

(POLITIC) DUTCH FLOOD CONTROL IN SURABAYA 1906-1942

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Abstract

Surabaya was one of the important cities in the Netherlands Indies since the nineteenth century. However as a coastal city, which had many potential plantations, busiest business districts & port, naval based, and defense area, Surabaya also faced annual flood problem in rainy season. So, what were the cause and the impact of the flood problem in Surabaya? What was the Dutch colonial government done to overcome flood and its impact? What was the Dutch's motive on its efforts? This paper would like to know the Dutch colonial's flood control in Surabaya city from 1906 to 1942 and its motivation. As a historical study, this paper uses literature study that is started from the colonial period. Finally, flood control was necessary for Surabaya where many ethnics and important economic activities based which needed good infrastructures and healthy environment. Therefore, flood as the source of diseases and inconvenience had to be eradicated from the influential city.

Keywords : flood, Surabaya, Dutch, health, hygiene, environment, disease.

Abstrak

Surabaya merupakan salah satu kota yang penting di Indonesia pada abad ke-19. Sebagai kota pesisir atau dekat dengan laut, Surabaya memiliki banyak perkebunan-perkebunan yang potensial, wilayah dan pelabuhan yang sibuk, serta sebagai basis angkatan dan wilayah pertahanan laut Belanda. Namun demikian, Surabaya juga menghadapi persoalan banjir yang sering terjadi pada musim penghujan. Kemudian, apa yang menjadi penyebab dan dampak dari banjir di Surabaya saat itu? Apa yang dilakukan oleh pemerintah Belanda untuk mengatasi banjir dan dampaknya? Apa yang menjadi maksud atau tujuan dari pemerintah Belanda dalam mengatasi banjir? Tulisan ini mencoba untuk mengetahui upaya pemerintah Belanda dalam mengatasi persoalan banjir yang terjadi di Kota Surabaya pada tahun 1906 hingga tahun 1942 serta motif di balik usaha tersebut. Sebagai kajian sejarah, tulisan ini menggunakan studi literatur yang dimulai sejak masa kolonial Belanda. Pada akhirnya, penanganan banjir merupakan sebuah kebutuhan mendesak bagi kota Surabaya yang merupakan kota dengan beragam etnis dan kegiatan ekonomi yang sangat penting bagi kolonial Belanda di mana semuanya membutuhkan infrastruktur baik dan lingkungan sehat. Oleh sebab itu banjir sebagai sumber dari ketidaknyamanan dan penyakit haruslah dijauhkan dari kota Surabaya.

Kata kunci : banjir, Surabaya, Kolonial Belanda, kesehatan, kebersihan, lingkungan, penyakit.

I. INTRODUCTION

In the early twentieth century the Free Flood Effort Program (*bandjirvrijmaken*) was applied with the irrigation program as part of the Ethical Politics. Generally, The Ethical Policy (1901-1942) became one reason for the Netherlands to assume responsibility for improvement within its colonies. The social effect of the Ethical Policy could be seen in the new neat public space of cities (Vickers, 2013:24), which the Department of Public Works had significant role in the construction of major public infrastructure (buildings, roads, ports, flood control, irrigations) and introduced city planning.

In case of Surabaya, the historian H. W. Dick (Dick, 2002, 159-160) gives several reasons why it was important for the Dutch to provide basic infrastructure in Surabaya (in Ethical Policy years). First, it was seen as important to improve Surabaya to a standard of cities within the Netherlands. This was because as the result of population growth and if the condition of Surabaya was compared to other European colonies such as Singapore under the colonial British, or even Batavia, Surabaya was in a worse state in urban living standards. Second, it

was important for the government to be involved in any necessary improvements, and the third, the increase of population and land usage became the essential problems of city development.

Howard Dick (Dick, 2002 : xvii) describes how Surabaya developed into a large port city in the nineteenth century, especially after the 1870s when East Java became the frontier of the expanding plantation economy. Just like Jakarta, Surabaya had a modern harbor, railways, sugar mills, dockyards, and other facilities. These had transformed Surabaya into a modern port city similar to places like Calcutta, Rangoon, Singapore, Bangkok, Hong Kong, and Shanghai. However, Surabaya had continuously expanded in population number (both through the urbanization processes and the increasing birthrates) and the consequent intensification to the land use prompted the colonial city administration to take care of public facilities like the provision of drinking water, sewerage works, and some strategies to combat *bandjirs* (floods) which turned out to be the main problems of the developing city (De Jong dan Ravesteijn, 2008:61).

Since the last 19th century, the expansion of colonial cities including Surabaya had forced colonial administration to provide technologies to limit natural and environmental problems, which the legacy of the Dutch technology is still visible in Surabaya (and other cities) and become a witness to the ability of the colonial engineers since that nineteenth century. This colonial technology evolved since the cultivation period (*cultuurstelsel*) which directed to minimize the effect of the natural disaster on the colony's economy. In case of flood problem, in effect, flood management systems were constructed along with the irrigation systems. Canals, drainages, dams, reservoirs, and floodgates were designed to move the water of rain and flood to the storage or to prevent it.

The efforts of Dutch colonial engineers in progressing of tropical water works were appreciated by some historians and political scientists. However, the good reputation of the colonial engineers (in water works) was faced the current flood problems. In Surabaya, the current Surabaya's flood analyses conclude that Surabaya floods are getting worse because the original drainage constructions dating from the colonial period were a localized construction and did not succeed in moving the water out of the city. In other words, the colonial waterworks tended not to be connected into some sort of master plan (*Detik Surabaya*, 2008), while modern studies of urban flood management conclude that efficient flood control can only be established by a good city-wide master plan in which both causes and impact are carefully considered (*Detik Surabaya*, 2008).

This paper would like to explain about: how was the problem of flood in Surabaya (1906-1942) in terms of cause and impact? How did the Dutch administrators fight against the floods and what was Dutch's motive? This paper is a historical study on Surabaya city in terms on flood problems in the colonial period. This research is based on Indonesian and Dutch Newspapers and government reports like the *Waterstaat* (water) report in the Netherlands Indies, *Verslag over de burgerlijke openbare werken in Nederlandsch-Indië 1e gedeelte: Gebouwen en assaïneringswerken* (Report on civilian public works in Dutch-India 1st part: Buildings and assaïning works), and *Verslag over de Burgelijke van Openbare Werken in Nederlands Indies 5e gedeelte: Bevoeiing, afwatering en waterkeering* (Report on the Civil Service of Dutch Indies 5th part: Irrigation, drainage and watering).

The change in the status of Surabaya into an independent city through decentralization act of 1906 (when the cities were given the authority to make their own decision and to manage their own administration) determines the starting period of this study. While the end of Dutch colonial rule by the Japanese in 1942 (Ricklefs, 1993:181) marks the end of this study.

II. SURABAYA CITY

Surabaya was one of the important cities in the colonial period especially after Governor General Daendels pointed Surabaya as a principal base of Colonial Navy in 1808. Since this period, Surabaya position on the Madura Straits was regarded as the most strategic place for a defense town (Diessen, 2004:60-61). Gradually, Surabaya.s position increased important when the Marine Establishment was founded in 1846 at the mouth of Kali Mas (Golden River), which popular as Surabaya.s naval quarter. This important position indirectly had accelerated Surabaya.s economic growth and (urbanization) population number which impacted on the expansion of urban space and the change of environmental condition.

As a residency, Surabaya encompassed five districts or regencies, such as Surabaya, Jombang, Gresik, Mojokerto, and Sidoarjo. On 1 April 1906, under *Decentralisatiebesluit* (Decentralization Order) and the *Locale Raden Ordonnantie* (Local Councils Ordinance), Surabaya district became independent as the Municipality (*Gemeente*). In this period, Surabaya city had population density around 350 people per hectare (Faber, 1937:1).

As a big deltaic city in the coastal area, Surabaya seems to be fertile, even though Surabaya was considerably vulnerable to flood water flow (from river into the sea) and backwards threat. Generally, the rainy season in Surabaya occurred from November to April. Heavy rain generally happens between December and January. Surabaya has the rainfall average about 181 mm (millimeter) and the rainfall goes above 200 mm from November to April (Petra University, Surabaya, <http://www.petra.ac.id/eastjava/cities/sby/sby.htm>). Surabaya has low-lying land and downstream from some rivers (Kali Mas and Pegirian River). Its Surabaya soil structure consists of 80 percent lowland plain, with an elevation of 3-6 meters. The prevailing slope of the low-land plain is about 0-2 percent and this area is located in the southern, northern, and eastern parts of the city. Surabaya has a rolling plain with an elevation of 5 meters above the low tide level and the slope is 5-20 percent, which this area is usually located in the west of the city. Meanwhile, the northern and eastern parts incline inundated areas, where the flat plain makes water slowly discharge to the sea (Susetyo, 2008:2).

Surabaya.s lands were mostly used for settlements, industries, factories, office buildings, public facilities, plantation, rice fields, and ponds. Nowadays, Surabaya.s area is about 32,667 Ha (with 2,599,796 inhabitants) and around 80.72% is lowland areas with average height of 3-6 meters above the sea level. In 1906, Surabaya area was around 4,275 Ha and had 150,188 habitants that consisted of 124,473 indigenous people, 8,063 European, 14,843 Chinese, 2,482 Arabs, and 327 Foreign Easterners (*Vreemde Oosterlingen*). In January 1917, Surabaya.s population was around 160,355 people with 20,847 Chinese communities, 15,000 European communities, 2,553 Arabs, and 121,559 indigenous people (*Verlag der Gemeente Soerabaja over 1917*, 1918:10).

Table 2. 1. Number of Surabaya's Population between 1905 and 1940

Years	Total
1905	150,000
1906	150,188
1917	160,355
1920	192,000
1930	331,509
1940	400,000

Source: *Verlag der Gemeente Soerabaja over 1917* and Von Faber, *Nieuwe Soerabaia: De Geschiedenis van Indie Voornaamste Koopstad in de Eerste Kwarteeuw sedert Hare Instelling 1906-1931*.

Surabaya population was highly increasing in the period of 1900s, from only 150,000 people in 1905 to 192,000 in 1920, 331,500 in 1930 and reached 400,000 people in 1940. In 1930, Surabaya covered 8,280 Ha with 331,509 inhabitants that comprised of 260,537 indigenous people, 26,376 European, 38,928 Chinese, and 5,668 Foreign Easterners (Faber, 1937:2). Generally, the number of the European in Surabaya was higher than in Batavia and Semarang. The ethnic composition in Surabaya comprised of indigenous people (Indonesians), Chinese, European, and Arab or other Asian. The number of European gradually increased, especially after the opening of Suez Canal (1867) and the increase of the role of Surabaya's port (Tanjung Perak) as the center of international trade in Java. As time went by, The Chinese number also increased, especially after 1911, when the government gave the Chinese a greater freedom of movement and activity in the city. Finally, Chinese bourgeoisies developed and they were easily diffused with European (Faber, 1937:61).

Table I.2. Ethnic Composition of Main Cities, 1930 (%)

Region	European	Chinese	Other Asians (Mainly Arabs and British Indians)	Indonesians
Batavia	6.9	14.8	1.4	79.9
Surabaya	7.6	11.4	1.6	79.4
Semarang	5.8	12.6	1.0	80

Source: H.W. Dick, *Surabaya, City of Work*, 2002, p. 125.

The number of the Europeans in the city was constantly rising. In 1813, there were only 307 Europeans and they became around 2,000 in 1830, 3,000 in 1850, 4,500 in 1870, 7,500 in 1890, and about 10,000 in the end of the nineteenth century. The Europeans were generally middle and upper class, who worked as government officials, traders, and industrial heads and investors (Faber, 1931:61).

3. Surabaya City and Rivers

One of main rivers¹ in Surabaya is Kali Mas. The important of Kali Mas had been known since Majapahit Kingdom (around the 14th and 15th centuries), when Surabaya had become an important and busy river port. Majapahit Kingdom established its central administration in the west of Kali Mas (now is around Pasar Besar area) and in the northern or eastern part of Kali Mas became a trading center, where the Chinese and the Arabs lived and later on became Chinese and Arabs settlements.

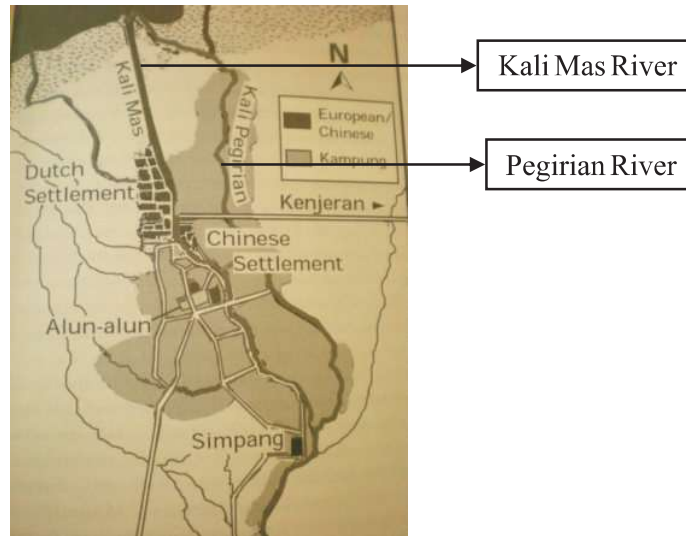
Kali Mas was an important lane for transportation or trading route that generated the growth of traffic signs, ports, lodgings, warehousing, and permanent settlements. Since 1830 some parts of Surabaya residency such as Jombang, Kediri, and Madiun planted sugarcanes, beside coffee and tobacco. All these products were distributed through Kali Mas. Kali Mas was also important for water supply, refreshment, and flood control. H.W. Dick (Dick, 2002:7) mentions that before World War I, Surabaya was a roadstead port and ships would have anchored among many others at the mouth of Kali Mas with its rich flow of commerce. Kali Mas continued to flourish as the center of the city with various settlements (of Western, Far Eastern, and indigenous people) and facilities, while (other side Kali Mas) Pegirian River was more dominated by agricultural lands and *kampongs*. Many indigenous *kampongs* sited surrounding winding river of Pegirian that usually hit by flood (because of poor sanitation and drainage) and post-flood problems, such as wide, long and dirty stagnant water, diseases, lack

¹ Other rivers that are well known in Surabaya are Pegirian, Porrong, Jagir, Brantas, and other rivers.

of clean water, properties and infrastructural damage (street, well, and other facilities).

Increasing population number had forced Surabaya city to expand, from the north (old city) to the southern part (new city). In general, Surabaya Municipality was divided into two major parts, Upper Town (Kota Atas *bovenstad*) and Lower Town (Kota Bawah *benedenstad*) where was characterized by many marshy lands. This city enlargement was accompanied by infrastructural facilities, such as main streets, new & wide residences, and also many villas were built by high government officials and rich traders (Basundoro, 2009:3).

Map 3.1. *Benedenstad* (Lower Town) of Surabaya (1787)



Source: H.W. Dick, *Surabaya, City of Work*, 2002, p. 329

In 1925, many factories and companies were established along Kali Mas (Governmental Surabaya City, <http://www.surabaya.go.id/dinamis/?id=641>). In the west bank of Kali Mas (opposite to the Marine Establishment), a new modern seaport of Tanjung Perak was established in the period of 1912-1925. Furthermore, new elite settlements, industries, trade, offices, companies, public areas, and urban population rapidly grew and affected the increase of land necessity that settlements and facilities usually competed in land seizing. Every year new housing was opened in some areas. These conditions eventually generated new problems for the city, such as the reduction of the catchment areas and the other ecological problems. The enormous increase of population threatened not only the city sphere, but also the river quality, such as silted canal and river (with household and industrial sewage and garbage that created sedimentation, unpleasant smell, inconvenience and disease). Besides, the clearing of the upland forest also impacted to the high of runoff and peak flow of the water on the river and low lands (Dick, 2002:173). Consequently, these conditions led a high flood risk for the city and its inhabitants.

4. Flood Experiences

Surabaya was one of big cities (especially coastal cities) that had risk of flooding during the several months of the rainy season. Newspapers in colonial Surabaya (1906-1942) show that the city experienced heavy rain from December to February, and *bandjir* (flood) usually occurred during this period. The flood frequently came from river overflows and the main cause of these was shallower river due to sedimentation.

Before the twentieth century, flood in Surabaya was usually caused by Brantas overflow which started by the development of plantation and well-organized irrigation (1830s) (Niel,

1992:79). In the 1890s, the scope and productivity of the sugar industry were developed by the introduction of steam tramways and the growth of sugar production. This was followed by the growth of tree-crop production, particularly coffee, in the highland areas (Dick, 2002:41). However, plantation activities worsened the flood problem in Surabaya. Many sugar mills were built at the side of the rivers, into which the cane pulp was frequently thrown. For instance in Batavia, the high sedimentation of cane pulp from the headwaters as well as along the river had reduced the river's capacity. This condition was the same in the downstream city of Surabaya, where two big rivers, Kali Mas and Pegirian, made Surabaya extremely vulnerable to flooding.

In torrential and lengthy rain, a river overflowing could cause property and infrastructural damage. For example, heavy rain on January 10th and 11th 1868 caused the Medjaboeng River on Post Road overflowed so that the water reached as height of three feet inside houses and damage people's properties, dikes and culverts (*Bintang Timor*, 22 January 1868.). Furthermore, flooding in Surabaya also tended to be caused by rainwater from upstream swiftly flowing downstream and flooding the most lowland areas.

Before the twentieth century, every flood frequently took place in the poor areas or indigenous *kampong* squares, which had problem of clogged sewers. Most sewers could not work well in the rainy season and stank unpleasantly in the dry season. The poor sewage system remained in place because the habitants could not afford to construct their own good sewers. Besides, the head of the *kampongs* normally did not have the bravery or encouragement to report the condition of the sewers to the local or central authority.

Flooding also was frequently happened in the marshland. Von Faber in *Oud Soerabaia* describes that in the early nineteenth century Surabaya was typically marsh land which some areas of old Surabaya had no drainage system. Therefore, a swamp was often created in the rainy season, especially in the areas surrounding the Kali Mas and Surabaya River. Therefore, in the nineteenth century, many magnificent and important water works for managing water power were established in Surabaya such as dams, canals, and sluices for flood relief beside irrigation means.

4.1. Flood Cause

Floods are normally caused by natural reasons and human activity. In these last few years of the 21 century, floods are generated by high human activities through the devastation of the natural or environmental stability, such as deforestation, careless garbage disposal into rivers, illegal settlement along riverbanks, and unfriendly environmental development such as massive buildings and real estates on the water catchment areas or highlands, including poor drainage system. Problem of sedimentation due to waste, garbage, mud, sand, and debris had disturbed the rivers' capabilities to accommodate the water and act as a traffic line in the city.

Floodwater from the rivers usually swiftly flowed to the lowlands and the level of the floodwater became worst due to dike damage. In February 1917, broken dikes along the Porrong River (because of water pressure on the Brantas and Porrong Rivers) caused a huge flood in the Porrong area. The floodwater damaged thousands of *bau* (unit area of land) of rice fields and submerged twelve *desa* (villages) (*Bintang Soerabaia*, 17 February 1917). In April 1917, Porrong was again flooded, due to the broken dike and the flood submerged many *desas* (*Bintang Soerabaia*, 16 April 1917).

Flood sometimes was induced by sluice dilemma. In Sawahan and Kedongdoro, in south Surabaya for example, river water frequently overflowed because of a high waterfall and the opening of the floodgates in Kaputren or Gunung Sari. The sluice had to open by directing to other sides to protect an airport and military camp (*Pewarta Soerabaia*, 11 February 1915,

Pewarta Soerabaia, 19 February 1915). Consequently, floodwater submerged areas of indigenous which the depth was as deep as fifty centimeters (created a swamp). Annual flood in those areas forced *kampung* dwellers to raise the height of their land until to one metre, even though this effort hereafter was not successful.

Problem of river overflow was the main cause of flood in the mainland areas including problem of flood tide in the rainy season which made the water from mainland was difficult to reach the sea.² Most of floods because of river overflows were caused by high rainfall and broken dikes as well as insufficient drainage systems, disposal management, and mismanagement of indigenous settlements³ in the mainland. Dike damage, such as in Porrong, caused river water to badly submerge the lowland areas that were usually inhabited by indigenous people. Rivers shifted their flows to broken riverbanks and river water continuously flowed to inland, increasing the flooding. Before the city expansion, mostly indigenous stayed in the city, however, the development of city forced indigenous (no choice and no money) to stay in the flood diversion. Besides, the attention of city administration sometimes was too scant to indigenous flood problems. The lack of reports from surrounding inhabitants and the press meant that the circumstances of the areas of flood were hardly realized by the city government, and there was insufficient direct or further response from the city. So, a lack of attention from the city administrators can cause situations caused by flooding to grow worse.

Exceptional floods frequently hit areas of indigenous people along the Pegirian River (was mostly resided by indigenous people, while Kali Mas River was mostly resided by middle high people and business districts). In 1928, an exceptional flood submerged the *kampongs* along the Pegirian River and surrounding Prins Hendrik fort, which were lower than the southern part and vulnerable to flooding. Flooding in the *kampung* areas near Prins Hendrik frequently ran into houses, sometimes reaching higher than a man's knee. The floods left stagnant water and sloppy, muddy soil. Heavy mud, waste, garbage and sedimentation came from the Pegirian River and caused a terrible smell for surrounding dwellers after the flood had subsided. The overflowing of the Pegirian River happened when the Gubeng floodgate was opened in order to lower the water level of Kali Mas. Generally, tide water from the sea was also problematic for Surabaya Lower Town. Some flood tides submerged areas of the western parts of Kali Mas and Tanjung Perak and caused the river to overflow and drown the drainage system in the city (*Pewarta Soerabaia*, 12 May 1933). The flood left waste and dirt in the drains and streets that caused a disturbing smell.

Abundant rainwater and river water overflow required a final drain such as a river or retention basin. Flooding in the early twentieth century occurred when there was a lack of adequate drains and gutters, and so the water stagnated in the lowland areas. Particular areas without suitable drains could affect other areas. Poor drainage in a marketplace, for example, could badly affect *kampongs* or settlements, since the water from the market carried waste and garbage to those areas. Market waste usually mixed with domestic waste and garbage and congested in the settlements. The congestion of floodwater plus garbage decomposed and caused a terrible stench in places such as the surrounding settlements of the Wonokromo market (*Swara Oemoem*, 10 June 1930).

Problem of maintenance on the drain could cause jammed drains, in which mosquitoes can flourish. In Kaliondo, for example, poor drain conditions caused the rainwater and

² In 1925, an unexpected flood happened. On the Saturday night of early February 1925, the areas of Sidhoarjo and Mojokerto sank into flood because of broken dikes in the Porrong River (*Pewarta Soerabaia*, 3 February 1925). A day after, the areas between the new Porrong Canal and the Sadar River (many villages such as *desa* Ngrane, Gembangan, and Gempol Malang) were flooded due to a broken *gilingi* near Ngrane (because of water pressure on the Brantas River). The authorities took effort (to tame Porrong River) by flowing some Porrong's water into the Surabaya River and Wonokromo Canal, where the water would be brought to the sea

³ Mostly the areas of indigenous were flood diversion which the time before were areas of swamp, rice fields, and soon.

floodwater to flow freely into the local inhabitants. houses and submerged the houses and yards. Because of inadequate dredging, the drains in Kaliondo shallow. In 1906, when *Gemeente* (the Municipality) existed, the drain was 1.5 metres in depth. However, by 1914, the drains were only 0.25 metres deep. Thus, the floodwater easily overflowed and submerged the local inhabitants. dwellings (*Pewarta Soerabaia*, 23 April 1914).

In January 1925, a flood struck many *desa* (villages) in Kupang, Darmo, Banyu Oerip, and Benowo (*Pewarta Soerabaia*, 29 January 1925). A big flood was caused by damage to the Gunung Sari drain and worsened by poor drainage. The health condition in these areas deteriorated as the flood water on the ground stagnated. In 1926, some important areas in Kupang such as parts of Reiniers Boulevard, Opakstraat, Sambasstraat, and Wiesestraat experienced a bad flood (*Pewarta Soerabaia*, 15 February 1926). The water level reached 60 centimetres and was worsened by the ineffectiveness of pumps in Darmo and Kupang to take water from the areas. Besides, the landlords who owned the lands seemed to show little concern for drainage maintenance. Therefore, without control and without cooperation between the state and the population, the flood level in Surabaya became higher and higher every rainy season.

Constructing a plan to increase the effectiveness of pumps or fill the lowland was a rational decision in the middle of environmental and economic problems. However, a decision was made to reduce the size of drains that were seen as having little or no benefit, and some drains were closed altogether. This would later cause problems as, for example, flooding at the Kalongan and Kemajoran *kampongs* occurred due to the closure of a large drain near the *kampongs*, as the remaining small drains could not accommodate the flood water (*Pewarta Soerabaia*, 9 December 1927). Today in Jakarta and Surabaya, city development often sacrifices colonial drains for capitalist interests such as stores and trade buildings. Therefore, floods in big cities such as Jakarta and Surabaya are very difficult to resolved, because of the increase in economic development and population growth.

However, poor drainage not only occurred because of a small number of drainage systems in certain areas, but also because of inadequate maintenance by the authorities and the owners of the drains. The rising level of silt in drains, caused by garbage, or the reduction in size of drains due to sedimentation meant that drains could not work efficiently, and eventually flooding became worse every year.

4.2. Flood Impact

Floods induced damage on infrastructures and properties. Damage to public facilities, such as streets, markets, bridges, and railways required costly reconstruction. Even, post-flood recovery and improvement in infrastructures and other public facilities could be more costly than a flood control project (dikes, pumps, drainages, soon). Surabaya and Jakarta have recently spent a lot of money setting up and constructing a new infrastructure to replace that which was broken by floods. At a community level, building new houses, buying new equipment, clothing, and furniture, psychological and health recoveries, as well as getting a new job are all potential issues to be overcome after a flood disaster.

Even today, the risk of flood remains a serious problem, since flood control is not always successful. Most lowland areas in the northern and eastern part (Kali Mas) of Surabaya are frequently flooded and the floods submerge houses, rice fields, and other facilities.

Overflowing rivers massively harmed farms and plantations along and surrounding the rivers. In the 1916 exceptional flood in Java, landlords had lost hundreds of tons of sugar-cane, besides rice field damage. There were hundreds of *bau* of sugar-cane lands damaged after two months of being drowned under floodwater. The overflow of the Gedek and Kedongsoro

Rivers submerged 90 *bau* (around 63 hectares⁴) of sugar-cane lands and destroyed around 11 *bau* of plants (*Pewarta Soerabaia*, 9 October 1922). In 1925, a large flood at the Porrong River destroyed European, Chinese, and indigenous farms. There were 1,000 *bau* of lands damaged that consisted of 600 *bau* of rice fields, 126 *bau* of sugar plants, and 250 *bau* of lands of villagers (*Pewarta Soerabaia*, 4 February 1925).

In February 1928, flood water from the Konto River damaged many rice fields when sandy and muddy floodwater covered the fields (*Pewarta Soerabaia*, 13 February 1928). In 1936, floodwater and sand damaged thousands of *bau* of rice fields, farms, and ponds in some areas along the Brantas River (*Pewarta Soerabaia*, 8 May 1936). Based on the official report, the Porrong flood (1936) that was caused by broken dikes damaged lands and ponds at many *desas*⁵ in the Porrong district (*Pewarta Soerabaia*, 11 May 1936). There were around 1,500 commercial fish ponds damaged and around 1,400 *bau* of rice fields submerged. The loss from pond damage was around f30,000 and from the paddies around f10,000. Swift river overflow was harmful to agricultural and plantations. Sandy and muddy floodwater were also hazardous for agricultural lands. Agricultural and husbandry damages were mostly suffered by wealthy Chinese and Europeans, who owned large scale farming, plantations and ponds. However, even though the indigenous people had only small scale farms and ponds, the quality of their loss in terms of agricultural and husbandry damage was higher as they were highly dependent (in income) on farms or ponds as livelihood.

Infrastructures were the most vulnerable to be damaged by exceptional or frequent flood. The worst deluge in 1916 and some other exceptional floods caused infrastructural damage in many areas, such as a huge flood because of three days rain in Tanjung Bali. A high water level submerged almost all houses and streets and damaged paddy and plantation warehouses (*Bintang Soerabaia*, 30 October 1916). In November 1917, heavy rain which lasted for two hours submerged many streets and *kampongs* in Ngalik and Kalisari (*Bintang Soerabaia*, 22 November 1917). Flooding in the streets caused damage and eventually disrupted economic activities, especially for the Chinese residents. In February 1916, the Brantas River enormously overflowed in the Modjokerto district. Some public facilities such as railways and rice barns were submerged by water as high as half a metre. The 1916 flood was the biggest flood in 30 years, and it damaged dikes and drowned settlements, streets, steam tramways, bridges, and many stores (*De Locomotief*, 1 February 1916; *Pewarta Soerabaia*, 4 February 1916).

Flooding resulted in loss and damage, and the most influential impact of the flood was the destruction of public facilities such as roads, railways, and bridges that were very important for transportation media of goods and people. Damages on those of could hamper the economic activities, especially for the European, Chinese, Arab, and Malay traders.

The other influential impact was environmental inconvenience. Heavy flooding can leave problems of damage and stagnant water. Stagnant floodwater lowland areas in Surabaya left a severely damaged in local environment. Stagnant water produced an unpleasant smell, while heavy muddy water obstructed people's daily activities. Stagnant water in the residential areas threatened health, as dirty water polluted sterile water (underground water) or became a breeding place for mosquitoes. Stagnant water was usually found the areas inhabited by indigenous people. The floodwater in the indigenous *kampongs* caused dirty and dangerous environment which threatened resident's health. However, sometimes, the report of local people to local medical care service (*Plaatselijke Geneeskundige Dienst*) got a sluggish response or an unsatisfactory result (*Pewarta Soerabaia*, 1 March 1921).

⁴ One *bau* is around 7,000 meters.

⁵ *Desa* Balongtani, Panggrah, Koepang, Trompo, Semamboeng, Kedoengpandan, Kedoengredjo, Djemirahan, and Doekoehsarie.

In 1921, two hundred inhabitants of *kampong* Kemajoran and Kalongan sent a petition to the *Burgemeester* (city mayor) to request the improvement of their residences (*Pewarta Soerabaia*, 17 January 1921). The inhabitants of the *kampongs* were desperate to avoid stagnant floodwater post-flood, and finally Surabaya.s administration tried to conduct *kampong* improvement.

5. Why and What of Dutch Flood Control

Problems of sedimentation because of plantation waste, household garbage, and materials from the Kelud eruption⁶ needed special colonial attention. In the nineteenth century, the colonial government in Surabaya constructed massive water works to support the cultivation system and later on also to evade flood problems. However, diseases and health became essential for Dutch to control flood problems. Flood problems that usually stroke indigenous settlements with poor drainage and sanitation had discomforted colonial government. Flood water that always stagnated in the areas of indigenous had effected to inconvenience and diseases that spread to other places including middle high class settlement and traders dwellings that mostly were European and Chinese.

In the way of structural measure of flood control, many efforts was done by Dutch such as constructing flood system in terms of drainages and floodgates, doing river maintenance, and *kampong* improvement which was aimed to eradicate diseases or to create health and hygiene in the city. First of all, Dutch colonial tried to face flood in Surabaya city by establishing many drains (*loopgraven*) to redirect floodwater from flooded areas to another direction such as to the river or to the sea. In 1917, the *Waterstaatsafdeeling* planned flood-free planning for the central city by a radical change in the hydraulic conditions surrounding Wonokromo (*Verslag der Gemeente Soerabaja over 1917*, 1918:53). The Wonokromo Canal was constructed, while a big ditch and drains were built near Kali Mas and Wonokromo. These works were carried out to overcome flooding of the frequently high river-water level between Wonokromo and Gubeng (*Bintang Soerabaia*, 17 February 1917). The Wonokromo project, encompassing a drainage system, canal, floodgate construction, and land elevation, was handled by the *gemeentewerken* (Division of City Works) and supported by the Mayor and Division of City Health. The importance of the Wonokromo project motivated the *gemeentewerken* and B.O.W to set up a special bureau, the *assaineeringsbureau* (1920), with the special aim of taking out puddles and floodwater in *gemeente.s* and *particulier.s* (private) lands (*Pewarta Soerabaia*, 19 November 1920).

After the 1917 exceptional flood, some improvements were made to existing drains, such as an improvement at Frederik Hendrik straat in the east of Surabaya that cost around f739.62 (*Verslag der Gemeente Soerabaja over 1917*, 1918:192). In the 1920s, drain improvements were conducted in some parts of Surabaya. Beside drainage improvement, a dam (Pewarta Soerabaia, 7 July 1923, 24 July 1923)⁷ was also established at *Bozeemkanaal* (reservoir canal) (*Pewarta Soerabaia*, 28 April 1924). The colonial government also tried to establish pump-station, sewers, gutters, dikes, and big drains in some influential places (middle class settlements, trade center, service areas, and important facilities) that sometimes the fund was bigger than to other places, which then, gutters and drains also necessary built in areas of indigenous people (*kampongs*).

Catchment areas for floodwater also decreased significantly due to the continuous increase of the population, particularly in the 1920s and 1930s, and the economic activities of

⁶ Kelud volcano eruptions in 1848, 1875, 1901 and 1919 brought masses of sand and mud into the Brantas River and this caused high sedimentation and flooding from the Surabaya River

⁷ For improvement and setting up a dam, Lengkong floodgate was closed and its role was transferred to Djagir floodgate, which from Djagir, the water was directed to Surabaya River

the European, the Chinese, the Arabs, and the Malay populations. The population in Surabaya quickly increased in response to periods of good economic condition. Trade activities dramatically flourished, especially after the development of the Tanjung Perak port and industrialization in Surabaya. The Marine Establishment was also a big employer of Europeans and indigenous people. These economic activities stimulated massive urbanization and land use, particularly in the *Benedenstad*. Furthermore, housing and settlements developed around the city periphery, to which the indigenous settlements were forced by the city and by capitalism development. This area was, however, a vulnerable environment. The periphery vastly grew through new settlements and *kampongs*. New settlements might occupy areas of retention basins for rainwater. The areas were usually near rice fields or open terrain, where most *kampongs* expanded or lands were filled for new high-class settlements. Unfortunately, most new indigenous settlements again had poor drainage and sanitation and became worse when the rainy season came. Thus, the city development was generally followed not only by city management problems, but also by water management crises, such as problems with drainage systems and in directing water-flow, which were important for dealing with the rainy season.

There were many difficulties regarding water catchment and water flow in the lowland areas. Inside the settlements, flood control was based on the establishment of drainage systems, and so drains and canals were often established along the streets. Flood areas did not usually have good sanitation and drainage, and so the Municipality had an obligation to provide these. Sanitation was necessary in order to avoid communities using the river or gutter as a place for defecation, which would be brought by floodwater to other areas and could contaminate enclaves, rivers, canals, and groundwater.

Even in circumstances of international political crises, the Dutch still continued the flood control program. In January 1941, the government greatly desired to construct a tunnel or culvert under the Kali Mas, along Tanjung Perak and Ujung (Oedjoeng) (*Pewarta Soerabaia*, 27 January 1941), where European settlements for naval labors, Dutch officials, and traders were based. In addition to settlements, economic activities were also based in this area. The construction of the tunnel was very costly, since it was built on a hill as a vulnerable soil. The tunnel system caught the water on the ground and collected it in an underground tunnel system (Media Indonesia, 2007). The tunnel system was an integrated system which could handle flood problems, the scarcity of standard water, and urban wastewater. It was also useful for the management and conservation of groundwater, and it can support the improvement of the condition and quality of the rivers because of urban pollution.

The construction and the improvement of the drainage system in Surabaya in the early twentieth century were followed by some improvements and maintenance on the rivers, even though mostly maintenance were done along important areas and taken to save important infrastructures and facilities. The river has a role as a final disposal and primary drainage within the city. River improvements were by dredging, widening, cementation of the river side, and dike reinforcement. River maintenance is called river normalization which is aimed to restore the river's condition, which in turn can overcome the risk of overflowing river.

After the 1916 exceptional floods, the Watershed Management Service tried to strengthen the dikes and to improve the watershed. Normalization was carried out on the Surabaya River near Gubeng, and the Kali Mas as far as the Pegirian River bridge (*Javanesche Courant*, 10 November, 1916). However, in some cases, flood control was borne by city dwellers, when they had fully or partly contributed to the improvement and construction cost of drainage system. However, it was interfered by dwellers' reluctance, sluggish city response, and expensive drainage construction (*Pewarta Soerabaia*, 17 March 1927; 24 November

1924). Collecting inhabitant.s money by sluggish action to construct the drains, such as in *kampong* Kertopaten, was recognized by few city council members since the water-work was the municipal responsibility as the same as public work construction (such as street and bridge) (*Pewarta Soerabaia*, 27 April 1928).

The river sedimentation of soil, mud, sand, waste, and garbage also came from the mainland. In the dry season, wet sedimentation containing mud and waste disseminated an unpleasant smell to the surroundings. The communities on the rivers in Surabaya at that time tended to treat the river very badly. The local inhabitants frequently threw garbage into the rivers. Furthermore, household garbage and waste in the rivers became a problem for the city.s health and cleanliness. The sedimentation of waste was often carried by floodwater to the mainland and then would clog the drains or settlements. The Municipality tried to prevent people from throwing their garbage into the river by building fences along the river. Furthermore, there was a growth in housing on the riverbank, which legally or illegally increased the river pollution. Therefore, city tried to demolish the houses along the riverbank (*Pewarta Soerabaia*, 15 October 1925), even though without initial information to dwellers.

The improvement also focused on the Pegirian River due to the poor condition of this river. The Pegirian River passed many Chinese and Arab squares and was generally flanked by many indigenous *kampongs*. In the dry season, the Pegirian River spread terrible smells and diseases, and in the rainy season, floods submerged wide areas and triggered malaria problems. Finally, the health issue was the main reason for the Pegirian River maintenance. River maintenance in Surabaya by dredging and widening the rivers, physical river improvement, and strengthening dikes (normalization). They were carried out not only to ensure the acceleration of water flow in the rainy season and the river function as a traffic line, but also to improve city health. In addition, the problem of low awareness of the community surrounding the river in terms of proper usage and protection of the river also prompted the authority to act on these areas.

Flood became the trigger for colonial government to improve indigenous settlements. *Kampong* improvement was often directed at regions that had health and hygiene problems. The areas typically had many puddles and widespread stagnant water that triggered health hazards, such as malaria, pests, cholera, dysentery, and typhus, for *kampong* dwellers and their surroundings. So that *kampong* improvement in Surabaya was performed by building good drainage and sanitation systems especially after the effects of plague post rainy season.⁸

Kampong improvement was a means to create health and hygiene in the city. In Surabaya, *kampong* improvement was carried out by renovating houses and improving the environmental condition of the areas, which previously had become a breeding ground for anopheles mosquitoes and thus malaria. Houses in *kampongs* were usually surrounded by poor sewers and drains, in which water stagnated as the result of floodwater and the bad drainage system (Faber, 1937: 155-156). The worst problems occurred after the monsoon season, when malaria, cholera, pests, and dysentery spread. Any pleasant and healthy environment also deteriorated as the result of steady and polluted floodwater. It made that flood control had to be an important part in the *kampong* improvement analysis, and the engineers, for drains, sewers, and gutter technology, and health service might cooperate in conducting the flood control and *kampong* improvement.

The Health Service (*Dienst der Volksgezondheid* - D.V.G) was founded in 1911 and the Local Health Service (*Plaatselijke Gezondheidsdienst* - P.G.D) was established in 1916 in Surabaya as a part of the hygienic service of East Java (Faber, 1937:289). Following the

⁸ This happened in *Kampongs* Kaputren Kedjambon, Sawahan, Kemajoran and Kalongan. These *kampongs* sent petitions to the government to ask for an improvement in health after the annual flood.

disease eradication effort in 1920s in Surabaya, *kampong* improvement began in 1924 by the establishment of drains and sewers, costing about f 600,000. Special improvements on the drainage system were conducted based on the impact after the flood season. In 1925, *kampong* improvement was performed systematically and directed at establishing drains, gutters, pump-stations, public baths and toilets (Faber, 1937:156).

Gemeente Soerabaia Besluit No. 77/No. 3276.12, April 14th 1917 stated that Surabaya's assistant resident requested that the city pay attention to *kampong*, canal and drainage improvement, carried out by the *gemeentewerken*. About f320 was provided for 80 metres of small canal and sewer constructions. Money was taken from the municipal budget for the malaria eradication program which was given by central government (about f 25,000) (*Bintang Soerabaia*, 21 April 1917). Initially, the *gemeenteraad* showed not intention to participate in *kampong* improvement. Although *kampong* improvement received funds from various parties, plus tax and rent from communities, the *gemeenteraad* Mr. Morren felt that the effort was too excessive and could not be tolerated. The city's tax and land rent revenues were assumed to be lower than the cost of *kampong* improvement (*Pewarta Soerabaia*, 27 July 1923).

Essentially, diseases were problem for abundant naval armies, ship labors, European workers, traders, and residents, who typically dwelled in the Lower Town of the northern Surabaya. Therefore, the *kampong* improvement was essential, especially surrounding European squares.

Kampong improvement in terms of drain, sewer, gutter, and pump-station inside or around indigenous squares was conducted to present health and hygiene that became frequently worse after the flood, especially in the settlements with poor environment and disposal system. The poor environment brought some diseases problems that spread out to its surroundings, even European, Chinese or other non-indigenous dwellings. Therefore, the city with its decision No. 46, No. 1089-23, February 20th 1917 attempted to eradicate the influential diseases such as smallpox, cholera, dysentery, typhus, malaria, and bacilli in the main city, while malaria prevention was done by drying the soil with budget f5,000 (*Bintang Soerabaia*, 24 February 1917).

The role of *kampong* improvement was related to the effects of flooding on the outbreak of diseases such as malaria, cholera, and dysentery. The diseases mainly broke out in the crowded and disorganized indigenous settlements. Indirectly, disease eradication had to be completed by improving *kampong* conditions by an assumption that *kampong* was a source of disease and as unhealthy and unhygienic environment in the city. Unhealthy *kampong* with many diseases was unfavorable for other community groups (notably Dutch) and it discomfited the Lower House and Ministry of Colony (*Locomotief*, 22 October 1913).

The *Kampong* improvement program included drain and sewer construction, and this improvement constituted part of the efforts to avoid flooding in the indigenous squares. *Kampong* improvement by the construction of new houses was not very appealing to the dwellers because of the cost or tax to be paid, compared to the improvement of the drainage system and sanitation, since the dwellers mostly expressed interest in overcoming stagnant floodwater and disposal problems.

The making of Surabaya into a city with European style, which was characterized by big houses, parks, canals, permanent drains and roads, had changed Surabaya, which had been dominated by indigenous houses (stage houses), gardens, traditional drains, and small rivers. Indirectly, the colonial city also minimized the role of the soil in absorbing rainwater, since the land was filled by buildings, roads, and stone houses. Flood control within the city with the

drainage system had prompted the local people to adjust to the settlement of a European standard which was performed through *kampung* improvement. This circumstance also forced the local community to admit the authority policy in terms of rent and tax cost, as some *kampongs* and dwellings were built on private or city land, so the dwellers had to pay property rent and tax as city's income.

The flood works in Surabaya were well recorded in the newspapers, and this linked information and flood technology that indirectly built a relationship between the people (colony) and the (colonial) authority (Moon, 2007:2). However, many plans for flood work were constructed only partially implemented due to economic problems. Flood control by doing the construction or the improvement of the flood prevention system was only done on the problematic flood areas, especially the areas that were struck by heavy or exceptional floods. Work tended to be mostly performed in the high-class settlements or European lands, while the authority was less willing to carry out flood control in the indigenous *kampongs*.

The issue of health became a dominant reason for preventing floods in some areas, even though methods such as floodgates only simply diverted floodwater to another place to protect the certain areas. For instance, the floodgates of Gubeng and Ngemplak or Gunung Sari were controlled to protect the industrial areas (Ngagel), new high-class settlements, influential infrastructures (railways, main road), and trade centers. Therefore, flood control was usually planned to improve public facilities, which developed quickly alongside economic and population growth.

Flood works were also usually conducted after an exceptional flood, based on the condition and location, and highly dependent on uncertain city cash or central government funds. Therefore, preventing flooding was difficult for a developing city, especially in terms of finance. Eventually, a master plan would be considered useless because of unpredictable economic, social, and natural conditions.

In the 1906-1942, many improvements and constructions had been done by the Municipality of Surabaya to face the flood risk and mainly were done after the conditions of economic congestion and diseases. Indirectly, the intention of flood control efforts was not only to evade Surabaya from flood, but also to espouse the specific social, economic, and political benefits.

Health was an important issue in Surabaya's development, while lowland in few feet above of sea level and sluggish drainage flow affected Surabaya as an unhealthy place on Java in the early twentieth century. Poor sanitation and many holes and ponds in the *kampongs* became an essential issue because stagnant water that mixed with waste, mud, and soil created unpleasant smell and various diseases after post-flood.

Typically tropical diseases, pest, cholera, typhoid, malaria, dysentery, and smallpox usually easily spread and quickly infected the population in the city, especially for a bulk of indigenous people. It was indicated by mortality rate in Surabaya which 50 percent directed to indigenous people, while only 8 percent to the Europeans (Tillema, 1915-1916:10). Diseases emerged in the messy and disorganized areas, which the *kampung* was the place.

Frequent flood and post-flood effect ultimately stimulated social consciousness, when the city inhabitants informed problem of long stagnant water to the city government even though the government slowly responded. In January 1939, malaria and typhus were the main topic of discussion among government officials. They believed that the diseases originated from *kampongs* around the city. For example, malaria and pest came from the crowded settlements with their lack of drainage system and a bad canal condition, which later on it led the *kampung* improvement in the city to avoid disease contagious (to large urban community).

Gradually, combating malaria dominated government response on disease and hygiene, which was one of main goals of *Dienst der Volksgezondheid* (public health service). The action was carried out by removing stagnant water (unmoving water), such as dried or buried the holes and completely salty or filled into the half salty water. In general, malaria eradication in East Java was done in Surabaya, Malang, Modjokerto, and Sidhoarjo, where malaria mosquito could simply be found at houses and riverside.

Malaria could attack any ages and chiefly it became a dilemma, especially when it infected the labor age and accordingly the malaria eradication became a part of municipal responsibility instead of doctors (*Pewartar Soerabaia*, 14 August 1941). Surabaya was the place where enormous sugar plantations and farms were located. The period of international political crisis also forced the Dutch to prepare massive people for defense. In the period of 1940s, the Netherlands was involved in the crucial situation of World War II, which forced it to fix its military installations in its colonies. In addition, the Dutch needed many people for any circumstances, which would be hindered by problem of malaria epidemic because malaria made the victims weak, limp, and listless to work and to do any activities (*Ibidem*). General number of malaria victims in Surabaya was the highest compared to pest ones added by smallpox victims. Therefore, *Gemente reinigingdienst* (Cleaning Department) intensively eradicated the malaria by eliminating stagnant water.

However, the drainage construction for flood control also showed the residential segregation between Europeanwealthy Chinese and indigenous people. Most indigenous *kampongs* had poor and had no appropriate drains, sewers, and water flush among crowded and disordered dwellings. Consequently, in the rainy season floodwater did not flow or stagnated in surrounding *kampongs* that caused epidemic usually took place in Surabaya. Nevertheless, after disease outbreak, criticism spoke about an equal treatment on flood system improvement and construction between the European and the indigenous people (*Pewartar Soerabaia*, 13 January 1938). Especially, health and hygiene in the city were important to support a modern and pleasant environment and like Tillema said in one article published in 1927 ("Torch of Indonesia") that "pray that the great Indonesia does profit from the benefits that only hygiene can bring" (Mrázek, 2002:58).

River maintenance had role to suitability of clean water supply and it was related to the interest of Surabaya economy, when it supplied the Marine, markets, industries, and companies water necessity. Hygienic water supply (*waterleiding*) in Surabaya was required by urban communities, industries, trading offices, markets, plantations, and other official facilities while river cleanliness and dam canal improvement was related to effort to keep the sustainability of water drinking supply. Cholera outbreak in the early twentieth century also became an initial effort to force communities away from the rivers and their surroundings even though the communities still needed the rivers, especially for washing, bath, and even cook.

Finally, flood control by managing drain system and river maintenance was the way to construct a healthy and tidy city, and ordered people. Abidin Kusno states that city plan was directed to create a good citizen by ways of applying a good urban form (Kusno, 2005:494). Abidin Kusno argues that the nature of urban design in the period of twentieth century was emphatically concerned with critical issues of hygiene. Then, the improvement was emphasized on the necessity to prevent and avoid the radicalism in urban life. Besides, it was to create a sense of living in a new time and space with normal, peaceful, and harmonious life. Flood control was the way to control flow of rainwater and river water in the monsoon time. It also could be directed to control health and people behavior to be hygienic and responsible to environment. Finally, flood control could be engaged to ensure that there was no obstacle to social, economic, and political activities in the city.

6. Conclusion

Based on the discussion, it can be concluded that the rapid growth of population and economic in the early twentieth century in Surabaya caused a crowded and uncontrolled urban space. Particularly, the new settlements usually did not consider the areas of water catchment, which they were established in the retention basin, swamp, and rice fields without concerning that the areas were vulnerable to floodwater direction from heavy rainfall and river overflow. This also was caused by a lack of control of government and the awareness of landlord and dwellers. Consequently, occupation for settlements and infrastructures decreased the capability of soil to absorb rainwater in the rainy season. The way to control the flood in the occupied lands was by the improvement of drain, sewage, and river management even though as a deltaic city Surabaya would be difficult to be completely free from flood.

Flood control was conducted by considering the probability of flooding and the impact in certain areas in terms of health and hygiene, clean water supply, peaceful city life, and stable social, economic, and political situation in the city. There are other some reasons why the problem of flooding could not be completely resolved in Surabaya at that time. For example, the flood works were tended to be carried out in particular areas such as the European squares, and economic, political, and trade centers which were significant for the city. Furthermore, the probability of flood was widespread because of flood diversion to other places and the decline of water catchment areas due to the rapid development of the city and population, especially after industrialization, the development of Tanjung Perak Port (1920), and the urbanization of the city (1930). Therefore, flood works that had been built was no longer effective. On the other hand, the new constructions for flood prevention still depended on subsidies from the central colonial government and on community awareness regarding the rivers. Finally, the Dutch implementation on flood control in Surabaya tended to be successful in maintaining health. Although the Surabaya water works did not completely overcome the flood problems, especially in the large and crowded indigenous areas.

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