3.8 LAND ACQUISITION

3.8.1 Procedures of Land Acquisition

The new law on Land Acquisition Procedures is stipulated in Presidential Regulation No 36/ 2005 issued May 2005. The law should be effective since the issued date, but so far the implementation of this law is being argued. Therefore, the State Minister of Land No.1/1994, which was prepared for the Presidential Decree No.55/1993, is still used as a guideline.

Following is a case of land acquisition procedures actually on-going for the Eastern Banjir Canal. Land acquisition is financed by local government budget (APBD: Anggaran Pendapatan Belanja Daerah). This is the reason the DKI Jakarta takes responsibility for the land acquisition of the Eastern Banjir Canal.

(1) The CILCIS, the project owner, submits a proposal of the land acquisition to the Governor of the DKI Jakarta via Provincial Land Agency. The proposal describes:

   (a) project location,

   (b) the area and maps of the required land,

   (c) existing land use of the required land, and

   (d) general project description, including financial sources and construction duration.

(2) The Governor checks that the project is already mentioned/stipulated in the DKI's Regional Spatial Planning (Rencana Tata Ruang Wilayah) before land acquisition is processed. In case of the Eastern Banjir Canal, this has already set in the DKI's Spatial Planning in 1993.

(3) If not included, then the governor rejects land acquisition of the project.

(4) The Governor creates Committees at Provincial level and Local (municipality) level. Since, the Eastern Banjir Canal passes through two (2) municipalities of Eastern Jakarta and Northern Jakarta.

   The tasks of the Provincial Committee are:

   (a) to give recommendations to the Governor relating land acquisition process (such as type of compensation, land price negotiation etc),

   (b) to prepare a proposal for forced expropriation of land ownership and to establish a law consultation with High Court, and

   (c) to monitor land acquisition process by the local committee.

The tasks of the Local Committees are:

(a) to campaign the project plan/aims to the public/communities, the land of which will be acquired under the project,

(b) to inventory the land and all matters available on the land,

(c) to investigate the land status, and

(d) to measure the land.

The Local Committee is responsible for:

(a) to estimate and to propose the land price,

(b) to facilitate and to establish a negotiation between the communities and the project owner,

(c) to make minutes of meeting of the result of each negotiation, and

(d) to act as a witness of handover of the ownership from the communities to the government/project owner.

Members of the Provincial Committee are (DKI Jakarta Decree No. 1222/2005 on The Committee for Land Acquisition in DKI Jakarta);

(a) Deputy Governor of DKI, as Honorary Head,

(b) Secretary of DKI (Sekretaris Daerah Provinsi DKI), as Head and a member of the committee

(c) Assistant of Administration of DKI (Asisten Tata Praja dan Aparatur Sekda Prop DKI), as First Deputy Head and a member of the committee

(d) Chief of Land Agency Office of DKI (Kanwil Badan Pertanahan Prop. DKI), as Second Deputy Head and a member of the committee

(e) Chief of Land and Mapping Service Office (Kantor Dinas Pertanahan dan Pemetaan), as First Secretary of the committee

(f) Chief of Bureau of Law in Secretary of DKI (Kepala Biro Hukum Setda Prop. DKI), as Second Secretary

(g) Head of City Planning Service Office of DKI (Dinas Tata Kota Prop. DKI), as a member of the committee

(h) Chief of Bureau of Regional Administration in Secretary of DKI (Biro Administrasi Wilayah Setda Prop. DKI), as a member of the committee

(i) Related units as an observer

Members of the Local Committee are (the same Governor DKI Decree mentioned above);

(a) Mayors of related municipalities, as Head of the committee

(b) Assistant of Administration (Asisten Tata Praja) of related municipalities, as First Deputy Head and a member of the committee

(c) Chief of Local Land Agency (Kepala Kantor Pertanahan) of related municipalities, as Second Deputy Head and a member of the committee

(d) Chief of Land and Mapping Service Offices of related municipalities, as First Secretary of the committee

(e) Chief of Division of Local Administration of related municipalities; as Second Secretary of the committee

(f) Chief of Land Tax Office (Kantor Pelayanan Pajak Bumi dan Bangunan), as a member of the committee

(g) Chief of Division of Law (Bagian Hukum dan Ortala), as a member of the committee

(h) Chief of related District, as a member of the committee

(i) Chief of related Sub-district, as a member of the committee

(j) Related units as an observer

(5) The results of the land investigation and land measurement are published and informed to the related communities. Within 30 days the communities can address their objections of the results to the Local Committee. The Local Committee, then, may conduct a reinvestigation.

(6) If the results of land investigation are accepted by the related communities, the Local Committee then starts land price negotiation.

The factors, which influence the land price, are:

(a) land price list issued by government relating to the taxation,

(b) land location,

(c) land occupation,

(d) type of ownership,

(e) existing land use, and

(f) infrastructures and utilities available on the land

The Local Committee may propose several kinds of compensation to the community such as;

(a) money,

(b) land substitution,

(c) relocation/resettlement,

(d) combination of above, or

(e) others agreed by all parties.

(7) If the land price negotiation is successful, the Local Committee, then, issues a letter of agreement and submits to the Governor. Based on this minute of agreement, then the Governor issues a decree, and instructs to the Local Committee to make payment/compensation.

(8) If a community disagrees with the proposed price, the Local Committee will conduct renegotiation. This can be frequently conducted. The community also can address their objections to the Governor. If the renegotiation still fails, then, the Local Committee makes a minute of objections, and reports to the Governor.

(9) Based on the objection reports both from the community and the Local Committee, the Governor, the project owner and the Local Committee approach to the community to conduct renegotiation. If the renegotiation is successful, payment/compensation commences.

(10) If failed, the Governor reports to the PU and Minister of Home Affair (MHA).

(11) Based on this report, the PU coordinates with the MHA and discusses the requested land price by the community.

(12) If they agree, the PU sends a letter of agreement to the Governor. The Governor issues new decision letter and instructs to the Local Committee to make payment/compensation.

(13) If the PU disagrees to pay the requested price, then, the Governor proposes forced expropriation of their land ownership. This proposal submits to the State Minister of Land (SML) as the Head of National Land Agency.

(14) Then, the State Minister of Land coordinates with the Minister of Home Affair, the PU and also Minister of Justice, and submits the proposal to the President.

(15) The President issues a decree on forced expropriation of land ownership after the payment/compensation completed.

Note: In Indonesia, State Minister is a minister without department.

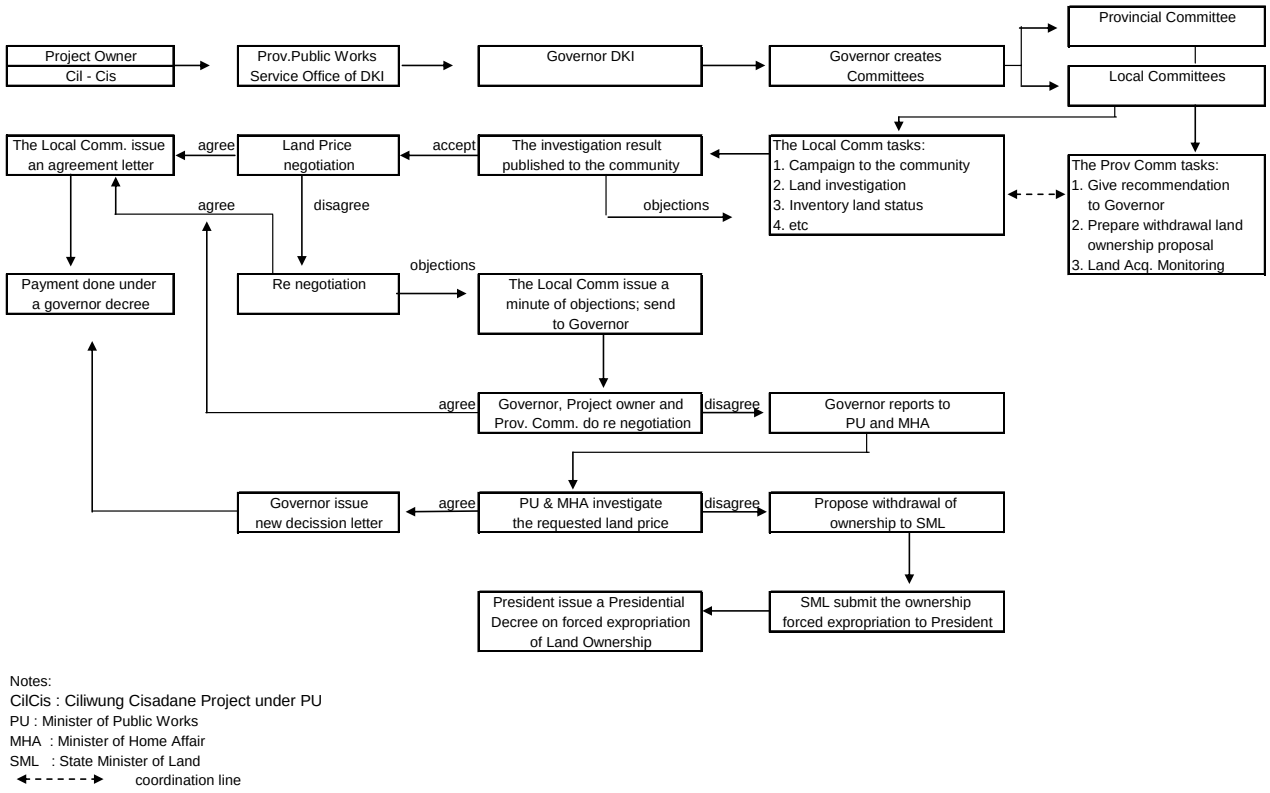


Figure 3.28 Procedures of Land Acquisition for Eastern Banjir Canal

3.8.2 Land Occupation Types and Compensation Value

Land occupation types can be classified as follows in accordance with Law No 5/1960 on Basic Regulation on Land.

(1) Certified Ownership (Hak Milik)

This ownership is further classified into two types.

(a) Registered on Land Agency

(b) Registered on village office (Tanah Girik)

This type of ownership was formerly administered by colonial and is still registered at the village office only. This ownership is not yet registered at the Land Agency.

(2) Estate Business Permit (Hak Guna Usaha)

This permit is given to a person/firm to conduct estate business on the state land of more than 25 ha. within period of 25 – 35 years. This permit can be extended by considering that the land is being managed well or not. If the estate is well managed, the permit extension can be processed but if not, the extension is rejected.

(3) Building and Residence Permit (Hak Guna Bangunan)

This permit is given to a person/firm to build and reside on the state land or other owner. This permit usually expires up to 30 years at a maximum, but it can be extended to another 20 years at a maximum.

(4) Land Use Permit (Hak Pakai)

This permit is given to a person/firm to use and manage the land (state land or other owner). The period of permit depends on the time limit mentioned in the agreement.

(5) Granted land (Tanah Wakaf)

This occupation type is granted by government relating to a social purpose such as mosque, temple, church etc.

Table 3.22 indicates compensation value according to land occupation type.

Table 3.23 Land Occupation Type and Compensation Value

No	Land Occupation Types	Compensation Value (% x land price)*
1.	Certified Ownership (Hak Milik)	
	a) Registered on Land Agency (Sertifikat)	100
	b) Registered on village office (Tanah Girik)	95
2.	Estate Business Permit (Hak Guna Usaha)	
	a) The permit still valid and the state is managed well	80
	b) The permit is expired but the estate is managed well	60
	c) Both the permit is valid or expired but the estate is not managed well.	No compensation
3.	Building and Residence Permit (Hak Guna Bangunan)	
	a) The permit still valid	80
	b) The permit is expired and the permit is being extended; or remaining period to the expired date is not more than 1 year	60
4.	Land Use Permit (Hak Pakai)	
	a) Unlimited time	100
	b) Limited time (max. 10 years)	70
	c) The permit is expired and the extension being processed; or remaining period to the expired date is not more than 1 year	50
5.	Granted Land (Tanah Wakaf)	To be relocated incl. all properties on the land
6.	To those who do not have any legal occupation permit, the government will give compensation regulated by the Mayor	

*) Land price is usually based on negotiation, including buildings, plants and others available on the land.

3.8.3 Squatters

In general, data of squatters can be obtained at the sub-district offices in charge. In order to identify data which sub-districts obtain, the study team conducted an interview survey at the Sub-district Office of Bukit Duri, Tebet District of the South Jakarta along

the Ciliwung River.

Squatters are inhabitants who occupy illegally in state land area. The lands illegally occupied are those along rivers, along railways, under toll bridges or fly over, or others.

They firstly came and started to reside in houses of their families or friends, who have already stayed and fixed ID or temporary ID for some years. Referring to the Perda DKI no.4/2004 (Regional Regulation No. 4/2004) on the Population and Registration, they must report their residency to the local RT/RW. They can apply a temporary ID freely by showing their documents issued by their original village/sub-district office, such as original ID and trip permit sheet (this permit mentions the destination and the objective of the trip). These documents are completed by local RT/RW recommendations to get a temporary ID, and then, submitted to the sub-district office. They can use their family or friend address on the temporary ID. The temporary ID expires up to 6 months and must be extended.

For those who are not applying temporary IDs (usually they do not have complete documents from their village/sub-district office), sub-district office urges RT/RW to identify their residency and to convince them to get temporary IDs for security reason. The temporary ID can not be used to get social services of the community, such as medical check-up in health center of sub-district and education of public schools. But, in the case of flood disaster, the aids are given to all flood victims including those without temporary IDs. For other basic needs, in most cases, they can get services of electricity, clean water (use communal shallow well) and common toilets with their neighbors.

The population data, which is published by sub-district office, is composed according to RW units, and officially do not describe the category of squatters or legal inhabitants. The data of squatters or legal one are indicated by their ID type. These kinds of data also kept in sub-district office, even though not officially published as statistical data. Also these data are distributed to the Sub Housing Service Office (Suku Dinas Perumahan) of South Jakarta and the Housing Service Office DKI Jakarta.

The data do not differentiate the squatters and legal one but more focused on the number of inhabitants on the riverbank. The main objective of this data compilation is for identification of number of victims so that the aids can be estimated and distributed quickly for emergency activities after flood, since the riverbank inhabitants are considered to be the first victims of flood.

3.9 DEVELOPMENT OF JAKARTA AND LAND USE PLANNING

3.9.1 Development of Jakarta

Jakarta was established originally in 16th century on natural levees of the Ciliwung River near its estuary. Jakarta became a special province (DKI Jakarta) in 1966 due to its important role in Indonesia. Rapid development occurred particularly in 1970s and Jakarta has extended to the neighboring regencies of Bogor, Tangerang and Bekasi of West Java Province. Further growth of Jakarta has made it necessary to coordinate

management and development plan with neighboring regencies/municipalities and thus, JABOTABEK or the metropolitan area has been established consisting of DKI Jakarta, Municipality and Regency of Bogor, Municipality and Regency of Tangerang and Municipality and Regency of Bekasi. At present, the metropolitan area is called as JABODETABEK including Depok Municipality, since it is newly created in the Bogor Regency of the West Java Province.

Figure 3.29 shows urban area of Jakarta in 1950's. In 1950', urbanized area (orange color portion) was limited only in the present Central Jakarta and continuation of this area in north-south direction. Other areas were mostly used as paddy fields.

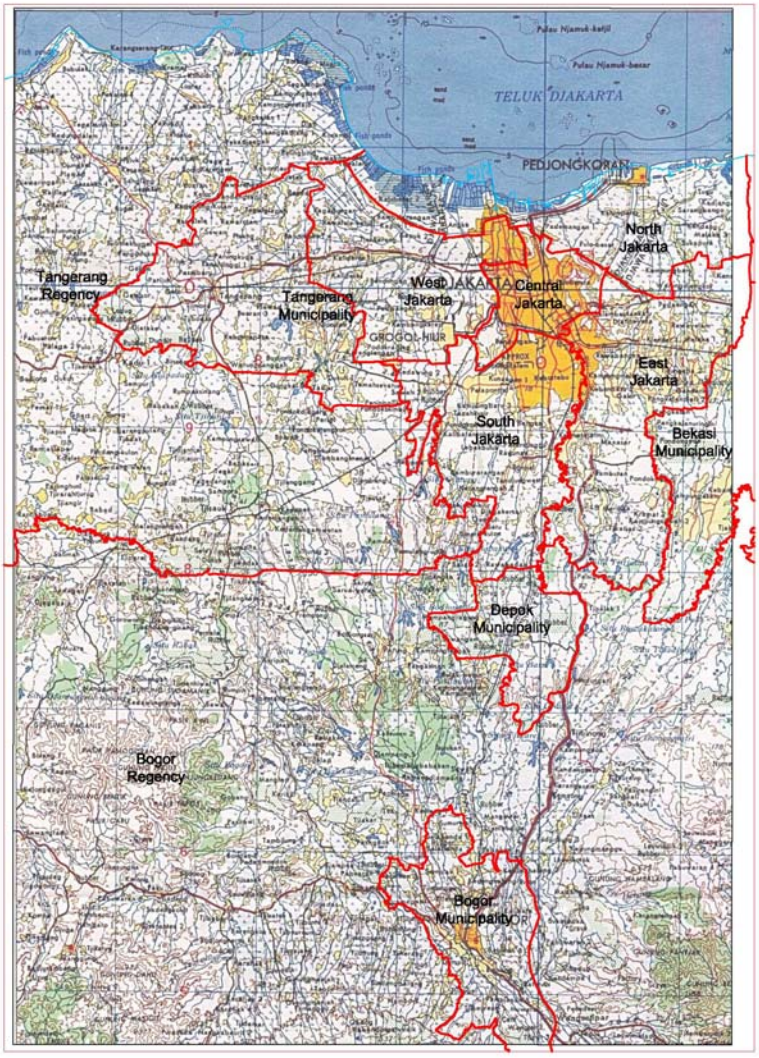


Figure 3.29 Urbanized Areas in 1950's in and around Jakarta

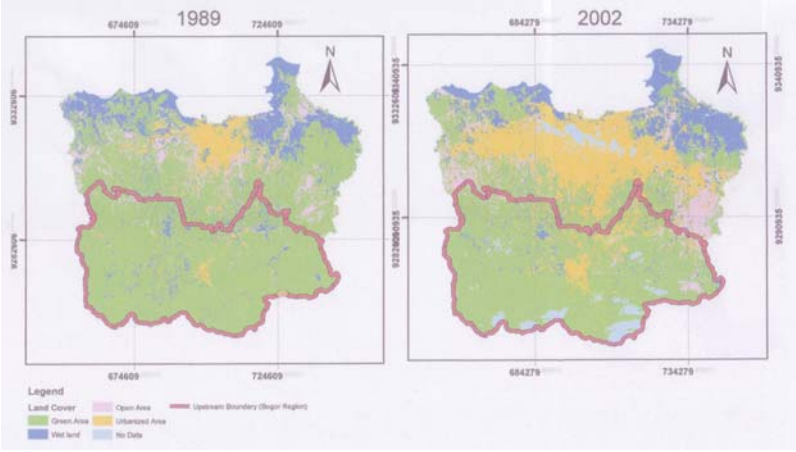


Figure 3.30 Urbanization of JABOTABEK
(from Urgent Inventory Study on Damage of Flood 2002
in JABODETABEK Area in Indonesia, JICA, 2003 May)

Figure 3.30 indicates land cover change in JABOTABEK from 1989 to 2002 based on the Landsat image. In JABOTABEK, urbanization (yellow portion in Figure 3.30) occurred in east-west direction, namely, Tangerang and Bekasi Municipalities and then started in the south, Bogor Municipality.

Table 3.24 Population Increase of JABOTABEK

Pro-vince	Regency/ Municipality	Population			
		1971	1980	1990	2000
DKI Jakarta	South Jakarta	1,050,859	1,582,194	1,913,084	1,784,044
	East Jakarta	802,133	1,460,068	1,067,213	2,347,917
	Central Jakarta	1,260,297	1,245,030	1,086,568	874,595
	West Jakarta	820,756	1,234,885	1,822,762	1,904,191
	North Jakarta				1,419,091
	Seribu	612,447	981,272	1,369,639	17.245
	Sub-total	4,546,492	6,503,449	7,259,266	8,347,083
West Java	Bogor Regency				3,508,826
	Depok Municipality	1,667,687	2,493,843	3,736,897	1,143,403
	Bekasi Regency				1,668,494
	Bekasi Municipality	830,838	1,143,463	2,104,459	1,663,802
	Bogor Municipality	195,142	246,946	271,711	750,819
	Sub-total	2,693,667	3,884,252	6,113,067	8,735,344
Banten	Tangerang Regency				2,781,428
	Tangerang Municipality	1,060,733	1,524,803	3,375,986	1,325,854
	Sub-total	1,060,733	1,524,803	3,375,986	4,107,282
Total		8,300,892	11,912,504	16,748,319	21,189,709

Note:
Seribu Regency was separated from North Jakarta and created in Year 2001.
Bekasi Municipality was separated from Bekasi Regency and created in Year 1996.
Depok Municipality was separated from Bogor Regency and created in Year 1999.
Banten Regency was separated from West Java Province and Banten Province was created in Year 2000.
Tangerang Municipality was separated from Tangerang Regency and created in Year 2000.

Table 3.24 and Figures 3.31 and 3.32 show population increase in JABOTABEK.

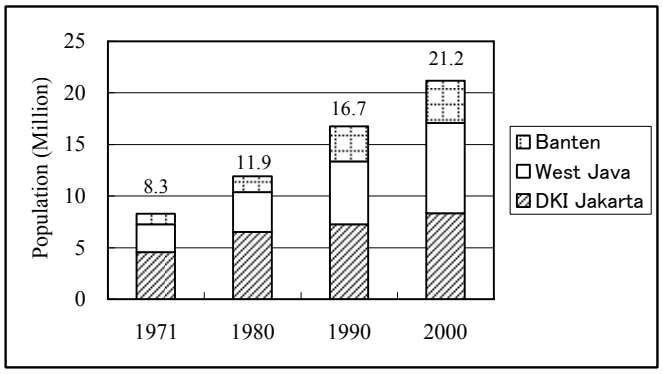


Figure 3.31 Increase of Population in JABOTABEK

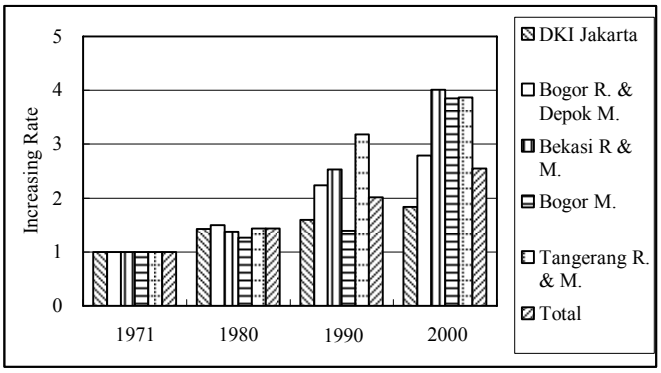


Figure 3.32 Increasing Rate of Population in JABOTABEK

In 2000, total population of JABOTABEK increased 2.6 times of that in 1971. Out of regencies/municipalities, order of population increase rate from 1971 to 2000 is Bekasi (Regency and Municipality) of 4.0 times, Tangerang (Regency and Municipality) of 3.9, Bogor Municipality of 3.8, Bogor Regency with Depok Municipality of 2.8 and DKI Jakarta of 1.8 as shown in Figure 3.32.

3.9.2 System of Spatial Planning

In Indonesia, future land use is directed by system of spatial planning. The objective of the spatial planning is to administer the spatial resource to be optimally used for the benefit of the country. This spatial planning also intends to guarantee the sustainability and to conserve the environment. And in order to be just and fair, the process of administration requires several steps of planning. Under the definition the space are composed of regions with all physical and biological components in it. So, regions are divided into the region of natural conservation and the region of human settlements including all their activities such as industry, agriculture, urban, rural etc.

Spatial planning, which covers strategy and structure of spatial use, has been prepared for every administration units, even to the level of respective districts. Target year of the latest spatial planning is 2009/2010 and these are formulated based on the following laws:

(1) Law No. 24/1992 on Spatial Ordering (Article 19) conveying:

(a) National Spatial Planning.

(b) Spatial Planning for Province.

(c) Spatial Planning for Regency/Municipality.

(2) Government Regulation No. 47/1997 on National Spatial Planning.

Figure 3.33 explains relationship between spatial planning and other planning and/or policies for the Bogor Regency as an example. In order to make the spatial planning integrative between the national, the provincial, and the regency level, the regency spatial planning Bogor needs to consider the state policy guidelines, the spatial planning of the provincial level of West Java and the National Spatial Planning .

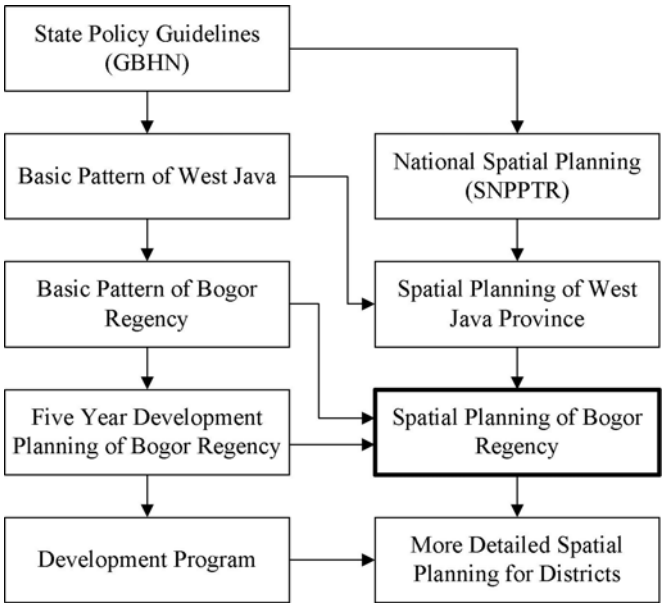


Figure 3.33 Spatial Planning Procedures

3.9.3 Spatial Planning

(1) Bogor Regency (2009)

Figure 3.34 shows spatial planning for Bogor Regency. Under the spatial planning of Bogor Regency, 38 % of land is designated as new built-up area and added to the existing built-up area (26 %), while remaining forest and conservation area are 5 % and 30 %, respectively.

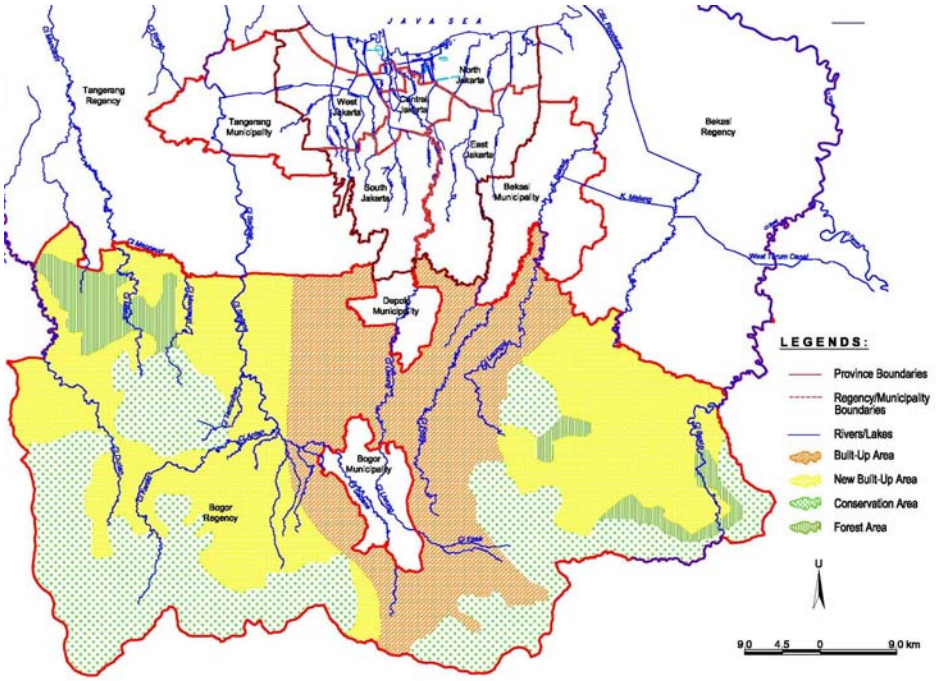


Figure 3.34 Spatial Planning of Bogor Regency

(2) DKI Jakarta (2010)

Figure 3.35 Spatial Planning of DKI Jakarta

Figure 3.35 indicates spatial planning for DKI Jakarta. Most areas of DKI

Jakarta are designated as housing areas or industrial areas.

3.10 LAND SUBSIDENCE

It is said that one of the causes of recent serious flooding in Jakarta is attributable to land subsidence due to over extraction of groundwater, which provides at least 30 % of population of DKI Jakarta.

Jakarta is located on a groundwater basin, known as the Jakarta Groundwater Basin. The base of the aquifer system is formed by impermeable Miocene sediments which also cropped out at the southern boundary of the basin. Quaternary deposits, which fills Miocene sediments with up to 300 m thickness, may be classified into three (3) aquifer systems on the basis of the hydraulic characteristics and depths, namely, 1) Phreatic Aquifer System (0 to 40 m), 2) Upper Confined Aquifer System (40 to 140 m) and 3) Lower Confined Aquifer System (> 140 m).

The CILCIS office conducted leveling survey in 2002 at 279 bench marks situated in DKI Jakarta. In 1978, the NEDECO conducted leveling survey at 22 benchmarks. Moreover, leveling survey was undertaken in 1981 by Project Banjir, 1989 by the DPU DKI and 1994 by the CILCIS.

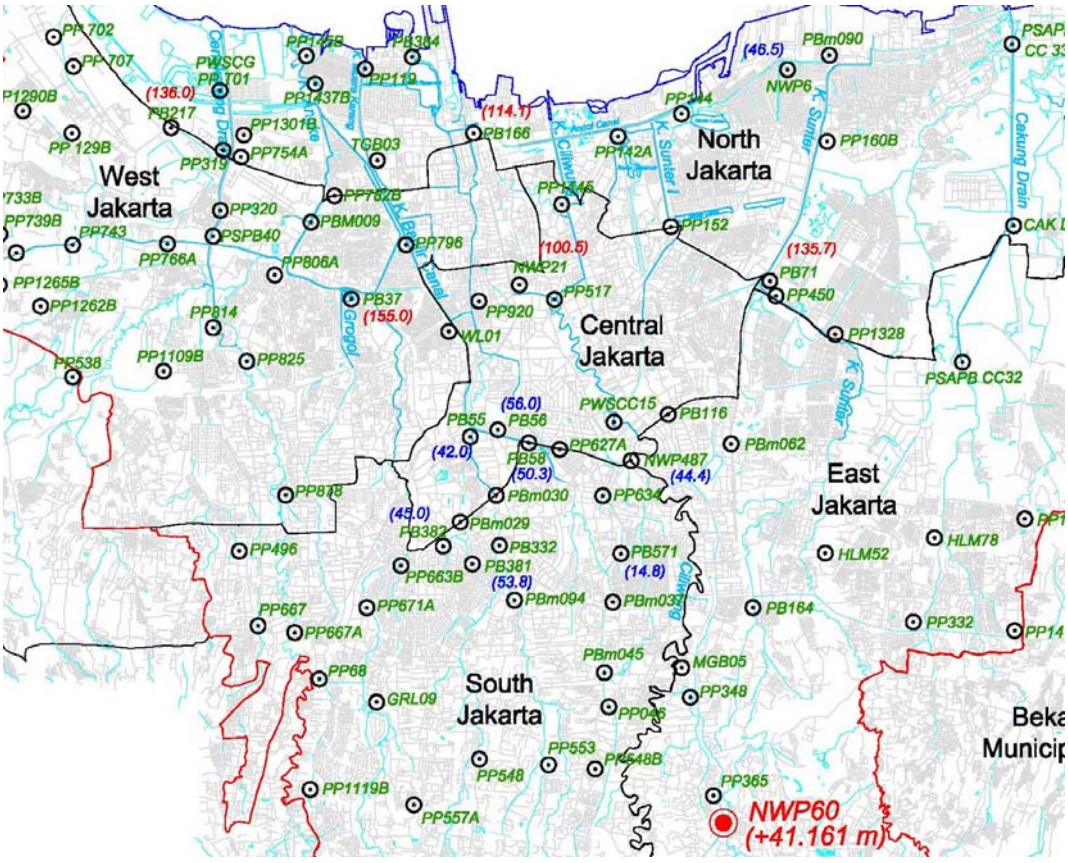


Figure 3.36 Land Subsidence between 1978 and 2002

In Figure 3.36, land subsidence for 24 years from 1978 to 2002 is shown in parentheses

in unit of cm besides benchmarks at which leveling was conducted. Values in red color means the subsidence is more than 100 cm, while those in blue color are less than 100 cm. Land subsidence is approx. 50 cm near the Manggarai, while it exceeds 100 cm in the northern low-lying areas.

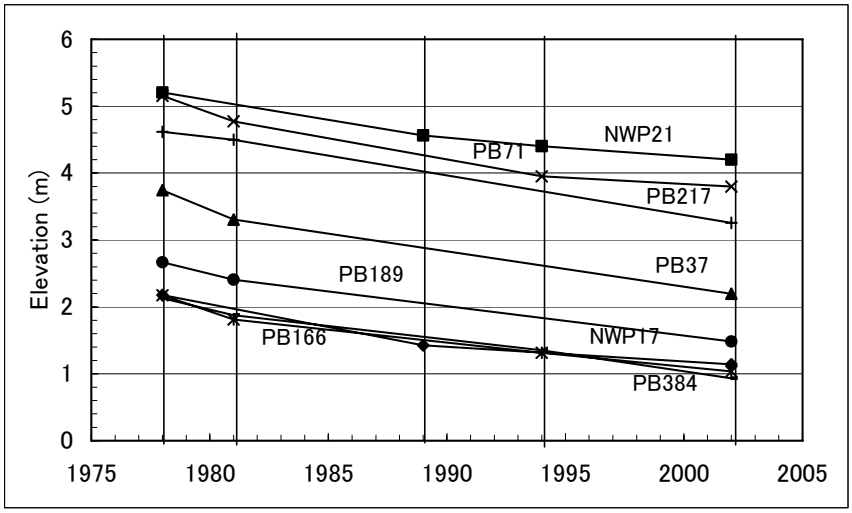


Figure 3.37 Change of Land Subsidence Rate

Figure 3.37 indicates change of subsidence rate for 24 years of the benchmarks at which subsidence exceeded 100 cm.

According to these data, subsidence rate may decreases in some places such as NWP 21 and PB 71, while, in lower areas such as PB 166, subsidence rate may not be changed.

The problem of this estimation is that land subsidence is measured from the reference benchmark of the NWP 60 (refer to Figure 3.36), elevation of which is assumed to be constant, 41.161 m above PP. The NWP 60 is located in the southern part and land subsidence might be small. But if there is land subsidence at this benchmark, this value should be added to those of the respective benchmarks.

3.11 SEDIMENTATION

2002 Flood Damage Study Report wrote “sediment, or soil gets into the river due to slope failure, erosion or debris flow” and concluded that this is one of the causes for devastation of river flow capacity. However, trace of slope failure or debris flow cannot be found, though the study team conducted a field reconnaissance survey. The team found sheet erosion at the wide subdivisions/resorts of Village (Desa) Hambarang, parts of which are still under construction, and also conversion areas of forest to vegetable field at Village Gunung Geulis (Refer 3.38). But, it is judged that sediment volume eroded from these areas cannot aggradate river bed in consideration of its volume, though river water contains wash load, most of which is transported to the Java Sea.

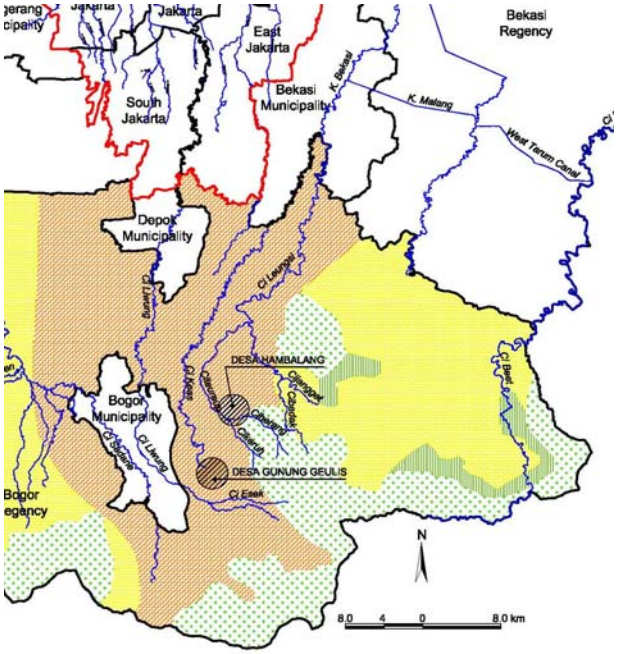


Figure 3.38 Location of Sheet Erosion in JABOTABEK

3.12 SURVEY ON SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

A survey was conducted through interview to inhabitants so as to collect information on socio-economic and culture environment of inhabitants and squatters in three (3) flood prone areas in DKI Jakarta. The report of the survey is attached in Annex 4.

3.12.1 Objectives

Objectives of the Survey are to obtain the following data of socio-economic and cultural characteristics of inhabitants and squatters in flood-prone areas along the rivers,

(1) Necessity/urgency of flood mitigation measures;

(2) Participation in organization of/ implementation of flood fighting and/or mitigation of flooding;

(3) Necessity of improvement of river environment; and

(4) Acceptable relocation conditions.

3.12.2 Location of Interview Survey

Interview Survey was conducted at three (3) flood prone areas in DkI Jakarta, namely, South Jakarta (Tebet District, Manggarai Sub-district), Central Jakarta (Kemayoran Distriict, Serdang Sub-district) and North Jakarta (Penjaringan District, Penjaringan Sub-disctict) as shown in Figure 3.39

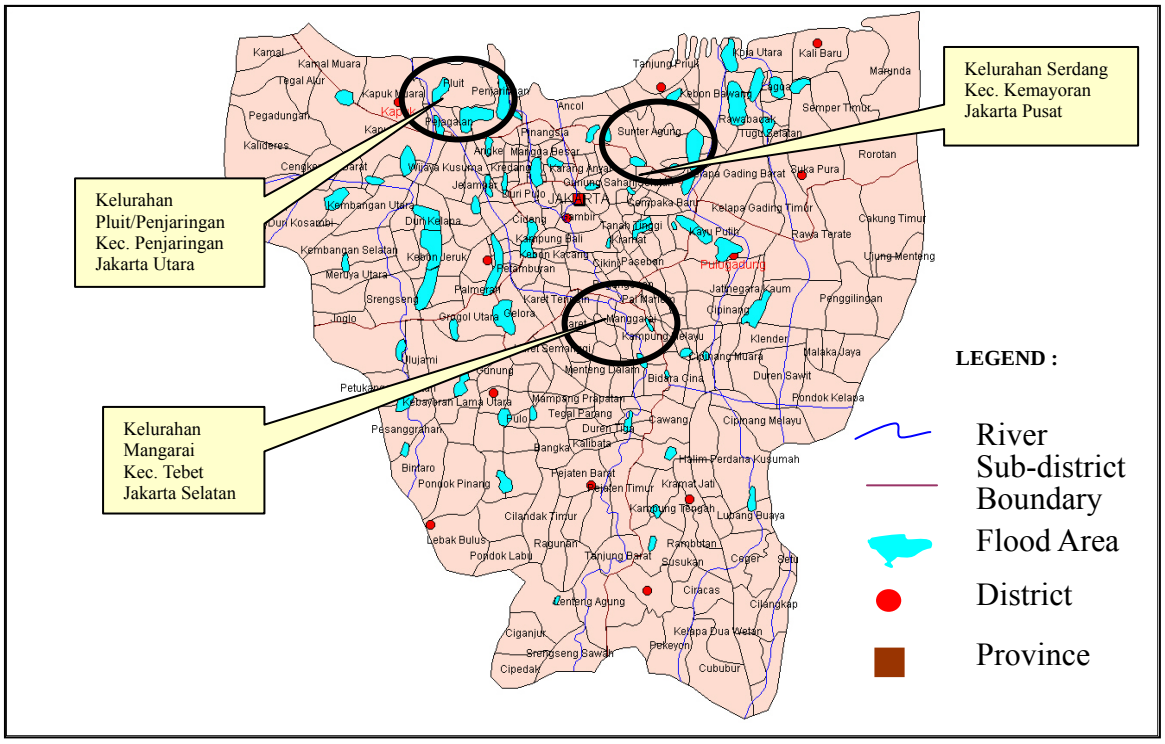


Figure 3.39 Location of Sub-districts for Interview Survey

3.12.3 Socio-economic and Cultural Characteristics of Inhabitants

(1) Most people in the survey area are occupying the flood prone areas for more than 25 years, and some of them have built permanent houses with a higher floor at about 30-50 cm above the land to protect from flooding. Furthermore, some of the people have built two (2) stairs houses for rescuing them during flood events.

(2) Respondents in South Jakarta, Central Jakarta and North Jakarta own lot in 33.3 %, 66.7 % and 50 %, respectively, while own houses in 63.3 %, 80 % and 73.3 %, respectively. The rest are renting lot and house for their habitation. Some people claim that the lot and the house belong to them, since they have been there for such long time and endorsed by the government as indicated by lot and housing tax (PBB) payments every year.

(3) Most of them are low educated people and few of them are educated until academy or university level.

(4) The households' income is contributed mostly from both of husband and wife. They have been mostly working, either as construction and industrial labors or as garbage collectors and temporary labors. Average income per family per month is Rp 1.19 million for South, Rp 1.41 million for Central and Rp 1.17 million for North Jakarta, respectively. Total average is about Rp 15.1 million per year or equal to about Rp 1.25 million per month (about Rp 179 thousand per capita per month) on average, which is lower than the official regional minimum wage rate of Rp 750 thousand per capita per month.

(5) Except for South Jakarta, people have permanent house (cemented wall, ceramic or cemented floor, and permanent roof). Supply of water for bathing, washing, drinking, and cooking are mostly from manual pump well. Only few of them get water from PDAM (Drinking Water Supply Company). Toilet is located outside the house, not permanent building, and no tank. Physical environment conditions become worse, but that was actually improving the neighborhood relations, especially for cooperation in solving environmental problem.

(6) Most common group action is cleaning ditch, since it is considered important action for the people to drain water flow from rain and household waste. Security problems such as thieves, robberies, killings, physical conflicts, drugging and gambling in the community tend to occur. The communities have formed groups of night patrol under responsibility of Security staff of Lurah (Head of village) to keep security and orderliness against them and each group of patrol is scheduled for one night, even there is Satuan Polisi Pamong Praja (Sub-district Police Unit).

3.12.4 Flooding Conditions

(1) Frequency of Flooding

Most respondents said that average flood frequency per year is 1.3 times a year in South Jakarta, 1.6 in Central Jakarta and 2.4 in North Jakarta. In South Jakarta, the river is deeper compared to the two other areas and people build houses until the bottom of river slope. Therefore, many people especially those who inhabit in the bottom of river slope, experience flood more frequently than others.

(2) Flooding Conditions in 2002 Flood

The 2002 Flood is one of the biggest floods so far experienced in Jakarta. Respondents reported that depth of the flood is 2.68 m in South Jakarta, 0.85 m in Central Jakarta and 1.23 m in North Jakarta. The average duration of flooding is 14 days in South Jakarta, 4.2 days in Central Jakarta and 16 days in North Jakarta. North Jakarta recorded the longest duration, because this area received runoff water from Central Jakarta and South Jakarta. The 2002 flood has brought about serious damages not only to the people but also to houses and goods.

Most respondents said that the main cause of flood was heavy rain. Respondent in South Jakarta said that the flood is attributable to the heavy rain in the upstream area especially in Bogor, which is flowing into their area. Respondent in Central Jakarta said that the flood is caused by water overflowed from Sunter Barrage. Respondents in North Jakarta said that the causes of flood are overflow water from upstream area (South Jakarta and Central Jakarta), high wave from Java Sea, narrow outlet canal and water pump, which did not fully function.

The respondents in South Jakarta said that flood information comes from Sub-district Office or RT/RW, while respondents in Central Jakarta and North Jakarta said that no flood information is provided except information by TV.

3.12.5 Community's Opinion, Perception and Attitude

Followings are summary of community's opinion, perception and attitude of three (3) representative flood prone areas in DKI Jakarta based on the interview survey conducted in the study.

(1) Inspection and Improvement of Flood Control

Most respondents in all areas said that inspection and improvement of flood control is satisfactory. In Central Jakarta, the respondents consider that improved water gates in Sunter River and added water pump with higher capacity are effective.

(2) Flood Information/Flood Forecasting

Almost all respondent said that flood forecasting is available. Flooding is habitual and causes a lot of damages and thud, people in these areas have methods to detect flood as earlier as possible.

People in South Jakarta obtain the flood information from gate keeper through telephone, when river water level at the water gate in Katu Lampa or Depok has reached the Alert Water Levels. When river water level is approaching certain levels, the gate keepers announce through telephone/handy talkie to Sub-districts, RWs, and RTs along the rivers that flood would come soon. Respondents in Central Jakarta and South Jakarta use the same method, but river water level at Manggarai water gate.

For North Jakarta, flood forecasting is not so accurate because flooding conditions are affected by tide level of Java Sea in addition to the flood water from upstream areas.

(3) Weather Forecast

Only few respondents said that weather forecast is available or even some do not know. If it is available usually, they said it is not so accurate. They get information from TV news, but it is usually delayed.

(4) Evacuation

The respondents in all areas, especially respondents in South Jakarta, said that information of preparedness and evacuation is available. Most respondents said that evacuation is important for them. In each Sub-district, there is POKOMAS, members of which come from Sub-district officers and representatives of RT and RW. POKOMAS prepares place of evacuation, kitchen for cooking, and health service. The evacuation centers are public schools, government offices and/or guest house of railway company.

Most respondents in all areas reported that they know place and route of evacuation center and they judge the centers are wide enough. But, the problems

are no bed for sleeping and shortage of drinking water and toilet.

Regarding North Jakarta, more than half of respondents do not evacuate during flood time, because almost all area is covered by water. They stay on the second floor or on the roof during flood time.

(5) Willingness to Participate

Almost all respondents said that flood mitigation activities are mostly under responsibility of the provincial government and thus willingness to participate in flood mitigation activities is low except for Central Jakarta. In this area, most of houses and lots are owned by themselves. This gives high motivation to the people to participate in flood mitigation activities to protect their own houses from flooding. In North Jakarta, willingness to participation of the people is particularly low, because almost all area is covered under water and there is no chance for them to help each other.

(6) Rescue Effort

The rescue effort by government in South Jakarta and Central Jakarta is high, while in North Jakarta is low. The low rescue effort in North Jakarta is due to the flooding conditions of the place, in which during flood time all areas are covered by water and they do not evacuate.

(7) Need and Willingness to Relocation

More than half of respondents in North and South Jakarta intend to be relocated, while percentage of respondents, who want to be relocated in Central Jakarta, is only 23 %. Most respondents want to be relocated to areas without flooding, while the reasons why they do not want to be relocated are; 1) they do not know where to move and 2) they can get income easily in or nearby places they live at present.

(8) Improvement of River Environment

In South Jakarta and North Jakarta, respondents said that improvement of river environment is not satisfactory, while in Central Jakarta is the opposite. In Central Jakarta, people think that government is fully responsible for the improvement of river environment, while the respondents of two (2) other areas think none is responsible for the river environment.

3.13 NGOS IN DKI JAKARTA

Flooding in the year of 2002 totally damaged the JABOTABEK, particularly the DKI Jakarta and left problems unsolved for long time in such fields of rescue/rehabilitation including health, environment, employment and so on. The activities of rescue/rehabilitation cannot be done only by governmental organizations on tremendous disasters like the 2002 flood event and thus, it is necessary to invite/cooperate with NGOs, which have activities in these fields, so that rescue and rehabilitation activities

can be timely and fruitfully implemented.

There are 193 NGOs in JABOTABEK mostly located in DKI Jakarta (Annex 4). The field activities of the NGOs are in environment, community development, nursery and tree plantation, non-formal education, marine, health, and ecotourism. Out of these NGOs, followings NGOs have high possibility to cooperate/assist for the rescue/rehabilitation activities as tabulated in the table.

Table 3.25 Possible NGOs for Rescue and Rehabilitation Activities

Name of NGO	Area of activities	Fields of activities	Address	Contact person
BUMIESOK HUMANITY CARE	All Indonesia	Community development, community health, sanitation, information and education, mitigation and capacity building	Jl. Basuki Rahmat No. 2, Cipinang Muara-Jatinegara, Jakarta Timur, 134200 Tel. 021-8520266 Fax. 021-85902522 vanthmh@yahoo.com bumiesok@yahoo.com	Mr. Gatoo Poernomo Tel. 0816-1616115
INDONESIA RESCUE	All Indonesia	Information and education, mitigation and capacity building	Indonesia-rescue@mail 2emergency.com	

4. FLOOD EVENT IN THE YEAR OF 2002

4.1 2002 FLOOD EVENT

4.1.1 FLOOD DAMAGE

In the year of 2002, the JABOTABEK suffered from tremendous flood damage from Jan. 26th to Feb. 20th. After this flood event, JICA Study "Urgent Inventory Study on Damage of Flood 2002 in JABODETABEK" was intensively conducted by a local consultant to identify the flood damage and to analyze causes of flooding. According to the report, inundation area was 526 km^2 or equivalent to 8.6% of total area of JABOTABEK (Figure 4.1). Out of them, areas, where flooding depth exceeded 0.5 m for more than 1 week, totaled 53 km^2 or 0.86%.

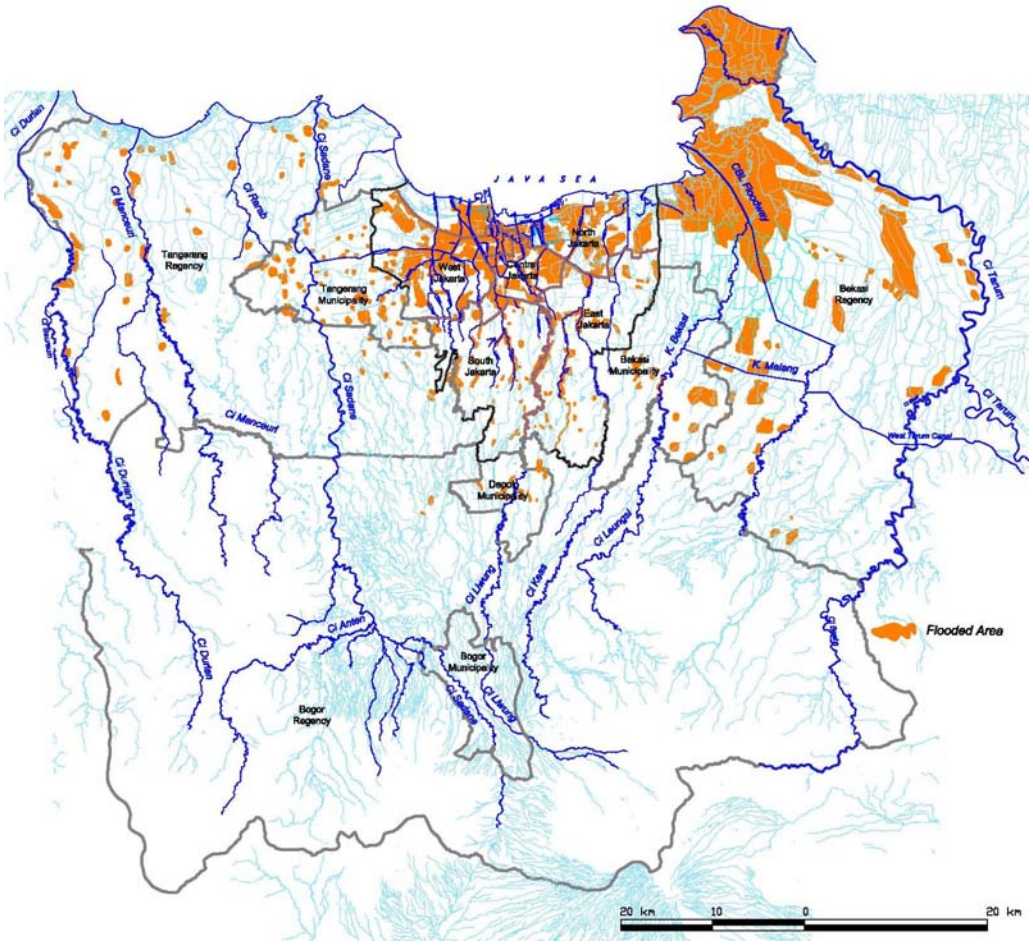


Figure 4.1 Flooded Area in 2002 Flood Event

The flooding continued from a few days to almost 2 months with depth ranging from 0.2 m to more than three (3) meters. Flooded urban area reached around 87.1 km^2 in DKI Jakarta and 15.2 km^2 in municipalities of Tangerang, Bekasi and Depok. Figure 4.2 shows flooding conditions of central portions of DKI Jakarta. Most of the low land in

the pump drainage areas was inundated.

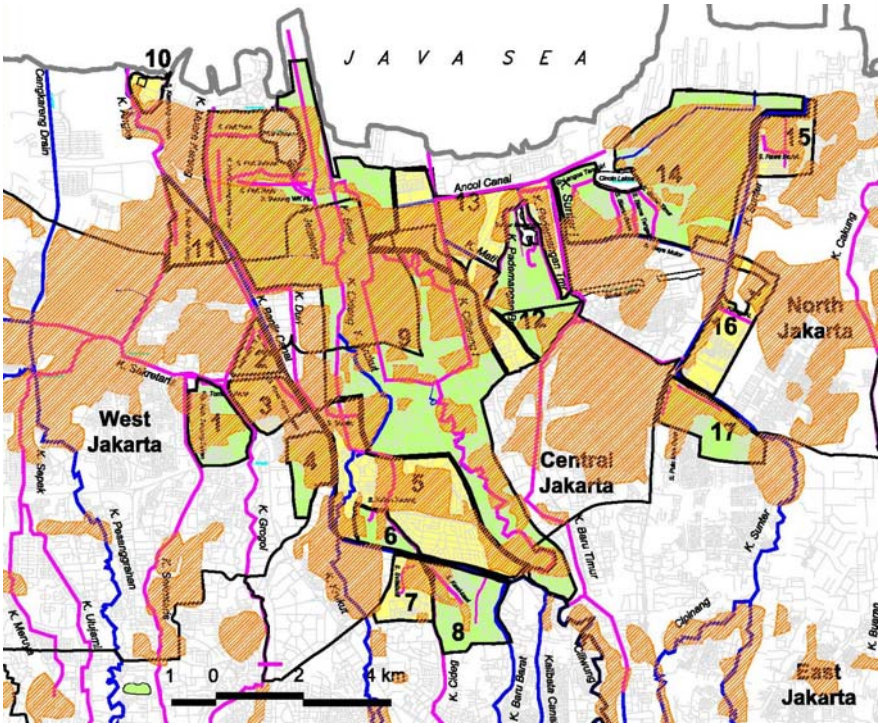


Figure 4.2 Flooding Conditions in Pump Drainage Areas in 2002 Flood Event

Due to deep and continuous flooding, 380 thousand persons were forced to be evacuated, while number of casualties was more than 30 persons according to the news papers as shown below.

Table 4.1 Number of Casualties during 2002 Flood Event

No	Location	Number of casualties	Causes	Sources
1.	Jakarta	14	No information	Jakarta Post, Jan. 31 02
2.	Jakarta	17 5 missing	Drift and drawn	Jakarta Post, Feb. 01 02
3.	Jakarta, Depok and Tangerang	23	Drawn, elec. cute, building collapses	Jakarta Post, Feb. 02 02
4.	Jakarta	15	Related Flood illnesses	Jakarta Post, Feb. 14 02
5.	Jakarta	2	Drift and drawn	Kompas, Jan. 30 02
6.	Pondok Pinang Subdistrict (Pesanggrahan R.), Jakarta	8	4 – drift and drawn 2 – asthmatic sufferer 2 – electro cute	Kompas, Jan. 31 02
7.	Tangerang (Poris river)	2	drift and drawn	Kompas, Feb. 01 02
8.	Jakarta, Bekasi and Tangerang	25*	drift and drawn	Kompas, Feb. 04 02

Note: * Total of casualties up to Feb. 04.

4.1.2 RAINFALL

In Figure 4.3, daily rainfall from Jan. 26 to Feb. 3 is indicated. Location map of these stations are shown in Figure 3.11. The Jakarta Pusat Station (Code 02027) is located in almost the center of the central Jakarta. The other three (3) stations, namely, Bekasi (8TP), Cileduk (0232C) and Depok (9TP) are selected to represent the rainfall distribution of the east, the west and the south of the JABOTABEK, respectively.

These data are taken from the facsimile, which were sent everyday during the 2002 flood event by the BMG to the CILCIS. Out of these stations, the Depok and Bekasi stations are of manual rainfall gauge, while the Jakarta Pusat and the Cileduk stations are equipped with automatic recorders.

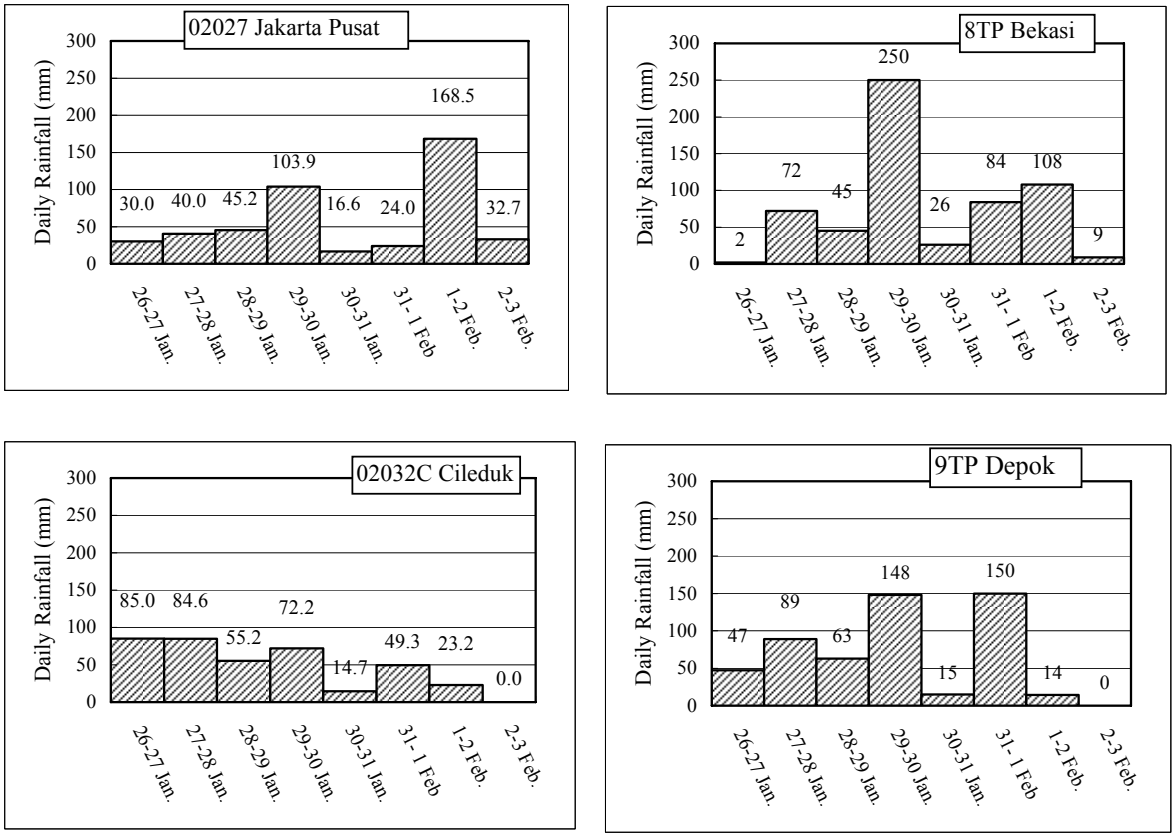


Figure 4.3 Daily Rainfall Distribution in 2002 Flood Event

The 1973 Mater Plan Study and the 1997 Master Plan Study estimated the probable rainfall. The 1973 Master Plan estimated probable rainfall for long duration of the Jakarta Pusat Station as tabulated below.

Table 4.2 Probable Rainfall for Long Duration at Jakarta Pusat

Duration	Probable Rainfall (mm)						
	2 y	5 y	10 y	20 y	25 y	50 y	100 y
1-day	112	152	179	204	212	237	262
2-day	143	199	235	269	280	313	346
3-day	170	241	290	335	350	390	435
5-day	210	304	367	425	445	500	557
10-day	297	425	508	586	613	686	765

On the other hand, the 1997 Master Plan Study estimated the probable daily rainfall of the rainfall stations in JABOTABEK, using the historical data in this area. The following table indicates the probable daily rainfall of the related four (4) stations.

Table 4.3 Probable Daily Rainfall for Four Stations

Code No.	Station	Probable Rainfall (mm)					
		2 y	5 y	10 y	20 y	50 y	100 y
02027	Jakarta Pusat	101	144	172	196	233	259
02078A	Bekasi	101	135	158	179	207	228
02046	Bogor	122	158	182	206	236	258
02030	Tangerang	96	129	150	171	198	219

. Table 4.4 Maximum Rainfall and Return Period in 2002 Flood

Duration	02032C Cileduk	0207 Jakarta Pusat	8TP Bekasi	9TP Depok
1-day	85.0 (< 2 y)	168.5 (5y to 10y)	250 (> 100 y)	150 (2 y to 5 y)
2-day	169.6 (2 y to 5 y)	201.2 (5 y)	295 (25 y to 50 y)	211 (5 y to 10 y)
3-day	224.8 (2 y to 5 y)	225.2 (2 y to 5 y)	367 (25 y to 50 y)	313 (10 y to 20 y)
5-day	311.7 (5 y to 10 y)	358.2 (5 y to 10 y)	513 (50y to 100 y)	465 (25 y to 50 y)

Note Values in parentheses are return period estimated based on the previous studies as explained above.

From the probable rainfall mentioned above, the maximum rainfall of the 2002 flood event had the return period as tabulated in Table 4.4 and followings may be concluded.

(1) Rainfall in Jakarta (Jakarta Pusat Station) had two (2) peaks. The probable rainfall was less than 10-year return period from 1-day to 5-day duration.

(2) Rainfall in southern hilly areas (Depok Station) also had two (2) peaks. Probable rainfall was not so high especially 1-day rainfall, which was less 5-year return period but longer the duration was, larger the return period became. For 5-day rainfall, return period was more than 25-year.

(3) In eastern part of JABOTABEK (Bekasi Station), probable 1-day rainfall exceeded 100-year return period. Also, the return period of rainfall with longer duration was more than 25-years.

(4) Western part of the JABOTABEK (Cileduk) had smaller rainfall compared with the other areas. 1-day rainfall was less than 2-year return period.

4.2 2005 FLOOD EVENT

In 2005 January, heavy rainfall hit the DKI Jakarta, but only light flooding occurred. In order to analyze the causes of flooding in 2002, this flood event is also analyzed.

4.2.1 Flooding Conditions

Figure 4.4 indicates the flooded areas in the 2005 flood event. Flooding occurred only along the Ciliwung River– WBC and Cipinang – Sunter rivers.

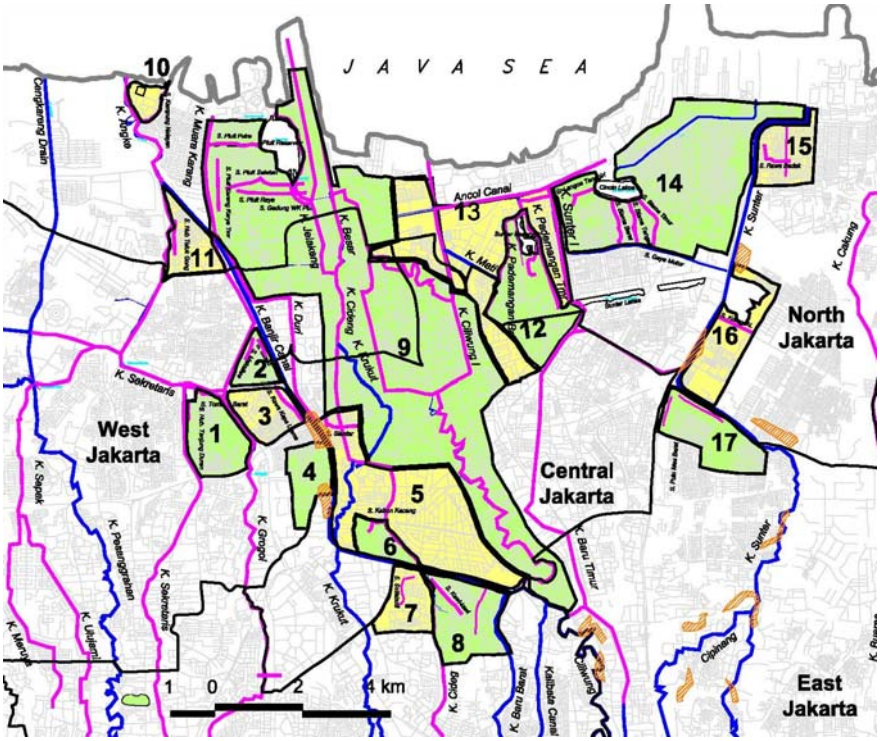


Figure 4.4 Inundation Area in 2005 Flood Event

4.2.2 Rainfall

The CILCIS installed its flood monitoring system in Feb. 2003 and commenced its operation for the Cisadane, the Pesanggrahan, the Ciliwung, the Sunter and the Bekasi rivers. In this system, rainfall gauges are installed at 5 stations as explained in **3.3.1**. Using daily rainfall data at the Manggarai Station, flood events since commencement of operation are analyzed. Following table tabulates the maximum to the5th maximum daily rainfall observed at the Manggarai Station. The 2005 flood event has the largest daily rainfall so far observed in the Manggarai Station.

Table 4.5 Maximum Daily Rainfall Observed at Manggarai Station

Order	1st	2nd	3rd	4th	5th
Year and date	2005 Jan. 19	2003 Dec.31	2003 Dec.30	2004 Dec.25	2004 Feb.19
Daily rainfall (mm)	165.0	158.5	142.5	100.5	71.5

Figure 4.5 indicates daily rainfall distribution during the 2005 flood event at Manggarai, Cibinong (in Bekasi River Basin), Ranca Bunger (in Cisadane River Basin) and Cilember (in Ciliwung River Basin).

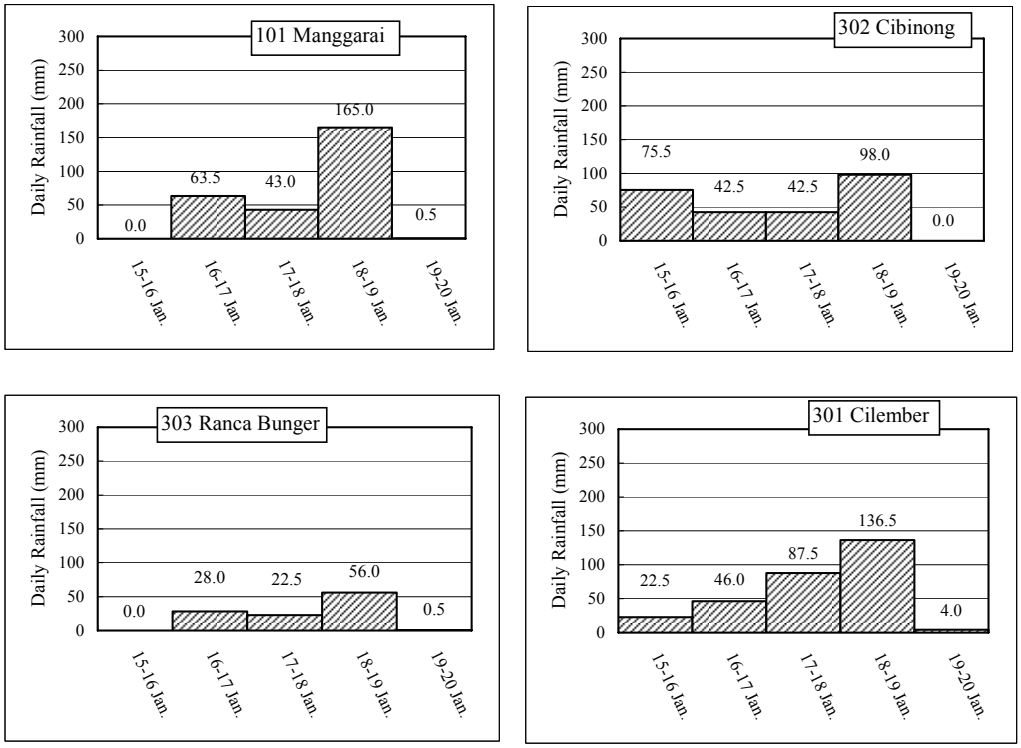


Figure 4.5 Daily Rainfall Distribution in 2005 Flood Event

Table 4.6 Maximum Rainfall and Return Period in 2005 Flood

Duration	303 Ranca Bunger <Tangerang>	101 Manggarai <Jakarta Pusat>	302 Cibinong <Bogor>	301 Cilember <Bogor>
1-day	56.0 (< 2 y)	165.0 (5y to 10y)	98.0 (< 2 y)	136.5 (2 y to 5 y)

Note Values in parentheses () are return period estimated based on the previous studies using rainfall station in parentheses <>, which are as explained above.

Table 4.6 shows maximum daily rainfall at the respective rainfall stations and return period taken from the corresponding stations. From these data, the followings may be concluded.

(1) Only daily rainfall near or in the central area of DKI Jakarta reaches 5-year to 10-year return period.

(2) In the western and eastern areas, the rainfall is less than 2-year return period.

(3) In the southern area such as the upper area of the Ciliwung River Basin, the rain was 136.5 mm, the return period of which was 2-year to 5-year return period.

Because of this rainfall, the water level at the Manggarai Station reached to 9.6 m above PP at 20:00 Jan.19 2005, which is near to bankful discharge as shown in Figure 4.6. Alert I was issued between 15:00 to 22:00 of Jan.19.

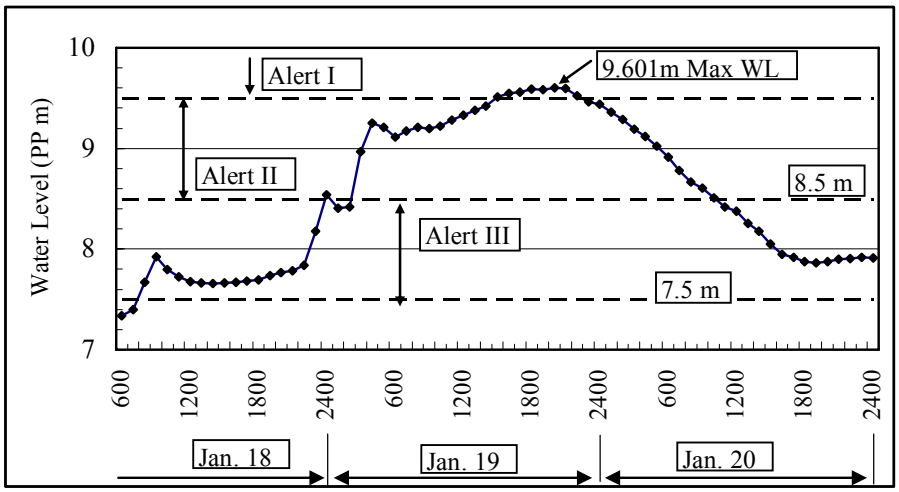


Figure 4.6 Water Level at Manggarai Gate during 2005 Flood Event

4.3 CAUSES OF FLOODING IN 2002 FLOOD EVENT

4.3.1 Problems of Rivers

The 2002 Flood Damage Study listed up rivers as indicated below, which overflowed at portions with low flow capacity and/or damaged dikes, out of eight (8) river systems in the JABOTABEK. Regarding location of these rivers, please refer to Figure 2.3.

(1) Cimanceuri River: overflow

(2) Cisadane River : overflow

(3) Cengkareng Floodway

  (a) Mookervart Canal: overflow

  (b) Angke River: dike damage

  (c) Pesanggrahan: dike damage

(4) Ciliwung River – WBC

  (a) Ciliwung River: overflow and dike damage

(b) WBC: overflow

(5) EBC

(a) Cipinang River: dike damage

(b) Sunter River: overflow and dike damage

(6) CBL Floodway System

(a) Bekasi: over flow and dike damage

Eight (8) river systems running in the alluvial plain is easily flooded. Even the Ciliwung River and the Western Banjir Canal, which runs the middle of the central areas of Jakarta, have low flow stretches and bottle neck portions. Flooding occurred at these stretches and portions during the 2005 flood event, rainfall of which had a return period less than 5-year.

In order to upgrade the safety level of these rivers, master plan studies were conducted for DKI Jakarta in 1973 and for JABOTABEK in 1997. However, the proposed improvement plans have not been materialized except the Eastern Banjir Canal, the construction of which is ongoing at present.

It is clear that the main cause of flooding is attributable to delay of implementation of flood control projects to upgrade safety level of eight (8) river systems. Overflowed water flowed into the low-lying areas including the pump drainage areas of the DKI Jakarta, which were used as paddy field. Flooding in those areas naturally tends to be long and furthermore, drainage systems in these areas have problems as explained hereinafter. In addition, delay of maintenance or rehabilitation of damaged portions of rivers may have increased flood damages.

4.3.2 Problems of Drainage System

In the 1973 Master Plan, two (2) measures were mainly proposed after protecting the central area of the Jakarta by the WBC and the EBC; 1) Usage of existing rivers as main drains, and 2) Pump drainage by dividing low-lying areas into several drainage areas. Following this plan, improvement of main drains and installation of pumps have been implemented to drain a design flood with 25-year return period scale.

However, the pump drainage areas were seriously affected during the 2002 flood event. One of the main causes of serious flooding in drainage areas is inflow of overflowed water from the rivers as explained above. For the drainage area surrounded by the WBC and the Ciliwung Drain, opening of Ciliwung-Manggarai Gate at the Ciliwung Drain to avoid gate damage due to overflow increased flood damage in addition to the overflow from the WBC.

Regarding the drainage systems, followings may be possible causes, which cannot be confirmed due to lack of data at present.

(1) Combination of Pump Capacity and Storage Volume of Reservoir

If reservoir may not yet be empty before the second peak of rainfall of the 2002 flood event, small pump capacity is a cause of flooding and pump capacity needs to be increased to drain the same rainfall pattern and intensity.

(2) Increase of Planned Pump Drainage Area

Pump capacity may not be enough, if rainwater outside of the planed drainage area is necessary to be accepted and to be drained by the pump, because gravity drain outside of the pump drainage area cannot be made due to high tide or influence of possible land subsidence.

(3) Improper Secondary and Tertiary Drains

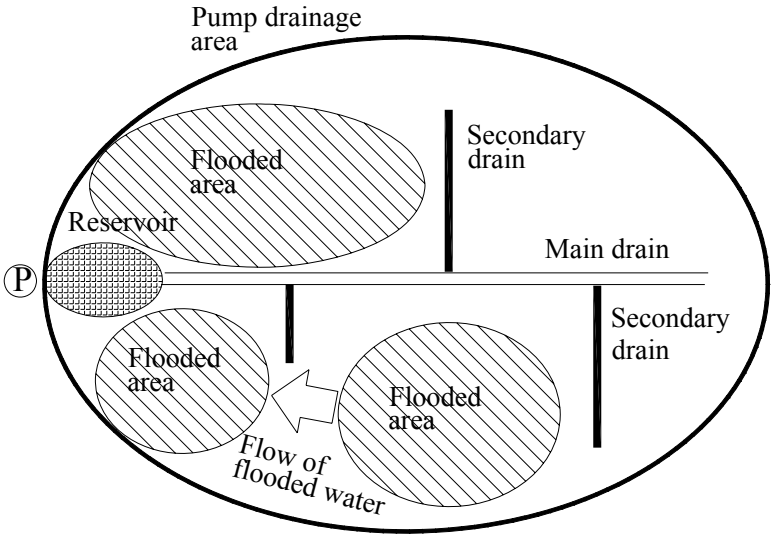


Figure 4.7 Flooding due to Improper Secondary/Tertiary Drain

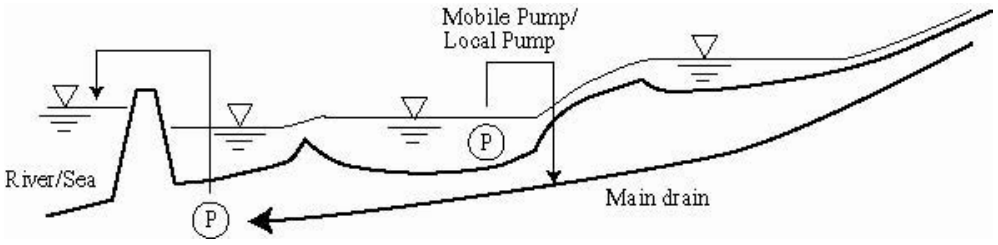


Figure 4.8 Flow of Flooded Water to Lower Areas

Pump capacity and pump starting water level of the reservoir are so determined that maximum water level of the main drain of the drainage area does not exceed the bank height of the main drain for one day flood with 25-year return period.

To determine the pump capacity and pump starting water level, no consideration

was given to the existing secondary and tertiary drains, assuming that most of the rain water in the drainage area can be collected to the main drain.

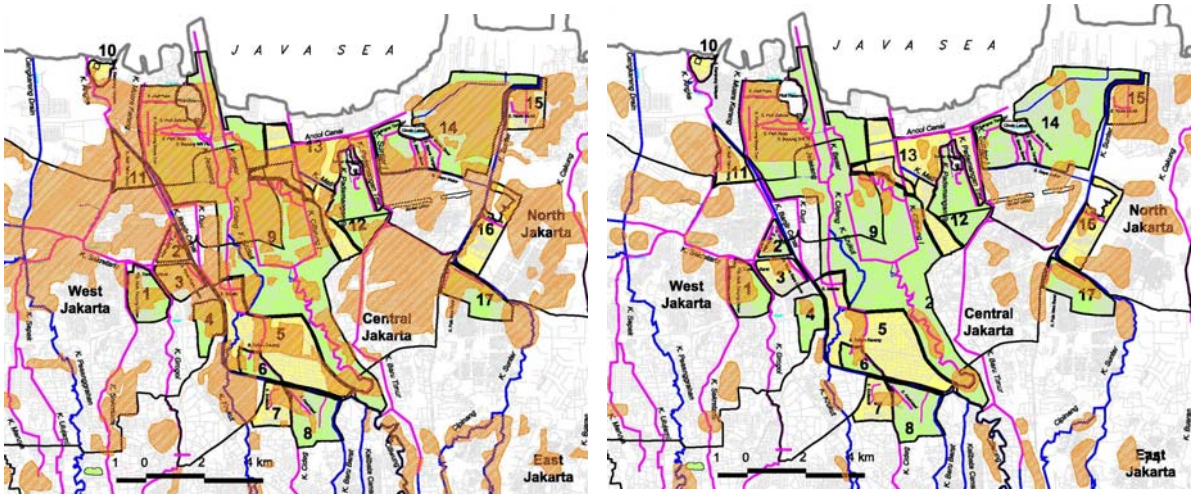
In DKI Jakarta, 15 local pumps have been installed as listed in Annex 3. Moreover, both of the DPU DKI and the CILCIS have movable pump equipments including equipments provided under Japan's grant aid. These pumps are used to drain flooded water to main drains in habitual flood prone areas, in which secondary and tertiary drains are not installed well or not maintained well as well as water level of the main drain is higher than that of flooded water.

During the 2002 flood event, the followings may occur. Rain water started to flood in low areas in the respective drainage areas. However, flooded water could not be drained to the main drain due to improper secondary and tertiary drains. Thus, flooded water gradually increased its areas and depth and then started to flow to the lower areas in the same drainage area or in the continued different drainage area.

Finally, flooded water flowed to the lowest areas such as the coastal areas. Again, due to the problems of secondary/tertiary drains, it took long duration to drain the flooded water through the pumps.

4.3.3 Problems of Preparedness

In the flood operation manuals for both of the CILCIS and the DKI Jakarta, one flood risk map is attached (Figure 3.25). This map explains 78 habitual flood prone areas, which are likely to occur every year. Figure 4.9 compares actual flooded areas in 2002 flood shown in (a) and those indicated in flood risk map shown in (b), mainly concentrating in the pump drainage areas and west portions of DKI Jakarta.



(a) Flooded Area in 2002 Flood (b) Flood Risk Map

Figure 4.9 Comparison of Flooded Area in 2002 and Flood Risk Map

This difference in flooded areas may cause problems in preparedness as explained below, since it is hard to recognize for the related persons/organizations that flooding may occur outside of the flood prone areas shown in flood risk map, corresponding to the volume and pattern of rainfall, particularly as time goes on after the 2002 flood event.

(1) POKOMAS in Sub-districts and RWs/RTs outside of the flood prone areas (Figure 3.25) may not well organized and not prepare for water monitoring, evacuation centers, evacuation route and so on.

(2) Operators of gates/pumps and water level monitoring units in upper streams and the DKI Jakarta may not inform flood information including Flood Alerts to Sub-districts outside of the flood prone areas shown in flood risk map (Figure 3.25).

4.3.4 Other Problems

The 2002 Flood Damage Study concluded several causes of flooding. Followings are results/comments of this Study on these causes of flooding.

(1) Maintenance of Rivers and Drainage Structures

Lack of maintenance of the flood control and drainage structures might be one of the causes, since the CILCIS and the DKI Jakarta do not have necessary data to conduct maintenance activities as well as maintenance records. Data necessary for maintenance are cross-sectional survey of rivers and drains as well as inventory of the flood control and drainage structures under their responsibility, such as dikes, levees, groundsills, gates and so on. Based on these data, change of cross sections, reduction of flow capacity and damage of structures can be analyzed in more detail in connection with the causes of flooding. Therefore, timing of dredging and design depth is hard to be decided without records of cross-sectional change. Also prioritization of maintenance activities for flood control and drainage structures cannot be made without inventory and evaluation of damage.

(2) Operation of Pump and Gates

Operation procedures of pumps and gates are explained in detail in the flood operation manuals for both of the CILCIS and the DKI Jakarta. When the water level of the monitoring water level gauging stations reaches/enters to the Alert IV water levels, information for preparation is issued and notified to the related pumping stations. And when the water level of a river/drain rises to the predetermined water level, the corresponding pumps and/or gates are operated following the manuals.

Judging from information flow and contents of operation manuals, problems cannot be found on operation of gates and pumps. However, water level for operation may be necessary to be revised based on the change of flow capacity

of rivers/drains, when cross-sectional survey of the rivers/drains is conducted and flow capacity is newly estimated.

(3) Sedimentation

According to the 2002 Flood Damage Study Report, sediment/soil, which gets into the river due to slope failure, erosion or debris flow was one of the causes for devastation of river flow capacity. However, trace of slope failure or debris flow cannot be found, though the team conducted a field reconnaissance survey. Sheet erosion is occurring in some places but these cannot be cause of aggradation in consideration of erosion volume, though river water contains wash load, most of which flows to the sea.

5. PROBLEMS AND ISSUES ON FLOOD DAMAGE MITIGATION IN JABOTABEK

5.1 PRESENT SITUATION

Northern area of DKI Jakarta and also Northern area of JABOTABEK along Java Sea are low-lying flood prone areas, where a lot of rivers are running from mountainous southern areas to the Java Sea. Furthermore, DKI Jakarta and neighboring areas have remarkably urbanized in recent years and thus, become easily and seriously damaged due to concentration of population and properties into the flood prone areas.

To tackle flooding problems, the Government of Indonesia has formulated a drainage and flood control Master Plan in 1973, in which the idea to protect the DKI Jakarta by interceptors and then to improve drainage system inside the interceptors was proposed. Rivers from the south is planned to be intercepted by two (2) floodways, namely the Western Banjir Canal (WBC) and the Eastern Banjir Canal (EBC) and to be discharged to the Java Sea at less populated areas. This concept of interceptors was planed to implement by extension/improvement of the WBC constructed in 1918 and new excavation of the EBC, but both of them could not be materialized due to difficulty in land appropriation.

Then, a new flood control master plan was formulated in 1997, target area of which is not only DKI Jakarta, but also covers the developing JABOTABEK area. The 1997 master plan proposed to set the design scale of eight (8) river systems in the JABOTABEK to be 100-year, 50-year and 25-year return period in accordance with importance of their river basins. As priority projects, construction of the Ciliwung Floodway to divert a part of flood to the Cisadane River at the Bogor Municipality was proposed with improvement of the lower Cisadane River and the WBC so as to upgrade the design scale of the lower Cisadane River and the WBC to 50-year and 100-year return period, respectively.

Out of the priority projects, construction of the Ciliwung Floodway and improvement of the lower Cisadane River commenced in 1998 under the JBIC loan, but canceled due to difficulty in making consensus among stakeholders. At present, the EBC construction is on-going by local fund based on the 1997 master plan to drain flood water of 100-year return period, scheduled to be completed in the year of 2010. Regarding drainage system, based on the 1973 master plan, lowland of DKI Jakarta has been divided into drainage areas, in which construction of pumping stations and improvement of main drains have been implemented with the design scale of 25-year return period, though improvement of the WBC and the construction of the EBC have not been completed.

From late January to mid-February 2002, low-lying areas of JABOTABEK suffered from tremendous flood damages, particularly, most drainage areas of the DKI Jakarta was deeply submerged for long duration. The return period of rainfall during the 2002 flood event may be approximately 10 year in Jakarta, though that in Bekasi may reach to 100 year. Rivers flowing in the JABOTABEK overflowed at lot of places of low flow capacity. Main cause of the serious flooding can be attributable to delay of flood control

projects to improve these rivers. Furthermore, it can be estimated that drainage system in drainage areas composed of pumps, main drain and secondary/tertiary drains are not enough as a total system, particularly for rainfall with long duration, though capacity of pumps and main drains have been improved, intending to cope with a flood with 25-year return period scale.

It still requires a long period of time to implement flood control projects and drainage system improvement, which drastically increase safety level against flood of JABOTABEK. In addition, there is a high possibility that peak discharge of rivers largely increases due to development of paddy fields and forest areas located in their upper basins and flood overflows from the existing rivers and drainage systems, which are hard to be upgraded in short time, thus causing much more serious flood damages in low-lying flood prone areas.

Under these circumstances, it is judged as urgently necessary to implement following measures to minimize flood damages.

(1) Preparation of inventory and execution of basic analysis

(2) Utilization of maximum capacity of existing rivers and drainage systems

(3) Encouragement of preparedness in flood prone areas

(4) Prevention of rapid runoff increase

5.2 NECESSARY FLOOD DAMAGE MITIGATION MEASURES

5.2.1 Preparation of Inventory and Execution of Basic Analysis

(1) Preparation of Inventory Database System of Rivers, Flood Control Structures and Drainage Structures

The respective organizations in charge of flood control and drainage should prepare inventory database system of rivers, flood control structures and drainage structures under its responsibility with location maps. The inventory system may include 1) name of rivers/structures, 2) location , 3) length, width and/or main dimensions, 4) year of construction for structures, 5) present condition, 6) records of damage, 7) records of dredging, cleaning and repair/rehabilitation, and so on.

(2) Execution of Cross-sectional Survey

Cross sectional survey should be periodically conducted not only for flow capacity estimation but also for river management to control encroachment and garbage dumping to river zone and river conservation zone. Cross-sectional survey should cover secondary and tertiary drains particularly running in the flood prone areas. Elevation of cross sections is precisely obtained in connection with PP or other sea level to estimate effect of tide.

(3) Estimation of Flow Capacity for Rivers and Drains

One dimensional flow simulation model is prepared using the cross-sectional data and operation procedure of gates and pumps explained in flood operation manuals so as to estimate flow capacity and to find optimum operation of the existing pumps and gates.

(4) Execution of Post Flood Survey and Analysis of Causes of Flooding

After remarkable flooding, post flood survey should be executed. Flood survey should collect; 1) hourly rainfall data not only under the CILCIS but also under the BMG, 2) water level data at water level gauging stations, 3) operation records of gates and pumps, 4) flood operation records including time of issuance of alerts and related activities of flood operation units, 5) flooded areas with depth and duration. Using these data and cross-sectional data, causes of flooding should be analyzed including lack of pump capacity and low flow capacity of secondary/tertiary drains. Flood inundation simulation model explained in 5.2.3 should be applied to analyze causes of flooding.

5.2.2 Utilization of Maximum Capacity of Existing Rivers and Drainage Systems

(1) Selection of Problematic Sites and Structures for Monitoring and Inspection

Problematic sites and structures such as low flow capacity portions and damaged dikes are selected based on the cross-sectional survey and inventory. At these sites and structures, intensive monitoring by monitoring units is conducted before and during flood events. After flood events, inspection of condition of the rivers and the structures under the responsibility is executed.

(2) Study of Flood Fighting Activities and Execution of Flood Fighting

To avoid overflow and dike breach, possible location, applicable flood fighting works and warehouse are studied/selected in consideration of flow capacity and type/condition of dike.

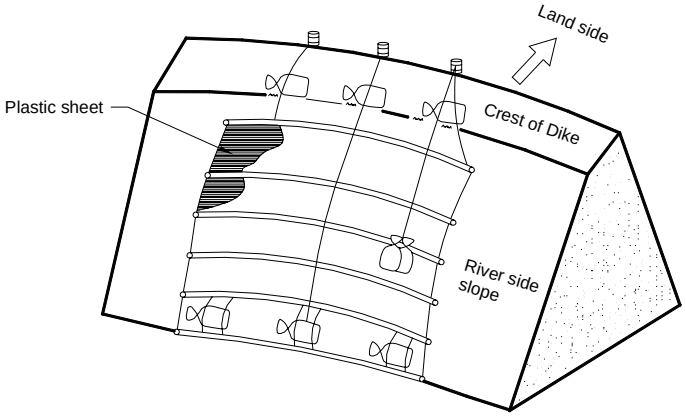


Figure 5.1 Covering by Plastic Sheet

Based on the study, warehouses are prepared and necessary materials such as sandbags, plastic sheets and equipment are stocked in warehouses. And if judged as necessary, emergency activities of flood fighting using the stocked sand back, etc. are executed to prevent overflow and/or dike collapse.

(3) Study and Execution of Maintenance Works

Periodical dredging/cleaning is planed and conducted based on the results of cross-sectional data. Regarding damaged structures, causes of damages are estimated based on inspection results, inventory and cross-sectional survey and necessary repair/rehabilitation is conducted.

(4) Executions of Actions to Illegal Activities

Based on the periodical and continuous cross-sectional survey, necessary actions should be taken for illegal activities, such as 1) encroachment to the river zone and the river conservation zones, and 2) dumping of sediment/garbage to river zones.

(5) Study of Operation of Pumps and Gates

Based on the latest cross-sectional survey of the drains, optimum operation of the existing pumps and gates is studied/analyzed. Also, limitation of the present improvement policy of the drainage systems, which plans to improve pumps and main drains without consideration of the secondary/tertiary drains, are analyzed.

(6) Estimation of Necessary Personnel and Budget for Maintenance and Operation Activities

Based on these data, necessary personnel and annual budget should be secured through estimation of activities such as; 1) necessary equipment and materials of flood fighting against overflow and dike collapse, 2) frequency and volume of dredging and/or cleaning to retrieve the original or maximum flow capacity, 3) average frequency of damage/repair/rehabilitation to flood control and drainage structures and 4) execution of optimum operation of pumps and gates.

(7) Revision of Flood Operation Manuals

Based on the activities, necessary revision is done to the existing Flood Operation Manuals.

(8) Recommendation for Flood Control and Drainage Master Plan

Based on the accumulated data and analyses, recommendation should be made to formulate flood control and drainage master plan.

5.2.3 Encouragement of Preparedness in Flood Prone Areas

(1) Preparation of Flood Inundation Simulation Model

Using the results of flood damage survey, cross-sectional survey and the existing digital map with scale of 10,000 prepared by the DKI Jakarta, flood inundation simulation model is established.

(2) Preparation of Flood Risk Maps

Flood risk maps will be prepared based the inundation conditions estimated by the flood inundation simulation model as well as the actual inundation conditions. Regarding the drainage areas, since flooding conditions varies with overflow from rivers and without overflow, a lot of cases changing rainfall volume and patterns need to be computed and analyzed before publication of flood risk maps. These flood risk maps intend to indicate flooding areas corresponding to the scale of rainfall so that inhabitants and organizations, even outside of the habitual flood areas, can recognize the risk of flooding and proceed to necessary preparation for information dissemination method, evacuation route and evacuation centers with full understanding of their possible risk including frequency, depth, causes and so on.

(3) Revision of Flood Alert Water Level

Based on analyses to prepare flood risk maps, flood alert water levels should be revised. Warning to be issued should not be only water level information such as Alert IV to I but also should include areas to be flooded. Flooding areas may be analyzed based on rainfall data as well as water level of upstream reaches.

(4) Establishment of Flood Forecasting and Warning Center

To issue the warning on areas to be flooded, engineering judgment is necessary based on integrated analysis of discharge upstream, water level surrounding and rainfall so far. To execute the analysis and to issue the warning, a flood forecasting and warning center may be necessary to be established.

5.2.4 Prevention of Runoff Increase due to Development

Development of DKI Jakarta has occurred in the low-lying alluvial areas along the coast, namely, in east-west direction. These areas are easily and seriously flooded. Present and future development, however, tends to transfer to middle and upper basins in southern Jakarta and Bogor Regency, which will develop the existing urbanized areas more densely and change existing paddy fields/forest areas into urbanized areas, as indicated in their spatial planning.

Development of paddy fields/forest areas destroy storage functions, where rain water is stored, and dense development decreases remained open spaces. Thus, rainfall water tends to flow into rivers directly and immediately and thus runoff discharge largely increases in downstream areas. It is extremely difficult in the populated low-lying areas to widen rivers and/or to construct new floodways so as to accommodate increased peak discharge. However, it is surely clear that, if no actions are taken, flooding in the populated areas will become more serious due to the increased discharge.

There are two (2) methods to prevent rapid runoff increase. One method is to designate the areas with storage functions as conservation areas, in which development activities are restricted or controlled in consideration of attainment of flood control and drainage system improvement. In the case of the JABOTABEK, the DKI Jakarta has designated most of the areas as housing area and industrial areas, while in the Bogor Regency, 38 % of the total area has been designated as new built-up areas, which were previously forest areas, in addition to the existing built-up areas.

The other method is to install a lot of retention and/or permeable facilities to minimize increase of runoff discharge. Considering further increase of discharge and difficulty in widening/new construction of rivers, it is necessary to explain to stakeholder about increase of flood damages due to development and to take actions so as to install retention/permeable facilities, in addition to conservation of the remaining forest and open space as well as small lakes/ponds (Situ-situ).

Followings may be applicable retention/permeable facilities in JABOTABEK.

- Retention pond particularly for large scale subdivision, which stores increased portion of runoff due to development
- Retention at park, school, sport ground, tennis court, parking lot, space between buildings/apartments, roof, etc.
- Permeable pavement, which enables infiltration, at the place groundwater level is low and ground slope is not steep.

5.3 STEPWISE IMPLEMENTATION PLAN FOR FLOOD DAMAGE MITIGATION MEASURES

Flood mitigation measures proposed above may be implemented in two (2) phases as explained below.

5.3.1 1st Phase

(1) Rivers (Flood Control)

(a) Preparation of Inventory and Execution of Basic Analysis

(i) Preparation of inventory database system of rivers and flood control structures

(ii) Execution of cross-sectional survey

(iii) Estimation of flow capacity

(iv) Execution of post flood survey

(b) Utilization of Maximum Capacity of Existing Rivers

(i) Selection of problematic sites and structures

(ii) Study and preparation of applicable flood fighting works and necessary equipment/materials

(iii) Study and preparation of maintenance activities

(iv) Study and preparation of optimum operation of pumps and gates

(v) Revision of flood operation manual

(vi) Recommendation for flood control master plan

(c) Prevention of Runoff Increase

(i) Study of applicable retention/permeable facilities from the hydrology/hydraulics, regulations, socio-economy and so on

(2) Drainage System

(a) Preparation of Inventory and Execution of Basic Analysis

(i) Preparation of inventory database system for drainage structures

(ii) Execution of cross-sectional survey

(iii) Estimation of flow capacity

(iv) Execution of flood damage survey

(b) Utilization of Maximum Capacity of Existing Drainage Structures

(i) Selection of problematic sites and structures

(ii) Study and preparation of applicable flood fighting works and necessary equipment/materials

(iii) Study and preparation of maintenance activities

(iv) Study and preparation of optimum operation of pumps and gates

(v) Revision of flood operation manual

(vi) Recommendation for drainage master plan including increase of pump capacity, improvement of secondary/tertiary drains and so on

(c) Prevention of Runoff Increase

(i) Study of applicable retention/permeable facilities from the hydrology/hydraulics, regulations, socio-economy and so on

(3) Preparedness

(a) Data collection for flood inundation simulation model

(b) Preparation/establishment of flood inundation simulation model

5.3.2 2nd Phase

(1) Rivers (Flood Control)

(a) Preparation of Inventory and Execution of Basic Analysis

(i) Additional data input to Inventory database system for rivers and river structures

(ii) Execution of additional cross-sectional survey for problematic stretches

(iii) Estimation of flow capacity, if necessary

(iv) Execution of flood damage survey

(b) Utilization of maximum capacity of existing rivers

(i) Implementation of monitoring, inspection and maintenance activities

(ii) Implementation of flood fighting

(c) Prevention of Runoff Increase

(i) Workshop for installation of retention/permeable facilities

(ii) Recommendation for installation of retention/permeable facilities

(2) Drainage System

(a) Preparation of Inventory and Execution of Basic Analysis

(i) Additional data input to Inventory database system for rivers and river structures

(ii) Execution of additional cross-sectional survey for problematic stretches

(iii) Estimation of flow capacity, if necessary

(iv) Execution of flood damage survey

(b) Utilization of maximum capacity of existing drainage system

(i) Implementation of monitoring, inspection and maintenance activities

(ii) Implementation of optimum operation

(iii) Implementation of flood fighting

(c) Prevention of Runoff Increase

(i) Workshop for installation of retention/permeable facilities

(ii) Recommendation for installation of retention/permeable facilities

(3) Preparedness

(a) Analysis of flood inundation conditions

(b) Preparation and publication of flood risk map

(c) Revision of Flood Alerts

(d) Issuance of accurate flood information and Flood Alerts to related organizations and inhabitants

(e) Preparation for establishment of Flood Forecasting and Warning Center

Reference

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Annex 1

Member List
Study Schedule
Interview List

Member List

Name	Field in Charge	Stay Period	Affiliation
Junji YOKOKURA (Dr)	Team Leader	Sep.11～Sep.15, 2005	Senior Assistant to the Director General, Global Environment Department, JICA
Masanobu TAKEUCHI (Mr)	Flood Control	Sep.11～Sep.17, 2005	Planning Officer, Councellor's Office, Hokkaido Bureau, Ministry of Land, Infrastructure and Transport
Kazuhiko TANAKA (Mr)	Cooperation Planning	Sep.11～Oct.25, 2005	Staff, Water Resources and Disaster Management Team II, Group III, Global Environment Department, JICA
Susumu HEISHI (Mr)	Flood Management	Sep.11～Oct.25, 2005	Head of Engineers Water Resources Dep. International Div. Yachiyo Engineering Co. Ltd.
Keizo SUEYOSHI (Mr)	River Management System	Sep.11～Oct.25, 2005	Section Manager Water Resources Dep. International Div. Yachiyo Engineering Co. Ltd.

Study Schedule

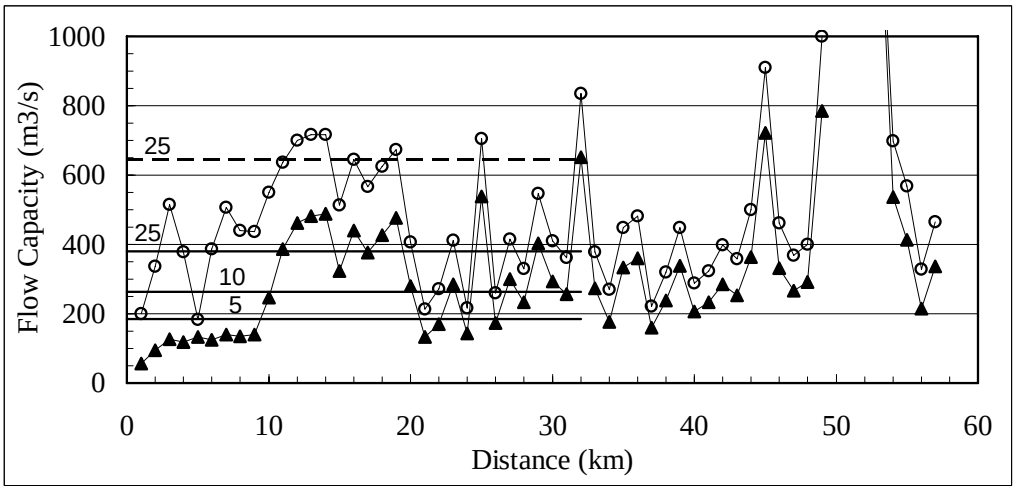
No.	Date	Time	Activities
1	Sep.11 (Sun.)	16:50	Arrival at Jakarta by JL-725
2	Sep.12 (Mon.)	9:00	Courtesy call to JICA Indonesia Office
		11:00	Courtesy call to Japanese Embassy
		13:00	Courtesy call to Ministry of Public Works
			Meeting with the officials concerned on the Study, purpose, work plan and schedule
		16:30	Meeting with JICA Experts
3	Sep.13 (Tue.)	8:00	Ciliwung Cisadane River Basin Development Project Office
		9:30	Field observation on flood prone areas at East Jakarta
		11:00	Manggarai Gate
		14:30	Construction Site of Eastern Banjir Canal
4	Sep.14 (Wed.)	7:30	Ciliwung Cisadane River Basin Development Project Office
		9:30	Katulampa Weir
		10:30	Proposed tunnel site connecting Ciliwung and Cisadane rivers
		11:30	Proposed dam site at upper stream of Ciliwung River
		14:30	Field observation on flood prone areas at West Jakarta
		15:00	Down stream of Angke River
		16:00	Tomang Pump Station
		17:00	Pluit Pump Station
5	Sep.15 (Thr.)	11:00	Meeting with JICA Experts
		13:30	Meeting with DGWR Officials
		15:00	Report to Japanese Embassy
		16:00	Report to JICA Indonesia Office
		20:35	Leave for Teheran by EK-349 (Dr. Yokokura)

No.	Date	Time	Activities
6	Sep.16 (Fri.)		Meeting with officials concerned Leave for Narita by JL-726 (Mr. Takauchi)
9	Sep.19 (Mon.)	14:00	Meeting with the DG of DGWR
10	Sep.20 (Tue.)		Data collection and analysis
11	Sep.21 (Wed.)	10:00 14:00	Meeting with the officials concerned Meeting with JICA Officials
12	Sep.22 (Thr.)		Data collection and analysis
13	Sep.23 (Fri.)		Data collection and analysis
16	Sep.26 (Mon.)		Data collection and analysis
17	Sep.27 (Tue.)		Data collection and analysis
18	Sep.28 (Wed.)		Data collection and analysis
19	Sep.29 (Thr.)		Data collection and analysis
20	Sep.30 (Fri.)		Data collection and analysis
23	Oct.03 (Mon.)		Data collection and analysis
24	Oct.04 (Tue.)		Data collection and analysis
25	Oct.05 (Wed.)		Data collection and analysis
26	Oct.06 (Thr.)		Data collection and analysis
27	Oct.07 (Fri.)		Data collection and analysis
30	Oct.10 (Mon.)		Data collection and analysis
31	Oct.11 (Tue.)		Data collection and analysis
32	Oct.12 (Wed.)		Data collection and analysis
33	Oct.13 (Thr.)		Data collection and analysis
34	Oct.14 (Fri.)		Data collection and analysis
37	Oct.17 (Mon.)		Data collection and analysis
38	Oct.18 (Tue.)		Data collection and analysis
39	Oct.19 (Wed.)		Data collection and analysis
40	Oct.20 (Thr.)		Data collection and analysis
41	Oct.21 (Fri.)	14:00	Report to the DGWR Officials
42	Oct.22 (Sat.)	8:00 9:30 11:00 13:00	Ciliwung Cisadane River Basin Development Office Field observation on erosion site at Bogor by subdivision development Field observation on erosion site at Bogor by agricultural development Field observation on flood prone area
44	Oct.24 (Mon.)	11:00 16:00 22:35	Report to Japanese Embassy Report to JICA Indonesia Office Leave for Narita by JL-726
45	Oct.25 (Tue.)	7:55	Arrival at Narita

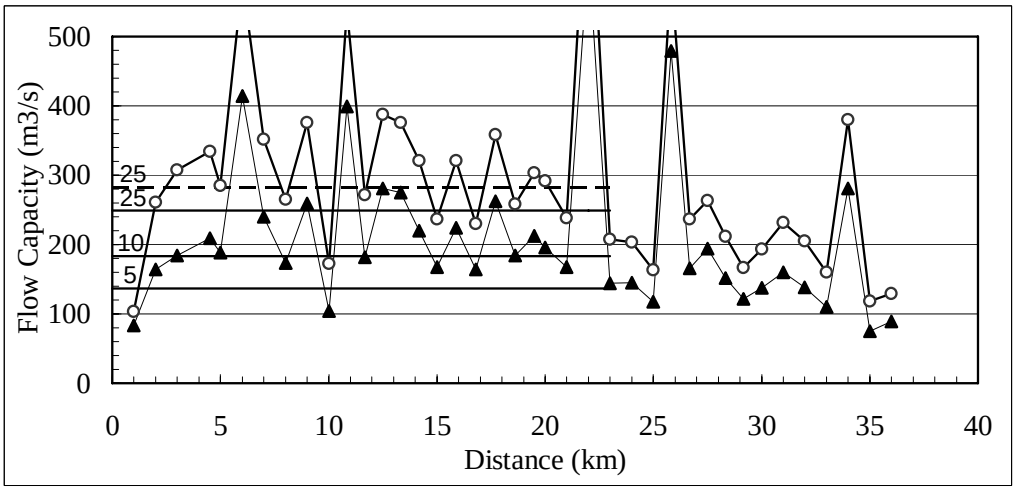
Interview List

Ministry of Public Works	
Ir. Siswoko, Dipl. HE	Director General of Water Resources
Ir. Dyah Rahaya Pangesti, Dipl.HE	Director of Rivers, Lakes and Dams, DGWR
Ir. Agni Handoyoputro, Dipl.HE	Sub Director of Strategy and Policy, Directorate of Planning and Programming, DGWR
Drs. Her Wirjanto MSc.	Sub Director of Programming and budgeting, Directorate of Planning and Programming, DGWR
Ir. Bambang Sigit S, M.Eng.	Sub Director of River Basin Planning, Directorate of Planning and Programming, DGWR
Ir. Slamet Budi Santoso, Dipl.HE	Sub Director of River, Lake and Dam Technical Planning, Directorate of Rivers, Lakes and Dams, DGWR
Ir. Bambang Warsito, Dipl.HE	Sub Director of Water Resources Conservation, Directorate of Rivers, Lakes and Dams, DGWR
Ir. Prasidananto Nugroho Meng.	Sub Director of Implementation for West Region, Directorate of Rivers, Lakes and Dams, DGWR
Duki Malindo	Staff, Sub Director of Implementation for West Region, Directorate of Rivers, Lakes and Dams, DGWR
Jodi	Staff, Sub Director of Implementation for West Region, Directorate of Rivers, Lakes and Dams, DGWR
Ciliwung Cisadane River Basin Development Project Office	
Ir. Pitoyo Subandrio, Dipl.HE	Director of the Project Office
Ir. Hari Suprayogi, Dipl.HE	Head of Planning Section
Ir. Djoko Prakoso, ME	Head of Flood Control Section
Sihar Simanjuntak ATP	Sub Head of Implementation II, Flood Control Sec.
Japanese Side	
Mr. Takashi FUKUWATARI	First Secretary, Embassy of Japan in Indonesia
Mr. Keiichi KATO	Resident Representative, JICA Indonesia Office
Mr. Shinji TOTSUKA	Assistant Resident Representative, JICA Indonesia Office
Mr. Tomoyuki NAITO	Assistant Resident Representative, JICA Indonesia Office
Mr. Yasuyuki HIRAI	JICA Expert on Water Resources Policy
Mr. Masato JOGASAKI	JICA Expert on Sabo Planning
Mr. Makoto NISHIKORI	JICA Expert on Spatial Planning

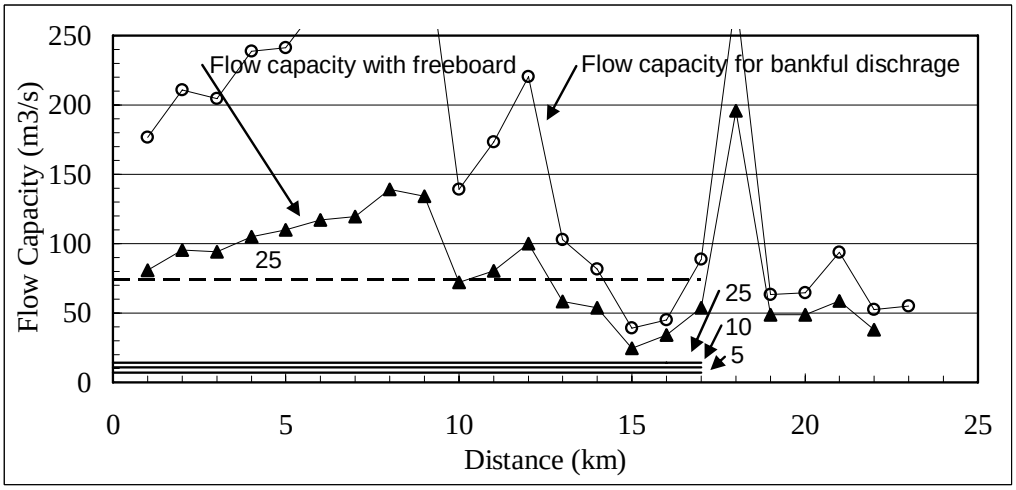
Annex 2
Flow Capacity of Rivers



(a) Cidurian River

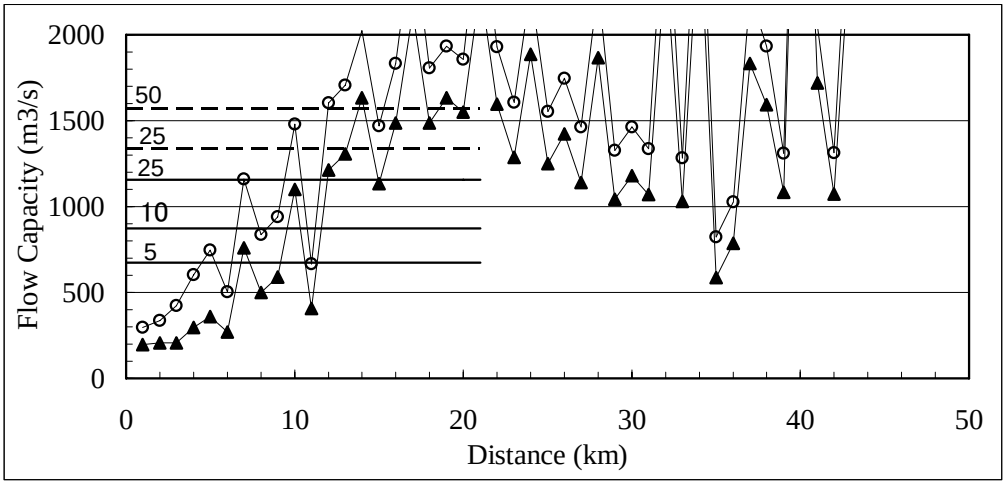


(b) Cimanceuri River

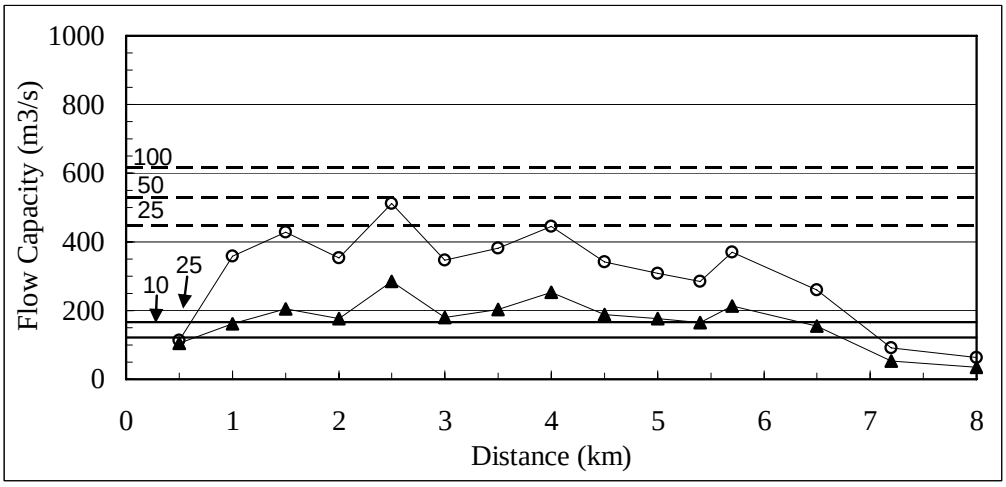


(c) Cirabrab River

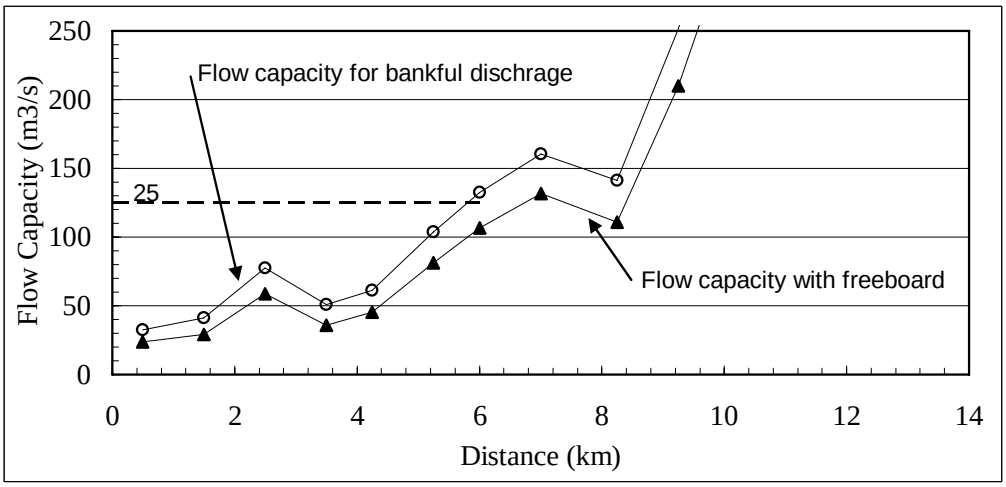
Note: - - - - - Discharge for future land use (2025)
——— Discharge for land use in 1996
Values on discharge are corresponding return period



(d) Cisadane River

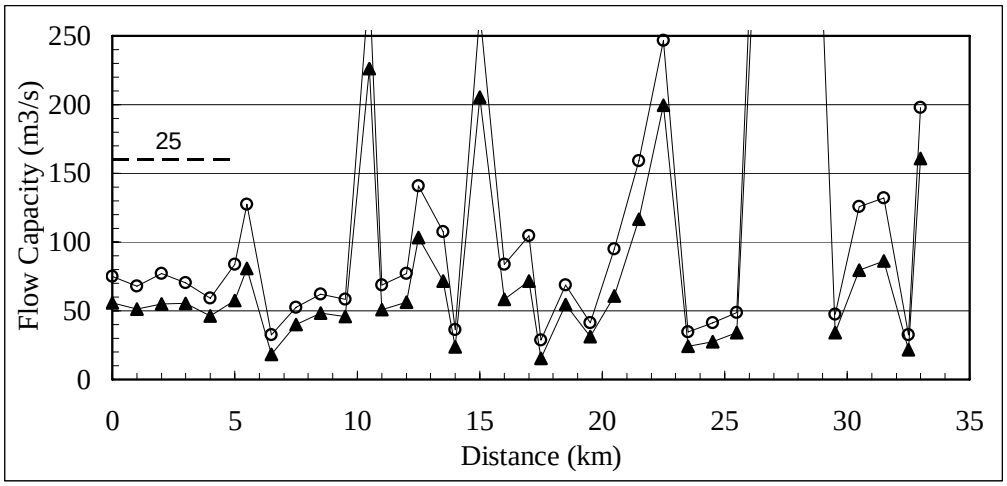


(e) Cengkareng Floodway

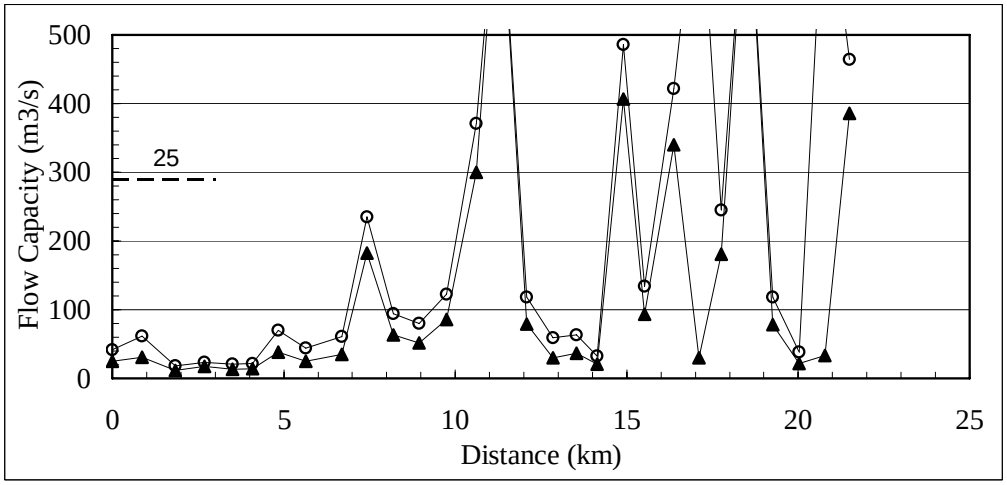


(f) Mookervaart Canal

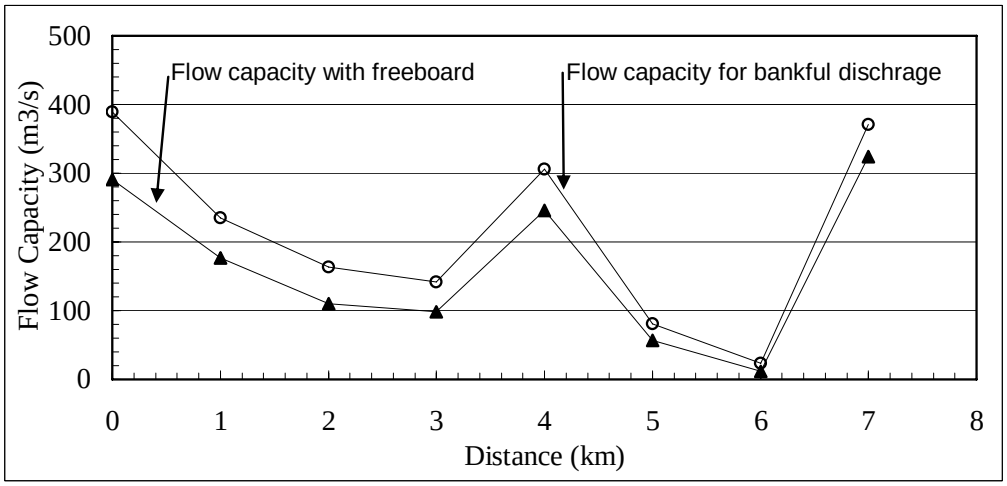
Note: ----- Discharge for future land use (2025)
——— Discharge for land use in 1996
Values on discharge are corresponding return period



(g) Angke River

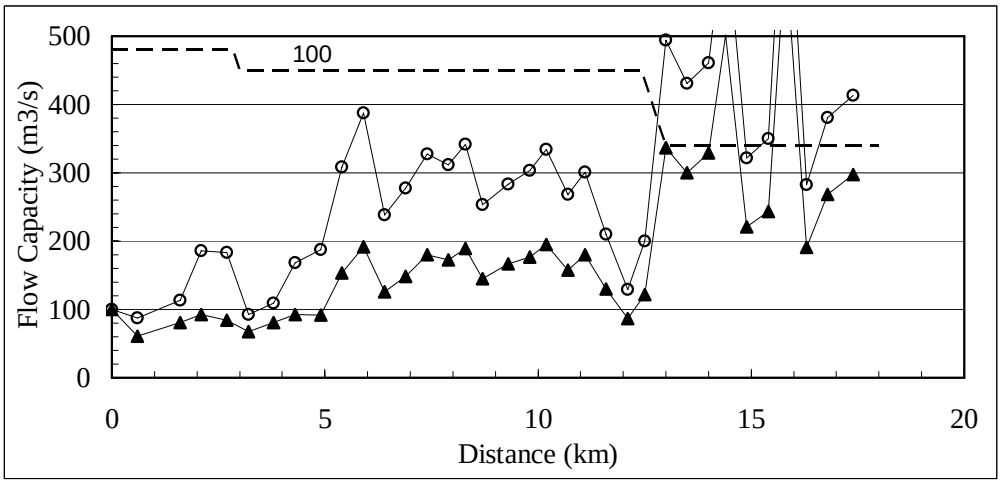


(h) Pesanggrahan River

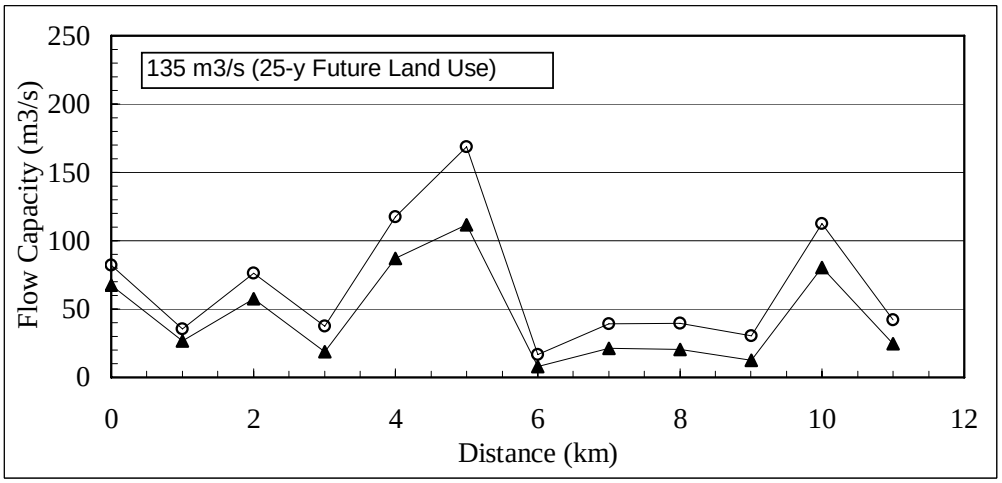


(i) Grogol River

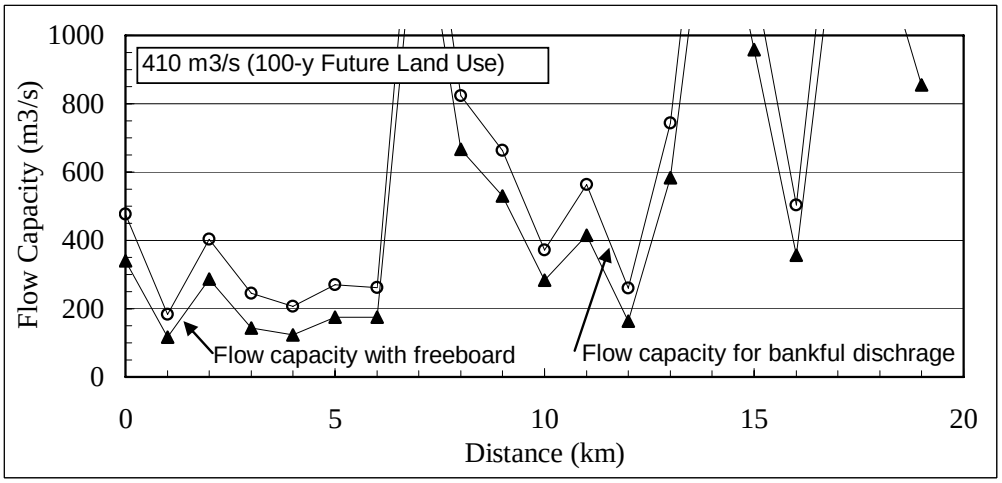
Note: ----- Discharge for future land use (2025)
——— Discharge for land use in 1996
Values on discharge are corresponding return period



(j) West Banjir Canal

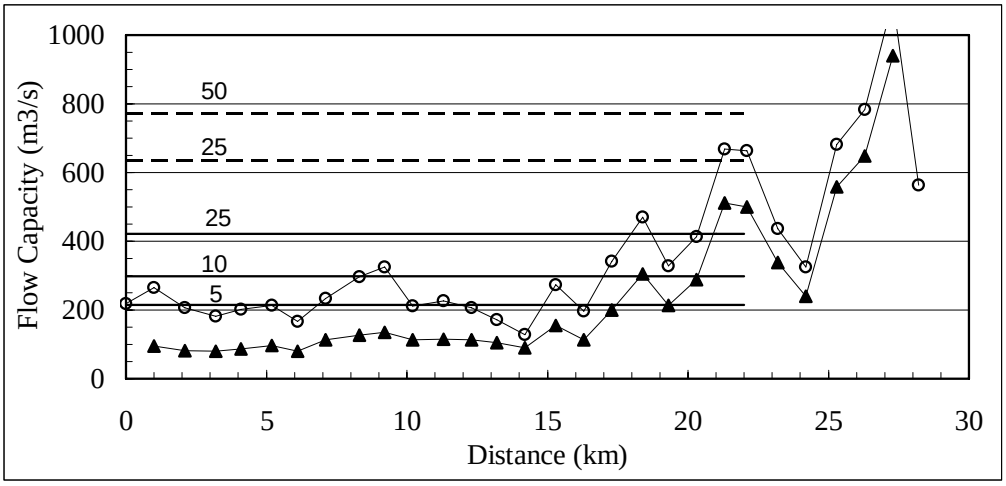


(k) Krukut River

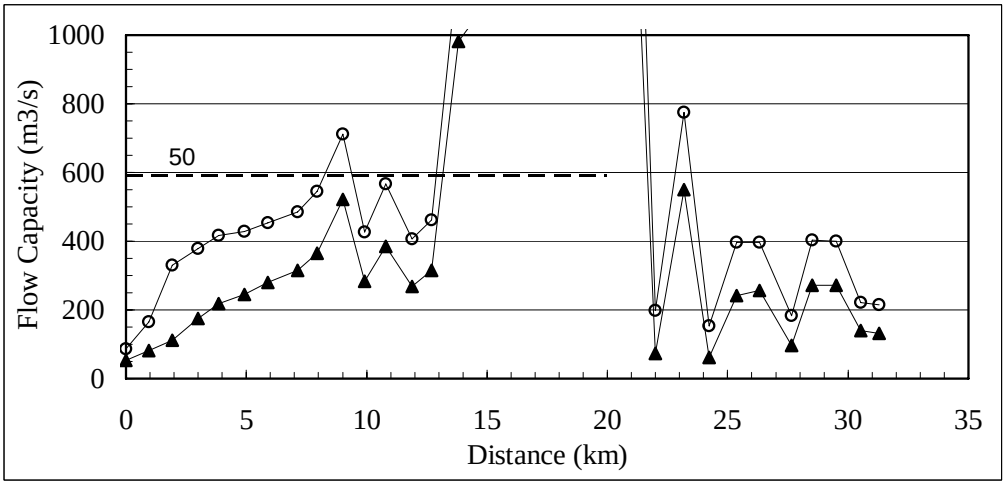


(l) Ciliwung River

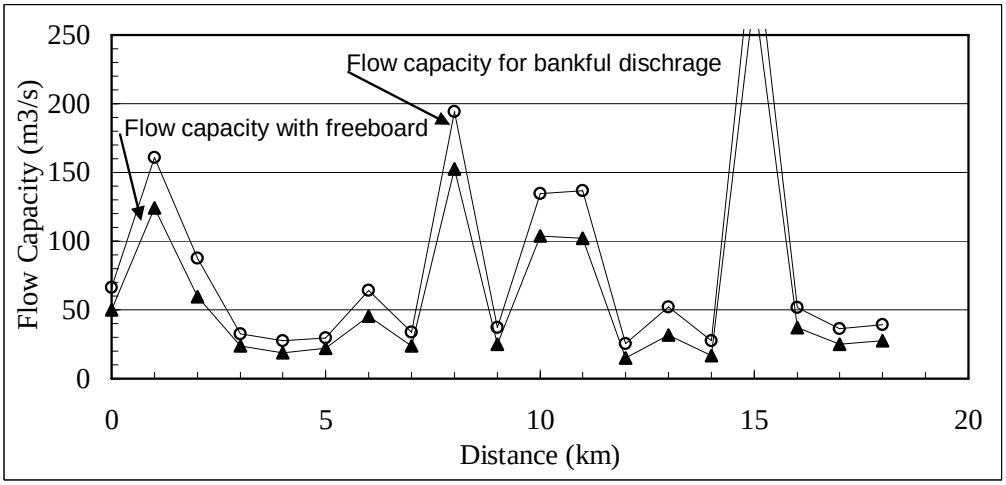
Note: Discharge for future land use (2025)
Discharge for land use in 1996
Values on discharge are corresponding return period



(m) CBL Floodway

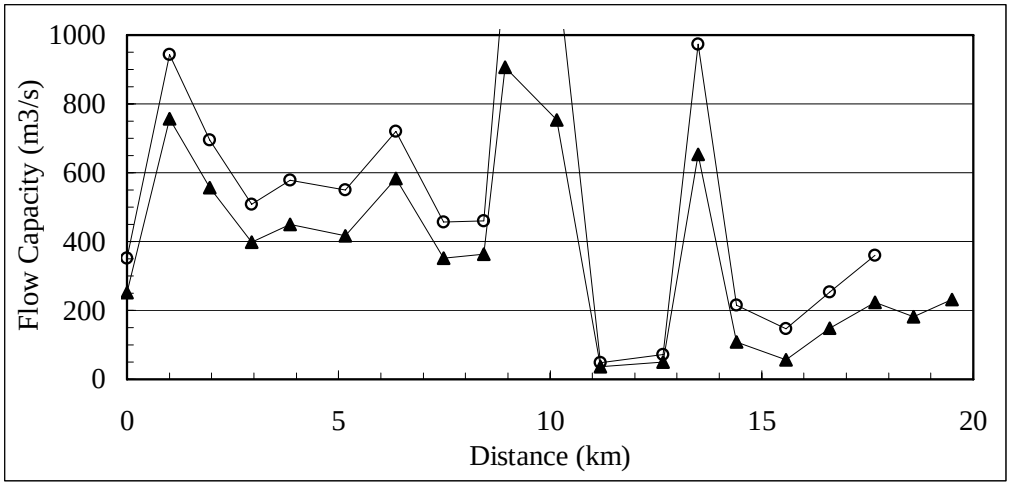


(n) Bekasi River

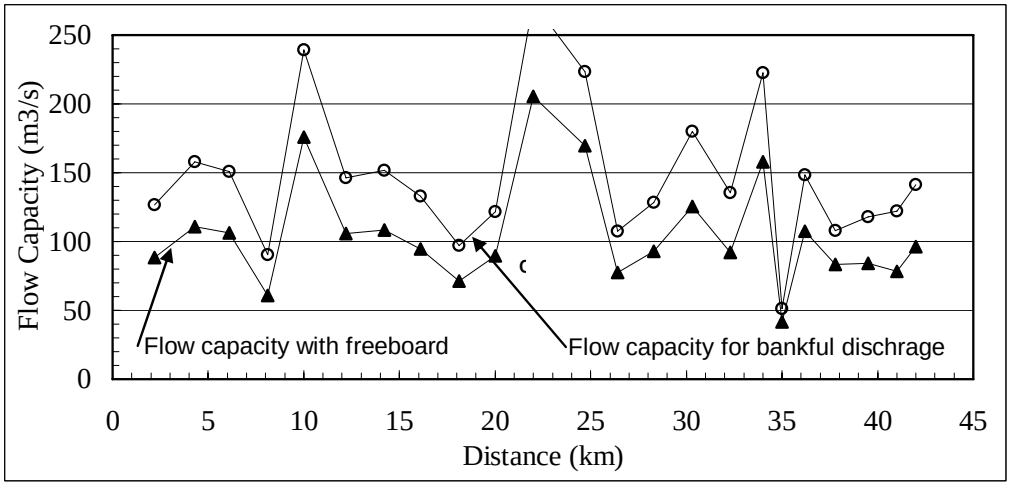


(o) Cisadang River

Note: ----- Discharge for future land use (2025)
——— Discharge for land use in 1996
Values on discharge are corresponding return period



(p) Cikarang River



(q) Cilemahabang River

Note: - - - - - Discharge for future land use (2025)
——— Discharge for land use in 1996
Values on discharge are corresponding return period

Annex 3
Drainage Facilities

Table A3-1 List of Main Drains and Gates in Pump Drainage Areas in DKI Jakarta

D Code	Drainage Zone Name	Drainage Zone Area	Main Drain			Gate		
			Name	Length (km)	Width (m)	Name	Nos	Size
1	Tomang Barat	170	S. Tomang Barat	1.225	4	Grogol (G41)	No Data	No Data
			S. Hub Tanjung Duren	0.36	1			
2	Grogol	80	S. Makaliwe	0.63	4			
			S. Susilo	1.855	3			
3	Rawa Kepa	229	S. Rawa Kepa Utama	-	-			
4	Pondok Bandung	90	-	-	-			
5	Cideng - Siantar	750	S. Siantar	-	-	Manggarai (G25)	2	2 x 5.20
						Karet (G30)	2	No Data
						Tanah Rendah (G31)	2	2 x 2.0
6	Melati	110	S. Kebon Kacang	-	-			
7	Setiabudi Barat	216	S. H.R. Rasuna Said	1.05	2			
			S. Jl. Setiabudi	0.81	2			
8	Setiabudi Timur	132	S. Kawi-Kawi	0.725	2	Minang Kabau (G28)	No Data	No Data
						Sultan Agung (G29)	No Data	No Data
9	Pluit	3258	S. Gedong Wd. Pluit	2	8	Pasar ikan Gate(G16)	2	2 x 2.5
			S. Jl. Pluit Putra	2.45	2	Tangki Gate (G17)	No Data	No Data
			S. Jl. Pluit Selatan	0.71	1	Gajah Mada (G-43)	No Data	No Data
			S. Jl. Pluit Raya	1.035	5	(G18)	4	4 x 3.60
			S. Jelakeng	2.37	11			
			S. Pluit Karang Karya Timur	-	-	Jembatan Dua (G14)	No Data	No Data
						Duri (G15)	No Data	No Data
			Ciliwung-Gunun Sahari			Ciliwung Gunung Sahar(G19)	2	2 x 2.0
			Ancol			Ancol (G21)	2	2 x 3.0
			Ciliwung-Gunun Sahari			Tidal (G22)	5	No Data
			Ciliwung			Istiqlal Gate (G23)	No Data	No Data
			Ciliwung			(G24)	No Data	No Data
10	Muara Angke	50	S. Kampung Nelayan	0.5	2			
11	Teluk Gong	90	S. Hub Teluk Gong	1.155	2			
12-1	Kamayoran	850	S. Pademangan Timur	2.35	12.5			
			S. Al Pademangan	2.1	3			
			S. Pademangan Barat	3.95	15			
12-2	Pademangan/ Ancol	670	K. Ancol	-	-	K. Mati Gate (G20)	1	1 x 1.0
13	Sunter Barat Utara	1250	S. Lagoa Tenggiri	4.55	6 - 25	Koja Gate (G35)	2	2 x 3.0
			S. Hub Gaya Motor	3.25	4	Sunter C Gate (G48)		
			S. Hub. Bisma Timur	1.2	3			
			S. Hub. Bisma Tengah	0.95	4			
			S. Hub. Bisma Barat	1.05	4			
14	(Rawa Badak)	570	S. Rawa Badak	3.115	2.6	(G40)	No Data	No Data
15	(Kodamar)	200	S. Komp. AL	1.645	2.5	Sunter Gate (G34)	5	No Data
16	Pulomas	460	S. Pulo Mas Barat	1.365	3.5	Pulo Mas Gate (G44)	2	No Data
			S. Pulo Mas Utara	0.665	4			

Table A.3-2 List of Gates in DKI Jakarta

No.	Name of Gate	River System	Total Gate (Nos)	Dimension (m)	Management
1	Sodetan K. Pesanggrahan - Grogol	Sodetan K. Pesanggrahan	No Data	No Data	DPU DKI
2	Grogol Pondok Pinang	K. Grogol	No Data	No Data	DPU DKI
3	Polor	K. Angke	No Data	No Data	CILCIS
4	Koneng I	K. Pesanggrahan	No Data	No Data	CILCIS
5	Koneng II	K. Pesanggrahan	No Data	No Data	CILCIS
6	Koneng III	K. Pesanggrahan	No Data	No Data	CILCIS
7	Cengkareng Drain	Cengkareng Drain	No Data	No Data	CILCIS
8	Apuran	Cengkareng Drain	No Data	No Data	CILCIS
9	Kamal / Jalan Tol	K. Kamal	No Data	No Data	DPU DKI
10	Wk. Teluk Gong	K. Angke	No Data	No Data	CILCIS
11	Kampung Gusti	K. Angke	No Data	No Data	CILCIS
12	K. Jodo	K. Angke	No Data	No Data	CILCIS
13	K. Tubagus Angke	K. Grogol	No Data	No Data	CILCIS
14	Jembatan Dua	K. Jelangkeng	No Data	No Data	DPU DKI
15	K. Duri	K. Duri	No Data	No Data	DPU DKI
16	Pasar Ikan / Sunda Kelapa	K. Besar	2	2 x 2.5	DPU DKI
17	Tangki	K. Gajah Mada	No Data	No Data	DPU DKI
18	Jembatan Merah	K. Ciliwung Kota	4	4 x 3.60	DPU DKI
19	Ciliwung Gunung Sahari	K. Ciliwung Gunung Sahari	2	2 x 2.0	DPU DKI
20	K. Mati	K. Mati	1	1 x 1.0	DPU DKI
21	Ancol / Flushing	K. Ancol	2	2 x 3.0	DPU DKI
22	Tidal Gate / Pekapuran	K. Ciliwung Gunung Sahari	5	No Data	DPU DKI
23	Istiqlal / Kapitol	K. Ciliwung	No Data	No Data	DPU DKI
24	Ciliwung Manggarai	K. Ciliwung	No Data	No Data	DPU DKI
25	Manggarai	WBC	2	2 x 5.20	CILCIS
26	Gang Kelor / KW. 31	K. Sentiong	No Data	No Data	DPU DKI
27	Hek	K. Baru Timur	No Data	No Data	DPU DKI
28	Minangkabau	K. Baru Barat	No Data	No Data	DPU DKI
29	Sultan Agung	S. Malabar	No Data	No Data	DPU DKI
30	Karet	WBC	2	No Data	CILCIS
31	Tanah Rendah / Jatibaru	K. Krukut	2	2 x 2.0	DPU DKI
32	Jago I Dam	K. Item	No Data	No Data	DPU DKI
33	Jago II Dam	K. Item	No Data	No Data	DPU DKI
34	K. Sunter depan Honda	K. Sunter	5	No Data	CILCIS
35	Koja / Lagoa	K. Ancol	2	2 x 3.0	DPU DKI
36	Roa Malaka	K. Cakung	No Data	No Data	DPU DKI
37	Marunda	K. Cakung	No Data	No Data	DPU DKI
38	Cakung Drain	Cakung Drain	No Data	No Data	CILCIS
39	Pulo Gadung	K. Sunter	No Data	No Data	CILCIS
40	Rawa Badak	K. Rawa Badak	No Data	No Data	DPU DKI
41	Grogol / Citra Land	Sodetan K. Sekretaris	No Data	No Data	DPU DKI
42	Ancol	K. Ancol	No Data	No Data	DPU DKI
43	Gajah Mada	K. Gajah Mada	No Data	No Data	DPU DKI
44	Pulo Mas	K. Sunter	2	No Data	CILCIS
45	Pangadegan	K. Ciliwung	No Data	No Data	CILCIS
46	Warung Pedok	K. Baru Barat	No Data	No Data	DPU DKI
47	Warung Jengkol	Sodetan K. Petukangan	No Data	No Data	DPU DKI
48	Sunter C	K. Mati	No Data	No Data	DPU DKI
49	Bali Matraman	S. Kali Bata	No Data	No Data	DPU DKI
50	Pertamina Plumpang	K. Petukangan	No Data	No Data	DPU DKI
51	Cideng & Duri	K. Cideng	No Data	No Data	DPU DKI

Table A.3-3 List of Local Pumps in DKI Jakarta

P Code	Pump Name	Drainage Area (ha.)	Pump Capacity (m3/s)	Unit of Pump (Unit* Capacity m3/s)	Completion Year	Reservoir Area (ha.)	Outlet River	Management
P-1	Bimoli/Muara Karang	40	5.20	4*1.3	1999	-	K. Muara Karang	SDPU DKI
P-2	Mangga Dua	77	9.90	2*4.95	-	-	K. Ciliwung Gunung Sahari	SDPU DKI
P-3	Yos sudarso	20	0.25	2*0.5	1996	-	K. Sunter	SDPU DKI
P-4	Sunter Selatan	590	2.50	6*0.42	1999	8.0	K. Sentiong	DPU DKI
P-5	Terowongan Duku Atas	0.5	0.36	6*0.06	1994	-	WBC	SDPU DKI
P-6	Terowongan Manggarai	0.5	0.36	6*0.06	1996	-	WBC	SDPU DKI
P-7	Istana Negara	50	1.25	3*0.42	1974	-	K. Ciliwung Gajah Mada	DPU DKI
P-8	AIP/ABDAD	40	0.75	2*0.38	1984	-	K. Ciliwung Gunung Sahari	SDPU DKI
P-9	Gaya Motor	40	0.80	2*0.4	1995	-	S. Gaya Motor	SDPU DKI
P-10	Jelambar/Wijaya Kusuma	20	1.20	3*0.4	1996	1.0	K. Angke	SDPU DKI
P-11	IKPN Bintaro	40	1.20	3*0.4	1985, 1986, 1996	-	K. Pesanggrahan	SDPU DKI
P-12	Terowongan DI. Panjaitan	0.5	0.36	6*0.06	1995	-	K. Sunter Tributary	SDPU DKI
P-13	Hankam Slipi	50	0.36	6*0.06	1970, 1975	1.0	K. Grogol	SDPU DKI
P-14	Kapuk Indah	70	1.30	2*0.65	No Data	No Data	Cengkareng Drain	SDPU DKI
P-15	Pinangsia	No Data	0.35	2*0.18	1997	-	K. Ciliwung Mangga Besar	DPU DKI
Total			26.14					