4.3.6 Non-structural Measures

This Section describes the non-structural measures applicable to the drainage improvement in Malaysia.

Explanation:

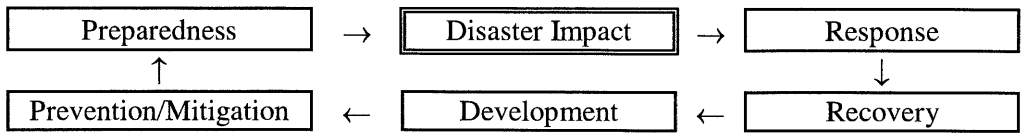
(1) Basic Consideration and Examination

Non-structural measures are crucial for attaining the flood-free circumstances as well as the structural measures, which are generally formulated in the drainage improvement plan. In this clause, applicability among the possible non-structural measures is examined considering the characteristics of flash floods prevailing in Malaysia.

Possible Non-structural Measures

The difference between structural and non-structural measures can be easily understood by using the disaster management cycle*[4-16]. A standard cycle is illustrated below.

Fig. 4.12 Disaster Management Cycle



Structural measures come under the stage of prevention/mitigation in the disaster management cycle. They are composed of the drainage structures such as channeling works, diking systems, retarding basins, pumping facilities, detention ponds and rainwater infiltration facilities. On the contrary, non-structural measures come under the other stages.

For instance, the concrete measures for each stage of the cycles are enumerated as shown in Table 4.11.

Table 4.11 Possible Non-structural Measures

Management Cycle	Non-structural Measures
Preparedness	Preparation and public awareness of flood risk map
	Flood insurance
	Raising or relocating of existing structures in specified threatened areas.
Response	Flood forecasting and warning
	Flood fighting
	Evacuation and rescue
Recovery Development	Community rehabilitation
	Land use regulation
	Land development guidance

Examination of Necessity and Applicability

The following are the characteristics of flash floods caused by overflow of drainage

channels.

(a) Duration of heavy rainfall and flooding is considerably short, but flooding occurs frequently and repeatedly.

(b) Direct damages by flash floods are not so serious to the residents, compared with the floods along a river course of a large-scale basin, but indirect damages widely influence the socio-economic activities particularly in the urban areas.

(c) Influential extent of heavy rainfall is also considerably small and mobile so that it is difficult to precisely forecast the rainfall amount and place.

Considering the above-mentioned characteristics, the necessity and applicability of the following non-structural measures are examined :

Table 4.12 Necessity and Applicability of Possible Non-structural Measures

Measures	Applicability/ Necessity	Note
Preparation and public awareness of flood risk map	Low	Flood risk map is a basic information for most of the non-structural measures, but the time is not ripe for public awareness.
Flood insurance	Mid	Long time is necessary for establishment of the system, and flood risk map is crucial for the establishment.
Raising or relocating of existing structures in specified threatened areas.	Low	The measures aim at reducing the damage potential of the low-lying area in particular. The measures could be applied only to individual or small groups of structures.
Flood forecasting and warning	Low	Establishment of precise forecasting system is difficult.
Flood fighting	High (not urgent)	Direct flood damage is not so serious. Welfare Dept. and related agencies already established a part of the systems. Thus applicability is high but necessity to be improved is not urgent.
Evacuation and rescue		
Community rehabilitation		
Land use regulation	High	Natural retarding function should be preserved as a part of river reserves. Natural hilly area should also be preserved as restriction of the urban sprawl.
Land development guidance	High	Construction of detention ponds should be adopted much wider for the newly developed area.

As examined above, land use regulation and land development guidance are urgently crucial for establishment of the integrated urban drainage improvement plan. In the succeeding clauses these applicable non-structural measures will be discussed in detail.

(2) Applicable Measures

River Reserves for Flood Retarding

Based on the results of flooding simulation, DID can select the effective natural retarding areas and designate the areas as river reserves. DID also should discuss the preservation of natural retarding functions with the related agencies, Town and Country Department and the local government. If an area to be preserved is large and can be clearly delineated, the area should be designated as a natural preservation area or a river reserve area in an urban planning.

Any type of land development activities should be prohibited in the area, except for a specific type of development that can preserve the retarding function, such as buildings with piling foundations.

Restriction of Urban Sprawl

Urban sprawl will cause various kind of urban infrastructural or environmental problems, inadequate social services, water pollution and garbage/rubbish littering as well as increment of urban flood runoff. In order to avoid sprawling of the urban area, the possible urbanizing areas should be restricted in due consideration of the projected population. Further, It would be more desirable that the remaining natural hilly and mountainous areas should be designated as a sort of reserve area. Those areas will contribute to preserving the natural hydrological cycle of groundwater recharge as well as checking the unlimited increment of urban flood runoff.

Land Development Scale to be Provided with Flood Detention Facilities

At present the responsible agencies guide the land developers in construction of the detention ponds, applying to the development area of 10 ha or more. Thus the land development with an area of less than 10 ha falls out from this guidance. If the land developer divides the land in pieces with an area of less than 10 ha and applies their development projects one by one to the responsible agencies, the necessary detention ponds could not be constructed in the developed area.

In order to avoid the above-mentioned undesirable circumstances, the base line of the area should be lower considering the appropriate balance between increment of flood detention effects and increment of inspection works for the project proposals and maintenance works for constructed ponds. In general, the base line of development area is set at 0.1 ha to 1 ha in Japan. Furthermore, some local governments require construction of detention facilities for the land development with an area of 0.05 ha or more.

4.4 Optimum Combination of Drainage Improvement Measures

The optimum combination of drainage improvement measures should be selected through the comprehensive evaluation on their technical viability, project cost, social impacts and natural environmental impacts.

Explanation:

The drainage improvement plan should be formulated with the optimum combination of the aforesaid various alternative drainage measures. Selection of the optimum combination of measures should be made through comprehensive consideration and evaluation on the following aspects:

(1) Technical Viability

The recent intensive land development in Malaysia tends to cause a drastic increment of the peak runoff discharge. If the drainage channel improvement were unrestrictedly made to cope with such incremental peak discharge, the downstream river would receive a serious overload of the river flow and cause frequent overflow. Moreover, it is virtually difficult to attain the unrestricted drainage channel improvement due to difficulties of land acquisition, unfavorable topographic conditions, and other natural and socio-economic conditions.

The flood detention/retention facilities could reduce the incremental peak discharge by the

land development, but their available construction sites will be limited due to topographic conditions, geological conditions, soil conditions and other natural and socio-economic conditions. Moreover, the flood detention/retention facilities without drainage channel improvement could not always perform the target design level due to their limited storage capacity.

In addition to the above drainage channel improvement and flood detention/retention facilities, the particular drainage facilities such as gate and drainage pump may be required when the water level of the interior drainage channel is often lower than that of the exterior drainage channel (refer to subsection 4.3.4.

Thus, the drainage effect as well as the technical advantage in construction, operation and maintenance of the alternative drainage measures will be closely related to various site conditions such as topography, geology, soil (erosion and permeability), vegetation, and flow capacity/water level of the exterior river or sea. Accordingly, the technically viable combinations of the alternative drainage measures should be selected through careful clarification on these site conditions.

(2) Project Cost

Increment of the project cost for flood detention/retention facilities could lead to less project cost for the drainage channel improvement and the river channel improvement. The variation of project cost for various combination of design scales of the flood detention/retention facilities and drainage channel improvement should be examined, and the combination with the least project cost should be given as one of the important factors to select the optimum combination.

(3) Social and Natural Environmental Impacts

Alternative drainage measures will bring various social and natural environmental impacts. In this connection, one of the important factors to select the optimum combination of the alternative drainage measures should be addressed to the following issues:

(a) Less relocation by the project implementation;

(b) Less adverse impact to the natural environment (water quality and aquatic life);

(c) Adding of value of the space for drainage facilities as amenity; and

(d) Improvement of urban scenery.

4.5 Rehabilitation of Existing Drainage Facilities

Among existing drainage facilities, the selected detention ponds should be rehabilitated, if they can play an important role in the urban drainage improvement plan.

Explanation:

(1) Problems identified in existing drainage facilities

The following items could be enumerated as the most critical issues on rehabilitation of the existing drainage facilities.

(a) Insufficient drainage capacity

(b) Environmental degradation

The former issue is the principal objective for urban drainage improvement itself. The latter issue is typically identified in the existing detention ponds constructed before the year of 1998.

The drainage networks of the detention ponds of which environment is deteriorated can be regarded as combined collection systems similar to combined sewers. The drains collect domestic wastewater, industrial wastes, and storm runoff water. In dry-weather, both domestic wastewater from the septic tanks and industrial wastewater from some treatment plants flow into the detention ponds. During storms, the combined wastewater and runoff water also flows into the ponds. As a result, the following environmental deterioration occurs in the ponds.

(a) In dry-weather the impounded wastewater emits offensive odor to the neighborhoods of ponds.

(b) During storms, storm runoff entrains the thrown rubbish and deposited sediment in the drainage channel, and they accumulate in the ponds as sludge.

(c) During heavy downpour, the accumulated rubbish is discharged out to the downstream channel, and it clogs the some portion of the channel resulting in flooding.

The above-mentioned conditions were already improved in the newly constructed ponds in accordance with the Indah Water's new guideline revised in 1998. Since then, the separate sewer system was adopted in the newly developed area.

(2) Selection of ponds to be rehabilitated

From the flood control viewpoints, the effective detention ponds should fulfil the following criteria.

(a) Drainage area of the pond is relatively large, and

(b) Specific storage volume in m^3/ha is also large, usually more than 900 m^3/ha, or

(c) There is a possibility to increase the storage volume by deepening or widening.

(3) Rehabilitation program

The rehabilitation works for existing detention pond need to be made by a comprehensive approach involving the following structural and non-structural measures:

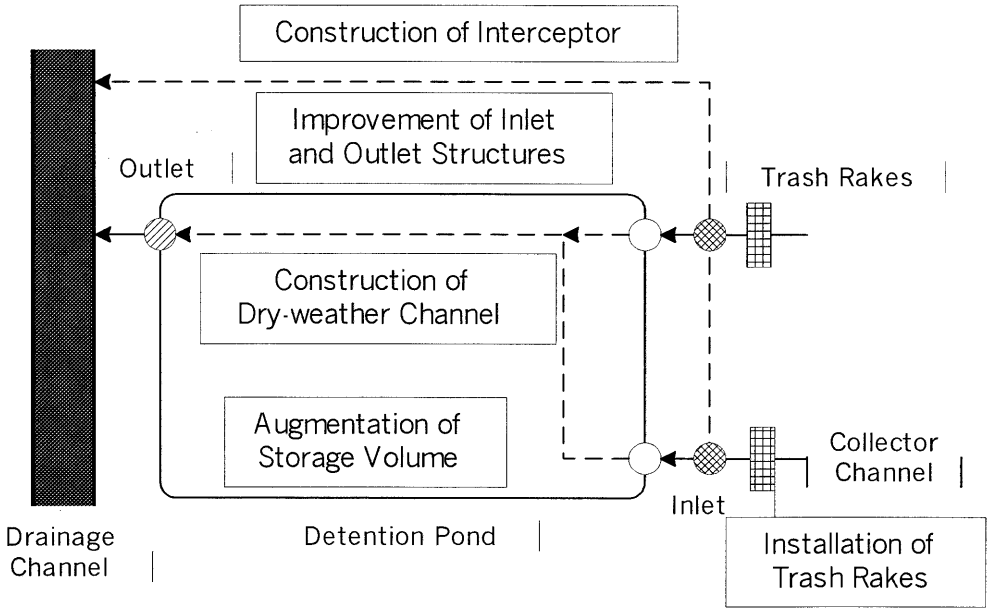
(a) Structural rehabilitation of pond: augmentation of storage volume, installation of trash rakes, improvement of inlet and outlet structures, construction of dry-weather channel or interceptor (refer to Fig. 4.13),

(b) Solid waste management: proper solid waste collection system,

(c) Domestic wastewater management: proper management of septic tank desludging and upgrading to the separate sewer system in future, and

(d) Educational campaign to residents: proper trash and wastewater treatment.

Fig. 4.13 Conceptual Layout for Rehabilitation of Existing Detention Pond



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