

Flood Disaster in Semarang City from Colonial to Reformasi: A Review of its Management

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Abstract: This article reveals Semarang City's history, an extremely vulnerable area to floods and examines what the government has done to overcome this greatly chronic problem. Its default condition as a lowland city in direct contact with hilly areas and sea makes the potential for floods exhaustive. Thus, it is prone to pluvial, local, and coastal floods. Various policies carried out from the colonial era to the Semarang City government have so far not been able to control floods as expected. Countermeasures using non-structural methods through spatial planning and environmental law enforcement have yielded no specific results. Countermeasures with structural methods such as river normalization or the construction of flood control infrastructure become no more than a dull blade. For years, spatial planning policies have been implemented and many infrastructures have been built, but the threat of flooding is increasing and expanding. It is necessary to change the development paradigm adopted by the government so that it no longer boosts infrastructure and investment, then re-applies the *memayu hayuning bawana* philosophy.

Abstrak: Artikel ini mengungkap sejarah Kota Semarang yang sangat rentan terhadap banjir dan mengkaji apa yang telah dilakukan pemerintah untuk mengatasi masalah yang sangat kronis ini. Kondisi bawaannya sebagai kota dataran rendah yang bersentuhan langsung dengan daerah perbukitan dan laut membuat potensi banjir sangat besar. Sehingga rawan terhadap banjir pluvial, lokal, dan pesisir. Berbagai kebijakan yang dilakukan sejak zaman penjajahan hingga pemerintah Kota Semarang selama ini belum mampu mengendalikan banjir seperti yang diharapkan. Penanggulangan dengan metode non-struktural melalui penataan ruang dan penegakan hukum lingkungan belum membuahkan hasil yang spesifik. Penanggulangan dengan metode struktural seperti normalisasi sungai atau pembangunan infrastruktur pengendalian banjir tidak lebih dari pisau tumpul. Selama bertahun-tahun, kebijakan penataan ruang telah diterapkan dan banyak infrastruktur telah dibangun, tetapi ancaman banjir semakin meningkat dan meluas. Perlu mengubah paradigma pembangunan yang dianut pemerintah agar tidak lagi menggenjot infrastruktur dan investasi, kemudian kembali menerapkan filosofi *memayu hayuning bawana*.

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INTRODUCTION

"*Semarang kaline banjir (Semarang is flooded)*" is the lyrics of one of the *keroncong* queen's songs, Waldijnah. Even though the lyrics can be said to be a generalization, at least it might confirm the title of Semarang City as a city of water. This City of Atlas has a coastline of 13.6 km with a total area of 373.70 km², most of which are classified as lowlands (RPJMD, 2016). As the capital city of Central Java Province, Semarang City bears the infrastructure and economic burden putting this-located-on-the-edge-of-the Java Sea area more prone to disasters, including hydrometeorological ones. Hydrometeorological disasters are those caused by damage to the sys-



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tem in the hydrological cycle, thus affecting the stability of climatic conditions and water reserves on the earth's surface (Hermon, 2018, p. 4). Irregular rain pattern conditions, the inconsistency of dry and rainy season variations due to climate change, loss of hydrological function of watersheds, loss of millions of hectares of forest, and land degradation due to human greed can have fatal consequences to the environment, thereby increasing the risk of occurrence disaster.

The Indonesian government also realizes the urgency of disaster management policies as a response to the high risk of disasters in Indonesia, one of which is by creating a legal umbrella law for disaster management, namely Law No. 24 of 2007 on Disaster Management. In Law 24/2007, the concept of disaster management is differentiated from the concept of mitigation. Disaster management is defined as a series of efforts that put in the establishment of development policies possessing the risk of reducing the occurrence of disasters, disaster prevention activities, emergency response, and rehabilitation. It is a series of efforts to reduce disaster risk through physical development, as well as awareness and increased capacity to face disaster threats. The two concepts tend to be synonymous. Therefore, they can replace each other even though the concept of disaster management is more often used in political language or at the level of public policy.

Flood, according to Kristianto (2010: 11), is water that exceeds the carrying capacity in the soil, waterways, rivers, lakes, or the sea so that it overflows and sometimes flows quite swiftly inundating the land or lower areas around it. The excess storage capacity in the soil can be caused by natural causes such as heavier than usual rainfall, or by human causes, namely human treatment of nature and the environment has a destructive impact. In determining the definition of flood, care needs to be taken regarding the distinction of the term flood in the popular everyday definition which roughly defines flood as merely a puddle of water that causes economic loss or even life. Asdak (2007, p. 429) warns two confusions over the term flood: first, flood has occurred if the river water flows beyond the river's capacity, so the flow overflows through the riverbank then it inundates the area around it. Secondly, flood has not occurred if the flowing water with an annual peak discharge does not pass through the river cliffs.

Disaster mitigation itself can be understood as a series of efforts to reduce the risk of flood disasters, whether through physical development and

awareness, as well as increasing the ability to face the floods' threat (Paimin in Hermon, 2018, p. 36). Hermon further explains that effective disaster mitigation must have three prior elements, namely: (1) hazard assessment to identify affected populations, threatened assets, and threat levels; (2) warning, namely to warn the public regarding a threatening disaster, and (3) preparedness, which requires knowledge of areas that are likely to be threatened by disaster and knowledge of warning systems to know the moments to evacuate and to return when the situation is safe (2018, p. 26).

Referring to Suliyati (2014, p. 60), overcoming or mitigating floods in Semarang City can be traced back to the pre-independence era, when the Dutch colonial government built canals across the two cities. The construction of the West Banjir Kanal (*west bandjirkanaal*) was started in 1850, while the East Banjir Kanal (*oost bandjirkanaal*) was built in 1896-1903. Even so, the development of Semarang City into a large city with "derivative products" such as population growth and expansion of residential areas kept Semarang City hit by floods. In the contemporary era, the flood disaster that is still attached to the residents' circle is the flash flood on January 26, 1990, which was caused by the breakdown of the West Banjir Kanal walls (*talud*) (Suara Merdeka, 2018). The inundation height due to the flood reached 2-3 meters in the Sampangan area and 2-2.5 meters in the Pengandan area. In Priyanto and Nawiyanto's research (2014, p. 2), material losses are estimated at IDR 8.5 billion, with the number of victims reaching 47 people dead, 6 people missing, hundreds of people injured, and thousands of people forced to flee. Similar flash floods also occurred in 1980, but with fewer victims, and in 1993, when the height reached 1 meter and material losses of around 1.6 billion IDR.

The phenomenon of flooding is like a "verdict" for lowland areas, especially with tropical climatic conditions such as in Indonesia. In the context of Semarang, Yuliarthana (2002, p. 37) divides floods into three types based on its causes, namely (1) pluvial flood, a consequence of the topographical conditions of the areas in the form of hills in the south of the city and lowlands in the north of the city. This results in water accumulation that occurs quickly because the slope of the river upstream is very steep while downstream is very gentle; (2) local flood, a result from changes in ecology and land use for settlements, industry, and transportation facilities. This situation brings about local inundation which usually affects areas lower than the road surface; (3) coastal flood, caused by the coastal

topography with the level of land elevation below the mean tide level, and recently exacerbated by global climate change. The characteristics of each flood are different, as well as their prone-to-be-affected areas. Therefore, questions arise regarding the concept of flood management that has been implemented by the government.

The researchers try to compile various policies that have been taken by the Semarang City Government in dealing with flood problems. If calculated since the 1990 flash floods, the Indonesian National Board for Disaster Management (BNPB) release notes that there have been 59 floods which resulted in 169 deaths (including missing victims), 826 injuries, and a total of 30,080 people who had to be evacuated (*bnpb.cloud/dibi/tabel2a*). Hence, the problems discussed in this paper are:

(1) What are the forms of Semarang City Government policies in implementing flood management?
(2) Have the Semarang City Government policies reduced the impact of flooding on community life? Thus, this research is expected to contribute to the writing of policy histories in Indonesia, particularly historical studies on flood policies. Besides, this paper is also expected to contribute to the formulation of a more comprehensive flood disaster management policy.

Historical studies of disaster policies are relatively rare. Dunggio and Gunawan (2009) attempted to examine the history of national park management policies in Indonesia which continue to face threats in their management, and have succeeded in identifying the problems they face, but in general, they have not reached the cataloging of the policies in question. If there is any, historical policy studies would be more focused and contrasting, as was done by Witasari (2017), who examined forest management policies in the Mangkunegaran area by Mangkunegara VII (1916-1944). The research has succeeded in uncovering Mangkunegara's conservation efforts, but again, apart from only focusing on one government regime, it is also not up to date enough to be used as a reference for contemporary policies. The most ideal reference may be obtained from Wijono's (2017) research which collects structuring policies in the area which is now known as Banten Province from the colonial to the reformasi era. It's just that the policies studied are administrative in nature, instead of examining spatial policies relating to the environment in the Banten area, so it is more accurate to say that the history of policies is not a history of disaster policies.

METHOD

This research was conducted using the critical historical research method, wherein its implementation (Gottschalk, 1969, p. 32), the research was carried out through four stages, namely heuristics (data collection), criticism (internal and external), interpretation (analysis and synthesis), and historiography. This article is based on historical research. The types of data used are primary and secondary data. Data collection techniques utilized documentation and observation methods. Some of the sources used in this article have been obtained from literature searches of various previous studies, as well as government documents. From these sources, data were obtained regarding the causes of flooding in the city of Semarang, its accumulated losses, and various policies that have been implemented by the Semarang City Government. The data obtained were then analyzed and interpreted.

FLOOD DISASTER AND ITS MANAGEMENT IN SEMARANG

Semarang City is the capital of Central Java Province which is located on the north coast of Java Island, so it is directly adjacent to the Java Sea. Its spatial layout is unique. Among the public, there are terms of "Semarang Bawah" or Lower Semarang as the lowland part and "Semarang Atas" or Upper Semarang as the highland (Lisdiyono, 2008, p. 238). In Semarang Bawah area, which is close to the beach and crossed by the Pantura Highway, there are problems in the form of land subsidence and settlement density. Later, the settlement problem shifted to the Upper Semarang area, due to the high interest in making the area a residential area. As a result, areas that should be water catchment areas or at least have a role in the hydrological cycle, have now reduced their hydrological contributions. This also increases the risk of pluvial or flash floods. This means that the carrying capacity of the environment in both Semarang Bawah and Semarang Atas areas has decreased.

In the beginning, it has been stated that Semarang City is greatly prone to flooding based on its geomorphological, hydrological, climatological, and hydrogeological considerations. The topography of Semarang Bawah area ranges from an elevation level of 0-0.75 masl, while Semarang Atas area can reach 0,75 - 348 meters. The lowest point is very likely to have been lower than the record, considering that the lowlands directly adjacent to the shoreline have been regularly affected by tides. Climatologically, Semarang City experiences a tropical climate that has constant rainfall, ranging from 1500

mm to 3000 mm per year. Its hydrological conditions include several river sections that store water potential with several large rivers such as Kali-garang, Pengkol, Kripik, Kreo, Banjiranal Timur, Babon, Sringin, and Dungadem (RPJMD, 2016, p. II-11). The rivers are managed in 11 river areas, namely Tugu, Babon, West Banjir Kanal, East Banjir Kanal, Barat, Bringin, Blorong, Plumbon, Silandak, Tengah, and Timur. The condition of the area which is filled with river currents, along with the condition of the sloping plains in the northern region, makes several areas more vulnerable to flooding.

The demographic burden of Semarang City has also contributed to the increased level of flood vulnerability. The population growth rate, which has reached more than 2% per year until the new millennium, has indeed decreased to 0.47% in 2016 (BPS, 2016). However, the population in Semarang is always increasing. In 2010, the total population had exceeded 1,527,433. This number jumped at the end of the period to around 1.79 million people. This escalating population has a direct impact in the form of an increase in population density, which generally brings about the area in the city center being burdened with dense settlements. No matter how recent trends show that the distribution of the population starting to widen to the outskirts of the city, this still contributes to a higher risk of flooding. At present, the widespread use of land as settlements results in reduced green land and infiltration. The disaster map released by BNPB in 2009 shows that more than half of the sub-districts in Semarang City are flood-prone areas, including Gunungpati, Tugu, West Semarang, Gajah Mungkur, Candisari, North Semarang, East Semarang, Gayamsari, Pedurungan, and Genuk Sub-districts.

Historical traces show that the physical condition of Semarang has experienced the development of various morphological forms that have also “initiated” the vulnerability of floods. The northern coastline of Java Island, which according to Van Bemmelen lies several kilometers inland from the current line, also applies to its coastal area (Miladan, 2009, p. 73). The formation of new lands, along with the retreat of the coastline, took place before the 15th century. Historical records reveal that in 1478, the coastline had reached the area which now incorporates Imam Bonjol, Gendingan, and Jurnatan. It is not surprising that at first, the area was the beginning of the growth and development of settlements in Semarang City. With such a history of contact with water, it is no wonder that in its journey, Semarang is closely related to various

problems of environmental degradation in coastal areas associated with hydrology. Therefore, the development of settlements in recent times has begun to lead to the hilly areas on the south side. Human nature’s attitude to avoid these disasters eventually creates another risk, namely the reduction of watershed areas in Semarang Atas.

The geographical condition in Semarang Atas which is hilly—where more settlements are built here, and the northern area which is very flat, inevitably causes short-term and long-term effects in the form of hydrological issues. The greater the expansion of the residential area coupled with the reduction in watershed areas in Semarang Atas will affect the speed of water runoff during the rainy season (Bakti, 2010). This high acceleration water runoff will not be a problem if the rivers are able to be accommodated in normal conditions. The problem is that there has been narrowing and sedimentation in many rivers, especially exacerbated by the less than optimal drainage system around the watershed. If the flow of water is so heavy that it exceeds the capacity of the river, the flood will inundate the drainage basin in Semarang Bawah. A further problem in the flat area, especially in the area near the coast, is that the area has a lower elevation than the sea level, so that it will receive an overflow of water from three sources at once, namely rainwater from upstream (pluvial flood), water local rain (local flood), and high tide (coastal flood) (Wahyudi, 2010, p. 33).

It is the government’s duty to carry out various efforts related to flood mitigation in Semarang City—no matter how big the risk is borne by this city due to the various geological-demographic conditions mentioned previously. This research collects flood prevention policies, both in the form of spatial planning and various flood infrastructures that were built, starting from the colonial era to the contemporary government era.

Dutch Colonial Era

The Dutch colonial government realized that Semarang City had a high risk of being hit by floods. The efforts made by the colonial government—as were done in other colonies such as Batavia and their ancestors’ lands, was to build two large canals on the west and east sides of Semarang. Both were built to drain water from Semarang Atas in a large discharge. The West Banjir Kanal (*west bandjirkanaal*) which was built in 1850 was used to anticipate flooding in the north-west region, while the East Flood (*oost bandjirkanaal*) which was built in 1896 was intended to control water flow in the eastern

region and the Tanjung Mas port development area. The two canals were built by employing indigenous people through the compulsory work system (*heren diensten*) (Suliyati, 2014; 60). At the beginning of the construction, the West Banjir Kanal and East Banjir Kanal were still equipped with a barrier. It has now changed to Basudewo Street, Kokrosono Street, and Madukoro Street.

In this pre-independence period, it was also noted that the draft spatial planning policy was first formulated. The initiation was marked by the Semarang City Master Plan (RIK) developed in 1931-1933 by Thomas Karsten (Lisdiyono, 2008, p. 310). Karsten's urban planning was held by zoning or hierarchies as in Europe. If the settlement zoning system was based on ethnicity in the previous era, Karsten's version of the design-based zoning on economic class, namely high, medium, and low. In Lisdiyono's notes, the architect from Netherlands who also designed Malang City planning followed Semarang topographical conditions, including slopes and turns, as far as possible. The result of this design was a prominent development that occurred in Krobokan, Seroja, Pleburan, Darat, Jangli, and Merican areas.

Independence-New Order Era

The city planning design pioneered by Karsten was tried to be continued by the Semarang City authorities after the independence era. The concept of city planning by the administrative government of the Semarang municipality was first implemented in 1971 through the Semarang City Master Plan (RIK) 1972-1992, which was later passed into Regional Regulation No. 2/kep/DPRD/1972. Four years later, the Department of Home Affairs (now the Ministry of Home Affairs) expanded Semarang City by adding Mijen, Genuk, Banyumanik, and Gunungpati Sub-districts. Later on, Banyumanik and Gunungpati would fall into the area known as "Semarang Atas" or Upper Semarang. Five years later, there was a renewal of the city management plan in the form of RIK Semarang for the 1975-2000 period based on Regional Regulation No. 5 of 1981 on the 1975-2000 Semarang City Plan. The city spatial plan was then updated in 1990 through Regional Regulation No. 2 of 1990 on the First Amendment to Regional Regulation No. 5/1981 on the 1975-2000 Semarang City Plan. The RIK divided the spatial planning of Semarang City into four areas (Listiyono, 2008, p. 315), namely: (1) Region I with Kota Lama (Old Town) as the center of business, warehousing, and high-density settlements; (2) Region II with Tugu and Genuk as suburbs, in-

dustrial zones, and low-density housing; (3) Region III with South Semarang as a suburb, education zone, health zone, and low-density housing; and (4) Region IV with Gunungpati and Mijen as development reserves, agricultural zone, livestock zone, forestry area, fishery area, agrarian industry sub-sector, and would be concentrated into suburban areas.

The next few years, according to the enactment of Law No. 24 of 1992 on Spatial Planning, RIK, which has now changed its term to Semarang's General Spatial Plan (RURTK), was re-updated through Regional Regulation No. 4 of 1999 on Regional Spatial Plans for Semarang Level II Municipality of 1995-2005. The division of Semarang City in the RURTK 1995-2005 is adjusted into 10 City Area Sections (BWK), namely: (1) BWK I included Central Semarang, East Semarang, and South Semarang as office, trade and service areas, settlements, and culture; (2) BWK II included Candisari and Gajahmungkur as office, trade and service areas, military areas, and sports/recreation education; (3) BWK III covered West Semarang and North Semarang as areas for transportation, warehousing, recreation, settlements, trade and services, offices and industries; (4) BWK IV contained Genuk as industrial, transportation, fishery cultivation and settlement areas; (5) BWK V included Pedurungan and Gayamsari as residential, trade and service areas, universities, industry and transportation; (6) BWK VI included Tembalang as a residential area, universities, trade and services, offices, and conservation; (7) BWK VII contained Banyumanik as a residential area, offices, trade and services, conservation, transportation, and a special military area; (8) BWK VIII included Gunungpati as a conservation area for agriculture, tourism and recreation, universities, settlements, and trade and services; (9) BWK IX included Mijen as an area for agriculture, settlement, conservation, tourism or recreation, trade and services, education and industry; (10) BWK X incorporated Ngaliyan and Tugu as industrial, residential, trade and service areas, ponds, recreation, and warehousing.

From a series of urban spatial planning above, no area was really devoted to watershed areas, or at least, policies concerning flood management. By widening the scope of research by looking for a number of regulations related to drainage or river management, the following are various policies in the form of legal regulations used as the basis for implementing flood prevention and irrigation activities related to drainage and/or river management in Semarang City. The following include: (1)

Law No. 11 of 1974 on Irrigation; (2) Government Regulation No. 35 of 1991 on Rivers; (3) Presidential Decree No. 43 of 1990 on the National Coordination Agency for Disaster Management; (4) Regulation of the Minister of Public Works No. 63/PRT/1993 on River Boundaries, River Benefit Areas, River and Former River Controlled Areas; (5) Regulation of the Minister of Public Works No. 39 of 1989 on the Division of River Basins; (6) Technical Guidelines for Road Surface Drainage Design No. 008/T/BNKT/1990 Directorate General of Highways, Ministry of Public Works; (7) Central Java Provincial Regulation No. 1 of 1990 on Environmental Management in Central Java; (8) Semarang City Regional Regulation No. 4 of 1999 on Detailed Spatial Planning (RDTRK) of Semarang City; (9) Semarang City Regional Regulation No. 1/1999 on Semarang City Regional Spatial Planning (RTRW); (10) Semarang City Regional Regulation No. 6 of 1993 on Cleanliness; (11) Semarang City Regional Regulation No. 2/1985 on the Boundary Line for the Semarang River and the Banger River; (12) Semarang Mayor's Decree No. 640/295/1998 on the Old Town Building and Environmental Planning (RTBL); (13) Mid-term Integrated City Infrastructure Development Program (PJM P3KT) of Semarang City.

Several flood mitigation efforts derived from those regulations hold: (1) the normalization of the Semarang River and its secondary and tertiary channels in 1985-1990 which at that time, was full of settlements; and (2) construction of the Simongan Dam along with culverts and flood-retaining embankments in 1991. In that era, there was also cooperation between the Infrastructure Creation of Public Works Office of Central Java Province and Hasfarm Dian Konsultan Inc. who produced the Kota Lama (Old Town) polder design note, which contained the distribution of the drainage area in five watersheds, namely: (1) East Region with an area of 48 km². This area is bordered by the Babon River on the east side, East Banjir Kanal on the west and south sides, and the coastal embankment between the Babon and Banjir Kanal Rivers with an interceptor channel on the north side. In this area, there are three main drainage channels, namely Tenggeng I River, Sringin River, and Tenggeng II River; (2) Central Semarang Region with an area of 27.23 km². This area is bordered by the coast on the north side, East Banjir Kanal on the east side, Candi River interceptors and the CBZ channel on the south side, and West Banjir Kanal on the west side. In this area, there are two main drainage channels, namely Banger and Baru Rivers;

(3) West Semarang Region with an area of 12.4 ha. This area is bordered by the sea on the north side, West Banjir Kanal on the east side, and the Silandak River watershed on the south and west side; (4) The Tugu Region is mostly in the form of ponds in the north and hills in the south. This area is bordered by the sea on the north side, Silandak River on the east side, the southern border on the south side, and Semarang city border on the west side; (5) South Region with an area of 4,089.73 ha. This area is bounded by the borders of Semarang City on the west side, Semarang Regency on the south side, Demak Regency on the east side, and Tugu Region on the north side.

One of the elements in the spatial planning of Semarang City is the direction of land use in the Kaligarang watershed/drainage basin. The results of a study by the Center for Land Rehabilitation and Soil Conservation (BRKLT) in 1995 were in the form of plans and directions for land use in the Kaligarang watershed for 1995-2010 (Dewajati, 2002), including: (1) the upstream part, which is a potential area for water absorption, will be used as a protected area, forest, limited cultivation such as production forest, and agriculture such as agrotourism and agribusiness; (2) the middle part, a watershed area with low-density land use for agriculture and rural settlements; and (3) downstream, a cultivation area with land use as a central area for trade, government, services and offices, and settlements with high density. Even though the city planning design is such an ideal as above, as noted by Yuliarthana (2002, p. 142), various regulations related to flood management in Semarang City have not been implemented completely. Thus, they have not been able to minimize the impact of floods. Yuliarthana's notes (2002, p. 178) also describe the various measures that have been carried out in the Jratun Watershed (Jragung and Tuntang) and the Seluna Watershed (Serang, Lusi, and Juana). The note examines the form of handling of three types of floods (coastal, local, and pluvial), namely: (1) coastal flood, namely by implementing a polder system in eight main subsystems which incorporate Bulu, Tanah Mas, Asin, East Bandarharjo, Kota Lama (Old Town), North Banger, South Banger, and West Bandarharjo; (2) local flood, namely by applying a gravity system to the Angker River, Banger River, and Sringin River systems, as well as secondary and tertiary drainage in the Semarang River and Asin River systems; and (3) pluvial flood, namely by dredging the Silandak River, West Banjir Kanal, East Banjir Kanal, and Babon.

Post-Reformasi Era

In the Reformasi era, the Semarang City Government began to have an awareness of implementing specific flood management and started to emerge with a legal umbrella for disaster management. Among the various regulations that intersect with flood management include: (1) Semarang Mayor Regulation No. 7 of 2006 on Standard Procedures for Implementing Disaster Management in Semarang City; (2) Semarang City Regional Regulation No. 13 of 2010 on the Implementation of Disaster Management in Semarang City; (3) Regional Regulation No. 12/2010 on the Organization and Administration/Procedures of the Semarang City Disaster Management Agency; (4) Regional Regulation No. 15 of 2014 on Management of Watersheds in the Territory of Central Java Province; (5) Semarang Mayor Regulation No. 39 of 2016 on Guidelines for Providing Unplanned Social Assistance due to Disaster.

In addition, the milestone of flood mitigation efforts in Semarang City can be seen with the realization of the Semarang City Drainage Master Plan in 2007, which was later ratified as Semarang City Regional Regulation No. 7 of 2014 on Semarang City Drainage System Master Plan 2011-2031 (Erlani and Nugrahandika, 2019, p. 52). The master plan is translated into flood prevention programs which include the construction of the Jatibarang Reservoir, construction and optimization of the drainage system, construction of pumping stations, construction of sea walls, the elevation of roads, construction of parapets (water barrier walls), construction of pump houses and retention ponds, and cleaning of drainage channels. These efforts have not counted the inclusion of flood and tidal issues in the medium-term strategic development issue in the 2016-2021 Semarang City Mid-Term Development Plan. In the document that was ratified based on Regional Regulation No. 6/2016, the problem of flooding is considered a “disaster threat that is still being faced by Semarang City and its handling is prioritized”. Strategies undertaken to support flood and tidal management systems based on the RPJMD hold: management of drainage systems and river normalization and revitalization of city-scale drainage networks that are comprehensive and sustainable, with a focus on handling the Mangkang River, Bringin River, Banger River, East Banjir Kanal River, Tenggang River, and Babon River sub-systems. In addition to implementing flood prevention through the mentioned laws and regulations, the Semarang City Government has also carried out various flood prevention programs as compiled by

Risiandi (2013) as follows.

Firstly, construction of water retention ponds. The ponds were built to temporarily collect rainwater before being channeled into ditches. According to *Suara Merdeka*, the retention ponds that are currently operating incorporate those in Mukti-harjo, Kaligawe Low-cost Apartment (Rusunawa), Baru Traditional Market, and Banjar Dowo.

Secondly, Development of water pumping stations in built-up areas. The water pump station functions to move stagnant water from settlements to waterways that go directly to the sea. As reported by *Asatu*, it is noted that 41 pump stations have been empowered to cope with flooding at various points in Semarang City.

Thirdly, dredging drainage channels, namely canals in the shape of a square or trapezium to drain wastewater and rainwater to reservoirs. Construction of coastal embankments is done to stem seawater from entering settlements to prevent coastal flooding.

Fourthly, technical engineering/modification at certain locations that have a high enough level of flood vulnerability. Fifthly, greening of coastal areas as parts of the Coastal Zone Conservation Program, one of which is by planting mangroves.

Referring to Kodoatie (2002), flood prevention methods can be classified as follows. (1) Non-structural methods are in the forms of watershed and land use management, environmental law enforcement, erosion control in watersheds, and regulation and development of flood areas. (2) Structural methods include: (a) flood control structures in the forms of dams, retention ponds, river slope reduction structures, pump houses, polders, and the like; and (b) repair and regulation of the river system in the forms of widening or dredging the river (normalization), protecting embankments, *sodetan* (an alternative waterway), and the like.

Based on this flood prevention method, this research classifies the types of flood management policies that have been carried out by the Semarang City authorities from the colonial to the modern era. The classification was performed using a table like table 1.

Reviewing those various policies, this study tries to determine whether the flood problem in Semarang City has been resolved or not. The analysis was carried out by comparing the flood conditions in the past with the conditions in the present. The oldest data that could be obtained regarding flood inundation areas in Semarang City can be found in the JICA report (1993). Based on it, the locations of floods in Semarang City during that era

Table 1. The types of flood management policies in Semarang

Period	Non-Structural Method	Structural Method	
		Flood-Control Infrastructure	River System Management
Colonial Era	Semarang City Master Plan (RIK) 1931-1933	-	<ol style="list-style-type: none"> 1. West Banjir Kanal Development (1850) 2. East Banjir Kanal Development (1896-1903)
Independence-New Order Era	<ol style="list-style-type: none"> 1. Semarang City Master Plan (RIK) 1972-1992 2. Semarang City Master Plan (RIK) 1975-2000 3. Semarang City General Spatial Plan 1995-2005 4. Semarang City Regional Regulation No. 2/1985 on the Boundary Line for the Semarang River and the Banger River 5. Semarang Mayor Decree No. 640/295/1998 6. Semarang City Regional Regulation No. 6/1993 on Cleanliness 7. Semarang City's Medium-Term Integrated City Infrastructure Development Program (PJM P3KT) 8. on Kaligarang Watershed Land Use Plan 1995-2010 	Simongan Dam Development (1991)	Normalization of Semarang River (1985-1990)
Reformasi Era	<ol style="list-style-type: none"> 1. Semarang Mayor Regulation No. 7/2006 on Standard Procedures for Implementing Disaster Management in Semarang City. 2. Semarang City Regional Regulation No. 13/2010 on the Implementation of Disaster Management in Semarang City 3. Semarang Mayor Regulation No. 39/2016 on Guidelines for Providing Unplanned Social Assistance due to Disaster 4. Semarang City Regional Regulation No. 7/2014 on Master Plan for Semarang City Drainage System 2011-2031 	<ol style="list-style-type: none"> 1. Retention ponds in Muktiharjo, Kaligawe Low-cost Apartment (Rusunawa), Baru Traditional Market, and Banjar Dowo 2. 41 water pumps 3. Coastal (rob) embankment on the north coast of Semarang City (2019) 4. Polder Banger (2014) 5. Jatibarang Reservoir (2015) 	<ol style="list-style-type: none"> 1. Normalization of drainage channels 2. Normalization of West Banjir Kanal (2012) 3. Normalization of East Banjir Kanal (2019)

included Tugu, West Semarang, West Banjir Kanal, Central Semarang, Banger River, and East Semarang Sub-districts with a total inundation area of 127.7 ha, and with varying depths ranging from 0.2 to 1,2 meters. The flood inundation areas based on the current flood hazard mapping of Semarang City

are based on rainfall parameters, slope parameters, and land cover parameters by Ujung et al. (2019). It points out areas with low-class threats covering an area of 12,748 ha or 32.7% of Semarang City, the medium threat class covers 9,827 ha or 25.1%, and the high threat class covers 16,510 ha or 42.2%. The

data is not apple to apple, so it cannot be validly used as a comparison. However, the important point that can be obtained is that the problem of flooding in Semarang City is not getting decreased by times, but is getting worse and with a wider impact.

Another indicator that can be used to determine the success of flood management in Semarang is to pay attention to land subsidence and sea-level rise. These two variables exceptionally affect the vulnerability of the northern region of Semarang, especially in areas near the coast that are threatened by coastal flooding. Data released by the Department of Maritime Affairs and Fisheries (now the Ministry of Maritime Affairs and Fisheries) noted that the sea level on the coast of Semarang City in 1985-1998 reached 58.2 cm, or an average increase of 4.47 cm/year. In 1993-2008, the sea level continued to rise to 37.2 cm, with the average increase rising to 7.43 cm/year. In 2012, Wibawa et al (2012, p. 9) noted that there had been a shoreline shift of 49.54 meters in Tugu Sub-district, which was caused by rising sea levels. These findings are sufficient to prove that the coastal area of Semarang City is in danger of sinking if this trend goes on. On the other hand, alarming figures also appear in the data on land subsidence there. Kahar et al (2010, p. 90) explains that land subsidence at various points for the Lower Semarang area had occurred with a variation of subsidence of 1 cm to 9 cm in 2000-2010. Meanwhile, more recent research by Islam et al (2017, p. 35) states that land subsidence there reached 4.37 cm per year. Several mainstream media such as *Kompas* or *Tribun Jateng*, citing the Geological Agency of the Ministry of Energy and Mineral Resources, even indicated that land subsidence in the city of Semarang has reached 10 cm per year. These two variables cannot be felt directly by the community as the cause of flooding such as heavy rains or overflowing river water. However, land subsidence and sea-level rise have been shown to significantly contribute to the magnitude of the risk of coastal flooding. The reality that people are often unaware that they are living in the land that continues to sink has made the phenomenon of subsidence dubbed "the silent killer".

Other comparative data can also be obtained from disaster records obtained from BNPB. Calculated from the records of the number of disasters and losses, there is "consistency" in terms of the impact and losses due to flooding. When BNPB first recorded in 1990, the flood disaster in Semarang City occurred twice with the number of victims who died and disappeared reached 162 people,

most likely "contributed" by the flash floods that year. Nearly 30 years from that, in 2019, the number of floods was recorded to have occurred 59 times, with a total of 169 people died and disappeared, 826 people were injured, and more than 10,000 houses were flooded.

CONCLUSION

Semarang City has been closely related to flood disasters since a long time ago. Various policies carried out by the authorities, starting from the colonial government to the current city government, are in fact still unable to solve the problem. Flood prevention with non-structured methods such as the enforcement of spatial planning laws that have been formulated one after another since the Dutch colonial era has found the reality that development does not always go according to plan. Therefore, it cannot be a reference for sustainable development. Instead, the development that occurs tends to be uncontrolled, characterized by expanding settlements and diminishing infiltration areas. As a result, flood mitigation with any structural methods, whether it is normalizing rivers or building reservoirs, retention ponds, dams or whatever, has never been able to cope with the load of water when it is at its fullest. Pluvial floods are still ongoing as Semarang Atas area has turned into a settlement, local floods continue to occur because the rainy season becomes erratic and unpredictable, and coastal floods are increasingly threatening due to rising seawater which is closely related to global warming. More than just comprehensive regulations governing various lines of the environment is needed to restore the balance of nature. The paradigm of "infrastructure development" and "boosting investment" that does not pay attention to the environmental carrying capacity that the government echoes needs to be reconsidered. Moreover, Semarang City as the heart of a province with a majority Javanese population is certainly familiar with the philosophy of *memayu hayuning bawana*, which means how to prosper, to beautify, and to maintain the beauty of the universe.

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