump system features Vansan Vertical Turbine Pumps, each measuring 8.00 x 9.00 m. These pumps boast a capacity of 150 l/day/unit (lt/s), with an impressive efficiency rating of 81.00%. Each pump requires 160.00 kW of power and can maintain a rate head of 70.00 meters, with a Net Positive Suction Head (NPSH) of 5.40 m and a rate speed of 1490.00 m. The pump reservoir measures 12.00 x 3.00 m, with a depth of 8.00 m, providing ample storage for the extracted water.

The generator room houses Cummings/6LTAA8.9-G2 Silent generators, each with a capacity of 250 kV A and a rated speed of 1500 rpm. There are three generator units in total, ensuring a continuous power supply for the pumps and other electrical installations. The generators are fuelled by diesel, with a fuel consumption rate of 53 l/hour. Additionally, two 2000 L fuel tanks are installed to provide an uninterrupted fuel supply to the generators. The electricity installation at the site is rated at 3500 kVA, with five panel units installed to monitor and control the entire system (Beça, 2023). The intake and pump layout, along with the generator room configuration, are depicted in Figure 2a, illustrating the systematic design and layout of the crucial components of the water extraction and distribution system at the Sukodono water reservoir.

### *Raw Water Pipe Network Technical Data*

The raw water pipe network at the Sukodono water reservoir plays a crucial role in transporting untreated water from Reservoir 2 to various locations for further processing or distribution. The pump system at Reservoir 2 consists of two pump units with electric motors, each capable of delivering 30 lt/s at a head of 16 m and requiring 9.2 kW of power. These pumps are controlled by variable-speed drive panels, ensuring efficient operation and control of water flow.

The generator room houses a single generator with a capacity of 50.00 kilovolt-ampere (kV A), fuelled by diesel to provide backup power for the pump system. The raw water pipe network comprises pipes of varying diameters and lengths to cater to different water flow requirements. There are 2,818.00 m of 315 mm diameter pipes, 5,773.00 m of 250 mm diameter pipes, 3,262.00 m of 160 mm diameter pipes, and 1,723.00 m of 110 mm diameter pipes laid out across the network.

The pipe network is supported by various utilities, including road and bridge crossings, washouts, and air valves, to ensure its stability and functionality. There are four road crossings, one bridge crossing with a 15 m span and a 300 mm diameter pipe, and another bridge crossing with a 15 m span and a 250 mm diameter pipe. Additionally, there are five washout locations and five air valve installations along the pipe network for maintenance and pressure regulation purposes.

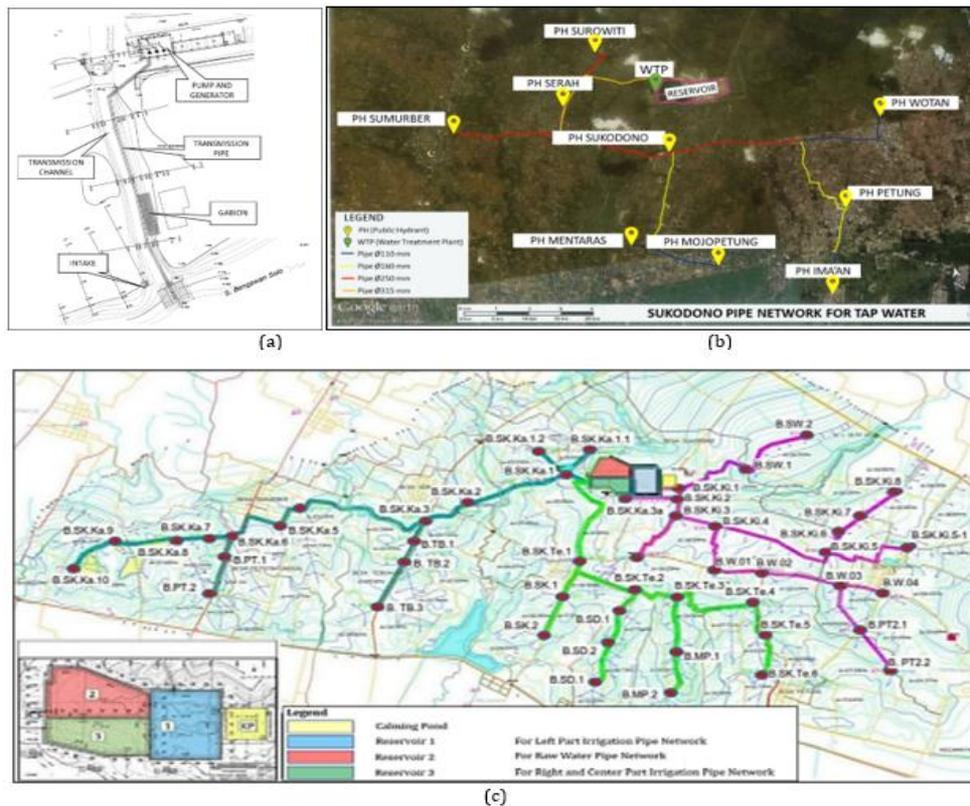
The network also includes nine public hydrants with a capacity of 15 cubic meters each, strategically located for emergency water access. Furthermore, a water treatment plant (WTP) with a capacity of 30 lt/s is installed to treat the raw water before distribution to consumers. Community-based management has been shown to enhance the sustainability of rural systems (Arsana et al., 2022). The location of the public hydrants is illustrated in Figure 2b, depicting their placement within the Sukodono water reservoir area for easy access during emergencies.

*Irrigation Pipe Technical Data*

The irrigation pipe network at the Sukodono water reservoir serves a vast area of agricultural land, with the primary and left irrigation areas covering 995.29 Ha, the right irrigation area spanning 703.85 Ha, and the centre irrigation area comprising 534.66 Ha. To meet the irrigation needs, Reservoir 1 supplies water to the

central and left irrigation areas, while Reservoir 3 provides water to the right and centre irrigation areas. Water is collected from Reservoir 1 by gravity, while a pump system is employed to extract water from Reservoir 3. The pump system in Reservoir 3 consists of two submersible pumps with electric motors, each capable of delivering 80 litres per second (l/s) at a head of 15 meters, requiring 22 kilowatts (KW) of power. These pumps are controlled by a control panel with an inverter for efficient operation. In case of power outages, a generator room houses a diesel-fuelled generator with a capacity of 125 kilovolt-amperes (kVA) to ensure the continuous operation of the pump system. Drip irrigation is favored for efficiency and yield-quality benefits in mango systems (Li et al., 2017; Pleguezuelo et al., 2018).

The irrigation pipe network comprises High-Density Polyethylene (HDPE) pipes of varying diameters and lengths to accommodate different water flow requirements. The network includes 9,341.28 m of 400 mm diameter pipes, 3,815.68 m of 315 mm diameter pipes, 2,526.41 m of 250 mm diameter pipes, 5,025.55 m of 200 mm diameter pipes, 6,473.44 m of 160 mm diameter pipes, and 1,343.08 m of 110 mm diameter pipes. The layout of the irrigation system and reservoirs is depicted in Figure 2c, showing the strategic placement of pipes and reservoirs to distribute water to the various irrigation areas efficiently.



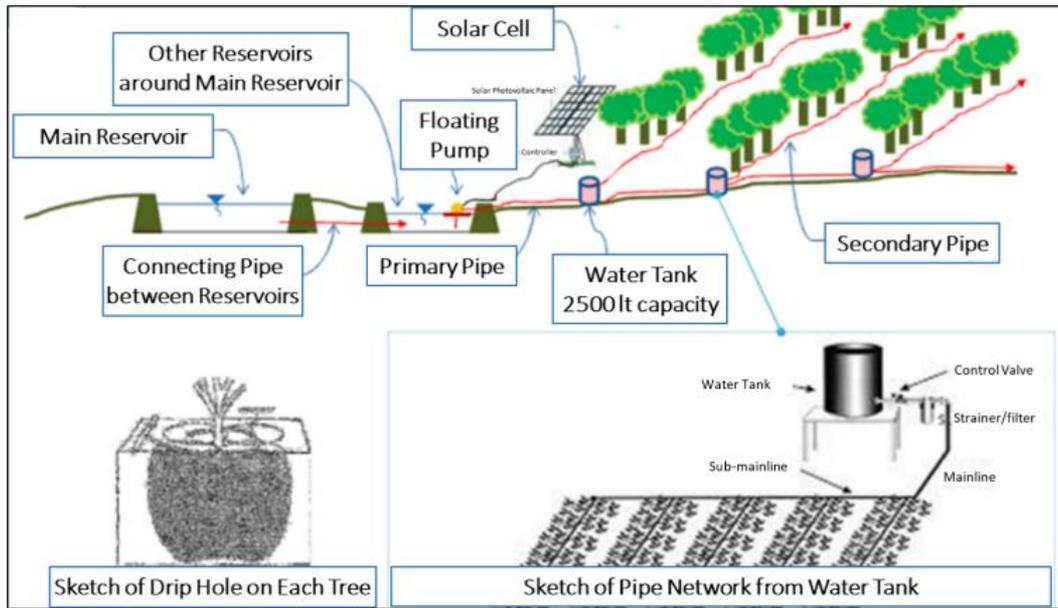
**Figure 2.** Irrigation pipe network, intake and pump layout: (a) intake and pump layout, (b) public hydrant location, (c) strategic placement of pipes and reservoirs

**Method**

*Method of Providing Irrigation Water for Horticultural Plants*

The method for providing irrigation water for horticultural plants to be applied at this location is drip irrigation. Providing irrigation water to mango plants is

carried out every 2 days for 3 hours over 6 months (dry season). Meanwhile, for corn plants, this is done every 2 days for 3 hours over 6 months. Drip scheduling is set to match phenological stages and local  $ET_0$ , consistent with mango irrigation literature emphasizing stage-specific supply for photosynthesis and fruit quality (Faria-Silva et al., 2019).



**Figure 3.** Sketch of the pumped drip irrigation system plan

*Population Projection*

Population projection analysis is used to determine the development and increase in population in the future. Population projection analysis is carried out using several methods, including linear, geometric, and exponential. The population data used is a minimum time series of 5 years. For the geometric method, it can be seen with the equation:

$$P_n = P_0 (1 + r)^n \tag{1}$$

Where  $P_n$  represents the number of residents in year  $n$ ,  $P_0$  denotes the total population in the base year,  $r$  stands for the population growth rate, and  $n$  indicates the number of intervals.

*Analysis of Clean Water Needs*

Based on SNI 19-6728.1-2002 (National Indonesian Standard), concerning the preparation of resource balances, water needs are calculated by multiplying the population by the need for clean water in l/person/day as in the following equation:

$$Q_{md} = P_n \times q \tag{2}$$

Where  $Q_{md}$  represents the need for clean water,  $P_n$  denotes the number of rural residents, and  $q$  indicates the water usage requirements in l/person/day. Analysis

of projected clean water needs is calculated by multiplying the population in the projected year by the total clean water needs.

*Sukodono Reservoir and Intake Operation System*

The period for Sukodono Reservoir impounding is in principle during the rainy season (November – March 2021). Water withdrawal from the Bengawan Solo River is planned with a pump with an installed capacity of 3 x 150 l/s or a production capacity of 3 x 121.50 l/s (pump efficiency 81%), where pump operation is planned for 2 operating units for 12 h and 1 standby pump unit.

With the operation of these 2 pump units, the discharge from the intake that will be transmitted to the reservoir is 243.0 l/s for 12 hours every day or 10,497.60 m<sup>3</sup>/day. Furthermore, the distribution of water from Lumbung Air to dry-land horticultural planting areas and raw water to public hydrants (HU) is gravity-driven. Pumping is carried out for 12 hours (2 pumps operate) during the 5-month rainy season, and the irrigation water process is carried out during the 6-month dry season. For raw water, it is carried out continuously every day for the whole year. The schedule reflects rule-curve or hedging concepts for multipurpose systems (Lai, 2022).

*Sukodono Reservoir Optimization Concept*

To avoid interference with the water allocation of the Sembayat Barrage, water pumping to fill the Sukodono Reservoir from the Bengawan Solo River only occurs during the rainy season (November to May). During this period, data from the Babat Barrage indicate that the average discharge of the Bengawan Solo River ranges from ± 454 m<sup>3</sup>/s to a maximum of ± 1900 m<sup>3</sup>/s, minimizing concerns for the Sembayat Barrage. Pumping operations are conducted for 12 hours daily throughout the 5-month rainy season, while irrigation processes utilize raw water continuously over the 6-

month dry season and are carried out daily throughout the year. Rainwater within the inundation area is disregarded for reservoir operations because of its impact on discharge. Inflow is exclusively obtained through pumping from the Bengawan Solo River during the rainy season. The planting pattern for inter-cropping follows secondary crops (corn). The minimum allocated storage is 111,972.54 m<sup>3</sup>, maintaining a reservoir bed height of 0.50 m at an elevation of +39.00 m. This operational concept is consistent with contemporary guidance on storage allocation, drought-limited levels, and hedging (Beça, 2023).

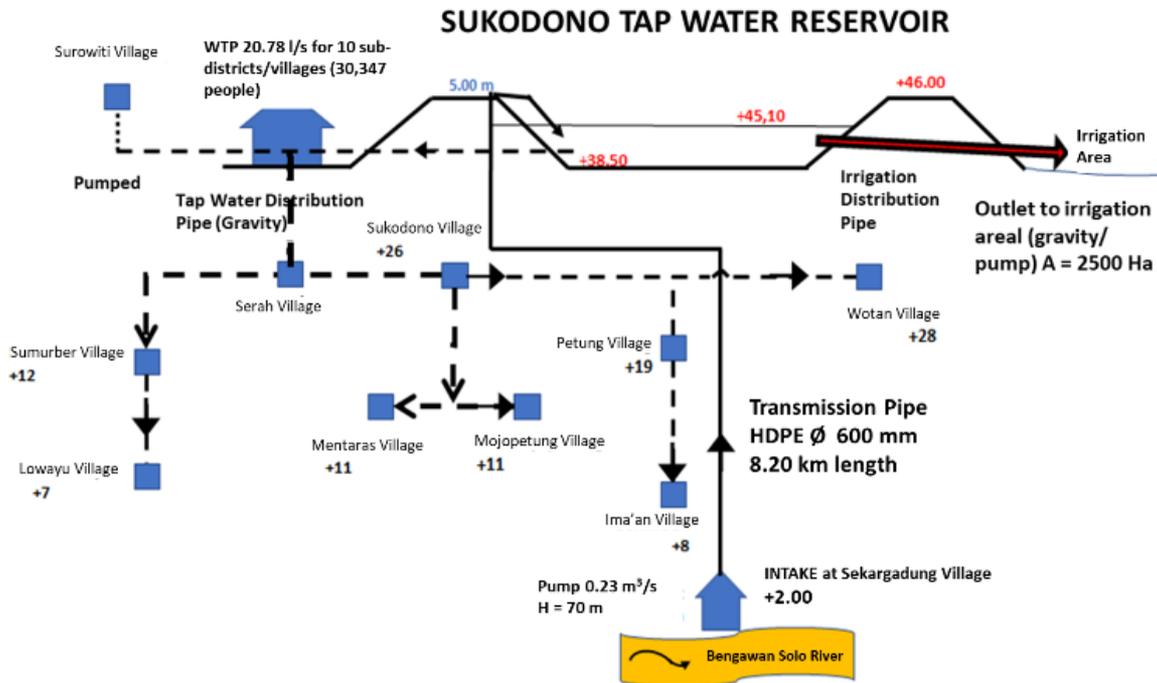


Figure 4. Concept of water allocation from Sukodono reservoir

*Financial & Economic Feasibility Indicators*

In financial feasibility analysis, there are three main parameters in assessing project feasibility using the discounted method (Andawayanti & Lufira, 2016):

1. Net Present Value (NPV)

$$NPV = B - C \tag{3}$$

2. Benefit Cost Ratio (BCR)

$$BCR = \frac{B}{C} \tag{4}$$

3. Financial Internal Rate of Return (FIRR)

In calculating financial feasibility indicators using FIRR and NPV analysis, it will be based on a weighted average discount rate in the form of Weighted Average Cost of Capital (WACC). Furthermore, other parameters that also need attention with the non-discounted method are the Pay-Back Period (PBP) or Investment Return Period. All price bases, tariff assumptions, and treatment of taxes/transfers are enumerated in an assumptions

table, and sensitivity analyses vary energy cost, pumping hours, and application efficiency.

**Result and Discussion**

*Benefits of the Sukodono Reservoir*

The Sukodono Reservoir is a pump-fed, multi-compartment system designed to deliver domestic raw water and support dryland horticultural irrigation in Panceng and Dukun Districts, northern Gresik. The system supplies a 30.00 L/s water treatment plant (WTP) and nine public hydrants serving nine villages, covering the projected 30,801 residents (design year 2039) at 60 L/person/day. In parallel, the reservoir enables irrigation across 2,233.80 ha (mango core plantations, mango-secondary crop intercropping, and corn). Prioritizing potable releases while building seasonal irrigation storage strengthens service reliability and aligns with multipurpose-reservoir practice (Polomski & Wiatkowski, 2023).

### *Irrigation Water Requirements for Horticultural Crops*

Mango occupies ~250 ha, with 2,250 ha under mango-secondary crop intercropping. Field information (with private-agency and university collaboration) indicates 200 L/tree/month; at 400 trees/ha (core orchards) this equals 80 m<sup>3</sup>/ha/month or 480 m<sup>3</sup>/ha over a 6-month dry season. Under the operational schedule (every 2 days for 3 hours), the instantaneous application rate per event is 0.4938 L/s/ha, derived from distributing the monthly volume over the discrete irrigation windows; this does not represent a continuous rate. For intercropping, the cumulative requirement is 120 m<sup>3</sup>/ha (6 months); for secondary crops (e.g., corn) an operational application rate of 0.25 L/s/ha corresponds to ~243 m<sup>3</sup>/ha over six months, consistent with local layouts and emitter grids.

These findings are consistent with global literature on mango water management, which emphasizes that irrigation timing is critical for maintaining photosynthetic efficiency and fruit quality during key phenological stages (Faria-Silva et al., 2019). In humid tropical climates, evapotranspiration rates range from 4–6 mm/day, with crop coefficients (K<sub>c</sub>) between 0.65 and 1.05, highlighting the importance of site-specific irrigation scheduling (Carr, 2014). In China, maintaining soil moisture at 65–70% of field capacity has been shown to improve mango growth and fruit quality (Li et al., 2017), while in Mediterranean environments, deficit irrigation at 50% of reference evapotranspiration (ET<sub>c</sub>) has been recommended as a sustainable strategy for balancing productivity and water savings (Pleguezuelo et al., 2018). The resulting irrigation storage targets remain 120,000 m<sup>3</sup> (core), 270,000 m<sup>3</sup> (intercropping), and 546,750 m<sup>3</sup> (secondary crops). These findings support the irrigation plan developed for Sukodono, which combines sufficient water allocation with efficiency measures.

### *Raw Water Needs*

The reservoir using 60 L/person/day and a growth rate of 0.87%/year, the 2039 population is 30,801. Continuous demand equals 22.00 L/s, with 1,900.80 m<sup>3</sup>/day, 57,024.00 m<sup>3</sup>/month (30-day basis), and 693,792.00 m<sup>3</sup>/year. A 30.00 L/s WTP provides capacity margin. Similar contexts highlight the importance of resilient intakes and treatment to sustain quality and reliability (Marselina et al., 2018; Umakant et al., 2017). Furthermore, community-based management practices, as observed in Bali, have proven critical for the sustainability of rural water systems (Arsana et al., 2022), suggesting that participatory governance could enhance the long term success of Sukodono's water services.

### *Reservoir Storage and Operation Optimization*

The active storage is 643,852.80 m<sup>3</sup> at initial impoundment. Pumping uses two units (third on standby) delivering 243.00 L/s to the reservoir for 12 h/day during the rainy season (November–March; 150 days). This yields 10,497.60 m<sup>3</sup>/day and a seasonal pumped volume of 1,574,640.00 m<sup>3</sup>. Local rainfall and runoff are included in the mass balance; open-water evaporation and seepage are deducted. Six scenarios represent staged irrigation service expansion from 534.66 ha to 2,233.80 ha over six years, while maintaining year-round potable releases (22.00 L/s) and honoring the minimum operating storage (111,972.54 m<sup>3</sup>). This staged approach aligns with best practices in reservoir operation, where dynamic allocation strategies and rule-curve-based management improve system resilience and water use efficiency (Beça, 2023; Zhou et al., 2022). These techniques are essential in regions with fluctuating hydrological conditions, as they help maintain balance between agricultural and domestic water demands while minimizing risks to downstream water users (Guan et al., 2020; Zhang et al., 2022).

### *Economic Feasibility*

The investment (intake, transmission, distribution, irrigation facilities, reservoir body) is IDR 225.39 billion (incl. VAT). O&M is projected for six years consistent with staged expansion. At WACC 5.50%, results are: IRR 18.52%, BCR ≈ 1.00 (break-even), NPV ≈ 0, and payback 7.10 years. These indicate marginal viability at base case, typical of rural water schemes where benefits accrue across sectors (Zhang et al., 2013). The Sukodono Reservoir has significant socio-economic potential beyond water provision. Residential development in Sukodono Sub-district has spurred economic activity, while the reservoir has created new business opportunities for local communities, contributing to revenue generation (Sudarmadji, 2014). On the environmental front, the reservoir's integration with advanced irrigation technologies and participatory governance mechanisms could enhance resilience to climate variability, aligning with calls for smart irrigation systems that optimize water and energy use (Nurdiyanto, 2019).

The Sukodono Reservoir effectively addresses the dual objectives of meeting potable water demand and improving irrigation efficiency for dryland agriculture. Its operational optimization strategy, combined with robust economic performance indicators, underscores its viability as a sustainable water resource project. By aligning technical interventions with socio-economic and environmental considerations, the reservoir contributes to regional development while supporting broader sustainable water management goals.

**Table 1.** Intake, transmission, water storage investment costs

Work Description	Cost (USD)
Preparation	57,025.27
Intake Development on The Bank of The Bengawan Solo River	
Hydromechanical and Electrical Work	90,623.77
Building Structure Work	705,571.86
Carrier Channel and Intake Pipe Structure Work	982.092,89
Construction of Transmission Pipeline Networks	
Road Crossing Works	327,652.31
Bridge Crossing Work	94,016.91
Transmission Pipe Procurement and Installation Work	3,622,082.21
Construction Of Tap Water Distribution Pipe Networks	4,603,511.43
Procurement and Installation of Raw Water Pumps	228,780.17
Road Crossing Works	53,046.96
Bridge Crossing Work	17,984.85
Air Valve Construction Work	58,441.88
Wash Out Development Work	26,522.12
Work on Procurement and Installation of Tap Water Distribution Pipes	867,418.22
Reservoir Work Capacity 15 m3 (9 units)	208.846.15
Construction Of Dry Land Irrigation Water Distribution Pipe Networks	1,477,632.35
Procurement and Installation of Pumps and Pump Houses	2,556,815.99
Road Crossing Works	100,574.18
Bridge Crossing Work	82,202.14
Air Valve Installation Work	130,832.57
Wash Out Installation Work	32,522.12
Procurement and Installation of Irrigation Water Pipes	3.108.397,57
Irrigation Tab Tank Work	138,295.53
Sukodono Reservoir Body	4,929,742.35
Total	14,320,572.03
Value Added Tax 10%	1,452,057.30
Total Prices	15,752,629.23
Round Up	15,752,629.30

## Conclusion

This study demonstrated that the Sukodono Reservoir, using a scenario-based operating framework, the pump-fed, multi-compartment Sukodono Reservoir can reliably meet the design potable-water demand while accumulating the planned irrigation storage across staged service expansion. The economic appraisal at WACC 5.50% yields IRR 18.52% and BCR  $\approx$  1.00, indicating marginal feasibility at the base case and highlighting sensitivity to energy tariffs, O&M efficiency, and irrigation performance. Accordingly, the main conclusion is that the operational concept is technically sound but economically conditional, requiring prudent cost control and efficiency gains rather than broad claims of socio-economic impact not measured in this study. Future assessment should focus on monitoring hydrologic variability and operational costs to reduce uncertainty and to reassess performance as the service area scales, thereby strengthening the evidence base for phased implementation.

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## Author Contributions

Conceptualization, R.D.L. and S.M.; methodology and supervision, U.A. and M.A.S.; data analyzer and writing original draft preparation, S.S., R.R.P., and R.T.U. All authors have read and agreed to the published version of the manuscript.

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## Conflicts of Interest

The authors declare no conflict of interest.

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