COMING TO GRIPS WITH CONTROLLING OUR WATER

Two of the Thames Barrier gates allow Royal Navy helicopter carrier HMS Ocean to sail through to dock at Greenwich.

Civilizations have always grown out of agriculture, made possible by irrigation from nearby sources of water. Urbanization often results in major cities being located near coasts or rivers, as they not only allow more even temperatures and better climates but also provide picturesque scenery.

However, with closeness to water comes the threat of flooding, often caused by weather. But topography and soil also affect a city's susceptibility to flooding.

A typical case is London.

Unfortunately, its soil mainly consists of clay, which swells or shrinks as moisture content changes, causing subsidence and increasing the riverbed level fluctuations and the risks of flooding.

Engineers have designed a barrier system across the Thames to prevent floods.

The system, built in the 1980s, consists of 10 gates across the 530-meter-wide river section upstream of London near Greenwich.

The four gates in the middle are larger to allow ships to pass. The others, closer to the banks, are mainly for flood control.

Rotary gates are used as they allow for quicker operation in case of storm tides. When raised, they can stop water waves of up to four meters tall.

Each of the gates' blades are normally rotated to lie horizontally beneath the river, providing a navigation draft of about 4.5 meters. When flooding occurs, a blade is turned 90 degrees so it effectively becomes a vertical dam. With a further 90-degree rotation, the blades can be hung horizontally in mid-air exposing their surface and part of the mechanism for routine maintenance and repair.

Normally raised and lowered in pairs, the gates' system is designed so that each one, operated by powerful hydraulic pistons, can be operated individually.

As reliability is vital to protect the city, a duplication in power supply plus a standby diesel generator ensure the dam system is fail-safe. To provide an extra layer of safety, in the most remote event of a total power failure, the gates can be manually cranked into position.

Operating the gates normally requires 90 minutes, but in an emergency, all of them can be closed simultaneously in 15 minutes, though such a fast action will cause huge rebound forces in the system.

Since the Thames Barrier was built, the city has seen some five closures annually, though in extreme situations there have been up to 30 closures.

We are much more fortunate. Our city is built across a harbor, with water passages of about one kilometer.

Our geotechnical conditions are far superior as our bedrock is mainly granite, which is much more robust and unaffected by moisture or underground water. This is why we have far lower flood risks.

We may have a higher risk of typhoon weather with torrential rain, but our drainage system has been vastly improved, especially with the recent installation of huge underground surge tanks for temporary holding at times when the storm water exceeds drainage system capacity.

For our Kau Yi Chau artificial island reclamation, it will be generally sheltered from the ocean. The disposition of the islands will be designed with a Y-shaped water passage so high waves caused by typhoons will be effectively diverted to further minimize flooding risks. It will also allow free flow of water in the area to prevent silting.

With population increases and rapid urbanization, land taken over for dwellings inevitably increase. With new technology, engineers can design facilities to allow continuous development of cities.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over features of modern life