No.

BASIC DESIGN STUDY REPORT

ON

THE PROJECT

FOR

IMPROVEMENT OF PUMP DRAINAGE IN POVERTY DISTRICT

IN JAKARTA

MARCH 2004

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIPPON KOEI CO., LTD.

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Pump Drainage in Poverty District in Jakarta and entrusted the study to the Japan International Cooperation Agency (JICA)

JICA sent to Indonesia a study team from December 14, 2003 to January 7, 2004 and from February 15 to 21, 2004.

The team held discussions with the officials concerned of the Government of Indonesia, and conducted a field survey at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the teams.

March, 2004

Kunimitsu Yoshinaga

Vice-President
Japan International Cooperation Agency

March, 2004

LETTER OF TRANSMITTAL

We are pleased to submit to you the basic design study report on the Project for Improvement of Pump Drainage in Poverty District in Jakarta in the Republic of Indonesia.

This study was conducted by Nippon Koei Co., Ltd. under a contract to JICA during the period from December 2003 to March 2004. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Indonesia and formulated the most appropriate basic design for the project under the Japan's grant aid scheme.

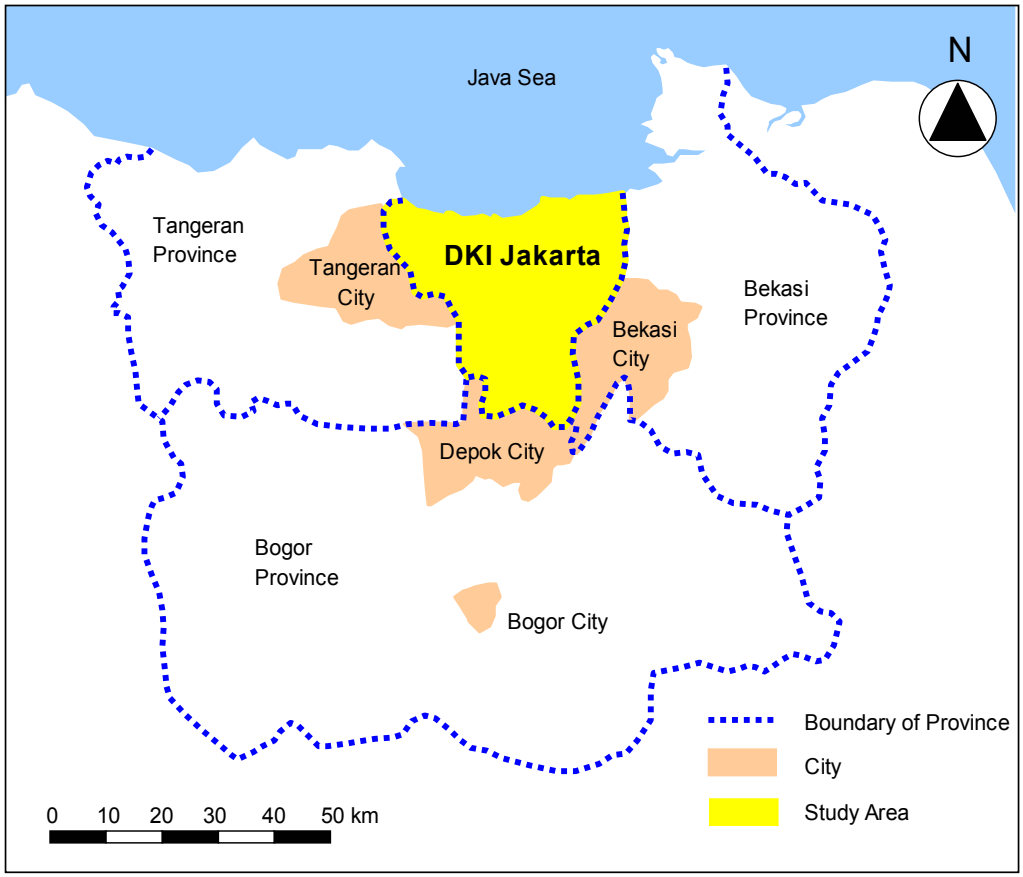
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Masanobu Sakamoto

Chief Consultant,
Basic Design Study Team on the Project for Improvement of Pump Drainage in Poverty District in Jakarta
Nippon Koei Co., Ltd.

Location of Indonesia and Jakarta



DKI Jakarta and Neighboring Region (JABODETABEK)

Location Map

Abbreviations

AC	Alternating Current
A/P	Authorization of Payment
B/A	Banking Arrangement
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Agancy)
CILCIS	Ciliwung-Cisadane River Basin Development Project
CPSU	Central Program Supporting Unit
DC	Direct Current
DGWR	Directorate General of Water Resource, Ministry of Settlement and Regional Infrastructure
DKI Jakarta	Daerah Khusus Ibukota Jakarta (Special Region of Capital City Jakarta)
E/N	Exchange of Note
E/S	Engineering Service
GDP	Gross Domestic Product
GRDP	Gross Regional Domestic Product
GOI	Government of Indonesia
GOJ	Government of Japan
KIMPRASWIL	Permukiman dan Prasarana Wilayah (Ministry of Settlement and Regional Infrastructure
IMF	International Monetary Fund
JABOTABEK	Jakarta-Bogor-Tangeran-Bekasi
JABODETABEK	Jakarta-Bogor-Depok-Tangeran-Bekasi
JBIC	Japan Bank for International Cooperation
JEM	Japan Electric Manufacturers Association
JICA	Japan International Cooperation Agency
LNG	Liquid Natural Gas
M/M	Man-Month
O&M	Operation and Maintenance
ODA	Official Development Assistance
PROPENAS	Program Pembangunan Nasional (Medium-term Development Strategy)
PDM	Project Design Matrix
SAPI	Special Assistance for Project Implementation
TA	Technical Assistance
TOR	Terms of Reference
WJEMP	Western Java Environmental Management Project
UHF	Ultra High Frequency

Units

Length			**Electric Measurement**		
mm	=	millimeter	V	=	volt
cm	=	centimeter	A	=	ampere
m	=	meter	Hz	=	hertz
km	=	kilometer	MHz	=	megahertz
			W	=	watt
			kW	=	kilowatt
			MOhm	=	mega ohm
Area			**Others**		
cm^2	=	square centimeter	%	=	percent
m^2	=	square meter	^oC	=	degree Celsius
ha	=	hectare	HB	=	Brinell hardness
km^2	=	square kilometer			
Volume			**Derived Measures**		
m^3	=	cubic meter	VA	=	volt ampere
			kVA	=	kilovolt ampere
			N/mm^2	=	Newton per millimeter
			kg/cm^2	=	kilogram per square centimeter
			AH	=	Ampere Hour
Weight					
mg	=	milligram			
g	=	gram			
kg	=	kilogram			
t	=	tons			
Force					
N	=	Newton			
kN	=	kilo Newton			
Times as denominator					
/sec	=	per second			
/min	=	per minute			
/day	=	per day			

Currency

JPY	Japanese Yen
US$	US Dollar
Rp	Indonesian Rupiah

Exchange Rate as of the end of January 2004
1 US$ = Rp 8,407.4 = JPY 111.19

Summary

The Republic of Indonesia prepared the National Development Program (PROPENAS 2000-2004), which proposes a settlement infrastructure development program aiming at enhancing construction of infrastructure in urban and rural settlements and improvement of the operation and maintenance of the infrastructure. The development of infrastructure for flood control and urban drainage is recognized as one of the important subjects in the program.

In the city of Jakarta, the infrastructures for urban drainage are not sufficiently developed for the growth of the city. The living environment in the city has worsened seriously due to the habitual inundation. There are 78 areas prone to habitual flooding and inundation in the city of Jakarta. Of these, 55 areas suffer mainly from the inundation due to difficulty of inland rainwater drainage and 30 areas out of 55 areas belong to poverty districts. In the areas prone to inundation, the rainwater drainage system ('sub-macro' and 'micro' drainage) composed of trunk rainwater drains, branches, and ditches is not satisfactorily provided at all. In particular, there is no proper drainage development in the poverty districts as a whole.

In order to improve the current situation, the Government of Indonesia introduced Indonesian-made mobile pumps after the serious flooding/inundation in 2002 and initiated the emergency operation of the mobile pumps at the habitual inundation areas suffering from difficulties with rainwater drainage. However, emergency drainage operations were only carried out in 13 areas out of all the habitual inundation areas in the city of Jakarta in 2003. The present number of mobile pumps is insufficient for the inundation areas scattered throughout Jakarta. In addition, the operating efficiency of existing mobile pumps is not sufficient for emergency alleviation of rainwater inundation because of the limitations in their mobility.

The Government of Indonesia plans to continue and strengthen the emergency drainage operation using mobile pumps in the habitual inundation areas until the implementation of flood control and urban drainage works including the Ciliwung floodway, Cisadane river improvement and West Banjir Canal attains a sufficient level of development. To cope with the present problems and alleviate the frequent inundation taking place in Jakarta, the Government of Indonesia made a request to the Government of Japan for

grant aid to procure high-efficiency and easily operated mobile pumps for rainwater drainage in the habitual inundation areas, including poverty districts in Jakarta.

In response to a request from the Government of the Republic of Indonesia, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Pump Drainage in Poverty District in Jakarta (the Study) and entrusted the Study to the Japan International Cooperation Agency (JICA). JICA sent a study team to Indonesia from December 14, 2003 to January 7, 2004. The team held discussions with the officials concerned in the Government of Indonesia, and conducted a field survey of the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia from February 15 to 21 in 2004 in order to discuss a draft basic design, and as a result of this, the basic design of the project was accepted by the Government of Indonesia.

At the time of the request for the Japanese Grant Aid, the Indonesian side originally planned 20 units of the mobile handy pumps to carry out emergency drainage operations for 41 areas out of 78 habitual inundation areas. When the Study was initiated, the Indonesian side proposed nine project areas for studying the emergency drainage operation using mobile handy pumps. The nine project areas selected by the Indonesian side were reviewed from the viewpoints of 1) inundation depth in 2002, 2) causes of inundation, 3) existence of poverty districts, 4) influence of land subsidence, and 5) condition of drainage systems. As a result, the need for emergency drainage operations in the nine project areas was confirmed. Through the discussions during the initial stage of the Study, it was agreed that the site survey and planning of the emergency drainage operations would be conducted for these areas.

Project Areas Proposed by Indonesian Side

No.	Region	Name of Project Area	Drainage Area (ha)	Inundation Area (ha)	Population
1	North Jakarta	Lagoa Buntu	16.3	5.1	1,585
2	West Jakarta	Cengkareng	15.8	7.1	1,429
3	North Jakarta	Teluk Gong	23.4	9.6	1,236
4	North Jakarta	Pluit	28.6	8.7	1,120
5	West Jakarta	Kapuk Kedaung	20.0	6.0	1,207
6	West Jakarta	Rawa Buaya	21.6	4.5	490
7	West Jakarta	Pesing	4.1	1.2	109
8	Central Jakarta	Karang Anyar	6.1	1.5	921
9	Central Jakarta	Jati Pinggir	22.8	5.3	2,117
		Total	158.7	49.0	10,214

An equipment plan for emergency drainage operations for the nine project areas was studied on the basis of individual drainage characteristics and suitable drainage methods for these areas in order to propose appropriate specifications and quantities of equipment. As drainage systems have not been developed in the project areas, an alternative of small scale pumping stations that should be planned in combination with development of drainage systems are not suitable for the purpose of emergency drainage operations in the project areas. For the equipment plan relating to emergency operations, the alternative pump equipment, i.e. mobile handy pumps, requested by the Indonesian side along with the trailer-type mobile pumps presently available in Indonesia, were taken into consideration.

The Study was carried out to enable the preparation of a plan for emergency drainage operations for alleviating inundation caused by stagnant rainwater runoff every year in the poverty districts located in the low-lying land. However, the Study did not cover measures against widespread flooding and inundation occurring once in several years.

In the city of Jakarta, probable daily rainfall occurring at least once in a year was estimated at 35 mm. Most of this rainfall concentrates within a short time and causes inundation. In the project areas, all of the rainwater runoff concentrates into the inundation area within two to six hours from the beginning of rainfall. As rainwater drainage systems do not function at all in the project areas, inundation occurs due to the rainwater runoff concentrating within such a short period and it is unavoidable even in the case of probable 1-year rainfall. In addition, the neighboring rivers keep high water levels due to the rainfall in the upper basins during the rainy season. Therefore, the project areas are likely to suffer from prolonged inundation due to the difficulty in discharging inundation water into the neighboring rivers.

The purpose of the emergency drainage operation is to clear the inundated condition in the project areas as early as possible. The design drainage volume for each project area was therefore computed on the basis of the probable 1-year daily rainfall. Based on the characteristics of tropical rainstorm and rainwater runoff as well as rainfall occurring almost every day during the wet season in the city of Jakarta, a plan for emergency drainage operation was considered on the condition that the emergency drainage operation should be carried out within 24 hours from identification of inundation occurrence to the end of drainage pumping at the site.

The required number of mobile handy pump units was based on the unit capacity (5 m^3/min×2 nos. = 10 m^3/min), the time for pumping the design drainage volume (= inundation water volume), and the time for installation and removal of equipment at the site. To resolve inundation within a day (24 hours) in a project area, the drainage operation time at the site will need to be within 20 hours after deduction of mobilization time to site (4 hours). The drainage operation time at the site is equivalent to the sum of the time for pumping and the time for installation and removal of equipment at pumping points in a project area.

The required number of mobile handy pumps for each project area was obtained as below. For the areas No. 7 and No. 8, the required drainage operation time is relatively short. It is therefore proposed that these two areas be covered by one unit. For areas No. 5 and No.6, two pump equipment units are required for each with due consideration of the characteristics of the drainage system that drains rainwater through an outlet channel crossing a dike or trunk road. It is therefore proposed that a trailer-type mobile pump is installed at the downstream end of the drainage area and a mobile handy pump is used for draining inside the drainage area in both cases.

Required Number of Pump Equipment Units

No.	Name of Project Area	Drainage Area (ha)	Design Drainage Volume (m^3)	Drainage Operation Time by One Unit (hours)	Required Number of Pump Equipment Units	
					Mobile Handy Pump	Trailer-type Mobile Pump
1	Lagoa Buntu	16.3	5,705	18	1	0
2	Cengkareng	15.8	5,530	17	1	0
3	Teluk Gong	23.4	8,190	23	2	0
4	Pluit	28.6	10,010	33	2	0
5	Kapuk Kedaung	20.0	7,000	18	1	1
6	Rawa Buaya	21.6	7,560	19	1	1
7	Pesing	4.1	1,435	3	1	0
8	Karang Anyar	6.1	2,135	8		
9	Jati Pinggir	22.8	7,980	23	2	0
				Total	11	2

Note: (Design Drainage Volume) = (Extent of Project Area)×（Probable 1-year Daily Rainfall)
The required number of units is one for an operation time within 20 hours and two for an equivalent single unit operation time over 20 hours.

Finally, it was concluded that a total number of 13 units, consisting of 11 units of mobile handy pump and 2 units of trailer-type mobile pump, should be procured under the project. Within the project, the responsibility of the Japanese side will cover the procurement of equipment as listed below. The responsibility of the Indonesian side will be the provision of suction pits required for pumping using the mobile handy pump.

Summary of Equipment to be Procured

Equipment	Major Components	Q'ty
Mobile Handy Pump Units	Drainage Pump Package (containing submergible handy pump, control panel, drainage hoses and other accessories), Diesel Generator, and Cargo Truck	11 units
Trailer-type Mobile Pump Units	Submergible Pump, Diesel Generator, and Trailer	2 units
Spare Parts	Provided to replace parts consumed for two years, assuming that operation hours of the equipment would be 200 hours per year.	1 lot
Operation and Maintenance Equipment	Tools for dismantling the handy pump, tools for checking electric parts of the equipment, other required tools for repairing the equipment, tools and instruments for improving the performance of the existing workshop.	1 lot

An implementation schedule for the project was prepared in accordance with the procedures of Japan's Grant Aid. The procurement will be implemented during the 11 months after the Exchange of Note (E/N), consisting of three months for detailed design and tendering procedures, and eight months for procedures involving the supplier's contract, manufacturing, equipment combination tests, transportation, final inspection and taking-over, and operators' training.

The project cost is estimated at 337 million yen in total, including the cost by the Japanese side of 336 million yen and the cost by the Indonesian side of 1 million yen, respectively.

The project will be implemented and operated as an element of flood fighting activities in the city of Jakarta. The Ministry of Settlement and Regional Infrastructure (KIMPRASWIL) is the responsible agency for the project and the Ciliwung-Cisadane River Basin Development Project (CILCIS) is the executing agency under KIMPRASWIL. The flood control and coastal protection division of CILCIS is a main division responsible for the site works of the emergency drainage operation. 105 technical staff of CILCIS will be trained for emergency drainage operations by the proposed equipment supplier.

With implementation of the project, an emergency drainage operation will be in place in the selected nine areas, including poverty districts, where emergency drainage operations have not been previously implemented. The objective of the project is to improve drainage conditions in the habitual inundation areas, including poverty districts, in the city of Jakarta. This objective will be achieved by means of shortening the time duration of inundation by provision of emergency drainage operations earlier and improvement of the living environment for 10,200 people in the nine project areas through early clearance

of inundation. Operation and maintenance of the proposed equipment can be undertaken by the Indonesian side within their financial and technical capability. Accordingly, the project implementation under Japan's Grant Aid scheme is justified.

In addition, the following issues should be fully taken into consideration for smooth implementation and effective performance of the project.

1) The Ciliwung-Cisadane River Basin Development Project should continue further efforts for strengthening the emergency drainage operation by implementing proper operation and maintenance for existing and proposed equipment in order to maintain sustainability of emergency drainage operations in the city of Jakarta.

2) Provision of suction pits for mobile handy pumps and securing required spaces for installation of trailer-type mobile pumps under the obligations of the Indonesian side should be completed before taking over the proposed equipment.

3) The Ministry of Settlement and Regional Infrastructure and the Municipality of DKI Jakarta should coordinate their emergency drainage operation by close communication with each other to identify locations of their mobile pumps in operation on a real-time basis.

4) Monitoring records of emergency drainage operations should be done to clarify the effects of the project and continuously improve operational performance into the future.

Basic Design Study Report
on
the Project for Improvement of Pump Drainage in Poverty District in Jakarta

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CHAPTER 1

BACKGROUND OF THE PROJECT

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BACKGROUND OF THE PROJECT

The city of Jakarta (DKI Jakarta), the capital of Indonesia, is located in the north west of Java Island. The area of the city is 672 km^2 and it is densely populated. The population of the city is 7.5 million and the population density represents 11,000 persons/km^2.

In the city of Jakarta, flooding due to congestion of rainwater drainage takes place frequently in January and February during the rainy season. Frequent inundation causes public nuisances such as heavy traffic jams created by flooding of roads and deterioration of the living environment due to flooding of houses. In particular, damage in poverty districts is a serious problem. Many poverty districts are located in low-lying areas alongside rivers or ponds and in topographically depressed areas that are prone to drainage congestion. Such low-lying lands are seriously affected by inundation causing not only damage inside houses but also a threat to human lives.

In January and February 2002, the city of Jakarta experienced prolonged and widespread flooding/inundation causing enormous damage. A maximum inundation depth of 4 m occurred, 60 people were killed and the living environment in poverty districts deteriorated very badly due to the prolonged inundation for more than 45 days.

The Government of Indonesia introduced Indonesian-made mobile pumps after the serious flooding/inundation in 2002 and initiated an emergency drainage operation at habitually inundated areas suffering from difficulties with rainwater drainage. However, the present number of mobile pumps is insufficient for the inundation areas scattered throughout Jakarta. In addition, the operating efficiency of existing mobile pumps is not sufficient for alleviation of emergent rainwater inundation because of the limitations in their mobility.

The Government of Indonesia plans to continue and strengthen the emergency drainage operation using mobile pumps in the habitual inundation areas until the implementation of flood control and urban drainage is sufficiently developed. To cope with the present problems and alleviate the frequent inundation taking place in Jakarta, the Government of Indonesia made a request to the Government of Japan for grant aid to procure high-efficiency and easily operated mobile pumps for rainwater drainage in the habitually inundated areas including poverty districts in Jakarta.

CHAPTER 2

CONTENTS OF THE PROJECT

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2-1 Basic Concept of the Project

The Republic of Indonesia prepared the National Development Program (PROPENAS 2000-2004), which proposes a settlement infrastructure development program aiming at enhancing construction of infrastructure in urban and rural settlements and improvement of the operation and maintenance of the infrastructure. The development of infrastructure for flood control and urban drainage is recognized as one of the important subjects in the program.

In the city of Jakarta, the infrastructures for urban drainage are not sufficiently developed for the growth of the city. The living environment in the city has worsened seriously due to the habitual inundation. The low-lying lands in the city are prone to widespread inundation because of topographic difficulty with rainwater drainage. In addition, the flow capacity of the rivers flowing into the city is not sufficient to cope with flood runoff increasing with development in the upstream basins. Accordingly, the city suffers from both flooding of rivers and rainwater inundation in the low-lying lands. Risks of flooding and inundation have been increasing with the expansion of densely populated urban areas in the city.

There are 78 areas prone to habitual flooding and inundation in the city of Jakarta. Of these, 55 areas suffer mainly from the inundation due to difficulty of inland rainwater drainage and 30 areas out of 55 areas belong to poverty districts. In the areas prone to inundation, the rainwater drainage system (‘sub-macro’ and ‘micro’ drainage) composed of trunk rainwater drains, branches, and ditches is not provided at all satisfactorily. In particular, there is no proper drainage development in the poverty districts as a whole. In the city of Jakarta, the principal rivers and drainage channels (‘river’ and ‘major’ drainage) should be improved in advance against large scale flooding causing widespread damage. However, improvement works in the habitual flooding and inundation areas are delayed due to social and financial constraints and the individual drainage systems remain unimproved at present.

In order to improve the current situation, the Government of Indonesia introduced Indonesian-made mobile pumps after the serious flooding/inundation in 2002 and initiated an emergency drainage operation with the mobile pumps in the habitual

inundation areas suffering from difficulties with rainwater drainage. However, the emergency drainage operation was only carried out in 13 areas out of all the habitual inundation areas in the city of Jakarta in 2003. The Government of Indonesia plans to continue and strengthen the emergency drainage operation with mobile pumps in the habitual inundation areas until the implementation of flood control and urban drainage works including the Ciliwung floodway, Cisadane river improvement and West Banjir Canal attains a sufficient level of development.

The objective of the project is to improve living and sanitary conditions in the habitual inundation areas, including poverty districts, through alleviation of frequent inundation. To meet this objective it is expected that they will improve the efficiency of the operation by introducing high-efficiency and easily operated mobile pumps. As a conclusion of the basic design study (the Study), the procurement of eleven (11) units of the mobile handy pump and two (2) units of the trailer-type mobile pump under Japan's Grant Aid, is proposed in order to carry out emergency drainage operations in the nine (9) project areas (population 10,200 in 2002) in the city of Jakarta.

A Project Design Matrix (PDM) of the Study is shown in Table 2.1.

Table 2.1 Project Design Matrix (PDM)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal Living environment in 78 habitual inundation areas are improved through alleviation of frequent inundation.	a) Rainwater drainage facilities are developed. b) Frequency of inundation is decreased. c) Economic loss by inundation is decreased. d) Occurrences of diseases relevant to inundation are decreased.	a) Monitoring at site after project implementation b) Monitoring for organizations in charge of flood control and urban drainage and residents concerned c) Official statistics	a) Measures against inundation are further implemented continuously in the city of Jakarta.
Project Purpose Inundation water is drained satisfactorily by emergency drainage operation in the project areas.	a) Mobile pumps are dispatched at every inundation event. b) Emergency drainage operations are carried out according to work plan.	a) Monitoring for the project implementation agency	a) Flood control and drainage facilities for wider catchments are operated properly.
Outputs a) Emergency drainage operations are initiated in the project areas. b) Duration (days) of inundation is decreased. c) Time taken for preparation of pumping at site is shortened. d) Living environment of residents is improved. e) Pump drainage services are expected for the habitual inundation areas including poverty districts other than the project area.	a) Events of emergency drainage operation increase. b) Frequent inundation occurring every year is resolved within one (1) day. c) Existing mobile pumps are utilized for functionally suitable usage. d) Duration of inundation above floor level is shortened.	a) Operation records of mobile pumps b) Rainfall records c) Inundation level records d) Interviews with residents in the habitual inundation areas including districts with poverty	a) Discharge site for pumping is ensured (no significant change in river/channel due to relocation or reclamation). b) Access to site is ensured (no significant factor constraining access to site such as large scale development).
Activities **GOJ** a) Procurement of Equipment • Mobile Handy Pump Unit • Trailer-type Mobile Pump Unit • Operation and Maintenance Equipment b) Training for operation and maintenance of mobile handy pump unit **GOI** a) Operation and maintenance for procured equipment b) Provision of drainage pit for pumping by procured equipment	**Inputs** **GOJ** Human Resources a) Assistance for procurement (Consultant) 4.32 M/M b) Training (Supplier) 0.83 M/M Equipment a) Mobile handy pump units b) Trailer-type mobile pumps c) Operation and maintenance equipment	**GOI** Human Resources a) Pump operators (105 persons) Facilities a) Drainage pit for pumping	a) Budget arrangement for operation and maintenance by the project implementation agency is ensured b) Organization for operation and maintenance is properly established. c) Trained operators are not alternated or resigned. **Preconditions** a) Emergency drainage operation is sustained as the responsibility of the project implementation agency.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Concept

At the time of the request for the Japanese Grant Aid, the Indonesian side originally planned 20 units of the mobile handy pumps to carry out an emergency drainage operation for 41 areas out of 78 habitual inundation areas. These areas suffer from rainwater inundation that has difficulty in discharging to the river by gravity. A list of 78 habitual inundation areas in the city of Jakarta is attached in Annex 5-1.

When the Study was initiated, the Indonesian side proposed nine (9) project areas for studying the emergency drainage operation using mobile handy pumps as shown in Figure 2.1. Through the discussions during the initial stage of the Study, it was agreed that site survey and planning of the emergency drainage operation would be conducted for these nine areas. The estimated inundation areas in the nine project areas are shown in Annex 5-5.

The nine project areas selected by the Indonesian side were reviewed from the following viewpoints:

1) Inundation depth in 2002
2) Causes of inundation (flooding of river or rainwater inundation)
3) Existence of poverty in the district
4) Influence of land subsidence
5) Condition of drainage system

As a result, as shown in Table 2.2, the need for the emergency drainage operation in the nine project areas was confirmed. An equipment plan for the emergency drainage operation for the nine project areas was studied on the basis of individual drainage characteristics and suitable drainage methods for these areas in order to propose appropriate specifications and quantities of equipment.

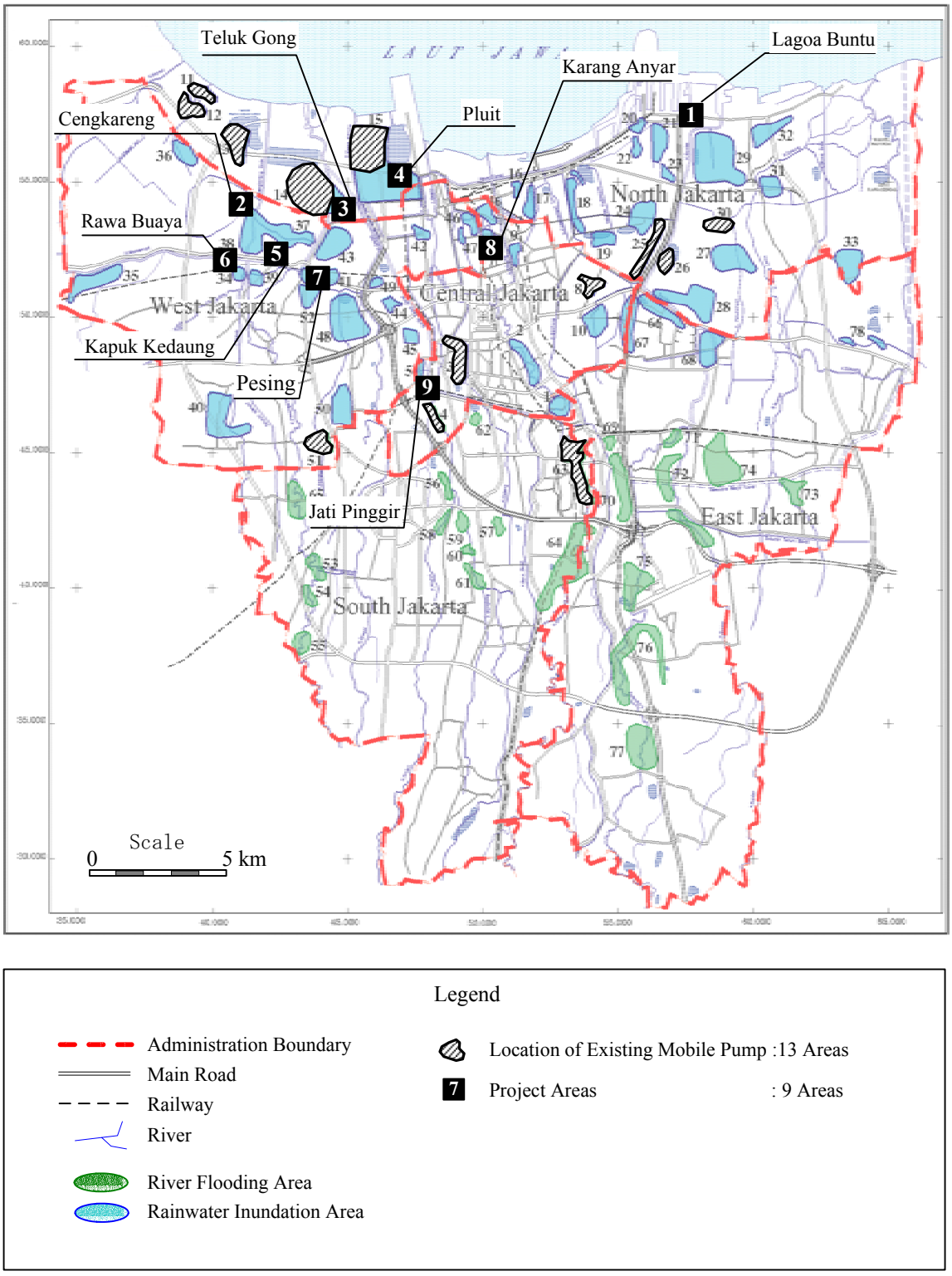


Figure 2.1 Locations of 78 Habitual Inundation Areas, Proposed 9 Project Areas, and 13 Operation Areas of Existing Mobile Pumps in 2003

Table 2.2 Evaluation of Nine Project Areas Proposed by Indonesian Side

Area			Inundation depth in 2002 (cm)	Major cause of inundation	Poverty in district	Land subsidence	Condition of drainage system
North Jakarta	1	Lagoa Buntu	40	Rainwater runoff	Exists	30～40 cm	Deteriorated, not functioning
West Jakarta	2	Cengkareng	125	Rainwater runoff	Exists	30～50 cm	Not developed
North Jakarta	3	Teluk Gong	100	Rainwater runoff	Exists	40～60 cm	Deteriorated, not functioning
North Jakarta	4	Pluit	50	Rainwater runoff	Exists	40～50 cm	Deteriorated, not functioning
West Jakarta	5	Kapuk Kedaung	160	Rainwater runoff	Exists	50～80 cm	Deteriorated, not functioning
West Jakarta	6	Rawa Buaya	150	Rainwater runoff	Exists	70～90 cm	Deteriorated, not functioning
West Jakarta	7	Pesing	100	Rainwater runoff	Exists	60～70 cm	Not developed
Central Jakarta	8	Karang Anyar	50	Rainwater runoff	Exists	50～60 cm	Deteriorated, not functioning
Central Jakarta	9	Jati Pinggir	200	Rainwater runoff	Exists	20～30 cm	Deteriorated, not functioning

Notes: Land consolidation data from the Study on Comprehensive River Water Management Plan in JABOTABEK (JICA, 1997).

2-2-1-2 Natural Conditions

In the low-lying land in the city of Jakarta, there are a number of polder-formed areas, which are topographically depressed areas resulting from uncontrolled development into the low-lying land and land subsidence. The majority of the poverty districts in the city of Jakarta are formed on such areas. The Study was carried out to prepare a plan of an emergency drainage operation for alleviating inundation caused every year by stagnant rainwater in the poverty districts located in the low-lying land. However, the Study did not cover measures against widespread flooding and inundation occurring once in several years.

Based on the characteristics of tropical rainstorm and rainwater runoff as well as rainfall occurring almost every day during the wet season in the city of Jakarta, a plan of emergency drainage operation was prepared. The condition considered was that the emergency drainage operation in a project area should be carried out within 24 hours from identification of inundation occurrence to the end of drainage pumping at the site. It takes at least four hours from the identification of inundation occurrence to the arrival of a pumping vehicle to initiate pumping at the site. Therefore, the time period for pumping should be within 20 hours. After pumping, the pumping vehicle takes precautions in case of heavy rainfall the next day. The proposed plan for the emergency drainage operation is shown in Table 2.3.

Table 2.3 Operation Plan for Emergency Drainage Operation

Operation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1	2
Report of Occurrence of Inundation	▽																									
Preparetion of Pumping Operaion	↔																									
Despatching Pumping Vehicle		▽																								
Arrival at Site			▽																							
Start Pumping				▽																						
Pumping					→																			→		
Precaution																									↔	

As the project targets the habitual inundation areas and the emergency drainage operation should be done within 24 hours, the design drainage volume was estimated on the basis of rainfall occurring at least once in a year (probable 1-year daily rainfall).

In general, duration of rainfall causing inundation in the city of Jakarta continues between one to four hours and most of the rainfall in a day is concentrated within this time period. The extent of the individual project areas is less than 30 ha and the time of rainwater runoff discharging into the downstream end is estimated within a range of one to two hours. Therefore, all of the rainwater runoff concentrates into the inundation area within two to six hours from the beginning of rainfall.

The rainwater drainage system does not function at all in the project areas. As a result, inundation occurs due to the rainwater runoff being concentrated within a short period. Such inundation is unavoidable, even in the case of probable 1-year rainfall. In addition, the neighboring rivers keep high water levels due to the rainfall in the upper basins during the rainy season. Therefore, the project areas are likely to suffer from prolonged inundation due to the difficulty in discharging inundation water into the neighboring rivers.

The project for emergency drainage operation is to resolve the inundated condition in the project areas as early as possible. The design drainage volume for each project area is computed on the basis of the probable 1-year daily rainfall on the assumption that the amount of runoff caused by the daily rainfall becomes stagnant totally within the estimated inundation area of each project area. This amount of runoff (= the amount of inundation water) is regarded as equivalent to the design drainage volume. The design drainage volumes for the probable 2 and 5-year rainfalls have also been computed for reference as shown in Table 2.4.

Table 2.4 Computation of Design Drainage Volume (1/2)

Area		Proposed by CILCIS			Analysis Result						
		Inundated area (ha)	Depth (cm)	Inundation water volume (m^3)	Ground elevation (m)	Inundation depth in 2002 (cm)	Drainage area (ha)	Inundation area (ha)	Rainfall (mm/day)	Inundation water volume (m^3)	Depth (cm)
1	Lagoa Buntu	3.0	10	3,000	1.2～2.0	40	4.8	1.7	35	1,680	18
		2.0	10	2,000			4.7	1.9	35	1,645	7
		3.0	10	3,000			6.8	1.5	35	2,380	20
2	Cenkareng	4.0	30	12,000	1.3～3.0	125	11.7	4.3	35	4,095	14
							4.1	2.8	35	1,435	11
3	Teluk Gong	16.0	30	48,000	0.9～2.5	100	23.4	9.6	35	8,190	22
4	Pluit	6.0	20	12,000	0.2～0.5	50	28.6	8.7	35	10,010	22
5	Kapuk Kedaung	5.0	30	15,000	1.0～2.5	160	20.0	6.0	35	7,000	25
6	Rawa Buaya	12.0	50	60,000	1.8～4.2	150	21.6	4.5	35	7,560	27
7	Pesing	2.0	20	4,000	2.0～2.7	100	4.1	1.2	35	1,435	20
8	Karang Anyar	2.0	10	2,000	1.7～2.0	50	6.1	1.5	35	2,135	33
9	Jati Pinggir	8.0	30	24,000	6.0～10.0	200	22.8	5.3	35	7,980	21
	TOTAL	63.0	－	－	－	－	－	49.0	－	－	

Table 2.4 Computation of Design Drainage Volume (2/2)

Area		Analysis Result												
		Ground elevation (m)	Inundation depth in 2002 (cm)	Drainage area (ha)	Inundation area (ha)	Rainfall (mm)			Inundation water volume (m^3)			Inundation depth (cm)		
						1 year	2 years	5 years	1 year	2 years	5 years	1 year	2 years	5 years
1	Lagoa Buntu	1.2～2.0	40	4.8	1.7	35	98	135	1,680	4,704	6,480	18	50	69
				4.7	1.9	35	98	135	1,645	4,606	6,345	7	21	28
				6.8	1.5	35	98	135	2,380	6,664	9,180	20	56	77
2	Cenkareng	1.3～3.0	125	11.7	4.3	35	98	135	4,095	11,466	15,795	14	40	55
				4.1	2.8	35	98	135	1,435	4,018	5,535	11	30	41
3	Teluk Gong	0.9～2.5	100	23.4	9.6	35	98	135	8,190	22,932	31,590	22	61	84
4	Pluit	0.2～0.5	50	28.6	8.7	35	98	135	10,010	28,028	38,610	22	61	84
5	Kapuk Kedaung	1.0～2.5	160	20.0	6.0	35	98	135	7,000	19,600	27,000	25	70	97
6	Rawa Buaya	1.8～4.2	150	21.6	4.5	35	98	135	7,560	21,168	29,160	27	77	106
7	Pesing	2.0～2.7	100	4.1	1.2	35	98	135	1,435	4,018	5,535	20	55	75
8	Karang Anyar	1.8～2.0	50	6.1	1.5	35	98	135	2,135	5,978	8,235	33	92	127
9	Jati Pinggir	6.0～10.0	30	22.8	5.3	35	98	135	7,980	22,344	30,780	21	58	80
	TOTAL	－	－	－	49.0	－	－	－	－	－	－	－	－	－

2-2-1-3 Social and Economic Conditions

The population of the poverty districts in the city of Jakarta is estimated about 290,000 and almost half of that population lives in North Jakarta and West Jakarta where the low-lying lands are prone to habitual inundation. In line with uncontrolled urbanization, the poverty districts have been densely housed as a whole. The living conditions are unfavorable due to stagnant wastewater directly discharged into drainage ditches along narrow footpaths in the densely housed area. Once inundation occurs with heavy rainfall, the wastewater overflows together with rainwater runoff and inundates the surfaces of footpaths as well as the floors of houses.

The nine project areas belong to the poverty districts as described above. Rainwater drainage systems have not been provided or do not function at all without proper maintenance for a long period. Therefore, the project areas are prone to rainwater inundation that easily takes place and is prolonged due to the poor drainage conditions.

In consideration of such conditions in these poverty districts, the type and specifications of pump equipment suitable for the emergency drainage operation needed to be carefully studied. The type and specifications of pump equipment was studied in line with the pumping operation conditions consisting of site access conditions and selection of pumping points coupled with discharging points in the densely housed area. In addition, potential mechanical damage is anticipated due to the inundation water containing solid waste and wastewater. Mechanical durability of the pump equipment itself and protection measures against solid waste and wastewater have also been taken into consideration to determine the specifications of pump equipment.

2-2-1-4 Procurement Conditions

The basic components of existing mobile pump facilities are pump and accessories including drainage pipes, diesel generator (or engine), and cargo truck (or trailer). All of the components are produced or assembled in Indonesia.

Meanwhile, the equipment requested by the Indonesian side consists of a drainage pump package composed of small-size and light-weight submergible

pumps and accessories including light-weighted hoses, diesel generators, and cargo trucks. Of these, the drainage pump package is not available in Indonesia but diesel generators and cargo trucks, both imported and locally made, can be procured in Indonesia if the specifications are suitable for the combination with the drainage pump package.

In consideration of the procurement conditions above, the procurement plan was prepared on the basis of the following principles:

1) Local products or imported products prevailing in the local market are primarily selected if quality and delivery times for the product are acceptable.

2) Products to be imported are procured from Japan or other countries and are selected through comparative studies on price of product, appropriateness for operation and maintenance after taking-over, availability of local agent for after-sales services, price of spare parts, etc.

2-2-1-5 Operation and Maintenance by Project Implementation Agency

The Directorate General of Water Resources (DGWR) under the Ministry of Settlement and Regional Infrastructure (KIMPRASWIL) will supervise the project and the office of the Ciliwung-Cisadane River Basin Development Project (CILCIS) will be the project implementing agency responsible for implementation, operation and maintenance of the project.

KIMPRASWIL has a guideline of emergency procedures for flood fighting in DKI Jakarta (Pedman Siaga Banjir DKI Jakarta). According to this guideline, KIMPRASWIL and the municipality of DKI Jakarta coordinate the procedures for precautions and emergency activities against flood. In addition, CILCIS has been operating the existing mobile pumps since 2002. The required budget for the operation and maintenance of the existing mobile pumps has been arranged to cope with the situations of flooding each year. From the present management status by KIMPRASWIL and CILCIS, basic organizational arrangements have already been attained to manage operation and maintenance for the emergency drainage operation.

The equipment plan for the project was prepared in consideration of a number of equipment alternatives and specifications appropriate for the organizational and financial arrangements by the Indonesian side.

2-2-1-6 Type and Specifications for Equipment

As drainage systems have not been developed in the project areas, an alternative of small scale pumping stations that should be planned in combination with development of drainage systems are not suitable for the purpose of emergency drainage operations in the project areas. For the equipment plan relating to emergency operations, the alternative pump equipment, i.e. mobile handy pumps, requested by the Indonesian side along with the trailer-type mobile pumps presently available in Indonesia, were taken into consideration.

The trailer-type mobile pump is mobilized and temporarily fixed on site during the rainy season. It was observed that this operation method is already employed at several sites in the city of Jakarta because the existing pump equipment takes a long time for installation on site.

The mobile handy pump is manually portable. From a location accessible by cargo truck, a pumping point can be selected flexibly. When a discharge point is available within the distance reachable by extending the drainage hoses, the pumping point is selected within the distance equivalent to the length of power supply cable extending from the diesel generator mounted on the cargo truck and connecting with the portable pump. With this flexibility in selecting the pumping point, it can be selected not only at the downstream end of a drainage area but also at locally inundated locations inside a drainage area (refer to Figure 2.2 and 2.3).

The trailer-type mobile pump is utilized as a semi permanent facility and is suitable for pumping at the downstream end of a drainage area where rainwater runoff concentrates through the drainage system. However, the proposed nine project areas are densely housed and undeveloped as a whole. In most cases, it may be hard to install the trailer-type mobile pump at the downstream end due to the unfavorable access conditions and difficulties in finding an installation space in the densely housed area (refer to Figure 2.4).

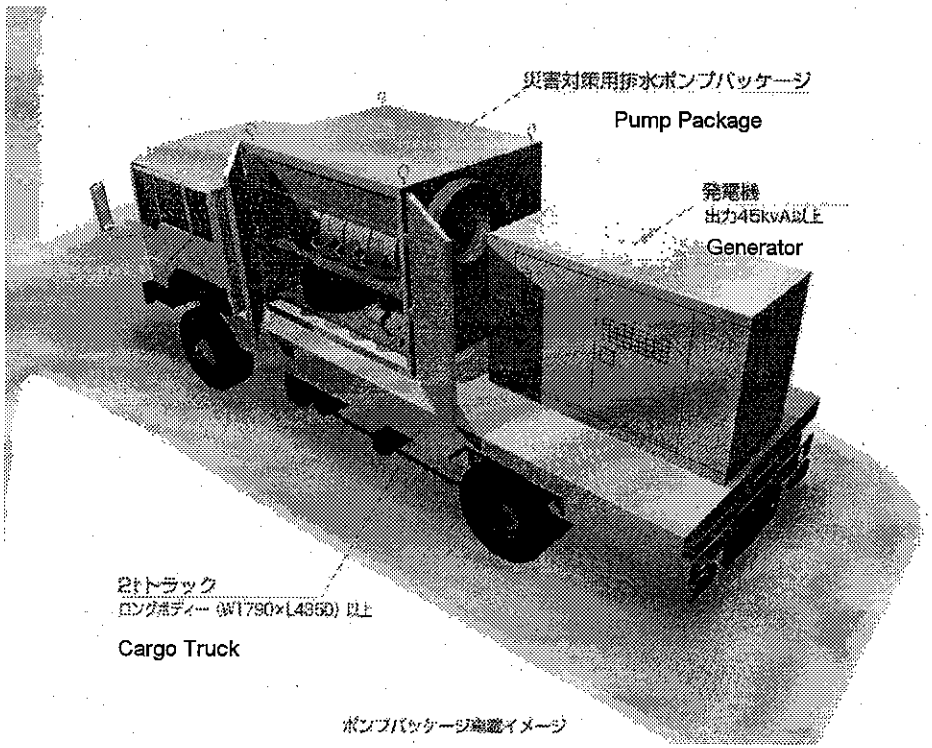
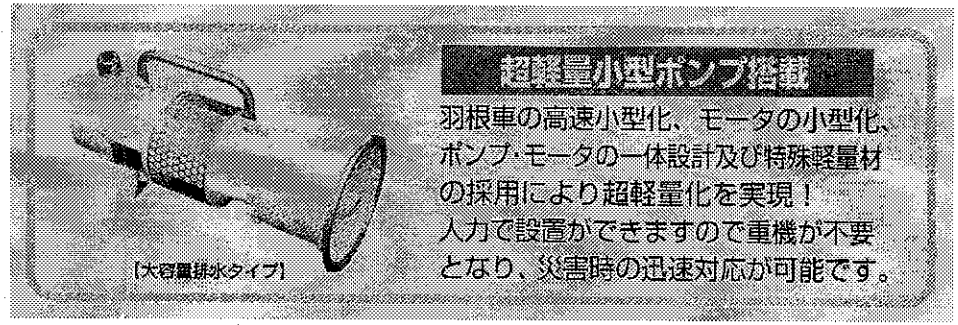


Image of Mobile Handy Pump Unit
(For Standard Spacifications)



Handy Pump (Submergible Pump, High Capacity Model)

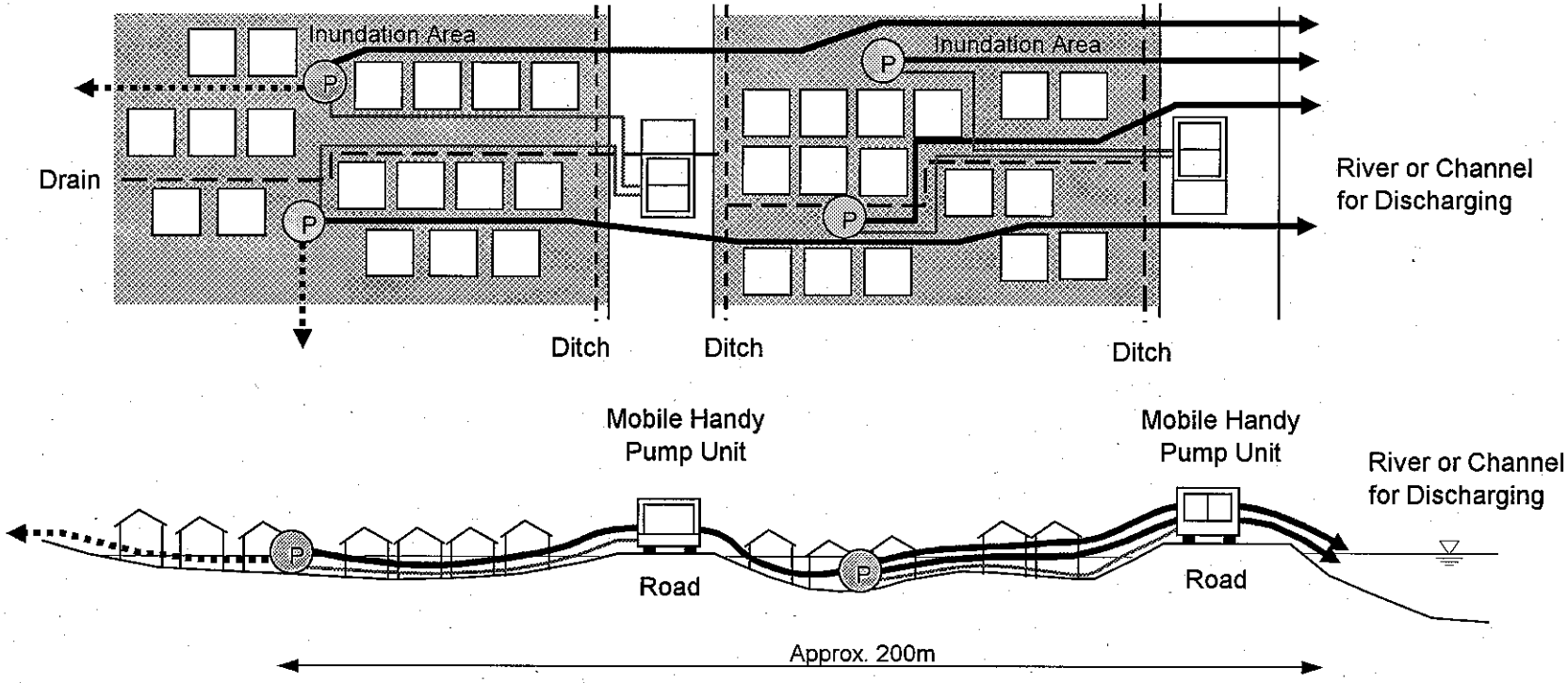
Handy Pump is smaller-sized and light-weighted. Weight of a pump is 25 to 30 kg for portable by manpower.

One unit of pump package contains two handy pumps. A capacity of one pump is 5 m^3/min. One Mobile Handy Pump Unit has a capacity of 10 m^3/min = 5 m^3/min x 2 pumps.

A standard length of drainage hose is 40m. The total length of drainage hose is extended practically up to 200m.

Source: Drainage Pump Package for Emergency Operation (Association of Pump System Engineering)

Figure 2.2 Image of Mobile Handy Pump Unit



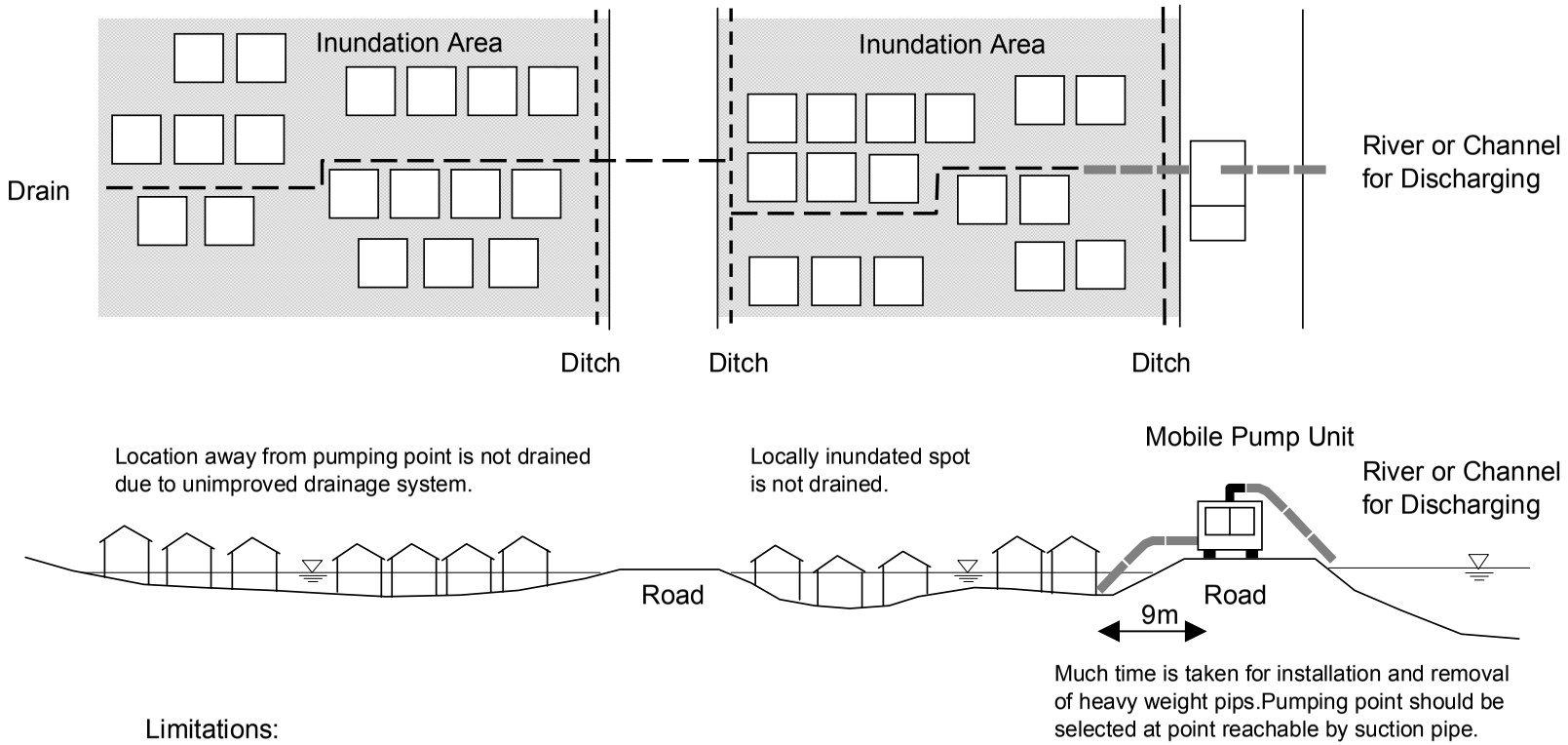
Expected Advantage:

1. Pump is portable by manpower. From a location accessible by the cargo truck, pumping points can be selected flexibly.

2. Time taken for installation and removal at site is much shorter than existing mobile pump. Pumping can be done at several points by moving cargo truk.

3. Pumping can be brought into narrow path in desely housed area from cargo truk parking on road. Locally inundated spot in densely housed area can be drained.

Figure 2.3 Expected Advantage of Mobile Handy Pump for Emergency Drainage Operation



Limitations:

1. Suction side requires pipes made of steel or hard rubber. Extension of pipe connection is practically 9m. Pumping point should be selected at point reachable by suction pipe.

2. Weight of a piece of pipe made of hard rubber is some 100kg. Much time is taken for installation and removal of pipes at site. Mobile pump is therefore temporarily fixed at site during the rainy season.

3. Drainage system in densely housed poverty district is deteriorated and does not function during heavy rain. Location away from substantially fixed pumping point is not drained due to unimproved drainage system.

4. Road accessible to inside densely housed poverty district is limited. Locally inundated spot is not drained due to the limitation of drainage distance.

Figure 2.4 Limitations of Existing Mobile Pump Unit

2-2-1-7 Project Implementation Schedule

An implementation schedule for the project was prepared in accordance with the procedures of Japan's Grant Aid. The procurement will be implemented during the 11 months after the Exchange of Note (E/N), consisting of three months for detailed design and tendering procedures, and eight months for procedures involving supplier's contract, manufacturing, equipment combination tests, transportation, final inspection and taking-over, and operators' training.

2-2-2 Basic Plan

2-2-2-1 Pump Drainage Plan

When the mobile handy pump is adopted for the project areas, pumping points are selected at: 1) a location just beside the road accessible by cargo truck and 2) a location able to be reached by extension of the power supply cable from the parking place of the cargo truck. Such points should be selected on the condition that a discharge point is available from the pumping point within the maximum extension of the drainage hose (refer to Annex 5-5).

The length of discharge hose and power supply cable were planned in consideration of the required length depending on the site conditions in the project areas as follows:

1) Length of drainage hose: in principle maximum length of 200m
2) Length of power supply cable: in principle maximum length of 140m

These are regarded as practical maximum lengths for the drainage hose and power supply cable in view of installation and removal works at the site. However, a longer drainage hose is required when no discharge point is available within the above length. In this case, more extension is allowed as far as technically possible.

In selecting pumping points in each project area, the following conditions were also taken into consideration:

1) The downstream end of a drainage area is selected as a pumping point in principle.
2) Pumping points are selected as much as possible in consideration of deteriorated drainage systems.
3) Existing drains that are sufficiently sized are utilized as suction pits for pumping. Provision of a suction pit may be required when such existing drains are not available.
4) Power supply cables and drainage hoses are extended through roads or footpaths that are at least passable by walking.

2-2-2-2 Required Number of Pump Equipment Units

To study the required number of units of pump equipment, it was assumed at first that each project area would be drained by one mobile handy pump. Several pumping points were planned within a project area in consideration of accessibility by cargo truck, distance from parking point of cargo truck and pumping point, and distance from pumping point to discharge point.

In the process of the study, it was identified that the trailer-type mobile pump could be applicable at two project areas in combination with the requested mobile handy pump.

Of the nine project areas, the area No. 5 needs the drainage crossing the trunk road (Daan Mogot Road). It is not practical to cross such a trunk road with much traffic using drainage hoses extending from the portable pump operated inside of the drainage area. One pumping point is therefore required at the downstream end of the existing underground culvert crossing the trunk road. One pump should be operated at this pumping point throughout the time period of the emergency drainage operation for area No. 5 because this point is the only discharging outlet from the drainage area to the river. Accordingly, one pump is always in operation at the outlet of the culvert during an emergency drainage operation and another pump is operated at the pumping points within the drainage area for draining inundation water through the existing drains connecting with the culvert.

From the operational concept in area No.5 as discussed above, the mobile handy pump is not necessarily required at the downstream end. It is proposed that a

trailer-type mobile pump is installed at the downstream end and a mobile handy pump is used for draining inside area No. 5.

In area No.6, the western part of the inundation area is a significant distance from the discharge point to the Cengkareng Drain. For draining the western part of the inundation area, the emergency drainage operation should be done in the vicinity of this inundation area in order to discharge the inundation water to the existing drain along the railway. Therefore, one pump should go in the vicinity of this area and another pump should be operated at the downstream end of the existing drain at the same time.

From the operational concept in area No.6 as discussed above, it is proposed that the downstream end of the existing drain is a fixed pumping point throughout the period of an emergency drainage operation. This fixed pumping point is suitable for installation of a trailer-type mobile pump. At the same time, a mobile handy pump should be operated at the other pumping points inside area No.6.

The required number of mobile handy pump units was based on the unit capacity (5 m^3/min $\times$ 2 nos. = 10 m^3/min), time for pumping the design drainage volume (= inundation water volume), and time for installation and removal of equipment on site. To resolve inundation within a day (24 hours) in a project area, the operation time on site will be within 20 hours after deduction of mobilization time to site (4 hours). The drainage operation time at the site is equivalent to the sum of the time for pumping and the time for installation and removal of equipment at pumping points in a project area. The drainage operation time at the site for each project area has been estimated as shown in Table 2.5. The required number of units is one for an operation time within 20 hours and two for a “one pump” operation time over 20 hours.

Table 2.5 Drainage Operation Time and Required Number of Mobile Handy Pump Unit

Project Area	Design Drainage Volume (m^3)	Total of Time for Pumping by One Unit (hours)	Total of Time for Installation and Removal (hours)	Drainage Operation Time with One Unit (hours)	Required Number of Units
1	5,705	10	8	18	1
2	5,530	9	8	17	1
3	8,190	14	9	23	2
4	10,010	17	16	33	2
5	7,000	12	6	18	1
6	7,560	13	6	19	1
7	1,435	2	1	3	1
8	2,135	4	4	8	1
9	7,980	13	10	23	2
				Total	12

Note: (Design Drainage Volume)
= (Extent of Project Area)× (Probable 1-year Daily Rainfall)

As seen in Table 2.5, the areas No. 7 and No. 8 indicate short operation times. It is therefore proposed that these areas can be covered by one unit in the basic plan. In addition, one unit of the trailer-type mobile pump each is proposed for the areas No.5 and No.6 as discussed above.

Finally, the total number of 13 units, consisting of 11 units of mobile handy pump and 2 units of trailer-type mobile pump, will be required for the nine project areas as shown in Table 2.6. The locations of the project areas and corresponding number of the pump equipment units are shown in Figure 2.5.

Table 2.6 Required Number of Pump Equipment

Project Area	Mobile Handy Pump Units	Trailer-Type Pump Units	Total
1	1	0	1
2	1	0	1
3	2	0	2
4	2	0	2
5	1	1	2
6	1	1	2
7	1	0	1
8		0	
9	2	0	2
Total	11	2	13

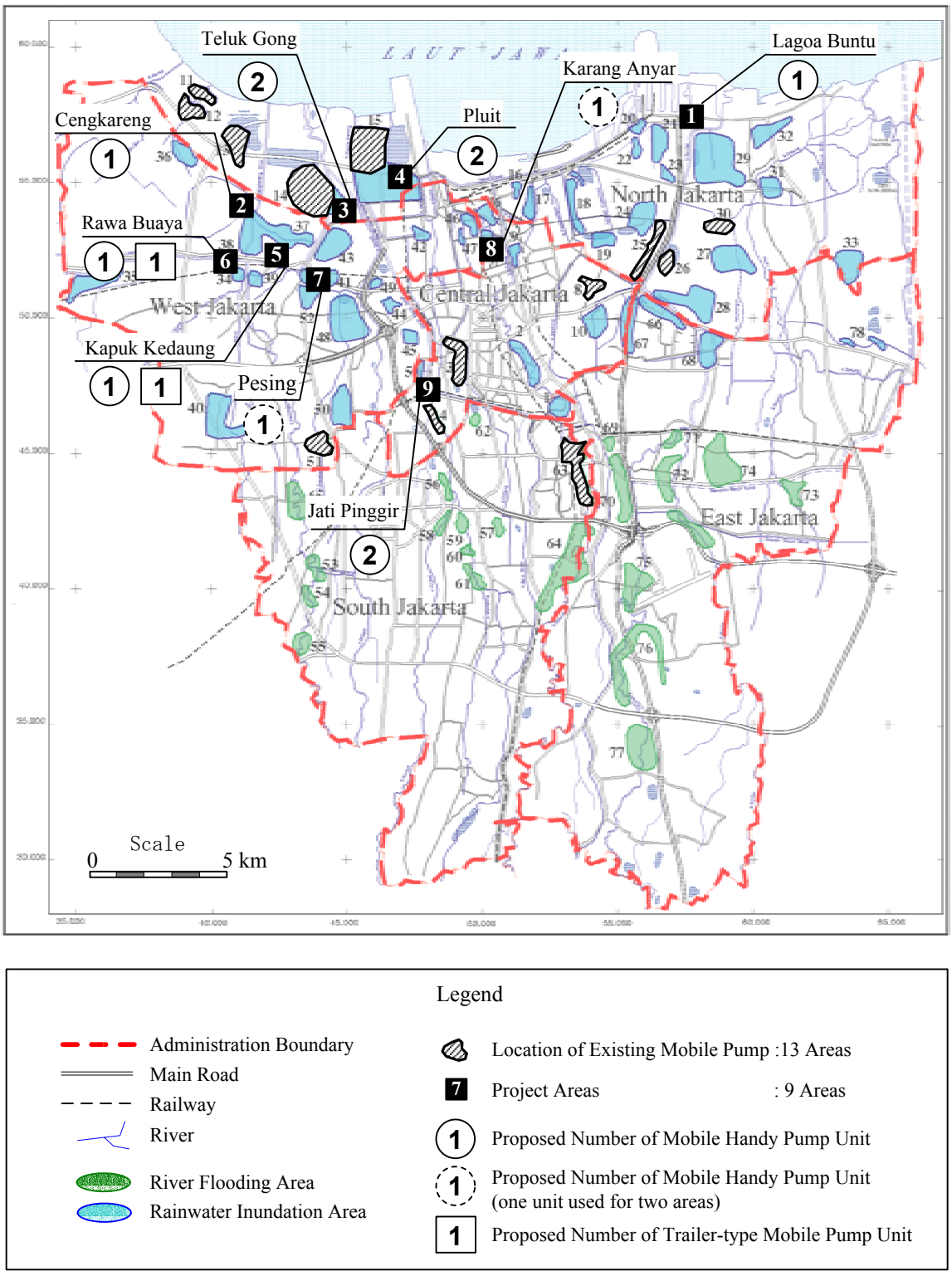


Figure 2.5 Proposed Locations of Mobile Handy Pumps and Trailer-type Mobile Pumps

2-2-2-3 Equipment Plan

(1) Mobile Handy Pump Unit

1) Components of Unit

The mobile handy pump unit comprises a drainage pump package (consisting of small-size and light-weight submergible pump, control panel and accessories), diesel generator and cargo truck.

Table 2.7 Components of Mobile Handy Pump Unit

Component	Principal Specifications	Unit	No.
1. Drainage Pump Package		Unit	11
(1) Small-size, Light-weight Submergible Pump	Total Head: 10m Capacity: 5 m^3/min×2 sets Power Supply Cable: 40m×2 sets		
(2) Light-weight Hose	200m（25m×8 nos.）× 2 sets		
(3) Power Supply Cable for Extension	100m×2 sets		
2. Diesel Generator	Type: Low Noise Type Output: 45kVA Phase: 3-phase (4-core) Frequency：60Hz Voltage: 220V (Allowable Equivalent Reverse Current: Over 15%)	Unit	11
3. Cargo Truck	Type of Engine: Water-cooled Diesel Engine Seat: 3-seater Load: 3-ton	Unit	11

2) Submergible Pump

For portability of pumping for emergency drainage operation, a light-weight submergible pump has been developed. This kind of submergible pump weighs less than 25 kg with a total head of 10m and capacity of 5 m^3/min.

Table 2.8 Comparison of Submergible Pump

Item	Usual Type	Handy Type
Capacity (m^3/min)	5	5
Total Head (m)	10	10
Weight (kg)	420	25
Method of Installation	By Crane	By Manpower
Mobility	Less	Excellent

In this type of submergible pump, the pump casing and motor frame are made of aluminum alloy in order to be light-weight. Alloy of aluminum has a fair tensile strength compared with cast iron (FC200) used for the usual type of submergible pump but it is relatively weak with respect to abrasion due to the lower hardness.

In the project areas, it is necessary to drain inundation water containing high concentrations of suspended sediment causing abrasion of the pump casing. From this viewpoint, part of the pump casing adjacent to the impeller needs to be designed and made of stainless steel. However, provision of a casing liner removable for repair is also applicable as an alternative measure against abrasion.

Table 2.9 Comparison of Pump Casing Material

Item	Usual Type	Handy Type
Material	Cast Iron FC200	Alloy of Aluminum AC4CH
Tensile Strength (N/mm^2)	200	165
Hardness（HB）	223	55

Note: AC4CH: Material used for wheels of vehicles, fittings for transmission power cable, parts of air craft engines, parts of oil pressure machinery, etc.

3) Control Panel

For pumping operation at high temperatures, the control panel is required to protect against excessive internal temperatures. The control measures are provision of a cooling fan and a cover plate with heat insulation. The electric circuit of the control panel follows the standard specifications in Japan but the power supply for a floodlight needs to provide a voltage suitable for lights available in Indonesia.

4) Drainage Hose

The light-weight drainage hose (diameter 200mm) developed with the submergible pump weighs half that of usual vinyl hose and has the appropriate physical strength as shown in Table 2.10. The unit length of the hose is 25m movable by hand and up to 200m (25m×8 nos.) is provided for each drainage pump package according to the operation plan for the site.

Table 2.10 Comparison of Hose Material

Item	Usual Hose	Light-weight Hose
Weight: 25m length with fittings (kg)	53.5	27.5
Fiber Material	Polyester	Polyester
Coating Material	Vinyl Chloride	Polymer Alloy
Internal Diameter (mm)	204	207
Standard Thickness (mm)	2.4	1.5
Pressure Tolerance Test for Straight (kg/cm^2)*1	7.3	7.0
Pressure Tolerance Test for Bend (kg/cm^2)*2	4.1	8.4
Damage Tolerance Test (kg/cm^2)*3	5.7	4.9
Fire Hose Abrasion Test (times)*4	231	322
V-shape Dragging Abrasion Test (m)*5	29	31

Note: *1 Tolerance pressure for straight condition of hose
*2 Tolerance pressure for bend condition of hose
*3 Burst pressure with 10mm dia. hole in hose
*4 Times of test until leak from hose detected
*5 Dragged distance on asphalt surface until leak from hose detected

5) Power Supply Cable for Submergible Pump

The standard length of the power supply cable is 40m. For extension of the power supply cable, an additional 100m is provided for each submergible pump, together with a cable reel with casters.

6) Diesel Generator

It is necessary to consider the allowable equivalent reverse current for selecting a diesel generator. Japanese generators are manufactured in accordance with the Japan Electric Manufacturers Association (JEM) specification, which gives a rate of allowable equivalent reverse current of 15%. The capacity of the

required generator for pump equipment is calculated using the following equations:

(Required Capacity of Generator)
= (Equivalent Reverse Current) / (Allowable Equivalent Current)

(Allowable Equivalent Reverse Current)
= (Pump Capacity) × (High Frequency Current)

From the above, the required capacity of generator is computed at 45 kVA. However, the Indonesian products are manufactured on the basis of a different standard that gives a rate of allowable equivalent reverse current of 5%. Therefore, the required capacity of generator becomes 125 kVA. This generator is much heavier than a 45 kVA generator. From the economic viewpoint, the larger generator is not favoured because of the fuel consumption and need of a larger cargo truck.

7) Cargo Truck

A long-body truck with a loading capacity of 3-ton is required for transporting the weight of 2,600 kg of the drainage pump package and diesel generator. A set of radio equipment is provided for the truck to enable communication with the office of CILCIS during an emergency drainage operation. The radio equipment keeps the same frequency as the existing ones used by CILCIS. A warning lamp, siren and speaker are also provided.

(2) Trailer-type Mobile Pump Unit

The submergible pump is suitable for site installation. A unit consists of diesel generator, submergible pumps, and crane mounted on a trailer.

Table 2.11 Components of Trailer-type Mobile Pump Unit

Equipment	Specifications	Unit	No.
Trailer-type Mobile Pump Unit (Submergible Pump Type)		Unit	2
(1) Submergible Pump	Capacity: 3.5m^3/min. (Head 6m)×3 nos. Power Supply Cable: 25m×3 nos.		
(2) Generator	Type: Diesel Generator Output: 80kVA Phase: 3-phase Frequency: 50Hz Voltage: 380V		
(3) Spiral Hose	DN200×15m×3 nos.		
(4) Trailer	4-wheel		

(3) Spare Parts

Operating hours of the proposed equipment are estimated at 200 hours per year. Based on the operating hours, spare parts are provided to replace parts consumed for two years.

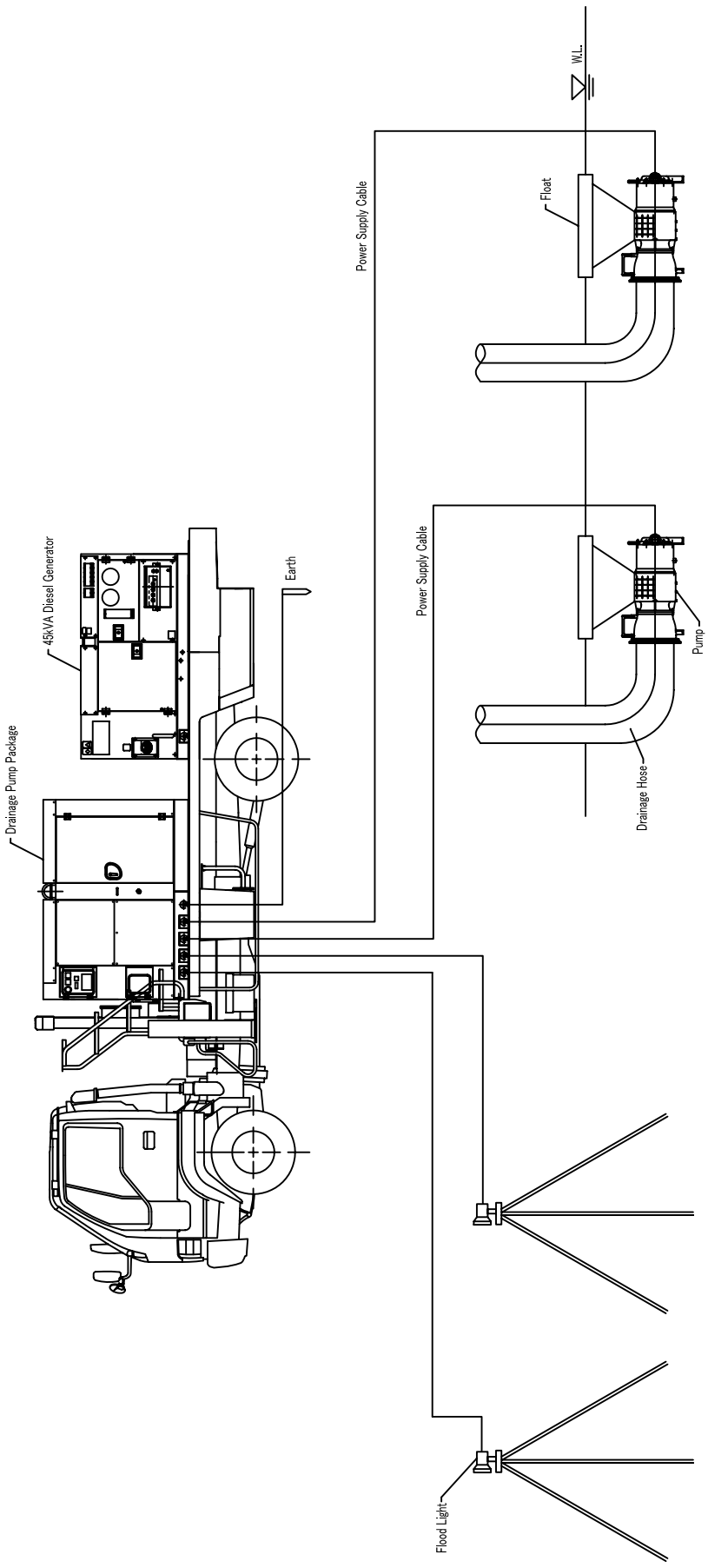
(4) Operation and Maintenance Equipment

The operation and maintenance equipment covers tools for disassembling the handy pump, electric tester and non-conductance (resistivity) ohmmeter for checking electric parts of the equipment and other required tools for repairing the equipment. In addition, tools and instruments for improving the performance of the existing workshop are also included in the operation and maintenance equipment.

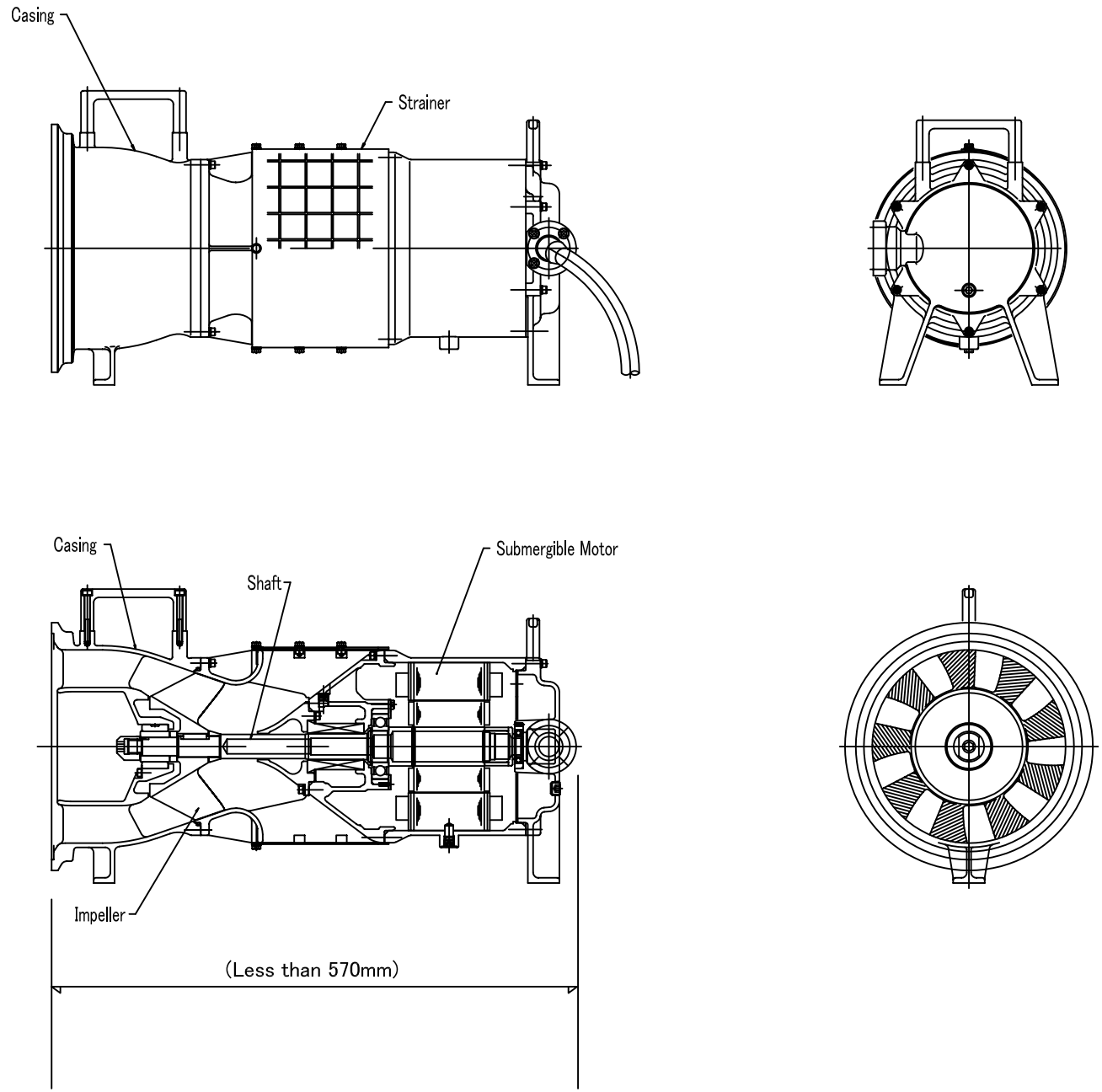
Table 2.12 Operation and Maintenance Equipment

	Item	Specifications	Q'ty
1	Spanner Set	Open ended, ring, max. 41mm, tool box	3 sets
2	Hydraulic Jack	3.5-ton	2 units
3	Chain Block	3-ton	1 unit
4	Chain Block	1.5-ton	3 units
5	Box Spanner	Both ended box spanner, hexagonal, 37mm	10 units
6	Electric Grinder	Disc diameter 100mm	2 units
7	Disc for Electric Grinder	Disc diameter 100mm, for item 6	100 pcs.
8	Electric Drilling Machine	Vertical shaft, drill diameter max. 20mm	2 units
9	Drill Bit	Drill diameter 0.5 to 20mm	4 sets
10	Engine Pump	Bore 50mm	5 units
11	Vinyl Hose	Diameter 50mm x 10m	5 sets
12	Spiral Hose	Diameter 50mm x 10m	5 sets
13	Spiral Hose	Diameter 150mm x 6m	20 sets
14	Spiral Hose	Diameter 200mm x 4m	24 sets
15	Spiral Hose	Diameter 300mm x 4m	36 sets
16	Battery Charger	Input: AC220-240V, 250VA, Output: DC6V & 12V, 10A	2 sets
17	Battery	DC12V, 100AH	18 units
18	Steel Wire Rope	Diameter 10mm	100m
19	Wire Rope Clip	Diameter 10mm, for item 18	20 pcs.
20	Nylon Sling Belt	2-ton lifting capacity, length 7m	4 pcs.
21	Electric Pipe Cutting Machine	Disc diameter approx. 375mm	1 unit
22	Disc for Electric Pipe Cutting Machine	Disc diameter approx. 375mm, for item 21	20 pcs.
23	Electric Hand Drill	Drill diameter 5 to 12mm	4 units
24	Drill Bit	Drill diameter 5 to 12mm	8 sets
25	Clamp Tester	AC (A, V), DC (A, V), Ohm	2 nos.
26	Insulation Tester	1000MOhm	2 nos.
27	Torque Wrench	20kN	2 nos.

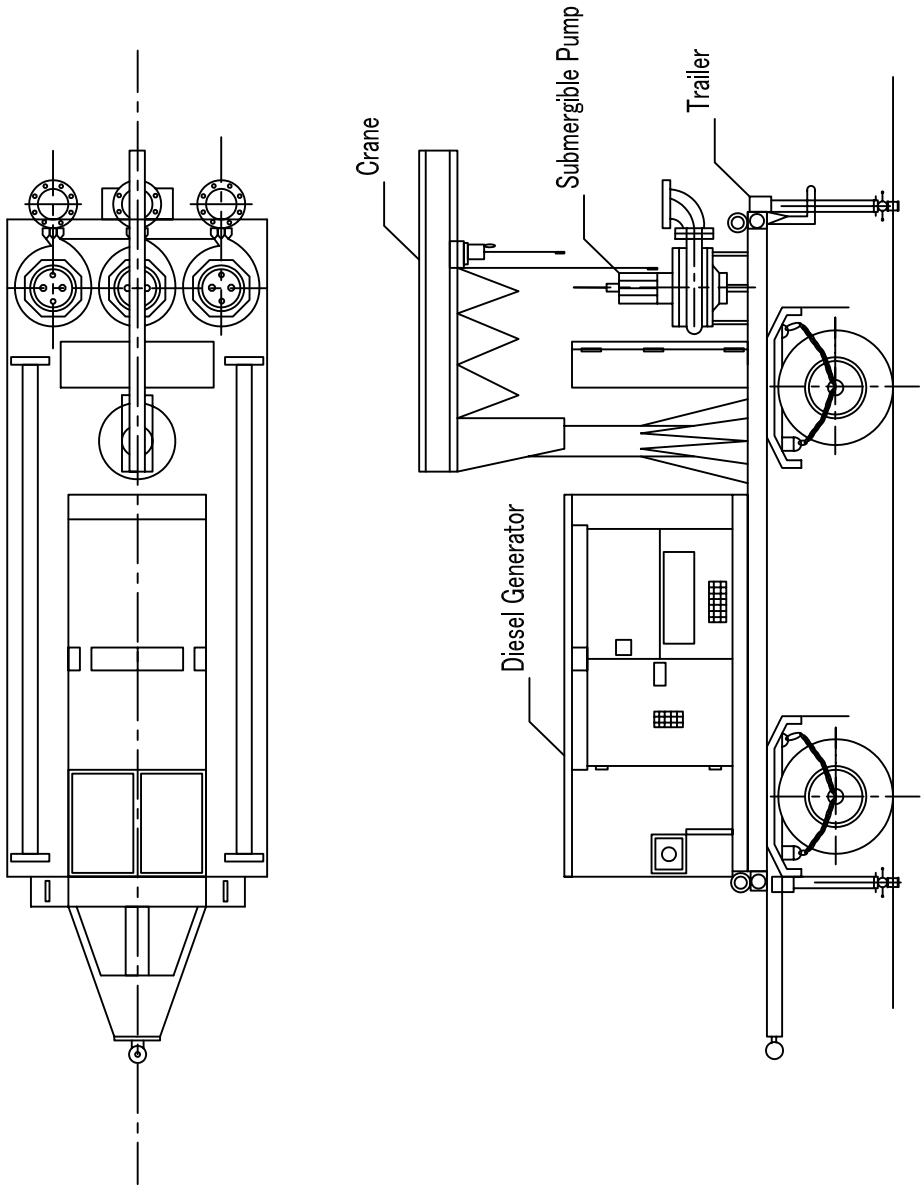
2-2-3 Basic Design Drawings



Drawing1 Mobile Handy Pump Unit



Drawing2 Handy Pump



Drawing3 Trailer–type Mobile Pump Unit

2-2-4 Procurement Plan

2-2-4-1 Implementation Policy

The objective of the project is to improve the efficiency of the emergency drainage operation using mobile pumps that is currently carried out by the Indonesian side in the city of Jakarta. In order to perform this objective, the Study proposes to procure 1) mobile handy pump units and 2) trailer type pump units under Japan's Grant Aid.

The proposed equipment comprises drainage pump units, generators, cargo trucks, spare parts, and operation & maintenance equipment for existing and proposed pump equipment. Operation and maintenance procedures for the mobile handy pump units have not yet been promulgated in Indonesia. It is therefore necessary to get a supplier to train the staff of the project implementation agency in the operation and maintenance of the mobile handy pumps.

The Ministry of Settlement and Regional Infrastructure (KIMPRASWIL) is the responsible agency for this project. CILCIS is the project implementation agency. In CILCIS, the administration division will handle the procedures of customs clearance for the equipment to be imported. The implementation division will be responsible for supervision of emergency drainage operations. The division of flood control and coastal protection project will be responsible for site operations.

The procurement country of origin for each item of the equipment was examined depending on prices, specifications, delivery period, and after-sales services.

2-2-4-2 Implementation Conditions

The scope of works of the Japanese side includes procurement of the proposed equipment, shipment to a domestic port in Indonesia, inland transportation to the CILCIS office in the city of Jakarta, rigging the equipment, and provision of training for Indonesian operators. There is no significant issue to be considered in terms of import of the equipment.

2-2-4-3 Scope of Works

(1) Japanese Side

1) Detailed design,
2) Preparation of tender documents, evaluation of bidders' tender documents and assistance to the Government of Indonesia for awarding the contract,
3) Procurement, inspection of packing and loading of equipment in Japan, shipment of equipment to Indonesia, inland transportation to the office of CILCIS,
4) Procurement of equipment in Indonesia, and inland transportation to the office of CILCIS,
5) Rigging of equipment procured in Japan and Indonesia,
6) Inspection, acceptance and handing-over of equipment to the Government of Indonesia,
7) Training of CILCIS staff for operation and maintenance of equipment, and
8) Supervision of procurement of equipment.

(2) Indonesian Side

1) Customs clearance of equipment,
2) Securing of storage for equipment in CILCIS,
3) Provision of place for rigging equipment in CILCIS, and
4) Provision of place for training of CILCIS staff.

2-2-4-4 Procurement Supervision

(1) Supervision Procedure

The Consultant will examine the necessity for revision in terms of specifications and quantities of equipment planned in the Study, through engineering review for the project areas, after an agreement for consulting services between the Government of Indonesia and a Consultant.

The Consultant will announce tendering in daily newspapers relevant to construction and economics in Japan on behalf of the Government of Indonesia. The Consultant will execute tendering procedures and support representatives of the Government of Indonesia in order to carry out the procedures smoothly.

The Consultant will confirm specifications and designs submitted by the supplier, comparing them with the contract between the Government of Indonesia and the supplier. Throughout the manufacturing of equipment, the Consultant will inspect the work periodically and in a timely manner, in order to keep the progress of the procurement on schedule.

(2) Consultant Staffing

The Consultant will consist of three engineers; namely, team leader, electrical/mechanical engineer, and procurement expert.

The team leader is responsible for supervision for preparation of agreement for consulting services, tendering and contract award for the supplier of equipment, shipment of equipment, handing-over equipment to the Government of Indonesia and preparation of required reports.

The electrical/mechanical engineer is responsible for review of the specifications and quantities in the Study, preparation of design and specification documents, review of the design and specifications submitted by the supplier, and inspection for factory tests of equipment. The procurement expert is responsible for preparation of a set of tender and contract documents.

2-2-4-5 Quality Control Plan

Quality control for equipment supply will be made by review and acceptance of design drawings, factory inspection of equipment by confirming requirements in specifications, pre-shipment inspection and post-shipment inspection at the office of CILCIS. The main inspection works are described as follows:

Factory inspection : Appearance inspection, size measurement, hydraulic test of pumps, and mechanical property tests

Pre-shipment inspection : Product inspection before packing, and packing inspection

Post-shipment inspection : Packing appearance inspection, packaging inspection for quantities.

2-2-4-6 Procurement Plan

As the proposed equipment consists of pumps and other relevant equipment, trading firms or pump manufacturers could be candidates to bid or represent bidders. There are a number of branch offices of Japanese trading firms in Indonesia. There are also several Japanese pump manufacturers with factories or agents in Indonesia. These firms can offer prompt services to cope with problems in shipment and provide services during the warranty period of one year.

The plan for equipment procurement is described as follows:

1) Mobile Handy Pumps

The mobile handy pumps with a capacity of 5 m^3/min, which is requested by the Indonesian side, were developed and manufactured in Japan. Submergible pumps with the same or similar specifications are not produced in Indonesia and other countries. Therefore, the mobile handy pumps need to be procured in Japan.

2) Trailer-type Mobile Pumps

CILCIS and the municipality of DKI Jakarta execute emergency drainage operations in the city of Jakarta at present, using the same type of drainage pumps. Therefore, it is planned that this type of pump, including spare parts, be procured in Indonesia.

3) Diesel Generator

Alternatives of diesel generators are Japanese products, Indonesian products, and another country's products (UK) available in Indonesian markets. However, the required capacity for the mobile handy pump unit varies by product. The

required capacity is 45 kVA for Japanese products. Meanwhile, Indonesian and another country's products are 125 and 90 kVA, respectively. These differences of required capacity are caused by different standards of allowable equivalent reverse current.

The mobile handy pump employs an inverter starting system. The inverter creates high frequency reverse current during the starting operation. An allowable limit capacity of the reverse current for diesel generators is 15% standardized in Japan by the Japan Electric Manufacturer's Association (JEM). On the other hand, the allowable limit capacities are one-third of the Japanese figure in Indonesia and half in another country, respectively. Therefore, Indonesian products require some three times the capacity of Japanese products for the intended use of the mobile handy pump. The capacity of another country's product should also be around double the capacity of Japanese products.

Consumption of fuel increases almost proportionally with capacity of the diesel generator. The weight of the diesel generator also becomes heavier as capacity increases. A heavier generator combined with the drainage pump package would need to be loaded on a larger cargo truck.

According to the considerations above, diesel generators in Japan, Indonesia, and another country were evaluated from the viewpoint of life cycle cost as shown in Table 2.13. As a result, it was concluded that Japanese products could be most economical in view of life cycle cost.

Table 2.13 Comparison of Life Cycle Cost of Diesel Generator

Products	Required Capacity	Required Scale of Cargo Truck	Depreciation (JPY1000)	Fuel Cost (JPY1000)	Total (JPY1000)
Japan	45 kVA	3-ton	3,674	662	4,337
Indonesia	125 kVA	4-ton	3,416	1,374	4,791
Another Country	90 kVA	4-ton	3,176	1,209	4,385

4) Cargo Truck

Prices of trucks manufactured in Japan, Indonesia and another country (Vietnam) are compared as follows:

Table 2.14 Comparison of Cargo Truck

Countries	Loading Capacity (tons)	Estimated Price (JPY1000)
Japanese	3	3,230
Indonesian	3	1,850
Another country	3	2,191

Through comparison of prices, trucks manufactured in Indonesia have advantage in price. In addition, the Indonesian trucks have other advantages in after-sales services and procurement of spare parts. On the other hand, rigging of the drainage pump package and generator on the truck is required in Indonesia but it is carried out within a short duration and does not largely affect the implementation schedule. As a result, it is proposed to procure trucks manufactured in Indonesia.

5） Operation and Maintenance Equipment

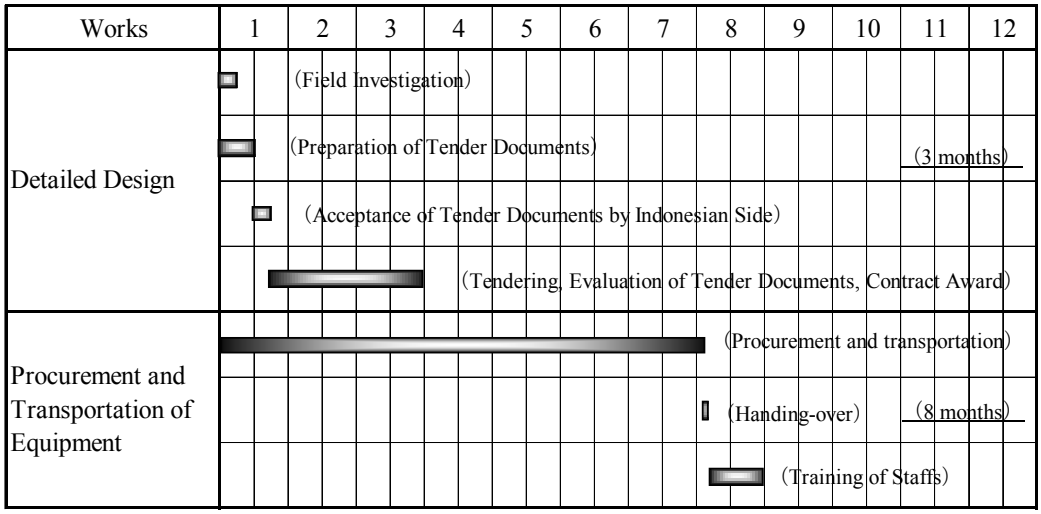
The operation and maintenance equipment such as tools for dismantling pumps, circuit testers for checking electrical equipment, insulation ohmmeters, spare parts and other equipment for improving existing pump equipment are planned for procurement. Most of the operation and maintenance equipment will be procured in Indonesia but some items not available in Indonesia will be procured in Japan.

2-2-4-7 Implementation Schedule

The implementation is expected to be completed in the following periods:

Detailed Design, Tendering, and Supplier Contract : 3 months
Procurement : 8 months

Table 2.15 Implementation Schedule



2-3 Obligations of Recipient Country

Undertakings of the Government of Indonesia are drafted as follows:

1) Accordance of Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts,
2) Opening of an account in the name of the Government of Indonesia in an authorized foreign exchange bank in Japan, and issuance of authorization of payment of the expenses of the Government of Indonesia,
3) Provision of data and information required for implementation of the project,
4) Securing of land and spaces for storing equipment,
5) Securing of required land for installing equipment,
6) Exemption of Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
7) Permission required for implementation of the project,
8) Operation and maintenance of equipment in accordance with the plan established by CILCIS,
9) Securing of assignment of staff and budget necessary for proper and effective operation and maintenance of equipment purchased under the Grant Aid,
10) Maintenance of equipment procured by the project, and
11) Payment of expenses other than those of the Government of Japan:

Required suction pits, which are necessary to maintain water depth for pump drainage, shall be prepared by the Government of Indonesia. Construction work for the pits needs little excavation and concrete work since the planned handy pump has a diameter of 200 mm and length of 500 mm to 600 mm. Therefore, the Indonesian side will be able to carry this out easily without any engineering problems.

2-4 Operation and Maintenance Plan of the Project

2-4-1 Organization for Operation and Maintenance

The Ministry of Settlement and Regional Infrastructure (KIMPRASWIL) has carried out flood fighting activities jointly with the municipality of DKI Jakarta. The emergency drainage operation using mobile pumps is an element of the flood fighting activities. KIMPRASWIL is the responsible agency for the project and Ciliwung-Cisadane River Basin Development Project (CILCIS) is the executing agency under KIMPRASWIL. These organizations as of January 27, 2004 are shown in Figure 2.6.

The total number of staff in CILCIS is 225, and licensed drivers for heavy vehicles and trained pump operators are 17 and 19, respectively. The currently employed drivers are working on a contract basis, and it is easy to increase the number of drivers as required.

Operations of the mobile handy pump unit on site are mainly 1) installation of drainage hoses, power supply cables and submergible pump, 2) operation of the control panel, and 3) removal of drainage hoses, power supply cables and submergible pump. These operations do not require special skill or knowledge and the present technical staff of CILCIS will be able to learn the operations by means of training to be provided at the time of taking over the equipment.

2-4-2 Operation and Maintenance Plan for Proposed Equipment

CILCIS organizes an inter-divisional system for the flood fighting activities in the city of Jakarta under the implementation department. The implementation department supervises the emergency drainage operation by CILCIS in coordination with the public works department of the municipality of DKI

Jakarta. The division of flood control and coastal protection project is a main division responsible for site works of the emergency drainage operation. The required number of staff for the emergency drainage operation using the proposed equipment will be at least 33 persons consisting of 11 teams of three (3) persons.

The present number of drivers is sufficient for the emergency drainage operation if all the proposed equipment is operated simultaneously. Meanwhile, the technical staff of 105 people, including 19 operators trained for existing mobile pumps, will be trained for the emergency drainage operation using the proposed equipment.

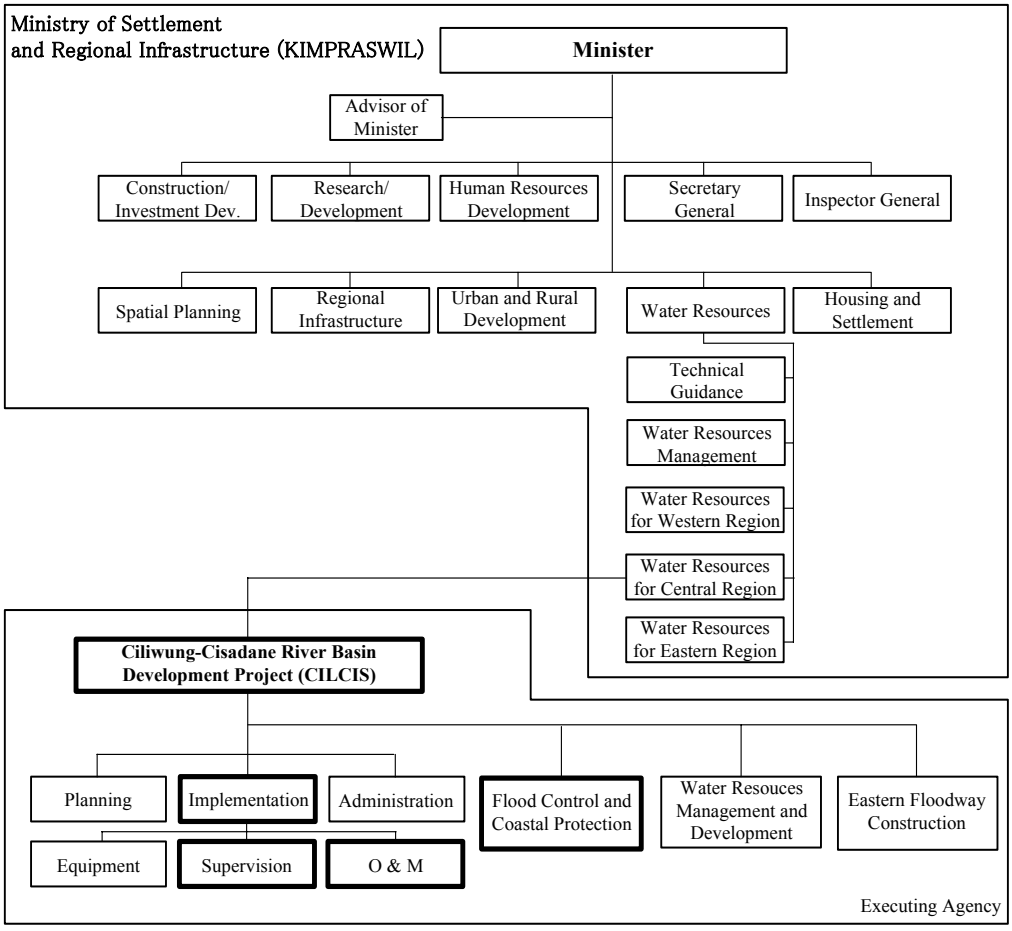


Figure 2.6 Organization Structure of Ciliwing-Cisadane River Basin Development Project

2-5 Project Cost

2-5-1 Project Cost

The project cost is 337 million yen in total on the basis of the conditions mentioned below. This cost estimate is provisional and would be further examined by the Government of Japan for the approval of a Grant.

1）Japanese Side

Table 2.16 Cost to be Paid by Japanese Government

Item		Cost (million yen)	
Equipment	Mobile Handy Pump	305	323
	Trailer-type Mobile Pump	13	
	Operation and Maintenance Equipment	5	
Engineering Services			13

2）Indonesian Side

Table 2.17 Cost to be Paid by Indonesian Government

Item		Cost	
		(million rupiah)	Equivalent Yen (million yen)
Construction	Suction Pits	107	1

3) Conditions of Cost Estimate

Time of Estimation : January 2004
Exchange Rate : 1 US$ ＝ JPY 111.19
: 1 US$ ＝ Rp 8,407.40
: 1 Rp ＝ JPY 0.0132
Procurement Period : As shown in the implementation schedule
Others : The project shall be implemented in accordance with the regulations and systems of the Japan's Grant Aid Scheme.

2-5-2 Operation and Maintenance Cost

The annual budgets for CILCIS during the five years starting in 2000 are summarized as follows:

Table 2.18 Annual Budget for CILCIS

Fiscal Year	Total Budget (Mil Rupiah)	Equivalent JPY (Mil JPY)	General Accounting Budget (Mil Rupiah)	Financial Assistance for Development (Mil Rupiah)
2000	24,975	333	9,067	15,908
2001	80,304	1,071	10,240	70,064
2002	22,678	302	15,778	6,900
2003	71,616	955	68,616	3,000
2004	37,000	493	22,000	15,000

Note: Personnel cost is counted in the budget of the Ministry.

Operation and maintenance costs for emergency drainage operations out of the annual budget are given as follows:

Table 2.19 Operation and Maintenance Cost for Pump Drainage

Fiscal Year	Total Budget (Mil Rupiah)	Equivalent JPY (Mil JPY)	O&M Cost (Mil Rupiah)	Equivalent JPY (Mil JPY)	Rate to Annual budget (%)
2000	24,975	333	1,566	21	6.3
2001	80,304	1,071	1,394	19	1.8
2002	22,678	302	2,256	30	10.0
2003	71,616	955	3,462	46	4.8
2004	37,000	493	1,097	15	3.0

Note: Personnel cost is counted in the budget of the Ministry.

The annual budget of CILCIS has been fluctuating from Rupiah 1 billion in 2004 to 3.4 billion in 2003. This fluctuation is caused by the magnitude of flood in these years. The annual budgets in 2002 and 2003 increased due to the occurrence of the large flood in 2002 and precautionary works in 2003. The incremental budget was created by reallocation of the annual budget of CILCIS. According to the staff of CILCIS in charge of budget planning, operation and maintenance costs have been requested from the Ministry, assuming 5 % of the procurement cost of equipment.

The operation and maintenance cost for the proposed equipment is estimated at Rupiah 545 million (equivalent to JPY 7 million). Comparing this with the annual budget, this amount corresponds to 0.7 to 2.4 %. It is therefore expected

that CILCIS could cover the aforesaid incremental cost for the procured equipment from the annual budget, taking into consideration the budgeting experience during the floods in 2002 and 2003.

2-6 Key Points for Project Implementation

To ensure smooth implementation of the project, the Indonesian side is requested to fulfill the following requirements.

1) To ensure staffing and financial arrangements for the project implementation as well as operation and maintenance,

2) To perform procedures for the equipment to be imported smoothly,

3) To obtain required permissions or agreements from relevant organizations for the project implementation,

4) To provide suction pits required for mobile handy pumps, and

5) To secure spaces required for installation of trailer-type mobile pumps.

CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 3
PROJECT EVALUATION AND RECOMMENDATION

3-1 Project Effect

3-1-1 Effects of Implementation of the Project and Improvements

The expected effects of implementation of the project are listed in Table 3.1.

Table 3.1 Effects of Implementation of the Project and Improvements

Current Situation and Problems	Measures for the Project	Effects and Improvements
An emergency drainage operation using mobile pumps is required until implementation of drainage system development in 78 inundation areas in Jakarta. The present coverage of emergency drainage operations is quite limited due to the insufficient number and mobility performance of existing mobile pumps. For these reasons, emergency drainage operations have not been carried out in poor districts prone to habitual inundation.	By procurement of the proposed mobile pump equipment, the emergency drainage operation will be carried out in the selected nine (9) project areas, including poverty-stricken districts, which suffer from frequent inundation.	The time duration of inundation will be shortened by emergency drainage operations in the nine project areas where emergency drainage operation has not been done. It is expected that alleviation of inundation by applying the emergency drainage operation will contribute to improvement of the living environment in the nine areas with a total population of 10,200 people.

3-1-2 Direct Effects

1) Increase of Emergency Drainage Operation Events

Emergency drainage operations will be carried out in the selected nine project areas, including poverty districts, where emergency drainage operations have not previously been done. It is expected that events involving emergency drainage operations will increase to at least nine per year (one per year for each area).

2) Time Duration of Inundation to be Shortened

In the nine project areas, the drainage system has not been developed as a whole and inundation currently continues for more than two days every year. The project will contribute to shortening the time duration of inundation to within one day.

3) Installation Time before Pumping to be Shortened

For the existing mobile pumps equivalent in capacity to the proposed mobile handy pump, it takes about six hours to install the equipment on site before pumping. The installation time for the mobile handy pump at the site is within one hour, which is five hours less than the installation time of existing mobile pumps.

3-1-3 Indirect Effects

1) The project will contribute to improvement of the living environment for 10,200 people in the nine areas through early clearance of inundation.

2) By improvement of the mobility performance of the equipment, it is expected that the emergency drainage operation will be extended over the remaining 21 inundation areas including poverty districts.

3-2 Recommendations

For smooth implementation and effective performance of the project, it is recommended that the following issues should be fully taken into consideration.

1) Strengthening of Operation and Maintenance for Emergency Drainage Operation

For implementation of the project, it is essential for CILCIS to organize the required staffing for emergency drainage operations using the proposed equipment. In addition, further efforts should be continued to conduct more efficient operation and maintenance for existing and proposed equipment in

order to maintain sustainability of emergency drainage operations in the city of Jakarta.

2) Provision of Suction Pits for Mobile Handy Pumps and Securing Required Space for Installation of Trailer-type Mobile Pumps

To initiate emergency drainage operations without any delay, these issues under the obligations of the Indonesian side should be completed before taking over the proposed equipment.

3) Strengthening of Coordination between KIMPRASWIL and Municipality of DKI Jakarta for Emergency Drainage Operations

At present, both organizations communicate with each other by means of monthly coordination meetings, a telephone communication network and radio communications for emergency drainage operation in the city of Jakarta. For further enhancement of coordination with each other, it is important that both organizations identify the locations of their mobile pumps in operation on a real-time basis. For example, a map showing current locations of mobile pumps according to radio communications with each other is useful for coordinating the emergency drainage operations.

4) Record and Monitoring of Emergency Drainage Operations

The effects of the project will be clarified by monitoring records of emergency drainage operations such as acquisition of inundation reports, time of dispatching mobile pumps, operation hours, etc. Monitoring will also be helpful for feeding back the results of emergency drainage operations, i.e. identification of problematic locations suffering from inundation with a high frequency and review of operational issues arising at sites, in order to continuously improve operational performance continuously in the future.

3-3 Project Justification

Based on the findings and results of the study, the project implementation under Japan's Grant Aid scheme is justified from the following viewpoints.

1) Emergency drainage operations will be carried out in the selected nine (9) project areas, including poor districts, where emergency drainage operations have not previously been done.

2) The objective of the project is to improve drainage conditions in the habitual inundation areas including poverty-stricken districts in the city of Jakarta. This objective will be achieved by means of shortening the time duration of inundation by provision of emergency drainage operations earlier and improvement of the living environment for 10,200 people in the nine project areas through early clearance of inundation.

3) Operation and maintenance of the proposed equipment can be undertaken by the Indonesian side within their financial and technical capability.

4) The project will contribute to the principle of the settlement infrastructure development program aiming at enhancing construction of infrastructure in urban and rural settlements and improvement of operation and maintenance of the infrastructure as outlined in PROPENAS 2000-2004 and therefore is in accord with the national development policy of Indonesia.

5) No significant negative environmental impacts due to implementation of the project are expected.

6) The project can be implemented under Japan's Grant Aid scheme without any constraints.

3-4 Conclusions

The project is justified for implementation under Japan's Grant Aid scheme from the aforementioned effects and contributions to alleviation of frequent inundation as a part of the flood fighting activities in the city of Jakarta. The Indonesian side will be able to properly organize the operation and maintenance, including staffing and financial arrangements, for the project.

In addition, the following issues should be fully taken into consideration for smooth implementation and effective performance of the project.

1) The Ciliwung-Cisadane River Basin Development Project should continue further efforts for strengthening emergency drainage operations to provide proper operation and maintenance for existing and proposed equipment in order to maintain sustainability of emergency drainage operations in the city of Jakarta.

2) Provision of suction pits for mobile handy pumps and securing required spaces for installation of trailer-type mobile pumps under the obligations of the Indonesian side should be completed before taking over the proposed equipment.

3) The Ministry of Settlement and Regional Infrastructure and the Municipality of DKI Jakarta should coordinate their emergency drainage operations with each other to identify locations of their mobile pumps in operation on a real-time basis by close communication.

4) Monitoring records of emergency drainage operations should be done to clarify the effects of the project and improve operational performance continuously into the future.