

IMPLEMENTATION OF ABSORPTION WELLS IN ORGANIC WASTE PROCESSING IN KAMASAN VILLAGE, BANJARAN DISTRICT, BANDUNG REGENCY

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Abstract

Kamasan Village, Bandung Regency, was known as a flood-prone area from 2012 to 2020. Although flood mitigation efforts have successfully reduced flooding since early 2020, household waste management, particularly organic waste, remains a major challenge. This study examines the implementation of biopore infiltration wells with a diameter of 11 cm and a depth of 1 meter that utilize media from processed organic waste as a filtration layer. This system not only aims to increase the rate of water infiltration and reduce runoff but also utilizes household organic waste as an integrated solution. In addition, this study also examines the impact of infiltration well implementation on community awareness of organic waste management. Initial observations indicate that the use of organic waste media has been shown to increase soil absorption capacity without producing leachate. This model has the potential to be an effective local solution for groundwater conservation and sustainable waste management, while simultaneously increasing active community participation.

Keywords: *biopore infiltration wells, organic waste processing, public awareness, infiltration capacity,*

INTRODUCTION

Heavy rainfall and the growth of built-up areas have increased the risk of flooding in many urban areas. Impermeable land surfaces reduce natural infiltration, increasing surface runoff and increasing the risk of inundation and flooding (Bahunta & Waspodo, 2019). Flooding not only causes material losses but also reduces groundwater quality due to reduced rainwater infiltration into the soil. One effective water conservation measure is the construction of infiltration wells, structures that collect rainwater so that it seeps into aquifers and helps maintain groundwater balance (Bahunta & Waspodo, 2019; Arifin et al., 2020). By capturing runoff, infiltration wells can also reduce the potential for local flooding and reduce the burden on urban drainage systems (Baskoro, 2022; Bahunta & Waspodo, 2019). On the other hand, organic waste is the largest component of urban waste, and it urgently needs to be managed properly. In Indonesia, approximately 50–60% of total urban waste consists of easily decomposed organic materials (Lestari, 2018). If organic waste is not managed at its source, its accumulation in landfills (TPA) can cause various environmental problems, such as leachate pollution and methane gas emissions that cause the greenhouse effect. Furthermore, indiscriminate disposal of organic waste contributes to blocked drainage channels and becomes a source of disease (Aznedra et al., 2018). This situation demonstrates the urgency of innovation in organic waste management that can reduce the volume disposed of in landfills while utilizing its organic potential.

The biopore infiltration hole approach emerged as a relevant local solution to address these two problems simultaneously. Biopore technology essentially involves creating small-diameter, vertical cylindrical holes in the soil filled with organic waste to increase water absorption and serve as a simple composting medium (Ichsan & Hualalata, 2018; Arifin et al., 2020). Biopore holes scattered throughout yards or open areas can increase rainwater infiltration pathways, thereby reducing surface waterlogging (Arifin et al., 2020). Simultaneously, organic material placed in the holes is decomposed by soil organisms and converted into compost (Zulaihah et al., 2018). Thus, biopores are a multifunctional, appropriate technology: increasing water infiltration, reducing flood-causing runoff, and simultaneously serving as a receptacle for processing household organic waste (Arifin et al., 2020). Previous research has shown that implementing biopore holes can reduce the volume of organic waste disposed of in

landfills and produce compost that is beneficial for soil fertility (Hutabarat & Simanjuntak, 2022; Sari et al., 2019). The urgency of implementing infiltration wells and biopore holes lies not only in the technical and environmental aspects, but also in empowering communities in managing these solutions. Active community involvement is crucial because maintaining infiltration wells and biopore holes requires ongoing participation, from construction to routine maintenance (Arifin et al., 2020).

Community-based organic waste management programs have been shown to increase public awareness and behavior change in sorting waste and processing it into compost (Sari et al., 2019; Waluyo et al., 2019). However, many regions still rely on government-led waste management and have not yet optimally engaged community participation (Sucita et al., 2020). Studies show that government efforts alone are insufficient to reduce waste volume and flood risk; participation and initiative from local communities are needed (Rambe & Febriani, 2020). Based on the problems and potential solutions mentioned above, the infiltration well and biopore hole approach is highly relevant for implementation through community service programs based on local solutions. This approach addresses two pressing needs simultaneously: water conservation through increased infiltration and organic waste reduction through in-situ composting. Through appropriate mentoring and education, communities can be encouraged to build and utilize infiltration wells and biopore holes in their own environments. Thus, this community service program is expected to increase the community's capacity to independently reduce flood risks, process organic waste into resources, and foster community independence in maintaining their environment sustainably.

METHOD

A. Time and Place of Implementation

This community service implementation was carried out from May 28 to June 28, 2025, by constructing eight biopore infiltration wells in three different locations to compare their effectiveness under varying soil conditions. Three wells were installed in densely populated residential areas, three around waste processing sites (TPS) or active composting sites, and the remaining two in rice fields. All wells were installed manually and simultaneously in early June 2025, with initial observations for two weeks after installation, focusing on the soil's water absorption capacity, moisture levels, and environmental response.

B. Implementation Steps

This community service activity was implemented through a series of systematic stages designed to address environmental issues in RW 07, Kamasan Village, specifically related to flooding and organic waste management. The approach used was participatory, actively involving the community from the planning stage through evaluation. Each stage was structured based on the principles of cost efficiency, sustainability, and ease of replication. The steps for implementing biopore infiltration wells are explained in detail below:

a. Observation and Location Determination.

The team conducted an initial survey in neighborhood unit (RW) 07, Kamasan Village, to identify areas prone to waterlogging and with low soil absorption capacity. Based on field observations and discussions with local residents, the locations were divided into three main categories: densely populated residential areas, areas surrounding waste processing facilities (TPST), and rice paddies. A total of eight infiltration wells were identified for construction: three in each densely populated residential area and the TPST, and two in the rice paddy area.

b. Socialization and Community Involvement.

Prior to the technical implementation, outreach activities were conducted with residents of RW 07 to introduce the concept of biopore infiltration wells, their benefits in water conservation and organic waste management, and opportunities for community participation in each stage of the activity. Outreach activities were conducted through neighborhood association (RT/RW) meetings, group discussions, and the distribution of simple educational materials. Residents were encouraged to play an active role in collecting household organic waste to be used as infiltration media.

c. Making Biopore Infiltration Wells.

The infiltration well construction process is carried out manually using a biopore drill. Holes are dug with a diameter of 11 cm and a depth of 1 meter at each predetermined point. After excavation is complete, a 1-meter-long PVC pipe is installed to support the well structure. This pipe has been drilled in a spiral or parallel vertical lines, with holes spaced approximately 10 cm apart and 1 cm in diameter, allowing water to permeate evenly throughout the soil.

d. Organic Waste Processing as a Soakaway Media.

Organic waste is collected from surrounding homes within a one-meter radius of the infiltration well. The waste is shredded and decomposed initially to create a stable infiltration medium free from odor, leachate, or pathogens. This medium is then placed at the bottom of the well to a thickness of approximately 80 cm. This step aims to improve the quality of the filtration media while also improving soil structure and fertility.

e. Well Closing and Marking.

After the infiltration media is inserted, the top of the well is covered with wire mesh to prevent foreign objects from entering, then covered with a perforated plate to allow rainwater to enter. As a sign and monitoring tool, each well is marked with a visual marker in the form of a bamboo pole or a small pipe inserted nearby.

f. Monitoring and Evaluation of Effectiveness.

Initial observations were conducted two weeks after well installation, measuring several key parameters, such as water infiltration rate (cm/hour), soil moisture and pH, and the volume of water absorbed by the well (liters/hour). Measurements were made using simple tools such as a manual infiltrometer, a soil moisture tester, and a pH meter. The data obtained was used to assess the well's effectiveness in increasing soil absorption and reducing surface runoff.

g. Data Analysis and Infiltration Model.

The quantitative data obtained was analyzed using a multiple linear regression model, taking into account the percentage of organic waste content and soil type at each location. The model results were used to project the long-term effectiveness of the wells and to assist in developing technical recommendations for other locations with similar characteristics.

h. Preparation of Recommendations and Replication Plans.

Based on the implementation results and initial measurements, practical recommendations were developed for communities and village governments to independently replicate biopore infiltration wells. Furthermore, technical training, the development of simple standard operating procedures (SOPs), and the creation of educational media (posters, infographics, or videos) were designed to support the sustainability and wider adoption of this system.

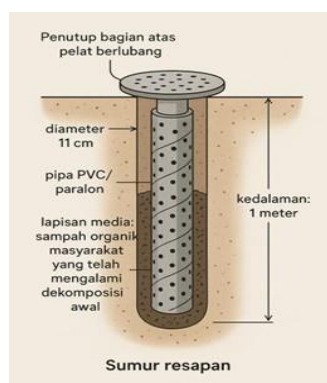


Figure 1 Biopore Infiltration Well Construction Activity

RESULTS AND DISCUSSION

A. Activity Explanation

The infiltration well design is simple yet efficient and sustainable. The well has a diameter of 11 cm and a depth of 1 meter. Inside, a perforated PVC pipe (about 1 cm in diameter, 10 cm apart vertically) is installed as a vertical support to prevent the hole walls from collapsing. The hole pattern is made in a spiral or vertically aligned manner so that water spreads evenly across the surrounding soil. The bottom of the well is filled with a layer of media consisting of pre-decomposed organic household waste, which functions as a water filter and improves soil quality. The top of the well is covered with a perforated plate to allow rainwater inflow and prevent foreign objects from entering.



To estimate the infiltration rate based on the proportion of organic waste and soil type, a simplified multiple linear regression model is used as follows: in the media (between 40%–80%) and the influence of the physical dimensions of the well, and the type of soil at the location, a multiple linear regression model is used as follows:

$$I=a+bO+eT$$

Information:

I: Infiltration rate (cm/hour)

O: Percentage of organic waste volume in media (%)

T: Soil type (dummy variable: 0 → Clay soil (rice fields), 1 → Dense humus soil, 2 → Sandy soil)

a,b,e: empirical constants from observations

a) Water Infiltration Rate per Location and Soil Type (Initial Observation - Week 2)

Because observations have only been ongoing for two weeks, the infiltration rate data presented below is preliminary and serves as an initial indication for observing trends in infiltration well effectiveness. Infiltration rate measurements were conducted using a simulation of incoming water volume versus infiltration time, without relying on the time of inundation receding.

Table 1. Water Infiltration Rate

Location	Soil Type	Percentage of Organic Waste (%)	$I=a+bO+eT$	Infiltration Rate (cm/hour)
Housing area	Loose sandy soil	40%	$2+0.05\times40+0.8\times2$	5.6
Housing area	Loose sandy soil	50%	$2+0.05\times50+0.8\times2$	6.1
Housing area	Loose sandy soil	60%	$2+0.05\times60+0.8\times2$	6.6
Housing area	Loose sandy soil	70%	$2+0.05\times70+0.8\times2$	7.7
Housing area	Loose sandy soil	80%	$2+0.05\times80+0.8\times2$	7.6
polling station	Dense humus soil	40%	$2+0.05\times40+0.8\times1$	4.8
polling station	Dense humus soil	50%	$2+0.05\times50+0.8\times1$	5.3
polling station	Dense humus soil	60%	$2+0.05\times60+0.8\times1$	5.8
polling station	Dense humus soil	70%	$2+0.05\times70+0.8\times1$	6.3

station				
polling station	Dense humus soil	80%	$2+0.05 \times 80 + 0.8 \times 1$	6.8
Ricefield	Water-saturated clay	40%	$2+0.05 \times 40 + 0$	4.0
Ricefield	Water-saturated clay	50%	$2+0.05 \times 50 + 0$	4.5
Ricefield	Water-saturated clay	60%	$2+0.05 \times 60 + 0$	5.0
Ricefield	Water-saturated clay	70%	$2+0.05 \times 70 + 0$	5.5
Ricefield	Water-saturated clay	80%	$2+0.05 \times 80 + 0$	6.0

Assumed model parameters: $a=2.0$, $b=0.05$, $e=0.8$.

b) Infiltration Rate Analysis Based on Soil Type and Organic Content

The data shows a consistent increase in the infiltration rate as the percentage of organic waste in the media increases.

- Housing (loose sandy soil): Infiltration rate increased from 5.6 cm/hr (40% organic) to 7.7 cm/hr (70% organic), indicating high responsiveness to organic matter addition. The slight decrease to 7.6 cm/hr at 80% organic may be due to pore saturation.
- TPS/Compost (compact humus soil): A significant increase was seen from 4.8 cm/hour (40% organic) to 6.8 cm/hour (80% organic), indicating that the addition of organic matter can open up the compact soil structure and increase pores.
- Paddy fields (saturated clay): Although initially slow (4.0 cm/hr at 40% organic), infiltration rates can reach 6.0 cm/hr at 80% organic, proving the benefits of infiltration well systems on non-ideal clay soils.
- Overall, infiltration wells perform better in soils with greater natural infiltration capacity, but less-than-ideal soil performance can also be improved with optimal infiltration media composition and design. The combination of soil type and organic content is key to achieving maximum performance.

c) Organic Media Security and Management

The use of organic waste as a seepage medium requires caution. Organic waste that has undergone initial decomposition minimizes the risk of leachate, odor, or pathogens. Clear Standard Operating Procedures (SOPs) are required to ensure organic processing reaches a stable point (close to mature compost). The distribution and type of waste must be controlled to prevent future problems, such as gas formation, extreme pH changes, or pathogen mobilization, especially if the material is fresh or contains inorganic materials. Organic waste management should include material selection (avoiding plastics, metals, and chemicals), initial drying, shredding, and microbial fermentation. A safe distance between the seepage well and drinking water sources also needs to be considered to prevent contamination. With proper management, organic waste can be a safe and functional medium, which also improves soil structure and pH stability.

d) Hopes for Future Water Quality

One of the main indicators of infiltration well quality is its impact on groundwater quality. From a technical perspective, smooth infiltration means rainwater moves slowly into the ground through the media and structural layers, enabling a natural filtration process. Solid particles and harmful microorganisms are trapped in the organic media and soil walls, while the infiltrated water is purer if it exits into an aquifer or saturated zone with unstable soil jacket properties or is not directly discharged to the drain.

In the long term, groundwater quality in this catchment area is expected to improve—as evidenced by a reduction in suspended particles and pathogens, as well as an increase in beneficial low-soluble organic matter. However, analysis of pH, microbial content, dissolved organic matter, and water conductivity must be periodically verified to ensure there are no negative effects from immature organic matter.

Strategically, these infiltration wells not only prevent localized flooding but also add value by enriching groundwater—maintaining aquifer reserves and improving the quality of underground ecosystems. The hope for the future is for groundwater to become clearer, healthier, maintain optimal pH stability (neutral to slightly acidic depending on local conditions), and increase the sustainability of water availability during the dry season.

e) Durability and Reliability of PVC Pipes as Supports

PVC pipe is chosen because it is corrosion-resistant, lightweight, easy to install, and inexpensive. This material does not react with organic media or soil moisture, so it lasts for years. PVC pipe is also easy to

perforate for even water distribution. Its underground placement protects it from UV rays. While there is a small potential for chemical degradation in acidic soils, PVC is generally resistant. Regular monitoring is recommended. This structure can last 5–10 years or more. The use of PVC pipe makes the well more sturdy, reducing the risk of landslides and contamination.

f) Cost and Energy Efficiency

A notable feature of this study is the simplicity and cost/labor efficiency of the installation method. The work is performed manually by one to two people in approximately two hours per well, using simple tools such as a biopore drill, a shovel, and PVC pipe cutting equipment. This means low labor costs, eliminates the need for expensive heavy equipment, and allows for relatively short-term target achievement.

The materials are also readily available: standard-sized PVC pipe, household organic waste, wire mesh, and perforated plates. With no significant material costs, each well costs only a few dollars—enabling mass replication in urban or rural settings without relying on a large budget. Because the process is simple, communities can be directly involved in the construction, reducing installation costs and providing empowerment value. Each specific feature (soil layer, organic waste distribution, pipe holes) can be modularly adjusted to suit local conditions. This makes these infiltration wells ideal for bottom-up, community-scale solutions.

B. Level of Understanding of Ongoing Activities

a) Community Participation and System Replication

The method's simplicity and cost/labor efficiency open up significant opportunities for direct community involvement. With minimal training, residents can take on roles ranging from collecting household organic waste, assisting with initial decomposition (through a composting system), to installing infiltration wells in front of their homes or in their yards. These activities not only foster community ownership of the project but also foster a critical understanding of environmental issues such as local flooding, water infiltration, and waste management. The success of this implementation has inspired a replication model. If each household installs one infiltration well, a network of infiltration wells within a block radius will be established, significantly reducing runoff. This participation also opens up access to education, as residents share experiences with organic fermentation, techniques for creating spiral holes in pipes, and simple infiltration rate measurement parameters using a home infiltrometer.

b) Potential for Development to Larger Systems

Having proven its effectiveness on a small scale, this system has the potential for broader development. For example, it could be integrated into rain gardens and infiltration gardens that absorb water from rooftops or walkways. These infiltration wells could also be synchronized with rainwater harvesting systems—water from gutters is collected in reservoirs and then channeled into mini wells. This network would integrate with greywater treatment, where water from showers or light washing is filtered through a layer of media before being absorbed into the ground, reducing clean water use and potential sewerage pollution. Furthermore, within community-based development, a technical education and training platform could be established: video tutorials, field practice, and demonstration projects in schools or village offices. Organizing seminars or workshops would expand the system's adoption to the private, urban, and rural sectors, and would also open up funding opportunities through environmental programs. Thus, biopore infiltration wells are not only a local method of flood mitigation and water retention, but also a socio-ecological movement that could trigger major changes in community water and waste management patterns.



Figure 3 Biopore Infiltration Well Poster

Table 2. Benefits of implementing infiltration wells

Benefit Aspects	Conditions Before Implementation of Infiltration Wells	Conditions After Implementation of Infiltration Wells
Environment		
Flood	The area experienced severe flooding every year from 2012 to 2020, with water levels reaching more than 50 cm and lasting up to a full day. The flooding was caused by a combination of heavy rainfall, clogged drains, and decreased soil absorption.	Floods have reduced significantly,
Soil Absorption Capacity	Decreased soil absorption capacity due to surfaces covered by buildings and waste.	Increased soil absorption capacity, especially in sandy soils (7.7 cm/hour at 70% organic) and clay soils (reaching 6.0 cm/hour at 80% organic). Media made from organic waste has been shown to increase soil absorption capacity.
Organic Waste Management	Organic waste such as food scraps, vegetables and leaves is still often thrown away carelessly or burned.	Organic waste is used as a permeation medium, aiding water filtration and improving soil quality. It has the potential to reduce household waste.
Groundwater Quality	Potential contamination from unmanaged water runoff and waste.	The expectation is that groundwater quality will improve, with a reduction in suspended particles and pathogens, and an increase in beneficial, low-soluble organic matter. Groundwater is expected to be clearer and healthier.

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Environmental Sustainability	Environmental problems have not been completely resolved, especially household waste.	This method offers a local solution for integrated waste management and groundwater conservation. Biopore infiltration wells are a socio-ecological movement that has triggered changes in water and waste management patterns.
Social Economy		
Public health	Disposal and burning of garbage carelessly causes unpleasant odors and potential health problems.	Better organic waste management minimizes the risk of leachate formation, odor, or the growth of pathogenic microbes.
Community Participation	Flood mitigation efforts were initiated jointly by residents, village governments, and local organizations.	Communities can be directly involved in waste collection, initial decomposition, and the installation of infiltration wells, encouraging community ownership and a critical understanding of environmental issues.
Cost & Energy	Requires efforts to dredge water channels and build culverts.	Manual work by 1-2 people takes 2 hours per well, without heavy equipment. Low material costs, allowing for mass replication.
Community Empowerment		Encourage community empowerment through simple, self-paced processes. Open access to education and sharing of experiences among residents.
Development Potential		Has the potential to be developed into a larger system such as

CONCLUSION

The use of small-diameter biopore infiltration wells combined with infiltration media from community organic waste has proven effective in increasing the rate of water infiltration in various types of soil. This system not only contributes to flood risk reduction and increased groundwater reserves, but also offers an integrated solution for organic waste management at the household level. Its cost and labor efficiency, as well as its simple design, strongly supports active community participation, encourages widespread system replication, and raises awareness of the importance of sustainable environmental management. The potential for its development into a larger system emphasizes the role of mini infiltration wells as a local innovation with broad impact. Suggestions for further service, 1) Further monitoring is needed in the first and third months after well installation to observe long-term infiltration rate trends. 2) It is recommended to repeat the test on other types of soil such as rocky soil or peat soil to test the effectiveness of the system under more varied conditions. 3) Increase education and outreach to the community regarding the proper and safe management of organic waste before it is used as an infiltration medium. 4) Develop more detailed standard operating procedures (SOPs) for organic waste processing and infiltration well maintenance. Mini.ngan test on other types of soil such as rocky soil or peat soil

REFERENCES

- Arifin, Z., Tjahjana, DDDP, Rachmanto, RA, Suyitno, Prasetyo, SD, & Hadi, S. (2020). Application of biopore technology to increase groundwater availability and reduce organic waste in Puron Village, Sukoharjo. *Jurnal Semar*, 9(2), 53–63.
- Aznedra, A., Putra, RE, & Desma, Y. (2018). Community empowerment through socialization of Waste Regional Regulation No. 11 of 2013 in Batu Merah Village, Batu Ampar District, Batam City. *Minda Baharu*, 2(2), 196–209.
- Bahunta, L., & Waspodo, RS (2019). Design of rainwater infiltration wells as an effort to reduce runoff in Babakan Village, Cibinong, Bogor Regency. *Journal of Civil and Environmental Engineering*, 4(1), 37–48.
- Hutabarat, LE, & Simanjuntak, IV (2022). Using bio-pore infiltration holes to reduce flooding in densely populated communities of Jakarta and surrounding areas. *IOSR Journal of Engineering*, 12(8), 1–9.
- Ichsan, I., & Hulalata, ZS (2018). Analysis of the application of biopore infiltration in flood-prone areas in Telaga Biru District. *Journal of Infrastructure & Science Engineering*, 1(1), 33–46.
- Ministry of Public Works and Public Housing. (2020). Technical Guidelines for Rainwater Infiltration Wells.
- Prasetyo, A. (2022). "Effectiveness of Infiltration Wells on a Household Scale." *Journal of Civil Engineering*, 11(2).
- Minister of Health Regulation No. 32 of 2017 concerning Water and Soil Quality.
- Lestari, MI (2018). Community empowerment through organic waste management into compost by the Sarop Do Mulana Cooperative, Wek II Village, Batangtoru. *At-Taghyir Journal: Journal of Islamic Propagation and Village Community Development*, 1(1), 11–27.
- Sari, MP, Pratiwi, DA, & Mulyati, S. (2019). Community empowerment through household organic waste management in composting. *Minda Baharu*, 3(2), 84–90.
- Suryani, L. (2021). "Takakura Compost as a Solution for Organic Waste." *Journal of Environmental Management*, 5(2).
- Waluyo, MR, Rahayu, F., & Mardiyah, A. (2019). Community empowerment on waste management with composting techniques and utilization of school yards for vegetable crops as a Healthy Living Community Movement. *International Journal of Community Service Learning*, 3(3), 122–126.
- Zulaihah, L., Siregar, AH, & Marasabessy, A. (2018). Biopore-based organic waste management in Bojong Kulur Village, Gunung Putri District, Bogor Regency. *Proceedings of the National Seminar on Research and Community Service*, Pangkal Pinang, October 2, 2018, 256–260.