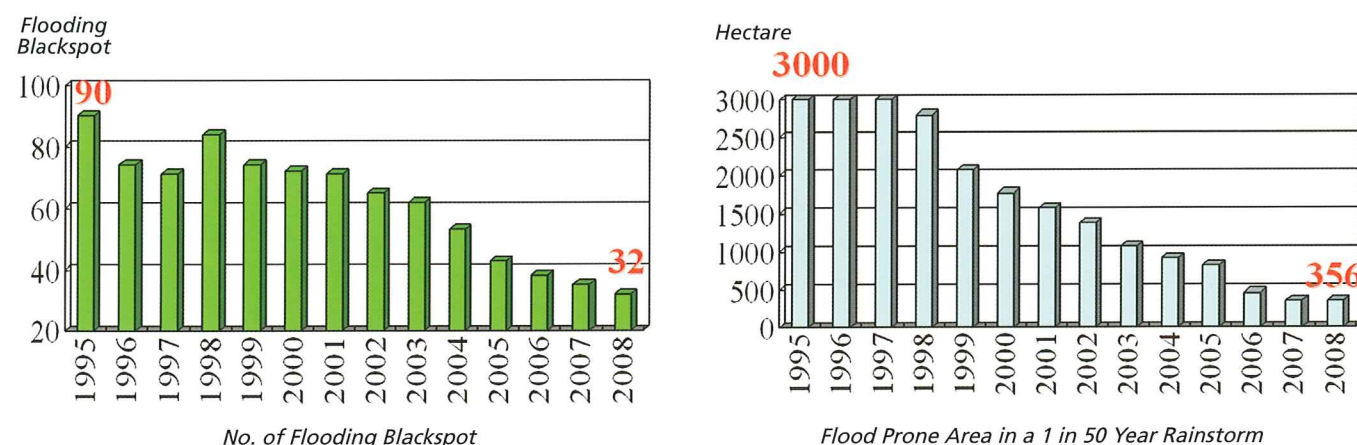


## Reduction of Flooding Blackspots and Area Prone to Flooding During Very Heavy Rains

With the progressive completion of major flood prevention projects, the flooding situation in most of the flooding blackspots and areas prone to flooding during very heavy rains has been significantly improved as shown below. Further improvement works are being carried out or planned for the remaining flooding blackspots.



## Continuous Improvements to Stormwater Drainage Systems

Through implementation of continuous drainage improvement works, the flooding situation in many locations has been relieved substantially. The DSD is closely monitoring the performance of the stormwater drainage systems in Hong Kong and will carry out drainage improvement works where necessary.

In 2008, drainage works at a total cost of about \$9 billion are under design and planning or construction, which include the Lai Chi Kok Drainage Tunnel, Hong Kong West Drainage Tunnel and Tsuen Wan Drainage Tunnel. These tunnels can divert the upstream runoff to reduce the flood risks in congested urban areas. In the New Territories, the DSD also carries out drainage improvement works at the upstream of major drainage channels in order to improve the capacity of the concerned drainage systems enabling sustainable developments.

## Flood Prevention

### Flooding Problems

Hong Kong is frequently visited by tropical cyclones and can experience very heavy rainstorms at times. With an annual average rainfall exceeding 2,300 millimeters, one of the highest among the cities in the Pacific Rim, flooding occurs frequently in the rural low-lying areas, natural flood-plains in the northern part of the territory and in some old urban areas.

Over the years, intensive development associated with urbanization has taken place in the flood-plains, turning large areas of natural ground into paved areas. Rainwater, which formerly retained largely by natural unpaved ground, now quickly becomes surface flows. If litter and wash-down debris are not properly handled in those development areas near major watercourses, the flood carrying capacity of these watercourses would be reduced and further aggravating the flooding problem.

In old urban areas, flooding occurs because stormwater drainage systems built decades ago to old flood protection standards are becoming inadequate due to aging of the systems and the expansion of built-up areas.

### Flood Prevention Strategy

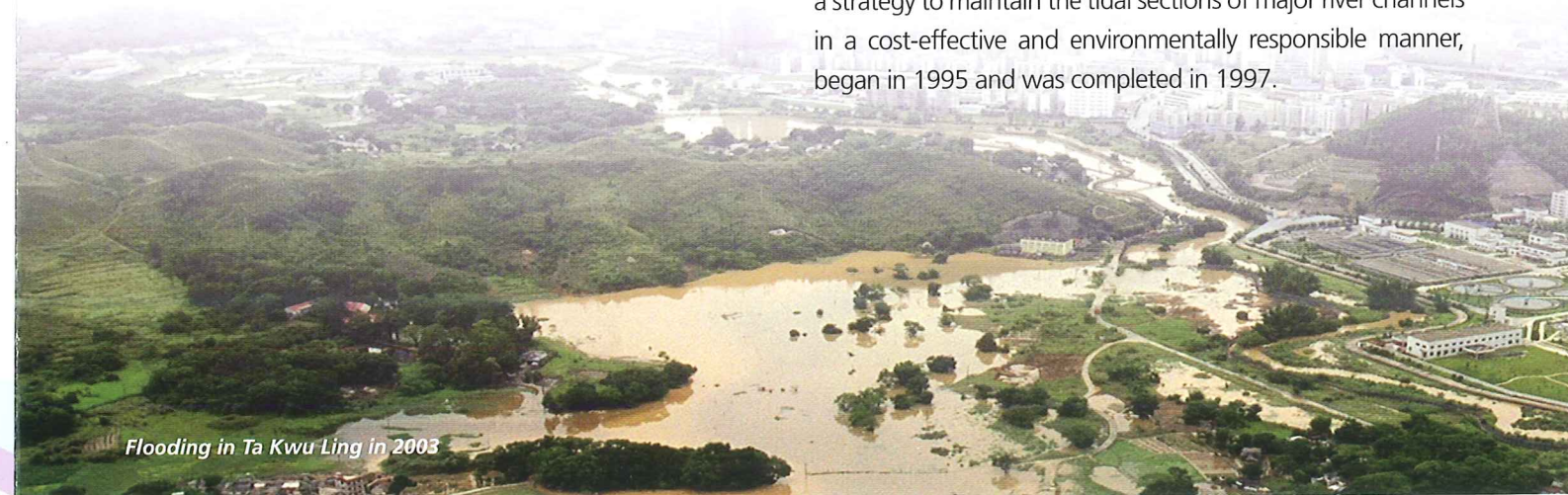
In view of serious flooding in the past, the Government has conducted a series of studies to formulate a comprehensive flood prevention strategy.

The "Territorial Land Drainage and Flood Control Strategy Study-Phase I" (TEL1) was commissioned in 1988 and endorsed the following flood prevention strategy in 1990:

- Non-structural measures
- Conventional structural measures
- Identification of major river training schemes
- Introduction of legislation and management measures

The "Territorial Land Drainage and Flood Control Strategy Study-Phase II" (TEL2) began in 1991 and was completed in 1993. The study provided the Government with more concrete plans and tools to make the strategy effective in the 5 most flood prone basins in the North New Territories. The principal recommendation from the study was a Basin Management Plan for each of the basins.

The "Territorial Land Drainage and Flood Control Strategy Study-Phase III, Sedimentation Study" (TEL3), which generated a strategy to maintain the tidal sections of major river channels in a cost-effective and environmentally responsible manner, began in 1995 and was completed in 1997.



### Our Vision

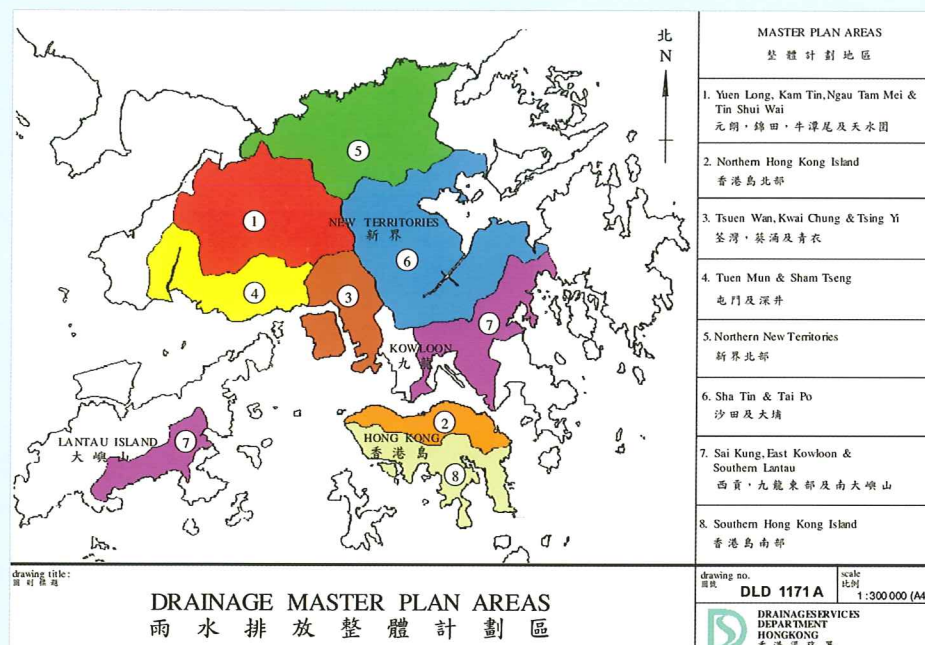
To provide world-class wastewater and stormwater drainage services enabling the sustainable development of Hong Kong.



## Drainage Master Plan Studies

In 1989, the Government established the Drainage Services Department (DSD) responsible for resolving the flooding problems. Since then, based on the strategy adopted under the studies of TELI, TELII and TELIII, a number of further studies have been conducted by DSD, including eight stormwater drainage master plan (DMP) studies covering all the flood prone areas of the territory.

These DMP studies comprehensively examined the adequacy of the existing drainage systems and developed short to long term drainage improvement measures to meet the current standards and the future needs.

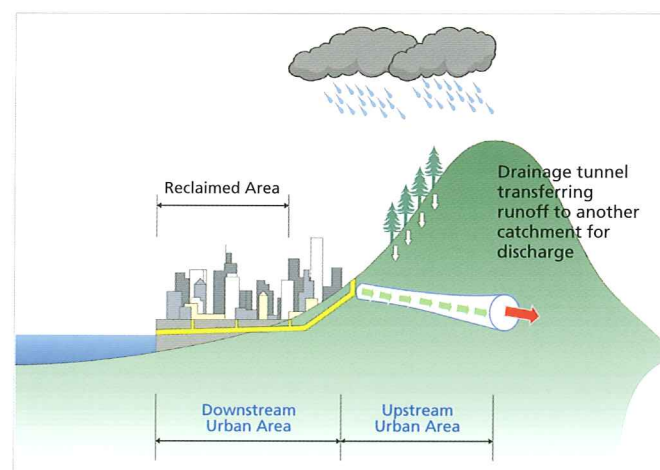


Drainage Master Plan Areas

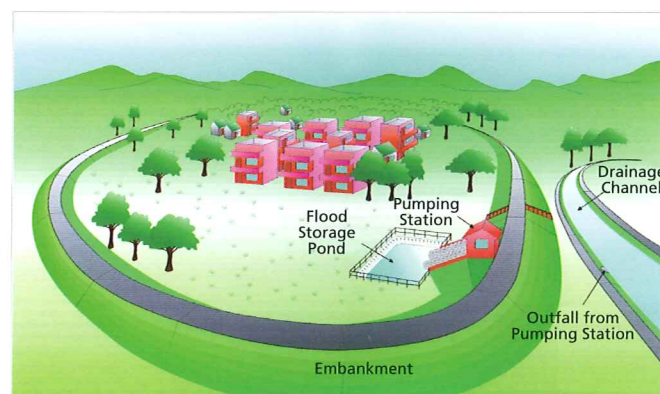
## Flood Prevention Projects

Based on the findings of the DMP studies, DSD has been actively implementing a series of major flood control projects since early 1990's in order to tackle the flooding problem. Usually, these major flood control projects are implemented in stages from downstream to upstream so as to gain early benefits from each phase of the completed works.

In the New Territories, a series of major river training projects have been implemented to provide the primary drainage network to alleviate the flooding problem. These include improving the Shenzhen River (between Ping Yuen River and Deep Bay), Ng Tung River, Shan Pui River and Kam Tin River. Besides, the programme also incorporates a number of flood protection schemes at low-lying villages. Protective bunds are built around the villages to prevent flood water in surrounding areas from entering the villages, whereas rainwater fallen within the village areas will be collected and pumped out of the protective bunds to nearby channels.



Concept of drainage tunnel



Village Flood Pumping Scheme

## Achievement of Progressive Improvements

In urban areas, various options have been identified and adopted for improving the existing drainage systems. They can be categorised as follows:

### 1. Flood Storage and Pumping

Flood storage tanks are provided at low lying area to retain the flow from upstream catchment such that the peak flow in the downstream drainage system can be attenuated. Pumps are used to convey the stored flood water directly into the sea after the rainstorm.

### 2. Tunnelling

A tunnel system can intercept and divert storm flows from upland catchment directly to the sea instead of passing through the drainage systems at downstream urban areas, hence relieving substantially their hydraulic loads.

### 3. Interception

Intercepting drains are used to intercept upstream surface runoff to storage tanks or nearby stormwater drainage systems with sufficient drainage capacity and thus prevent the runoff from flowing to flood-prone areas.

### 4. Upgrading Existing System

This option involves local drainage improvement to the pipelines, rivers, nullahs or culverts by means of widening, enlargement or replacement of the existing drainage systems to enhance their hydraulic capacity.

### New Territories

Since 1997, the Government has invested on a programme of major river training and flood control projects in the New Territories at a total cost of \$9.1 billion. In the North-west New Territories, over \$4 billion flood control projects have been completed. These include about 32 km of drainage channels in Yuen Long, Kam Tin and Ngau Tam Mei areas and the 3.8 km Yuen Long By-pass Floodway. In the North New Territories, \$3 billion of works have been completed including Shenzhen River Regulation Projects, river training of Ping Yuen River, Ng Tung River, Sheung Yu River, etc, while \$900 million of construction works are actively underway.

### Urban Areas

The Government has implemented a series of major projects costing some \$2.3 billion to tackle the flooding problem in West Kowloon. The completed Tai Hang Tung Flood Storage Scheme and Kai Tak Transfer Scheme have greatly reduced the flooding threat in Mong Kok during heavy rainstorms.

