

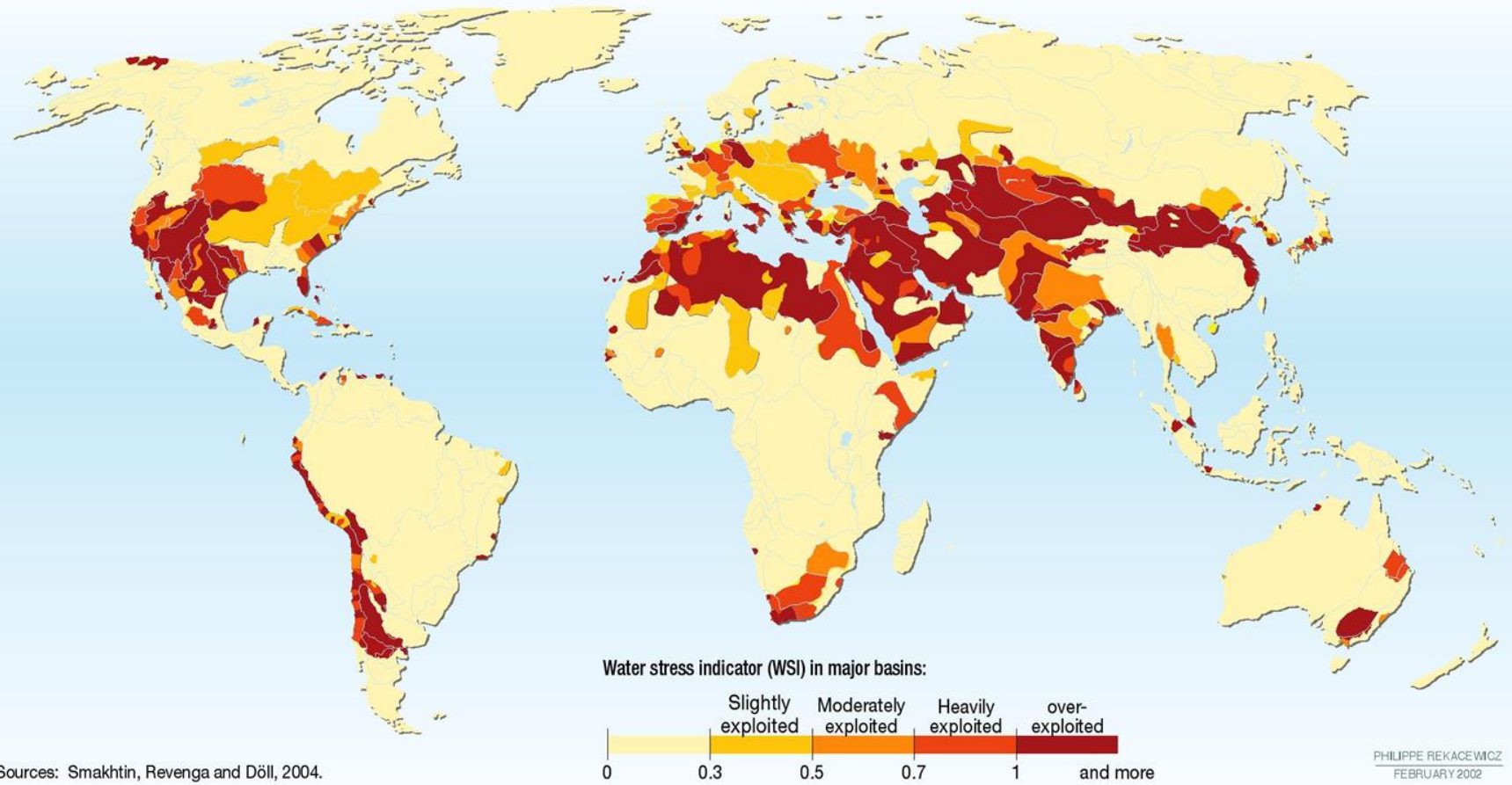
An Integrated Approach in Flood Prevention and Water Reclamation in a Densely Populated Metropolitan: Will the Innovation Work?

13 November 2014

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Sources: Smakhtin, Revenga and Döll, 2004.

PHILIPPE REKACEWICZ
FEBRUARY 2002





Flooding Event:

a) 24 August 2000

➤ Happy Valley Race Course



b) 24 April 2006

➤ Leighton Road



Upstream

(140 HA)

Midstream

(130 HA)

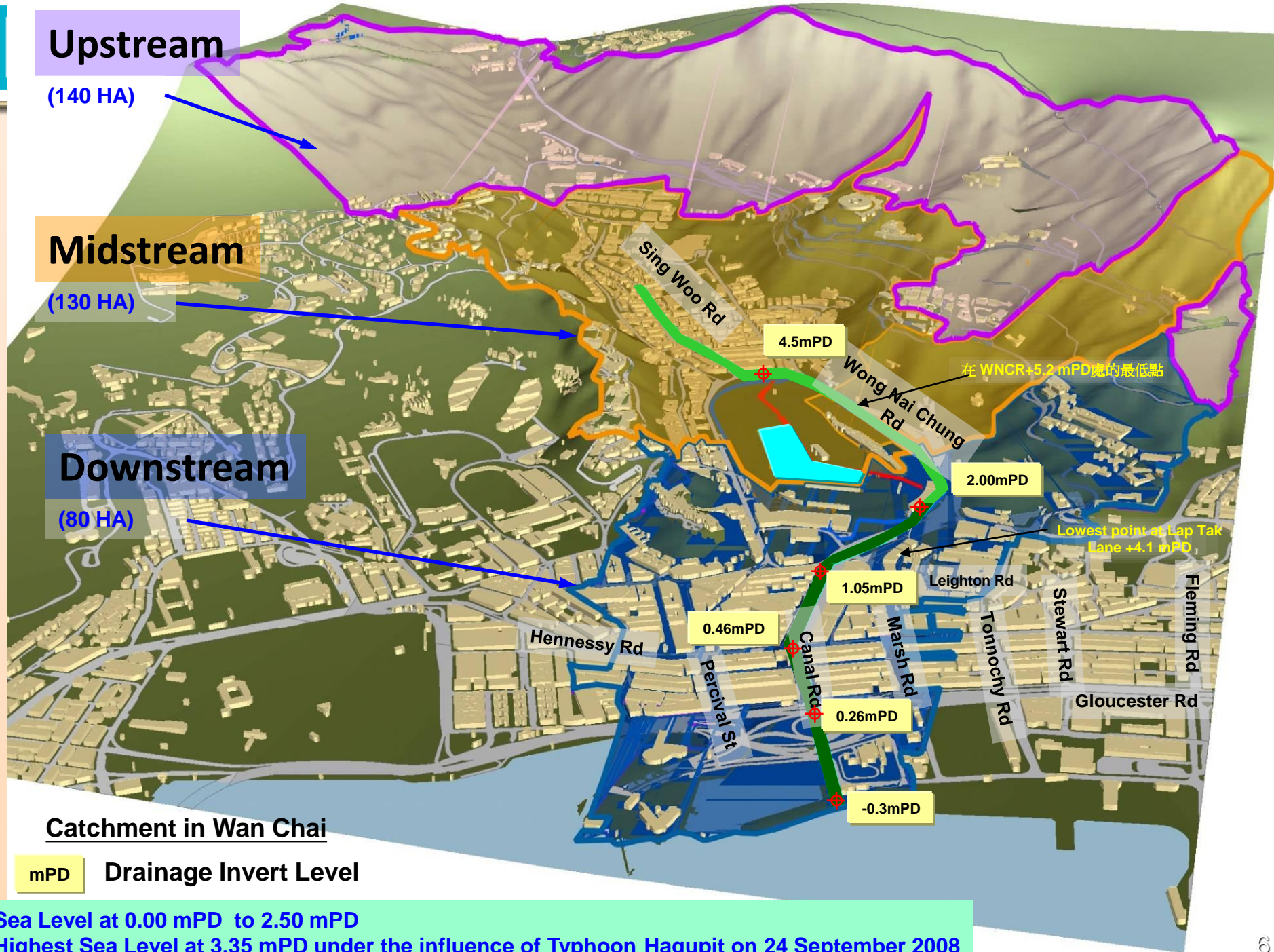
Downstream

(80 HA)

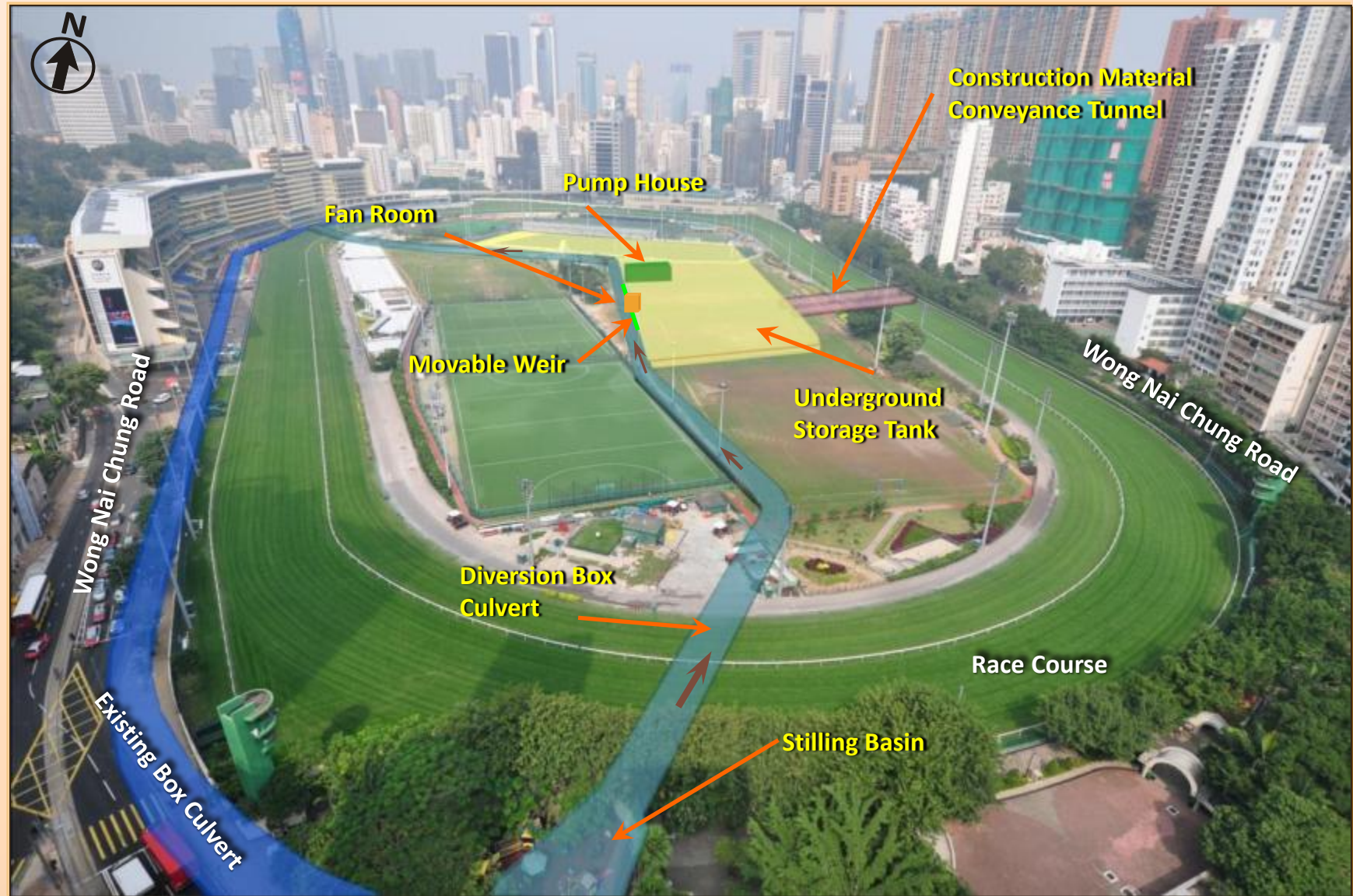
Catchment in Wan Chai

mPD Drainage Invert Level

Sea Level at 0.00 mPD to 2.50 mPD
Highest Sea Level at 3.35 mPD under the influence of Typhoon Hagupit on 24 September 2008

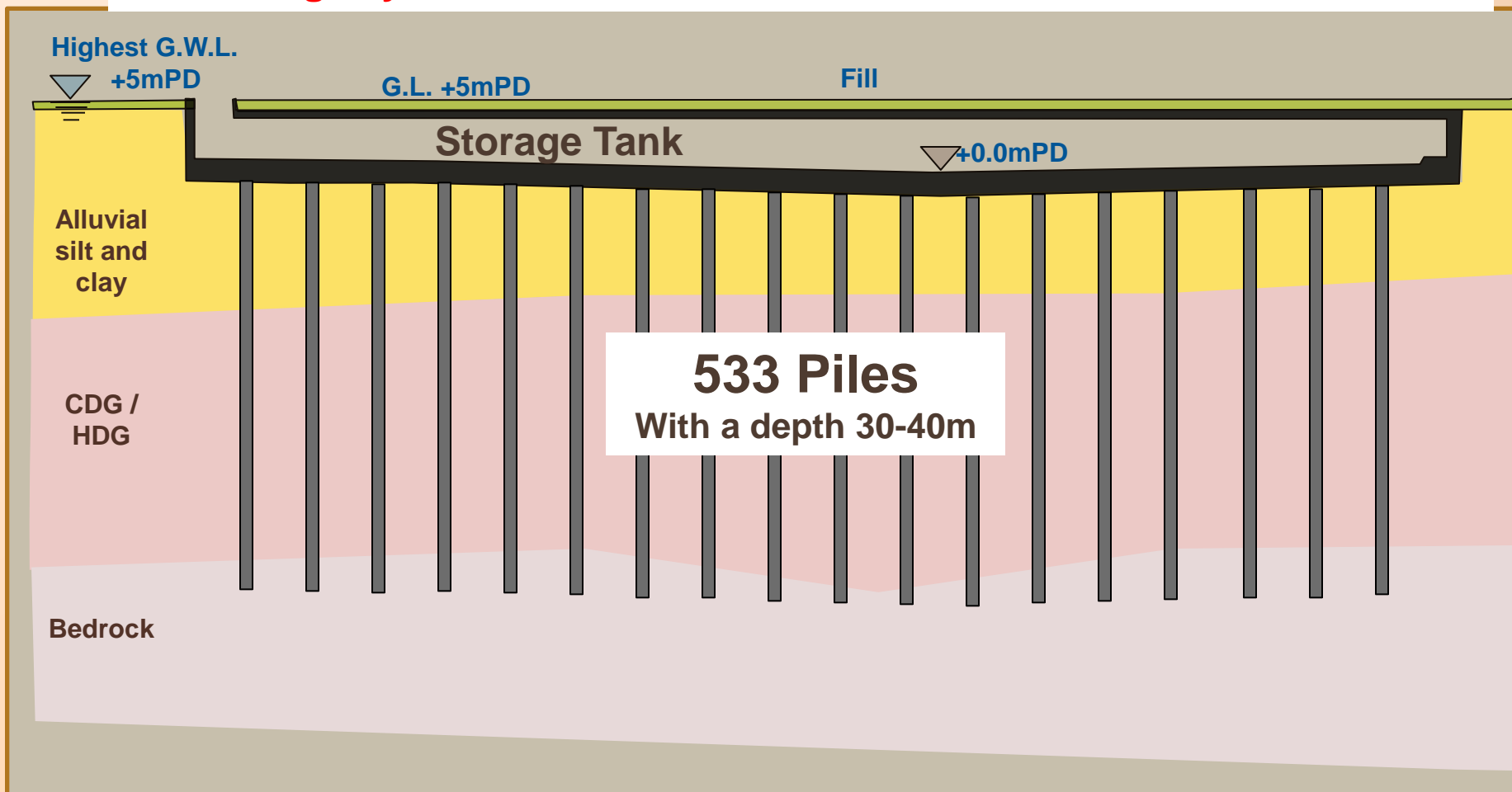


Happy Valley Underground Stormwater Storage Scheme (HVUSSS)

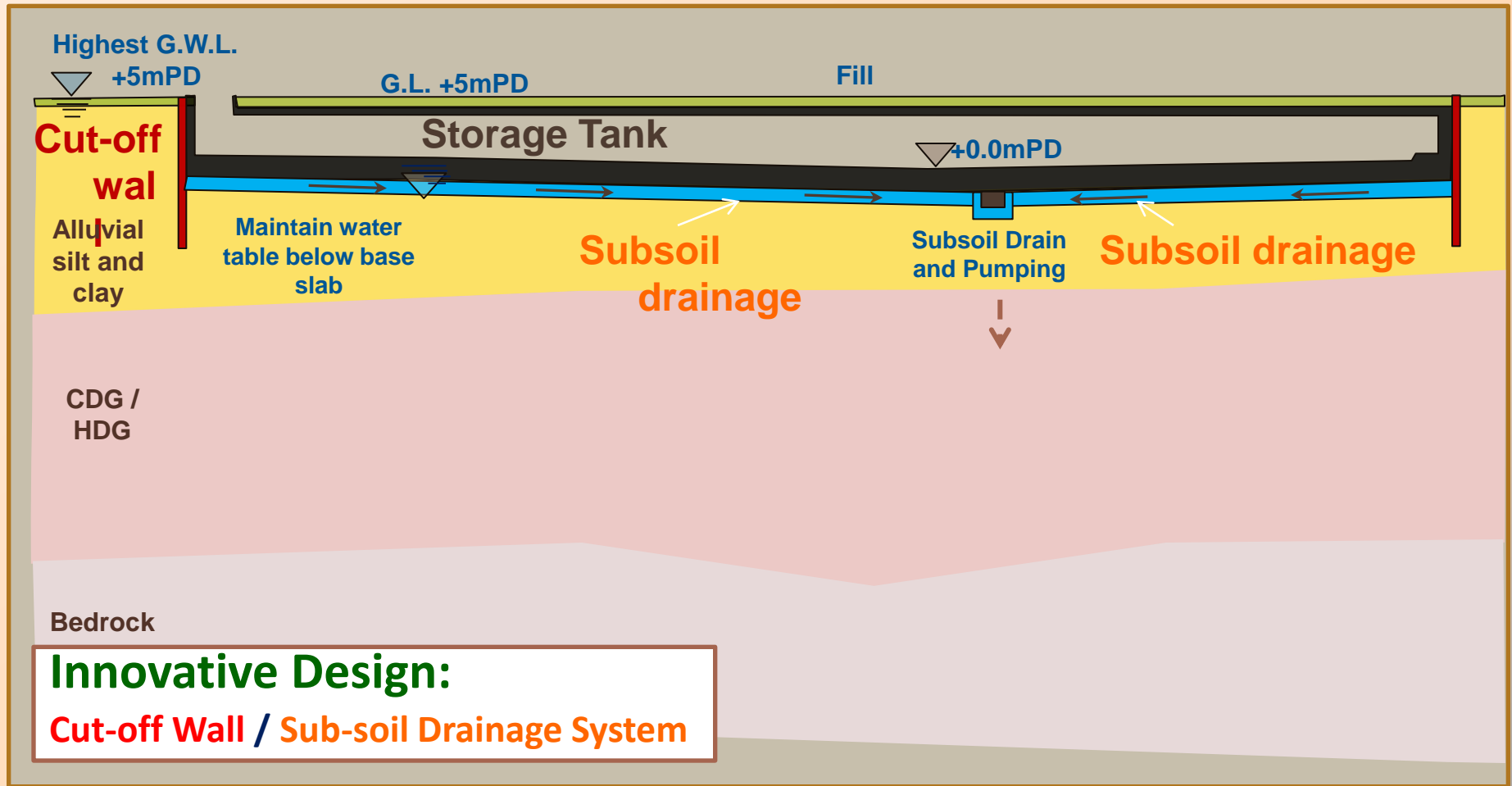


Alternative Innovative Foundation Design

Replace original pre-bored H piles by **cut off wall** and **subsoil drainage system**

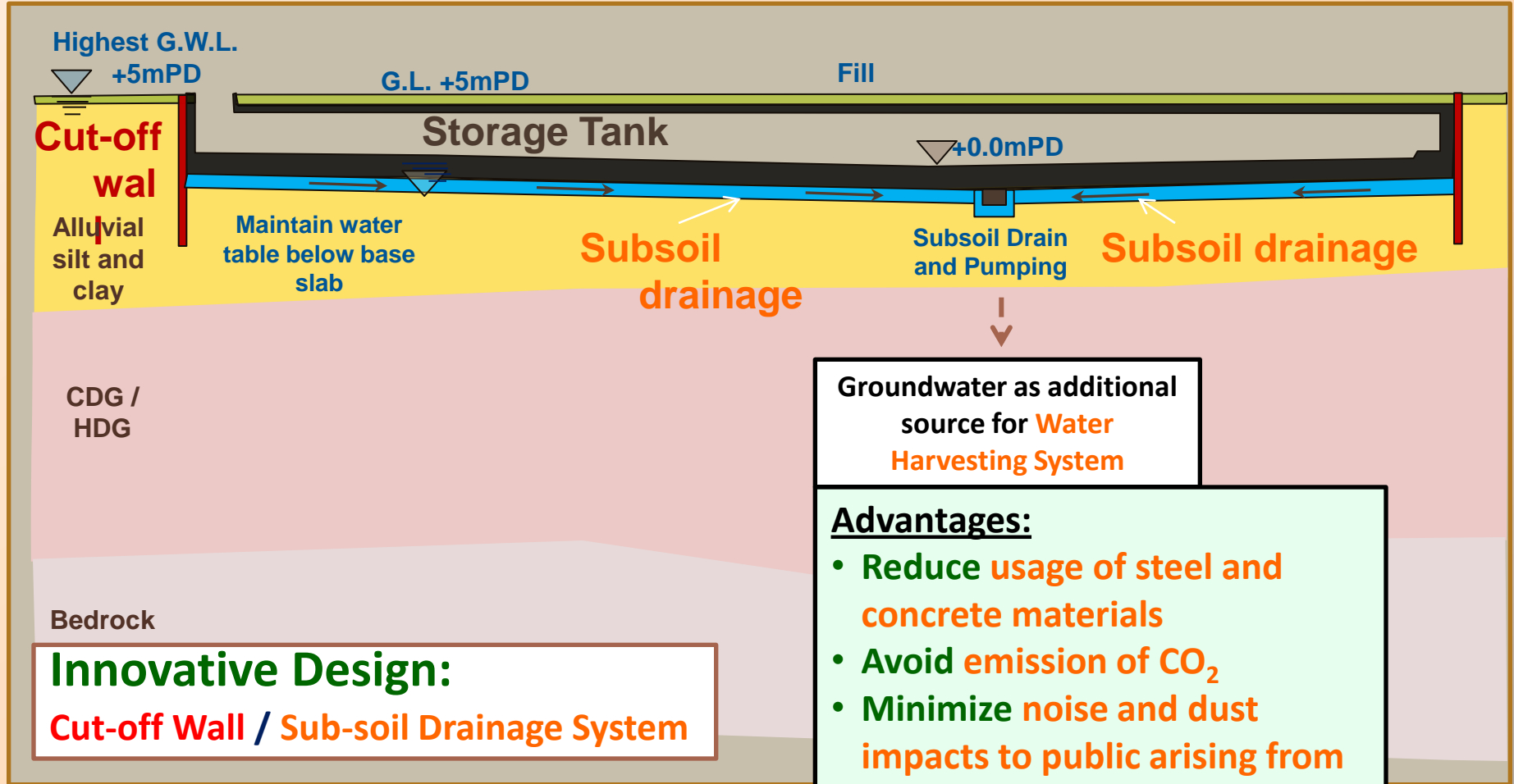


Alternative Innovative Foundation Design





Alternative Innovative Foundation Design



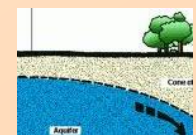
Three-in-One Design Approach



**Rain-
water**



**Irrigation
Water**



**Ground-
water**

Treatment



**Treated
Water**



Reuse

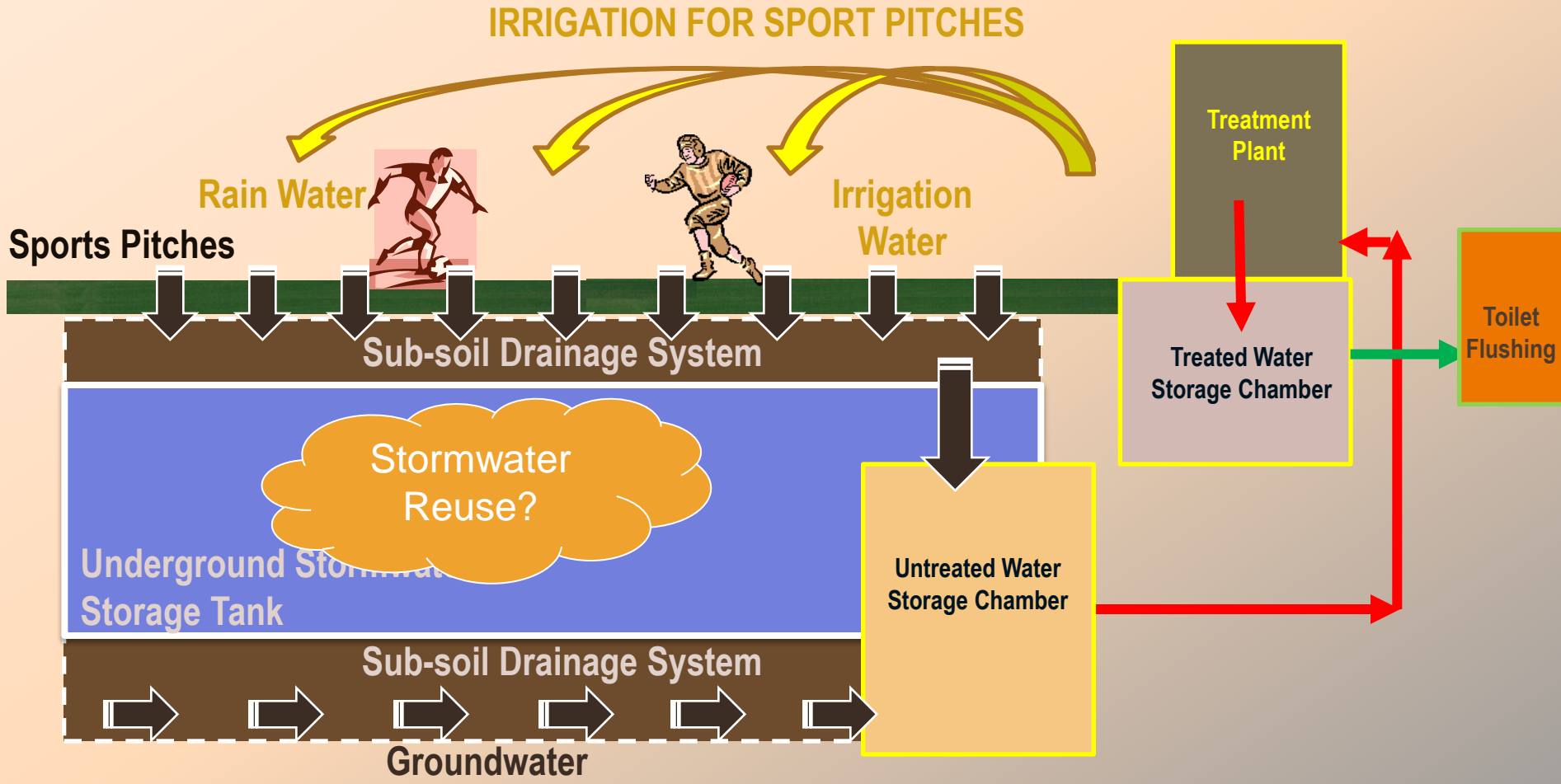
**Toilet
Flushing**



Irrigation



Illustration of Water Reclamation System





Stormwater Reuse

Considerations:

- Water quality
- Availability
- Spatial requirements
- Influence on flood protection standard
- Treatment standard
- Potential use

Quality of Groundwater Samples

		Sampling Date & Time	June 2013
		Location	Sport Pitch
Parameter	Unit	WSD's Recommended Water Quality Standards	
E. coli	No. / 100ml	Non-detectable	Non-detectable
Total residual chlorine	mg/l	≥ 1 exiting treatment system ≥ 0.2 at user end	<0.2
Dissolved oxygen	mg/l	≥ 2	6 - 8.1
Total suspended solids (TSS)	mg/l	≤ 5	<2
Colour	Hazen unit	≤ 20	<2.5
Turbidity	NTU	≤ 5	<1
pH	-	6 - 9	6.0 - 6.5
Threshold Odour Number (TON)	-	≤ 100	<1
5-day Biochemical oxygen demand (BOD ₅)	mg/l	≤ 10	<2
Ammoniacal nitrogen	mg/l as N	≤ 1	0.01 - 0.03
Synthetic detergents	mg/l	≤ 5	<1

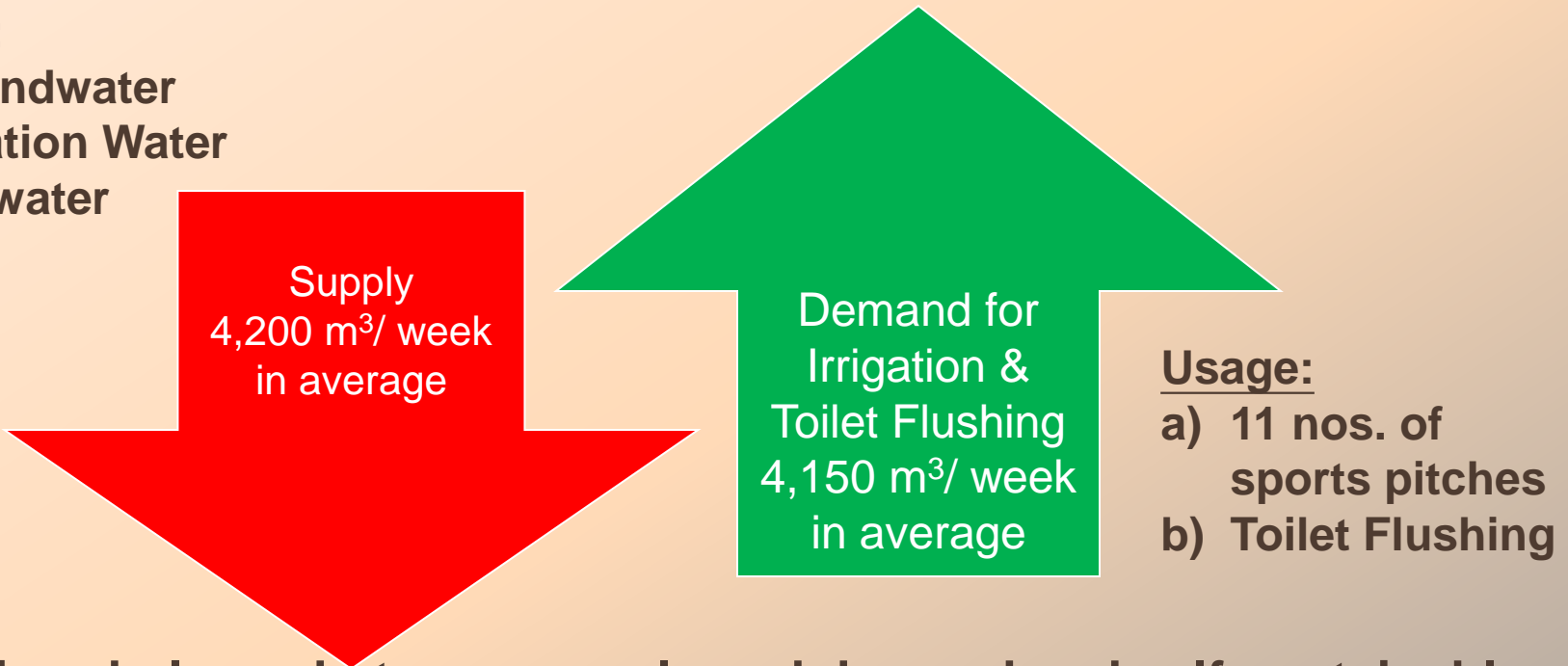
Quality of Stormwater Samples

		Sampling Date	23 & 30/8/2013 rainstorm events
		Location	Box Culvert (WNCR)
Parameter	Unit	WSD's Recommended Water Quality Standards	
E. coli	No. / 100ml	Non-detectable	78,000 - 27,000
Total residual chlorine	mg/l	≥ 1 exiting treatment system ≥ 0.2 at user end	<0.2
Dissolved oxygen	mg/l	≥ 2	8.4 - 5.7
Total suspended solids (TSS)	mg/l	≤ 5	180 - 32
Colour	Hazen unit	≤ 20	75 - 25
Turbidity	NTU	≤ 5	66 - 6
pH	-	6 - 9	7.3 - 6.9
Threshold Odour Number (TON)	-	≤ 100	1
5-day Biochemical oxygen demand (BOD ₅)	mg/l	≤ 10	8 - 12
Ammoniacal nitrogen	mg/l as N	≤ 1	0.56 - 0.16
Synthetic detergents	mg/l	≤ 5	<2

Water Demand

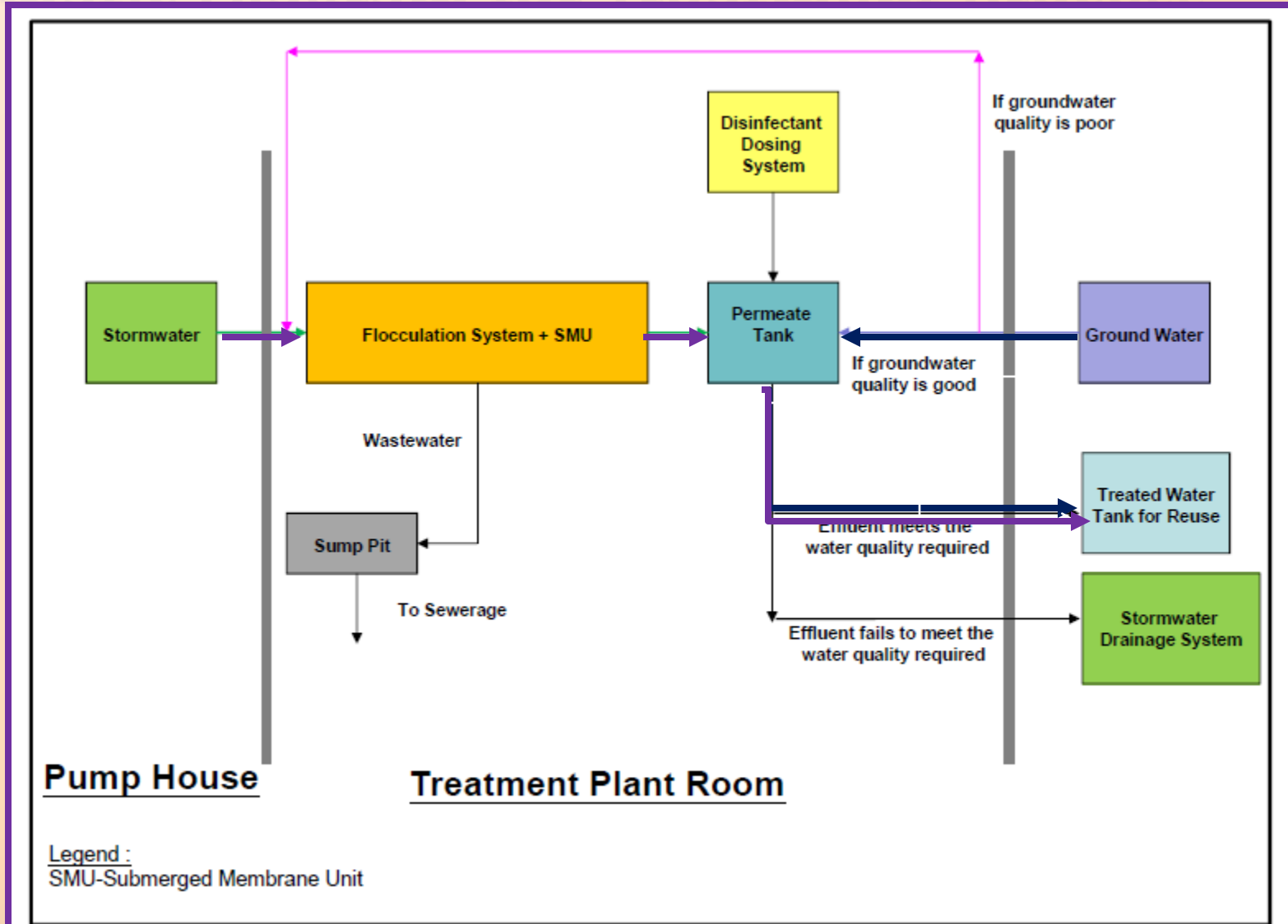
Source :

- a) Groundwater
- b) Irrigation Water
- c) Rainwater



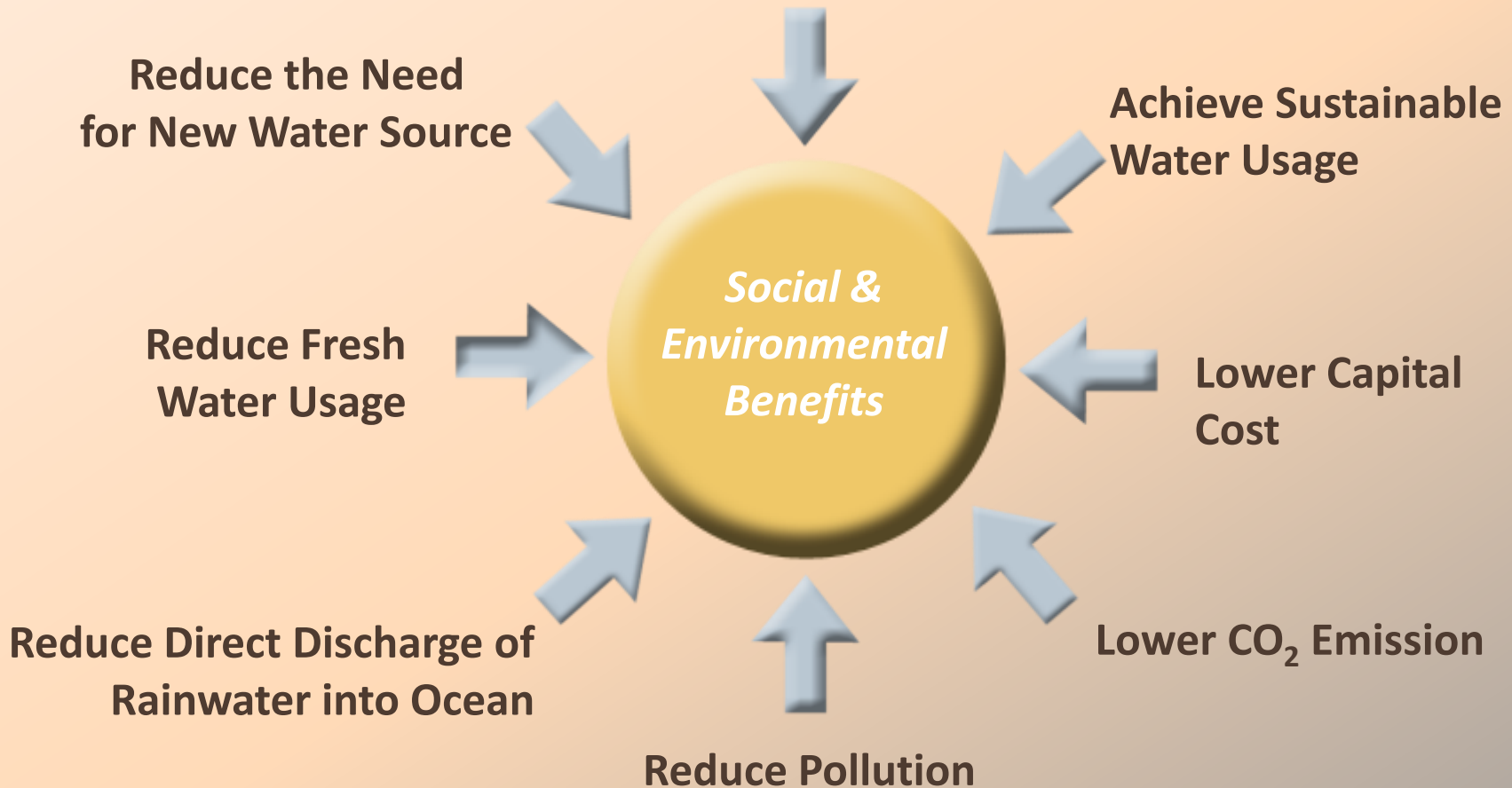
- Achieve balance between supply and demand and self-sustainable
- Peak water demand : 1,000m³/day
- Additional supply for toilet flushing
- Total harvesting of around 220,000 m³ per annum
- R&D on cost for Stormwater Harvesting

Schematic Diagram for Treatment Process



Gathering and Reusing Water Source

Facilitate Future Development



Green Infrastructure



- **Innovative, sustainable, cost-effective and environmentally friendly solution to alleviate flooding**
- **Pioneering Design Approach**
- **Sustainable Development**



Thank You!



Back-up Slides

Project Recognition

- **The 2012 International Water Association (IWA) Project Innovation Awards East Asia Regional Awards in Planning Category Joint Winners**

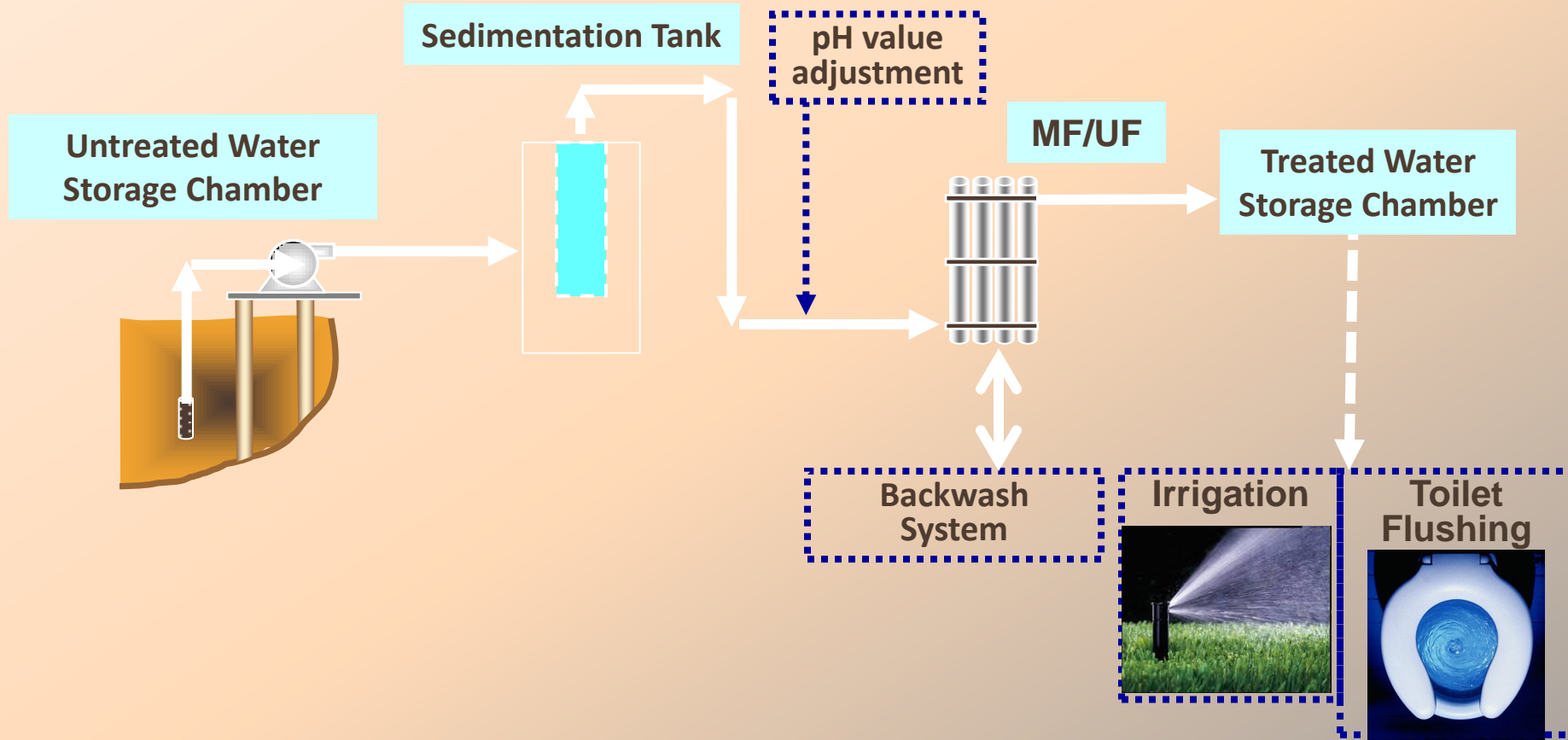
- Drainage Services Department (DSD)
- Black & Veatch Hong Kong Limited



- **The Hong Kong Institution of Engineers (HKIE) The Innovation Award for the Engineering Industry 2012/2013**
 - Merit (Construction Category)

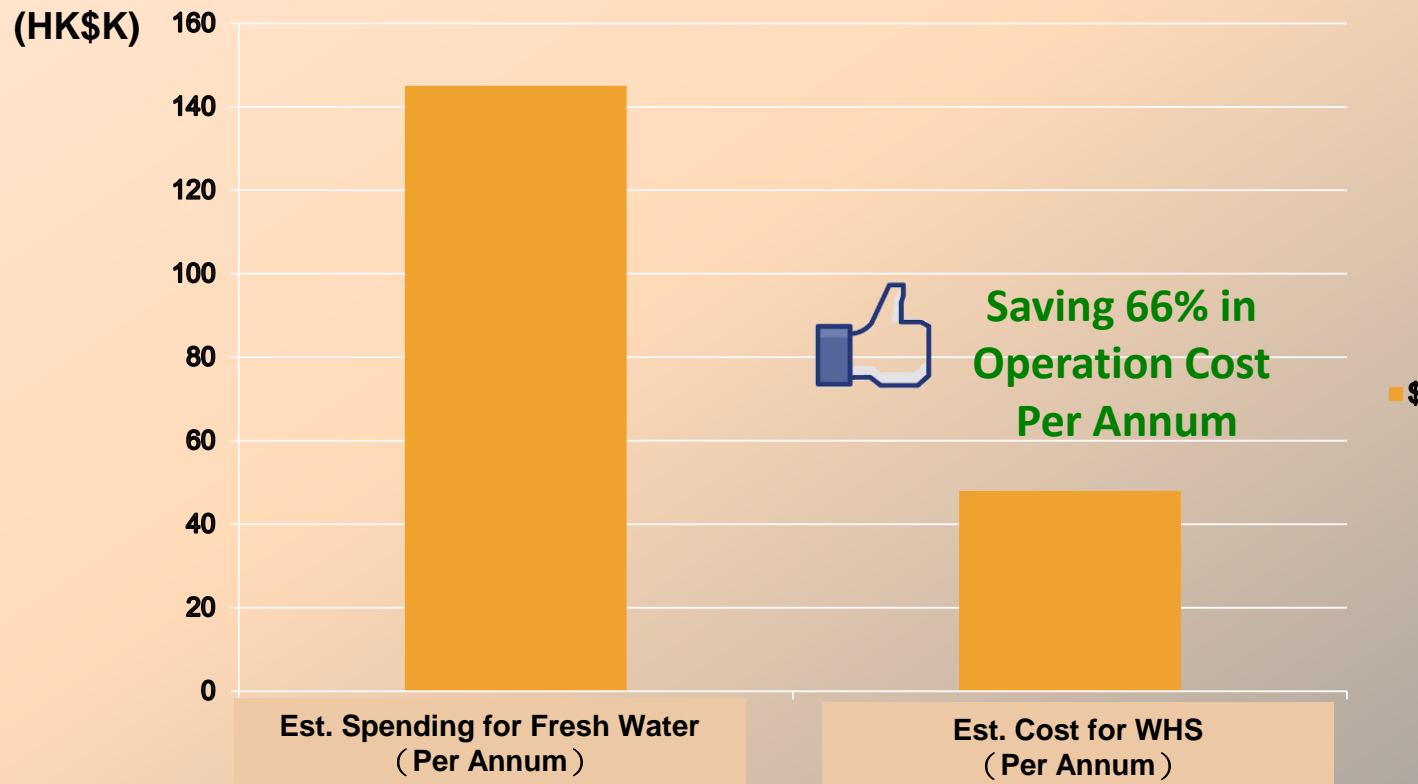


Mechanism of Membrane Filtration



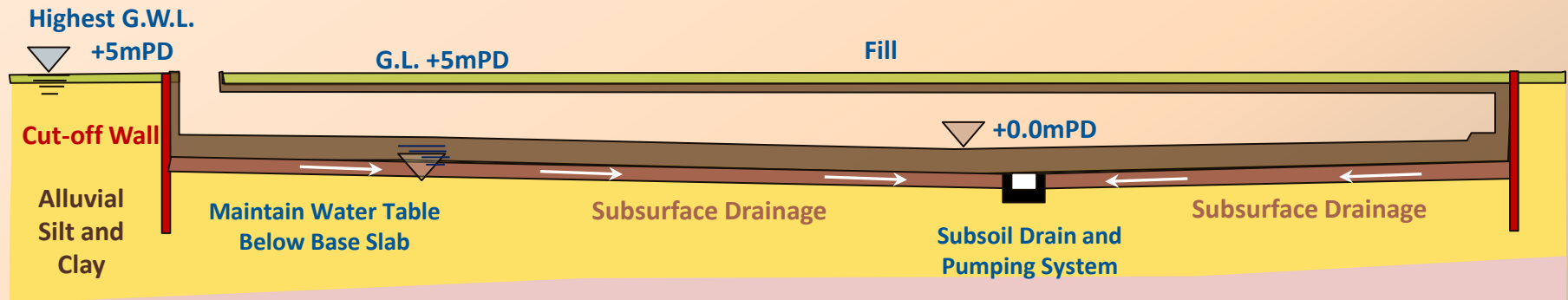
Construction Cost Estimate and Operation Cost

- Estimated construction cost (13 M. approx.) and operation cost for Water Harvesting System (48 K. approx. per annum)
- Estimated spending on fresh water for irrigation and toilet flushing (1.45 M. approx. per annum)



Cut-off Wall and Sub-surface Drainage System

Integrate Cofferdam Design using Sheetpiles as Cut-off Wall for Controlling Drawdown of Groundwater Level (GWL) to Eliminate Buoyancy



Where should we discharge the groundwater and rainwater collected through this sub-surface drainage system?