2.4.3 4th and 5th Activities in Indonesia

(1) Summary

1) Activities Results regarding the Target Outputs in this Term

Activity for [Capacity Development of Operation and Maintenance for River and Drainage Facilities] (for Project Output - 1) and for [Capacity Development of Data Collection and Analysis for Flood] (for Project Output - 2)

- To prepare the inventory of river and drainage system, gates and weirs installed in the Ciliwung River and WBC (West Banjir Canal) were surveyed and the elevation of each facility was obtained. Also the reservoir of Pluit Pump Station was surveyed to estimate the reservoir volume.
- "Inventory on River and Drainage System" was prepared by compiling all the data and information collected so far on river and drainage system and facility. And the Manual for Rivers and River Structures (Draft) covering Inventory, Maintenance and Facility Evaluation was prepared also. These outputs were confirmed among the counterparts and the experts.
- Discharge measurements at the Depok Station (Design Reference Point for Flood Alert) were carried out by the expert together with the Counterparts.
- The existing pump stations and gated were surveyed by the experts together with the Counterparts. Operation manual on Pump and Gate (Draft) was confirmed among the counterparts and the experts, and prepared in Draft-Level.
- The presentations on these manuals were done by the Counterparts at the Steering Committee Meeting on March 13 at the meeting room of DGWR.

Activity for [Capacity Development of Flood Information System] (for Project Output - 3)

- Maximum Inundation Map and Flood Risk Map for probability year 1/5, 1/20, 1/30. 1/50 and 1/100 were prepared as the first trial version by using the Flood Inundation Analysis Model [JYECA-FLOW 2D] which was established for this Project.
- The outline of the model and results of simulation were introduced and presented by the expert at the Steering Committee Meeting mentioned above.

Activity for [Capacity Development for Runoff Control Measures] (for Project Output - 4)

There is no scheduled activity in this category.

Main Achievement

- ✓ Inventory of Rivers and River Structures and Situ-Situ
- ✓ River Survey in Ciliwung, WBC and Pesanggrahan River Systems
- ✓ Digital Map Analysis
- ✓ Land Use Analysis
- ✓ Inspection for Current Conditions of Pluit, Cideng and Melati Pump Stations
- ✓ Inspection for Gate Stations in Lowland Ares
- ✓ Analysis of Flow Capacity in Pluit Drainage Area
- ✓ Inundation Analysis in Ciliwung and WBC Rivers Basin

2) Counterpart Training

- Counterpart training was implemented through the OJT and the Counterpart Training in Japan.
- Two counterparts were sent to Japan for the topic of the training is "Comprehensive Flood Mitigation in Japan" in September 2008.

3) Seminar

- On December 4, 2008 the Seminar sponsored by DPU and co-sponsored by JICA was held to exchange information, to introduce and encourage comprehensive measures, and to confirm the coordination mechanism for flood management in JABODETABEC.
- Main outputs are: 1) Policy direction for flood mitigation measures, and 2) Inter-coordination framework among the related agencies on planning and implementing flood mitigation measures.

(2) Activity for [Capacity Development of Operation and Maintenance for River and Drainage Facilities] (for Project Output - 1) and for [Capacity Development of Data Collection and Analysis for Flood] (for Project Output - 2)

Activities in this category consist of the following items:

- ◆ Preparation of Inventory Database
- ◆ Post Flood Survey
  - Flood Survey of Pluit Pump Station and Reservoir on 14/Jan/2009
  - Piping at Pluit Pump Station on 18/Feb/2009 and 22/Feb/2009
- ◆ Study on Maintenance Problems of Rivers and Structures and Preparation of Maintenance Manual (Draft)
- ◆ Additional Survey of River and Drainage
- ◆ Data Collection and Analysis on Flood
- ◆ Improvement of Operation and Maintenance Manual for River and Drainage Facilities
- ◆ Survey for Drainage Pump and Gate

1) Preparation of Inventory Database

Inventory of rivers and river structures are drawing up in the Manual for River and River Structures. Database in the manual are categorized as flows,

- ◆ Rivers and Situ-Situ
- ◆ Gates
- ◆ Pump Stations
- ◆ Revetments

Administration of River

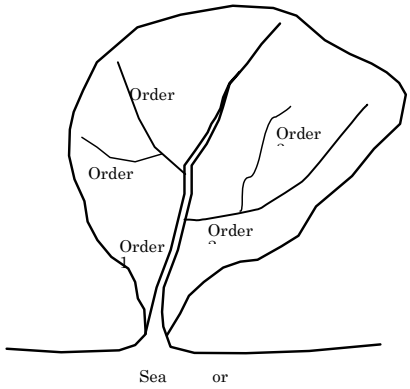
River is categorized three types according to the responsibility of owners, namely Macro, Sub-Macro and Micro.

- ◆ Macro river is administrated by BBWS Chiliwung - Cisadane
- ◆ Sub-Macro river is administrated by DPU DKI Jakarta (Agency pf PU DKI Jakarta)
- ◆ Micro river is administrated by SUK DINAS (SUB-Agency of PU)

River is naturally one of components involving water cycle on earth. Primary functions of it are to flow out rainfall into sea or lakes and convey sediment generated by erosive action. Human being try to utilize river and natural behaviors of the river are given various actions to human life. River has multipurpose functions for human life such as Flood conveyance, water utilization, river use, and water amenity and environment.

Classification of River Course

In Indonesia, river courses and channels in the same basin are classified into order1, order2 order3, which are numbered from a main river to tributaries and sub-tributaries.



Category of River Structure

Order	Category	Administration
1	Macro	BBWS
2	Sub- Macro	DKI
3	Micro	SKDINAS

Figure-2.7 Classification of River Course and River Structure

Categories and Types of River Structures in the Ciliwung River

River infrastructures in the river Ciliwung River Basin are classified into 10 categories to apply the methodology of maintenance work. Categories and type of river structures are shown in Table-2.13.

Table-2.13 Category of River Structure

No.	Category and Type	No.	Category and Type
1	Dike	6	Sluice Way
2	Parapet Wall	7	Flap Gate
3	Revetment	8	Pumping Facility
4	Weir	9	Siphon (Siphon over type and Siphon under type)
5	Gate (Flow Control Gate, Tidal Gate)	10	Flood Retention Pond (Farm pond)

2) Post Flood Survey

(2-1) Flood Survey of Pluit Pump Station and Reservoir on 14/Jan/2009

<Purpose>

The Pluit Pump Station and Reservoir are the trunk facilities of the drainage in the center of the Jakarta. In order to mitigate the flood damage, it is important to grasp the present condition of these facilities.

The JABODETABEK area has intermittent rainfalls from 12/Jan/2009. In the morning of 14/Jan/2009, the Project received the information that the water level of the Pluit Reservoir became – 20 cm at the installed staff gauge, although the rainfalls during this period were not heavy compared with the past major floods. Therefore, the urgent inspection of the Pluit Pump Station and Reservoir was carried out in the afternoon of 14/Jan/2009. During the urgent inspection, the Project Team found the following problems:

- Decrease of workable pump units of the Pluit Pump Station
- Sea water intrusion due to the spring high tide and high wave.
- Flow obstruction at the Pluit Siphon.

Figure-2.8 Location Map of Pluit Pump Station and Reservoir

<Condition of Pump Operation>

According to the information of the pump operators, the condition of the pump operation as follows:

Table-2.14 Condition of Pump Operation as of 14/Jan/2009

Pump House	Pump No.	Capacity (m^3/s)	Condition as of 14/Jan/2009	Condition as of 18/Nov/2008
Timur Pump House	1	3.2	Replacement of rachet just finished.	Under repairing
	2	3.2	Motor is damaged.	Motor is damaged.
	3	3.2	Pump is damaged by garbage.	Pump is damaged by garbage.
	4	3.7	Operation	Operation
Tengah Pump House	1	4.0	Operation	Operation
	2	4.0	Under repairing of trash screen.	Under repairing of trash screen.
	3	4.0	Operation	Operation
	4	4.0	Gear box is damaged.	Gear box is damaged.
Barat Pump House	1	6.0	Operation	Operation
	2	6.0	Operation	Under repairing of shaft.
	3	6.0	Under replacing of a timer. (It will be finished soon.)	Operation

* Note: The craine system for maintenance works in the Timur Pump House is under replacing. Therefore, it is difficult to implement the maintenance works.

Installed and workable pump units and capacities are summarized below:

Table-2.15 Summary of Condition of Pumps

Condition	Pump Units (nos)	Capacity (m^3/s)
Installed Pumps	11	47.3
Workable Pumps as of 18/Nov/2009	5	23.7 (50.1%)
Workable Pumps as of 14/Jan/2009	5	23.7 (50.1 %)
Condition at the end of Jan/2009	7	32.7 (69.1 5)

As shown in the above tables, the present capacity of pump is about 50 % of the installed capacity and it is almost same as the condition at the previous inspection on 18/Nov/2009.

During the inspection, the water level in the reservoir rose to + 0.05 m at the installed staff gauge (around 3 O'clock in the afternoon) as shown in the following photographs:

Photo-2.4
Staff Gauge at Inlet of Pump Station

Photo-2.5
View of Reservoir around Inlet of Pump Station

It seems that the workable pump condition is one of the causes of the water level rising in the reservoir.

The Pluit drainage area with an area of 34.2 km^2 is the low-lying land. Therefore, rain water cannot be drained into the sea gravitationally. The pump operation is the only way to drain rainwater in the area. Therefore, it is strongly recommended to accelerate the repairing/maintenance activities of the pump units in order to mitigate the flood damage during the coming heavy rain season.

<Sea-Water Leakage to Pluit Reservoir>

Other cause of the water level rising in the reservoir is the sea water intrusion from the eastern side of the reservoir. From 11/Jan/2009, the Java Sea had the spring high tide and high waves. As the result, the sea levee around the coal harbor in Muara Baru was damaged and sea water intruded to the Pluit Reservoir. During the inspection, the sea water still intruded to the reservoir and the Project Team could not pass through the Jl. Muara Baru. The condition of Jl. Muara Baru is shown in the photograph below.

Sea water intrusion like this has happened repeatedly during the spring high tide periods. Although there are some private property's problems for the sea levee, it is expected to take the drastic measures for the sea levee in order to prevent the sea water intrusion.

<Flow Obstruction at Pluit Siphon>

The Pluit Siphon is located at the inlet of the reservoir as the end of drain. At this site, the water level of the drain side was higher than that of the reservoir with height of about 20 cm measured by eye. The causes of this backwater are seemed to be the obstruction of flow by the accumulated garbage around the siphon and by the siphon itself. It is strongly recommended not only to remove the garbage around the siphon but also to remove or replace the siphon considering the original function of the installed siphon.

Photo-2.6 View of Jl. Muara Baru from the southern direction

Photo-2.7 Condition of Pluit Siphon(Inlet of Pluit Reservoir)

(2-2) Piping at Pluit Pump Station on 18/Feb/2009 and 22/Feb/2009

On 17/Feb/2009, staff members of the Project received the information from DPU-DKI for piping (leakage of sea water) around the Pluit Pump Station. The Pluit Pump station is a trunk facility of the drainage in the center of Jakarta. Therefore, urgent inspection of the Pluit pump Station was carried out in the morning of 18/Feb/2009.

<Present Condition of Piping at Pluit Pump Station>

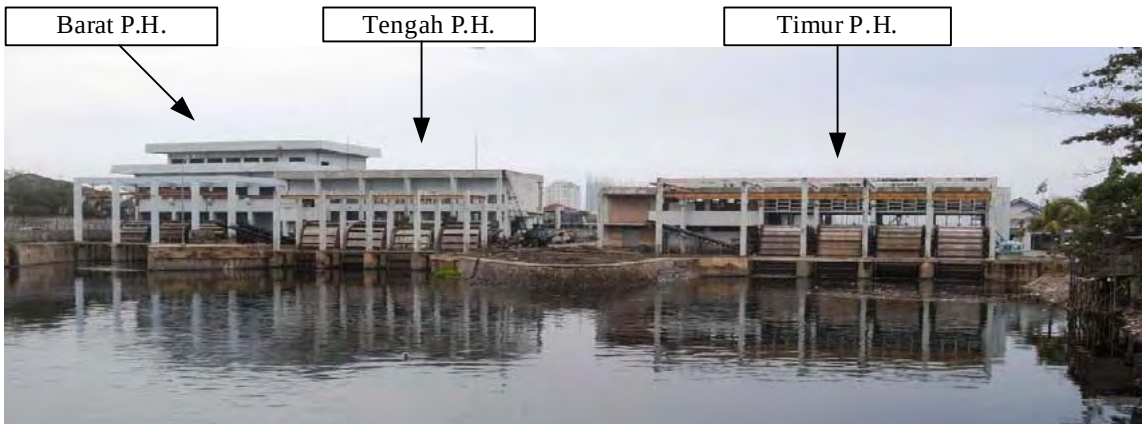


Photo-2.8 Pluit Pump Station

The Pluit Pump Station consists of 3 pump houses, that is, Timur (East), Tengah (Center) and Barat (West). Piping occurs at the East pump house as shown in Figure below:

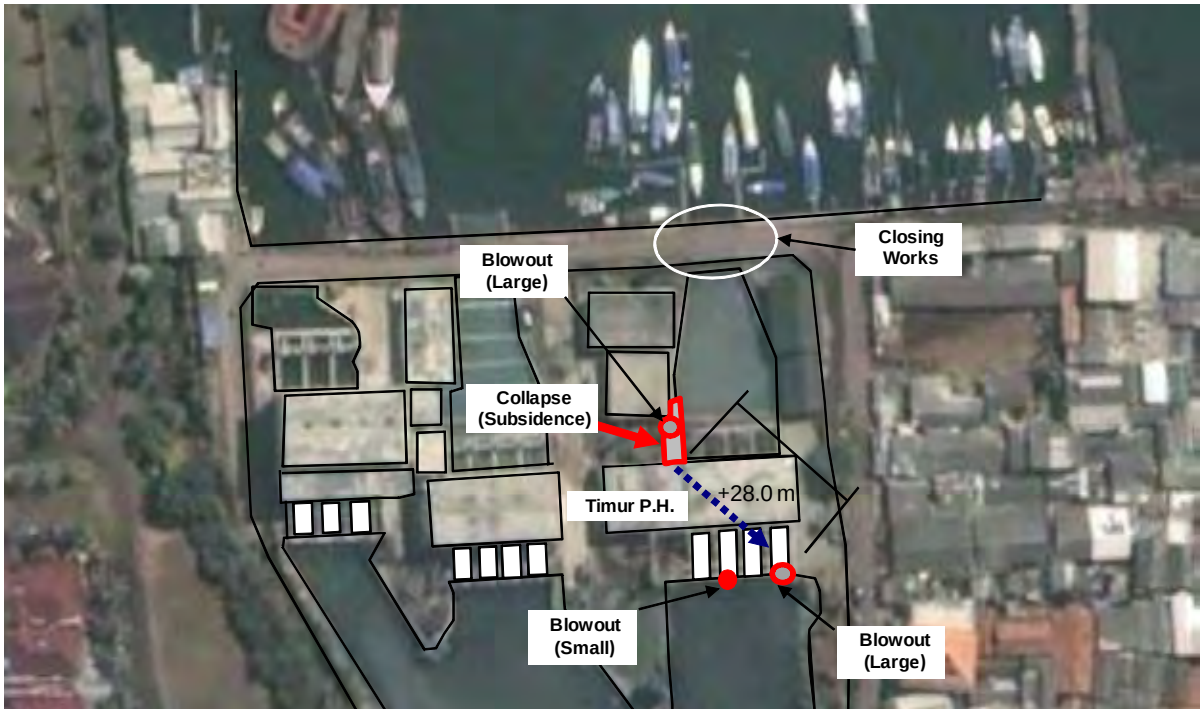


Figure-2.9 Location of Piping at East Pump House (on 18/Feb/2009)

Piping (leakage of water) occurs at the following three sites at the East pump house:

- No.1: Left side of outlet. (large quantity of water leakage)
- No.2: Just upstream point of the inlet of Pump 1. (large quantity of water leakage)
- No.3: Just upstream point of the inlet of Pump 3. (little water leakage)

Leakage route is from the outlet channel to No.1 and from No1 to No.2 and No.3. Condition of the leakage is as show in the following photographs.

Photo-2.9 Situation of Piping Collapse at East Pump Station

Photo-2.10 Inlet of Leakage flow under East Pump Station

Photo-2.11 Blowout of Leakage Water in front of Pump No.1

According to the rough survey by use of the measurement tape, the longitudinal condition of leakage of water (piping) is as shown in the following figure.

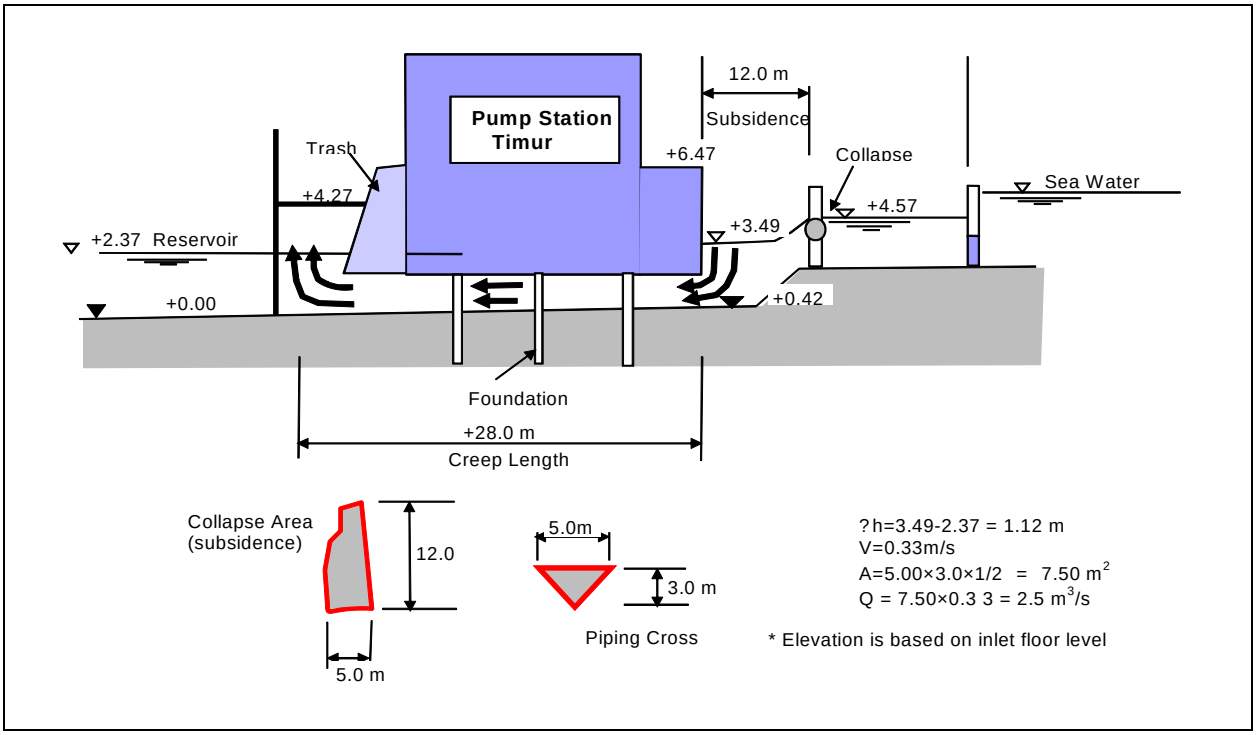


Figure-2.10 Image of Piping at East Pump House

The leakage of water flows from the end of floor slab at the outlet to the end of inlet of the pump unit. Leakage volume is measured roughly at the inlet of leakage at No.1 site and estimated at about 2.5m^3/s in maximum. This is a quite huge volume. The creep length of the piping from No.1 to No.3 is estimated about 28 m.

According to the operators in the Pluit Pump Station, the progress of sea water leakage is as follows:

- About 10 days ago during the spring tide, it was found the small leakage water at above three (3) sites.

- The sand bags and gabion mattresses were used at No. 1 site to stop the leakage of water. In addition, a closing works was begun at the end of the outlet channel in order to lower the water level at the outlet channel.
- However, the water leakage progressed bigger and bigger.
- Blowout of water at the No.3 was become smaller in these two (2) days.

<Inspection on 22-2-2009>

Urgent countermeasures taken by DKI

Inspection of Collapse due to piping was followed up on 22-2-2009. Urgent Countermeasures by DKI has already carried out as follows,

- Outlet at sea side from discharge sump has closed by sand backs to lower water level of sump.
- Water level of Discharge Sump has lowered near the bottom of it.

Condition of the discharge sump

- However some leakage from sea was still identified.
- Many cracks on the wall of sump were identified not only left side but right side.
- Almost same discharge with leakage from outlet is leaked to piping collapse point of behind left wall.

Leakage point is assumed to be from bottom to middle height of discharge sump wall. Due to the lower of water level of Discharge Sump, about 4 tf/m^2 Uplift is loaded under the bottom of Discharge Sump due to water level difference between sea water level and that of discharge Sump. This Situation might have possibility to float up the Sump and induce collapse of the bottom of it. When this accident is occurred, sea water flows into the pluit reservoir and suffer huge damage. As soon as possible, fill water in the Sump more than 2 m -4m to prevent collapse of Discharge Sump.

Cause of piping and collapse

- From the cracks of wall and bottom of Discharge Sump, leakage has been occurred for long time ago. Water pressure induced piping is same with the difference between sea water level and Pluit reservoir water level.
- In this case, creep length is shorter than that from the sea. Lengths of creep are about 25m from Dicharge Sump and about 50m from the sea. Short creep length from the discharge sump and cracks of it has induced piping collapse. Piping has been progressed between discharge sump and Pluit reservoir just at the front of pump station.
- So, there are possibility to exist many small piping hole and route under the pump station.
- By interview with the pump station staff, there are no sheet pipes under the pump station to prevent piping. And, no foundation pile under the discharge sump.

Photo-2.12 Location closing works of outlet of discharge sump

Photo-2.13 Situation of Discharge Sump East (22-2-2009) from sea side

Photo-2.14 Left side of wall

Photo-2.15 Cracks on left side wall

Photo-2.16 Situation of Piping Collapse

Photo-2.17 Hole under pump station

Urgent Countermeasure

It is difficult to put sheet pipe between discharge sump and pump station because steel pipe form pump station are existed between of them. As urgent countermeasures, below methods are proposed.

- Stop the sea water flow into discharge Sump and empty it. To prevent sea water flow, sheet pile shall be constructed at the front of outlet mouth.
- Check and repair cracks in the Discharge Sump. To repair cracks, cement milk shall be injected and filled up cracks
- Put the seepage control sheet around inside it.
- Put the cut-off sheet pile at the front of sea tide wall to long creep length with high tide dike. When this method is taken, sinking of Discharge Sump shall be carefully measured.
- Otherwise, put the slab on the bottom of Discharge Sump with foundation pile to prevent subsidence.
- Closing works of piping hole shall be carried out. As method of closing the hole, cement milk intrusion is also recommended.

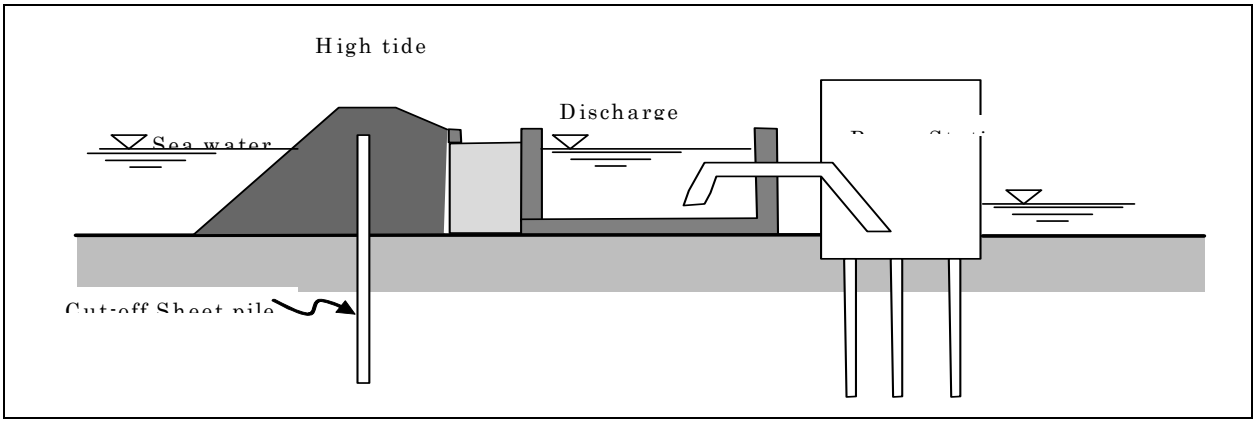


Figure-2.11 Location of Cut-off wall

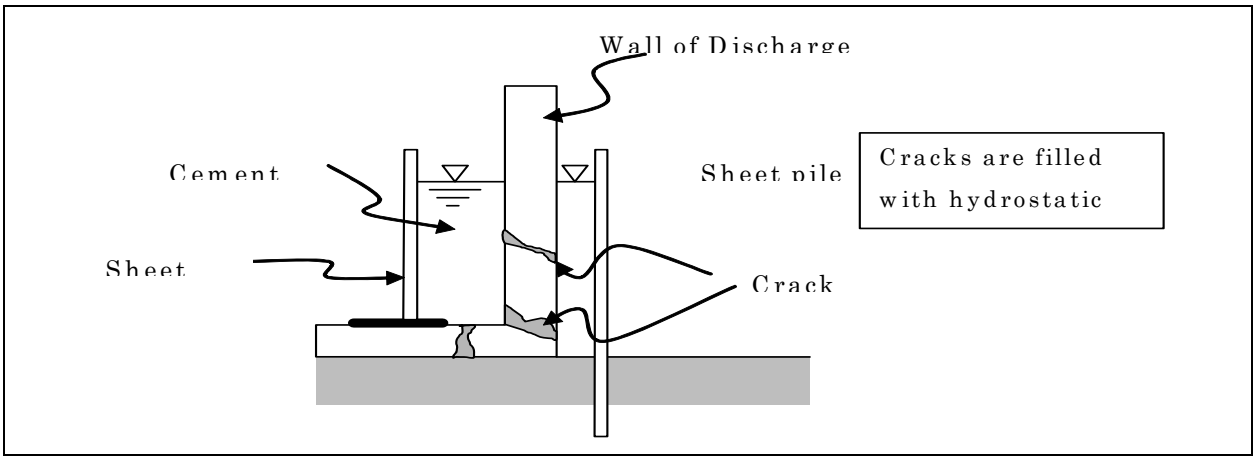


Figure-2.12 Method to repair cracks and piping hole

3) Study on Maintenance Problems of Rivers and Structures and Preparation of Maintenance Manual

Concerning the Maintenance of rivers and river structures are drawing up in the Manual for Rivers and River Structures. Please refer to the Manual for detail description.

<Objectives>

In the Ciliwung river basin, a multitude of river infrastructures such as revetments, gate facilities and pump stations, etc, are accumulated along the river. Most of these infrastructures were degraded the function due to a long time being passed from the construction. And such river structures, which are breakdown by the flood and left as it were, can be seen. In those structures, there seems to be over it durable time and reconstructions are required. And aging structures will be expected to increase from now to the future.

However, it takes long time and huge budget to reconstruct aging structures. Therefore, it will be crucial to maintain existed river structures and keep its functions for a long time as far as possible to mitigate flood damage by taking responsible actions for the damage river structures. To carry out such actions, it is also essential to prepare the guideline or manual which are described standard maintenance works.

From the background of above mentioned situations, this maintenance manual is formulated to propose the procedures of river structure maintenance work. In detail, this manual is made up in order:

- To grasp the existing river structures
- To grasp the condition of the structures
- To propose the standard maintenance works

<Procedures of Maintenance Work>

Patrol and inspection of the river structures is an initiatory activity of the maintenance work. Through the patrol and inspection, if any irregularities or defects of the river structures are found, those have to be rectified before becoming worse, and restore the functions or safety of the river structures.

Through the patrol and inspection, places or locations to be maintained or repaired shall be identified without delay. When large scale maintenance and/or repair works are required, an action program should be arranged in order to avoid seriously negative effect on the functions of the structures during and after the works. In a rainy season, an intensified patrol and inspection shall be programmed. If any irregularities or defects are found in the river channels and at the river facilities, repair work shall be immediately undertaken to prevent expansion or progression of the irregularities or defects.

Basically, maintenance works and activities start with monitoring which is conducted with visual check on the condition/status of river infrastructures considering the following objectives.

- To clarify any sign of damaged/irregularities and illegal/harmful acts which hamper the natural or designed functions.

- To take proper actions in order to retrieve and compensate its functions and to avoid damage on people's lives and properties.

Procedures of the patrol and inspection of the river structures is shown as follows:

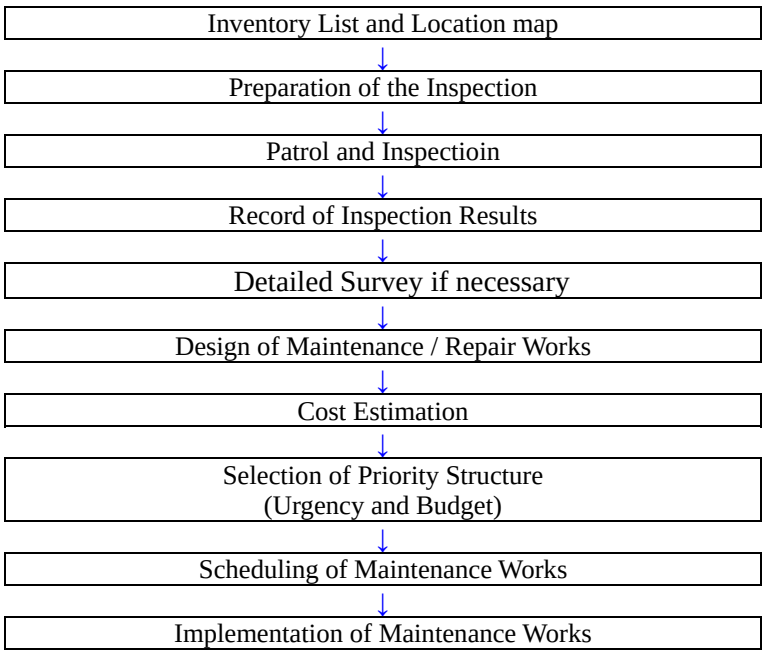


Figure-2.13 Procedures of Maintenance work

<Frequency of Inspection>

Classification of Inspection

Inspections are categorized into three types, one is daily inspection which shall be conducted during dry season and next is the inspection during rainy season, and other is conducted after natural disaster such as flood, tsunami, and earthquake. Inspection is classified as daily inspection, periodic inspection, and inspection before flooding.

To keep good maintenance of the river structures, daily walk-through inspections shall be conducted according to the plan. And walk-through inspection at flood events shall be conducted to grasp the condition of river flow, river structures, seepage from dikes, etc.

Periodical inspections shall be conducted to comprehend conditions and status of the river structures, specially aiming at concrete portion, mechanical equipments, paintings and electric equipments of such structures as weir, flood gate and sluice way, etc. In general, periodical inspections are separated into monthly inspection and annual inspection.

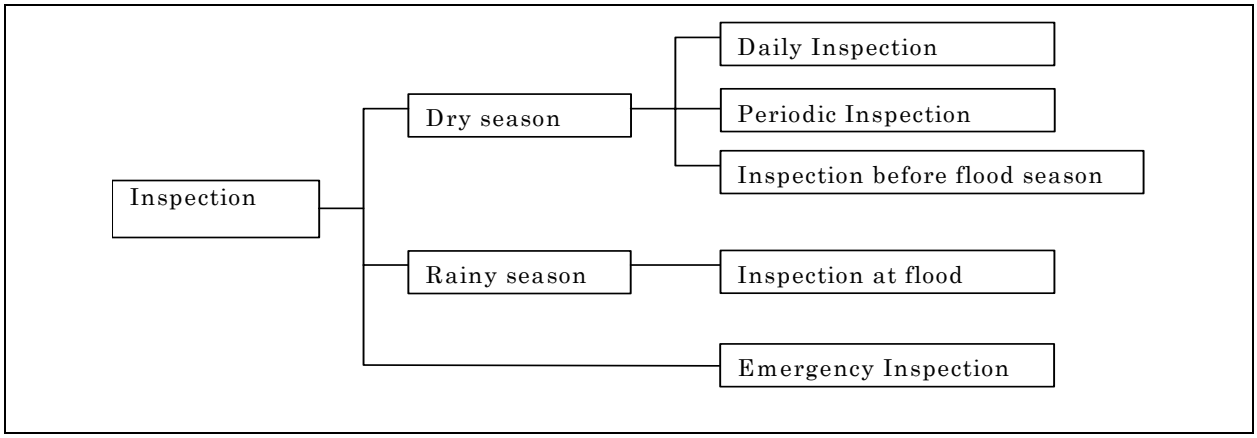


Figure-2.14 Classification of Inspection

Frequency of Inspection

Three types of inspections shall be conducted as described below.

- Inspection during dry season

  Inspection shall be conducted two times during dry season, namely at the beginning and the end of dry season. Walk-through inspection at the beginning of dray season is to conduct to grasp prepare inventory list. And the inspection at the end of dry season is to conduct after cutting glasses around river infrastructures to grasp conditions and status of the structures. Periodic inspection is carried out detailed investigation to the river structures once a month and once a year as overall.

- Inspection during Rainy Season

  During the rainy season and flooding is likely to occur, inspection shall be conducted before, during and after flood event.

- Emergency inspection after natural Disaster

  In addition to the above, special inspection shall be conducted after occurrence of natural disasters such as earthquake, tsunami, volcanic eruption and so on.

Table-2.16 Frequency of Walk-through Inspection

Classification	Frequency	Remarks
Daily inspection	1 times / year	・Beginning of dry season (June)
Periodic Inspection	1 time/month 1 time/year (overall)	・Overall Maintenance is conducted once a year.
Inspection before rainy season	1 time / year	・End of dry season (October)
Inspection at flood	During flood	
Emergency Inspection	After natural disaster	・Flood, Earthquake, Tsunami, etc

Maintenance Work

As a whole of the maintenance works of the related river structures, the same works are classified into the following two kinds in terms of the nature of works.

Table-2.17 Classification of Maintenance Activity

Classification	Explanation
Preventative maintenance	This work comprises all activities to be carried out to maintain optimal function of the river facilities, by evading any damage or interference to the facilities.
Corrective maintenance (Repair works)	This work is called for on the occasions of damage or interference to the facilities. This work comprises emergency maintenance work, rehabilitation work, repair work, upgrading work, etc.

The Preventative maintenance work is further divided into the following two categories in terms of frequency of the maintenance work

Table-2.18 Classification of Preventive Maintenance Works

Classification	Explanation
Routine maintenance	This work includes all repetitive works which are performed on a cyclical basis with the planned frequency, for example cleaning of the structures, removal of vegetation from the levees, etc.
Periodical maintenance	This work includes periodical works which are required from time to time for preserving the intended use of the facilities. This work also includes some small scale repair works necessary for the restoration of the facilities in case of occurrence of minor damage and failure.

4) Additional Survey of River and Drainage

As the additional surveys in 4th and 5th activities, below survey were conducted. Main purposes of the surveys are to confirm the elevation of the structures for the Inundation calculation and flow measurements. Refer to the location map shown in Figure-2.15.

Table-2.19 List of Additional Surveys

	Description	Purpose
1.	Pengukuran Leveling & Cross Section di Pantai Utara Waduk Pluit (Levelling and Cross Section Survey in Pluit Coastal Dike)	Urgent survey due to the tidal dike break
2.	Pengukuran Ketinggian Pintu Air Pasar Ikan Jakarta Utara (Elevation Survey of Staff Gauge of Pasar Ikan Gate in Jakarta Northern)	Confirmation of gauge level placed on Pasar Ikan Gate
3.	Siphon Survey and Staff Gauge Height of WL Station	Confirmation of gauge level placed on Pluit River
4.	Kinematic GPS Survey by Car	Supplemental survey of elevation
5.	Cross Section Survey (Manggarai and Karet)	Dimension of weir and cofirm the elevation
6.	Pengukuran Teluk Gong Siphon (WBC) (Measurement of Teluk Gong Siphon (WBC)	Confirmation of the Teluk Gong siphon structure
7.	Pengukuran Grogol Speilway (Measurement of Grogol Speilway)	Confirmation of the Grogol spillway structure
8.	Levelling and Cross Section Survey	
9.	Additonal Survey (Railway Bridge CIL-008, Spot Elevation arround MT. Haryono Bridge and Kalibata Bridge	Elevation survey to check the past flood
10.	Additonal Survey (Cross Section Surveys, Depok and Katulampa Weir)	Flow Measurement
11.	Cross section Survey Depok	Flow Measurement
12.	Cross section survey Waduk Pluit, Kebon Melati, Setiabudi Barat, Setiabudi Timur	Confirmation of reservoir elevation and volume

5) Data Collection and Analysis on Flood

Background and Objective

It is essential matter for the flood management to grasp flood discharge at the stations. At present, it is difficult to grasp the discharge along the WBC and Ciliwung Rivers, except the low water flow, because of scare discharge observations during floods. Therefore, the discharge observation was attempted to implement along the Ciliwung River during this rainy season.

Reference

The following book is applied as the reference of the discharge observation: "Ilustrasi Pengamatan Hidrologis" published by JICA Indonesia Office

Site Selection

At present, there are three (3) water level stations with the Alarm WLs along the WBC and Ciliwung Rivers, those stations are Manggarai, Depok and Katulampa Stations as shown in Figure below:

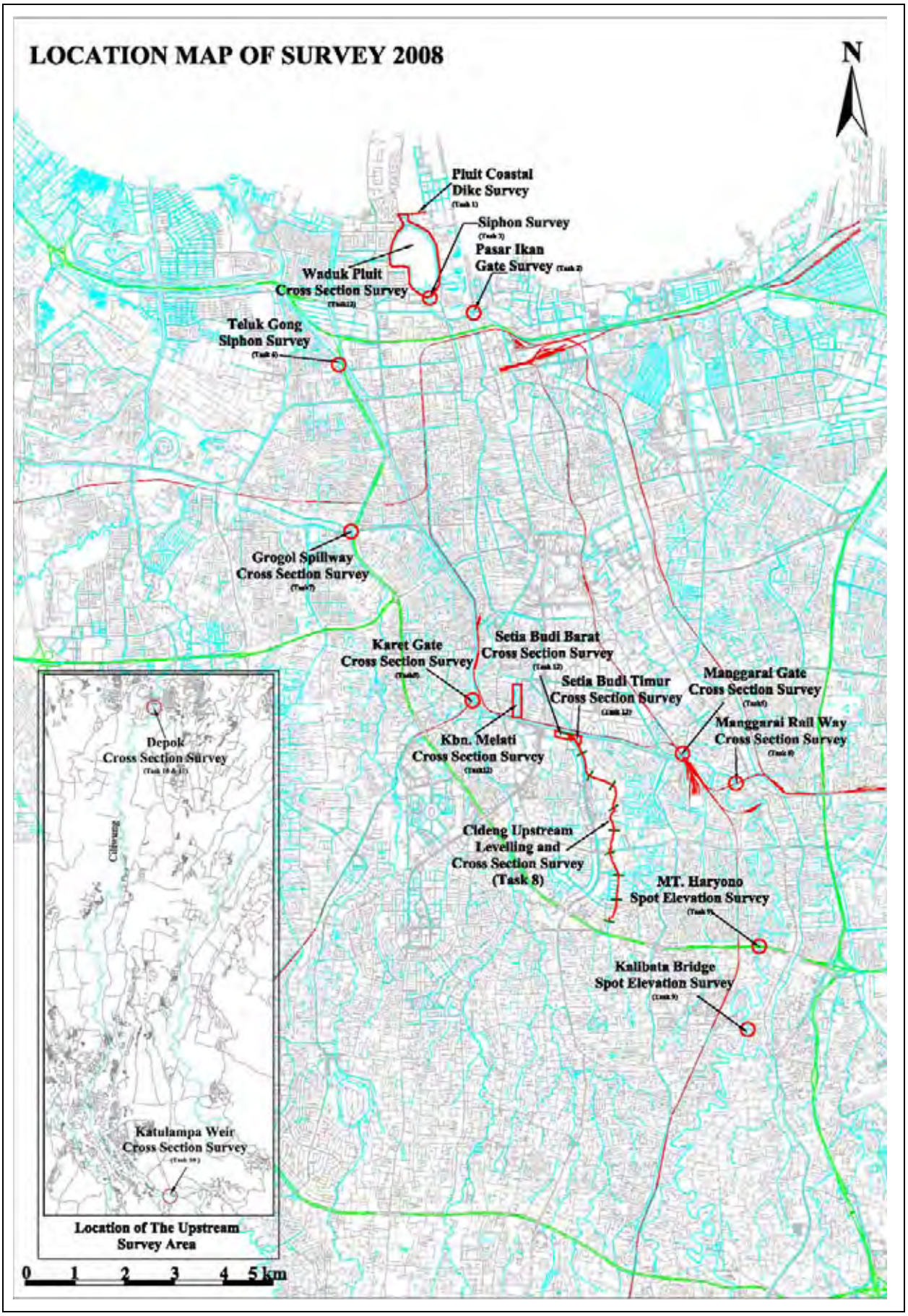


Figure-2.15 Location Map of Additional Survey

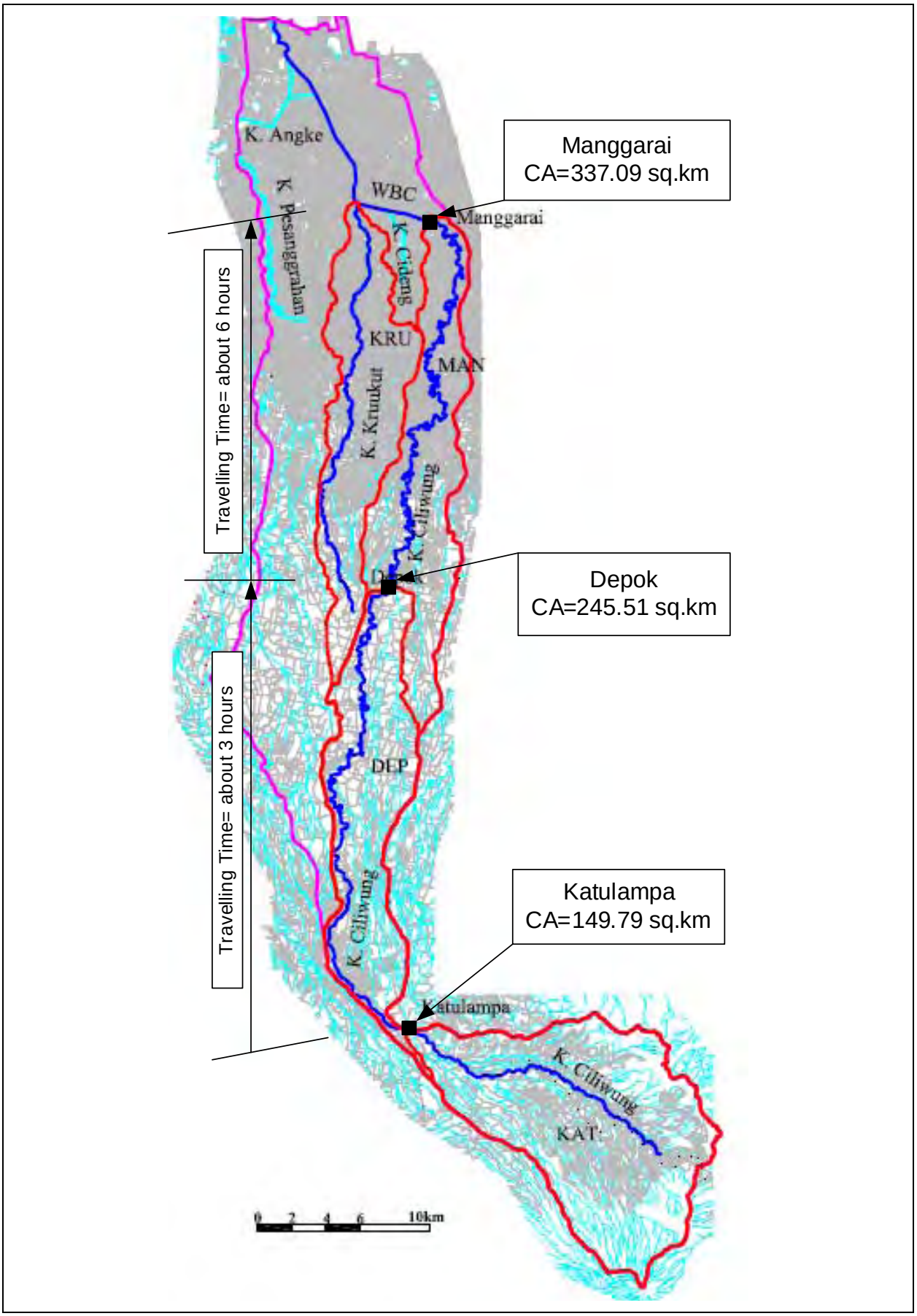


Figure-2.16 Location Map of Water Level Station

After the inspection of above three (3) sites, the Depok WL Station is selected to the discharge observation site, considering the condition of the existing discharge rating curves at the sites and the applicable measures at the sites as shown in Table below:

Table-2.20 Selection of Site for Discharge Observation

Station	Condition of H-Q	Possibility of Method		Selection
		Current Meter	Float	
Manggarai	No measurement H-Q based on flow calculation	Difiicult (due to garbage)	Difiicult (due to garbage, no straight stretch)	-
Depok	H-Q based on low flow measurement, H-Q based on flow calculation.	Difficult (by boat)	Possible by use of upstream bradge	Selected
Katulampa	H-Q base on flow calculation (weir formula)	Difficult (by boat)	Difficult (no dropping point)	-

Work Flow of Discharge Observation by Float

The discharge observation at the Depok WL station was implemented as the following flow:

- Cross-section survey (2 cross sections)
- Setting of measurement lines at site
- Preparation of floats (making of floats)
- Discharge measurement by floats during floods
- Setting of Measurement Section and Observation Line at Site

The measurement section and observation line were set as shown in Figures below:

Figure-2.17 Plan of Measurement Section

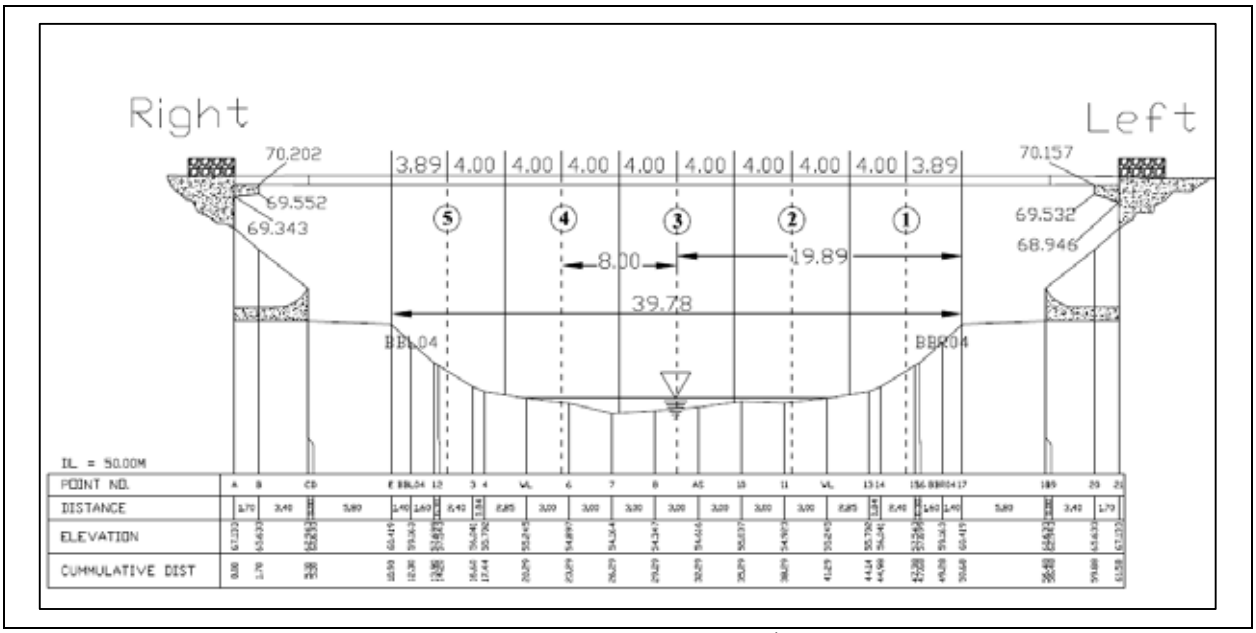


Figure-2.18 Measurement Lines of 1st Check Section

Preparation of Floats (Float Making)

Observation floats were made by the Project. Materials, tools and design of the floats are as follows:

<Material>

- PVC/Paper Pipe (L=0.7-2.4m, D=30 - 40mm)
- Sand
- Cushioning materials
- Adhesive tape (Wide)
- Plastic bag (small)
- Plastic sheet (for flag)
- Stick(15-20cm: for flag)
- Chemical light

Photo-2.18 Observation Float

<Tools>

- Spring balance
- Saw
- Scissors
- Cutter

Photo-2.19 Tools for Making Float

<Design of Float>

Type of Float

Type	Depth (m)	Draft (m)	Coeff.
Type-I	< 0.7 m	0.0	0.85
Type-II	0.7 - 1.3 m	0.5	0.88
Type-III	1.3 - 2.6 m	1.0	0.91
Type-IV	2.6 - 5.2	2.0	0.94
Type-V	> 5.2 m	4.0	0.96

Float Application at 1st Check Section

Line No.	Z (PPm)	WL at Panus Br. (SGm)	
		Type II	Type III
1	57.6	4.4	5.7
2	55.0	1.8	3.1
3	54.5	1.3	2.6
4	54.9	1.7	3.0
5	57.4	4.2	5.5

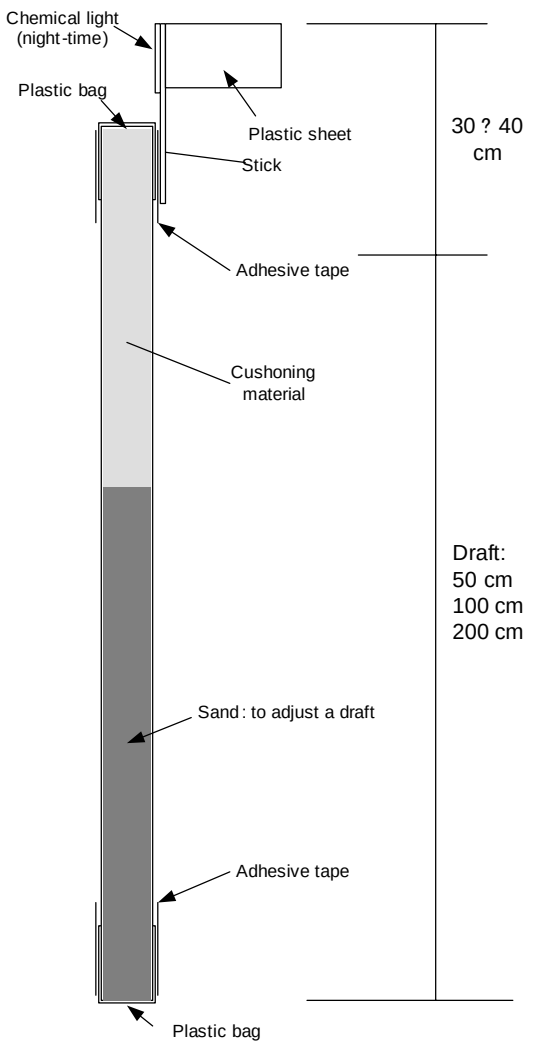


Figure-2.19 Design of Float

Discharge Observation by Floats during Flood

<Goods/Equipment>

- Floats (50cm, 100 cm, 200cm)
- Chemical-lights
- Field Note
- Stop-watch
- Measuring tape with plumb
- Flashlight
- Rainwear/boots
- Life-Jacket
- Camera

Photo-2.20 Goods/Equipment

<Step of Discharge Observation>

① Checking WL and time: 1st section by tape with plumb, 2nd section by staff gauge
② Selecting/Dropping float at measurement line 1
③ Timer start at 1st section
④ Timer stop at 2nd section and record
⑤ Continue②, ③ and ④ up to finish
⑥ Checking WL and time
⑦ Calculation of discharge

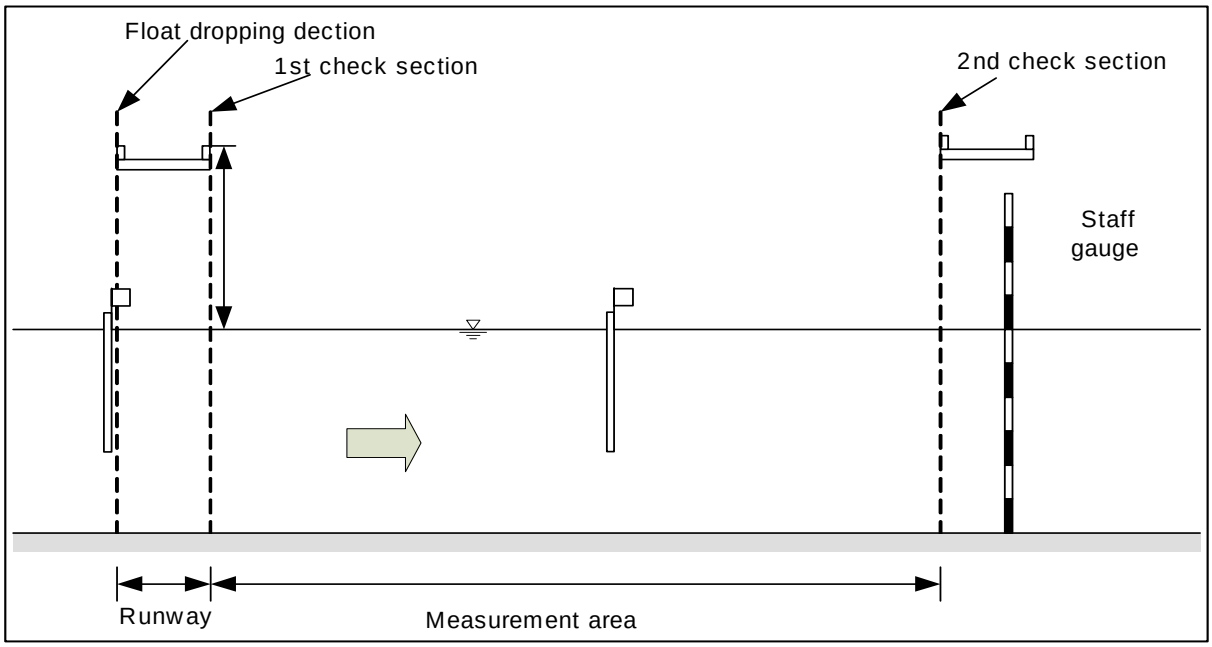


Figure-2.20 Longitudinal Profile of Discharge Observation

<Field Note of Discharge Observation>

Field Note (Discharge Observation at Panus Bridge)

Date: _____
Climate: _____
Wind: _____

Obs No.: _____

Water Level

Location	Start			End		
	Time	WL (SG)	WL (PP)	Time	WL (SG)	WL (PP)
Upstream Bridge						
Panus Bridge						

Note,
WL (PPm) at U/S Bridge = 70.78- WL(SG) -0.16
WL (PPm) at Panus Bridge = WL(SG) + 54.48

Float Observation

Line No.	Type of Float	Start Time	Travel Time (sec)	Condition
1				
2				
3				
4				
5				

Note, Distance between Panus Br and U/S bridge = 54.0 m

Selection of Floats

Line	Z (PPm)	WL at Panus Br. (SGm)	
		Type II (0.5m)	Type III (1.0m)
1	57.6	4.4	5.7
2	55.0	1.8	3.1
3	54.5	1.3	2.6
4	54.9	1.7	3.0
5	57.4	4.2	5.5

Float Type

Float Type	Type I	Type II	Type III	Type IV	Type V
Depth (m)	< 0.7 m	0.7 - 1.3 m	1.3 - 2.6 m	2.6 - 5.2	> 5.2 m
Draft (m)	0.0	0.5	1.0	2.0	4.0
Coeff.	0.85	0.88	0.91	0.94	0.96

Figure-2.21 Applied Field for Discharge Observation

Actual Observation

Photo-2.21 View of Panus Bridge

Photo-2.22 Staff Gauge at Panus Bridge

Photo-2.23 WL Measurement at Upstream Bridge

Photo-2.24 Observation of Flowing Time

Result of Discharge Observation

Date	Obs. No.	WL Discharge		(cu.m/s)
		Panus (SG m)	U/S Br. (PPm)	
10-Feb-09	Trial	1.50	56.11	47.3
12-Feb-09	1	1.32	55.90	35.3
12-Feb-09	2	1.30	55.91	37.8

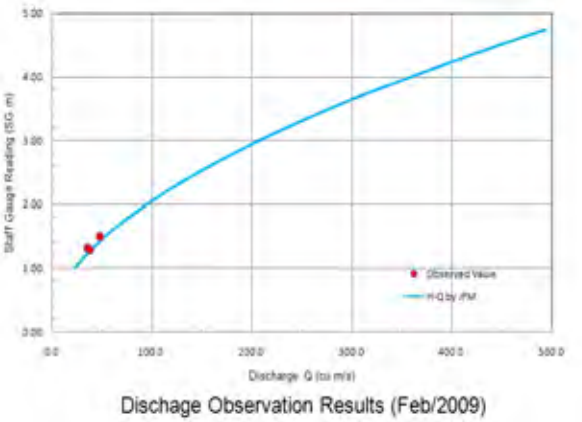


Figure-2.22 Observation Results

6) Improvement of Operation and Maintenance Manual for River and Drainage Facilities

<Outline of the Lowland Basin>

As the Basic Policy of the flood control of Ciliwung River, it has been considered that mountain (upstream) flood is intercepted at Manggarai Gate Complex not to enter the lowland area, and directed to Flood Way (West Banjir Canal) to flow into Java Sea by gravity. And flood control plan was formulated and implemented for both the mountain flood and the lowland flood separately in the past. In common, this method is called as "Mountain flow Separation System".

Mountain flood flow is blocked out by Manggarai II Gate and directed to West Banjir Canal (WBC) through Manggarai I Gate, finally flowing into Java Sea by gravity. On the other hand, flood in the lowland area which starts from Manggarai II Gate is drained into Java Sea by pumping or gravity. Lowland of the Ciliwung River is the area that is delineated by Manggarai Gate Complex as river head, West Banjir Canal and Muara River at South-West, Kramat Raya Street and East Railway at east, and Java Sea at North.

Of that, river basins which are flamed in by 4 gate stations and a pump station is our target area, named Manggarai II Gate, Jembatan Merah I Gate as flow control gate and Pasar Ikan Gate, Duri Gate as tidal gate, and Pluit Pump Station. The area is about 42.117 km^2 and the highest land elevation is +1.00mPP and the lowest is +9.00 mPP. River catchment in the low land area is shown in Figure 44. In the lowland area, there are three main rivers and drainage, one is Ciliwung River and others are Cideng River and Duri Drain, whose characters is briefly describes as follows,

Ciliwung River

Water course of the Ciliwung river in the low land is start from Manggarai II Gate as river head and runs to Jembatan Merah Gate Complex and then flows into Java Sea through Marina Tidal Gate. On the way to Jembatan Merah Gate Complex, there exist two (2) diversion channels, one is Ciliwung Channel which is diverted from left side at Istiqlal Mosque Complex, going through Tangki Gate, and flows to Java Sea at Pasar Ikan Gate. Other one is the Ciliwung tributary which is diverted at Jembatan Merah Gate to the Pluit Reservoir. When sea water level is higher than water level of the river, Merah II Gate is opened to convey river water to the Pluit Reservoir through Pasar Ikan Tidal Gate. On the way, Ciliwung Channel is confluent to this tributary. Area of the Ciliwung River Basin in the lowland is about 14.08km^2, which occupies about 33.4 % of the lowland. Length of the river course is 16.55 km, and the highest elevation is +9.00 PPm and the lowest is +1.50 PPm. Average river slope is 1/2100.

Cideng River

River course of the Cideng river is started from water resource gate placed at the right side of the Manggarai I Gate, and runs along Surabaya Street, on the way going through Sogo Gate and Siantar Gate, finally flows into Java Sea at Pasar Ikan Tidal Gate. At downstream, Cideng River is diverted to left channel which flows into Pluit Reservoir together with left tributary named Duri Drainage. When Pasar Ikan Tidal Gate is closed, main Cideng River water flows into the Pluit Reservoir together with river water of the left diversion channel. Area of the Ciliwung River Basin is about 20.574km^2, which occupies about 48.8 % of the low land. Length of the river course is 23.9 km, and the highest elevation is +9.00 mPP and the lowest is +1.00 mPP. Average river slope is 1/1600.

Duri River

Duri Channel starts from the overflow gate of Cideng Pump Station as river head and then confluent to Duri River from left side, finally flows into Java Sea through Duri Gate. However, Duri Gate is always closed due to high tide. Therefore, at the upstream of Duri Tidal Gate, river water is directed to Duri drainage and flows into the left diversion channel of Cideng River.

Table-2.21 List of River in Lowland

Name of river	Drainage area (km^2)	Length (km)	River slope	Remarks
Ciliwung River	14.08	16.55	1/2100	Highest +9.00
Cideng River	20.57	12.67	1/1600	Lowest +1.00
Residual area	7.47	-	-	
Total	42.117	-	-	

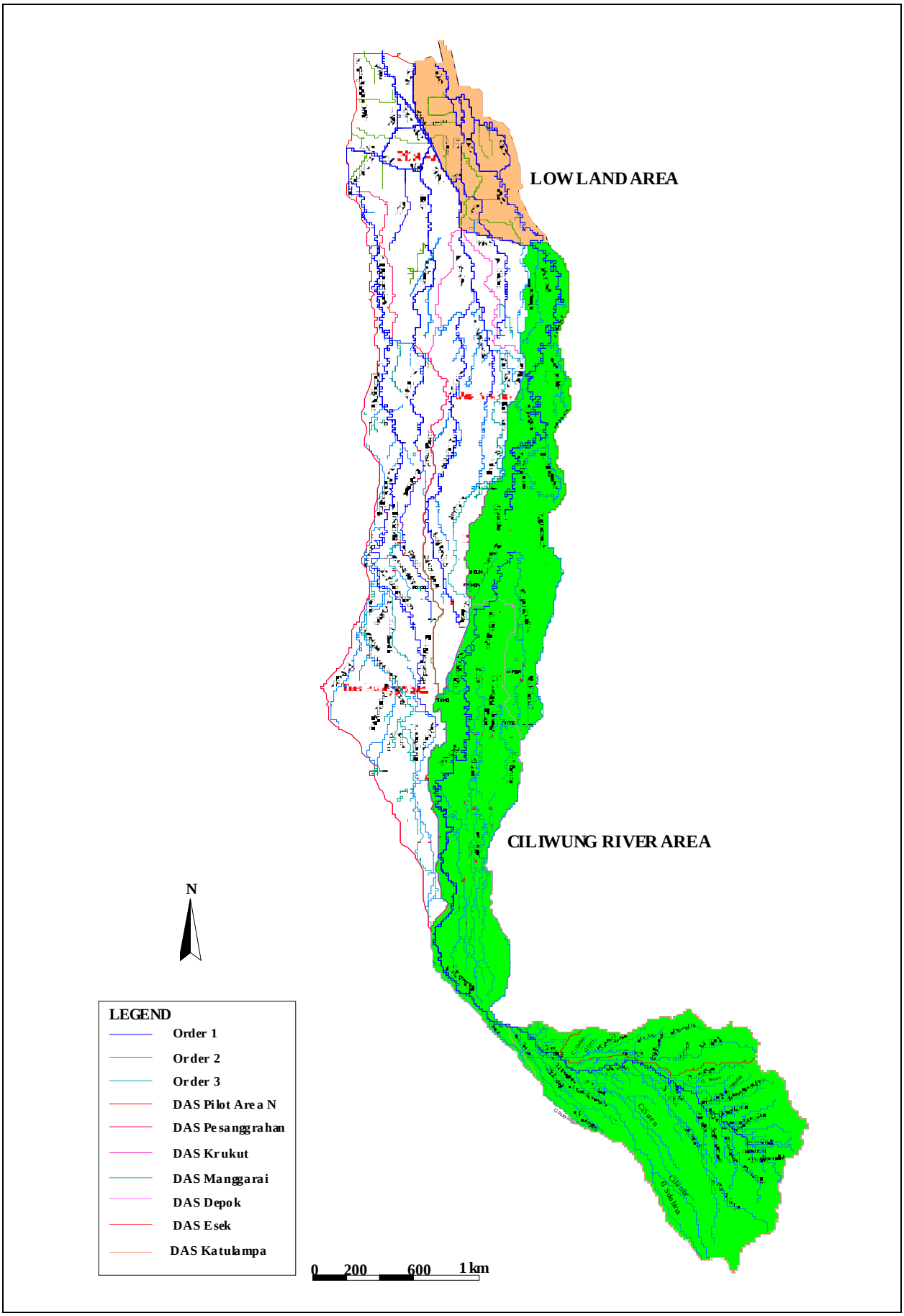


Figure-2.23 Area of the Lowland Ciliwung River Basin

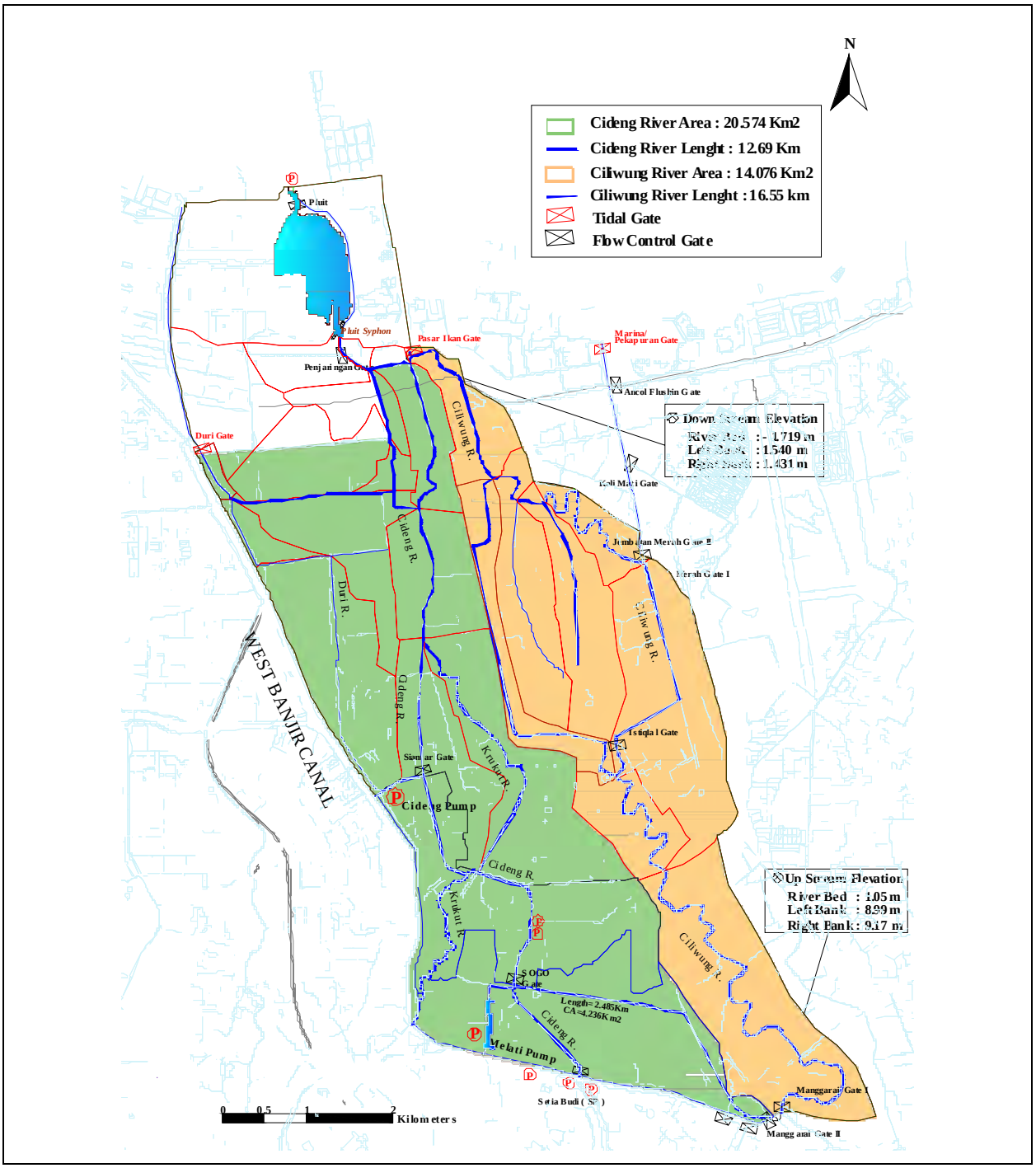


Figure-2.24 Areas of the Ciliwung River and Cideng River

<Pump Operation>

Flood Control in the Lowland Area

Flood control measures in the lowland area is carried out by three (3) Pumping Station and two (2) Flood Control Reservoirs, due to the most of this area is under high tide seawater level.

Total drainage area inside WBC is approximately 42.14 km^2 and drainage system is divided into three areas, corresponding to the pumping stations. Namely, Pluit Pumping Station drainage area is the largest, with 34.20 km^2, and next is Melati Pumping Station Drainage area with 4.24 km^2, last is Cideng Pumping Station Drainage Area with 3.70 km^2. In those pumping stations, Pluit and Melati pumping station have flood control reservoirs, while Cideng Pumping Station has no any flood control reservoir. Refer to Figure2-25.

Dimension of Pumping facilities and flood control reservoirs is shown in Table-2.22, and Areas and locations of each facility is indicated on the map Figure-2.25.

Table-2.22 Dimension of the Pumping Facility

		Pluit	Cideng	Melati
Drainage Area	(Km^2)	34.20	3.70	4.24
Pump Capacity	(m^3/s)	47.30	40.20	12.88
Number of Pump Unit	no	11	6	9
Area of Reservoir	(ha)	85.0	non	3.5
Reservoir Volume	(m^3)	1,665,000	non	98,000

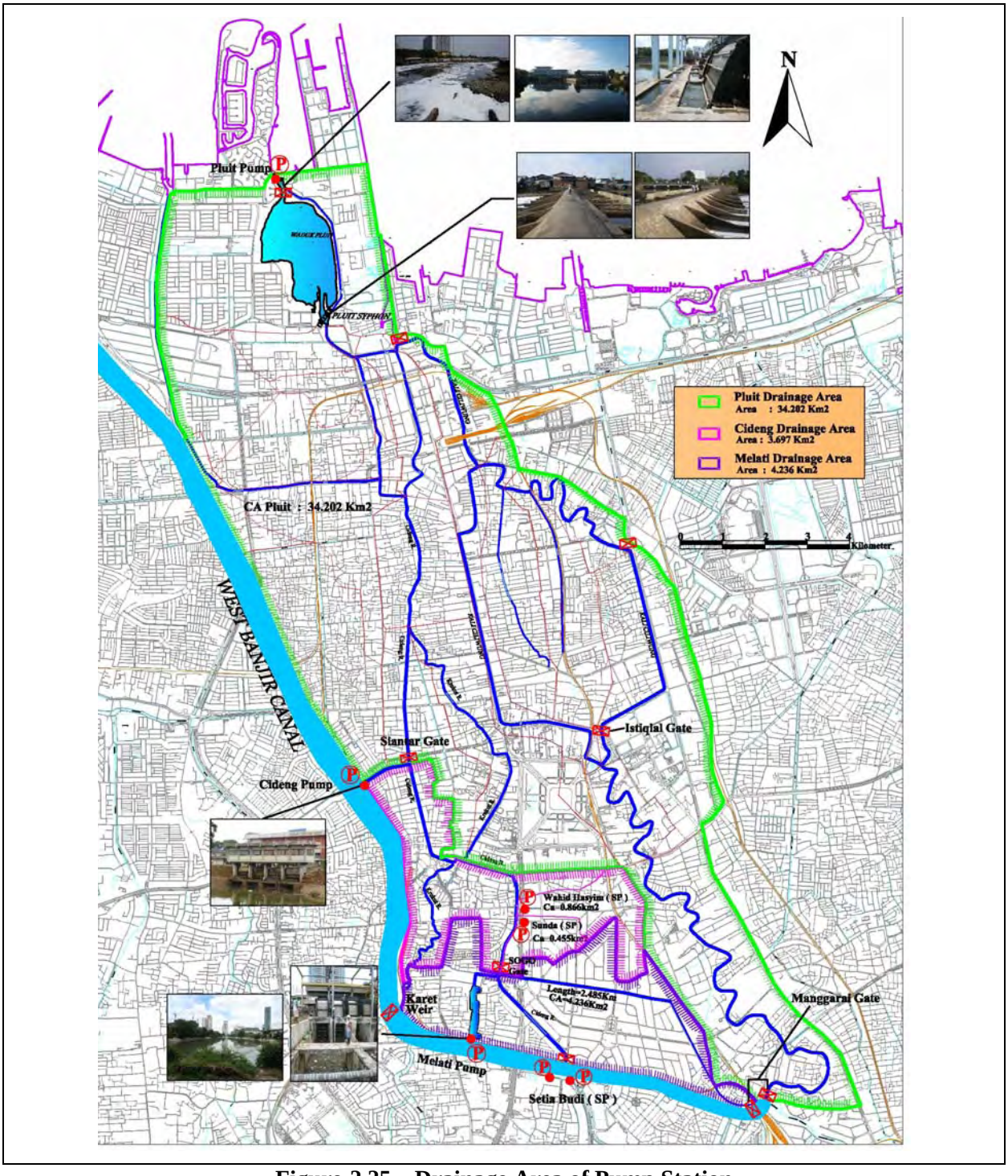


Figure-2.25 Drainage Area of Pump Station

Flood Drainage Capacity

Capacity of flood drainage was verified corresponding to the flood of Feb, 2008.

Pluit Pumping Station

Drainage of the Pluit pumping station area is conducted by Pluit Pump station with Pluit reservoir. As the result of the simulation, peak discharge flow into the Pluit Reservoir is Q= 314.27 m^3/s. To drain all discharge of Feb, 2008 flood safely with present Pluit Reservoir volume of 1,614,000 m^3, pumping capacity is needed to be about 141.9 m^3/s. This means other 93.5 m^3/s pumping capacity shall be increased. When pumping capacity is same, reservoir volume is needed to be increased from 1,614,000 m^3 to 6,203,000 m^3, this measure is considered to be difficult in view of the land acquisition for reservoir augmentation. However some volume can be increased by excavation of the bottom of the reservoir.

Table-2.23 Drainage Capacity of Pluit Pumping Station at Flood of Feb, 2008

Pump station	Peak Discharge Q1 (m^3/s)	Pump Capacity Q0 (m^3/s)	Needed Reservoir Volume V(m^3)
Present Situation	314.27	48.80	6,203,000
After augmentation of pumping capacity	314.27	141.9	1,614,000

Cideng Pumping Station

Peak flood discharge at the point of Cideng Pumping Station was approximately 29.0 m^3/s, while pumping capacity of Cideng Pumping Station is 40.20 m^3/s. As the result, it can be said that Cideng Pumping Station has enough capacity to drain peak discharge at flood of Feb, 2008. On the other hand, in Cideng Pumping drainage area, two local pumping stations are existed, namely Wahid Hasyim P.S and Sunda P.S. Those are located in most busy area in Jakarta. At the flood of Feb, 2008, peak discharges of those areas were estimated to be 10.3m^3/s and 8.3 m^3/s respectively according to the simulation. While, capacities of local pumping station are only 1.0m^3/s and 0.25m^3/s, those are too small to drain those peak discharges. P.S, 9.3m^3/s at Wahid Hasyim and P.S, 8.05m^3/s at Sunda of pump capacity are to small respectively. As the result, these situations are considered to be one of the reasons of flooding lasting long time in those areas. Therefore, augmentation of local pump capacity shall be considered.

Capacity of the pumping station in Cideng Pumping Station is shown in Table-2.24.

Table-2.24 Drainage Capacity of Cideng Pumping Station at Flood of Feb, 2008

Pump Station	Drainage Area (Km)	Peak Discharge Q1 (m^3/s)	Pump Capacity Q0 (m^3/s)	Difference Q0-Q1(m^3/s)
Cideng P.S	3.70	29.1	40.20	+11.10
Wahid Hasyim P.S	0.87	10.3	1.0	-9.3
Sunda P.S	0.46	8.3	0.25	-8.05

Melati Pumping Station

Melati Pumping has a reservoir with 87,500 m^3 (Area = 3.5ha) of its volume for flood control. Drainage of this area is conducted by Pumping facility with 12.88m^3/s of its capacity and the Melati flood control reservoir. As the result of the simulation, to drain flood of Feb, 2008, capacity of pumping station is needed to be about 38.64 m^3/s, this means that 25.76m^3/s pumping capacity shall be increased. When capacity of pumping is same, reservoir volume shall be increased from 98,000 m^3 to until 197,000 m^3, this measure is also considered to be difficult in view of land acquisition.

Table-2.25 Drainage Capacity of Melati Pumping Station

Pump station	Peak Discharge Q1 (m^3/s)	Pump Capacity Q0 (m^3/s)	Needed Reservoir Volume V(m^3)
Present Situation	39.19	12.88	197,000
After augmentation of pumping capacity	39.19	38.64	98,000

<Gate Operation>

Drainage system

Flood control at the lowland, basically is targeted on the downstream of Ciliwung River from Manggarai Gate Complex by closing Manggarai Gate. Flood from upstream (mountain) area is directed to West Banjir Canal to detour Jakarta central area, and then flow into Java Sea. However, when serious situation comes due to a big flood such as overflowing the Manggarai Gate, there are some cases opening Manggarai Gate instructed by designated authority. On the other hand, at the river mouth, three (3) tidal gates, Marina, Pasar Ikan, Duri, are placed to prevent reverse flow from the Sea to the lowland area.

When river water level of immediate upstream of the Gates is higher than sea water level, tidal gates are fully opened and then river water flows into Java Sea by gravity. However, recently, sea water is higher than river water lever in the most cases, so it is not able to open the tidal gates effectively. Only Marina Gate is operated every day, but other two gates are remained closed. Jembatan Merah Gate is one of flow control gate with Merah Gate which is closed when down stream water level is higher than that of upstream, and at the same time Merah Gate is opened to flow river water into Pluit Reservoir. Most of the cases, Merah I Gate remains closed. However, in case of flood at 2007, Merah Gate was fully opened. Lay out of the gate stations and pump stations in the lowland area are shown in Figure2-26.

Four (4) flow control gates are placed in the low land area, of that, two gates are on the Ciliwung River, named Istiqlal Gate and Tangki Gate. Other two gates are placed on Cideng River, named Sogo and Siantar are located, which are one of facilities of Melati Pump Station and Cideng Pump Station respectively.

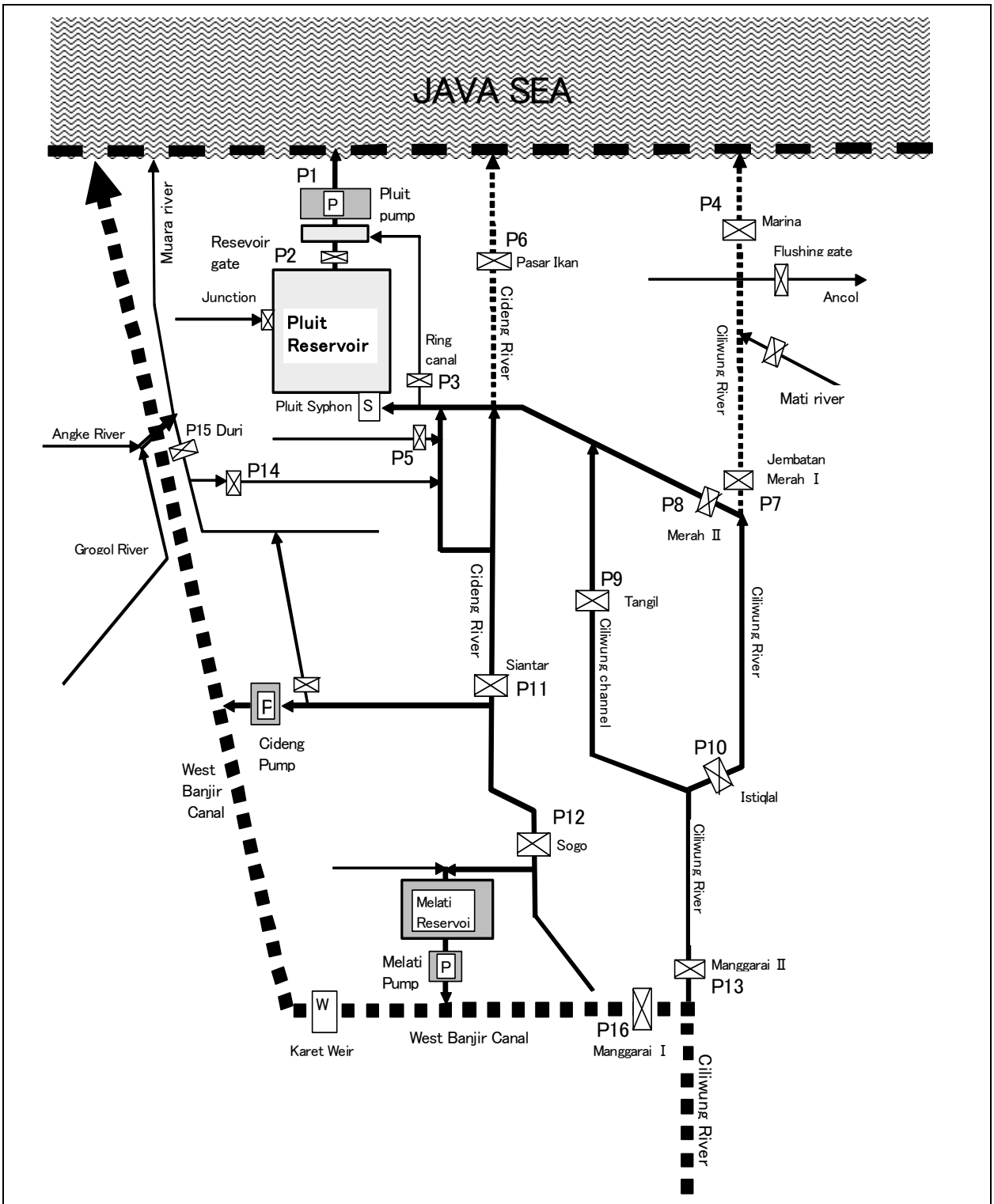
At normal condition, river water heading up by Istiqlal Gate is diverted to the Ciliwung Channel. Tangki Gate is placed to heading up river water and maintain water level of the Ciliwung Channel for flushing the garbage and rubbish and also environmental aspect. Most of the Ciliwung River water flows into the Ciliwung channel at normal condition due to the Istiqlal Gate being closed. But, both gates are opened during flood. Sogo Gate and Siantar Gate on Cideng river are placed to direct flood to the Melati Pump Station and the Cideng Pump Station respectively. When Melati Pump Station becomes full, Sogo Gate is fully opened to flow out flood to the Cideng Pump Station. When water level of Cideng River becomes high and over high water level, flood overflow on the fixed spillway placed at the right side of Siantar Gate to prevent flooding from upstream of Cideng River. Siantar Gate is not opened during flood even if river water overflowed on the spillway.

River water in the lowland area is basically gathered into three (3) Pump Station, Named Pluit, Cideng, Melati, and then drain into the Java Sea Catchment area of the lowland is 42.117 km^2; Pluit Pump Station is the lowest downstream with drainage area of 34.202 km^2. Siantar Gate and Sogo Gate are laid out in the most busy area in Jakarta, which areas are, 4.236km^2 , 3.697km^2 respectively.

Table-2.26 List of the Gates

Gate	Name of the gate	Location	Purpose	Remarks
P1		Outlet of pump flushing		No gate
P2	Reservoir gate	Reservoir closing gate	Flow control	
P3		Ring canal gate	Flow control	Gate function is broken
P4	Marina gate	Ciliwung river	Tide gate	
P5				
P6	Pasar Ikan gate	Cideng river	Tide gate	Basic sea water level
P7	Jembatan Merah	Ciliwung river	Tide gate	
P8	Jembatan Merah	Ciliwung river	Flow control	
P9	Tangi Gate	Ciliwung channel	Flow control	
P10	Istiqlal gate	Ciliwung river	Flow control	
P11	Siantar gate	Cideng river	Flow control	
P12	Sogo gate	Cideng river	Flow control	
P13	Manggarai	Ciliwung river	Flow control	
P14				Broken and No function
P15	Duri gate	Duri river	Tide gate	
P16	Manggarai	West Banjir Canal		

*Gate Numbers follow the Flood Alert Guideline of DKI Jakarta



Pump Station	Drainage are (km^2)
Pluit Pump Station	34.202
Cideng Pump Station	3.697
Melati Pump Station	4.235
Total	42.117

Figure-2.26 Locations of Gates and Pump Stations

7) Survey for Drainage Pump and Gate

<Pump Survey>

Inspection

In order to grasp the present condition of the pump stations along the Western Banjir Canal (Western floodway: WBC), the general inspection was carried out by the Departemen PU and DPU DKI Jakarta in corporation with the Project on November 18, 2008. This paper prepared as a summary of the inspection results. The locations of the inspected pump stations are presented in Figure-2.27.

Present Condition of Pump Stations

During the inspection, information on the present condition of the pump stations was collected from the operators of the pump stations. The results of interview are shown in Table-2.27 and summarized below:

Table-2.27 Summary of Present Condition of Pump Stations (As of 18/Nov/2008)

Station	Pump		Present Condition			Conditions in 2008/09		
	Nos	Capacity	Working	Capacity	Percentage	Working	Capacity	Percentage
	(Nos)	(m3/s)	(Nos)	(m3/s)	(%)	(Nos)	(m3/s)	(%)
Pluit	11	47.3	5	23.7	50.1	7	33.7	71.2
Cideng	6	40.2	5	33.5	83.3	6	40.2	100.0
Melati	9	13.6	4	7.9	58.1	5	9.0	66.2
Setiabudi Timur	6	8.52	2	3.48	40.8	5	6.78	79.6
Setiabudi Barat	7	8.98	0	0.00	0.0	4	5.68	63.3
Total	39	118.6	16	68.6	57.8	27	95.4	80.4

Note: Condition of pumps expected to work in 2008/2009 includes the pumps under repairing and the pumps with damaged trash screen.

At present, there are many damaged pump units required to repair. The present capacity is estimated about 70 % of the installed capacity of the pump stations and the capacity expected to work in 2008/2009 rainy season is about 80 % of the original capacity.

<Gate Survey>

Inspection

Main gate stations placed in the Low land area were inspected about the condition of facility and operation from 19 Feb to 20 Feb, 2009. Number of the gates being inspected is eleven (11). List of the gate station is shown in Table-2.28.

Table-2.28 List of the Gates

Gate	Name of the gate	Location	Purpose	Remarks
P1		Outlet of pump flushing		No gate
P2		Reservoir closing gate	Flow control	
P3		Ring Canal Gate	Flow control	Gate function is broken
P4	Marina gate	Ciliwung River	Tide gate	
P5				
P6	Pasar Ikan gate	Cideng River	Tide gate	Basic sea water level
P7	Jembatan Merah	Ciliwung River	Tide gate	
P8	Jembatan Merah	Ciliwung River	Flow control	
P9	Tangki Gate	Ciliwung Channel	Flow control	
P10	Istiqlal gate	Ciliwung River	Flow control	
P11	Siantar gate	Cideng River	Flow control	
P12	Sogo gate	Cideng River	Flow control	
P13	Manggarai	Ciliwung River	Flow control	
P14				No function and broken
P15	Duri gate	Duri River	Tide gate	
P16	Manggarai	West Banjir Canal		

Results of the Inspection

- O&M condition

  Staff officers are from Dinas PU DKI Jakarta. All of the inspected gate stations are maintained and operated by 2 -5 staffs of Dinas PU DKI Jakarta who are stay in administrative house placed beside the gate station for 24 hours in shifts. Some staffs are lived in the house. Sogo Gate and Siantar gate are maintained by the staff of the Melati Pump Station and Cideng Pump Station respectively due to those gate stations being one of the facilities of Pump Station.

- Condition of the facility

  Gate facilities being inspected still have function even though the facilities become too old. Routine maintenance such as gate moving check and greasing have been carried out once per two weeks.

- Gate operation

  Gate operation is carried out in accordance with the manual formulated by Dinas PU DKI Jakarta.

- Communication System

  Information about gate opening and the water level are exchanged by radio communication facility or telephone.

  Especially, information exchange is conducted every hour at normal condition and every 15 minutes at flood between Katulampa weir station and Manggarai gate station.

- Recording

  Recording of the operation is conducted at Manggarai Gate Station and Marina Gate Station. Sea water level at pasar Ikan gate is observed by automatic gage and manual. Automatic gate level is transmitted by telemeter every hours automatically.

  At Manggarai Gate Station, water level of Katulampa Weir and Manggarai Gate Station is recorded and the operation of the gate is recorded.

(3) Activity for [Capacity Development of Flood Information System] (for Project Output - 3)

1) Review of Flood Hazard Map

Objectives

From above mentioned situation, this manual is described about procedures of drawing up a map showing the areas expected to be flooded (Probable Flood Area), which will be contributed to formulating Flood Hazard Map of the Ciliwung River Basin in the JABODETABEK area. And also, Flood and Inundation Simulation Model is to be build up to identify the flood inundation area especially for the Ciliwung River Basin. Simulation program is to be handed over to the counter part agencies and training of the utilization method of this program is to be carried out by JICA Technical Cooperation team to the responsible agencies.

Target area

Target area of this manual is the Ciliwung River basin with the area of 537 km^2 and Pesanggrahan river basin with the area of 143km^2.

Proposed Flood Inundation Analysis Model

Flood Inundation Model is selected to facilitate such functions that,

- Flooding of both inland water and external water are able to simulate, reflecting the features of the basin (topographical and land use etc)
- Effectiveness of various flood control measures, which will be implemented in the basin, is able to evaluate.

So far, as the discharge analysis measures from basin, Concentration Model such as rational formula, tank model, storage function model and so on, have been applied. Parameters of these models required are average value or represent value in the basin. And the results derived from those models, are limited to the only information of the end of the basin.

However in recent years, continued water level and velocity of any points in the basin. Due to the concentration model can no be respond to those requirements, as the alternative model, distribution model is proposed. Characters of the Distribution Model are as follows,

- Whole basin is separated into micro mesh.
- Differences of the topography, geology, land use and so on are reflect on the mesh.
- Rainfall is given to each mesh directly.
- And, flows among mesh can be traced.

In this manual, Distribution Model is proposed to be applied to the flooding analysis method in the Ciliwung River Basin from below reasons,

- Rainfall discharge and process of the flooding at any location in the basin are required to be analyzed.
- The effectiveness of the various flood control measures are to be verified.

The model is created to be revised existing one and developed on the occasion of this project, and named as [**JYECS-FLOW 2D]** Model.

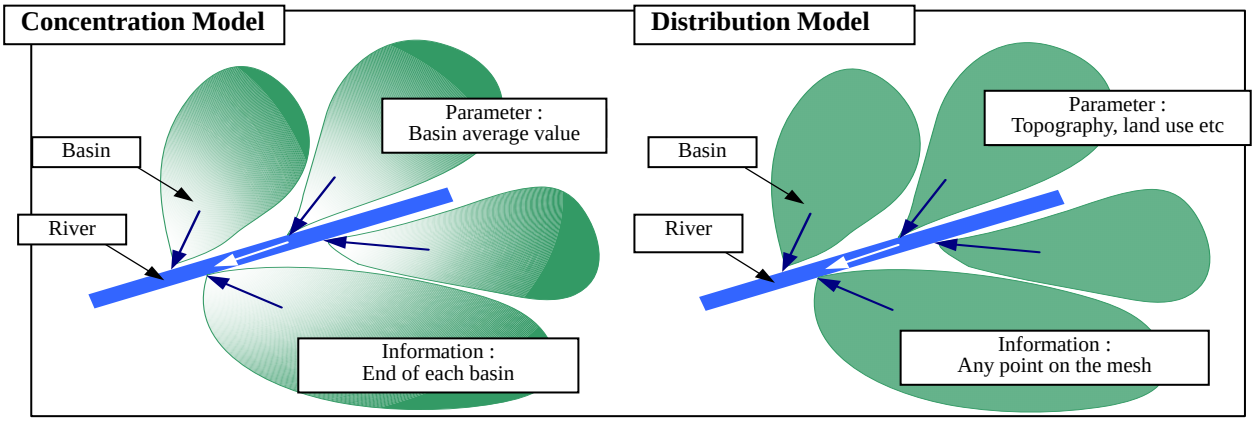


Figure-2.27 Images of Concentration Model and Distribution Model

Results of the inundation simulation

Simulations were carried out according to the each expected external forces (Probable rainfall) shown in the Table-2.29.

Table-2.29 Study cases of the inundation simulation

Case	Flood scale	With/without of dike break
Case-1	W=1/5	Non
Case-2	W=1/10	Non
Case-3	W=1/30	Non
Case-4	W=1/50	Non
Case-5	W=1/100	Non
Case-6	W=1/100	WBC138-R

Flood Risk Map making up from the simulation is shown in Figure-2.28 and Figure-2.29. As the basic map, 1/5,000 topographical map is applied.

Ciliwung

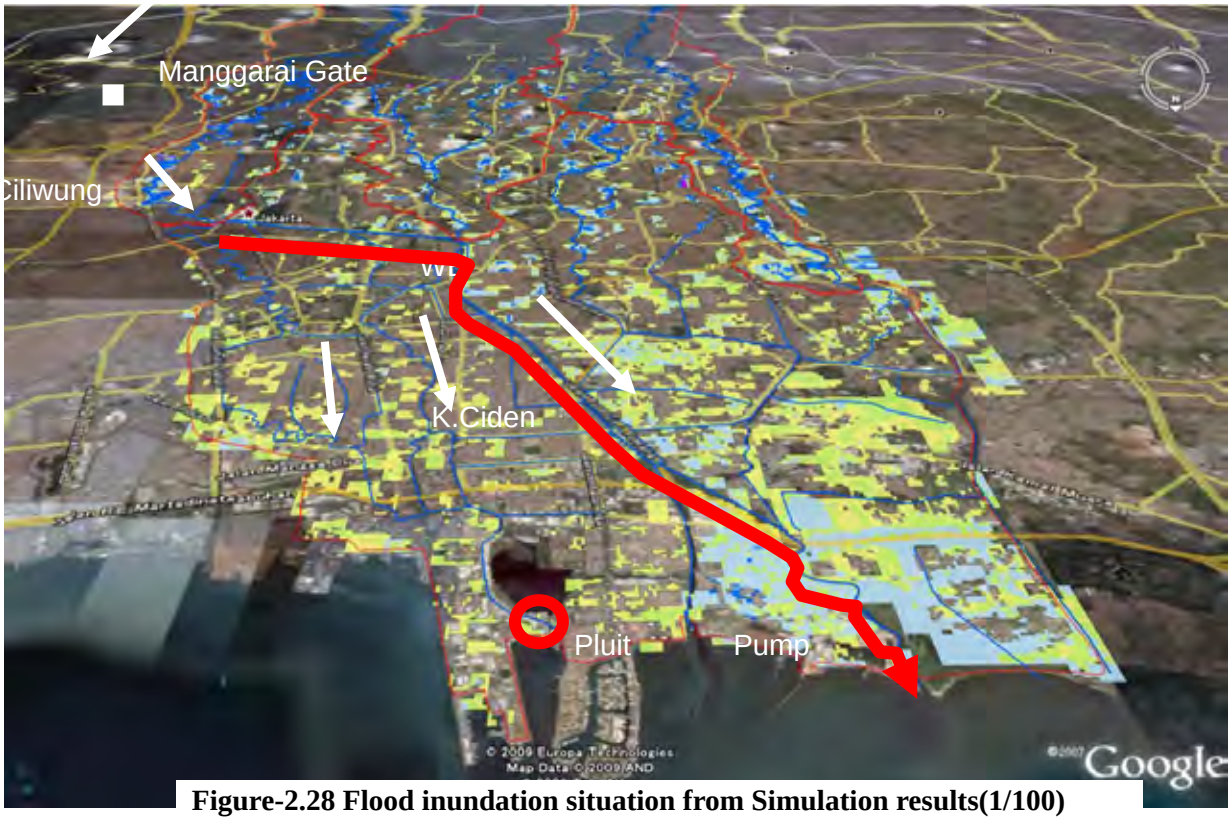


Figure-2.28 Flood inundation situation from Simulation results(1/100)

Comprehensive Flood Control Model

Discharge of Ciliwung river

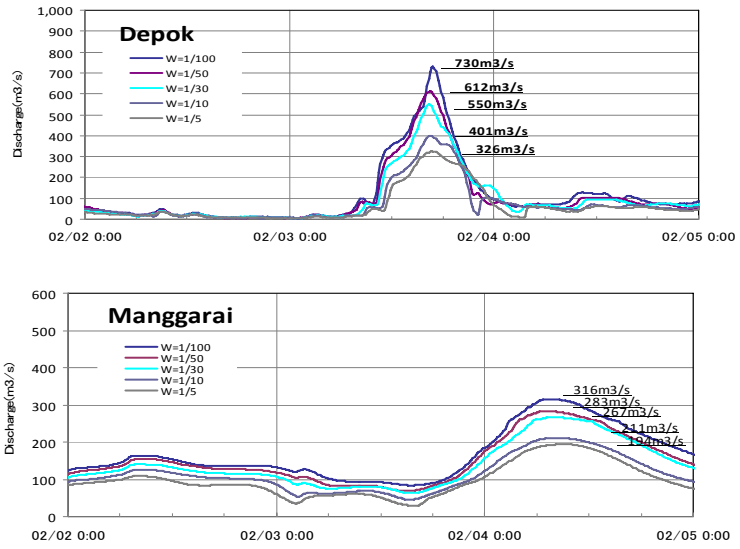


Figure-2.29 Flood Discharge calculated by Comprehensive flood Control model

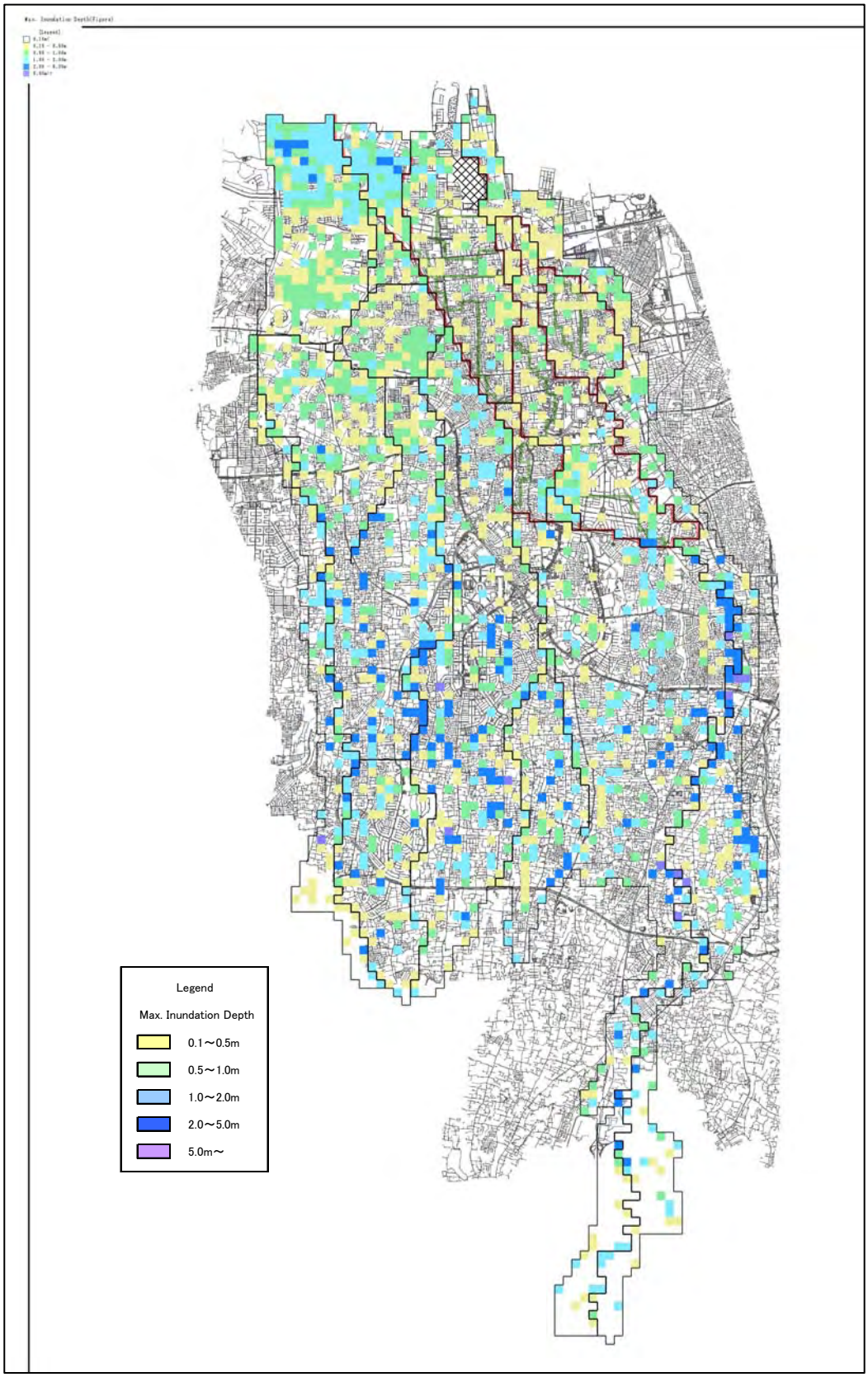


Figure-2.30 Map of Maximum Inundation Depth (CASE5: W=1/100)

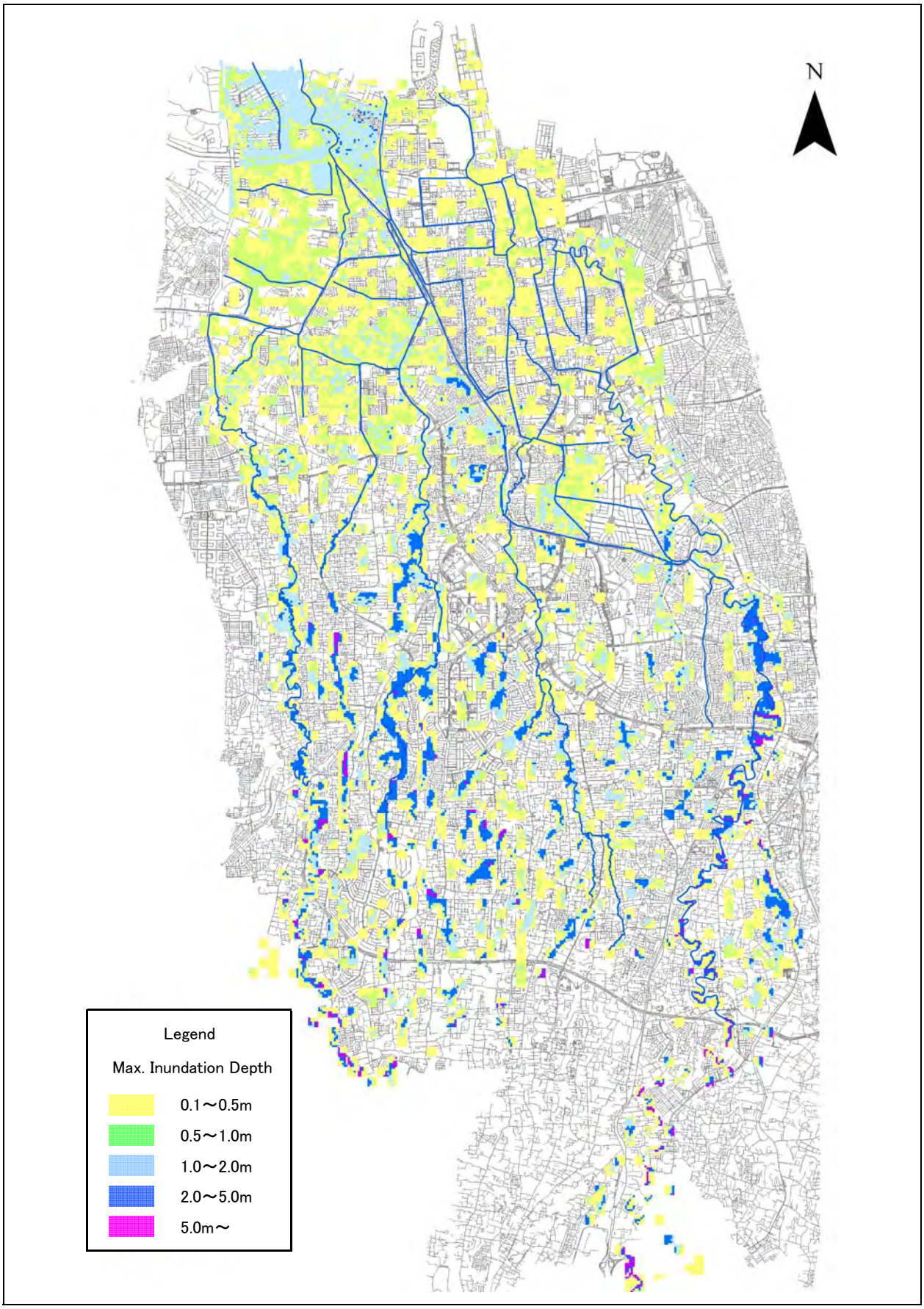


Figure-2.31 W=1/100 Flood Risk Map

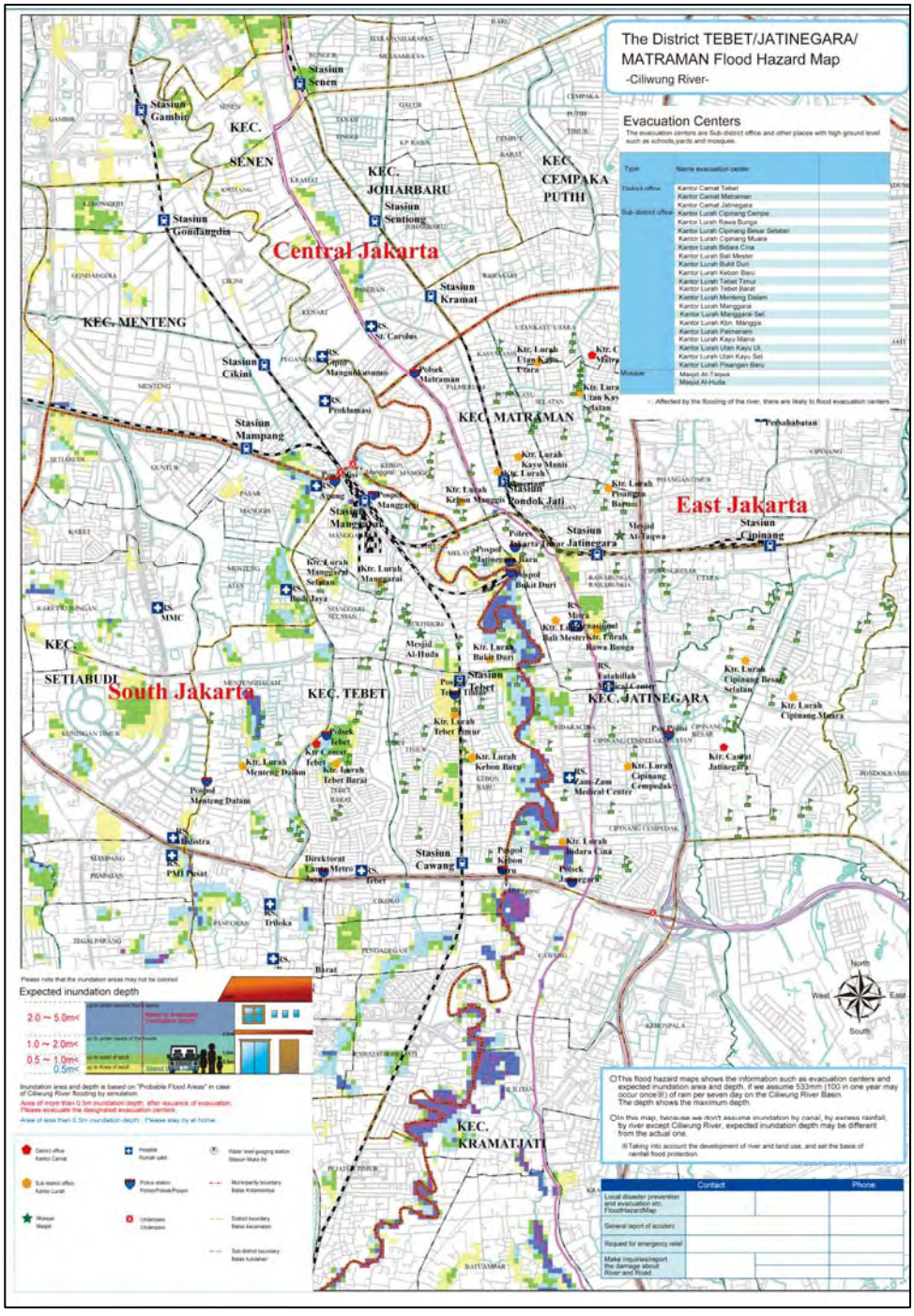


Figure-2.32 Hazard Map in Ciliwing River (Example)

2) Data Collection and Analysis on Inundation

The following three (3) activities were implemented in this fiscal year.

- Review of flooded area of the Ciliwung River for major past flood.
- Preliminary study on the alarm water levels (Alarm WLs) along the Ciliwung River and the WBC.
- Preliminary study of flood information dissemination.

<Flood Inundation Survey along the Ciliwung River>

In order to clarify the flood phenomena of the past major floods (1996 Feb, 2002 Feb and 2007 Feb floods), the study of flood area along the Ciliwung River was implemented by use of the following procedures:

- Field survey (interview with residents) along the Ciliwung River
  Inundation depth, flow direction, flow velocity, flood duration and condition of information from the authorities were surveyed through the interview with the residents.
- Conversion of surveyed depth to water level by use of spot elevation survey results and the GPS elevation survey results.
- Delineation of flood area based on the 28 m-mesh elevation data.

The flood water level along the Ciliwung River and the flood area for the past major floods are shown in Figures below, respectively.

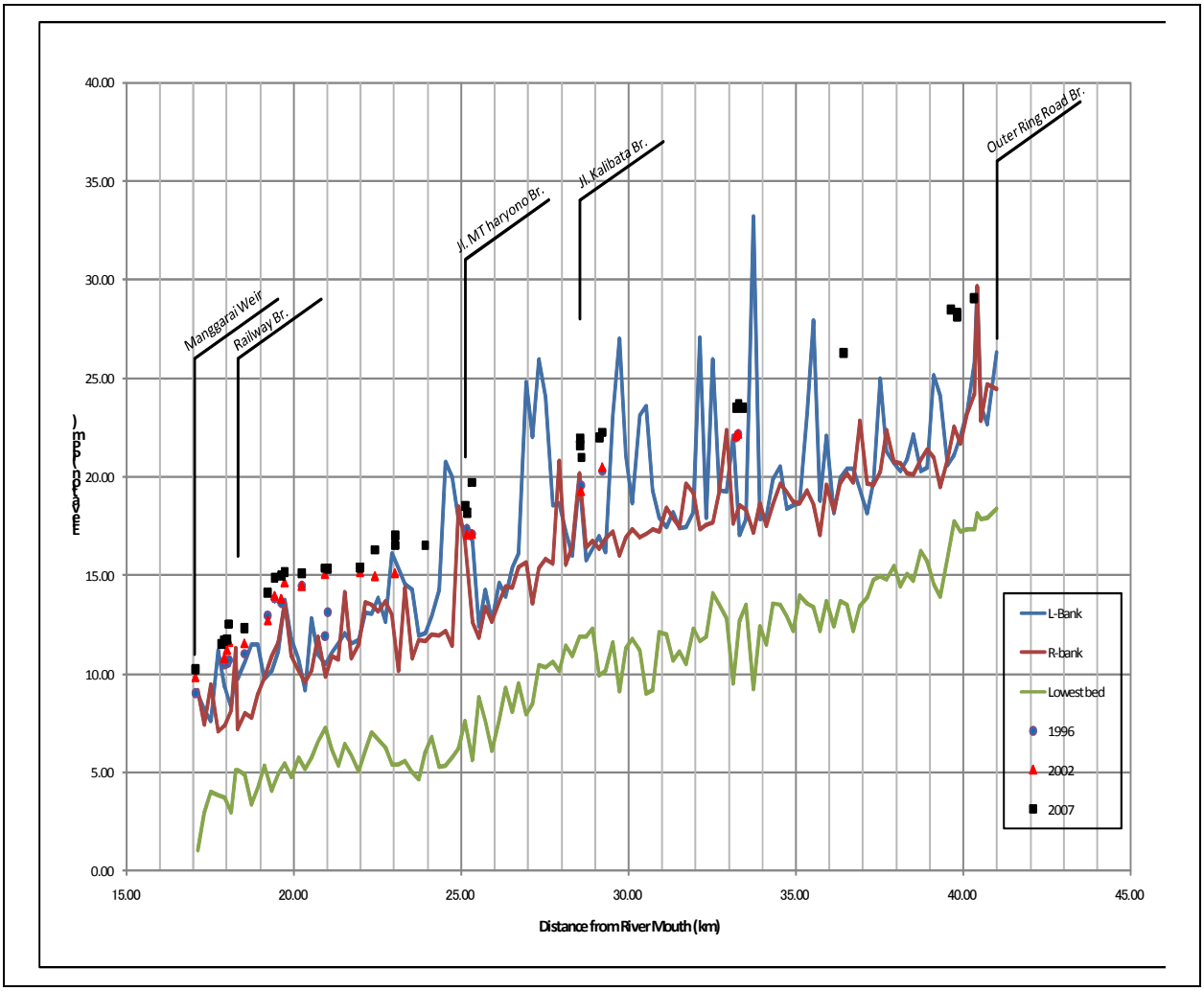


Figure-2.33 Flood Water Levels along the Ciliwung River for Past Major Floods

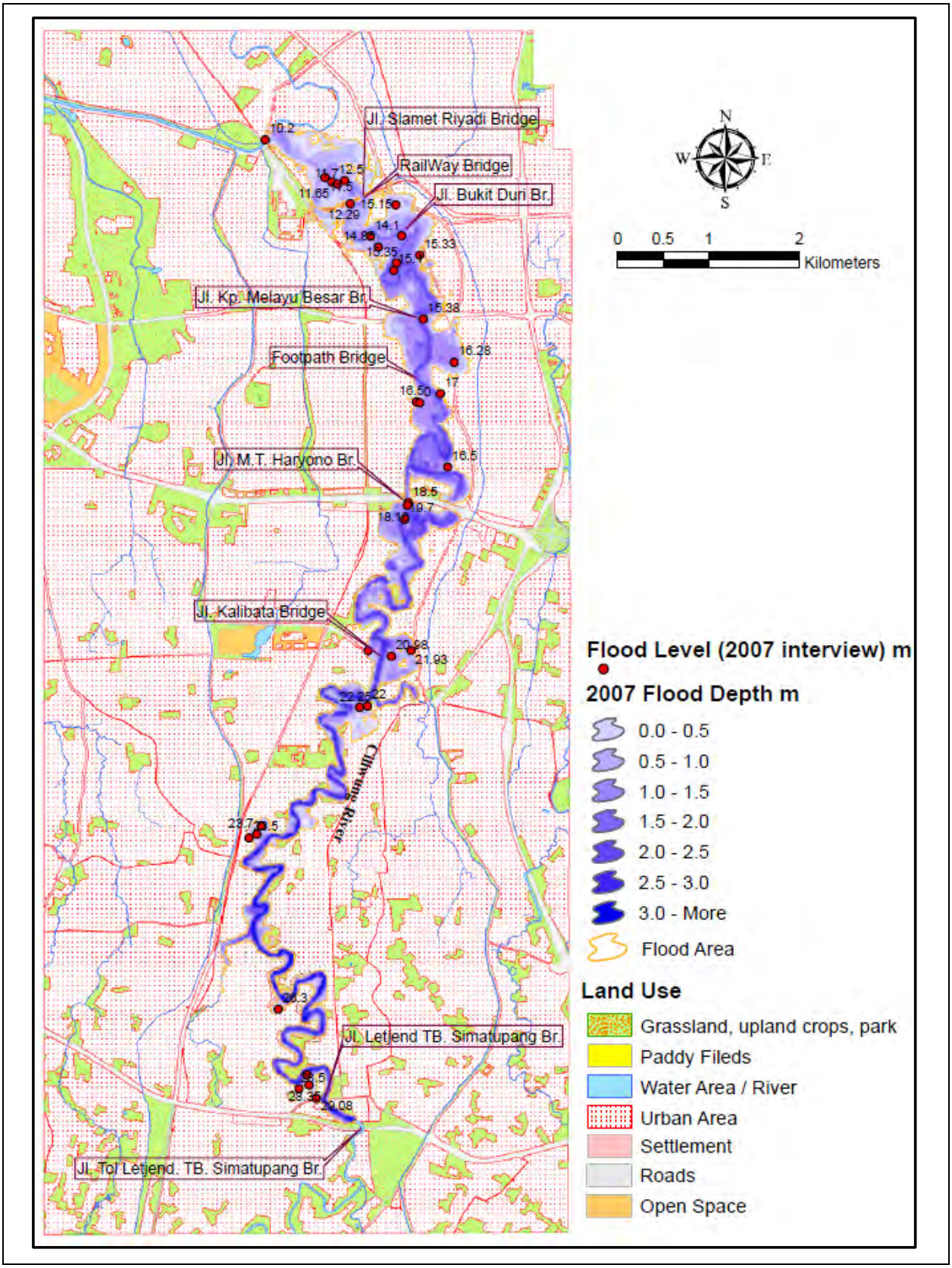


Figure-2.34 Flood Area along Ciliwung River (2007 Feb Flood)

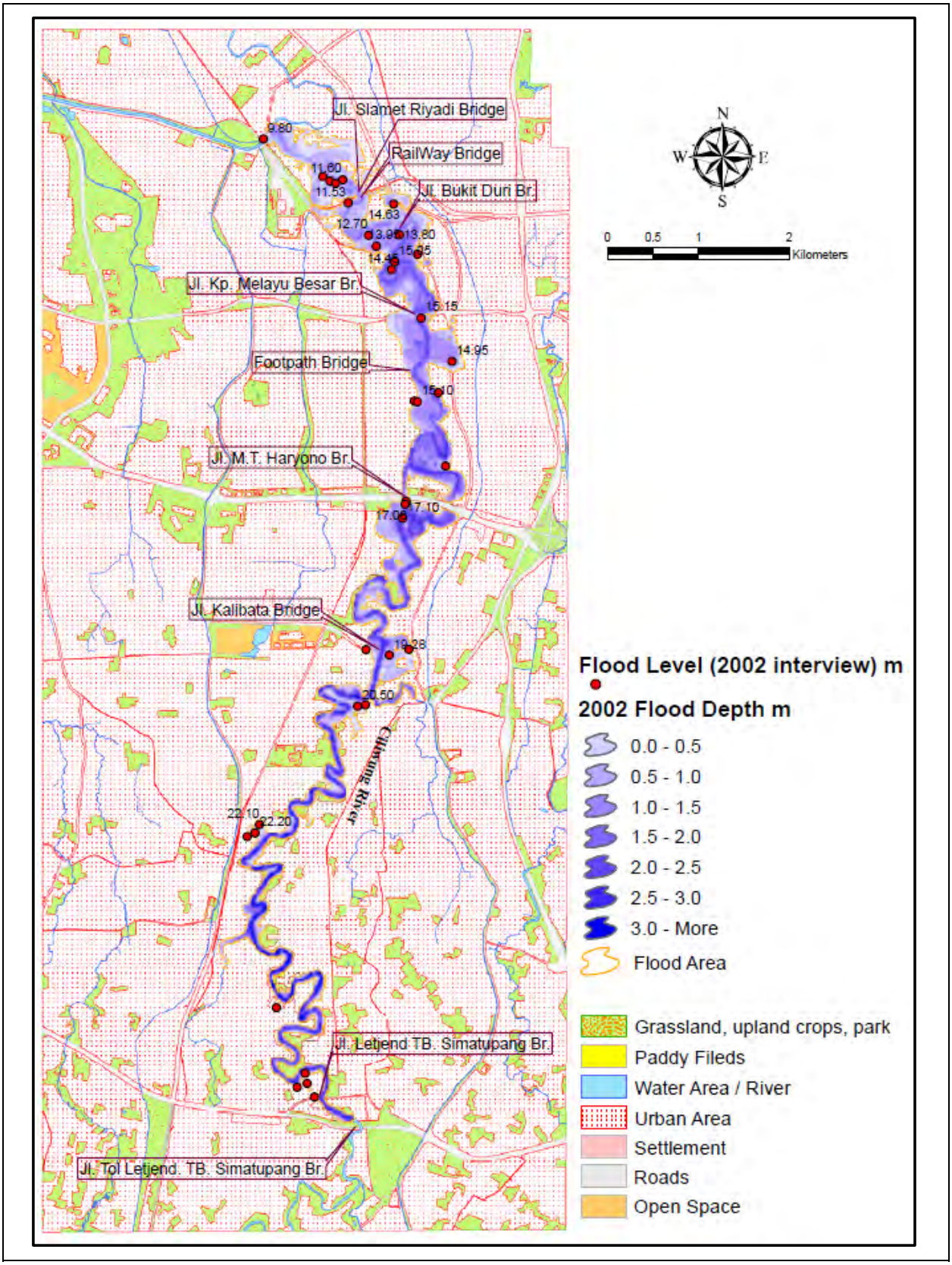


Figure-2.35 Flood Area along Ciliwung River (2002 Feb Flood)

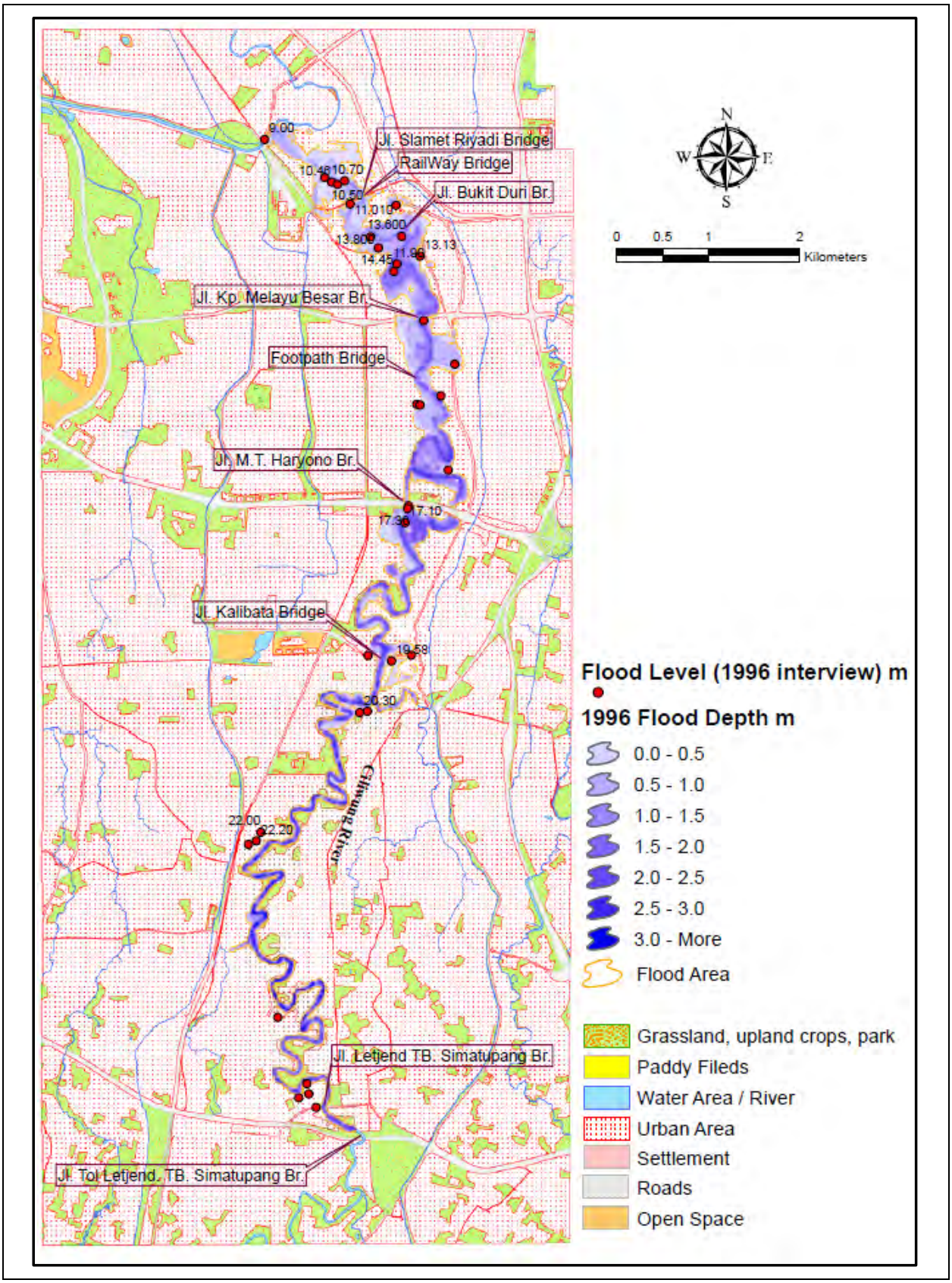


Figure-2.36 Flood Area along Ciliwung River (1996 Feb Flood)

Based on the field survey results and the relations between the water level and discharge computed by the non-uniform flow calculation, the peak runoff discharges for the past major floods were estimated as follows:

Table-2.30 Estimation of Runoff discharge for Past Major Floods

Location	Bank	Flood WL (PP m)			Estimated Runoff Discharge			Remarks
		1996	2002	2007	1996	2002	2007	
WBC-83	L	-	-	4.70	-	-	296.0	
WBC-140 -51	L	-	-	7.90	-	-	278.0	Upstream of Duku Atas Bridge
CIL-001 -67	R	9.00	9.80	10.20	212.5	279.7	308.3	Upstream of Manggarai Weir
CIL-009	L	11.01	11.53	12.29	236.0	273.8	334.1	
CIL-021 +100	R	13.13	-	15.33	187.7	-	311.8	Kp. Melayu Staff Gauge
CIL-42	R	-	-	18.50	-	-	458.5	Jl. M.T. Haryono Br.
CIL-042 +55	R	17.36	17.06	18.16	372.0	350.8	431.8	
CIL-059	R	-	-	21.93	-	-	378.7	Jl. Kalibata Bridge
WBC Ave					-	-	287.0	
Ciliwung Ave					252.0	301.4	370.5	

<Preliminary Study of Alarm Water Levels along the Ciliwung River and WBC>

Objective

Objective of this preliminary study are as follows:

- To clarify the present condition of the alarm water levels (Alarm WLs) along the WBC and Ciliwung River.
- To clarify the condition of flood at the present Alarm WLs along the WBC and Ciliwung River.
- To make recommendations on revision of the flood fighting guidelines.

Present Condition of Alarm WLs

At present, there are three (3) water level stations with the Alarm WLs along the WBC and Ciliwung River, that is, Manggarai, Depok and Katulampa Stations as shown in Figure below:

The present condition of the Alarm WLs applied at the central and provincial government level and kerulahan (sub-district) level are as follows:

Table-2.31 Alarm WLs applied in Central and Provincial Government Level

WL Station	C.A. (km^2)	WL (SG cm)			
		Siaga IV: Safe	Siaga III: Caution	Siaga II: Waning	Siaga I: Danger
Manggarai	337.09	< 750	750 - 850	850 - 950	> 950
Depok	245.51	< 200	200 - 270	270 - 350	> 350
Katulampa	149.79	< 170	170 - 240	240 - 310	> 310

Source: BBWS Ciliwung Cisadane, Procedur Operasi Lapangan Piket Banjir, DKI Jakarta, Pedoman Siaga banjir Provinsi DKI Jakarta, * WLs were set up empirically.

Table-2.32 Alarm WLs applied in Kelurahan KP. Melayu

WL Station	C.A. (km^2)	WL (SG cm)		
		Normal	Warning	Danger
Manggarai	337.09	< 700	700 - 800	> 800
Depok	245.51	< 160	160 - 250	> 250
Katulampa	149.79	< 90	90 - 160	> 160

Source: Interview to Office of Kelurahan KP Melayu.(on 22/May/2008)
* WL was determined empirically in KP Melayu. * Evacuation order will be issued at the WL of Danger.

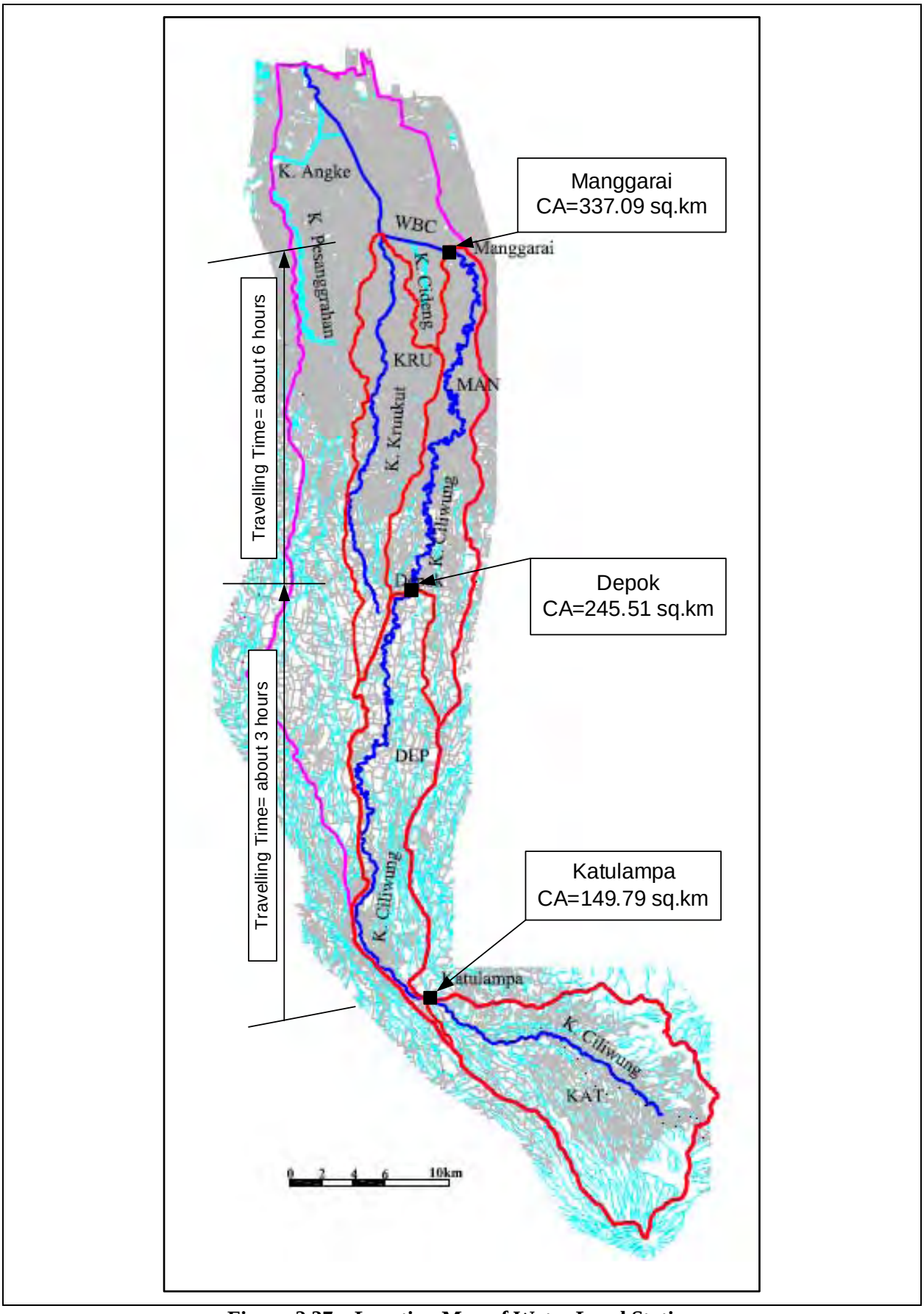


Figure-2.37 Location Map of Water Level Station

Discharges at Alarm WLs

The discharges at the Alarm WLs of respective stations are estimated by use of the existing discharge rating curves of respective stations, and are shown as follows:

Table-2.33 Discharges at Alarm WLs of Stations

Station	Manggarai	Depok	Katulampa
C.A. (km^2)	337.09	245.51	149.79
Alarm WL (SG cm)			
Siaga III	750	200	170
Siaga II	850	270	240
Siaga I	950	350	310
Q at Alarm WL (m^3/s)			
Siaga III	69.2	94.8	165.3
Siaga II	125.1	169.6	388.6
Siaga I	197.4	277.9	714.9

Note,
H-Q at Manggarai: Non-uniform flow computation (by Project)
H-Q at Depok: Non-uniform computation (by JFM)
H-Q at Katulampa: Flow computation (by JFM)

Condition along the WBC and the Ciliwung River at Discharge during Alarm WLs of Manggarai Station

Condition of the WBC and the Ciliwung River at the discharges during the Alarm WLs of the Manggarai WL Station is estimated by using the non-uniform flow computation. The results of the computation are summarized as the below Figures:

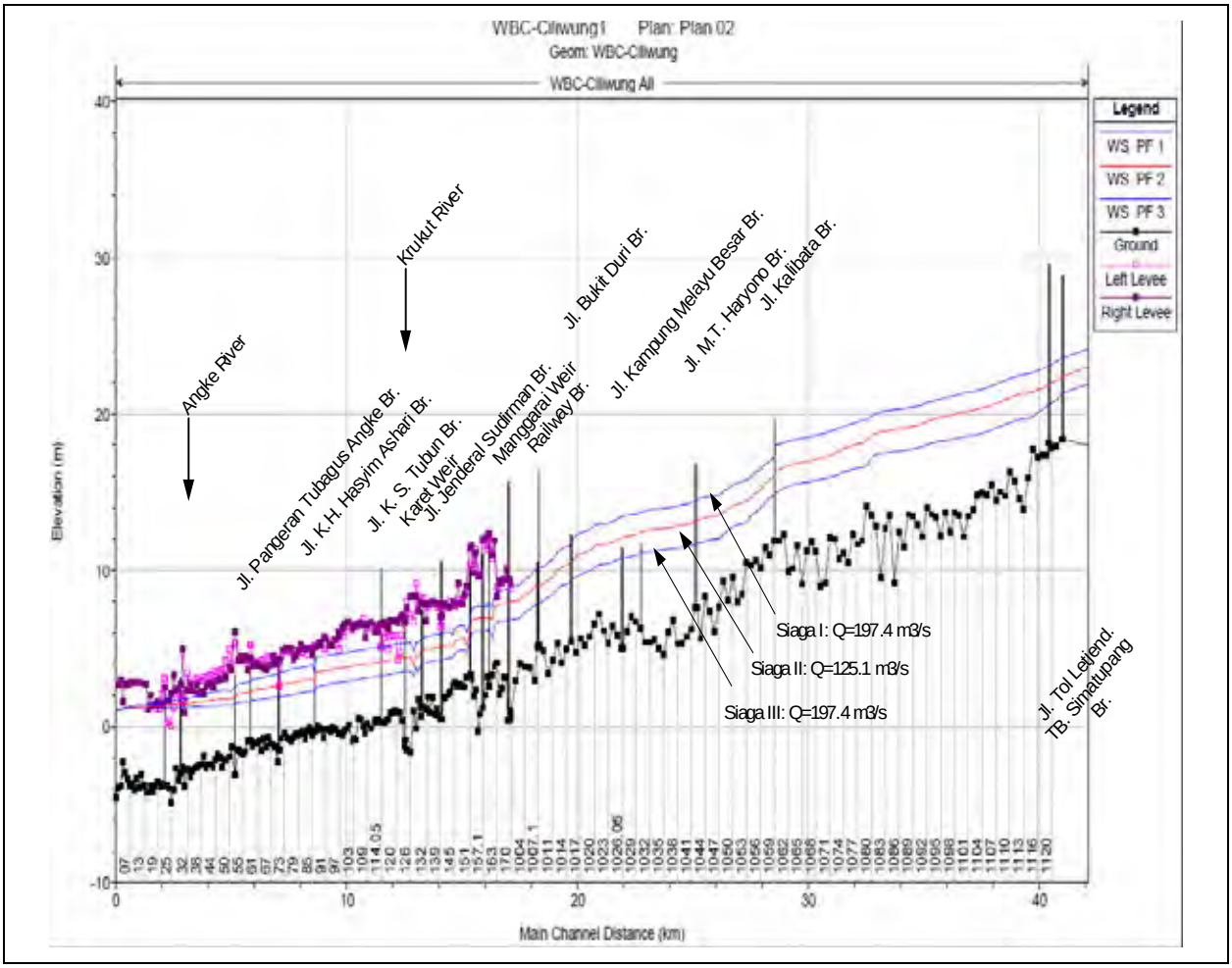


Figure-2.38 Water Surface Profiles along the WBC and the Ciliwung River

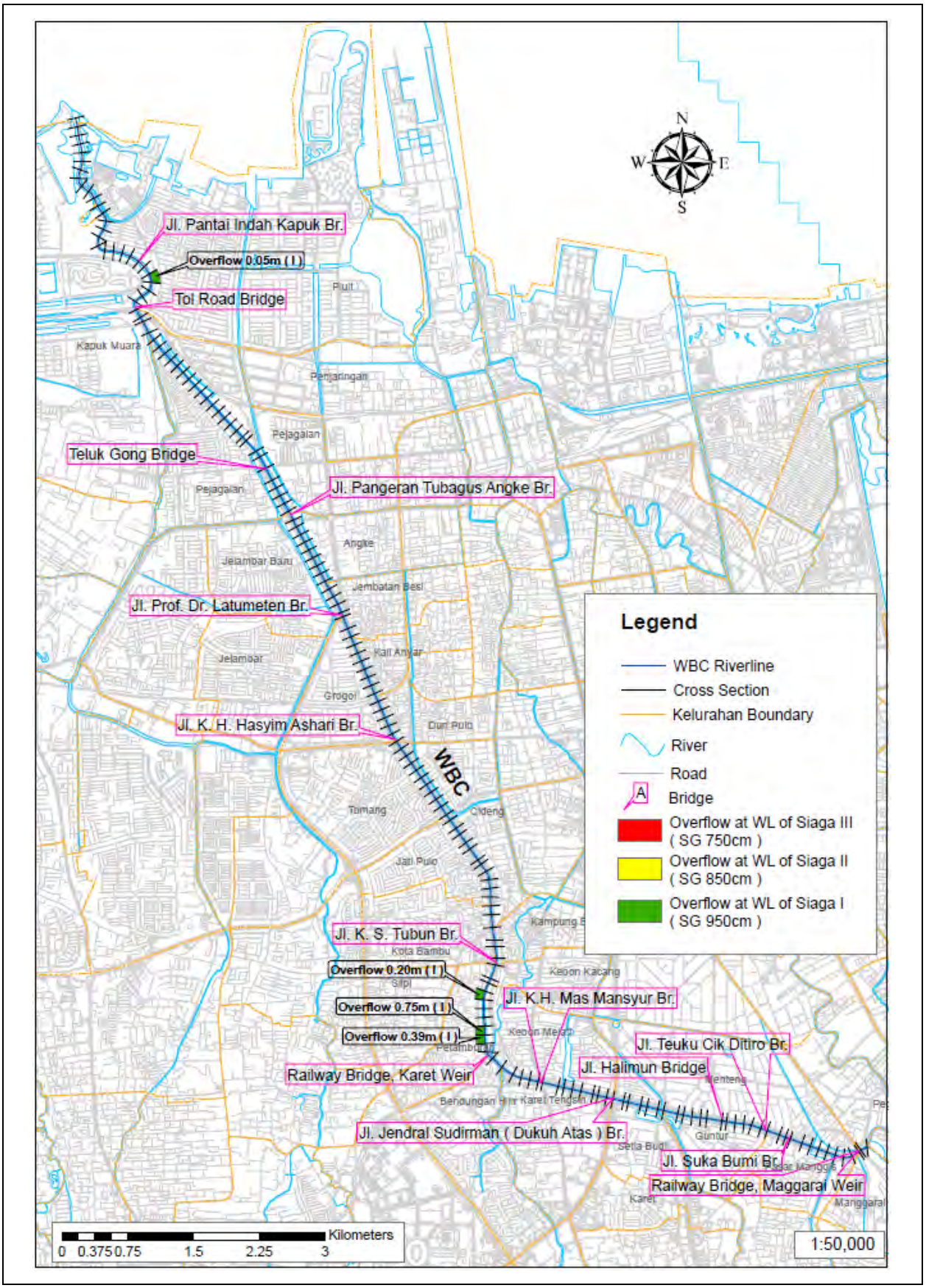


Figure-2.39 Conditions along the WBC

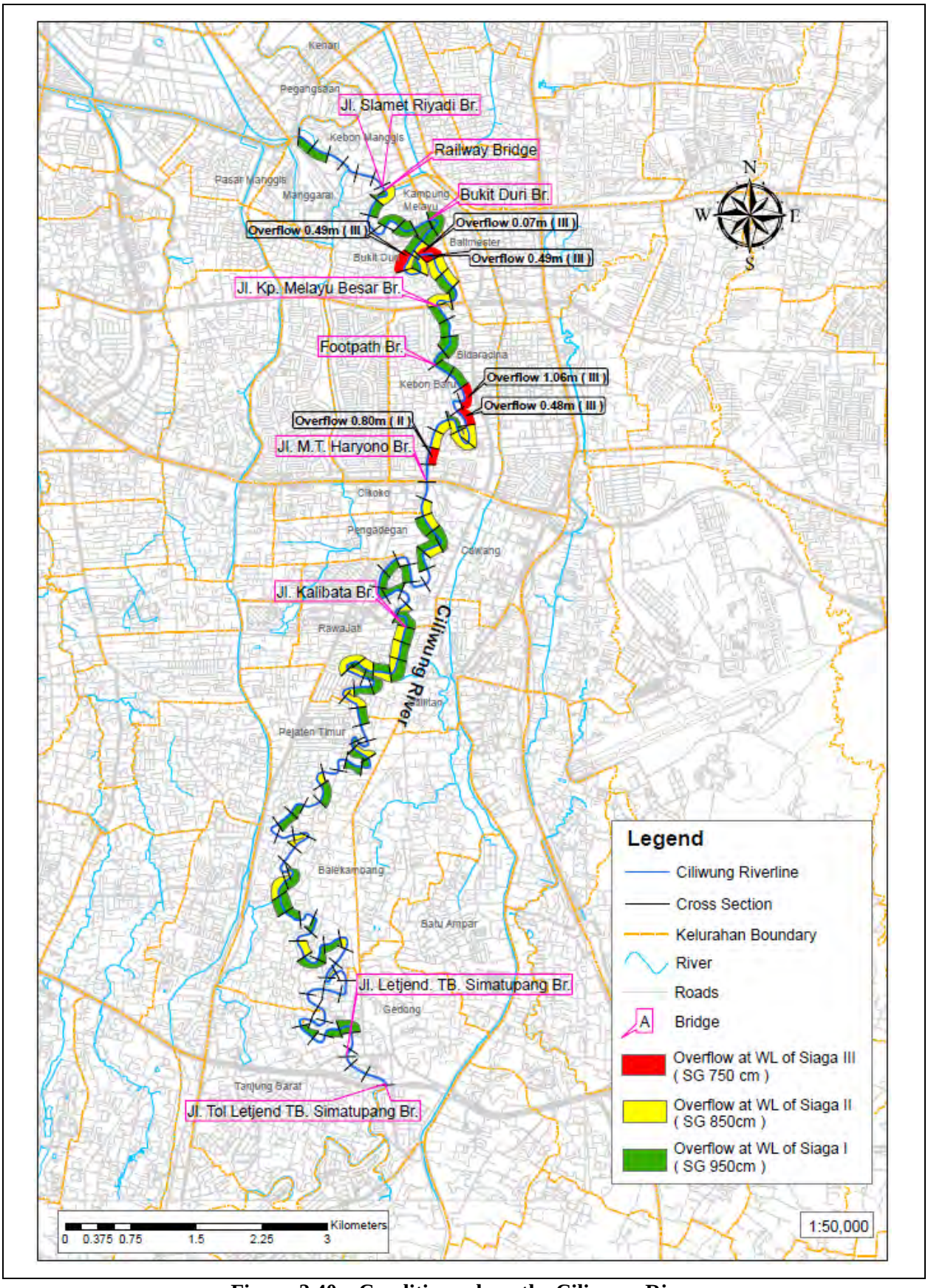


Figure-2.40 Conditions along the Ciliwung River

Consideration and Recommendation

From the above preliminary study results, the followings are considered and recommended:

- The Alarm WLs in the central and provincial level are the basis of mobilization for flood fighting in the organization. The Alarm WLs of respective stations have been used for long periods. However, no one knows background of those determination and relationship with flood condition exactly.
- On the other hand, the offices of Kelurahan have their own Alarm WLs based on the local condition and their experiences in order to apply the evacuation activities mainly.
- The Alarm WLs at the Manggarai station are applied to the WBC and lower reaches of the Ciliwung River and the Alarm WLs at Katulampa and Depok are considered as the early warning.
- There are discrepancies of flow capacities among the stretches of the WBC and the Ciliwung River. Considering the flood fighting and evacuation activities, it is difficult to apply 1 set of Alarm WLs for whole stretches.
- It is recommended to revise the Alarm WLs including those definitions, considering those objectives.

<Preliminary Study on Flood Information Dissemination>

Objective

- To clarify the present condition of the flood information dissemination.
- To find the homepages in the Internet as the proper information sources for flood.

Present Condition of Flood Information Dissemination

According to the flood operation guidelines in BBWS Ciliwung and DPU-DKI, flood information is collected by the POSKO of the related agencies by use of telemeter system, GSM system, radio transmission and telephone lines. Collected information is send to the SATLINMAS PBP in Kelurahan level and the SATLINMAS delivers this information to the inhabitants through the RT/RW (Neighborhood unit). This is the proper method for flood information dissemination and this condition is confirmed through the interview from the inhabitants by the project. However, the SATLINMAS delivers the flood information just before the evacuation condition. It makes the inhabitants to the difficult situation.

On the other hand, the agencies concerned become to deliver the flood information through the internet, TV and the newspapers. However, there is no special description about these in the said flood operation guidelines. Almost of the inhabitants including the government officials do not know such information. It is recommendable to include these information sources/method in the flood operation guidelines.

Internet Homepage as Proper Information Sources

There are many internet homepages related to the flood information. Among them, the following homepages would be useful.

BMG

- ✓ Homepage

  http://www.bmg.go.id/depan-gongxifacai.bmg
- ✓ Citra Sateite: Satelite Image by use of Infra red rays and Visible rays

  http://www.bmg.go.id/citrasatelit.bmg?Jenis=URL&IDS=6835985563934036130
- ✓ Prakiraan Angin Lapisan 3000 Feet

  http://meteo.bmg.go.id/index.jsp

HARIMAU Project

- ✓ Image of C-Band Doppler Rader (CDR) at Serpong

  http://turbulence.ddo.jp/cappi105.html

POLDA METROPOLITAN JAKARTA RAYA

- ✓ Information for inundation/flood area during flood

  http://www.lantas.metro.polri.go.id/news/index.php?id=1

DPU-DKI

- ✓ DPU DKI Homepage

  http://dpu.jakarta.go.id/

- ✓ System Peringatan Dini Banjir

  There is information of the water level and rainfall in Jakarta by use of the GSM information networks.
  http://dpudki.net/

Bureau of Meteorology, Australia

- ✓ Gradient Wind Analysis

  http://www.bom.gov.au/cgi-bin/nmoc/latest.pl?IDCODE=IDD80105

Japan Meteorological Agency

- ✓ Stream Line Analysis (Present, 24/48h Forecast)

  http://www.jma.go.jp/jmh/jmhmenu.html

Jakarta City View

- ✓ Video for staffgauges at Katulampa and Manggarai.

  http://www.jakartacityview.com/menu_livestream_poskobanjir.php?cmd=200860

2.4.4 6th Activity in Indonesia

(1) Summary

All the manuals and guideline prepared by the 5th Activity in Indonesia were reviewed and reexamined by the Japanese experts with the new data obtained. In addition, the Japanese experts carried out an intensive transfer of technology to the Counterparts regarding the manuals and guideline. The results of the technology transfer were presented by the Counterparts in a workshop carried out from 28 to 29 on July in 2009 and a seminar held on November 23, 2009. At the workshop and seminar, very useful opinions and comments for finalization were given to the counterparts from the participated representatives of the related organizations.

The counterparts prepared by themselves the manuals and guideline in Indonesian version, taking the comments at the workshop and the seminar, and referring the ones in English version that were prepared by the Japanese experts. The Japanese experts supported the work of the counterparts. The final Indonesian version of the manuals and guideline was discussed and prepared intensively at the workshop held from 23 to 25 on February in 2010. The manuals and guideline finally prepared are as follows.

① Manual for Inventory and River Structures
② Maintenance Manual on River Structures
③ Facility Evaluation Manual for River and River Structures
④ Operation Manual on Gates and Pumps
⑤ Manual for Drawing up Probable Flood Area
⑥ Manual for Post Flood Survey
⑦ Flood Alert Manual
⑧ Guideline for Runoff Control in Basin

The relationships among the manuals and guideline are as follows:

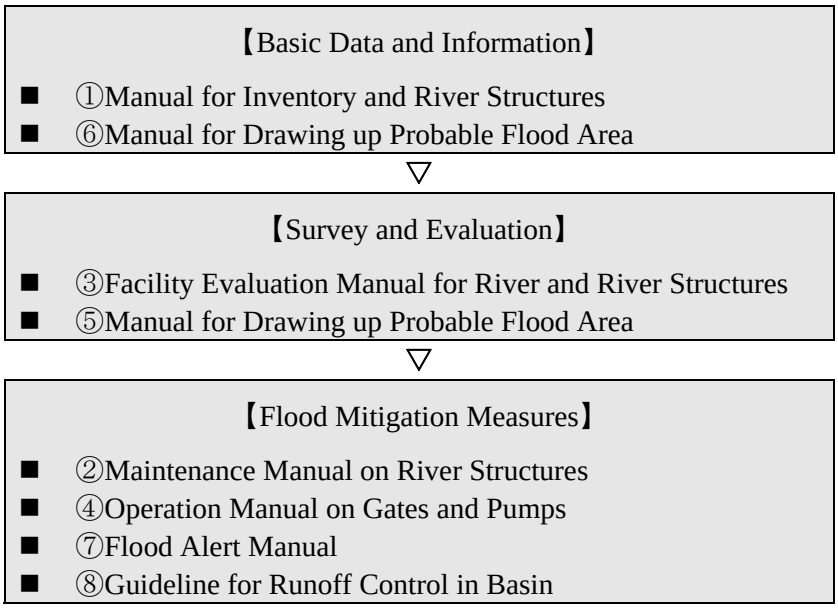


Figure2.41 Relationships among Manuals and Guideline

1) Activities Results regarding the Target Outputs in this Term

Activity for [Capacity Development of Operation and Maintenance for River and Drainage Facilities] (for Project Output - 1) and for [Capacity Development of Data Collection and Analysis for Flood] (for Project Output - 2)

- Renewal of Inventory Database for River and Drainage Structures
- Review of Evaluation Model of River System and Evaluation Model of Drainage System
- Flood Analysis of Data Obtained by Post Flood Survey
- Finalization of Operation and Maintenance for River and Drainage Facilities
- Finalization of Operation Manual for Drainage Pump and Gate

Activity for [Capacity Development of Flood Information System] (for Project Output - 3)

- Review of Flood Hazard Map
- Evaluation of Hydrological Observation Network
- Finalization of Flood Alert System

Activity for [Capacity Development for Runoff Control Measures] (for Project Output - 4)

- Review of Evaluation Model for Basin Runoff
- Calculation and Evaluation of Basin Runoff by Using the Model
- Study on Regal Control of Land Use

2) Counterpart Training

Counterpart training was implemented through the OJT and the Counterpart Training in Japan. Two counterparts were sent to Japan for the topic of the training is “Comprehensive Flood Mitigation in Japan” in November 2009. The counterparts participated in the training presented their training reports at the workshop held from 23 to 25 on February in 2010.

3) Seminar and Workshop

The following seminar and workshop were held by the Ministry of Public Works and JICA.

- Workshop on Manual and Guideline (From 29 to 30 on July in 2009 at Bogor)
- Seminar on Flood Management in Urban Area (November 23 in 2009 at Jakarta)
- Workshop for Preparation of Manual and Guideline (From 23 to 25 on February in 2010 at Puncak)

1st Workshop (From 29 to 30 on July in 2009 at Bogor)

The Ministry of Public Work and JICA held the 1st Workshop featuring the Manual and Guideline for Flood Management in JABODETABEK. The targets of the workshop are: 1) To deepen the counterparts understanding of flood management, 2) To discuss the contents of manual and guideline among the related organizations and 3) To spread the manual and guideline for Banten and West Java Provinces.

2nd Seminar (November 23 in 2009 at Jakarta)

The Ministry of Public Work and JICA held the 2nd Seminar featuring the flood management in urban area. The related organizations exchanged the opinions on the present flood control situation to promote the comprehensive flood control in JABODETABEK. Also the discussion about the adjustment method for the flood management in JABODETABEK was performed. Main results are: 1) Mutual consent of introduction of 'Comprehensive Flood Control Measures in Urban Area' and 2) Mutual agreement of promotion of the adjustment agency to implement 'Comprehensive Flood Control Measures in Urban Area'.

2nd Workshop (From 23 to 25 on February in 2010 at Puncak)

The Ministry of Public Work and JICA held the 2nd Workshop to prepare the manual and guideline for flood management. The target of the workshop is that the counterparts finalized by themselves the manual and guideline in Indonesian version

(2) Activity for [Capacity Development of Operation and Maintenance for River and Drainage Facilities] (for Project Output - 1) and for [Capacity Development of Data Collection and Analysis for Flood] (for Project Output - 2)

The following manuals were prepared regarding the items.

- Manual for Inventory and River Structures
- Maintenance Manual on River Structures
- Facility Evaluation Manual for River and River Structures
- Operation Manual on Gates and Pumps

The outlines of each manual are as follows:

1) Manual for Inventory and River Structures

This manual shows the procedure to make inventory of rivers and river structures in the Pilot Area (Ciliwung River Basin, West Flood Canal and Central Jakarta: 537km2) of the Project Area, and composed of the following contents:

- Category and Type of Rivers and River Structures
- Inventory of Rivers and Ponds
- Inventory of Gates
- Inventory of Drainage Pump Stations
- Inventory of Dikes

2) Maintenance Manual on River Structures

This manual shows the procedure to implement maintenance work for the rivers and river structures which are listed in the inventory mentioned above, and composed of the following contents:

- Procedure and Frequency of Patrol and Inspection
- Urgency and Priority of Maintenance
- Classification of Maintenance Work
- Maintenance of River and Channel
- Maintenance of River Structures
- Flow Capacity of River and Channel

3) Facility Evaluation Manual for River and River Structures

This manual shows the procedure to evaluate a discharge from basin, flow capacity of river and capacity of drainage pump station, and composed of the following contents:

- Calculation of Flood Peak Discharge
- Rainfall Analysis (Rainfall Stations and Data, Provable Rainfall, Rainfall Intensity Curve)
- Calculation of Non-uniform Flow
- Water Level and Discharge Curve
- Evaluation of Flow Capacity
- Evaluation of Drainage Pump Capacity (H-V Curve of Reservoir, Hydrograph in to Reservoir, Operation of Drainage Pump)

4) Operation Manual on Gates and Pumps

This manual shows the procedure to operate gates and drainage pump stations located in the Pilot Area, and composed of the following contents:

- Gate Operation
- Drainage System
- Tidal Gates
- Flow Control Gates
- Pump Operation
- Outline of Pump Stations
- Operation of Pluiot Pump Station
- Operation of Ciden Pump Station
- Operation of Melati Pump Station
- Evaluation of Pump Facilities
- Inspection of Gate and Pump

(3) Activity for [Capacity Development of Flood Information System] (for Project Output - 3)

The following manuals were prepared regarding the items.

- Manual for Drawing up Probable Flood Area
- Manual for Post Flood Survey
- Flood Alert Manual

The outlines of each manual are as follows:

1) Manual for Drawing up Probable Flood Area

This manual discusses the procedure to drawn up the flood hazard map of Ciliwung River Basin in JABODETABEK. Flood simulation model is prepared targeting the Ciliwung River Basin. This flood simulation model was transferred to the counterpart agency. JICA expert team gave training of the model operation. The training results were presented by the counterpart at the workshop held from 28 to 29 on July in 2009, and discussed among the attended related organizations. This manual is composed of the following contents:

- Explanation of Flood Hazard Map
- Preparation of Flood Simulation Model
- Proposed Flood Simulation Model (JYECS-FLOW 2D)
- Rainfall Model
- River and Channel Model
- Basin Discharge Model
- Inundation Model
- Calibration of Flood Simulation Model (JYECS-FLOW 2D)
- Simulation and Results
- Flood Risk Map (Probability: 1/5,1/10,1/30,1/50,1/100)

2) Manual for Post Flood Survey

This manual explains the procedure to implement a survey for flood condition, situation of flood damage, flood fighting etc. just after the occurrence of flood, and composed of the following contents:

- Hydrological Survey
- Survey for the Actual Operation of River and Drainage Facilities

- Flood Inundation Survey
- Survey for Actual Activity of Flood Fighting

3) Flood Alert Manual

This manual explains the policy of flood alert and shows the procedure to prepare the flood risk water level and the evacuation water level, and composed of the following contents:

- Current Flood Risk Water Level
- Clarification of Flood Risk Water Level
- Estimation of Flood Risk Water Level
- Flood Risk Water Level of Each River Section
- Flood Risk Water Level Connecting to Reference Observation Stations
- Estimation of Evacuation Water Level
- Clarification of Evacuation Water Level
- Evacuation Water Level Connecting to Reference Observation Stations
- Analysis of Past Floods (to Evaluate Rising Speed of Water Level)
- Evacuation Time (Preparation + Movement to Safe Point)
- Evacuation Water Level Corresponding to Flood Prone Areas
- Recommendations

(4) Activity for [Capacity Development for Runoff Control Measures] (for Project Output - 4)

Regarding this item, Guideline for Runoff Control in Basin was prepared. Contents are as follows:

- Necessity of Runoff Control
- Classification of Runoff Control Facility
- Runoff Control Facility – Storage Type
- Runoff Control Facility – Infiltration Type
- Function and Effectiveness of Runoff Control Facility
- Planning of Runoff Control
- Hydrologic and Hydraulic Plan
- Design Rainfall Scale
- Required Function of Runoff Control Facility
- Installation of Storage Facility
- Runoff Control in Pesangrahan River Basin
- Applicability of Comprehensive Flood Control in the area of JABODETABEK
- Applicability of flood mitigation Measures
- Planning Procedures by Stakeholder Participations
- Runoff Control Regulation
- Necessity of Runoff Control Regulation
- Structure of Runoff Control Regulation
- Regulation Related to Organization and Action Plan
- Regulation Related to Runoff Control Measures