

LANDSCAPE FORUM

LIVING THE GREEN LIFESTYLE

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FOR SUBSCRIPTION

THE MAKING OF GARDENS BY THE BAY

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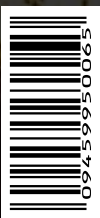
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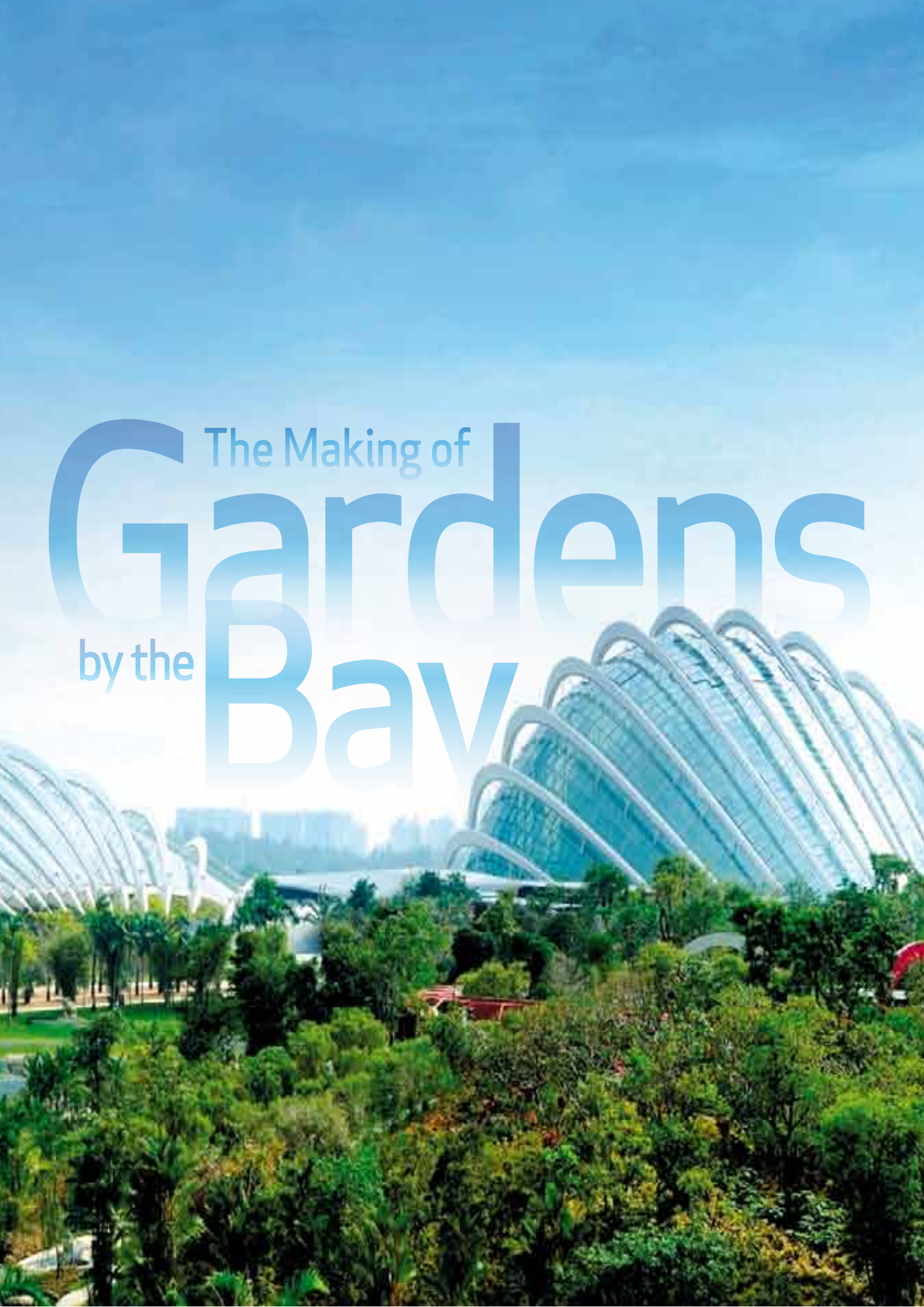


The complexity and matrix of grasses, wild flowers, plants and trees, the composition of these communities and their relationship to their respective context, make up the theme of a garden. The successful combination of stylistic elements will undoubtedly produce a sense of harmony yet intrigue, ornamental yet inspiring.

For Gardens by the Bay, it goes a step further by integrating diverse themed gardens, consisting of both natural and man-made elements, into a wholesome and complementary ecosystem that is wondrously sustainable.

GARDENS SHOULD INSTILL IN US AN AWARENESS OF ECOSYSTEMS, PLANT ADAPTATIONS AND NATURAL CYCLES. THE PLANTS AND ECOSYSTEMS OF A GARDEN USUALLY GIVE US AN INDICATION OF THE CHARACTER OF THE LANDSCAPE THAT THEY OCCUPY.





The Making of Gardens by the Bay



FROM IDEA TO REALITY

The genesis of Gardens by the Bay is an idea that has developed over the last four decades, as the concept of the 'Garden City' evolved into the 'City in a Garden'. Gardens by the Bay represents the culmination of the 'Garden City' initiative set in motion over 40 years ago by then Prime Minister Lee Kuan Yew, and is aligned with the 'City in a Garden' concept by underlining the recognition of the immense value that parks and gardens play as venues for our communities to bond and interact.

Following the inception, the next phase was to develop an aesthetically pleasing masterplan design that encapsulates the essence of what will enrich the lifestyle and recreational activities of both Singaporeans and visitors alike, while addressing today's pressing environmental concerns. This calls for

creativity and innovation, balanced with a sense of practicality and feasibility. Public feedback was also taken into consideration in finalising the masterplan for this national pride.

The end result is a horticulture haven, consisting of exotic species, towering vertical gardens, large collections of bromeliads and captivating displays of floral nuance to accentuate the significance of our ecosystem.

"Besides being aesthetically pleasing, the horticultural displays in Gardens by the Bay carry important themes and messages. Our aim is to entertain and educate visitors by transporting them into diverse botanical worlds and presenting the plant kingdom in a compelling way that illustrates its important relationship with Man and the ecosystem," says Mr Kenneth Er, Chief Operating Officer of Gardens by the Bay.





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— MR KENNETH ER, CHIEF OPERATING OFFICER OF GARDENS BY THE BAY.

COOL CLIMATES

Named the Flower Dome (cool dry biome) and Cloud Forest (cool moist biome), the two glass biomes located in the Bay South area are cooled conservatories that represent the amalgamation of architectural beauty, environmental engineering and horticultural excellence. Replicating the cool-moist climate of the Tropical Montane region and the cool- dry climate of the Mediterranean and semi-arid sub-tropical regions, these regions are among the most threatened habitats in the world, with many plant species facing the threat of climate change and habitat loss brought about by human activities.

These iconic features were designed with the Gardens' landscape in mind, as well as the surrounding urban context. With sustainability as the key factor for the Gardens by the Bay, the composition of the two forms is based on a unique geometry to maximise light levels through the use



of spectrally selective glass and light sensor operated shadings in the conservatories for plants to flourish within.

With the application of thermal stratification, it ensures that cool air settles at the lower occupied zone and warm air is allowed to rise and vented out at high levels. This is enhanced by ground-cooling, which is achieved by chilled water pipes cast within the ground slabs. "With the use of cutting-edge technologies to provide energy-efficient solutions in cooling, it displays a concerted effort in plan and design for sustainable cycles in energy and water use," adds Mr. Kenneth Er.

Possibly the world's largest spanning grid-shell structures, their distinctive forms blend into the rich landscape of the gardens, featuring about 226,000 exotic plants from every continent (except Antarctica), amazingly sustaining a whole new world of horticulture in Singapore.



OUT OF THE 18, ELEVEN SUPERTREES ARE EMBEDDED WITH ENVIRONMENTAL FUNCTIONS. THESE INCLUDE PHOTOVOLTAIC CELLS TO HARVEST SOLAR ENERGY FOR THE LIGHTING OF THE SUPERTREES, AS WELL AS INTEGRATION WITH THE CONSERVATORIES TO SERVE AS AIR EXHAUST RECEPTACLES.





VERTICAL HORIZONS

Uniquely designed vertical gardens ranging from 25 to 50 metres in height, the Supertrees call out an emphasis on the vertical display of tropical flowering climbers, epiphytes and ferns.

With a total of 18 Supertrees located at the Bay South, the massive heights of these plants allows the creation of vertical gardens that showcases tropical plants on a scale they have never been presented before in a garden. They counter balance the visual impact of the conservatories and create height in the Gardens to balance current and future tall developments in the surroundings.

While also marrying form and function of mature trees, the large canopies of the Supertrees provide shade and shelter in the day and lighting as well as projected media at night. Like dominant trees in the rainforest, they support a living skin of bromeliads, ferns and flowering climbers.

Comprising of four major parts, the Supertrees has a reinforcement concrete core in the inner vertical structure, trunk made out of a steel

frame, planting panels in preparation for the planting of living skin, and the canopy that will be assembled and hoisted via a hydraulic jack system.

Over 162,900 plants comprising more than 200 species and varieties of bromeliads, orchids, ferns and tropical flowering climbers, including *Tillandsia stricta* from Brazil, *Tillandsia fasciculata* from Panama, *Cattleya maxima* from Ecuador, and *Pseudorhipsalis* from Costa Rica, are planted on the Supertrees.

Out of the 18, eleven Supertrees are embedded with environmental functions. These include photovoltaic cells to harvest solar energy for the lighting of the Supertrees, as well as integration with the conservatories to serve as air exhaust receptacles. The plants are chosen based on a list of conditions, including their suitability for vertical planting, as well as their hardiness, lack of need for soil, and visual captivation.

AQUATIC HABITATS

At Bay South, two lakes are available to provide an integral addition to the environmental sustainability of Gardens by the Bay. Both the Dragonfly Lake and Kingfisher Lake are home to a myriad of living plants and aquatic creatures. Peppered with free-floating plants such as water hyacinth, emergents such as water banana, Nyle Papyrus and Bull-rush, as well as marsh plants such as Beach Morning Glory and Indian Shot, this water ecosystem also boosts a lively aquatic life consisting of dragonflies, lizards, butterflies, birds, terrapins, tilapias, guppies, mosquito fish, and apple snails.

Besides providing aquatic habitats for biodiversity, the lake system also acts as a natural filtration system for water from the Gardens catchment. Enveloping the Gardens' periphery, the lakes are designed for integration with the adjacent Marina Reservoir. Water run-off from within the Gardens is captured by the lake system and cleansed by aquatic plants before being discharged into the reservoir. Naturally treated water from the lake system is also used in the built-in irrigation system for the Gardens.



TEHC International played a prominent part in the making of Gardens by the Bay. The company constructed the beautiful Themed Gardens – Colonial, Malay, Chinese, Indian, Discovery, Eden, Fruits and Flowers, Understory, World of Palms and Secret Life of Trees.

With each garden reflecting a different theme, TEHC International was key in the conceptualisation of its unique designs, individualised storyline, personalised drawings, selection of materials and ultimately, transforming the concept to reality.

The tasks involved in constructing the gardens include the felling of the first tree, excavation of the ground, M & E installation to the irrigation systems, erection of foundations and structural works, placement of stone artefacts, scenic paint work, as well as timber and plastering work. The scope of work is mammoth. Thorough planning and flawless mobilisation of manpower, machinery and equipment were essential in making this project a success.

In addition, TEHC International was responsible for the planting of mature trees and plants in the themed gardens including the maintenance of these gardens. It was a challenge to plant massive, mature trees, with some reaching up to 12 – 15 metres high. The task requires skilful handling, patience as well as effective problem solving skills due to the complications that arise from transplanting. It involves precise arboriculture calculation for the right size of rootball and planning the most efficient logistic paths to minimise the stress on transplanted trees and palms. In total, TEHC International has carried out more than 2,000 successful transplantations from all over Singapore for Gardens by the Bay.





"To enhance the ecological function of the lake system, water-sensitive landscape design strategies have to be implemented," says Mr. Kenneth Er. "For example, filter beds comprising of aquatic reeds and wetlands are located where water enters and discharges from the lake system to reduce water flow and filter the sediments out. At the same time, to reduce nutrient load, islands of aquatic plants and reed beds are incorporated to absorb nutrients, such as nitrogen and phosphorus, in the water. A reduction of nitrogen levels is critical to minimising algae bloom and ensures better water quality."

CHALLENGES FACED

The massive task of incorporating different themed gardens, a diversified ecosystem and contrasting stylistic designs, combined with ambitious considerations for sustainability and cutting-edge technology, presents a set of challenges that had to be addressed.

Even before the first stalk of flower could be planted, as Gardens by the Bay sits on reclaimed

land, associated works had to be carried out before establishing any other development. This included soil improvement works and setting up basic infrastructure, such as drainage system and key vehicular access roads, to facilitate the construction of the Gardens.

The following important consideration that had to be made was determining the buying time for plants. It takes time for plants to establish and for a garden to grow and mature. To speed up the process of getting the Gardens ready, mature trees, instead of seedlings, were planted.

Planting huge matured trees was a demanding task, as it requires extreme patience and precise arboriculture calculation to avoid causing accidental damage or stress to these plants. As part of the Gardens' objectives to address environmental issues, some of these trees were salvaged from sites that were affected by other development projects. In testament of the Gardens' innovation and creativity, the Supertrees are another solution for 'buying time' as they provide immediate scale and dimension to the Gardens.

Ensuring that the Gardens is accessible to the masses is critical in making it a hotspot for people from all walks of life to visit, enjoy its offerings and learn about the flora and fauna of the ecosystem. In this respect, all the appropriate linkages and access from surrounding developments and public transportation, such as the bus, Bayfront MRT station and parking facilities, to the Gardens are provided. Universal design has also been incorporated into the Gardens, making it friendly for the disabled, elderly and families with small children. A people-mover system is also being provided to facilitate movement around the Gardens.

It is important to remember that Singapore has a hot and humid tropical climate, potentially dissuading people from visiting parks and gardens during a large part of the day to seek the cool comfort of shopping malls and other indoor recreational activities. The way to combat this issue was to drastically enhance visitor comfort naturally at the Gardens and providing them with cool solutions.

Landforms within the Gardens were designed with wind direction in mind, so as to create spaces with gentle breezes. A conscious effort was also made to provide as much shade as possible in the Gardens, using foliage and shelters. Additionally, the cooled conservatories provide an all-weather space for the enjoyment of horticulture while filling the gap in visitation when the outdoor heat and humidity deter visitors.

CITY IN A GARDEN

Gardens by the Bay celebrates a harmonious ecosystem that also captures the essence of a garden in a downtown setting, complementing the surrounding developments and contributing to making Marina Bay a vibrant destination to live, work and play. With its various key features and different themed areas, Gardens by the Bay offers a vibrant oasis showcasing floral displays while also celebrating city living.

As a leading supplier and manufacturer of specialty construction chemicals, **QUICSEAL** is the prime provider of waterproofing membranes as well as a host of other construction chemicals and products for the making of the Garden by the Bay. The company is dedicated to provide high performing standards and quality of his products, and is a corporate member of the Singapore Green Building Council and Singapore Environment Council.

QUICSEAL supplied a wide range of construction related materials for companioned involved in the project. Swee Hong used QUICSEAL 401 control crack inducer, as well as QUICSEAL 404, 201 and 208 used as sealants ideal for sealing movement joints in pavements.

For Thompson Industries, the company used liquid applied QUICSEAL 104 flexible cementitious waterproofing membrane, non-toxic QUICSEAL 607 latex bonding agent and QUICSEAL 201 PU Sealant for the creations of Chinese Garden Cascade, Dragonfly Lake, Spitting Lion, and Tadpole Play Garden. QUICSEAL 104 flexible cementitious waterproofing membrane is perfect for the job due to its high performance and suitability for use in contact with potable water. It is also Green Label and Singapore Green Building Council certified.

In addition, QUICSEAL high quality products were also instrumental in the making of the Malay Garden, Colonial Garden, Fruits and Flowers, as well as the Discovery Garden for TEHC. For the Chinese Garden water feature, QUICSEAL 104, 608, 604+602 and 621+609 were used for tiling while QUICSEAL 608, 604+602 and QUICSEAL 621WG were used for paving of the floor in the Indian Garden.

Challenges are common when undertaking such a massive task. QUICSEAL was faced the difficult test of filling large tile gaps exceeding 12 mm. Conventional colour grouts cannot fill these gaps without shrinkage cracking. To solve this issue, QUICSEAL's R&D and technical teams were enlisted to specially design a colour grout to meet such requirements.



Photos courtesy of
Gardens by the Bay and
Masayuki Fukuoka (Japan)



Vietnam International Construction & Building Exhibition 2013

Show Date

18-20/7/2013

Venue

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