

# DSD Projects with Green Infrastructure

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## LA1/ Headquarters, DSD

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# DSD Projects with Green Infrastructure

- 1. Introduction**
- 2. Yuen Long Bypass**
- 3. Ho Chung River Improvement Works**
- 4. Kowloon City Pumping Stations**
- 5. Shuen Wan Drainage Improvement Works**
- 6. Happy Valley Underground Stormwater Storage Scheme**
- 7. Kai Tak Midstream**



# 1. Introduction



## **DSD's vision**

- Provide world-class wastewater and stormwater drainage services
- Sustainable development of Hong Kong

## **DSD Environmental policy**

- Take into account ecology and environment protection

## **DSD in practice**

- Incorporate environmental friendly features into DSD projects as far as possible

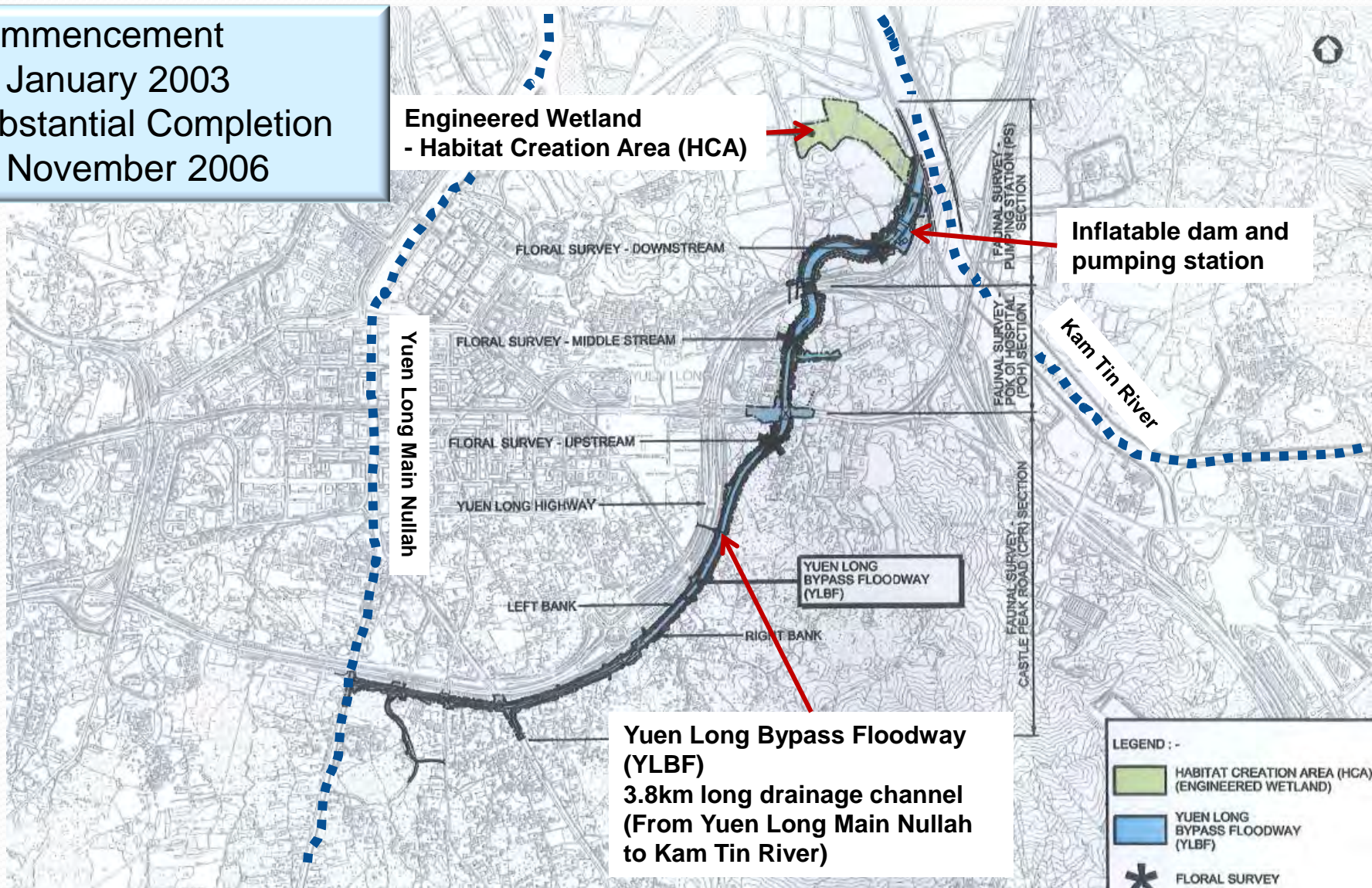


## 2. Yuen Long Bypass

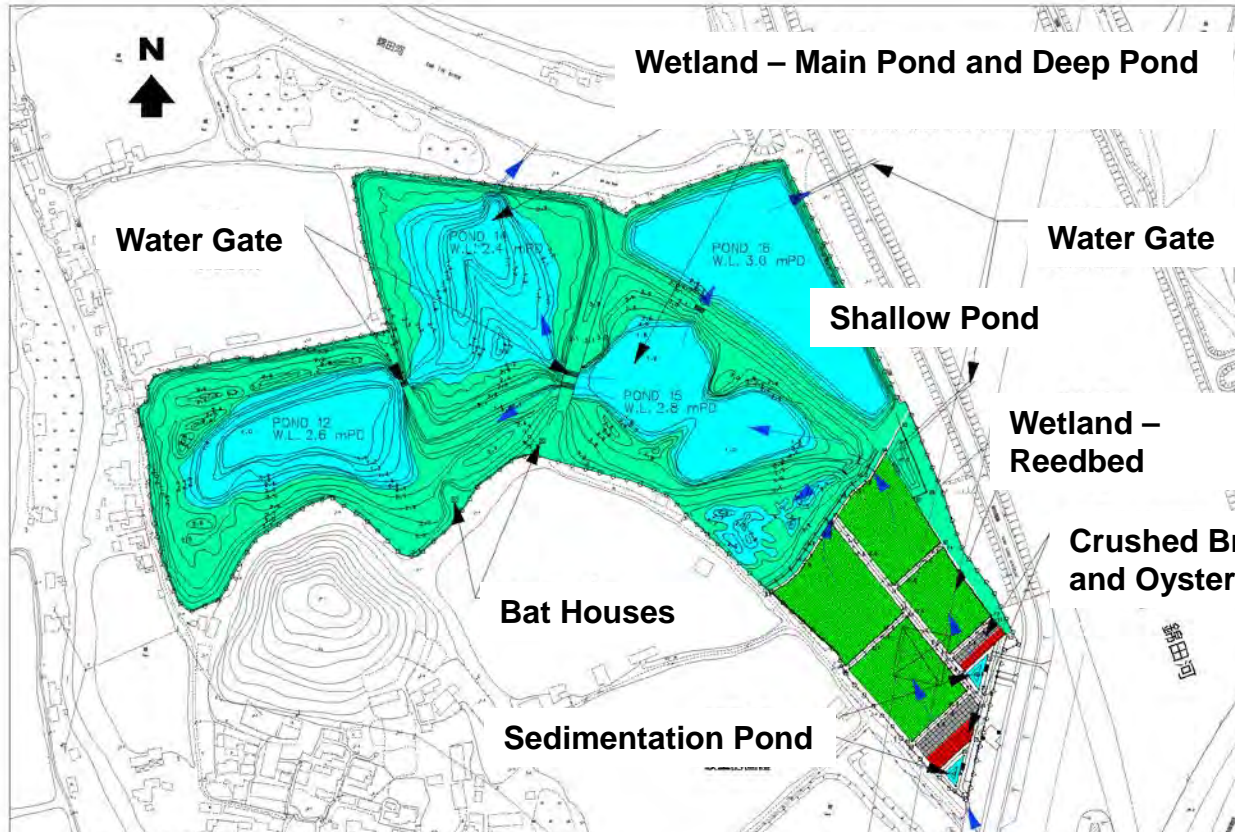


# Yuen Long Bypass

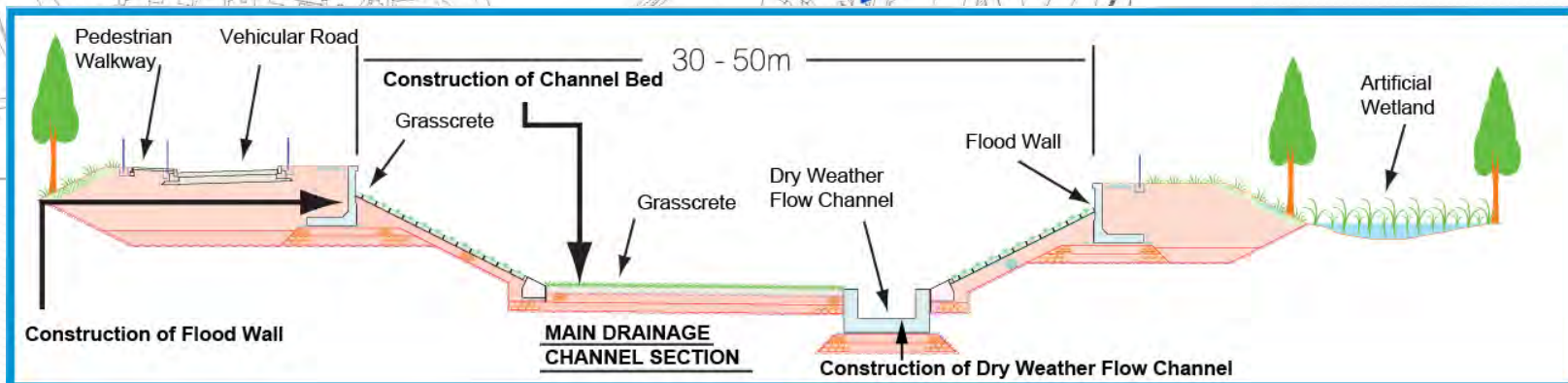
- Commencement on January 2003
- Substantial Completion on November 2006



# Yuen Long Bypass



- 7 ha artificial freshwater wetland to compensate the lost of fish ponds
- **Benefits:**
  - Slow down the peak flow
  - Improve water quality
  - Improve the biodiversity



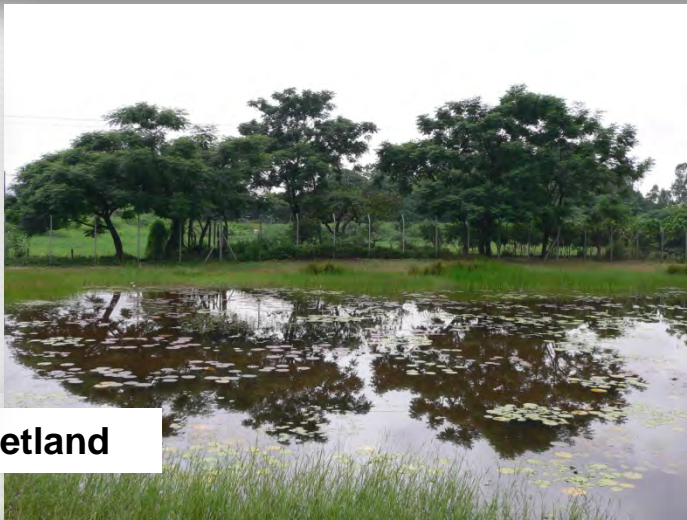
# Yuen Long Bypass



**Bypass Floodway**



**Bat House**



**Wetland**



**Shallow Pond**



**Crushed Brick Field  
and Oyster Shell Field**



## 5 - year post project ecological monitoring period

- Natural colonization / succession of plant species were observed
- > 100 bird species were observed (AFCD's observation)
- The abundances of dragonfly, butterfly and frogs were increasing



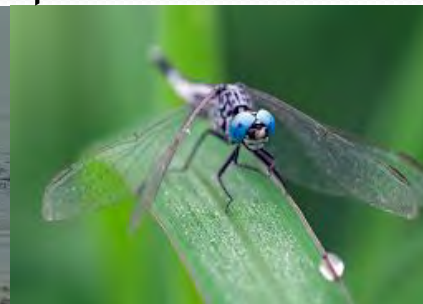
黑臉琵鷺  
*Black-faced Spoonbill*

水雉  
*Pheasant-tailed jacana*

彩鶺  
*Greater Painted-snipe*

锥腹蜻  
*Acisoma panorpoides*

高翔蜻蜓  
*Macrodiplax cora*





View towards the pleasure-boat dotted Hebe Haven, with Ho Chung River flowing through village houses in the foreground



## 3. Ho Chung Improvement Works

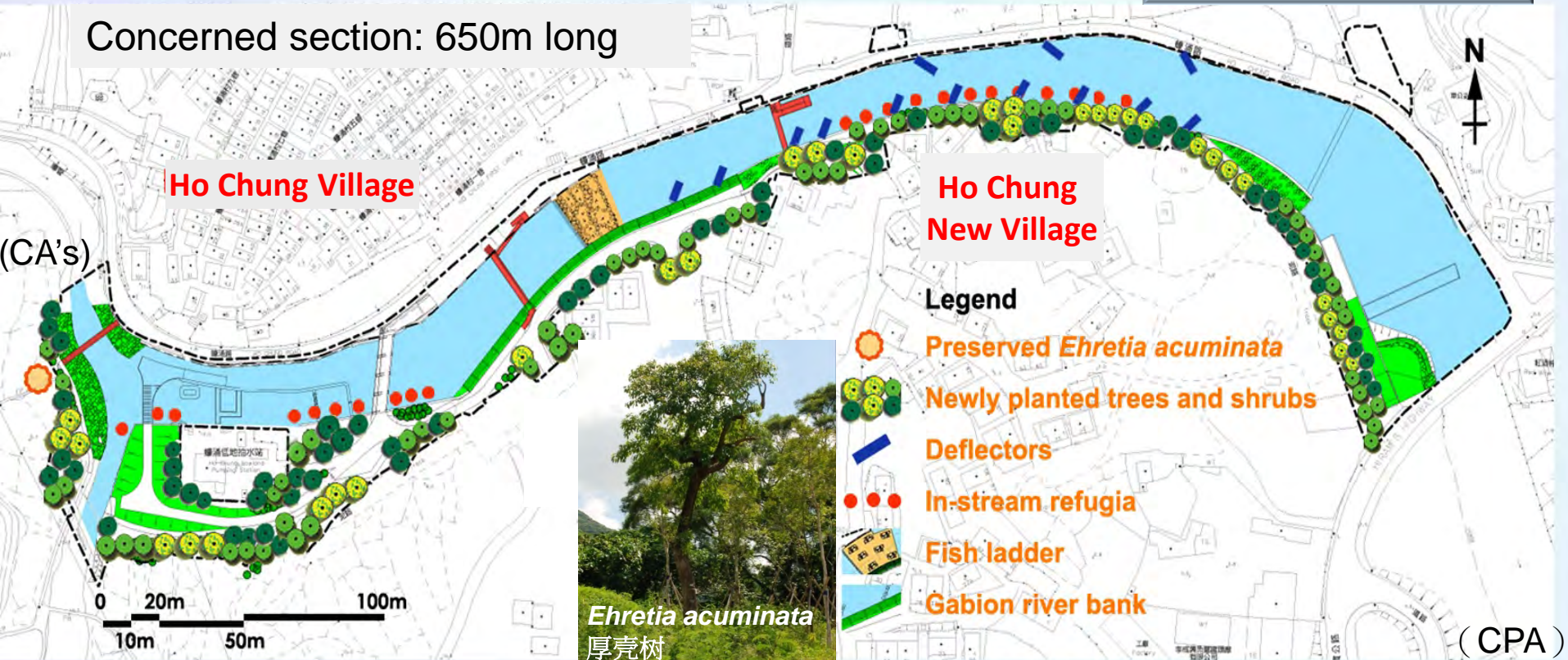


# Ho Chung Improvement Works

- Commencement on mid 2007
- Completion on 2010

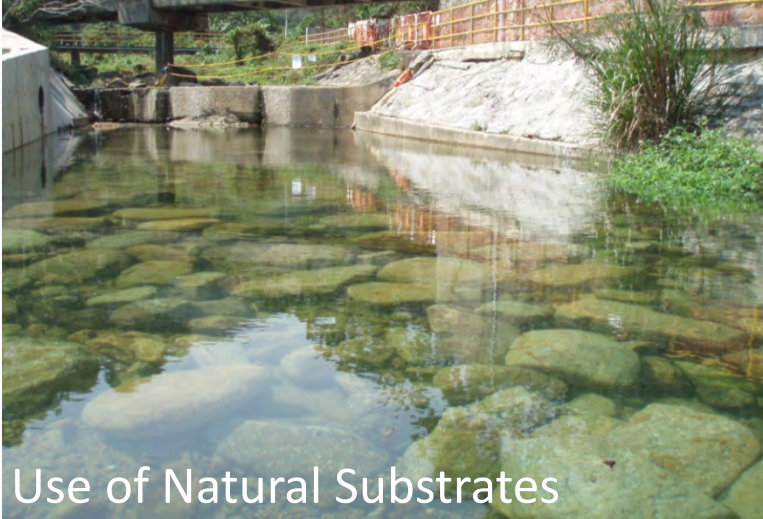
## Ecological Enhancement Features

Concerned section: 650m long

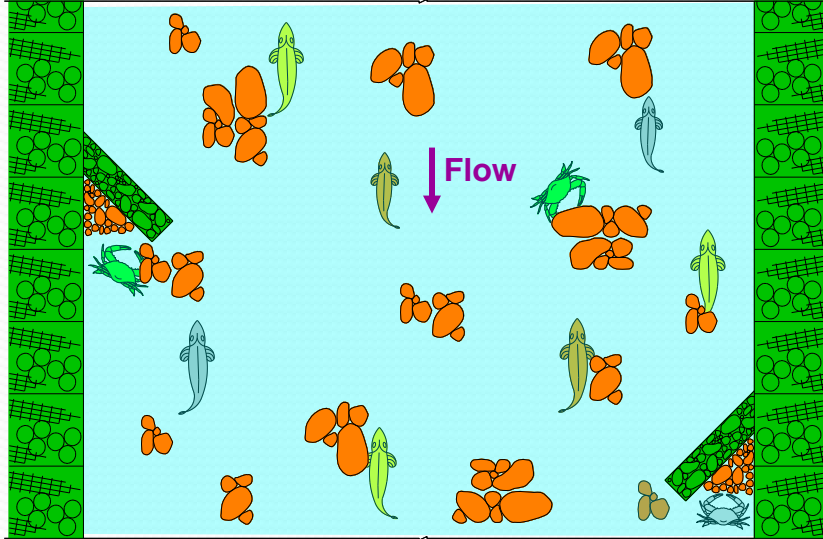


Bed width(m)		Bank width(m)		Depth(m)	
Original	After completion	Original	After completion	Original	After completion
7 to 28	<b>17 to 34</b>	15 to 30	<b>17 to 42</b>	3 to 5	<b>3.8 to 5</b>

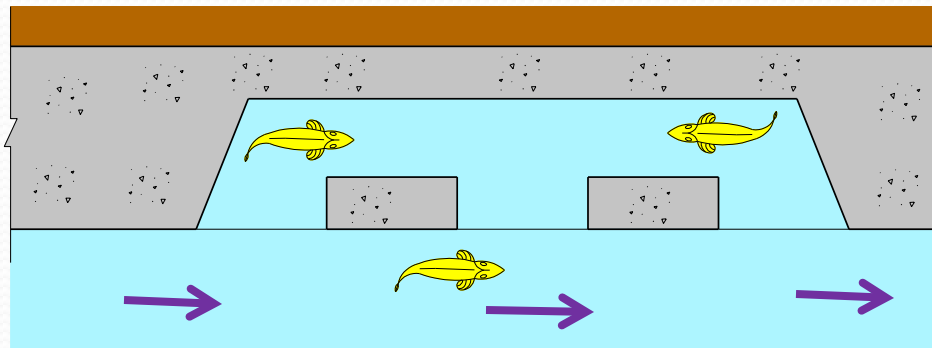
## Ecological Enhancement Features



## Ecological Enhancement Features



Deflectors



In-stream Refugia / Fish holes



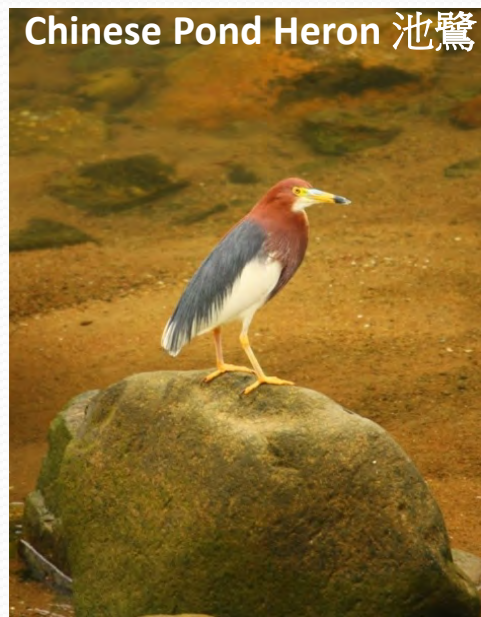
# Ho Chung Improvement Works

## Ecological Monitoring Surveys

Avifauna (鳥類) Recorded Along Ho Chung River						
Common Name	Scientific Name	Chinese Name	Distribution in HK	Site 1	Site 2	Other Area Along Ho Chung River
Little Egret	<i>Egretta garzetta</i>	小白鷺	Common	1	1	
Chinese Pond Heron	<i>Ardeola bacchus</i>	池鷺	Common		1	x
Black Kite	<i>Milvus migrans</i>	黑鳶 (麻鷹)	Common	2		
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	白胸苦惡鳥	Common			x
Rock Dove	<i>Columbia livia</i>	原鴿	Common			x
Spotted Dove	<i>Streptopelia chinensis</i>	珠頸斑鳩	Abundant	1	2	
Large Hawk Cuckoo	<i>Hierococcyx sparverioides</i>	鷹鴝	Common			x
Plaintive Cuckoo	<i>Cacomantis merulinus</i>	八聲杜鵑	Uncommon			x
Greater Coucal	<i>Centropus sinensis</i>	褐翅鴉鵂	Common	1		x
Barn Swallow	<i>Hirundo rustica</i>	家燕	Abundant	2	6	x
Grey Wagtail	<i>Motacilla cinerea</i>	灰鶺鴒	Common			x
White Wagtail	<i>Motacilla alba</i>	白鶺鴒	Common	2		
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	紅耳鸚	Abundant	1	1	x
Chinese Bulbul	<i>Pycnonotus sinensis</i>	白頭鸚	Abundant	1	2	x
Oriental Magpie Robin	<i>Copsychus saularis</i>	鶺鴒	Abundant	2		x
Masked Laughingthrush	<i>Garrulax perspicillatus</i>	黑臉噪鶇	Abundant	2		x
Eurasian Tree Sparrow	<i>Passer montanus</i>	麻雀	Abundant	2	4	x
Black-collared Starling	<i>Sturnus nigricollis</i>	黑領椋鳥	Common	2		x
Crested Myna	<i>Acridotheres cristatellus</i>	八哥	Common	3	8	x
Common Magpie	<i>Pica pica</i>	喜鵲	Common			x
Large-billed Crow	<i>Corvus macrorhynchus</i>	大嘴烏鴉	Common			x
Fish Species (魚類) Recorded along Ho Chung River						
Mud Carp	<i>Cirrhinus molitorella</i>	鯪, 十鯪魚	Not Protected			x
Common carp	<i>Cyprinus carpio</i>	錦鯉	Not Protected	x	xx	x
Mosquito Fish	<i>Gambusia affinis</i>	食蚊魚	Not Protected	x		
Silver Moony	<i>Monodactylus argenteus</i>	銀大眼鯧, 金鯧魚	Not Protected		x	
Grey Mullet	<i>Mugil cephalus</i>	鯮, 烏頭鯮	Not Protected		xxx	xxx
Mozambique Tilapia	<i>Oreochromis mossambicus</i>	莫桑比克口孵非鯽	Not Protected		xx	
Predaceous Chub	<i>Parazacco spilurus</i>	異鱮	Not Protected	xxx		x
Chinese Barb	<i>Puntius semifasciolatus</i>	七星魚	Not Protected	x		
-	<i>Rhinogobius duospilus</i>	溪吻鰕虎魚	Not Protected			xx
Variable Platyfish	<i>Xiphophorus variatus</i>	雜色劍尾魚	Not Protected	x		

# Ho Chung Improvement Works

## Photos of our visitors





## 4. Kowloon City Pumping Stations





# Kowloon City Pumping Stations

- Commencement on 8 July 2009
- Substantial Completion on 31 July 2012



# Kowloon City Pumping Stations

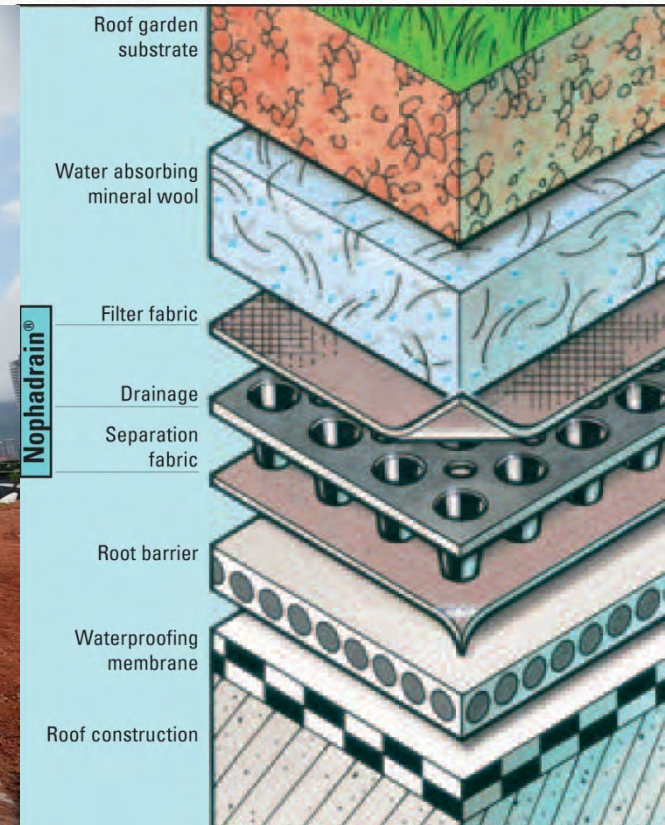
## Green Roof

SPS No. 1 = 688m<sup>2</sup> (Green Ratio = 63%)

SPS No. 2 = 885m<sup>2</sup> (Green Ratio = 93.5%)

### • Benefits:

- Reduce heat island effect
- Slow down the peak flow

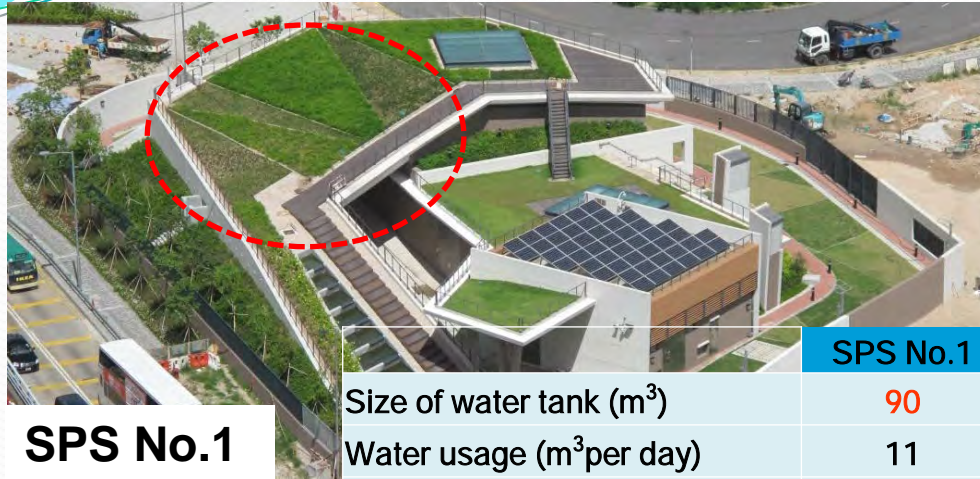




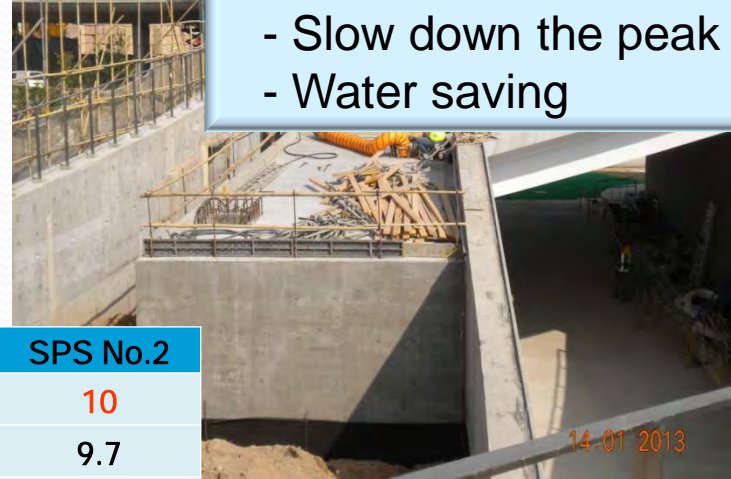
# Kowloon City Pumping Stations

## Rainwater Harvesting System

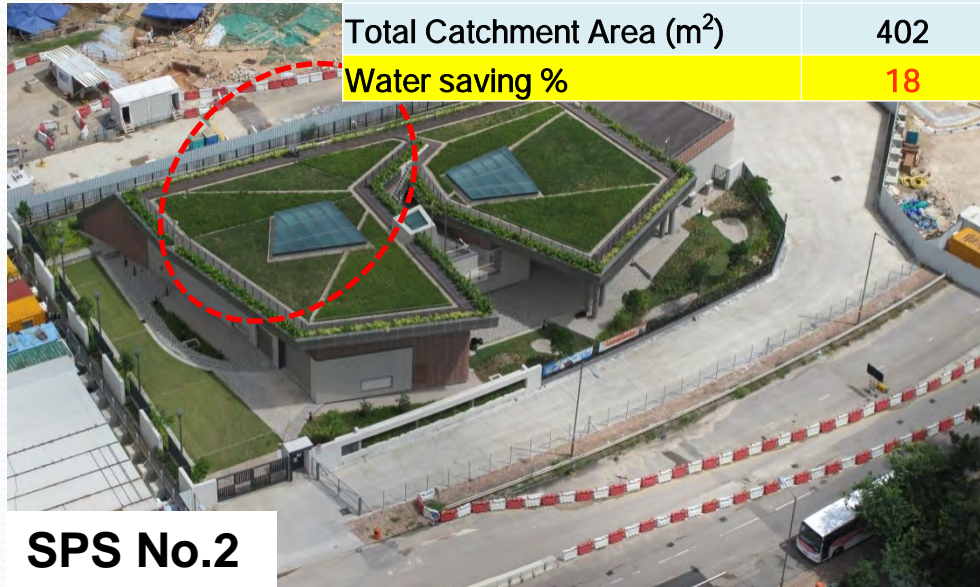
- **Benefits:**
  - Slow down the peak flow
  - Water saving



**SPS No.1**



	SPS No.1	SPS No.2
Size of water tank (m <sup>3</sup> )	90	10
Water usage (m <sup>3</sup> per day)	11	9.7
Total Landscape Area (m <sup>2</sup> )	2043	2244
Total Catchment Area (m <sup>2</sup> )	402	288
Water saving %	18	8



**SPS No.2**



Water usage for irrigation and flushing  
 Green roof system with water reservoir layer  
 Irrigation system with rain sensor: Automatic irrigation stop operate if rainfall > 25mm



# Kowloon City Pumping Stations

- **Benefits:**

- Reuse rain water
- Reduce heat island effect

Water Cascade in SPS No. 1



- **Benefits:**

- Slow down the peak flow
- Improve water quality



Rain Garden in SPS No. 2



# Kowloon City Pumping Stations

## Grass Paver Area

SPS no.1= 1007m<sup>2</sup>

SPS no.2= 160m<sup>2</sup>

Performance of system still under review

- **Benefits:**

- Slow down the peak flow



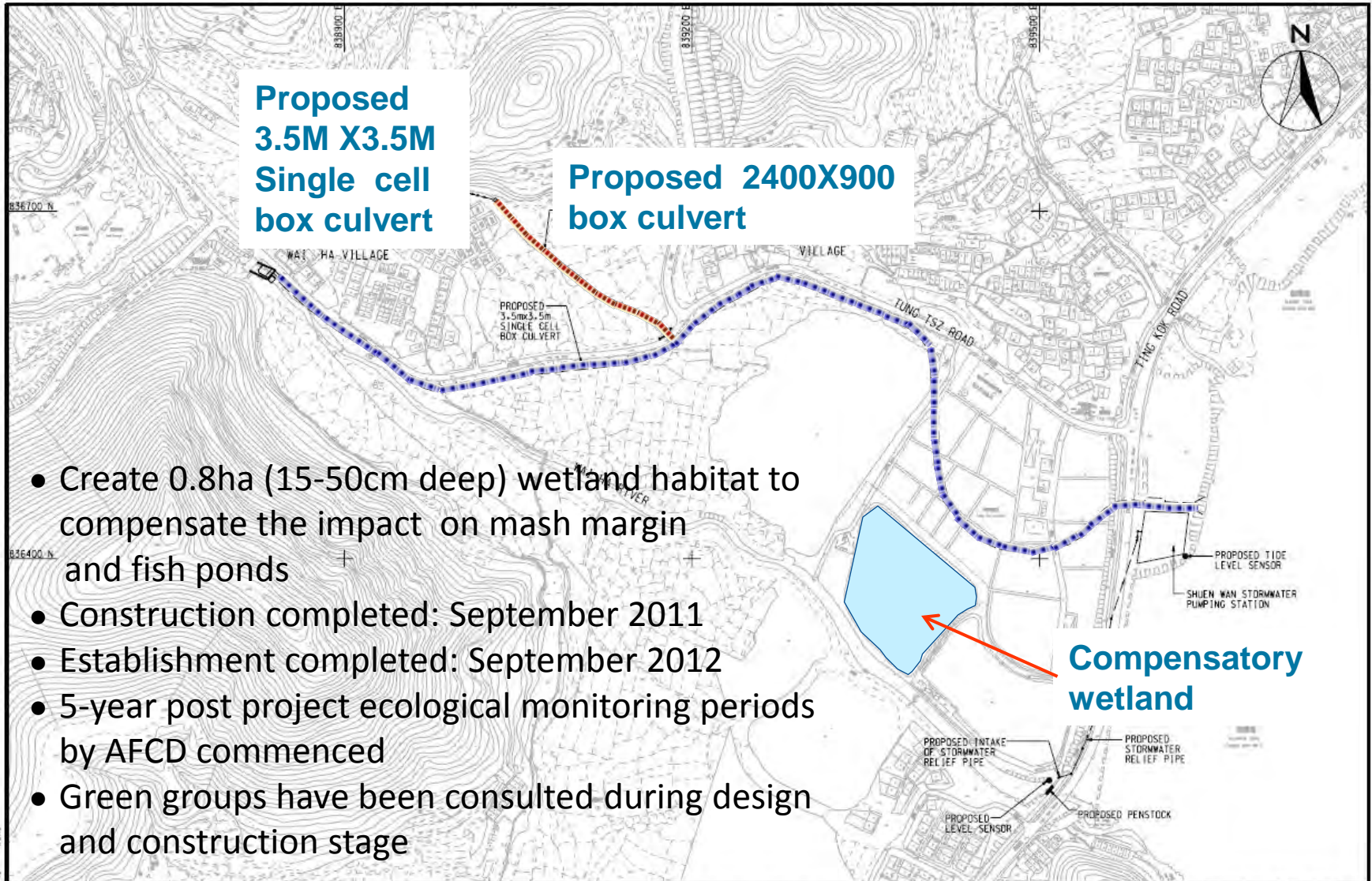


## 5. Shuen Wan Drainage Improvement Works





# Drainage Improvement Works in Shuen Wan



- Create 0.8ha (15-50cm deep) wetland habitat to compensate the impact on mash margin and fish ponds
- Construction completed: September 2011
- Establishment completed: September 2012
- 5-year post project ecological monitoring periods by AFCD commenced
- Green groups have been consulted during design and construction stage



AGREEMENT NO. CE50/2001 (OS), DRAINAGE IMPROVEMENT IN SHA TIN AND TAI PO  
 GENERAL ARRANGEMENT OF PROPOSED DRAINAGE IMPROVEMENT WORKS  
 IN SHUEN WAN - ALTERNATIVE ARRANGEMENT

SCALE	A3 1 : 3000	DATE	FEB. 2011
CHECK	WM	DRAWN	WX
DRAWING NO.	60016002	FIGURE NO.	FIGURE 4.1
		REV	-

2011-10-8 15:28:49 WMLK3  
 g:\projects\701602\REPORT\DESIGN\REPORT\FIGURE 4.2.dgn

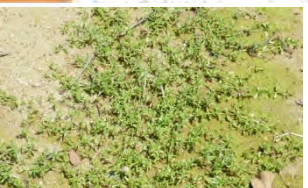
# Drainage Improvement Works in Shuen Wan

## Planting of native species

Mangrove planting



Brackish marsh herbs



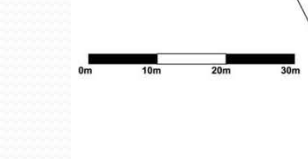
*Bacopa monnieri* 過長沙



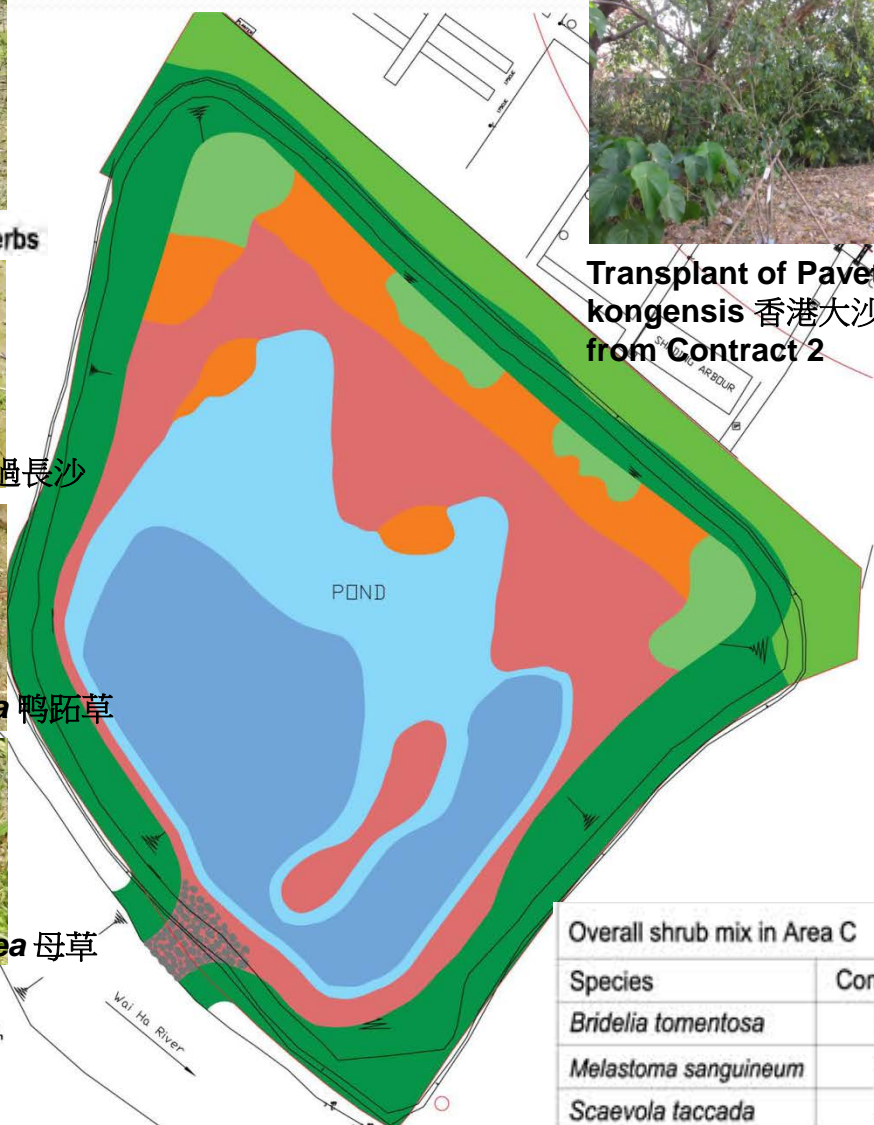
*Commelina diffusa* 鴨跖草



*Lindernia crustacea* 母草



Transplant of *Pavetta hongkongensis* 香港大沙葉 from Contract 2



Overall tree mix in Area C

Species	Composition
<i>Celtis sinensis</i>	25%
<i>Ficus superba</i> var. <i>japonica</i>	10%
<i>Hibiscus tiliaceus</i>	30%
<i>Macaranga tanarius</i>	15%
<i>Viburnum odoratissimum</i>	20%

- Site boundary
- Existing trees retained and additional trees (trans)planted
- Woodland tree and shrub planting
- Mangrove planting
- Brackish marsh herbs
- Intertidal mudflat
- Shallow water 0-50 cm at low tide
- Deep water 50-150 cm at low tide
- Natural rubble stone to reinforce bank and prevent scour

Overall shrub mix in Area C

Species	Composition
<i>Bridelia tomentosa</i>	25%
<i>Melastoma sanguineum</i>	30%
<i>Scaevola taccada</i>	45%





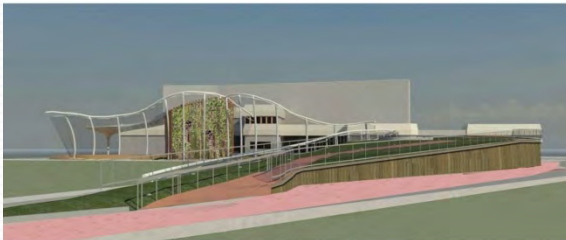
# Drainage Improvement Works in Shuen Wan

## Condition after 10 months



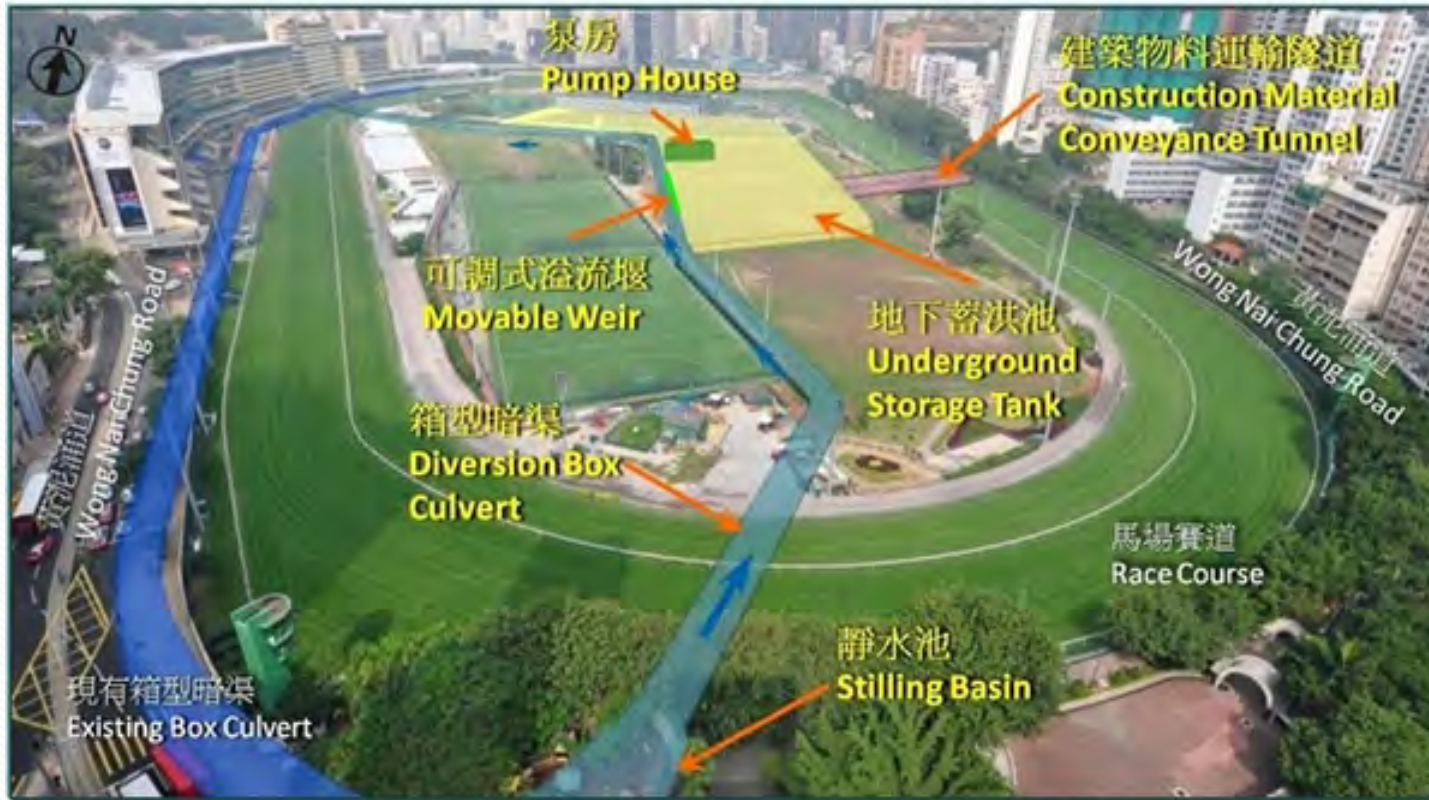


# 6. Happy Valley Underground Stormwater Storage Scheme





# Happy Valley Underground Stormwater Storage Scheme



- Commencement on September 2012
- Contract completion: Early 2018



# Happy Valley Underground Stormwater Storage Scheme

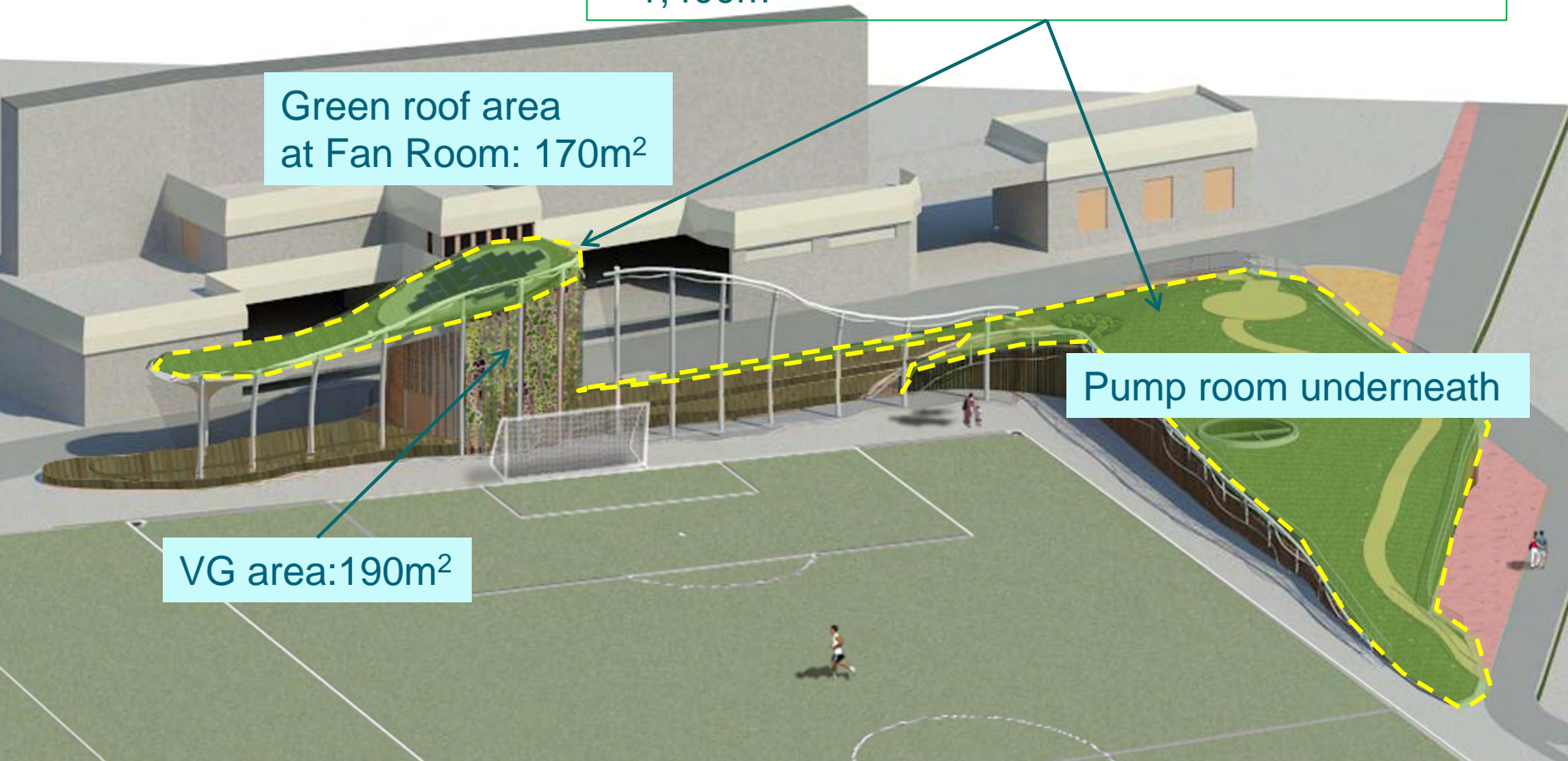
## Latest Architectural Design

Green Area (HVUSSS Pump House & Fan Room)  
= 1,400m<sup>2</sup>

Green roof area  
at Fan Room: 170m<sup>2</sup>

Pump room underneath

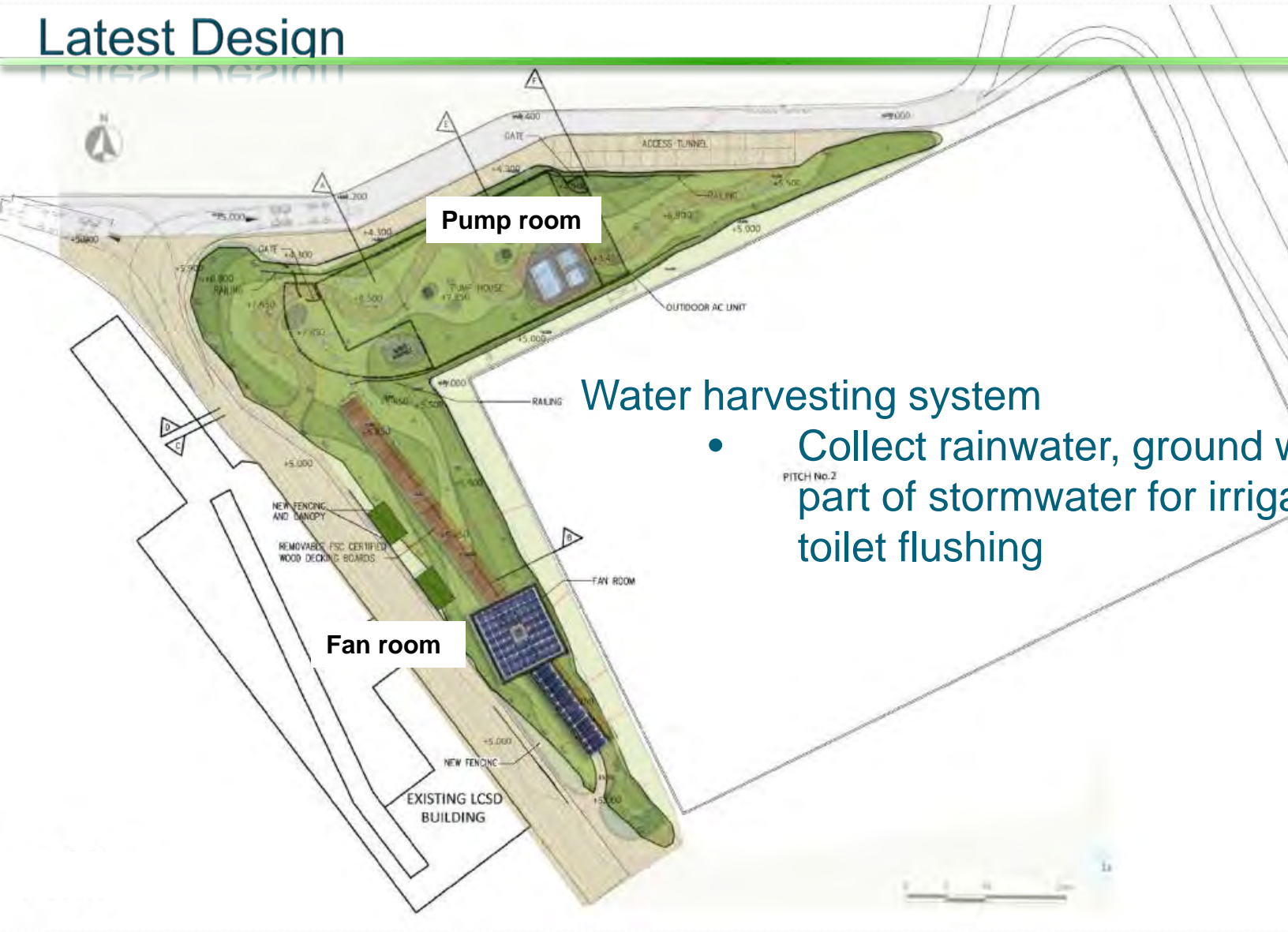
VG area: 190m<sup>2</sup>





# Happy Valley Underground Stormwater Storage Scheme

## Latest Design



### Water harvesting system

- Collect rainwater, ground water and part of stormwater for irrigation and toilet flushing

PITCH No.2



# Happy Valley Underground Stormwater Storage Scheme

## Water Harvesting System

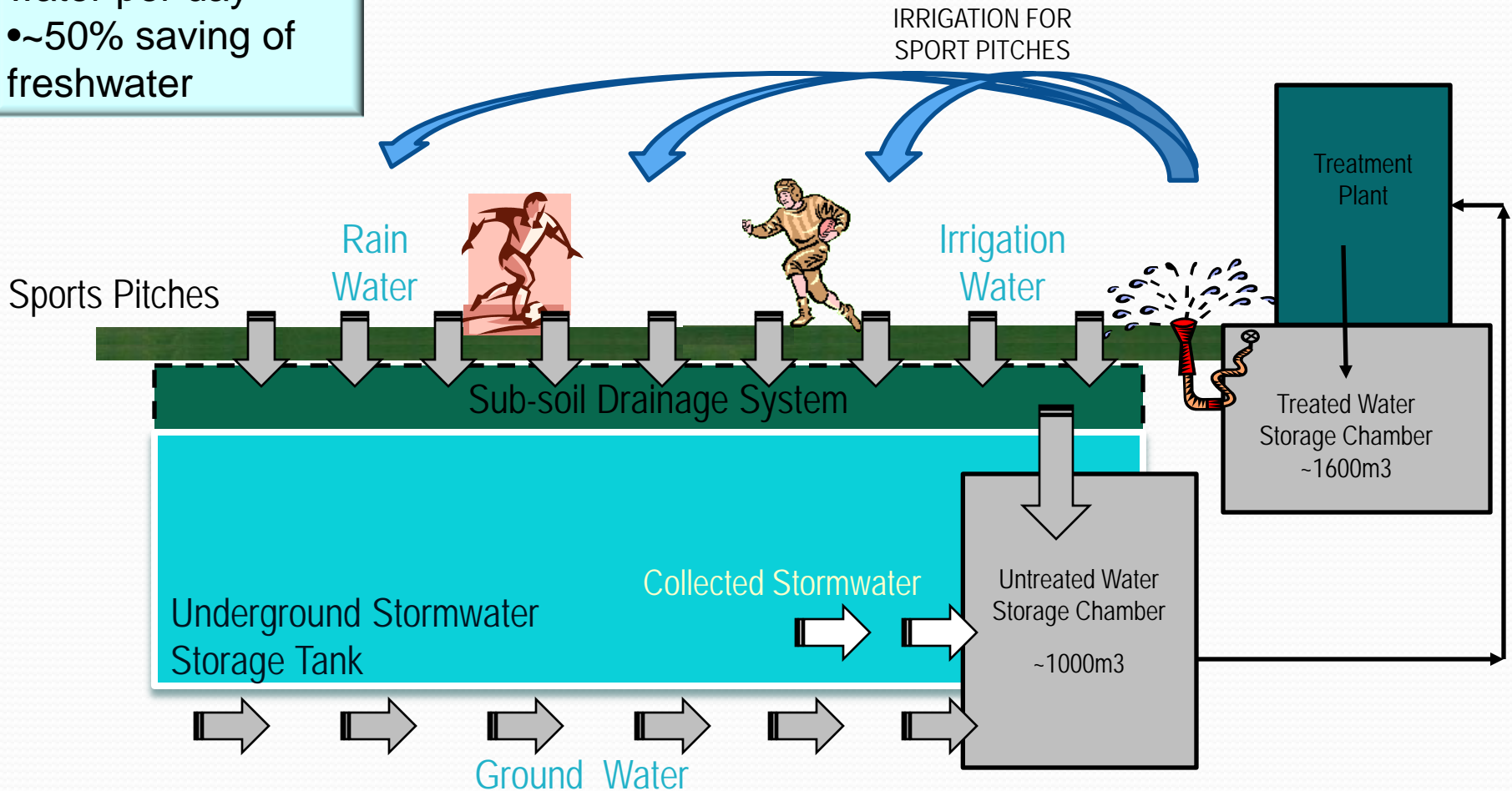




# Happy Valley Underground Stormwater Storage Scheme

## Water Harvesting System

- ~600m<sup>3</sup> reclaimed water per day
- ~50% saving of freshwater





新蒲崗  
SAN PO KONG ↑

彩虹  
CHOI HUNG →

九龍灣  
KOWLOON BAY →

↑ 黃大仙  
WONG TAI SIN

← 九龍城  
KOWLOON CITY

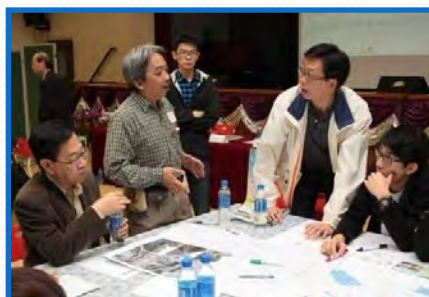
← 土瓜灣  
TO KWA WAN

## 7. Kai Tak Midstream





Kai Tak River	Department in Charge	Statue
Upstream Project	DSD	Constructing (Contract no. DC/2011/04)
<b>Midstream Project</b>	<b>DSD</b>	<b>Commence in the end of 2013</b>
Cross Prince Edward Road East Project	DSD	Constructing (Contract no. DC/2010/03)
Downstream Project	CEDD	Constructing (Contract no. KL/2011/01)



Public consultation workshops on 2010 and 2011

# Kai Tak Midstream

Extension of granite parapet

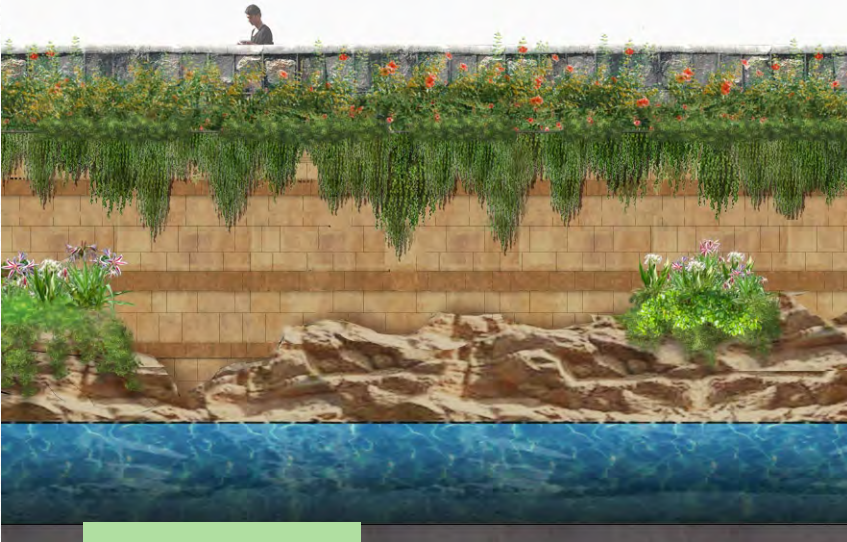
Planters replace the existing granite parapet

Existing granite parapet to be preserved





# Kai Tak Midstream



Elevation



Fish holes



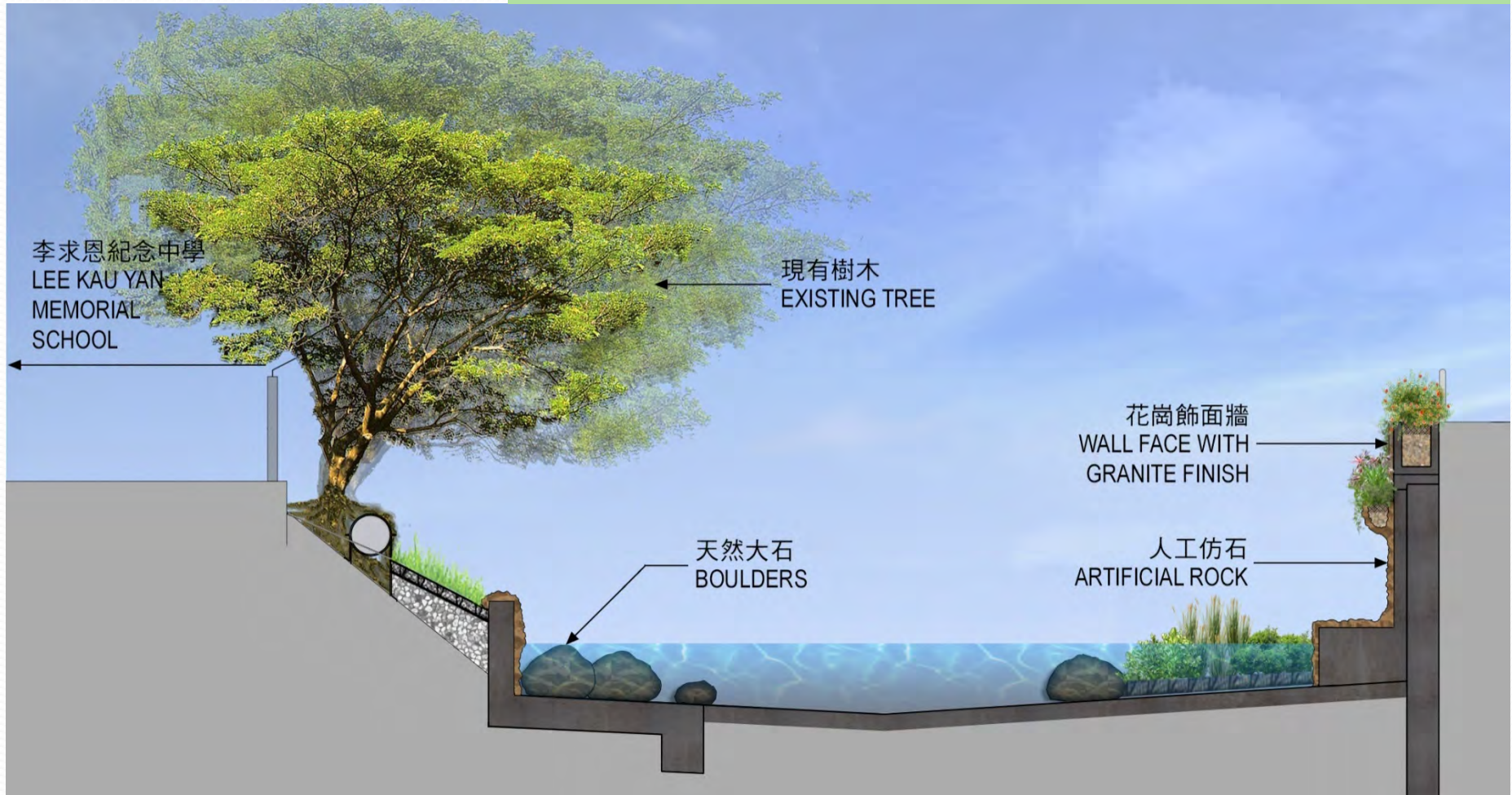
Deflectors



Typical section

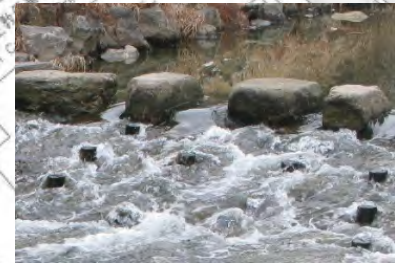


## Section near to Lee Kau Yan Memorial School





Proposed location of observation deck



Observation Deck  
Technical Assessing  
about 3m(Length) x  
2m(Width)



River side planting



**Thank you**

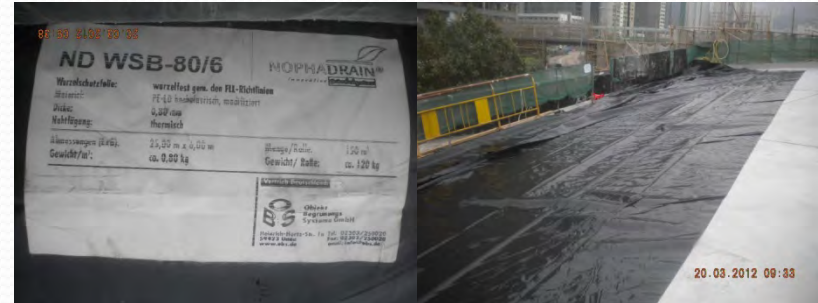
# Kowloon City Pumping Stations

## Green Roof System Submission & Installation on Pitch Roof

“Hydrolink” Elastic Guard PU Liquid Membrane Waterproof System



Root Barrier



Drainage Composite



Protective Cement Sand Screeding with Wiremesh



Drainage Reservoir Panel



## Green Roof System - Specification

Root Barrier	
Standard	Tested in accordance with the FLL Root Penetration Test
Material	Modified low density polyethylene (LDPE)
Colour	Black
Thickness	0.8mm
Weight	760g/m <sup>2</sup>
Dimension	(L) x (W)

Water Reservoir Panel	
Standard	Test on filter stability Test on drying behavior (drying time 78% longer than soil only)
Material	Hydrophilic mineral wool
Density	120kg/m <sup>3</sup>
Thickness	50mm
Water retention capacity	40L/m <sup>2</sup> = 80 Vol%
Air volume	16%
pH value	7-8
Weight	Dry 6kg/m <sup>2</sup> , saturated 46kg/m <sup>2</sup>
Dimension	1200mm(L) x (W) x 50mm(T)
Moisture Tension	Test Report: TBU Greven

Drainage Composite		
Standard	CE-marked and BSEN13252	
Material	Drainage Composite consisting of a perforated sheet of high impact polystyrene (HIPS) with a non-woven filter fabric bonded to each dimple as one integrated unit.	
Dimpled sheet	High impact polystyrene (HIPS)	
Filter fabric	Non-woven polypropylene (PP) approx. 140g/m <sup>2</sup>	
Damp open backing	Non-woven polypropylene (PP) approx. 125g/m <sup>2</sup>	
Thickness	27.5mm	
Dimension	(L) x (W) /roll	
Weight	1,280g/m <sup>2</sup>	
Water Reservoir	5.8 L/m <sup>2</sup>	
Compressive strength	480kN/m <sup>2</sup>	BSEN ISO 25619-2
Drainage capacity	1.77L/s. m (litter per second per meter) at fall ratio 100 (1%) with loading 10kpa	BSEN ISO 12958
Tensile Strength* (MD/CMD)	8/8 kN/m	BSEN ISO 10319
CBR Puncture Resistance*	1.4kN	BSEN ISO 12236
Dynamic perforation*	26mm	BSEN ISO 13433
Opening Size O <sub>90</sub> *	100µm	BSEN ISO 12956
Water Permeability H <sub>50</sub>	90mm/s	BSEN ISO 11058
*		
*Performance expressed of the filter/ geotextile only		