Jakarta Waterscape:
From Structuring Water to 21st Century Hybrid Nature?

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ABSTRACT

This paper explores how changing conceptions of human-environment relationships have been materialized within Jakarta, Indonesia's planning and development practices and how these practices have contributed to shaping today's problematic waterscape. By refusing the modern binary opposition of nature-culture and arguing that our city is a hybrid human-nonhuman nature, this paper shows that there have to be socio-technological solutions for the water sector's current problems. We center our chain of explanations on flooding without neglecting the fact that flooding is related to other water issues and broader issues of uneven spatial development. Hence, tackling the calamities of flooding has to be situated within the whole water sector framework and spatial planning processes.

Keywords: *urban metabolism, Southeast Asia urbanism, water resource management, socio-technological innovation*

1. INTRODUCTION

In school, children of Jakarta learn about the story of the hydrological cycle. In reality, Jakarta's water provision does not simply follow the logic of the material cycle through biological-chemical-physical processes. The source of water for Jakarta's more than eight million inhabitants (DKI Jakarta Government, 2010)[1], in fact, is not only from the precipitation that goes to the stream or our aquifers. Engineers have been manipulating waterways for hundreds of years. Rivers were diverted and canals were built to nurture Batavia, the colonial Jakarta, with water for both economical and ecological

[1] This is an official estimation the population of Jakarta Special Region, the provincial administration area. The population of urban agglomeration of Jakarta Metropolitan Area may double to 17 million people (DKI Jakarta Government, 2010). We assumed that official population data is excluding non-registered inhabitants such as those migrated from rural areas without proper administration procedures. Moreover, during the day, the population is increasing due to the commuters earning a living in the city.

functions. Since Jakarta does not grow its own rice and vegetables, there is plenty of water beyond our consciousness that is used for the populations. Today, transported by huge trucks, different brands of drinking waters in gallons are entering the city of at least 650 squares kilometres (Ibid.). Delivering water through gallons and plastic bottles is just one of several modes of water provision in Jakarta[2], i.e. the municipal piped water system that serves not more than 20 % of the population, community standpipes, shallow wells, artesian wells, open streams and water bought from petty traders. The rich, industrial and manufacturing enterprises have their own artesian wells while poor people in the city's kampung (urban villages) rely on shallow wells that were often found to be dangerously contaminated by E. coli bacteria, or buy water from vendors whose price is often more expensive than the municipal water. In the slums, people fetch polluted water from rivers, streams and canals. In 1997, one of the largest water and sewerage privatization schemes in the world were launched in Jakarta. Thames Water Overseas Ltd. and Suez Lyonnaise des Eaux allied themselves with two local Indonesian companies to run Jakarta water and sewerage system (Argo and Laquian 2004).

The socio-technological water management system brought by the Dutch for Batavia had not incorporated centralized underground sewerage systems. Open ditches were built for both domestic wastewater and storm water (Ravesteijn and Kop 2008). While centralized water provision has been organized before 1918 (Ibid.), it was only in the beginning of the 1980s that Jakarta started to have centralized waste-water management. The centralized waste-water infrastructure is functioning only for less than 3% of the population. The sewage line is passing an area with mainly tall buildings with office and commercial functions. It was argued that commercial functions should be served first in order to give the operator company benefits in order to subsidize residential areas and later expansion of the system. Until today, the coverage area of the sewerage system has not been expanded. Most of the buildings and houses in Jakarta have been relying on on-site sanitation systems such as septic tanks that should be emptied regularly by municipal trucks. Unfortunately, most of the domestic septic tanks are leaking and polluting the soil and ground water. It is often the case that houses in crowded areas channel the wastewater into the nearest streams since there is no space for the septic tanks.

Figure 1:
Drowned Jakarta
(Source: (consulted in 02 04 2010) http://media.photobucket.com/image/banjir%20jakarta/cipbox_2008/JlnThamrinJKT010208.gif)

In the last two decades, Jakarta has been facing big floods (or banjir in Bahasa Indonesia) with higher frequency (Steinberg 2007). These banjir, for example, in 2002, 2003 and 2007, affected not only poor settlements along the river banks but also rich residential areas, business districts and the national government quarters (Caljouw, Nas, and Pratiwo 2005; Steinberg 2007; Texier 2008). While the modes of water provision within the city can easily reflect the wealth levels of the inhabitants and the lack of clean water provision is mostly seen as a problem of the poor, banjir hit any single stratum of the population. Since banjir in those years lasted for days, economic activities were stopped and the calamities brought tremendous economic lost. Those events pushed Jakarta Provincial Government and the National Authorities to channel their financial resources to develop a strategy for mitigating banjir (Ibid.). In other words, banjir have brought 'the money' to the water sector, which has been marginalized within the infrastructure development for more than five decades.

This paper aims, first, to show that Jakarta problematic waterscape, with banjir as one of its issues, is caused by material practices that have

[2] For studies of the water provision dynamic in Jakarta within the framework of governance, consult for example Argo (1999), Argo and Laquian (2004), Kooy and Bakker (2008a, 2008b)

been socially constructed throughout history. Following the concept of 'urban metabolism' developed by Swyngedouw (1999; 2006) and Gandy (2004), we name the material practice and its social construction as a hybrid process. We believe that this conceptual framework will be able to structure our understanding of today's problematic water sector and urban environmental problem in general. Strategies planned by the Indonesian government to cope with banjir have been dominated by technocratic approaches that apply engineering measurements (c.f. Texier 2008). The metabolic approach challenges technological deterministic solutions supported by the engineering advances. If there are social causes, there should be social solutions (Blaikie and Brookfield 1987). At the same time, this approach advocates the needs to understand the locality of material culture and the importance of location-specific solutions. Continuous material processes that are observable in the physical environment were forgotten in the theories of social science (c.f. Swyngedouw 2006); social science often emphasized the notion of the power of human actors that enhances the road for social solutions while neglecting the power of non-human actors. Overweighing social solutions or supporting technological determinism is equally dangerous.

The second aim of this paper is to show that banjir are closely related to other issues within the water sector and broader issues of uneven spatial development. Hence, mitigating banjir could be an entry to reform the whole water sector and a start to materialize the concept of integrated water resource management within the context of the coastal city. At the end, this paper aims to advocate water sector issues as structuring points in spatial planning processes and the role of urban designers as the mediator between social and technological determinism. Creativity in urban design processes should bring socio-technological hybrid solutions.

This paper benefits from numerous previous scholarly works related to Jakarta's water sector. Among them are those unfolding the historical development of the water sector within the disciplines of sociology, anthropology and hydrology; others on governance and the socio-political processes of securing water supply from the city managers point of view referring to the processes of privatization and supply expansion; and finally others that are focused on seeking the pattern of Southeast Asian urbanism. However, research on integrated water infrastructure, its relation to the bigger infrastructure sector and its connection to urban life is still lacking. Adding to the existing literature, we would like to contribute in fulfilling what is lacking and answer the calls of 'de-centered theory' of urbanization (Kooy and Bakker 2008) in the context of the global South. In the following parts, we open the discussion by theorizing human-environmental relationship and afterwards move to the application of the conceptual framework into the phenomena of Jakarta spatial development in respect to the water sector.

2. UNFOLDING URBAN METABOLISM: CONTESTING NATURE AND CULTURE

Dutch colonialism transplanted the model of the Western modern city onto the land of Java, mostly in coastal areas. The inheritance of Dutch colonial cities can still be found today in the form of, for example, canals, cathedrals and art-deco buildings. Later on, far from the coastal cities in which the Dutch inhabited, hectares of tropical rainforest were transformed into plantation producing various types of export-based crops. For both types of environments, the Dutch administrators had to mobilize thousands of unpaid workers transforming the soil, stones, and bricks into the buildings and the irrigation canals. Without importing bricks, before they were produced in Java, and bringing the seeds from thousands of miles away for cultivating the colony, the landscape of Java would not become what it is today. It is interesting to see that within Indonesian society today, there are discursive ideas that the city is 'culture' while the plantation is 'nature'. Accompanied by the following explanation, we argue that both 'the city' and 'the plantation' are in the same time nature and culture.

The term 'metabolism' became familiar in the early nineteenth century and it refers to material exchanges within the human body through the respiration system, between organisms and the environments, and between living creatures, involving biological, chemical and physical processes (Swyngedouw 2006). Either metabolism happens within a living thing or between a living thing and its environment, each organism and environment has its totality of biochemical reactions and the possibility of affecting other metabolic systems (c.f. Ibid.).

The use of 'metabolism' became broader with its application within the dynamics of socio-environmental transformations. Swyngedouw points Marx as one among the first who used the term of 'metabolism' in this respect, influenced by the work of chemist agriculturalist Justus von Liebig. Marx

(1970 in Ibid.) applies 'metabolism' in defining labor. To summarize, labor is a process of controlling the material processes of the objects which humans try to transform while having their own metabolism within their bodies. It is not only a matter of technical experiences between human subjects and non-human objects, but labor is also affected by social relations, or experiences between humans, since metabolic activity has been always happening within social relations. On the other hand, by transforming nature, one has contributed to social-natural transformations. From both human-nonhuman and human-human interactions, and the process of relating one interaction to another, human beings develop a conception towards his or her environment (c.f. Sayer 1992).

Certainly in contemporary urban life, human work is not simply 'labor' with the meaning of transforming material objects to other forms, for example, cultivating rice or fabricating clothes[3]. Activities of the service sector have been transforming our urban landscape today. In the case of Jakarta Metropolitan Area, activities contributing to economic growth include manufacturing, finance, trade, transportation, and the building sector (Firman 1998). However, there are material processes in the activities of clerks, bus drivers, architects, developers and bank managers within certain social relations and physical environments (c.f. Latour 1999).

Following the above explanation, then we can define urban metabolism as socially mediated process of mass-collective environmental-transformation and trans-configuration by interconnected acts of all 'agents' (c.f. Swyngedouw 2006; Mollenkopf 1983; Harvey 1985). Urban metabolism is an uninterrupted assembling process of humans and non-humans whose own metabolism is an integral element. Cities, then, are spatial manifestation of 'heterogeneous assemblages' from continuous dynamic ecological relationships between humans and nature that are not neutral from the dialectics of human's perception, conception and sets of meaning (see Gandy 1999; 2004; Kaika and Swyngedouw 2000; Swyngedouw 1999;2006).

It is important to understand that the above concept of 'metabolism' within the dynamic of urban socio-environmental transformation as advocated by, for example, Swyngedouw and Gandy is different with the one that is used as a purely social metaphor, i.e. using the nature's processes of metabolism explained by biological and physical sciences as explanatory structures of social phenomena without incorporating that natural material processes are actually happening in the same moment (c.f. Gandy 2004;Swyngedouw 2006). Also important is to differentiate the above concept with the one that is utilized within urban and architectural discourse referring to the biophysical processes of urban metabolism as static functionalities that do not explain urban space as an historically produced environment (Gandy 2004).

The model of the modern city transplanted into the global South through colonialism has not been without continuous conflicts and reformulations within the original setting of industrialized Europe. From the stories of hydrological transformations in 19th Century European cities, we can argue that the process of reformulating and redeveloping the modern city, in this case the water system model, involved: environmental degradation due to industrialization that had changed the pattern of labor; significant development in science and engineering (see Melosi 2000; Porter (ed.) 1994); the role of the welfare state with some leading reformists, especially in public health sector e.g. Edwin Chadwick for Britain (see Porter (ed.) 1994); planners and engineers that materialized the discursive ideas at the time (Melosi 2000), like Joseph Bazalgette for London and Baron Haussmann for Paris (Gandy 1999).

The development of Batavia, colonial Jakarta, was influenced by the dynamic of the hybrid-process in the home country of Holland. Batavia's water management was part of an evolutionary process begun long before the Dutch arrived with a big ship containing the water management experiences of a 'centuries-long battle' in the low land attached to the North Sea (Kop 2008). On the other hand, it has been acknowledged that the socio-technological dialectics of water management in the colony influenced the development of knowledge and practice of water management in the mother land (Ravesteijn and Kop 2008). The explanation below shows how the Dutch engineers transplant the modernist concept of urban living in Batavia, the colonial Jakarta, from 17th to 20th Century. Perhaps we could point to this

[3] See Mollenkopf (1983) for the first and second urban transformation and the social characteristics accompanying them. What Mollenkopf refers as 'first' urban transformation is changes during the industrial era while 'second' transformation is changes during the growth of service sector.

highly technological approach towards the existing environment imported from the Netherlands as the legacy of living with banjir.

3. WATERING THE CITY AND MODERNIZING THE COLONY

During the maritime trading between China and India since the second century AD, the emergence of coastal cities across Southeast Asia augmented the number and intensity of urban agglomerations in Indonesia. However, until the eighth century AD (Ford 1993), major civilizations such as the Java and Sumatera kingdoms were concentrated inland with the Hindu-Buddhist palaces as the generators for the urbanization. Connected through the rivers, the kingdoms' territories ended to coastal areas that were supporting inland activities (Widodo 2009). The emerging coastal cities differed from the inland conurbations constructed based on Indian tradition. (Widodo 2004). As the connecting points between interior cities and the international world (Widodo 2009), the coastal cities underwent more dynamic experiences and they gradually became more important and bigger with their own morphological characteristics.

One of these coastal cities was Jayakarta (1527–1619) that was originally situated close to the mouth of Ciliwung River, the main river of Jakarta today. Emerged as a river settlement with an immense number of watercourses on a flat and low plain, Jayakarta flourished despite the risk of being wiped out by the greater volume of upstream water and sea level rise. The settlement was morphologically simple. The harbor, traditional market area, mosque, alun-alun (open public space), the prince's house, and warehouses were located on the left bank of Ciliwung River, while the opposite side of the river was given to native and foreign settlements (Widodo, 2004). Although the port town was one of the main harbor settlements in Java for international traders (Sugiantoro, 2005), Jayakarta was less recognized compare to its rival Banten Port, ruled by another kingdom located just to the east side of Jayakarta (Widodo, 2004). It was only in the early 17th Century, when the Dutch took over the area, that Jayakarta was entirely redeveloped as a major port city in Java with the new name of Batavia.

During the colonial era in Batavia, public perception towards water was reconstructed and new conception of water was imagined. Before unfolding the story of the urban metabolism of colonial Batavia through the history of its water management system, we would like to start the discussion by briefly unraveling the history of water management in the Netherlands to give us a foreground for analyzing the contemporary waterscape of Jakarta. We point to this 'foreground' due to the following rationalization. When the Dutch colonialists arrived in Java, they did not bring the latest model or an absolute form of water management. In the Netherlands, a modern approach towards nature was continually reformulated and an on-going process wwas developed to produce 'better' ways of dealing with water. It is relevant to show that the dialectics in the Dutch water sector, and generally in the global North, did not stop when the socio-technological system was imported into the Indonesian Archipelago through modern colonialism. By showing this, we counter the practices in the global South that often take the modern way of dealing with water as an absolute model and this has closed spaces for innovation, even when the transplanted model has been proved as non-performing.

3.1. Watering the Origin

Hooimeijer's work (2009 and in this volume) offers an outline of historical, current and future relationship between urbanization and water management in Dutch polder cities that is drawn on the relationship between water management and urban design. Hooimeijer shows that conceptual thinking behind polder cities has been changing and hence, continually recreating and transforming polder cities. We simplify the author's explanation by summarizing the narration within our conceptual framework into Table 1.

Table 1
Six Phases of Dutch Water Management
*Source: Authors based on Hooimejer (2009) * see also Meyer (2007) and Voogd (2006)*

Phase (Hooimejer 2009)	**Period (AD)**	**Influential Events**	**Responses**	**Characteristics**
Acceptation	-1000	Natural metabolism: forces of water and wind	Living in higher grounds	Surrender to the forces of nature – this has been seen as flexible character towards water
Defensive	1000-1500	The 'great reclamation' of agricultural grounds	Combination of dikes, natural watercourses and dams → mostly the dams turned into trading markets → estuary outside the dikes became a sheltered harbor	Combination of hydraulic and economical considerations; this era has been considered as flexible character towards water too
Offensive	1500-1800	Population growth; the formation of the 'Republic of Seven United Netherlands', organized army was formed; progress in science, technology and arts	Living on leveled 'dry' cores	Growing needs of group consensus to fight against the water; negotiation and co-operation between landowners and farmers
Early Manipulative	1800-1890	Growing industrialization; explosion of population; technological inventions; improvements in the fields of hydraulics, soil mechanics and engine power; French colonization	Spatial separation of conflicting functions and grouping of similar ones; better settlements for better-off populations; combining hydraulic engineering and city design	Centrally organized governmental structures; national concern of water management and education of related professions; water should bring quality and conditions for better living environments
Manipulative	1890-1990	The invention of steam power; Maturation of soil mechanic field	Much greater scale of land reclamation: reclaim water, not only wetlands; segregation of spatial functions; underground piping started to be in place; reintroducing of public space	Not only control but manipulate; maturation of and specialization within fields lead to disintegration of professions, e.g. designers ignored the logic of natural metabolism

Table 1
Six Phases of Dutch Water Management (Cont.)

Adaptive Manipulative	1990-	Calls not only to integrate water management but also between water management and spatial planning*; improvement in the fields of foundation engineering and building materials; the impacts of economic recession: no funding for public space; climate change	Water should be stored instead of drained as quick as possible; 'nature' as element of urban design: the concept of 'blue' and 'green' in spatial planning; increasing use of soft-surface (water, grass and soil) instead of hard one (concrete, etc.); easy and cheap maintenance of public space	Concerns on ecological systems; nature and city are one system; leaving rigid and purely technological approaches to water management; 'watering' urban design;

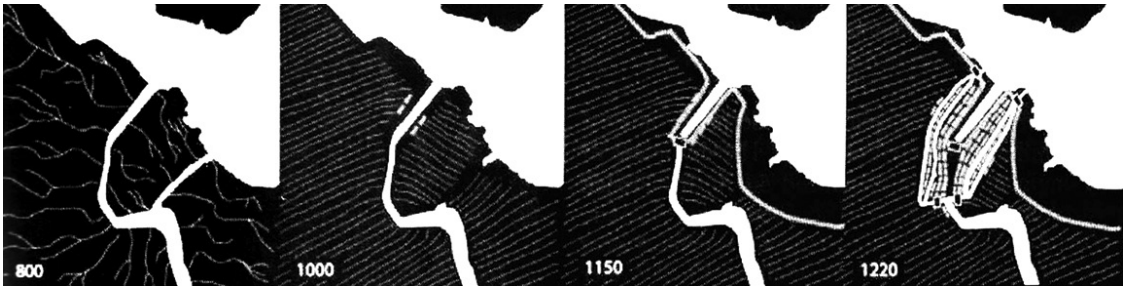


Figure 2:
Early Transformation of the Amsterdam landscape (Source: Hooimejer, 2009)

From the Dutch experiences in water management, we see that it is not simply a matter of controlling natural metabolism and transforming material culture but also maintaining institutional dynamics. Since water was a common enemy for the Dutch in the period before 19th Century, social consensus was required for devising a solution to flood control. Further, since reclaiming land necessitates resources, i.e. planning and labor, development has to be regulated (Ibid.). Hooimeijer raises another crucial point that not only confirms that the flourishing of knowledge of water-related engineering is affected by and affects practices of water management, but also the need to understand who owns this knowledge. It is explained by Hooimeijer (Ibid.) that military and civil engineers were those mastering the field since they were the first to develop interest in water management.

The Dutch water management system has been evolving for centuries, and today purely technological approaches have been perceived as not sufficient for responding the complexity of contemporary urban water issues (Hooimeijer 2009;Voogd 2006). Domination of 'technological innovation and historical transmission of water management techniques' has led to less appreciation of spatial quality (Voogd 2006) and put water experts in an exclusive box of professional privileges (c.f. Hooimejer 2009). However, there have been attempts to transform the relations between, for example, urban design and engineering in recent years. Although once, it was torn apart, today's complexity of urban life and the risk of rising of sea levels are demanding trans-disciplinary approaches (c.f. Meyer, 2007).

3.2. Banjir in Batavia: Natural and Normal

For the Dutch, settling in Batavia was not without difficulties. The material conditions and and the existing cultural processes together create important difference to the Western setting. Ravesteijn (2008) shows that the Dutch technology in East Indies generally faced two big challenges: nature and geographical features. Even without anthropogenic factors, Jakarta was already subject to flooding (Caljouw, Nas, and Pratiwo 2005) due to its natural metabolism. Jakarta today is a more-than 5,000 year-old delta formed by sedimentation of debris from the volcanoes in the South. The alluvial plain that is just above sea level has around 13 waterways cutting through the city; three of them are bigger with their springs in the steep mountainous highland. In the delta, water flows slower towards the sea due to a significant decrease of inclination. Most of the river outlets are heavily silted due to the low speed of water flow. High tide also reduces the flow of the stream. During wet season, these rivers carry enormous amounts of water containing heavy silt brought by fast streams in the higher lands. The combination of Jakarta causes increased inundation of the delta regularly.

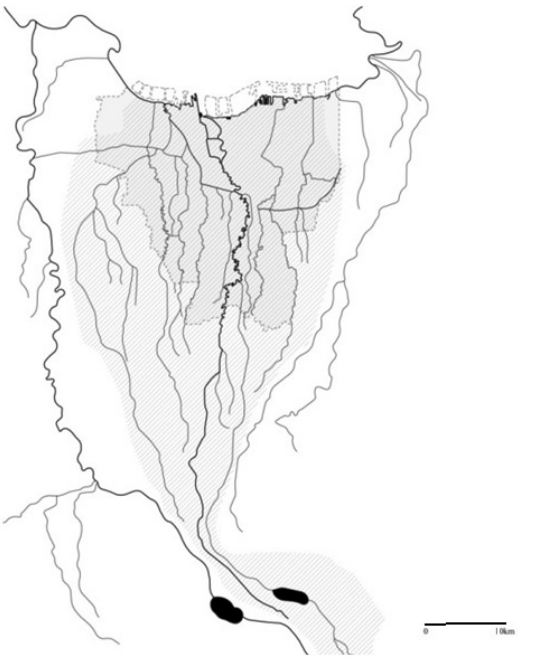


Figure 3:
Hydrological Situation of Jakarta Today within the River Basins (Source: Authors based on Nedeco 2002 in Caljouw et al 2005)

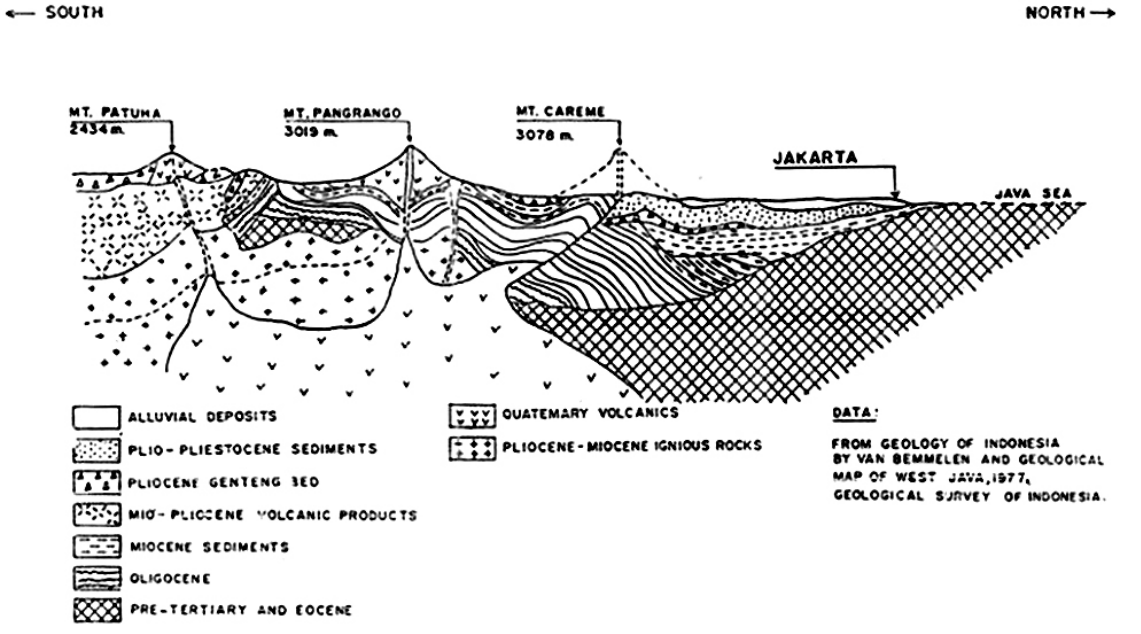


Figure 4:
Vertical section of Java Island positioning the low land Jakarta and the highland areas in the middle of the island (Source: Van Bemmelen, 1977 in Caljouw et al. 2005)

For the Dutch colonialists arriving in Batavia, the delta characteristics were basically not new, although it took years for them to adapt to the heavier rain - approximately three times of Amsterdam - and thicker silt carried from mountainous areas (Kop 2008). We assume that technocrats of pre-colonial Javanese kingdoms were also familiar with these natural phenomena. Both civilizations perceived inundation in the delta areas as natural and, due to the frequency, normal. But, we can see that both civilizations had different attitudes towards delta areas: the Javanese kingdoms avoided low lands while the colonists challenged it. Apart from the Dutch tradition towards water, perhaps there were other factors why the colonists settled along the bay of Jakarta. It seems that the colonists were securing their territory from inland 'native' rivals. Nonetheless, the colonists were 'ready' for the consequences of inhabiting the low land with their knowledge and skills carried from home. With the technological and institutional advances developed throughout times, it has been part of Dutch culture to have an offensive approach towards nature as manifest in water.

3.3. Channeling the Water: defending territory and structuring growth

Batavia, expected to be 'Amsterdam in the tropics', was built in the area of Sunda Kelapa, the harbor of Jayakarta. The 'offensive spirit' (c.f. Hooimejer, 2009) in respect to water was within the colonists' paradigm. They actively reclaimed wetlands; canals were dug and excavated soil was used for raising the ground (Caljouw et al, 2005). Waterways, housing blocks, and infrastructure were articulated in grid structures. Numerous navigable canals were inserted in between the urban blocks. However, while actively engineering the water, early activities in the new colony were essentials just for survival and defense of the territory against inland rivals and the climate. Batavia used water as defense against its neighboring native kingdoms by creating a strong fortification with an elongated canal enveloping the stronghold wall to protect the inner city (Sugiantoro, 2005). Later, water was used for productive landscapes, irrigating farmlands in the extensive lush delta region. The Ciliwung River was diverted through a network of irrigation channels, spilling into the agriculture areas located in the rural periphery (Figure 5).

Since sea-going ships could not bypass the sandbanks blocking the river's mouth, canals were also built for smaller ships and boats transporting goods to inland area during the high tide (Veering, 2008; Caljouw et al, 2005). The canals worked responsively to the seasons. To prevent upstream flooding during wet season, the canals were functioned to overflow water from the hinterland. It was also in wet season that the canals functioned optimally for water transportation. During dry season, when the flow of the Ciliwung could fall to 2m³/s, the canals provided the city with water. In the city, there was space for water to be diverted or distributed.

The modification of Batavia continued for decades, with water essentially positioned as the main regulator in constructing the city. By 1650, thirty years after occupation, the area of Batavia expanded three times (Figure 5). However, during its transition from a small defensive city to busy port, Batavia was hit by several major banjir due to both anthropogenic and natural factors. Upstream deforestation and irrigation for an over-extensive agriculture area worsened the situation. Forest clearance in the far south mountainous area for tea plantations caused floods in 1654 and 1714. Numerous waterworks were constructed such as sluices, dams, and canals since the beginning of the 18th Century (Kop, 2008a) to cope with flooding problems inside the city. Irrigation channels watering the agriculture area were unmanageable and likewise contributed to the amount of rising water. Special events generated other floods: excessive water quantity during the wet seasons and mud inundation caused by the eruption of Mount Salak.

In the early 19th Century, urbanization in Batavia expanded further South of the old town, as there was need for more area to accommodate increasing civic functions. The deteriorating environmental condition in the old town was another factor pushing this expansion. Leaving the coastal area of Batavia, the colonists were reaching higher ground. This decision was not without any consequence. Extended waterworks were still following the expansion.

As the flooding encroached upon the city more often, Herman van Breen, a water management engineer for Jakarta, developed a design for the West Flood Canals in 1917 (Figure 6). His idea was to control the abundant volume of water by redirecting discharge from the Ciliwung River to the western part of Batavia before it was released to the sea. Van Breen designed polders in parts of North Jakarta (Figure 6), using dredged sediment from the mouth of the river (Caljouw et al, 2005). During the construction of the West Flood Canals in 1920, Batavia covered an area of only approximately 25 square kilometers. The Dutch faced another challenge in dealing with

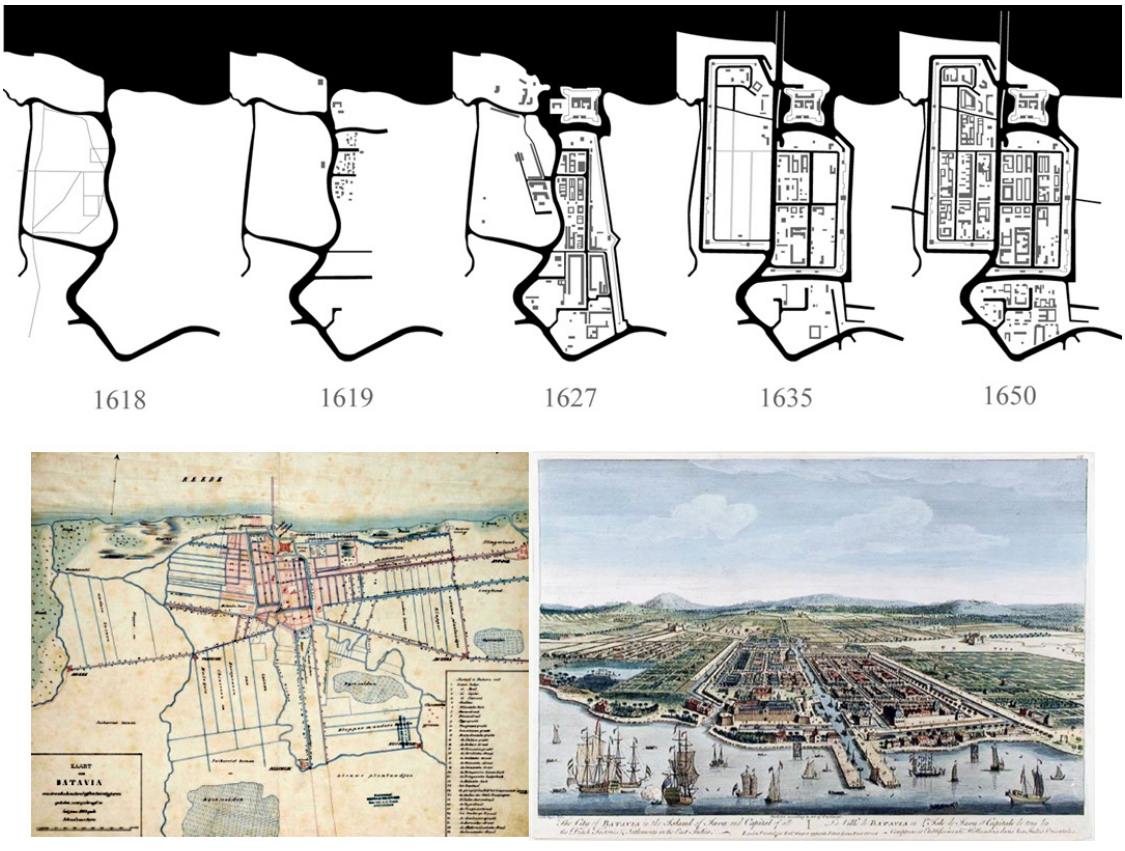


Figure 5:
From Jayakarta to Batavia during three decades of colonialism - map and view of Batavia in 1740 (Source: Authors based on Sugiantoro, 2008 – map and view are from the collections of the Royal Tropical Institute)

water in the tropical colony that did not exist in the mother country: malaria. Together with other diseases catalyzed by the presence of stagnant water, malaria was counted as a killer. Some techniques were combined to prevent public health disasters. People were endeavored to eradicate the breeding places of mosquitoes by keeping their pools and fish ponds clean, completely draining them, or by 'petrolizing' the breeding places. The pools and ponds were cleaned of all sorts of plants growing along the banks by regularly flushing them with fresh seawater. Biological control was implemented by introducing various sorts of fish either to reduce the mosquito larva or the unwanted plants. Drying out the ponds and pools was done by poldering or simply filling them with soil (Kop, 2008a).

Beside challenges in protecting urban areas from floods caused by the sea or rivers, sanitation and drinking water provision were also important issues. The expansion of the city to the south was not accompanied by sufficient water supply. Traditional public water supplies, i.e. tapping water from rivers or natural springs, shallow hand-dug pits/artesian wells and rain water collection, were no longer sufficient. Since 1918, Banjir Canal was a source of 'raw water' for the new company providing drinking water for the capital (Ibid.). However, the provisions of public water transport enriched urban life during this period and it was possible to navigate the canals that had been created for irrigation purposes (Ibid.)

By mid-20th century, the total area of Batavia was several times larger reaching 34 square kilometers, including more than 90 km of canals and main waterways (Kop 2008). In 1942, the West Flood Canal was completed, but, Batavia was still subject to inundation (Caljouw et al, 2005). W.J. van Blommenstein proposed an integrated system of irrigation and drainage for the whole area of West Java with dams and lakes used for electricity further upland. In the Batavia region, van Blommenstein commenced the construction of dikes in north Batavia combined with a polder system.

Figure 6:
Batavia Hydraulic Situation in 1923 - map depicts Batavia in 1935 (Source: Ravesteijn and Kop eds. (2008) – Map is in the collection of the Royal Tropical Institute)

4. FROM STRUCTURING TO MARGINALIZED WATER

> *"Build up Djakarta as beautifully as possible; build it as spectacularly as possible, so that this city, which has become the center of the struggle of the Indonesian people, will be an inspiration and beacon to the whole of struggling mankind and to all the emerging forces. If Egypt was able to construct Cairo as its capital, Italy its Rome, France its Paris and Brazil its Brasilia, then Indonesia must also proudly present Jakarta as the portal of the country". (Soekarno, 1962)*[4]

The Dutch surrender in 1945 opened a new phase in governing the country, including re-envisioning the capital city. Inspired by other big cities in the world, Soekarno, the first president of Indonesia, evoked his vision to make Jakarta recognized as a world city. According to his nationalist view, an urban revolution was needed to re-establish a new international image for Jakarta, opposing its former representation as an old colonial town. He believed that the powerful tools needed to realize his aspirations laid on the performance of several major urban projects. Agendas for fashioning Jakarta were inaugurated by erecting monumental buildings attached to grandiose boulevards (Silver, 2008). Unfortunately, Soekarno's priorities for urban development neglected to touch the deteriorating parts, and did not include the problem of flooding. Moreover, his priority to develop more road based infrastructural projects without public transport improvement was the embryo for private urban developments in the following years (c.f. Danisworo, 2002).

[4] Speech from Soekarno, first president of Indonesia, for his vision: The Transformation of Djakarta Raya, 1962, in (Silver 2008)

The 'New Order' of Soeharto, from 1965 to 1998, simply continued Soekarno's road based developments through big infrastructure projects such as boulevards, toll roads, highways, and flyovers in Jakarta. Within only three decades, from the 70's to the late 90's, approximately 45 high rise buildings and numerous shopping malls were built (Danisworo, 2002), representing development of consumerism.

One of the most controversial projects was the plan for a new waterfront development, North Jakarta Revitalization and Waterfront Reclamation Project, which would facilitate commercial, residential, and industrial development. Formerly initiated in 1995 by the Jakarta Regional Planning Board, the project officially obtained its endorsement from the government after several long disputes and delays. The reclamation project stretches 32 km from Tanjung Priok Harbour to the Jakarta's International Airport. This energy-intensive development requires enormous amount of soil for the reclamation. It is predicted that the realization of the project will worsen current flood conditions and compromise natural features in Jakarta Bay.

4.1. Privileging Asphalt, Marginalizing Water

Rapid urbanization has been worsening Jakarta's hydrological situation. More impermeable land makes water flow into the waterways with a higher speed. Hence, the river and canal volume increases quickly, especially during the rainy season. Upstream, less forest and green coverage cause greater erosion and the river carries more sediment. Garbage dumping into waterways adds the problem. At the same time, rivers are compressed by the urbanization and their width has decreased significantly. Gigantic constructions with large earth excavations for foundations and basement parking, and the uncontrolled extraction of ground water have led to land subsidence and allowed saline water to intrude the North part of Jakarta.

Jakarta has been transforming for over 60 years after Independence. Water has slowly evaporated from the mental map of the city's inhabitants. In Jakarta, people experience their daily life in vehicles – often trapped in traffic jams – through networks

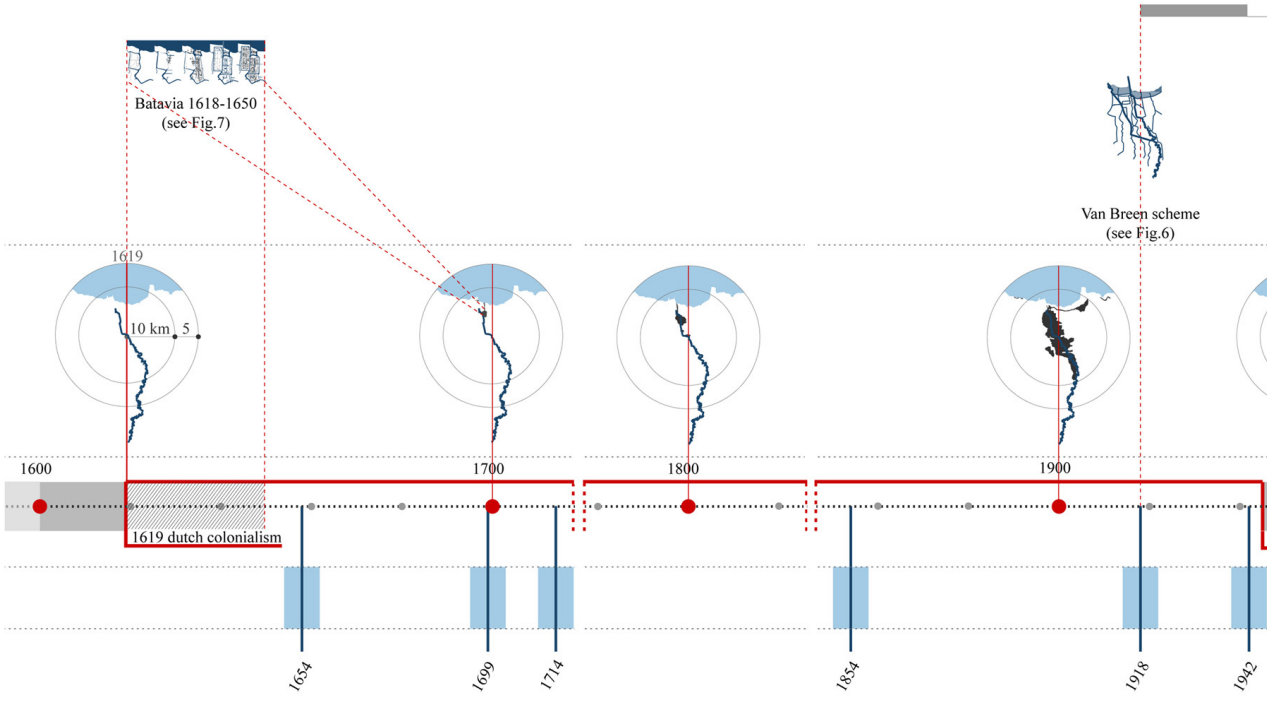
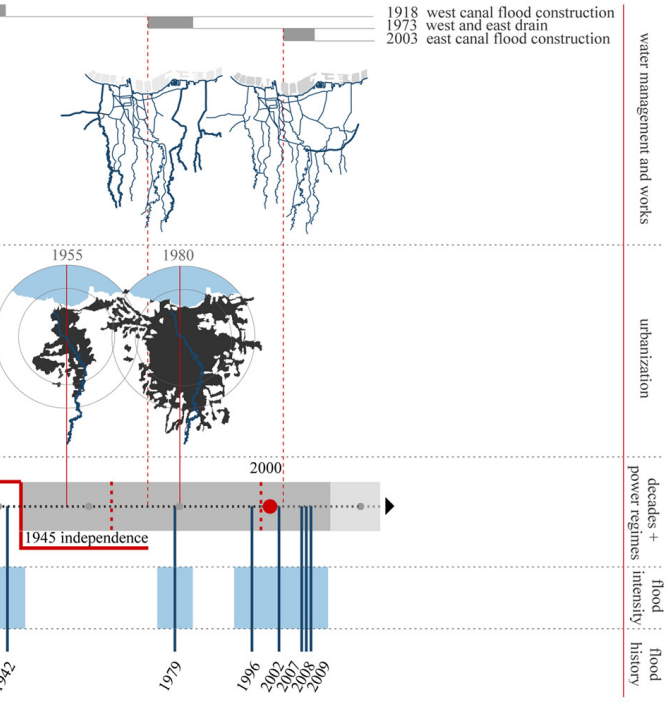


Figure 7:
Flood-management infrastructures have been lacking behind the growth of the city
(Source: Authors based on various sources)

of asphalt and concrete. Roads cover an area of 650 square kilometers and reach every corner of Jakarta. The surface area of roads has bypassed the width of Jakarta's main rivers. Since physical development face the roads and the coast and the river are blocked with private functions; there is no more contact between the city's inhabitants and the water. Jakarta's citizens are not aware that they live on a low level land near the sea. There is no open space along the river with city-scale public amenities. For the majority of the people, it would be very difficult to point the location of Ciliwung River, while it would be much easier to recognize the tallest landmark buildings of Jakarta, or to map the major asphalt lanes of the city surrounding the monumental commercial and business centers. Ironically, people were reminded of their vulnerable habitat it was only when banjir hit the city. That is how water culture has altered drastically to be perceived as a frustrating issue.



4.2. Marginalized Water and Forgotten Communities

Although banjir have become a common problem and has driven the attention of provincial and national government, each sector and income level has experienced its effects differently. Low-income populations accept the reality that the only places in the city to live are the areas with limited or even no access to public facilities, such as the river banks. Since the riverbanks are subject to flooding, these inhabitants have become the most vulnerable victims (Textier, 2008).

It is often that the society residing along the riverbanks is accused as being responsible for the calamity due to their unsanitary behavior. Dumping solid waste and channeling wastewater into the river have been seen as merely the poor's misbehavior. It is not that there is no flood awareness and environmental appreciation among the poor. In fact, their way of living is the only way to cope with poverty and uneven spatial developments (c.f. Textier, 2008). They have no choice but to inhabit congested dwellings without adequate fresh air and sunshine. As most of the households are not served by piped water, they can only use dirty water from the river for domestic use. During wet season, the waterways are blocked and water spills over into the city. In dry season, a stench permeates. Meanwhile, rich people simply raise their ground floor residential platforms. These individual actions actually cause higher water levels in the surrounding poor neighborhoods when flooding occurs.

Jakarta authorities claim that there have been comprehensive efforts to manage banjir including incorporation of non technical aspects such as economic, socio-cultural, and governance (see Kompas, 2010). In fact, technical parameters and engineering works are still used by the government as the measure of progress against the problems of banjir. Moreover, most of the infrastructural projects, like the East Flood Canal project, are accompanied by relocation of the settlements along the waterways. Ignoring the technical debates about the efficacy of the flood-canal on Jakarta's flood problems, the relocations have destroyed the socio-physical fabric of the city and do not solve the slum problem. The authorities argued that since the inhabitants along the waterways are vulnerable to banjir, relocating the settlements are needed in order to protect them.

Jakarta's government views banjir as not only the responsibility of the government, but also of the city's

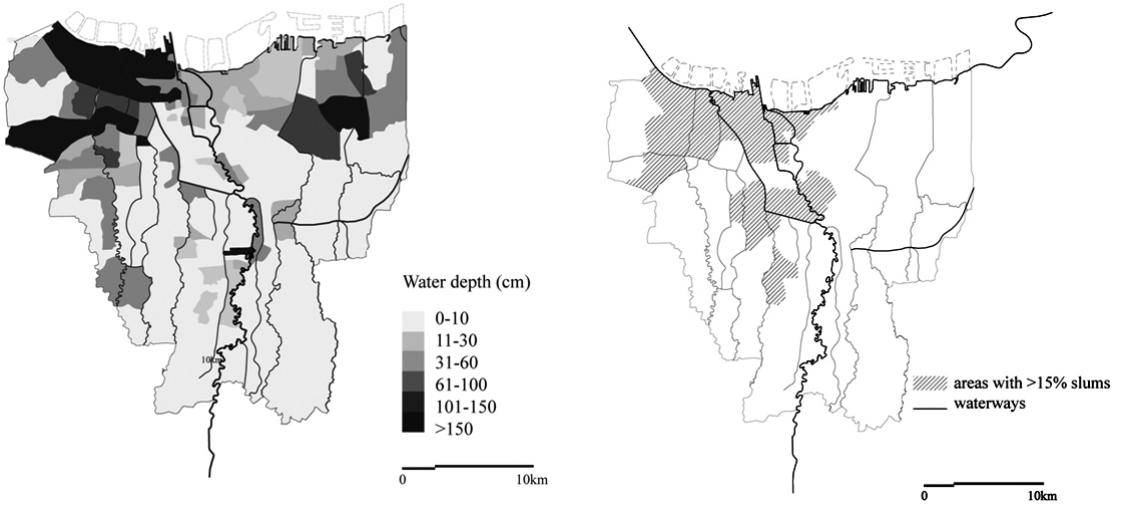


Figure 8:
Socio-hydrological Situation of Jakarta Today: flooded areas and slum distributions (Source: Left - based on Rijkswaterstaat et al. 2003 in Caljouw 2005 and RTRW DKI Jakarta 2010; Right - based on Bakker et al, 2008)

communities. The principle to share responsibility is, unfortunately, not a gate to a democratic space in city management. Instead, it has been seen as an effort to throw water management responsibility to others. The government justifies banjir as natural, as the city is built on the alluvial low land, and argued that it has been worsened by the practice of solid waste dumping into the river (see Kompas, 2010). This justification has been seen as a demonstration of an incapability of the state to handle the problems of banjir (see Kompas, 2010). The government builds discourses to divert the criticism addressed to them instead of, for example, regulating the physical development. The understanding that banjir are part of Jakarta's natural metabolism is not used as the foundation to create water-friendly urban development and promote living with water. Instead, it has been used as a political legitimation of a regime that is doing nothing for its communities.

In the meantime, a number of non-state led activities have emerged. Several social organizations and NGOs have launched programs related to sanitation behavior, such as neighborhood solid waste management and sanitation campaigns. Some organizations are working with communities to promote living with banjir: e.g. elevating their houses and freeing the ground floor, storing foods and other preparations for facing banjir, and introducing evacuation mechanisms. However, the fragmented efforts at the neighborhood level are not sufficient to improve Jakarta's water system overall. Given the physical fact that 40% of the urban area is already vulnerable to banjir and the social fact that local wisdom towards living with water has been erased by modernity, Jakarta has to face rather complicated socio-environmental problems.

5. SEEKING ALTERNATIVES: 21st CENTURY HYBRID NATURE

Water is both an essential material component and concept-dependant object at the same time, and it has ability to explain the dynamics of urban restructuring over time. By tracing the flow of water, we can understand comprehensively the flow of power within the cities and wider socio-ecological changes whether they are visible or invisible (c.f. Swyngedouw, 2004 and Gandy, 2006). Hence, socio-ecological narratives about cities can be created from the history of urbanization and domestication of water and the creation of its supporting infrastructures (c.f. Ibid.).

As we have unfolded Jakarta's waterscape we learned that the transformations of urban form cannot be separated from inhabitants' conceptions towards water. It was the sudden change after Independence that diverted the central attention of the state away from the water. With the shift from an agricultural-maritime based economy to industrialization and a service economy, the interaction between humans

and the materiality of water has transformed. Today, urban populations become specialized in their professions while water is bottled through mass production, disconnected from black water flowing along the nearby waterways.

Figure 9:
Coastal Skylines of Jakarta
(Source: Prabham W. Pratipodyo, 2008)

Our narrative disentangles Jakarta's urban history by unfolding the waterscape dynamic. We can conclude that apart from a hydrological understanding, we need to know how actors perceive water-related problems to form a consensus in creating the urban environment we wish to inhabit. It seems that it is still a very long journey towards a 21st Century hybrid nature that is able to bring so-called sustainability. However, although it is scattered and fragmented, there have been attempts from various communities. Individual architectural efforts, improvements in sanitary behavior and social capital in the form of social organizations are waiting to be organized collectively. Jakarta's population and geographic size make it too big for central management. The 13 river basins need to be considered as interlined individual clusters. Hence, the grand agenda for urban design practices in Jakarta includes integrating location-specific solutions within a framework of citywide spatial planning or provoking a citywide strategy by proposing location-specific solutions.

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