

International Association for Hydro-Environment Engineering and Research

Supported by Spain Water and IWHR, China IAHR World Water Day Forum on "Hydro-environment Engineering and Adaptation to Climate Change", 21 March, 2020

International Panel Discussion Climate Change and Adaptive Management - Challenges and Issues -

Innovative Urban Storm Water Management - adapting to climate change -

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Climate Change Impacts in Hong Kong



Record-breaking hourly rainfall events (1885-2016) (Source: Hong Kong Observatory) (Mean sea level rise: + 31 mm/decade)

Introduction

- Hong Kong, annual rainfall: ~ 2400mm/yr
- Global climate change More extreme rainfall events (> 100 mm/hr)
- Sea level rise urban areas on low lying reclaimed land are more vulnerable to flooding

180

150

120

90

60

30

00:00

03:00

Hourly rainfall (mm/hr)

Smithfield Road Flooding, June 24, 2005





06:00

Time

09:00

12:00

SPONGE CITY: CLIMATE CHANGE ADAPTATION





2017 CIC Innovation Award (First Prize Sustainability)



Diversion of storm flow into a 10.5 km deep tunnel system via 34 vertical supercritical vortex drop shafts. Total discharge: 135 m³/s

The Hong Kong University of Science and Technology



Drainage Services Department





Engineering Challenges for HKWDT

- Steep hillslope watercourses (average slope 40%)
- Supercritical flow with velocities in the order of 10 m/s (Fr = 3 8)
- Adjacent to densely-populated residential area (premium properties!)
- Land constraints (cannot use large stilling structures)
- Minimize public disruption
- Traffic & environmental impact

Compact intake structures have to be designed to dissipate the energy and transfer the flow into the drainage tunnel smoothly





STORM WATER FLOW AT INTAKES



Happy Valley Underground Stormwater Storage Scheme

2018 Da Yu Award, Chinese Hydraulic Engineering Society



Contract Name	Happy Valley Underground Stormwater Storage Scheme
Project Sum	HK\$1,065.8M (US\$ 137M)
Duration	Sep 2012 – Dec 2017
Contractor	Chun Wo Construction & Engineering Co. Ltd.











Climate Change Considerations in Drainage Design - Rainfall and Sea Level

Based on results of simulations of global climate models in the IPCC Fifth Assessment Report the Hong Kong Observatory has made projections of rainfall increase due to climate change in Hong Kong up to the late 21st century.

To consider the effect of climate change in the drainage design, the projected percentage increases in rainfall and sea level rise have been adopted in the design rainfall intensities/synthetic rainstorm profiles and design extreme sea levels.

	Rainfall Increase	Sea level rise (m)
Mid 21 st Century (2041 – 2060)	10.4%	0.23
End of 21 st Century (2081 – 2100)	13.8%	0.49

Source: Planning, Design and Management: Planning, Design and Management, Fifth Edition, January 2018, Drainage Services Department, HKSAR Government

CONCLUSIONS

- 1. An integrated supercritical storm water interception, transfer and storage system has been successfully developed for the Hong Kong Island Drainage Scheme with proven post operation performance since 2013.
- 2. Hydro-environment engineering is at the core of sustainability and urban resilience in a world class city.
- 3. The innovative urban storm water management strategy has ensured uninterrupted smooth running of the central business district and urban areas in Northern Hong Kong Island.
- 4. Hong Kong was well-protected from flooding during the super-typhoon Mangkhut in 2018 with maximum sustained winds of 175 km/h.



