



DESIGNING A NATION'S GARDEN
IN THE HEART OF SINGAPORE'S DOWNTOWN

GARDENS BY THE BAY

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“This move is a shift in urban planning paradigm as the choicest real estate, some 8.1 kilometres of waterfront, is allocated to the Gardens instead of commercial development.”

LEFT Masterplan showing the Bay South and Bay East Gardens.

Gardens by the Bay is Singapore's latest green legacy as it seeks to transform into a City in a Garden. Building upon more than 40 years of concerted greening efforts initiated by then Prime Minister Lee Kuan Yew who saw this as critical to Singapore's attractiveness and liveability, the City-State has in recent years unveiled a bold plan to create a Metropolis rising out of a pervasive mantle of tropical greenery.

This will see an intensification of the green landscape matrix of streetscape greenery, parks and gardens and nature reserves linked together by a network of more than 200 kilometres of park connectors across the entire island. This will be further enhanced by skyrise greenery, an effort that will see the urban infrastructure being draped by a lush green layer.

Marina Bay—Singapore's New Downtown—presents an excellent opportunity to realise this vision of a City in a Garden. Occupying 101 hectares of land reclaimed some 30 years ago, the Gardens by the Bay comprises three distinct but connected waterfront gardens—Bay South (54 hectares), Bay East (32 hectares) and Bay Central (15 hectares). The Gardens will emanate out from the Bay South Gardens at the very heart of the Singapore Downtown and encircle the Marina Reservoir like a green necklace, thereby creating an intimate and seamless interface between land and water. This move is a shift in urban planning paradigm as the choicest real estate, some 8.1 kilometres of waterfront, is allocated to the Gardens instead of commercial development. A *Newsweek* article in January 2006 lauded this as a shift in the right direction as cityscapes in Asia today seek to distinguish themselves by turning green.

Understandably, the economic returns would have to be satisfied in such a move. The returns are not just monetary—reaped from the increased value of surrounding real estate and tourism receipts—but strategic as the Gardens will launch Singapore into the realm of distinctive global cities with environmental sustainability and quality living as its distinctive hallmarks. This attracts not only international branding, but also investors and human talent.

More than anything else, the Gardens by the Bay will be a national garden to all Singaporeans. As Dr Kiat Tan, Project Director of the Gardens by the Bay, puts it at the launch of the Gardens by the Bay: “This is our stake in the

world's premier tropical City in a Garden. The most attractive and desirable part of Singapore has been set aside and will be accessible to all Singaporeans. Gardens by the Bay is dedicated to Singaporeans as their own space where they can participate in meaningful and memorable activities.”

The challenge lies in developing a masterplan design that will not only encapsulate the essence of what will enrich the lifestyle and recreational activities of Singaporeans and tourists alike through horticulture edutainment, but will enhance the Gardens' value propositions for Singapore, that of international branding and distinction in sustainable development.

An international design competition was called in January 2006 to seek out the best design ideas. This attracted more than 70 entries submitted by 170 firms from 24 countries worldwide, from which two firms—Grant Associates¹ and Gustafson Porter²—were eventually awarded the masterplan design for the Bay South and Bay East Gardens respectively. The Bay South Gardens are currently being constructed in Phase 1 of the Gardens development, and target to open at the end of November 2011. Full construction of the Bay East Gardens is slated for Phase 2 of the Gardens development.

This article provides an overview of the Bay South Gardens masterplan design, highlighting critical elements that have been incorporated to help bring about the essence of a Nation's Garden in Singapore's Downtown.

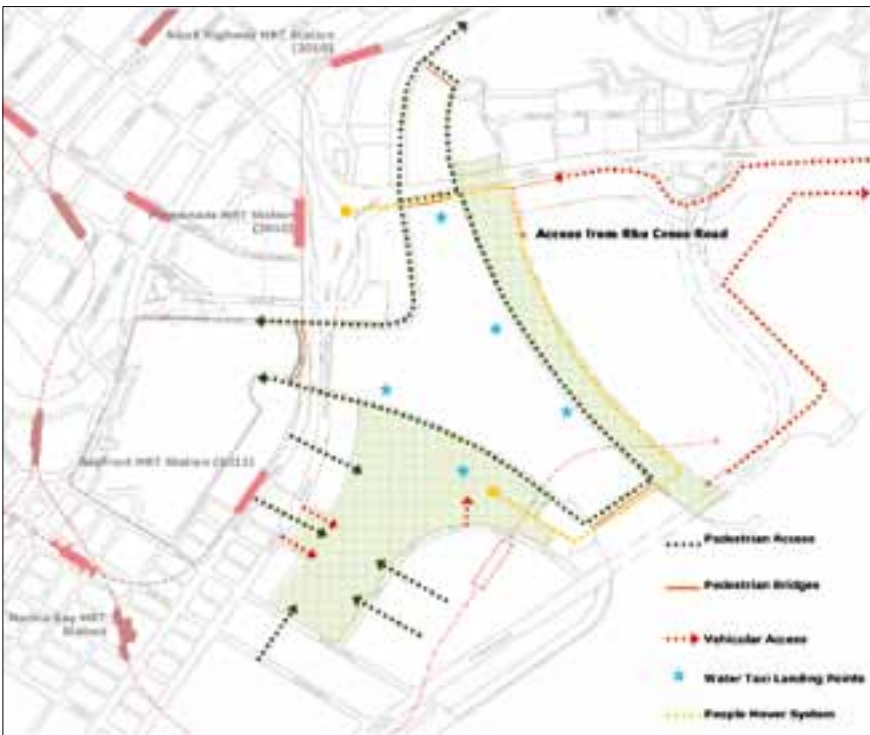


**BAY SOUTH GARDENS MASTERPLAN
 DESIGN—EMBRACING TROPICAL SENSIBILITIES
 AND ENVIRONMENTAL SUSTAINABILITY**

Grant Associates set out to put together a design that will respond to Singapore's unique location on the Equator—high rainfall and perpetual summer; rich plant materials; and melting pot of cultures. The plan was for them to weave these ingredients together and create a 24/7 destination that will excite and educate visitors. This represents a host of fundamental design challenges, which include strategies to enhance visitor comfort in the Gardens amidst the hot, humid and wet tropical climate that often dissuades visits to Gardens over a large part of the day; bringing to life the importance of plants not just as horticultural displays but their ecological function in the Tropical ecosystem and their socio-economic association to the different cultural groups in Singapore.

The overall concept of the masterplan draws its inspiration from the orchid, a plant that immediately evokes images of the tropics and is in itself an emblem of Singapore. Its epiphytic nature and reliance on a growing substrate from which it extends towards light further represents the growth of the Gardens on reclaimed land. This was translated into the masterplan as such: the orchid takes root at the waterfront, where the Conservatories and a Hub will be located. The leaves (landforms), shoots (paths, roads and linkways) and secondary roots (water, energy and communication lines) then form an integrated network with beautiful blooms (Theme Gardens and Super-Trees) at key intersections.

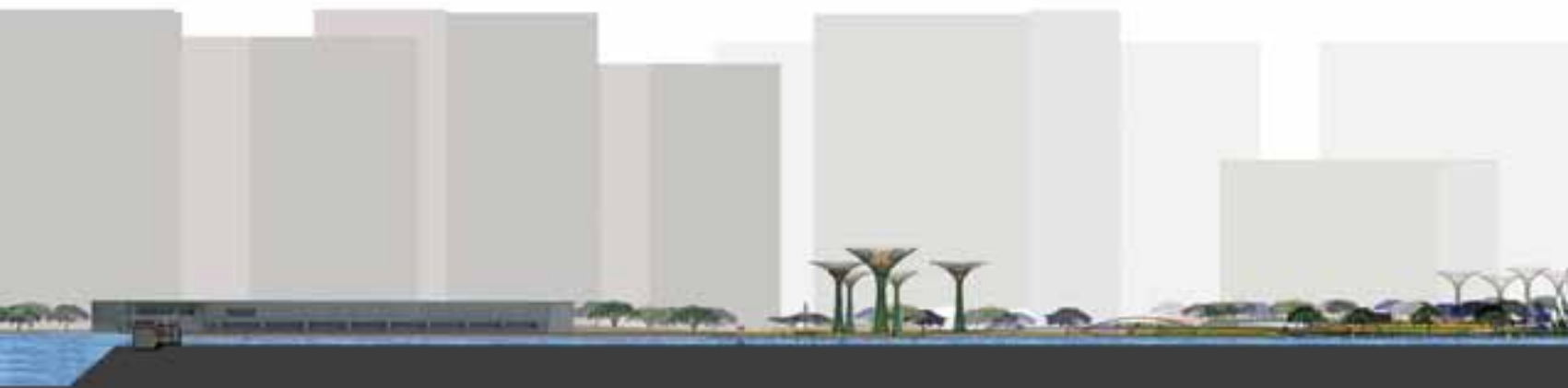
Underlying the concept of the masterplan design are the principles of environmental sustainability, particularly in relation to water and energy. A concerted effort is made from



LEFT, TOP Masterplan for Bay South Garden.

LEFT, BOTTOM Transportation diagram.

BELOW Waterfront view of the Bay South Garden.



the onset to plan and design for sustainable cycles in water and energy use. This extends into a sustainable web that further incorporates floral and faunal diversity. The intent is however a pragmatic one, aimed at showcasing interconnected and sustainable cycles and not the creation of a completely self-sustaining system.

LINKING TO THE CITY

Fundamental to the masterplan for the Bay South Gardens is the establishment of linkages and treatment of the interfaces between the Gardens and the surrounding development context. It is important that the Gardens be interwoven with the surrounding urban developments, as well as the Marina Reservoir.

The masterplan design has provided for several key pedestrian and vehicular linkages from the surrounding developments and public transport hubs, via waterfront promenade, pedestrian bridge and underpass, and a major road along the Gardens boundary (Marina Gardens Drive). Provisions to allow for connection via water taxis across the Marina Reservoir have also been catered for in the design. The intent is to allow visitors to gain access into the Gardens as readily as possible via public transport, so as to minimise the need to drive to the Gardens. This further reduces the footprint for car parking facilities.

While these linkages are key to the functionality of the masterplan, it is equally important that the interfaces are treated so that a "gardenesque" ambience permeates into the Downtown and creates a seamless transition between the Gardens and the surrounding landscape. For example, the Marina Gardens Drive will be planted with various layering of trees and shrubs with autumn colours. The canopy of the trees will extend into the Gardens, with windows into the Gardens being created from the road.

This gives a sense that the road is very much part of the Gardens. The waterfront will feature a broad promenade and the water edge will be re-profiled to create a more gentle and stepped edge with intensive planting.

To push this intent even further, the masterplan intends to create a lake system (i.e. Dragonfly and Kingfisher Lakes) that will surround the Gardens and be integrated with the Marina Reservoir. The design of the lake system will consider the aesthetics and hydrology within the Gardens catchment. Firstly, the Dragonfly Lake on the western side of the Gardens will create a second waterfront, which enhances the view from the future reserve. This adds value to the reserve sites. Secondly, both lakes will capture run-offs from within the Gardens and act as a natural "eco-filter". Water from the Gardens catchment will be captured within the lakes and also pumped from the Reservoir to enhance circulation. It is then filtered and cleansed by aquatic plants, before being discharged into the Reservoir.

CREATING THE ENVIRONMENT

Moving from the edges into the Gardens proper, Grant Associates then considered the various features that will be sculpted into the Masterplan design. This however necessitated the understanding and incorporation of critical environmental factors into the design—solar insolation, wind and humidity. Light for plant growth is key to the functionality of the Gardens, which will emphasise colour in the form of flowering blooms and foliage. This is even more important for the Conservatories, which are glasshouses optimised for the display of plants from cool environments. A solar insolation map of the Gardens was produced to guide the location of the Conservatories and floral landscapes, taking into account the

shadows that will be cast on the Gardens by the surrounding buildings in time.

Outdoor human comfort in the tropics is dependent not only on the ambient temperature, but also humidity levels. The latter is in turn influenced by wind. A good breeze will substantially lower the humidity that one experiences. Landforms within the Gardens were designed with the wind direction in mind, so as to create spaces with gentle breezes. This coupled with the judicious application of shade and shelter through tree-planting, plant trellis and linked canopies results in a more comfortable environment in the Gardens.

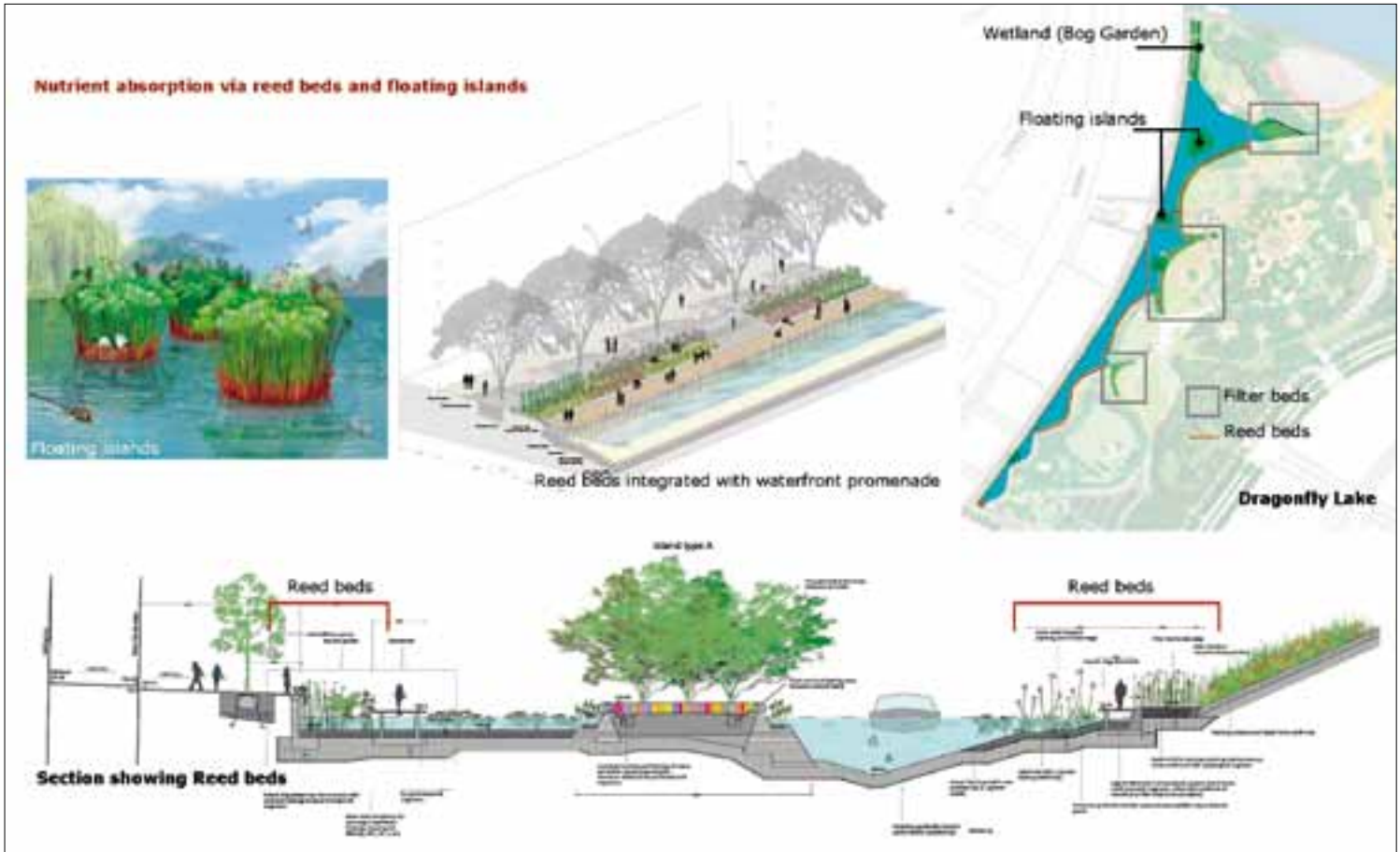
BRINGING PLANTS TO PEOPLE

The design of the Gardens does not just take into account aesthetics. A series of edutainment gardens will be created, showcasing by important themes and messages that will impact on the planting displays.

Edutainment also plays a key role in the design of the Gardens, in bringing plant knowledge to the people. The thematic gardens have been strategically located around the showcase gardens, which include the Conservatories and the Lion Grove areas. They will form the perimeter of the Gardens and create an Edutainment zone.

The themes that have been selected for these gardens reflect a more global perspective on the value of plants. On the eastern mounds, the gardens will feature the "Plants and People" theme, where the various cultural groups of Singapore will be featured, together with the important role that plants play in their respective cultures. It will also tell the story of "Plant Use by Man", focusing on economically important plants to Singapore and South East Asia.





To enhance the ecological function of the lake system, these water-sensitive landscape design strategies will be implemented:

- 1 **FILTERING OF WATER RUN-OFF.**
 Filter beds, comprising of aquatic reeds, and wetlands to be located where water enters and discharges from the lake system. Water flow will be reduced and sediments filtered out.
- 2 **REDUCING NUTRIENT LOAD.**
 Islands of aquatic plants and reed beds will be incorporated to absorb nutrients such as nitrogen and phosphorus in the water. A reduction of nitrogen levels is critical to minimising algal bloom and ensures better water quality.
- 3 **MAINTAINING AN AQUATIC ECOSYSTEM.**
 Habitats for fish and dragonfly/damselfly will be created within the lake system by maintaining a diversity of aquatic plants, good water circulation and aeration. This keeps in check potential problems such as mosquito breeding.

On the western mounds, the gardens will feature the "Plants and Planet" theme, where the web of relationships between the various flora within a Fragile Forest setting will be showcased. The Fragile Forest opens into windows that illustrate the different components of the forest such as tropical fruit trees, tropical blooms, the secret life of trees, the underworld, the World of Palms and the Tropical Eden where animal and plant interactions will be showcased.

SUPERTREES—VERTICAL GARDENS IN EDEN

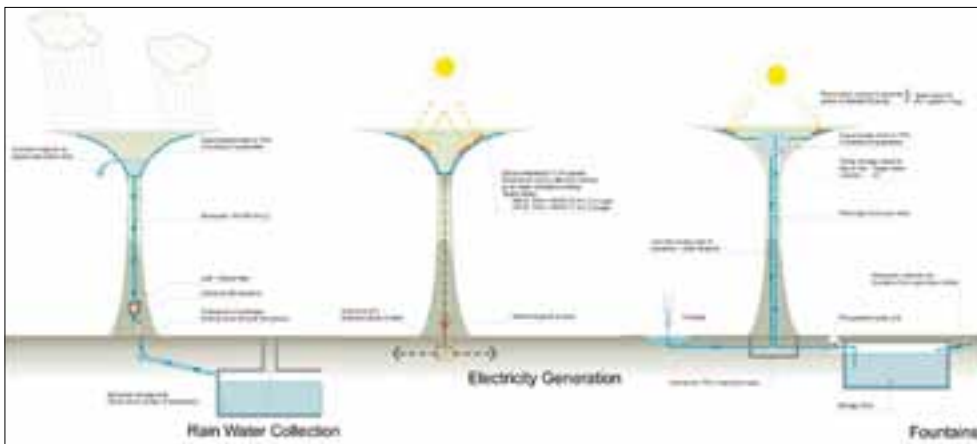
To add drama and impact to the Gardens, the SuperTrees are designed to a scale that would become instantly recognisable in views across the site and they offer the opportunity to create vertical gardens in the Tropics. Their heights range between 30 to 50 metres, rising significantly above the canopy of trees that will form a belt around the Lion Grove area. An elevated walkway between the SuperTrees would allow dramatic views across the rest of the Gardens, while offering a unique experience of exploring the SuperTree canopies. The 50-metre tree will also house a treetop bistro accessed by its own lift and spiral staircase. At night, the SuperTrees come alive with a lighting and projected media.

The SuperTrees illustrate man's attempts at recreating nature's balance. Like dominant trees in the rainforest, they support a living skin of epiphytes, ferns and flowering climbers—creating vertical gardens in tropical Eden. They are fitted with advanced environmental technologies that mimic the ecological functions of trees—photovoltaic cells harness solar energy for the functioning of the SuperTrees, just as how trees photosynthesise; rainwater harvests collect rain, just as how trees assist in cloud formation and bringing rain. Some of these environmental technologies are integral to the cooling systems for the Conservatories.

In this way, the SuperTrees become sophisticated structures that bring together horticulture and environmental technologies.

CONSERVATORIES — ETERNAL SPRING ON THE EQUATOR

The Conservatories are the green jewels in the Gardens, appearing like an exotic outcrop on the edge of the Marina Bay area. The cooled Conservatories are central to the Garden design concept. They serve as the Hub from which the Gardens grow.



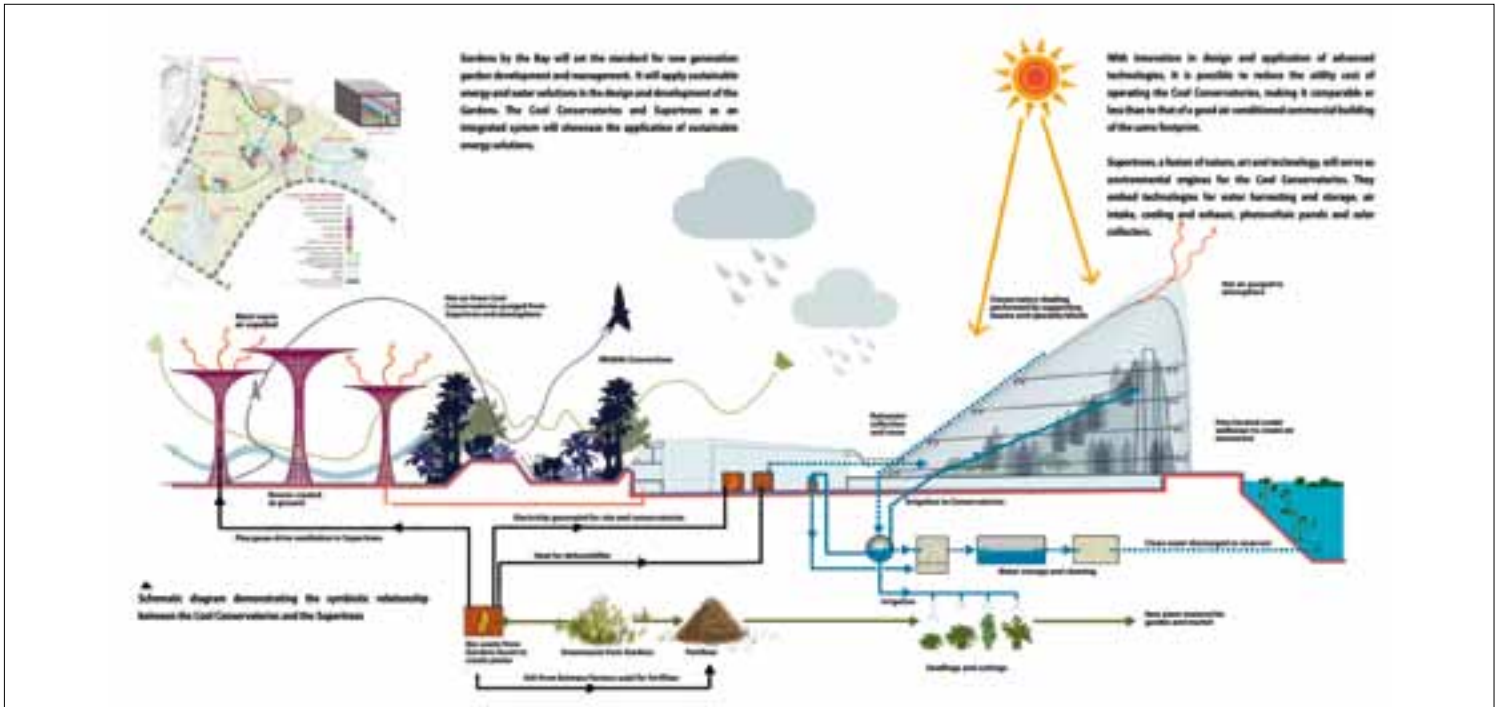
The Conservatories have been arranged to reinforce the sense that they are not just the main visitor destination and the visual focus for the Gardens, but also the focus for information and orientation. On top of that, they are at the heart of the distribution network for energy and water.

“ AN ELEVATED WALKWAY BETWEEN THE SUPERTREES WOULD ALLOW DRAMATIC VIEWS ACROSS THE REST OF THE GARDENS, WHILE OFFERING A UNIQUE EXPERIENCE OF EXPLORING THE SUPERTREE CANOPIES. ”

The two conservatories are located on the reservoir edge, with spectacular views across the Marina Barrage to the city on the far shore, and to the Bay East gardens. The cooled Conservatories will replicate cool dry and cool moist conditions to allow the display of plants and flowers from the Mediterranean and Tropical Montane regions in the world, displaying the range of habitats and flowering plant varieties in a setting offering springtime all year round, adding colour to the Gardens.

The larger Conservatory, sized at 1.2 hectare, will bring about the cool-dry, springtime climate of the Mediterranean-type and semi-arid regions. This will allow the display of habitats and plants from regions such as California, Western Cape (in South Africa), Western Australia, the Mediterranean Basin, and Madagascar. Special emphasis will be given to highlight the colours from the flowers,

OPPOSITE Strategies for the lake system.
TOP, BOTTOM The SuperTrees are fitted with advanced environmental technologies such as photovoltaic cells.



and interesting forms and adaptations of these plants to the cool and dry environments—the development of bulbous trunks in trees such as the Baobabs is one of several examples. The design intent is also to bring to life plants that provide food to man in his daily life—the olive tree being a prime example of this. A changing display field has also been incorporated to enable flower shows and displays to be held within the Conservatory.

Complementing the Cool Dry Conservatory is the smaller Cool Moist Conservatory, which is about 0.8 hectare. It will replicate the cool-moist climate found in tropical mountain regions between 1,000 to 3,000 metres above sea level. Plants featured will include highland rhododendrons, orchids, bromeliads, pitcher plants and other epiphytes. An artificial “mountain” will be constructed, accessible by an elevator at the look-out point at its peak. Visitors will be able to descend the “mountain” in a circular path, during which they will be able to enjoy the various plants that will clad this “mountain”.

The Conservatories will tell the story of man’s impact on the environment by highlighting the plight of plants and ecosystems due to climate change and habitat destruction in these regions. The Conservatories have also been designed with energy sustainability in mind; the target is to ensure that the cooling is reliant on renewable energy.

While the conservatories are envisaged to be iconic architecture structures, they also play a crucial role to showcase the horticultural displays in the Gardens. The cooled Conservatories will allow the display of an increased range of flowering plant varieties that can be brought into cultivation. Such displays are well-proven attractions for visitors from home and abroad.

More significantly, both Conservatories will provide an all-weather edutainment space within the Gardens, filling the gap in visitation when the outdoor heat and humidity deter Garden visitors.

In terms of the energetics, the conservatory and SuperTrees are integrated and have the potential to showcase a story on energy and water sustainability. Their energy budget will be no more than that consumed by typical commercial building in Singapore of the same footprint.

THE FUTURE OF GARDEN DESIGN

Gardens by the Bay is a prime example of how garden design has evolved beyond just landscape architecture and horticulture. It is representative of changes in recent years where it has become an integration of a multitude of disciplines ranging from architecture to structural and environmental engineering. It places greater emphasis on the integration of physical urban and environmental ecologies from the onset, in addition to aesthetics and recreational provisions.

“ THE COOLED CONSERVATORIES WILL ALLOW THE DISPLAY OF AN INCREASED RANGE OF FLOWERING PLANT VARIETIES THAT CAN BE BROUGHT INTO CULTIVATION. ”

TOP Energy cycle diagram showing the relationship between the conservatory and the SuperTrees.

OPPOSITE Singapore’s efforts in transforming into a City in a Garden continues with the Gardens by the Bay project which was commended at the 2008 MIPIM Architectural Review Future Awards in the Regeneration and Masterplanning category.

¹ The teams that worked with Grant Associates during the competition were Wilkinson Eyre Architects (UK), Atelier One (UK), Atelier 10 (UK), Meinhardt Infrastructure Pte Ltd (Singapore), Langdon & Seah Singapore Pte Ltd, Land Design Studios (UK), Winward Dexter (UK), Geoff Malone International (Singapore), and Thomas Matthews (UK).

² The teams that worked with Gustafson Porter during the competition were Ove ARUP, Davis Langdon and Seah Singapore Pte Ltd.

