CHAPTER 1. INTRODUCTION

1.1 Purpose

The principal purpose of this guideline is to supplement the existing guidelines related to the urban drainage improvement and present standard work procedures for optimum urban drainage improvement. Major concerns of this guideline are given to the following items:

(1) Drainage improvement by a combination of "source control of flood" and "quick disposal of flood";

(2) Drainage improvement for existing built-up area;

(3) Rehabilitation of existing drainage facilities; and

(4) Supplement to other manuals and guidelines related to urban drainage improvement in Malaysia.

Explanation:

The urban drainage improvement in structural aspects could be made by a combination of (a) drainage channel improvement to increase the drainage discharge (called "quick disposal of flood") and (b) flood detention and retention to decrease the peak flood runoff discharge (called "source control of flood"). In Malaysia, the major concerns has been given to the rapid disposal of flood", while less concerns to the "source control of flood". However, the recent intensive land development tends to induce a drastic increment of the peak flood runoff discharge. As the results, the drainage channel improvement often requires a remarkable channel enlargement together with high investment cost and extensive land acquisition. Moreover, the disposal of flood from the drainage channel concentrates to the downstream river causing a serious overload of river flow and frequent overflows from the river. Under these above backgrounds, this guideline was prepared with highlight to the following items:

(1) Drainage Improvement by a Combination of "Source Control of Flood" and "Quick Disposable of Flood"

In order to retrieve the adverse effect by the drainage channel improvement, this guideline highlights the engineering on "source control of flood" by various types of flood detention and retention facility. The "source control of flood" could contribute to reduction of peak flow discharge to the downstream river. Moreover, the "source control of flood" could response directly to the increment of runoff discharge by a specific land development and therefore progressively upgrade the flood control capacity in accordance with the change of land use.

Nevertheless, the flood detention and retention facility without any drainage channel improvement could not always perform the target design drainage level due to its limited detention and/or retention capacity. Moreover, the superiority of flood detention and retention facility to drainage channel improvement will depend on some mixtures of topographic conditions, geological conditions, soil conditions, downstream river conditions and other natural and socio-economic conditions. From these viewpoints, this guideline prescribes the methodology to select the optimum drainage improvement plan as the most appropriate combination of "source control of flood" and "quick disposal of flood".

(2) Drainage Improvement for Existing Built-up Area

The drainage improvement for a densely populated area could hardly take a large scale of drainage channel improvement and/or off-site flood detention facility due to difficulties in land acquisition. One of the justifiable drainage measure will be on-site flood detention and retention by storage tank in an individual house lot and storage facility in a public open space which could avoid any extensive house relocation.

The drainage improvement is also required to a low-lying area where the ground level is lower than the flood water level of river channel or the high tidal level at the outlet point of the objective drainage area. Such drainage improvement has been conventionally made by rising of the ground level through earth filling in Malaysia. Such earth filling is applicable only to a new land development area, but not the existing build up area. Instead of rising of the ground level, the pumping drainage is often justifiable for the existing built-up area located in a low-lying area. However, the engineering guidelines and/or manuals on the pumping drainage have not prevailed well in Malaysia, and the measures have been seldom applied to urban drainage improvement in Malaysia. In due consideration of the conditions, this guideline induce several prescriptions on the on-site flood detention/ retention and pumping drainage.

(3) Rehabilitation of Existing Drainage Facilities

In line with policy of the "source control of flood", Town and Country Planning Department, Ministry of Housing and Local Government has prepared a guideline*[1-1] for construction of a flood detention pond for a new land development area of more than 10ha. In accordance with the guideline, several flood detention ponds have been constructed in Malaysia. The guideline is, however, recently made available just in the late of 1990s, and the existing engineering guideline has less prescription on maintenance/operation of the flood detention ponds, and the existing flood detention ponds are not well maintained nor operated. In this connection, one of major concerns in this guideline is addressed to the prescription on the engineering for rehabilitation of the existing flood detention ponds.

(4) Supplementary Information to the Related Guidelines and Manuals

Department of Irrigation and Drainage (DID), Ministry of Agriculture has published "Urban Drainage Design Standards and Procedures for Peninsular Malaysia"*[1-2] in 1975 and "Hydrological Procedure"*[1-3 to 1-7] in 1977. These standard and procedure prescribes the engineering criteria and procedures for urban drainage improvement. However, their major concern have been to the "rapid disposal of flood" but less concerns to the "source control of flood".

In order to retrieve such conditions, DID is now preparing "Urban Stormwater Management Manual for Malaysia". The Manual has not been completed yet, and therefore its entire contents has not been figured out. Nevertheless, the Manual will prescribe comprehensive items for urban drainage improvement works.

This guideline aims at supplement prescription on the above related manuals and guidelines through the aforesaid items (1) to (3). This guideline is prepared as a part of "the Study on Integrated Urban Drainage Improvement for Melaka and Sungai Petani in Malaysia" undertaken by Japan International Cooperation Agency (JICA). Accordingly, the supplementary information in this guideline is principally based on the results of the Study and includes several examples of engineering on the flood detention and retention facility in Japan.

1.2 Scope

This guideline prescribes necessary work items on a series of survey, hydrological and hydraulic analysis, planning, designing, maintenance and institutional arrangement for urban drainage improvement. Among them, the planning aspect includes the structural measures as well as non-structural measures for urban drainage improvement.

Explanation:

This guideline is composed of the following seven (7) chapters and two (2) appendices:

Chapter 1: Introduction

This Chapter prescribes the purpose of the guideline, the scope of the guideline, the objectives and design scales of urban development, and the definition of engineering terms used in the guideline.

Chapter 2: Survey

This Chapter prescribes the standard methodologies for survey works which provide the basic information for analysis, planning and designing of the drainage facilities. The survey items include topography, land use, drainage networks and facilities and potential infiltration capacity of the ground.

Chapter 3: Hydrological and Hydraulic Analysis

This Chapter prescribes the standard methodology for hydrological and hydraulic analysis including the storm rainfall analysis, flood runoff analysis, and analysis on flood detention and retention effects. Among them, the storm rainfall analysis and flood runoff analysis are oriented to estimate the probable discharge hydrograph, which is essential for evaluation of flood detention and retention effects. The analysis on flood detention and retention includes the hydraulic designs for flood detention and retention facilities and the design discharge effected by the facilities.

Chapter 4: Planning

This Chapter prescribes the standard methodology for formulation of the optimum urban drainage improvement plan which include "source control of flood" and "quick disposal of flood" as its measure components. In the prescriptions, a particular attention is given to planning concepts to on-site flood detention and retention, pumping drainage and countermeasures to tidal influence. These planning concepts have been less applied in Malaysia, but could be useful to the urban drainage for the existing built-up area and the low-lying area where the ground level is lower than the water level of river channel and/or tidal levels at the outlet points of the drainage area.

Chapter 5: Designing

This Chapter prescribes the standard designing procedures for all major drainage facilities and sediment control facilities. Designing is oriented to not only drainage improvement but also environmental improvement by the facilities. East and sustainable maintenance of the facilities is also highlighted in the designing.

Chapter 6: Maintenance

This Chapter prescribes the necessary work items for maintenance and the standard

maintenance procedures for the various type of drainage facilities and sediment control facilities.

Chapter 7: Institutional Setup Arrangement

This Chapter prescribes the necessary institutional setup arrangement to facilitate the implementation of urban drainage improvement. The contents of prescriptions include demarcation of urban drainage works, cost recovery system and enforcement capacity.

Appendices:

The sewerage system and on-site detention facilities applied in Japan are introduced.

1.3 Objectives and Design Scale of Urban Drainage Improvement

The urban drainage improvement should be made in order to protect the low-lying against stagnant of rainstorm and/or overflow from the drainage channels which has a catchment area of less than 4km^2. The design scale for urban drainage should be expressed in terms of the recurrence probability of rainstorm and determined in due consideration of degree of flood damage potentials and economic viability.

This guideline preliminary prescribes the probable rainstorm of 5-year return period as the target design scale of urban drainage improvement. Among the drainage measures, however, the off-site detention and retention facility should be used both for urban drainage improvement and prevention of overflow from the downstream river channel, and its design scale is preliminarily prescribed as 100-year return period.

Explanation:

This guideline preliminarily prescribes the objectives and design scale of urban drainage improvement in due consideration of the following:

(1) Objectives of Urban Drainage Improvement

The flood discharge is generated from rainstorm in a basin and finally disposed to the sea through the following levels: (a) rainstorm → (b) flow into drainage channels → (c) concentration into the downstream river channel → (d) disposal to sea. According to these levels, the flood problem is classified into two types. The first is the drainage problem which includes stagnant of rainstorm at level (a) and/or overflow from the drainage channels at level (b). Second is the overflow from the downstream river channel which occurs at level (c). Among these two types of flood problems, the drainage problem is given as the objectives of urban drainage improvement.

As described above the drainage problem includes the overflow from drainage channel, which is different from the overflow from the river channel. In this connection, it is necessary to classify the drainage channel and river channel. In Malaysia, the waterways with a catchment area of less than 4km^2 are called in general as trunk drains ("Line", "Alur" or "Cabang" in Malay language), while those with a catchment area of more than 4km^2 are called as the river ("Sungai" in Malay language). In accordance with this idiomatic definition, this guideline preliminarily prescribes the waterways with a catchment area of less than 4km^2 as the drainage channel.

(2) Design Scale of Urban Drainage Improvement

The drainage problem tends to occur far more frequently than the overflow from the river

channel. The flood damage attributed to the drainage problem is such as a chronic hindrance to the regional economy and inconvenience to urban life but seldom involves casualty, collapse of house and other destructive damages. Moreover, the damage is confined to a rather limited area. On the other hand, the overflow from the downstream river channel far less frequently occur as compared with the drainage problem, but once it occurs, tends to cause destructive and extensive damage than the drainage problem.

Due to the above characteristics of flood damages, it is not appropriate to consider the target design scale for drainage improvement to be same as that for prevention of river overflow. That is, determination of the design scale should be based on the degree of flood damage potentials and economic viability in the objective drainage area . This guideline preliminary prescribes the following design scales with reference to design scales adopted in other countries and prescribed in the existing guideline in Malaysia:

(a) On-site flood detention and retention capacity : 5-year return

(b) Drainage channel flow capacity : 5-year return period

(c) Off-site flood detention and retention capacity : 100-year return period*

(*used both for urban drainage and prevention of overflow from the downstream river channel (refer to subsection 3.4.5))

Reference:

The design scales adopted for urban drainage improvement in United Kingdom, United States and Japan rage from 5 to 30-year return period. The followings are the design scales adopted to major cities in Japan.*[1-8]

Name of City	Area (km2)	Population (thousand)	Design Scale (return period)
Sapporo	1,121	1,800	10-year
Sendai	788	993	5-year
Tokyo	621	8,039	3-year*
Yokohama	434	3,387	10-year
Kawasaki	144	1,239	5-year
Nagoya	326	2,164	5-year
Kyoto	610	1,460	5-year
Osaka	212	2,590	12-year
Kitakyushu	484	1,012	5-year
Fukuoka	338	1,325	5-year

: The design scale is going to be upgraded to 10-year return period by 21st century[1-9].

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1-2 "Planning and Design Procedure No.1, Urban Drainage Design Standard and Procedures for Peninsular Malaysia" by Department of Irrigation and Drainage, Ministry of Agriculture, in 1975

1-3 "Preparation of Urban Stormwater management Manual for Malaysia, Interim Report II" by Jurutera Perunding Zaaba Snd Bhd, in 1999

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1-8 "Guidelines for Sewerage and Drainage Structures" by Sewerage and Drainage Association, Japan, in 1994 (written in Japanese)

1-9 "Second-generation's Sewerage Master Plan" by Tokyo Metropolitan Government, Japan, in 1992.