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OLGA PETROVA. JAKARTA'S FLOOD CONTROL METHODS

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Olga Petrova,

Research Associate,

Center of Southeast Asia, Australia and Oceania,

Institute of Oriental Studies, RAS,

e-mail: 1.petrova.olga@mail.ru

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Abstract. Indonesia is one of the most vulnerable countries in the world to natural disasters, and the situation is becoming more and more difficult every year. Indonesia, which is a tropical country, has only two seasons, namely the rainy season and the dry season, which results in heavy rainfall. Flooding in Jakarta is a common occurrence. The causes of flooding can be divided into two, namely natural causes and human-induced causes. Flood control has been carried out for a long time, but it has only focused on engineering technologies such as the construction of dams, pumping stations and dams. Now there is a transition where flood control methods are shifting towards a more adaptive and integrated flood risk management system. This requires a balanced integration of structural measures and well-organized disaster management.

Batavia, the colonial capital of the Dutch East Indies in the first half of the 20th century, was a small urban area with a population of about 150,000 inhabitants. In the second half of the 20th century, Batavia

became Jakarta, the capital of independent Indonesia [1]. Today, Jakarta is the largest and one of the most dynamic metropolises in Southeast Asia, and it faces most of the urban problems experienced across the region.

Flooding in Jakarta is a frequent occurrence. The city has suffered from floods since the 1960s, but the effects of climate change endanger more lives each year.

All floods in Jakarta in the first half of the 20th century were caused by heavy rainfall and the breaching of dikes and dams. To mitigate the effects of floods, the Dutch colonial administration established the Department of Public Works (*Departement van Burgelijke Openbare Werken*) in 1918 and built the Western Flood Canal in 1922. However, the frequency of flooding in Jakarta changed: while in the first half of the 20th century floods occurred every 3–5 years, since the 1970s they have become annual events [1].

Floods have had a critical impact on Jakarta's infrastructure and population. In 2008, floods inundated a large part of Jakarta, including the Sedyatmo toll road; nearly 1,000 flights at Soekarno-Hatta International Airport were delayed or diverted, and 259 were canceled. In 2012, floods submerged hundreds of homes along Jakarta's major waterways, including the Ciliwung, Pesanggrahan, Angke, and Krukut rivers, and forced 2,430 people to evacuate their homes. In January 2013, many parts of Jakarta were flooded after heavy rain; and, according to the National Agency for Disaster Management (BNPB), the subsequent floods killed at least 20 people and forced 33,502 people to flee their homes [1].

Of the 2,572 disasters that occurred in Indonesia during 2018, floods accounted for more than half, making them the most frequent disaster that year [2]. This is caused by various factors, such as climate change, land subsidence, rising sea levels, and socio-economic growth. The situation is worsened by Jakarta's high population, which has reached 10.4 million, and nearly 45 million including the suburbs, as people from across the country are forced to leave their homes and seek economic opportunities in the capital. Experts suggest this is due to insufficient economic development in other regions of Indonesia.

A study of flood observation data concluded that the largest floods occurred every five years in 1996, 2002, and 2007. However, from 2006 to 2017, the number of recorded floods in 92 Indonesian cities tripled: from 50 to 146 [3].

Jakarta suffered from two major floods on January 1, 2020, and February 20, 2021, both believed to be caused by extreme rainfall. In the