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Clean Water Supply in Cirebon during Colonial Period (1878-1940)

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Abstract

This paper aims to explain the development of clean water supply in Cirebon during colonial period (1878-1940). The method used is the historical method, which includes four stages: heuristics, criticism, interpretation, and historiography. The research results show that clean water provision in Cirebon is motivated by European residents' concerns about the clean water crisis and the spread of epidemic. Efforts to explore clean water were carried out in 1878 and ended in 1940. Cirebon has three sources: Sijambu, Sumber, and Cipaniis. Clean water system changed technology and clean water management in Cirebon. Cirebon residents no longer depend on water carrier or natural water sources but use free hydrants or paid plumbing.

Introduction

Germ theory development in the 19th century revolutionized the field of medicine. The physicians at that time discovered that germs, rather than *miasma*, were the cause of disease in humans (Ackerknecht, 2009). Based on these findings, they gain an understanding of how pathogens are transmitted to human. Contaminated water is leading cause of disease outbreaks such as cholera, diarrhea, and dysentery (Yeoh, 1993). In 1854, an English physicians John Snow researched the correlation between cholera and consumption of contaminated water. The research became groundbreaking discovery in the United Kingdom and succeeded in stopping cholera epidemics in London. Since the 1860s, a movement advocating for cleanliness, ventilation, and drainage began to surface in Europe. A prominent British physician, John Simon, advocated the importance of clean water consumption for maintaining health (MacPherson, 2002). This movement laid the foundation for the contemporary urban sanitation system encompassing clean water supply, waste disposal, and sewage management (Melosi, 2008).

The Epidemic not only occurred in Europe but also in colonial territories like Dutch East Indies. Between 1820 and 1880, a series cholera outbreak resulted in deaths of 125,000 individuals on Java (Nasihin, 2021). Rapid urbanization and population growth in colonies without proper sanitation, particularly clean water supply, led to epidemics (Budiman, 2022). Dutch East Indies population was vulnerable to disease like cholera, dysentery, tapeworms, and typhus due to limited access to clean water (Tuyter, 1930). As result, economic activity was hindered as workers in plantations and industry were infected by epidemics. For these reasons, colonial government must provide clean water supply to its population (Budiman et al., 2023).

The Agrarian Law of 1870 shifted the Dutch East Indies government's policy from Cultivation System (*Cultuurstelsel*) to Liberal Economic System. Economic liberalization attracted numerous European entrepreneurs to establish industries in Dutch East Indies (Samputri et al., 2017; Riyanto et al., 2022). Newly settled European population introduced modern sanitation to the Dutch East Indies. As a response to new technology and efforts to meet the living needs of its population, colonial government initiated the provision of clean water supply, starting

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with Batavia in 1873 and spread to other city in Dutch East Indies including Cirebon (Kooy & Bakker, 2015; Rinardi & Rochwulaningsih, 2020).

This paper examines the development of clean water supply in Cirebon from 1878 to 1840, along with their technology and management. Cirebon is selected as analysis focus in this paper due to several crucial factors (Triana et al., 2023). First, Cirebon plagued by clean water shortages in the 19th century but transformed into modern city with sophisticated clean water system by the 20th century (Puguh, 2010; Wutich et al., 2023). Second, the construction of clean water supply in Cirebon preceded other colonial cities such as Bandung and Medan, which only received attention from government since 20th century. Third, we have not discovered research that concentrates on the development of clean water supplies in Cirebon.

Studies concerning colonial-era sanitation and clean water supply have been conducted in Indonesia. Kooy & Bakker (2015) discuss the evolution of clean water supply in Batavia from the 19th century to the 20th century. Budiman et al. (2023) discuss the development, technology, and management of the clean water system in Bandung during the early 20th century. Emalia (2020) discusses the disease outbreak and its management in colonial Cirebon, including a brief discussion of river and drainage improvements. Sanusi et al. (2022) discuss the process of river normalization in Cirebon. A related study that quite intersected with this research conducted by Mutawally & Mahzuni (2023) focused on water scarcity in colonial-era Cirebon. However, the study solely focuses on factors behind clean water scarcity and subsequent conflicts. The study needs an in-depth explanation of exploration, technology, and water management.

Methods

This paper uses a historical method consisting of four stages: heuristic, source criticism, interpretation, and historiography (Herlina, 2020). In the heuristic stage, sources are collected from various places such as national archives, libraries and internet sites. The sources used consist of primary sources and secondary sources. We collected secondary sources such as books and journal articles to complement primary sources. Primary sources used include: (1) Government Official Journal (*Staatsblad van Nederlandsh-Indië*); (2) Public Works Department Report (*Verslag over de burgerlijke openbare werken in Nederlandsch-Indië*), Cirebon Municipality Report 1906-1917 (*Verslag van den toestand der gemeente Cheribon over 1917*); (3) Government official book: *Gedenkboek der Gemeente Cheribon, 1906-1931, 25 Jaren Decentralisatie in Nederlandsh-Indie 1905-1930*; (4) Individual books: *Kromoblanda Over het vraagstuk van het Wonen'in Kromo's groote land* (Tillema), *Onderzoek ingesteld te Cheribon in verband met het voorkomen van typhus* (Grijns); (5) Map: *Ontwerp drinkwaterleiding voor de stad Cheribon*; (6) Newspapers and magazines: *Algeemen Handelsblad for Nederlandsch-Indië*, *Bataviaasch Nieuwsblaad*, *De Koerier*, *De Inginieur*, *De Locomotief*, and *Het nieuws van den dag voor Nederlandsch-Indië*.

After the sources have been collected, the next stage is source criticism (external and internal criticism). At this stage, we check external aspects of the historical source (for example, font and paper condition) and the source's content (corroboration to compare content of one with another source). After the facts are collected, the next stage is interpreting the historical facts. We used environmental politics to analyze the historical facts. Environmental politics is authority to regulate society and surrounding nature environment (Carter, 2018). Political approach is used to explain the power struggles among political actors involved in clean water supply development. The final stage is historiography; interpreted facts then reconstructed and written in the form of research articles.

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Results and Discussion

Pre-pipeline Clean Water Supply in Cirebon

Before the colonial government introduced modern plumbing technology in the late 19th century, residents of Cirebon relied on wells, water carriers, or nearby water sources for their daily needs. Hand-dug wells were considered valuable assets only accessed by the upper classes. Before drilling machines were introduced in the late 19th century, the construction of wells was a difficult and costly project. Hand-dug wells are only constructed on specific sites such as mosques, palaces, or rich man households (Primaditya, 2021; Uddin & Jahan, 2023). In addition to symbolizing economic status, hand-dug well is believed to bestow mystical power to its owner. For instance, *Penganten* wells at Kanoman Palace are believed to bring a soulmate to those who bathe there (Atika et al., 2022).

Due to their contamination susceptibility, hand-dug wells rarely become reliable water sources. The wells lack safety measurements, making them vulnerable to contamination by floodwater from rivers. It is also unusable during the dry season due to lack of water (Molsbergen, 1931). To solve this problem, families from the upper classes employ water carriers to bring water to households. Water carriers collect clean water from various springs and supply it to the city for money. Jerry cans are typically used for household water transportation (Mutawally & Mahzuni, 2023).

Unlike the upper classes, the lower classes utilize the nearest water sources such as rivers for their daily needs. Rivers serve various purpose including for bathing, defecation, waste disposal, and bathing livestock (Sanusi, Arif, & Hasyim, 2022). They bathe and clean their clothes in river together, however, bathing areas for men and women are kept separate. They also built a bamboo latrine on bank of river for defecate (Burgerlijke Openbare Werken, 1920; Tillema, 1915). Therefore, the lower classes are vulnerable to disease outbreaks from the utilization of surface water (Emalia, 2020). During that period, people were not aware of the importance of hygiene as they did not understand the connection between waterborne bacteria and illness (Budiman, 2022).

After the fall of the Cirebon Sultanate to the Dutch East Indies Company (VOC) in 1681, the company then established a fort called *De Beschermingh* (The Protector) at the mouth of the Sukalila River as the company's economic and political centre. The company orientation only focused on the economy, causing changes in city morphology that followed economic needs. At that time, there was a change in settlement patterns, which were initially scattered in villages according to stratification and professions, becoming concentrated near ports and forts. As a result, the city became densely populated and brought problems to the city in the next century (Hendro, 2014).

In the 19th century, Cirebon faced water scarcity and disease outbreaks. The eruption of Mount Ciremai in 1805 contaminated the city's water supply. In addition, the buildup of waste being disposed of into the river results in water pollution. Urban inhabitants dispose of a variety of trash, including kitchen scraps and animal remains into rivers leading to floods in multiple locations. The city faces a clean water shortage leading to frequent disease outbreaks. For example, the cholera epidemic in 1805-1806 resulted in the death of a quarter of the city's population (Emalia, 2020). However, the colonial government viewed the clean water shortage for ships as the only concern due to its potential impact on colonial economic activities.

The initial attempts to supply clean water began during residency leadership of Mathijs Waterloo (1809-1815). During his tenure, he ordered the construction of Silayar Canal which channelled clean water from Cipager River to pond at Pasar Balong. The pond water then transported through clay pipeline to harbour in the north. The canal was built to provide clean

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water supply for ships, not to meet the needs of urban population. However, Urban dwellers negligent behaviour such as waste dumping into the river and vandalizing the clay pipe contaminated canal water. As result the canal could no longer be used and Waterloo received a reprimand for failing to provide clean water for ships (Emalia, 2020; Molsbergen, 1931).

Between 1850 and 1910, the population density of Cirebon City increased by 260%, while employment growth was only 75%. The population increase was a result of the urbanization of the indigenous inhabitants, who sold their land to European and Chinese entrepreneurs. Consequently, a large number of them work as peddlers and small-scale sellers. Such as *warung* vendors, factory laborers, and water carriers (Sulistiyono, 1994). Urbanization led to an increase in the number of water carriers in cities. They functioned as transporters transporting water from springs to households and expanded their services to include distributing water to ships at the port. As a private firm, the price is decided by the availability of water in nature. The colonial authority, which relied on them, started to be alarmed by the shifting prices. Therefore, they need additional initiatives to supply ships with clean water (Mutawally & Mahzuni, 2023).

The Dutch government began drilling modern artesian well in Amsterdam from 1839-1853. In 1853, the government built an artesian well in Haarlem which succeeded in solving the water crisis in Amsterdam (De Vries, 2007). This achievement motivated the colonial government to construct artesian wells in the Dutch East Indies. In 1863, the central government sent a delegation to discuss with Regent of Cirebon about construction of artesian well. The decision was made to drill a well in *alun-alun*. A 90-meter-deep artesian well was successfully built after months of work. However, the well was not producing water. The government then built two new artesian wells near border of Cirebon District. The well was built facing Mount Ciremai in hope that pressure on the slope could release water to the ground surface. However, water also does not come out of artesian wells (Molsbergen, 1931; Tillema, 1915).

Liberal Economic System implementation in 1870 changed the management of the Dutch East Indies. After economic liberalization, the purpose of colonial government changed from being an estate manager of a vast government industry to a facilitator of private sector participation. At that time, there was a change in the government's view, which saw that urban infrastructure was vital because it supported the livelihoods of European entrepreneurs. The project of creating a modern city with all the urban infrastructure to support the influx of European was begun, setting in motion a process that would change the urban landscape and the relationship between urban populations (Kooy & Bakker, 2015).

Apart from that, economic liberalization also caused many entrepreneurs to come to the Dutch East Indies. Entrepreneurs who were doctors brought germ theory, while engineers brought European water pipe technology to the colonies. The Germ Theory changed the views of the colony doctors, who still held the miasma view at that time. The newly settled Europeans brought the discourse that contaminated water contained germs which contributed to the spread of disease. Therefore, the need to make germ-free clean water from artesian wells or springs has emerged. Since 1873, in Batavia, clean water began to be provided through artesian wells (Kooy & Bakker, 2015). This effort is also applied in other places. For Cirebon, water supply provision came from spring.

Pipeline Water Supply Development in Cirebon (1878-1940)

In 1878, the central government funded an expedition to search for water sources in the Cirebon Residency. After conducting a series of searches, the explorers discovered a spring in Sijambu, Kuningan. In the same year, the government allocated *f* 82,500 for a clean water pipeline from Sijambu to Cirebon District. The pipeline construction was completed in 1880 and clean water

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stored in seven reservoirs. Due to its distance from the city, the water flow rate is limited to 6 litres per second. To overcome this problem, the central government allocated additional *f* 1,000 to fund new exploration. In 1884, explorers discovered a new spring in Jasi and Bunut. However, exploration was halted midway due to insufficient personnel. The remaining funds were then allocated for building a new reservoir in Sijambu. The project was unsatisfactory as water flow rate remained unchanged (Molsbergen, 1931).

In order to improve the water flow, the central government plans to build additional pipelines and reservoirs. In early 1884, a team of engineers was assembled to design plans for additional water pipeline and reservoir. After month of work, they produced a map titled "*Ontwerp drinkwaterleiding voor de stad Cheribon*" (Design of a clean water pipeline for the City of Cirebon). Based on this map design, the pipeline and reservoirs require an area of 195.5 hectares. The engineers also suggested adding a spring at Kemantren to support the Sijambu pipeline. The construction project was completed in 1886 and produced new reservoirs in Kematren, Sendang, Kecomberan, and Gambirlaya (Grijns, 1917; KITLV, 1884). The Sijambu water pipeline has succeeded in removing the port from dependence on water carriers. Figure 2. below contains additional information about new reservoirs in Cirebon.

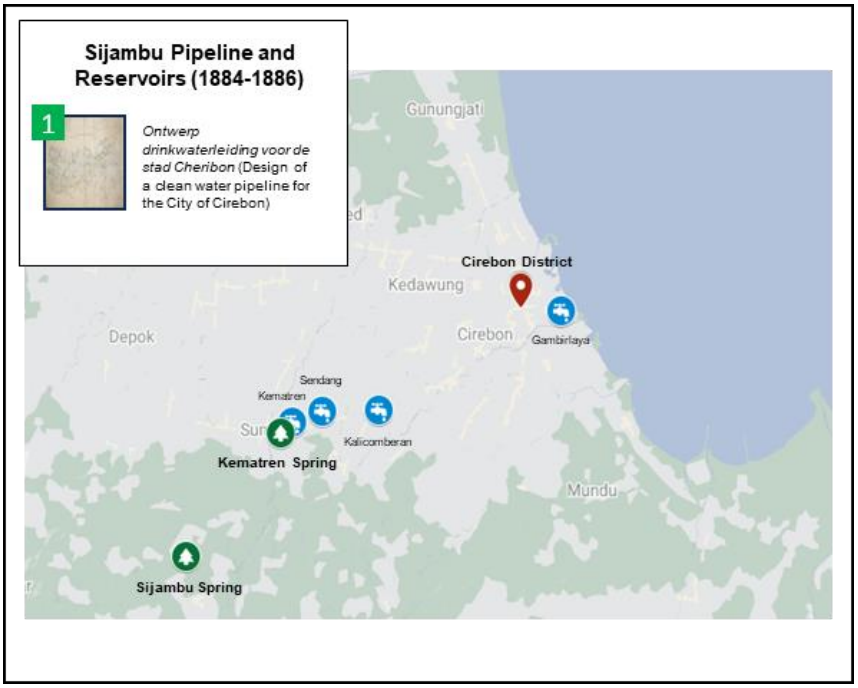

Figure 2. Design of a clean water pipeline for the City of Cirebon in 1884

Source: KITLV, 1884

In 1887, Cirebon experienced a severe clean water shortage and cause concern among European population in the city. The government arranged a meeting for official and engineers to discuss the increasing severity of the situation. Jan Ilcken, a leading engineer in Cirebon, proposed to replace concrete pipes with larger iron pipes. In response to Ilcken proposal, central government allocated *f* 137,547 to fund pipe replacement and new reservoirs construction in 1889 (Molsbergen, 1931). Ilcken also appointed to supervise the construction. However, he could not supervise the construction to completion as he was taken to Nethelands in 1890 due to severe illness (Heurn, 1896).

In February 20 1891, water reservoir in Lawanggada was opened by the inaugurated Cirebon Regent, R.A.A. Soeraadiningrat. Lawanggada Reservoir has a volume of 500 m^3, which makes it possible to build more pipeline network in the city. In 1893, 10 water pipeline and 43 hydrants

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were installed with the largest network in Tangkil. Construction of pipelines and reservoirs increased the water flow to 9.1 liters per second. However, due to uncontrolled population growth, clean water can only be enjoyed for a few years. Consequently, numerous urban inhabitants resorted back to contaminated river water for their daily needs. As results, Cirebon suffered a cholera outbreak in 1901-1902, which infecting 50,000 city residents (Emalia, 2020; Molsbergen, 1931; Tillema, 1915).

As a form of ethical policy system implementation. In 1903, the central government passed the Decentralization Law, which gave regional residents autonomy to govern their regions. It was done because the centralized colonial government system could not serve the needs of an increasing population. As a result of the implementation of this law, 15 municipalities were established in the Dutch East Indies, including Cirebon (Nugraha & Lubis, 2017). The municipality council (*gemeenteraad*) would oversee financial arrangements and regional regulations. Cirebon obtained municipal status on April 1 1906. Since then, development matters in Cirebon have become the responsibility of the municipal government, including handling clean water. Based on article 3, clean water management matters were handed over to municipal governments (ANRI, 1906).

In the early 20th century, physicians in the Dutch East Indies realized that improving infrastructure and altering people's behaviour was essential in policy implementation. They realize the importance of discouraging urban residents from utilizing rivers and encouraging them to rely solely on piped water (Kooy & Bakker, 2015). In 1911, indigenous city residents requested the municipality to repair the hydrant, but the department director refuse their demands citing a shortage of staff for repairs (Tillema, 1915). In 1913, a group of physicians requested the city authorities to reassess the water quality in Cirebon. They speculate that the inadequate water flow and the water's deteriorating condition are the reasons why residents are hesitant to use clean water. Nevertheless, the request was once more denied by the municipality government, this time on the grounds that the city-assigned physicians did not perceive a necessity for increasing the water discharge (Bataviaasch Nieuwsblaad, 1913).

During rainy season in 1917, municipality council leader J.H. Eycken expressed dissatisfaction with increasingly dirty pipe water. He then submitted a report to municipality health laboratory to assess the pipe water quality. Lab test indicate that Sijambu spring no longer suitable for use due to germs from rainwater. Eycken then arranged a meeting with council to find an alternative water source to replace Sijambu spring. In 1918, municipality council financed an expedition to explore new water source in the Cirebon Residency. The explorers located two springs in Cipaniis and Sumber as replacement. Cipaniis spring has a higher flow rate and pristine water quality compared to Sumber. However, Sumber was selected by council due its proximity to Cirebon (Kerchman, 1930; Molsbergen, 1931).

In 1918, council allocated *f* 200,000 initial funding for pipeline construction from Sumber. The pipeline from Sumber was constructed between 1918 and 1924 with assistance of contactors Sitsen and Louzada (Kerchman, 1930). The construction cost soars up to *f* 440,000, increased construction costs are due to pipe replacement. Initially the pipe used had a discharge of 9.1 liters per second, but after further investigation the spring could accommodate a water flow rate of up to 40 liters per second. Therefore, the pipe then replaced with a larger pipe. The pipe releases water at a rate of 40 liters per second into a new reservoir in Sumber, which can hold up to 800 m^3 of water. The clean water service radius has expanded to 16 km due to increased water flow rate. According to water engineering experts, the Sumber spring is projected to provide sufficient clean water until 1940 (Molsbergen, 1931).

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However, uncontrollable population growth and extreme drought from June to October 1929 led to water flow reduction from 40 liters to 25 liters per second. Consequently, numerous regions in Cirebon also suffer lack access to clean water. In same time, residents of Cirebon were surprised to find water contaminated with feces, possibly due to contamination from fertilizer factory in Sumber (Bataviaasch Nieuwsblaad, 1929). The failure of the Sumber Spring to meet the needs of the city's population has revived the discourse on building a pipeline from Cipaniis (Molsbergen, 1931).

In February 1930, municipal council initiated a survey in Cirebon Residency to map the land for Cipaniis pipeline network. In April 4, 1930, council instructed municipal health department to assess the quality of Cipaniis spring. Following an extensive laboratory testing, municipal engineering department then tasked with project designing by 1931 (Molsbergen, 1931). The construction project was delayed because of disagreement among council member about the designs. Disagreement emerged as engineering department aimed to implement a pipe with flow rate of 110 liters per second, while land survey department insisted on constructing a reservoir to reduce construction expenses (Nederlandsch-Indië, 1932, 1935). In 1935, engineers S. Snuijf and C.P. Mom wrote a letter to the council urging them to speed up the construction due to the deteriorating water supply in Cirebon, which ended the tensions (Bataviaasch Nieuwsblaad, 1935).

The project resumed under Mayor C.E.E. Kuntze (1936-1938). Kuntze arranged a meeting with council to discuss the status of Cipaniis pipeline on July 8, 1936. As result, Clean Water Supply Committee was established chaired by Oey Kok Tjing, and including Raden Enoeh, Pieplenbosch, M.R. Bartelds, and Ribberink. The committee was established to speed up the construction of the Cipaniis water pipeline and creating new pipe network design (Algemeen handelsblad voor Nederlandsch-Indië, 1936). The City Council assembled on December 27, 1936, to discuss on the pipeline design. The design was approved by all municipality council members, the mayor, and residents of Cirebon. The mayor approved the construction using the committee's design (Bataviaasch Nieuwsblaad, 1936).

Cipaniis pipeline construction began in 1937. Five contractor companies, including Sitsen and Louzada conducted the work. The council initially allocated funds totalling *ƒ* 54,875 for construction. In April 1937, three reservoirs, underground chambers, and pipes were constructed in Cipaniis (De Locomotief, 1937). Due Mount Ciremai Eruption in mid-1937, the council borrowed *ƒ* 250,000 from *Volkscredietbank te Cheribon* (Cirebon People's Credit Bank) to expand the project. The majority of the loan, *ƒ* 175,000, was allocated for expanding the construction of the Cipaniis pipeline and reservoirs, while the rest was utilized for repairing hydrants, urban pipes, and swimming pool projects in Cirebon (Bataviaasch Nieuwsblaad, 1937; De Locomotief, 1937). The pipeline construction was finished on March 19, 1938. The mayor and council visited Cipaniis on April 1, 1938, to open the pipeline (Bataviaasch Nieuwsblaad, 1938; De Locomotief, 1938). The municipality of Cirebon no longer needs the Sumber Spring. After two years of planning, the council ceased the distribution of clean water from Sumber to Cirebon on April 26, 1940. The pipeline from Sumber then transferred to Cirebon Regency (Bataviaasch Nieuwsblaad, 1940).

Distribution Technology

Before the construction of modern pipelines, the inhabitants of Cirebon were already acquainted with the pipe distribution technology. Bamboo pipe lines are frequently constructed by indigenous communities to transport water from rivers or water sources to rice fields. Water employees also utilize bamboo pipe technology to direct water from sources to jerry cans. The construction of this pipeline inspired the construction of the Pasar Balong pipeline using clay

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pipes. The Pasar Balong pipeline is located underground, beneath rice fields and swamps. Rice fields and swamp plants often infiltrate the clay pipes, causing leaks. Concrete pipes are also used alongside clay pipes, but their durability is restricted. In 1889, the colonial government introduced iron pipe technology to Cirebon at Jan Ilcken's recommendation. Besides iron pipes, the colonial government introduced modern water reservoirs and hydrants (Ilcken, 1892; Molsbergen, 1931).

Before 1935, water in reservoirs in Cirebon was treated with chlorine and disinfectant to remove germs and harmful chemicals. In 1917, Grijns observed that the water in the Sendang reservoir looked bubbly white because of excessive chlorination before it was filtered (Grijns, 1917). Aside from chlorination, the water in the reservoir is also aerated. The spring water is contaminated with iron as it flows through iron pipes. Aeration methods eliminate iron from water (Van der Linde, 2020). Aeration methods are used to remove particular gases, like ammonia. Eliminating ammonia from water enhances oxygen levels, improving water quality (Purba & Hartini, 2013).

The water reservoir in Cirebon have two large brick-based tanks (Eyken, 1917). The tank has two pipelines: one for delivering clean water to the hydrant in the city and the other for drainage (Grijns, 1917). Hydrants were strategically positioned along roadsides, similar to other urban areas in the Dutch East Indies (Tillema, 1915). According to the 1909 report, the water pipe in Cirebon City has a diameter of 6 meters and connects to 51 hydrants (Burgerlijke Openbare Werken, 1909). The topography of Mount Ciremai facilitates the distribution of water from the spring to reservoirs in due to gravity.

In 1935, S. Snuijf penned a letter to the Cirebon municipality addressing water problems in Sumber. He claimed that utilizing spring water with chlorine and disinfectant leads to worse water quality, unpalatable taste, and increased processing costs. He suggested using a lime saturator with activated carbon filtration. Utilizing carbon filtration can reduce costs and enhance the quality of water. Snuijf admits that the expense of overseeing water management through this method will be more expensive. According to his calculations, managing this way could result in up to *f* 300,000. Snuijf then recommended building a pipeline from Cipaniis because the cost of construction was cheaper with cleaner water than extensive water treatment (Bataviaasch Nieuwsblaad, 1935).

In 1937, during the construction of the Cipaniis pipeline, the municipality built a water tower in Perujakan with a capacity of 875 m3. The Perujakan Water Tower, like other colonial-era towers, balances the water pressure from spring reservoirs. Thirty-two iron pillars support the water tower, which has a height of 21.2 meters. The tower's sturdy and impressive design established it as a significant landmark in Cirebon (Van der Linde, 2020). Cipaniis spring has acidic water which poses a risk of damaging iron pipes, reservoirs, and water towers. Because of that Water undergoes a deacidification procedure to reduce acidity (Bataviaasch Nieuwsblaad, 1937).

Management and Policy

The management of clean water distribution is overseen by company named *Cheribonsche Waterleidingbedrijft* (Cirebon Water Company). This company operates under the supervision of municipal public works department (Tillema, 1915). Water company hire engineers and water carrier as part of their staff. In addition, the company also partners with physicians, engineers, and geologist from other department or municipality to ensure water safety. Physicians tasked to monitor water conditions in the laboratory, while geologist map the geological conditions in Cirebon.

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There are two services provided by the company, namely public clean water and commercial water. Urban residents received free water access from hydrants or public restroom. Water company also supplies commercial water to multiple industries in Cirebon. The municipality generates revenue from distributing water to ice factories, trains, ships, hotels, school, barracks, and swimming pools (Eyken, 1917). Municipality establish a rate *f* 0.2 per m^3 of clean water supplied. Commercial water generates a net profit of *f* 12,000 annually (Tillema, 1915). In addition to supplying water to large industries, company also provide water delivery services to residential areas through water carrier. Water companies charge rates ranging from 2 to 4 cents per picul of water (equivalent to 35 litres) or approximately *f* 0.6 to *f* 1.3 per m^3, based on the proximity of the house to the hydrant. However, water prices can rise to f 1.8 per m^3 during the extreme drought season (Molsbergen, 1931). The management scheme for clean water supply in Cirebon is illustrated in Figure 3.

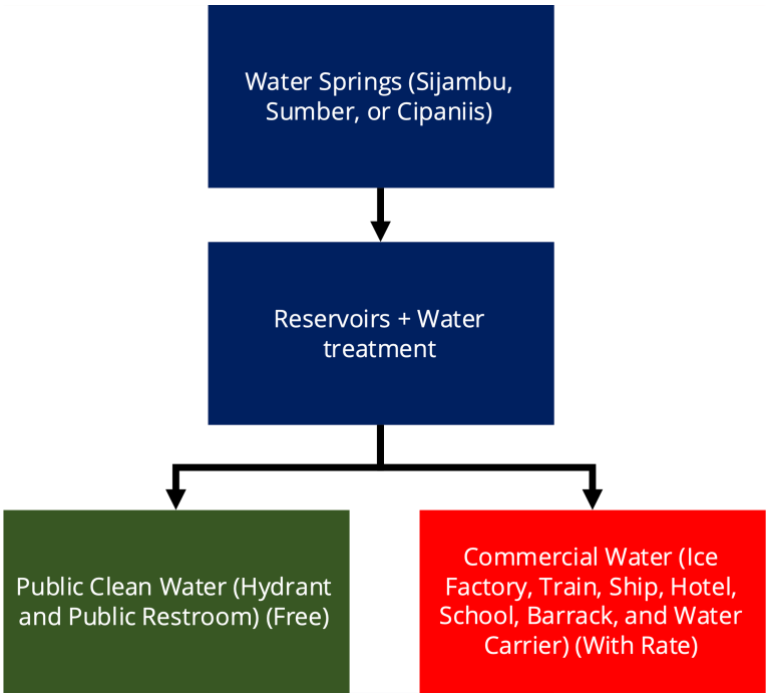

Figure 3. Management of clean water distribution in Cirebon

Sources: Eyken, 1917; Tillema, 1915

However, public clean water does not receive good service. Based on the 1909 Public Works Department report, of the 51 hydrants in Cirebon, only 27 were still operational (Burgerlijke Openbare Werken, 1911). Public water services in Cirebon prioritize only European people. Inadequate hydrants and poor water supply frequently cause conflicts between water carrier and indigenous inhabitants. Water carriers who noticed that hydrants were easier to reach stopped getting water from sources beyond the city, leading to a conflict between the two groups (Mutawally & Mahzuni, 2023). Despite the construction of public toilets in 1919, indigenous communities continued to struggle to access water. Unlike Europeans, who have access to water within their own homes behind closed walls (Taylor, 2011). The problem was later solved in 1937 with household plumbing service (Mutawally & Mahzuni, 2023).

In September 1937, municipality introduced a new regulation which effective from January 1, 1938. According to new regulation, every household in Cirebon is required to have clean water plumbing installed and pay a monthly rate *f* 7.5 to the water company. Although not mandatory, residents are encouraged to register in order to access water company pipelines. Many urban dwellers are intrigued by this service as it eliminates the need travel to a hydrant or hire a water

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carrier. Up to 1100 new pipelines were installed to households. Urban inhabitants no longer need to rely on hydrants or water carrier to fulfil their daily needs (Nederlandsch-Indië, 1937).

Conclusion

Before the introduction of water pipe technology by the colonial government, Cirebon residents used wells, water carrier, or water sources for their needs. However, environmental pollution causes a clean water crisis and disease outbreaks. The emergence of the Liberal Economic System changed the colonial government's view of providing clean water supplies for European entrepreneurs who migrated to the Dutch East Indies. From 1878 to 1940, Cirebon used three springs as sources for pipelines: Sijambu (1878-1924), Sumber (1924-1940), and Cipaniis (since 1938). The presence of pipelines brought air processing technology such as hydrants, reservoirs and Western-style water pipes to Cirebon. Future research should focus on water supply in Cirebon after Indonesian independence.

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