Water for All
Conserve, Value, Enjoy
PUB



Active, Beautiful and Clean Waters Programme

Sustainability Office, PUB

Outline

ABC Active, Beautiful, Clean Waters for all

- ABC Waters Programme
  - Background
  - Project updates
- Promoting adoption of ABC Waters concept
  - ABC Waters Design Guidelines
    - ABC Waters design features
    - Pilot Projects and Examples
  - Revisions to COP on Surface Water Drainage (6th edition – Addendum 1)
  - ABC Waters Certification
    - Case examples

Recognition for adopting ABC Waters Design features

Introduced into BCA's new Green Mark Scheme under Stormwater Management

- District - Up to 8 points awarded
- New Parks – Up to 12 points awarded
- New Buildings (RB & NRB) – up to 3 points awarded
- Existing Residential Buildings – up to 4 points awarded

BCA GREEN MARK

Green Mark District

Part 2 – Water Management	Green Mark Points		
2-1 Water Efficient Fittings for Infrastructure & Public Amenities Encourage the use of water efficient fittings covered under the Water Efficiency Labelling Scheme (WELS).	Rating based on Water Efficiency Labelling Scheme (WELS) V Good: 3	Excellent: 4	Points awarded based on the number and water efficiency rating of the fitting type used (Up to 4 points)
2-2 Stormwater Management Provisions of the following ABC Waters design features* within the site • Bioretention swales / other Bioretention systems • Rain Gardens • Constructed wetlands • Cleansing biotopes * Note: Singapore is adopting ABC Waters Management strategy where water will be retained and treated by natural means using plants and soil media for water quality improvement using the green features called "ABC Waters Design Features".	• 8 pts for the use of ABC Waters design features to treat runoff from greater than or equal to 50% of the impervious area within the site. In addition, provide a maintenance plan for ABC Waters design features. • 6 pts for the use of ABC Waters design features to treat runoff from greater than or equal to 50% of the impervious area within the site. • 3 pts for the use of ABC Waters design features to treat runoff from greater than or equal to 25% of the impervious area within the site		

Green Mark New Buildings

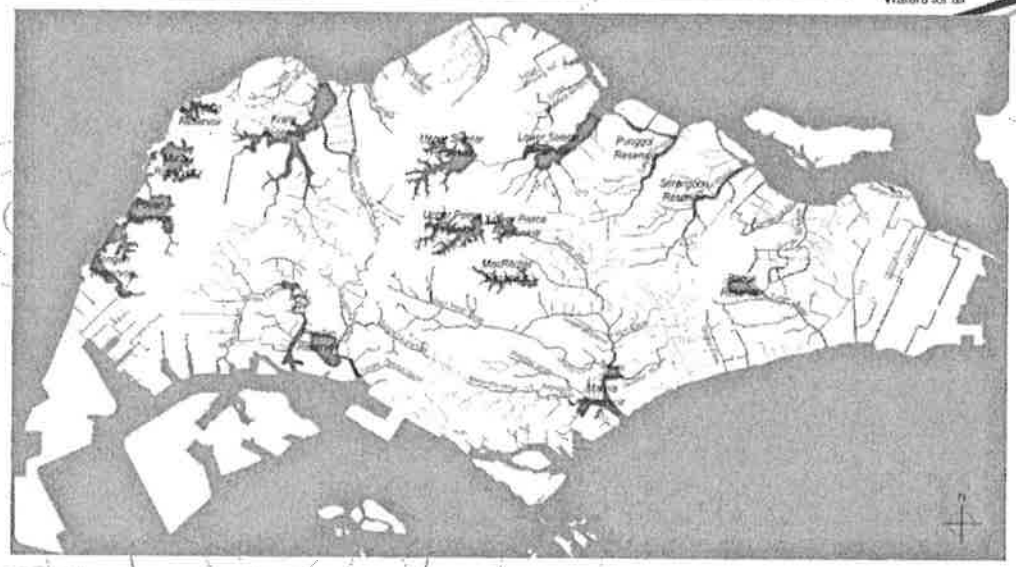
RB 3-6 Stormwater Management Encourage the treatment of stormwater run-off before discharge to public drains. Provision of infiltration features or design features as recommended in PUB's ABC Waters Design Guidelines : • Bioretention swales/ other bioretention • systems • Rain gardens • Constructed wetlands • Cleansing biotopes • Retention ponds	Points scored based on the extent of the stormwater treatment. 3 points for treatment of run-off from more than 35% of total site area or paved area 2 points for treatment of run-off from 10% to 35% of total site area 1 point for treatment of run-off from up to 10% of total site area

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Blue Map of Singapore

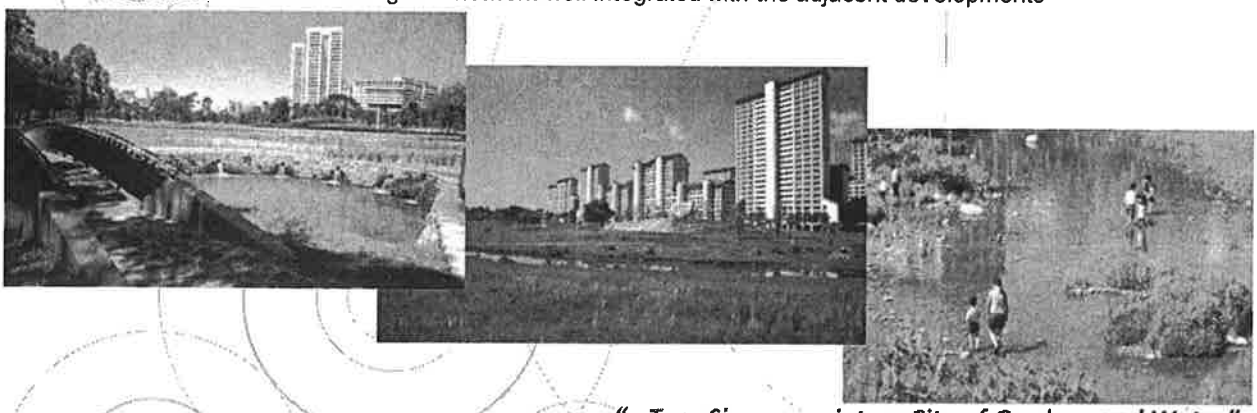


- 17 reservoirs
- 32 major river
- 8,000+km of waterways

Active, Beautiful, Clean Waters Programme

Long-term strategic initiative

- To transform our utilitarian drains, canals and reservoirs into vibrant, aesthetically pleasing and clean flowing streams, rivers and lakes
- To bring people closer to the water so that they will cherish and take ownership
- To create a seamless blue-green network well integrated with the adjacent developments



"...Turn Singapore into a City of Gardens and Water"
– PM Lee, ABC Waters Public Exhibition - Feb 2007

ABC Waters Programme

What it is all about

Active
- New recreational spaces

Beautiful
- Integrating waterbodies and waterways with their urban landscape

Clean
- Improving water quality





ABC Waters Masterplan


Alexandra Canal


Lorong Halus Wetland


Sengkang Floating Wetland

- Over 100 projects island-wide by 2030
- Phase 1 – 28 projects implemented by 2012
- Phase 2 – 19 projects to be implemented by 2017


Kallang River - River Vista & Kolam Ayer


Jurong Lake


Lower Seletar Reservoir

ABC Waters Masterplan – Recent Completed Projects

ABC Active, Beautiful, Clean Waters for all

Sg Ulu Pandan / Sg Pandan (opened in Jul 2013)





Kallang River @ Bishan-Ang Mo Kio Park (opened in Mar 2012)





Completed Projects

ABC Active, Beautiful, Clean Waters for all

Gaylang River (Opened in: Jan 2014)







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Promoting adoption of ABC Waters Concept

ABC Active, Beautiful, Clean Waters for all

- Challenge of larger urbanised water catchment

- Need to move towards sustainable water management (**ABC Waters Management**)

- involves detaining* and treating run-off near the source using ABC Waters design features

- Need for collaboration for **catchment wide implementation** and **long term sustainability**

* Help to achieve a runoff coefficient (C) of 0.55

Traditional stormwater Management

ABC Active, Beautiful, Clean Waters for all

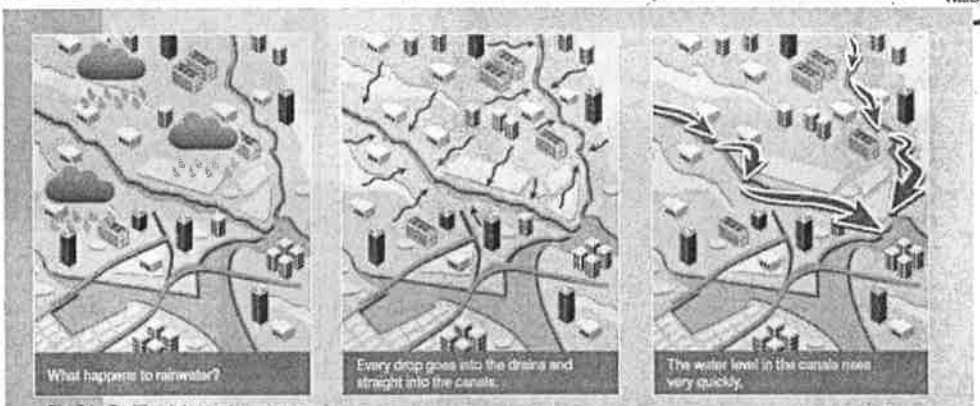


Fig. 2.1 Traditional stormwater management.

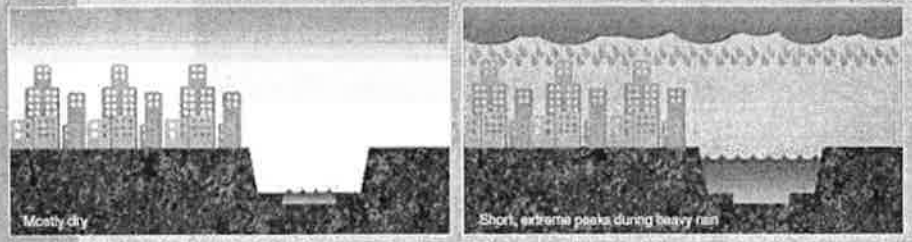
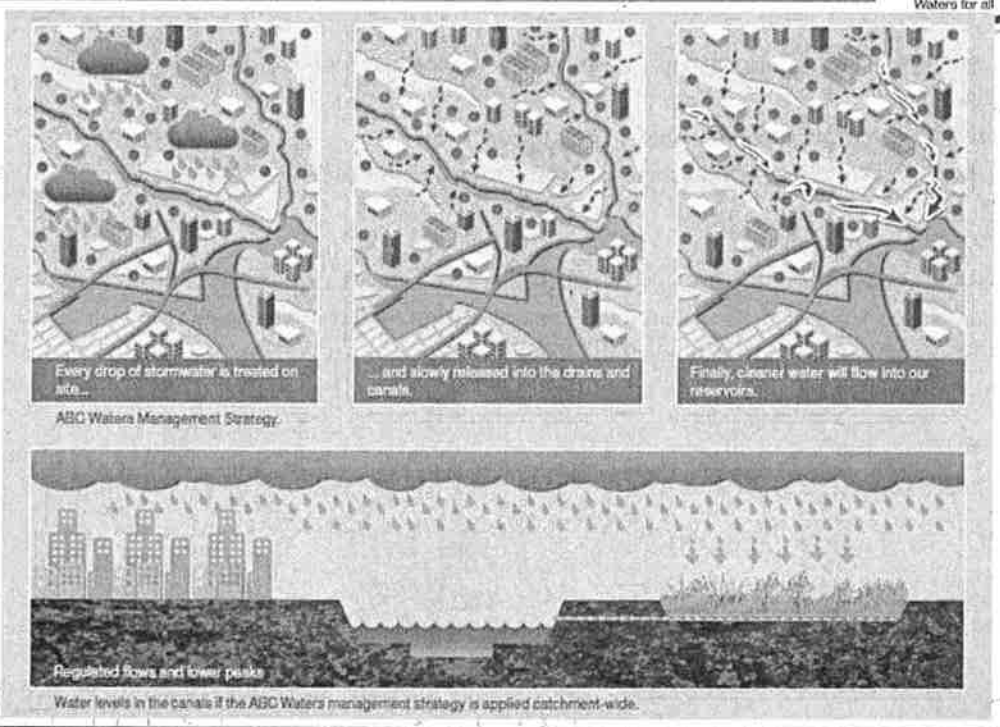


Fig. 2.2 Water levels in the canals under traditional stormwater management.

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ABC Waters Management

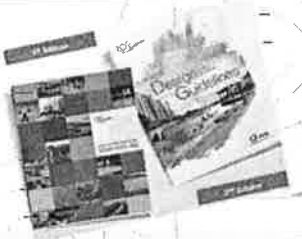


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ABC Waters Design Guidelines – *a call for partnership*

- **ABC Waters Design Guidelines 1st edition in 2009** – conceived as **a call for partnership** to the 3P Sectors:
  - to continue to promote the ABC waters programme
  - To encourage developers and professionals to integrate innovative waterscapes within their projects
  - To build industry capability
- **ABC Waters Design Guidelines** 2nd edition launched on 6 July 2011 with some updates and more local case examples on how the various types of design features are integrated in different land use (e.g. parks, residential, roadside, schools).
- 3rd edition was launched in Jun 2014
- Can be downloaded from http://www.pub.gov.sg/abcwaters/abcwatersdesignguidelines/Pages/default.aspx





Framework of ABC Waters Design Guidelines

Driven by the vision of sparkling, picturesque rivers and lakes with lush landscaped banks, Singapore has undertaken the challenge of transforming itself into a City of Gardens and Water.



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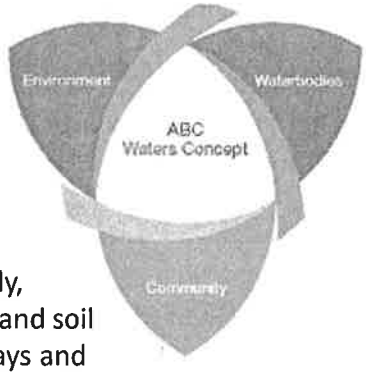
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Benefits of ABC Waters Design Features

ABC Waters concept – seamless integration of Singapore's environment (green), waterbodies (blue) and community (orange) to create a sustainable community



Benefits

- Treating stormwater runoff closer to the source naturally, without the use of chemicals through the use of plants and soil media, so that cleaner water is discharged into waterways and eventually our reservoirs
- Enhancing biodiversity and site aesthetics
- Bringing people closer to water, and creating new recreational and community spaces for people to enjoy
- One of the "source solution for "Holistic Stormwater management
- BCA Green Mark Scheme credit ABC Waters design features under stormwater management

Stormwater Quality Objectives

Pollutant	Stormwater Treatment Objectives
Total suspended solids	80% removal or less than 10 ppm
Total nitrogen	45% removal or less than 1.2 ppm
Total phosphorus	45% removal or less than 0.08 ppm

**Stormwater quality objectives may be revised as more monitoring results are gathered over time*

Performance curves developed to guide the professionals in the design of ABC Waters design features are available in the Engineering Procedures for ABC Waters design features.

Design should also fulfill necessary hydraulic requirements, mosquito control and rain water harvesting (if applicable) requirements

ABC Waters design features

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ABC Waters Design Features

- Green treatment features using plants and soil media to clean the water through sedimentation, filtration and nutrient uptake

Types

- Vegetated Swale
- Bioretention swale
- Rain Garden (Bioretention basin)
- Constructed wetland
- Cleansing biotopes



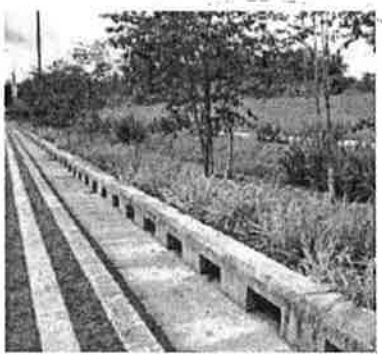
Bioretention Swales - Linear Systems

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Bioretention swales @ Sengkang west way



With Drop Inlet Chambers



With slotted kerbs

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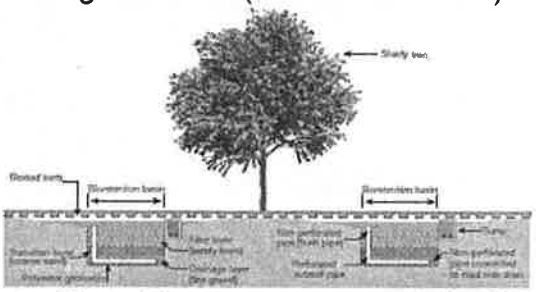
Bioretention Basins

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Bioretention swales are vegetated swales with bioretention system Located in the base.

They are typically used along roadside and car park and form attractive streetscape

They can be either linear or in pockets
- co-existing with trees (bioretention basin)





Bioretention basins @ Margaret drive

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Bioretention basin (Rain Garden)

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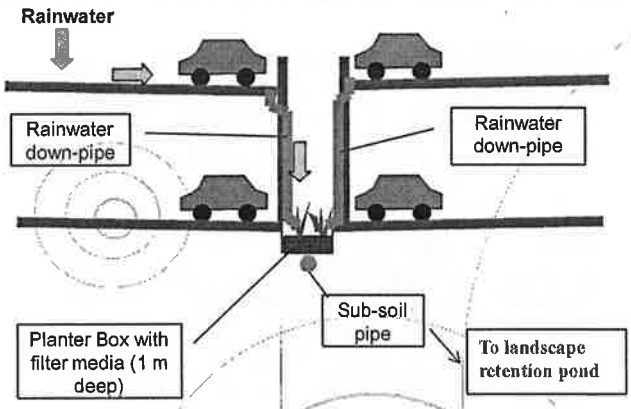


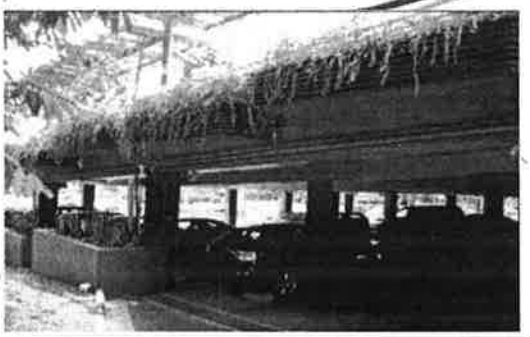


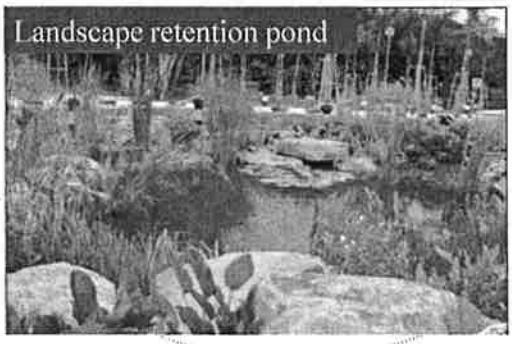
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Pilot Project - Bioretention Systems in Planter Boxes

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- Rainwater captured on upper deck flows through rainwater down-pipe into planter boxes
- Suspended solids will be filtered by soil media while soluble nutrients are absorbed by the plants
- Filtered rainwater is then channelled to landscape retention pond through a series of sub-soil pipes.

Vegetated swales

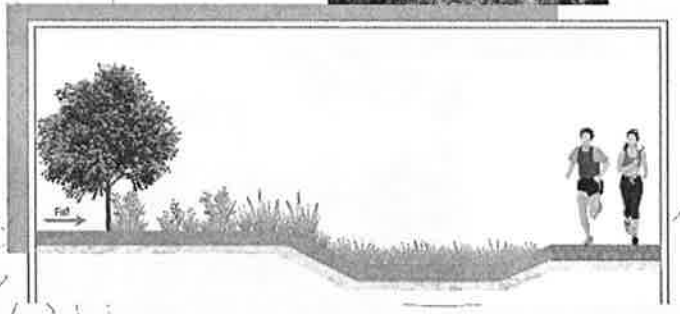
ABC Active, Beautiful, Clean Waters for all

Vegetated swales are like earth drains to convey stormwater Via overland flows and mild slopes





Provide effective pretreatment for downstream ABC Waters design Features by trapping coarse particles



Constructed Wetlands - types

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- **Surface flow wetland**
- **Sub-surface flow wetland**
- **Floating wetland**

i) Floating Wetland

The floating wetland is an engineered system that employs plants growing on a floating mat on the surface of the water.

Rooted emergents (plants which grow in water, with leaves and flowers above the water surface) are selected for planting on floating wetlands.



ii) Surface Flow Wetland

This wetland comprises marsh planting, with the water level kept at a constant depth. The marsh planting helps to remove impurities in the water, resulting in cleaner water.



iii) Sub-surface Flow Wetland

In this wetland, no water can be seen as it is flowing below the surface, through the filter media, which retains suspended solids. The roots of the plants absorb impurities in the water, thereby cleaning it. This wetland type is typically used to cleanse water with more organic content.



Grove Drive (Constructed Wetland)

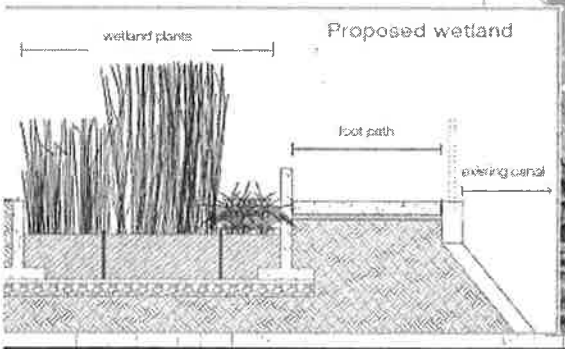
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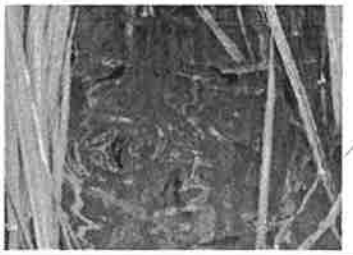












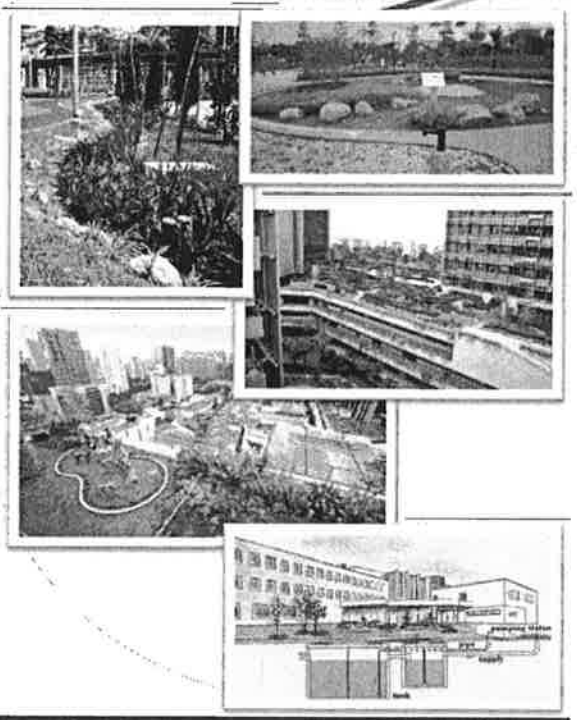
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Revisions to COP on Surface Water Drainage (6th edn – Addendum 1)

With the revisions to the COP on 1st Jun 2013, the following new clauses will come into effect from 1 Jan 2014 onwards:

- Maximum allowable peak runoff (Clause 7.1.5)
- Endorsement of ABC Waters design features by ABC Waters Professionals (Clause 8.2.2)
- Annual submission of certificate of inspection of ABC Waters design features (Clause 8.2.3)



Maximum Allowable Peak Runoff

- **Industrial, commercial, institutional and residential developments greater than or equal to 0.2ha in size** are required to maintain the predevelopment peak runoff discharged from the development site. The maximum allowable peak runoff to be discharged to the public drains will be calculated based on a **runoff coefficient of 0.55**, and for a **design storm with a return period of 10 years and for various storm durations of up to 4 hours (inclusive).**

- Peak runoff reduction can be achieved through the implementation of **ABC Waters design features and structural detention and retention features.**

- The QP shall be required to submit details **(calculations and/or hydraulic model results) showing how the proposed system meets the required peak runoff rates.** Due consideration shall be given to meeting ABC Waters stormwater quality objectives, which will often require treatment of stormwater runoff using ABC Waters design features.

COP on Surface Water Drainage (6th edn – Addendum 1)

Endorsement of ABC Waters Design Features by ABC Waters Professional

The developer/owner shall engage an **ABC Waters (Active, Beautiful, Clean Waters) Professional** to design, oversee the construction of, and develop a maintenance plan for the ABC Waters design features.

The developer/owner shall submit the concept design and design calculations, **endorsed by the ABC Waters Professional,** to the Board as part of DC submission.

Maintenance of ABC Waters Design Features

For ABC Waters design features that are designed to be part of the measures to comply with **Clause 7.1.5,** the developer/owner shall maintain the ABC Waters design features regularly to ensure that these features are well maintained and remain effective in serving the functions as stipulated in Clause 7.1.5. The developer/owner shall comply with the submission of documents as stipulated in Section13.2.

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ABC Waters Professionals

- ABC Waters Professional Programme introduced in September 2011
  - Organised by IES and supported by SIA, SILA, NParks, HDB, LTA and PUB
  - Comprises 4 core modules and 4 elective modules.
  - First run from Sep 2011 to Jun 2012
  - 4th run commenced in July 13
- From 30 May 2013, participants who complete all 4 core modules and any 2 out of the 4 elective modules, in addition to satisfying the registration criteria of IES / SIA / SILA, would be eligible to be registered as an ABC Waters Professional with IES / SIA / SILA.
- The registration of ABC Waters Professionals will be managed by IES, SIA and SILA.



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ABC Waters Certification

Introduced in Jul 2010

- Provide recognition to public agencies, private developers and professionals who embrace ABC Waters concepts
- Ensures that ABC Waters Design Features incorporated within the developments achieve a minimum design standard
- To date, 49 projects have obtained ABC Waters Certification (29 public projects & 20 private projects)

Application and assessment process

- Application open throughout the year
- Evaluation and assessment to be based either on as-built or detail design information
- No application fee
- Declaration during submission that design will be implemented according to submissions
  - Random verification during TOP stage
- More details and application form on URL

http://www.pub.gov.sg/abcwaters/ABCWatersCertification/Pages/default.aspx

ABC Waters Certification

- Launched on 1 July 2010, during SIWW
- 14 projects certified in the inaugural batch and 17 projects each were certified in the second batch (2011) and third batch (2014) respectively.



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PUB's ABC WATERS CERTIFICATION version 1

CATEGORY	POINTS
ACTIVE	30
BEAUTIFUL	30
CLEAN	30
INNOVATION	20
TOTAL : 110 Points	

REQUIREMENT

To achieve ABC Waters Certification : Minimum 45 points required with at least 5 points from 'Active', 'Beautiful' and 'Clean' Sections

ACTIVE SECTION

Section Aim:
To focus on the 'Active' part of the programme i.e. to bring people closer to water and to provide new community spaces

Section Criteria

ACTIVE	Points
1) Provision of facilities for new community spaces & public enjoyment, educational values	20
a) Provision of Facilities bringing people closer to water and promoting water side or fringe activities in development - (E.g. Viewing deck / look out decks / Boardwalks / Seating spaces by the waterway or ABC Waters design features - excluding swimming pools / fountains)	5
b) Accessibility and safety consideration for the facilities provided (e.g. barrier free design)	5
c) Maintainability of the ABC Waters design features (e.g. feature design to involve minimal maintenance)	5
d) Are there educational values brought out? (Educational signage to explain about water / nature / ABC Waters design features)	5
2) Usage by stakeholders & community engagement	10
a) Proposal for formation of interest groups or for holding activities (with the sustainability plan) at project site	5
b) Free and easy use by members of the public	5

Assessment Criteria – Details and Points

ABC tiful, Clean for all

BEAUTIFUL SECTION

Section Aim:
To focus on the 'Beautiful' part of the programme i.e. to achieve integration with water and greenery

Section Criteria

BEAUTIFUL	Points
1) Integration of water in the site architecture	**20**
a) Aesthetic improvements of surface water drainage (e.g. use of vegetated swales / bioretention swales instead of concrete drains, use of retention ponds, wetland plantings etc)	10
b) Aesthetic improvements to the sky terrace / Roofs (e.g. usage of intensive or extensive green roofs to slow down runoff)	5
c) Aesthetic improvements to the façade (e.g. through use of vertical greenery, planter boxes for treatment of rainwater)	5
2) Integration with greenery	**10**
Planting scheme with a variety of plants (pref. endemic plants) that are suitable to create habitat for butterfly / dragonfly and birds and enhance biodiversity	10

Assessment Criteria – Details and Points

ABC Active, Beautiful, Clean Waters for all

CLEAN SECTION

Section Aim:
To focus on the 'Clean' part of the programme i.e. to achieve sustainable water management adopting ABC Waters Management.

Section Criteria

CLEAN	Points
1) Incorporation of ABC Waters Design features to treat run-off from the site	**20**
(a) Treatment or retention of run-off from more than 35% of the total catchment area (site area) area of the site by infiltration, retention ponds and other ABC Waters Design features	20
(b) Treatment or retention of run-off from more than 10% to up to 35% of the total catchment area (site area) by infiltration, retention ponds and other ABC Waters Design features	15
(c) Treatment or retention of run-off from up to 10% of the total catchment area (site area) by infiltration, retention ponds and other ABC Waters Design features	5
Note: Treatment of more than 35% of total paved area of the site by infiltration, retention ponds and other ABC Waters design features will qualify for additional 15 points, subject to a maximum of 20 points	
2) Holistic water management of the site	10
a) Rain water harvesting and integration with ABC Waters design features	7
b) Rain water harvesting and re-use of rain water (e.g. for irrigation)	3

Assessment Criteria – Details and Points

INNOVATION SECTION

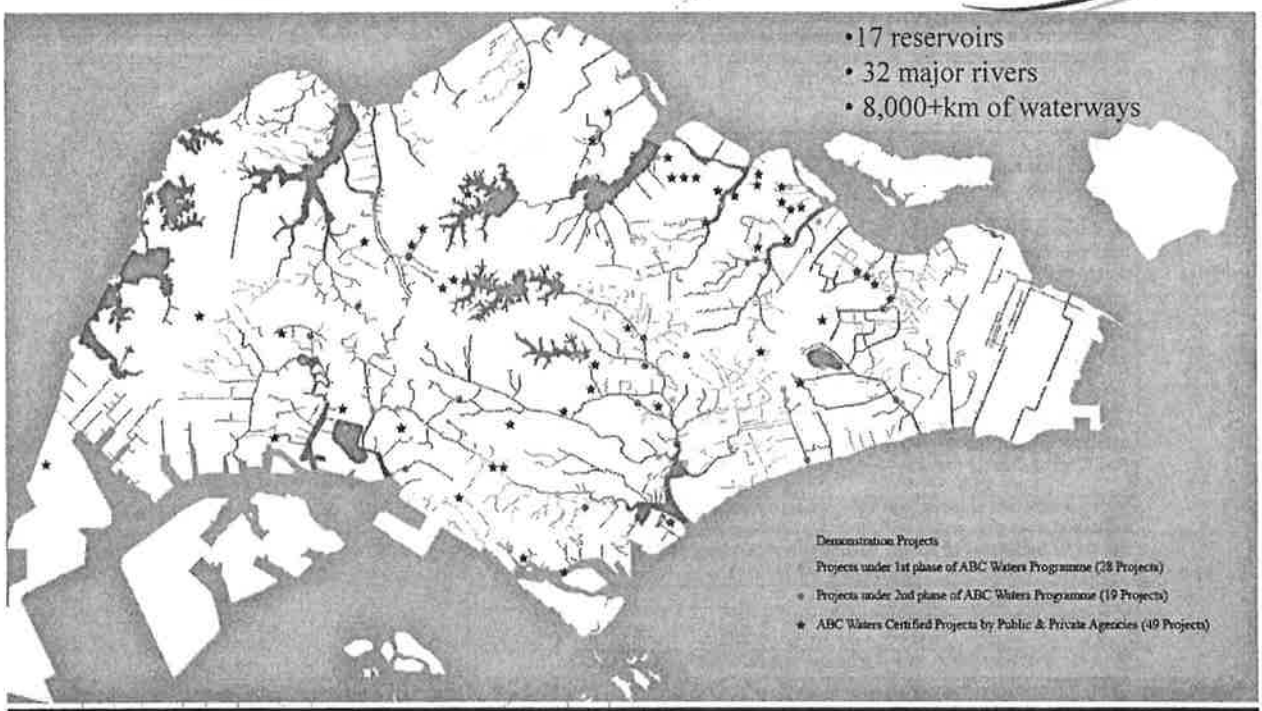
Section Aim:
To provide additional recognition for an applicant that is creative and innovative in incorporating ABC Waters Design Elements or other environmentally friendly features in their projects to minimize the impact of urbanization on the quality and quantity of stormwater.

It also aims to reward the applicants who demonstrate exemplary design going beyond the standard criteria listed in the ABC Waters certification.

Section Criteria

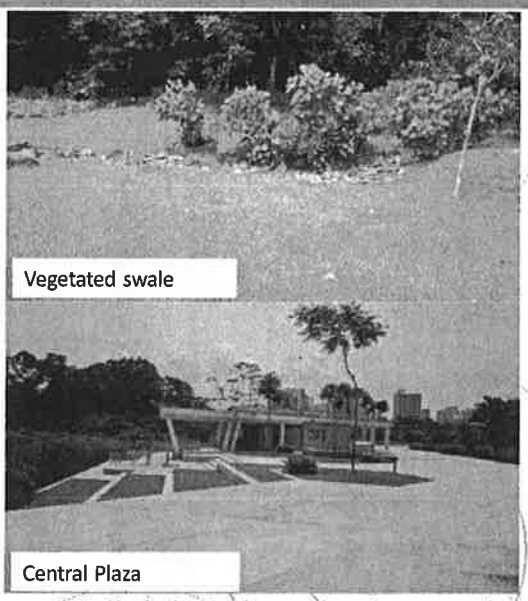
INNOVATION	Points
1) Incorporation of innovative ABC Waters design in projects	**Up to 20**
Examples: a) Infiltration measures e.g. porous pavement, engineering soil b) creative drain cover designs c) Innovative irrigation system using rain water d) Gross Pollutant Traps e) Other natural drainage systems f) Grey water recycling Etc...	

Blue Map with ABC Waters Projects Islandwide

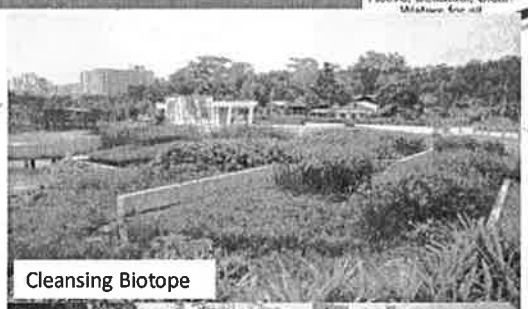


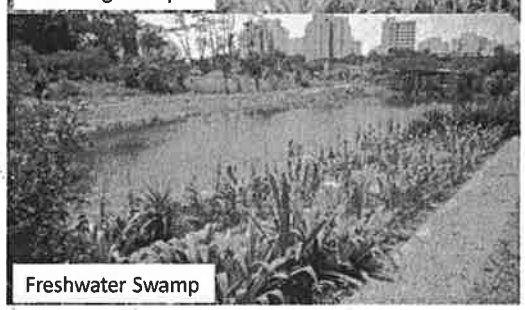
ABC Waters Certified Projects by Public Agencies

Jurong Ecogarden @ Cleantech Park (JTC)


Vegetated swale

Central Plaza

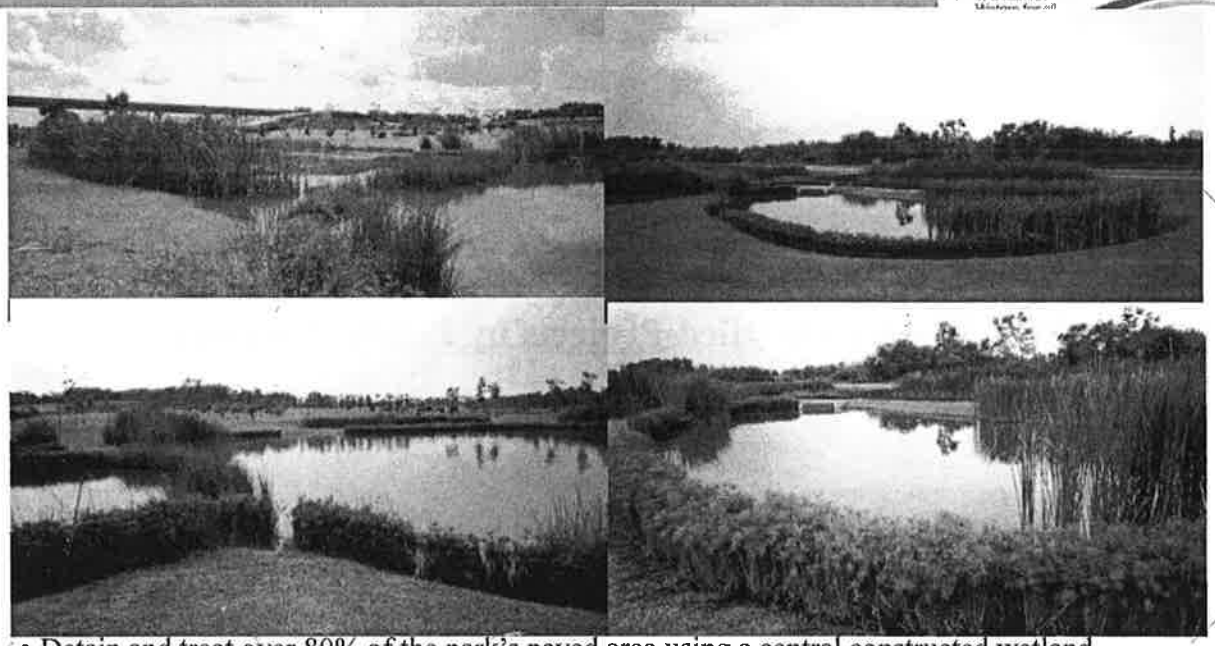

Cleansing Biotope


Freshwater Swamp

- Holistic hydrology plan that complements the concrete drainage system
- Rainwater is channeled from bioretention swales to a series of swamps and pond which will collect and retain rainwater, then treated by cleansing biotope to be reused for toilet flushing

Sengkang Riverside Park (NParks)

ABC Active, Beautiful, Clean



- Detain and treat over 80% of the park's paved area using a central constructed wetland
- open lawn next to wetland bring visitors closer to water
- RWH and reuse for irrigation

Sengkang N2 Neighbourhood Park

ABC Active, Beautiful, Clean









- Detain and treat 12% of the school area using rain garden
- Used as outdoor classroom, educational signage on principles of rain garden
- Integration with timber deck to bring students closer to water

HDB : Waterway Ridges (Bioretention Basins, Vegetated swales)

ABC Active, Beautiful, Clean Waters for all



- Large-scale integration of ABC Waters design features is implemented in a holistic manner within a public housing precinct.
- Treatment of runoff from 70% of catchment
- Achieved C=0.5 using ABC Waters Design features





Water for All : Conserve, Value, Enjoy PUB

Waterway Banks (HDB)

ABC Active, Beautiful, Clean Waters for all

- 3 rain gardens within the precinct integrated with footpaths, precinct pavilions and playgrounds, enhance the aesthetics and biodiversity in the precinct
- Rain gardens detain & treat run-off from 10.6% of total site area
- Boardwalks, viewing decks and open plazas overlooking Punggol Waterway
- Extensive green roofs, sky terraces with lush landscape
- Rooftop rainwater harvesting in rooftop tanks for cleaning of common areas













Water for All : Conserve, Value, Enjoy PUB

ABC Waters Certified Projects by Private Sector

H_2O Residences (CDL)

- The first private development to be integrated with the surrounding water body
- A promenade and a jetty platform next the banks to bring people closer to Punggol Reservoir
- Features like a rain garden, biopond, and water terrace with wetland plants to detain and treat rainwater run-off from approximately 29% of the total catchment area
- A meandering timber boardwalk cutting across the Kid's Discovery Biopond and education signage to provide an enriching opportunity to learn about the surrounding biodiversity
- Rainwater harvesting for irrigation of the landscape and integration with the rain garden





Tree House (CDL/Hong Realty Pte Ltd)

ABC Active, Beautiful, Clean Waters for all

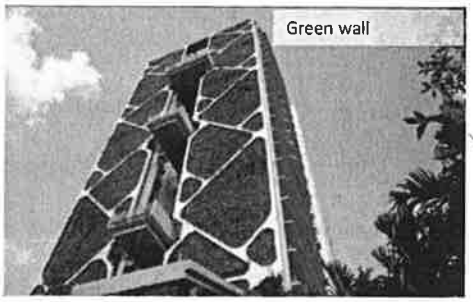
•Bioretention swales filters, detains and treats about 10% of the development area

•Green wall and sky gardens reduce heat build-up on exposed roof surfaces and slow down stormwater discharge

•Stormwater channelled and directed to rainwater harvesting tank in the basement, and used to irrigate surrounding areas via drip-irrigation

•Permeable pavement lining the walkways allow quick permeation of water to reduce amount of stormwater runoff



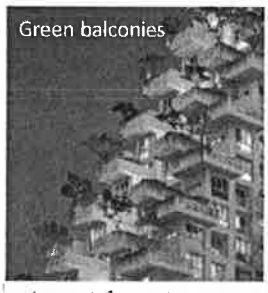




Sky Habitat (Bishan Residential Development Pte Ltd) [Capitaland]

ABC Active, Beautiful, Clean Waters for all

- Bioretention basin integrated with private social deck, and biopond with wetland planting and seating spaces brings residents closer to the features
- 3 levels of Sky terraces with linked bridges, green balconies with shrubs and tree planting
- Green wall at entrance drop off and boundary wall
- Collection of roof run off for auto drip irrigation system
- Creative drain covers on how water within the development contributes to drinking water supply as part of water catchment









The Interlace (Ankerite Pte Ltd) [Capitaland]

ABC Active, Beautiful, Clean Waters for all

•Development features a bioretention basin and vegetated swales integrated with seating spaces and accessible stepping stones footpath

•Extensive green coverage with green roofs, sky gardens, vertical greenery

•Rainwater from rooftops are collected in harvesting tanks at basement, and reused for irrigation

•Creative drain covers, auto-drip irrigation systems, green cell pavers to promote infiltration of runoff

•Residents' portal share water related messages with residents

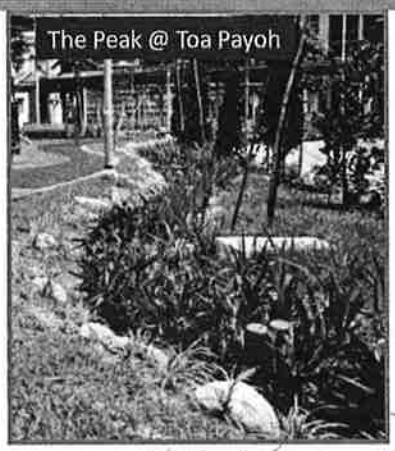






Other Projects by Private Sector

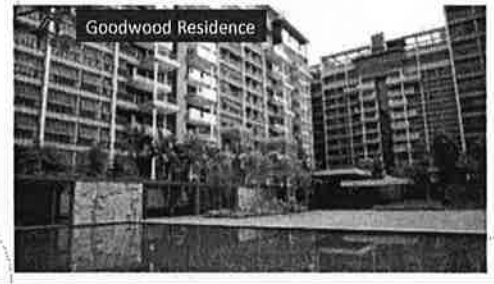
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Water for All
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Thank You