



significance of
sky gardens for
healthy high-rise living
of urban children and old adults

presented by:

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Organisers:



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41 years
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600+ staff








The higher we live from
the ground level, the more
disconnected we feel from
the natural world and even
from each other within a
community






[Psychological] - Urban green spaces with the natural setting can provide some peace and quiet away from the hustle and bustle of the city, and contribute to health and wellbeing (Baur & Tynon 2010).

A man wearing glasses and a green polo shirt is shown from the side, hugging a large, lush vertical garden wall. The wall is composed of various green plants, including tall grasses and large-leafed leafy greens. The background shows a building and a clear sky.


Natural environments evoked “soft fascination” and improved performance in memory and learning tasks as well as self-regulation tasks, such as impulse control. (Kaplan & Berman, 2010)



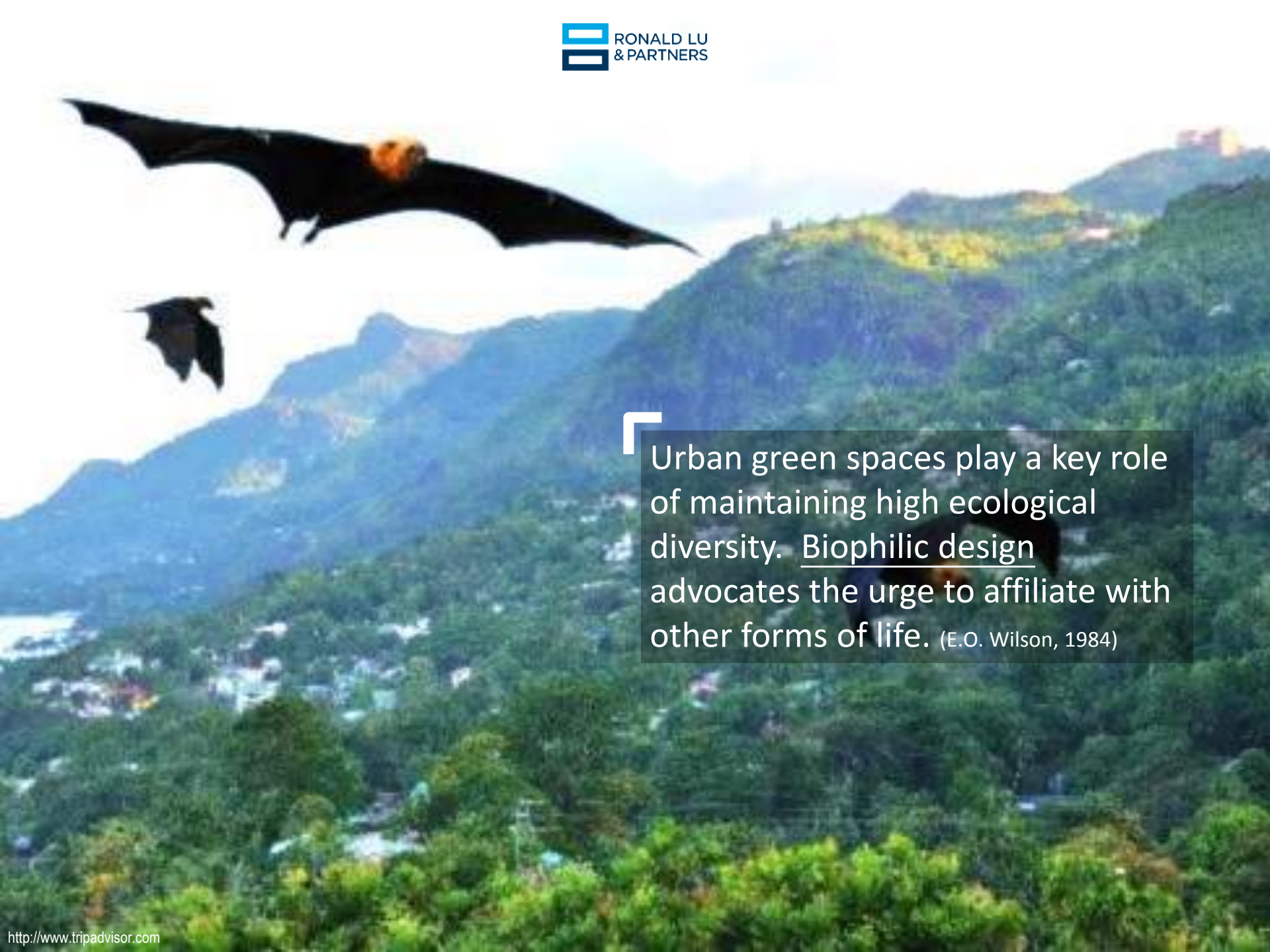
┌ [Physiological] - Daily activities in green spaces for 5 minutes can effectively give positive effects on mood and self-esteem (Barton & Pretty 2010).



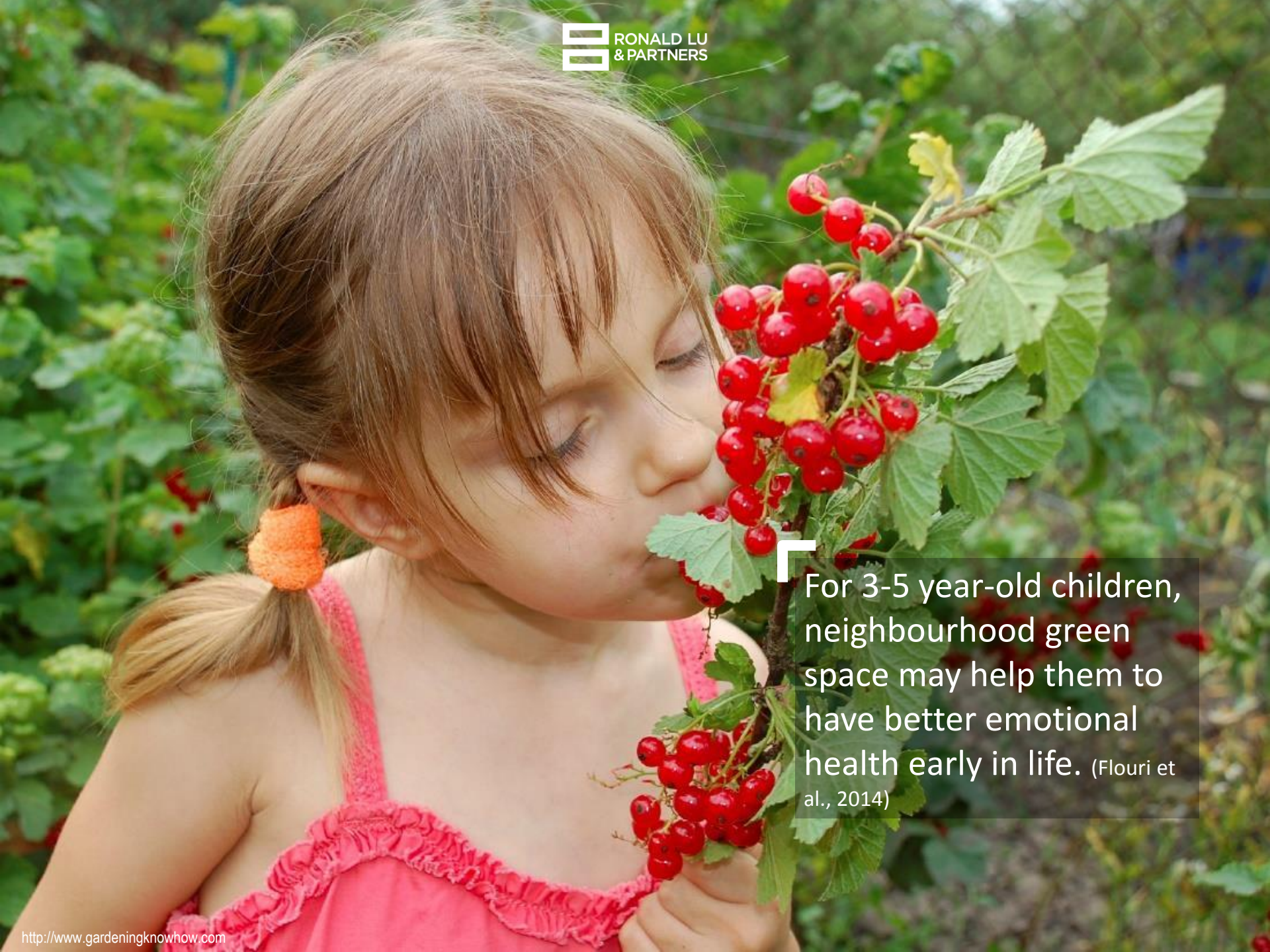
[Social] - Pleasure-derived leisure experiences are found in a garden which serves as a social arena for family and neighbours gathering (Connell 2004)



[Ecological] - Biophobia may be developed due to people's fear of living things and unexpectedness from nature. Urban children may have negative feelings such as fear, scary, disgusting and uncomfortable with nature. (Collado et al., 2015)



Urban green spaces play a key role of maintaining high ecological diversity. Biophilic design advocates the urge to affiliate with other forms of life. (E.O. Wilson, 1984)



For 3-5 year-old children, neighbourhood green space may help them to have better emotional health early in life. (Flouri et al., 2014)

For 7-12 year-old children, natural environment may catch children's attention easily and help them to learn new things especially situations, spaces and materials more effectively. (Laaksoharju, 2012)





For 9-10 year-old children, contact with nature had significantly positive effect on nurturing biophilic attitudes to wildlife and enhancing their willingness to support animal conservation. (Zhang et al., 2014)

Communal green spaces benefit elderly residents' social integration and healthy development (Delvin & Zaff ,1998; Kweon et al., 1998)



Sky Gardens?

Urban Living



「 Hong Kong 」



roof garden

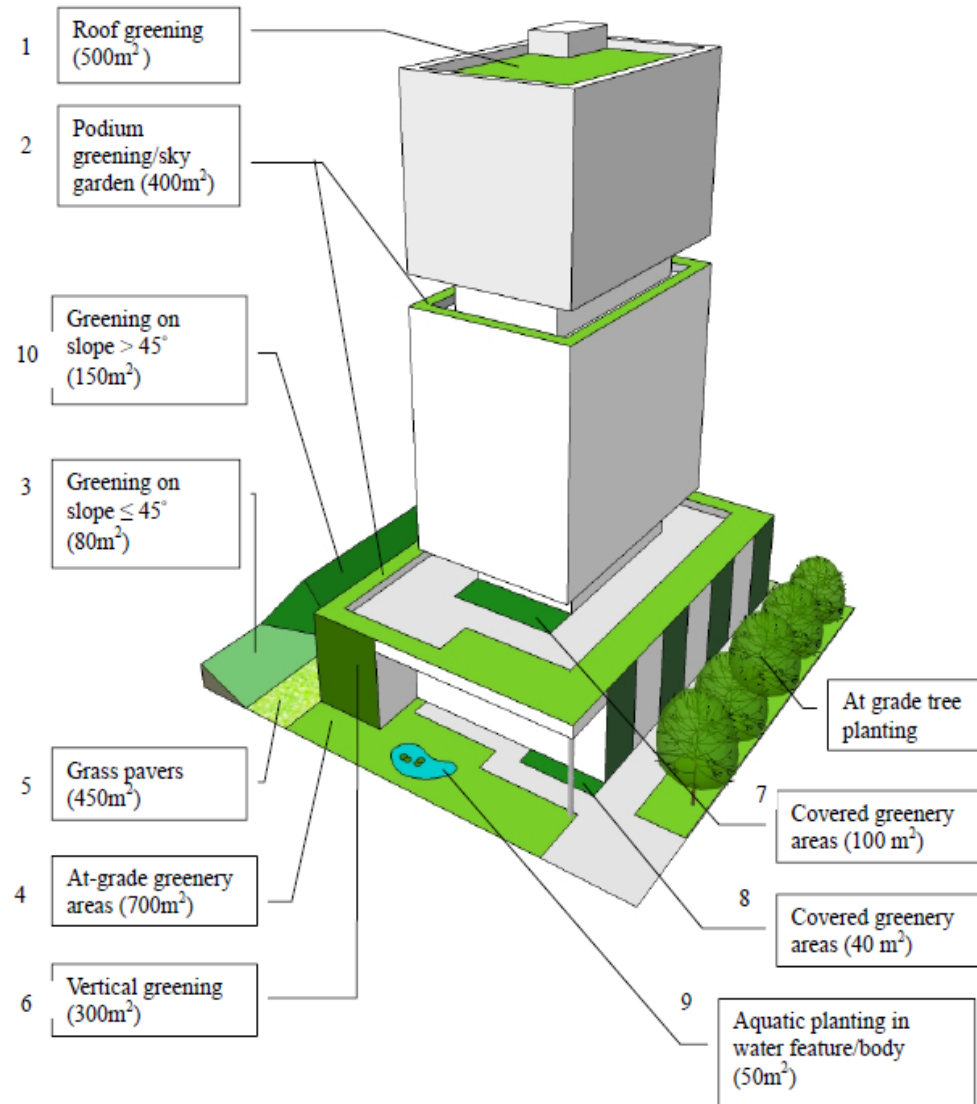
sky garden

podium garden



Hong Kong government issued 'green incentives' for sky gardens in new residential buildings in 2001, aiming at improving urban ventilation, greenery and recreational garden space for communal use.

A Worked Example for Calculation of Site Coverage of Greenery

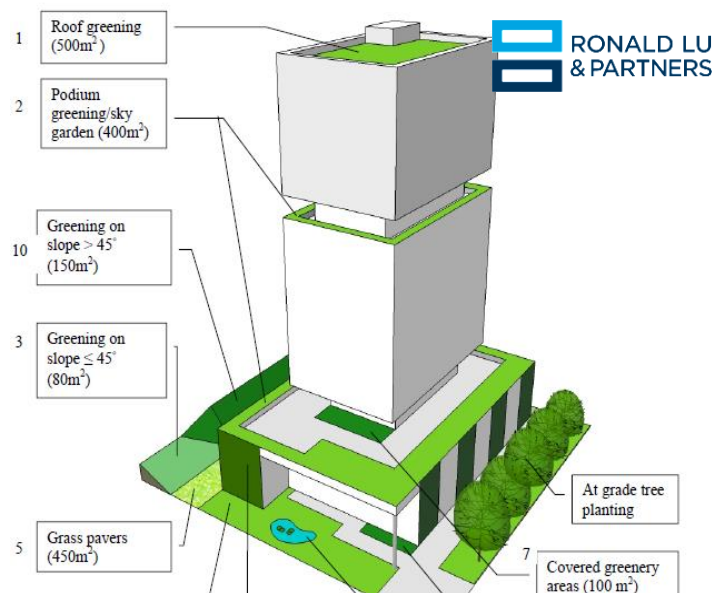


Types of Greenery Areas (Diagrammatic illustration only)

In Singapore, GFA exemption for sky gardens was first introduced in 1997, aiming at promoting more quality communal spaces and contributing towards the overall greenery and environmental quality of the surrounding areas.



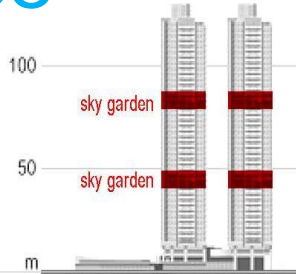
| | Hong Kong | Singapore |
|------------------------------|---|---|
| Government Policy | Joint Practice Note issued by Buildings Department, Planning Department and Lands Department. (JPN 1) | Circular to Professional Institutes issued by Urban Redevelopment Authority. (Circular No. URA/PB/2009/12-DCG) |
| Year | First issued in 2001; revised in 2011 | First introduced in 1997; revised in 2009 |
| Sky Garden Objectives | Sky gardens provide natural ventilation, greenery and recreational garden space for communal use. | Sky gardens serve as quality communal spaces; and contribute towards the overall greenery and environmental quality of the surrounding area |
| Configuration | The minimum headroom is 4.5m and it is open-sided above safe parapet height on at least two opposite sides for cross ventilation. | The proposed depth should be at least 5m. |
| Quantities | The maximum number of sky gardens provided is equal to or less than the number of residential storeys divided by 15. Such garden can be split into multi-levels but it occupies not less than one-third of the area of the floor plate. | No specific requirement. |
| Locations | Sky gardens are at least at 10 storeys apart from each other or podium garden unless under exceptional circumstances where strong environmental justifications are requested. | No specific requirement. |



| | Hong Kong | Singapore |
|-------------------|--|--|
| Greenery | Not less than 15% of the garden area is to be planted with greenery. | Lushly landscaped with a suitable variety of plants is required. The greenery should be enjoyed by the building users and be visible from the surrounding environment. |
| Incentives | <ul style="list-style-type: none"> GFA of sky gardens can be exempted if the above requirements are complied. However, floor height of sky gardens may not be exempted if the overall building height is capped under the Outline Zoning Plan (OZP) or the land lease. | <ul style="list-style-type: none"> GFA exemption is granted for areas within 45 degree projection line of sunlight from the building edge above. Additional floor height allowance for predominant sky gardens: If SG area exceeds 60% of the floor plate, additional heights of 10m(7-20storeys), 15m(21-30s), 20m(31-40s), 25m(41-50s) & 30m(>50s). |

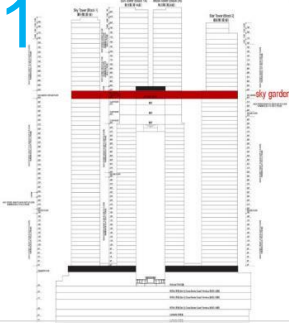
Hong Kong

1/38 storeys



The Orchard (2003)

2/51



The Arch (2005)

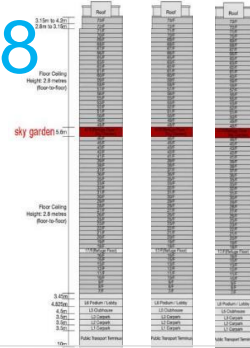
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3/27



Centre Place (2006)

4/58



Grand Promenade (2006)

5/55



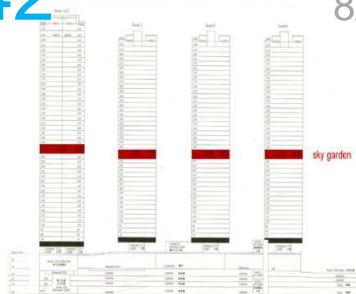
Indi Home (2006)

6/30



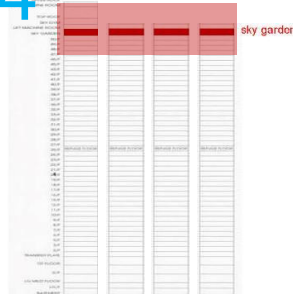
31 Robinson Road (2007)

7/42



Manhattan Hill (2007)

8/44



The Apex (2007)

9/26



SOHO38 (2008)

10/48



The Forest Hills (2008)

11/37



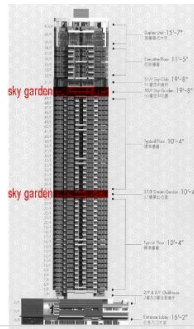
The Sparkle (2008)

12/37



i-home (2009)

13/48



Shining Heights (2009)

14/38



The Masterpiece (2009)

15/30



Aria (2010)

16/36



Island Crest (2010)

17/28



Larvotto (2011)

18/36



Lime Stardom (2011)

19/29



Harbour One (2012)

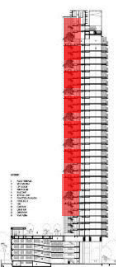
20/23



De Novo (2015)

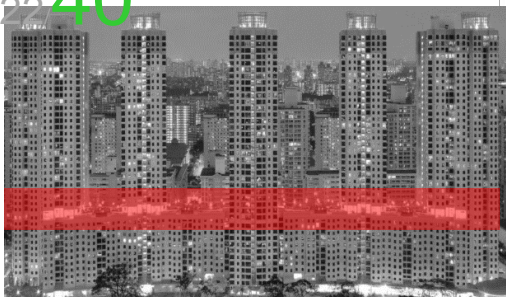
Singapore

21/36 ^{storeys}



Newton Suites (2007)

22/40



Central Horizon (2008)



23/50

Pinnacle at Duxton (2009)

24/43



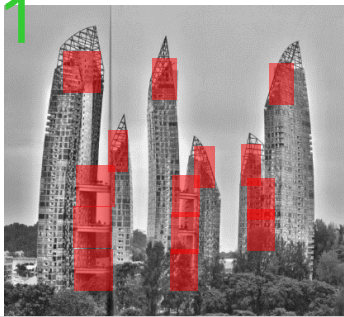
RiverGate (2009)

25/32



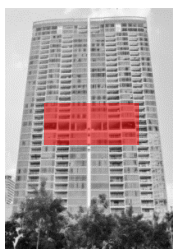
Skypark at Somerset (2010)

26/41



Reflections at Keppel Bay (2011)

27/33



Martin Place Residences (2011)

28/33



Soleil @ Sinaran (2011)

29/20



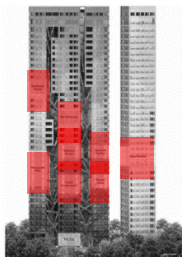
Parc Seabreeze (2012)

30/45



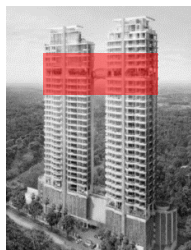
Ascentia Sky (2014)

31/36



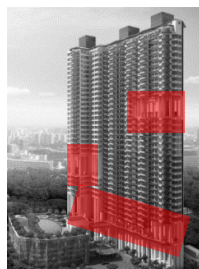
Novel 18 (2014)

32/30



Lincoln Suites (2014)

33/36



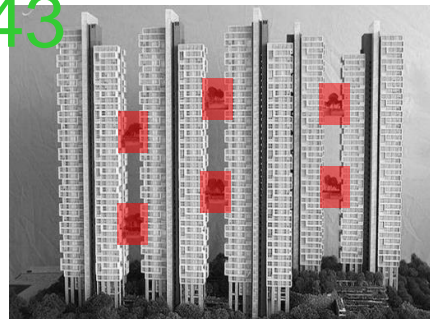
Spottiswoode Residence (2014)

34/36



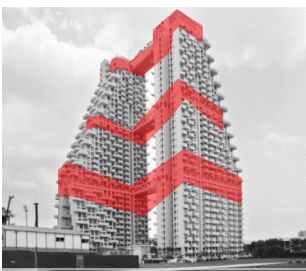
Spottiswoode 18 (2015)

35/43



SkyTerrace at Dawson (2015)

36/38



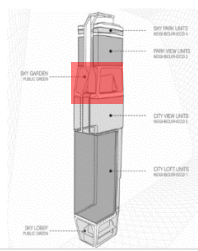
Sky Habitat (2015)

37/42



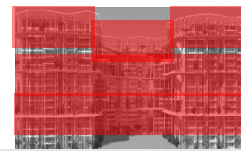
Robinson Suite (2016)

38/31



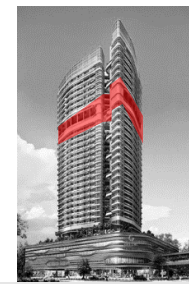
Scotts Tower (2016)

39/18




The Tembusu Kovan (2017)

40/30



City Gate (2019)

| 40 case studies | | No. of storeys (residential floors) | No. of sky gardens |  RONALD LU & PARTNERS Sky garden location | Separate floor | Doorstep from units | Near podium clubhouse | Near sky clubhouse | At roof level | Connect different blocks | Amenities, except seating |
|--------------------------|----------------------------------|-------------------------------------|--------------------|---|----------------|---------------------|-----------------------|--------------------|---------------|--------------------------|---------------------------|
| Hong Kong | The Orchard (2003) | 38 | 2 | 17, 32/F | ● | | | | | | |
| | The Arch (2005) | 50-51 (5-82/F) | 1 | 62/F | ● | | | ● | | ● | |
| | Centre Place (2006) | 27 | 1 | 25/F | ● | | | ● | | | ● |
| | Grand Promenade (2006) | 55-58 (7-73/F) | 1 | 47/F | ● | | | | | | ● |
| | Indi Home (2006) | 55 | 1 | 45R/F | ● | | | | | | ● |
| | 31 Robinson Road (2007) | 30 (8-42/F) | 1 | 7/F | ● | | ● | | | | |
| | Manhattan Hill (2007) | 40-42 | 1 | 25-26/F | ● | | | | | | |
| | The Apex (2007) | 44 (2-50/F) | 1 | R/F | ● | | | | ● | ● | |
| | SOHO38 (2008) | 26 (5-38/F) | 1 | 27/F | ● | | | | | | |
| | The Forest Hills (2008) | 48 (8/F-51/F) | 1 | 29/F | ● | | | | | | ● |
| | The Sparkle (2008) | 37 (7-49/F) | 1 | 45/F | ● | | | ● | | | ● |
| | i-home (2009) | 37 | 1 | 20/F | ● | | | | | | ● |
| | Shining Heights (2009) | 48 (5-60/F) | 2 | 27, 50/F | ● | | | ● | | | |
| | The Masterpiece (2009) | 38 | 2 | 9, 47/F | ● | | ● | | | | ● |
| | Aria (2010) | 30 (5-39/F) | 1 | 37/F | ● | | | ● | | ● | ● |
| | Island Crest (2010) | 36 (2-50/F) | 1 | 29/F | ● | | | | | | |
| | Larvotto (2011) | 25-28 (7-39/F) | 1 | 20-24/F | ● | | | | | | ● |
| | Lime Stardom (2011) | 36 (5-45/F) | 1 | 18R/F | ● | | | | | | |
| Harbour One (2012) | 29 (9-42/F) | 2 | 7, 32/F | ● | | ● | | | | | |
| De Novo (2015) | 23 (1-23/F) | 1 | 23/F | ● | | | ● | ● | ● | ● | |
| Singapore | Newton Suites (2007) | 36 | 7 | every 4 floors | | ● | | | | | |
| | Central Horizon (2008) | 11/40 | 1 | 12/F | | | | | ● | ● | |
| | Pinnacle at Duxton (2009) | 50 | 2 | 26, 50/F | ● | | | ● | ● | ● | ● |
| | RiverGate (2009) | 43 | 20+ | every 2-3 floors | | ● | | | | | |
| | Skypark at Somerset (2010) | 32 | 15 | every 2 floors | | ● | | | | | |
| | Reflections at Keppel Bay (2011) | 24/41 | 4 | 8, 15, 22, R/F | ● | ● | | | ● | ● | |
| | Martin Place Residences (2011) | 33 | 1 | 14/F | ● | | | | | ● | ● |
| | Soleil @ Sinaran (2011) | 33 | 1 | 14/F | ● | | | | | ● | ● |
| | Parc Seabreeze (2012) | 20 | 1 | 14/F | ● | | | | | | ● |
| | Ascentia Sky (2014) | 45 | 10 | every 5 floors | | ● | | ● | ● | | ● |
| | Novel 18 (2014) | 36 | 8 | 11-26/F | ● | | | ● | | | |
| | Lincoln Suites (2014) | 30 | 1 | 24/F | ● | | | ● | | ● | ● |
| | Spottiswoode Residence (2014) | 36 | 3 | 2, 10, 22/F | ● | | ● | | | ● | ● |
| | Spottiswoode 18 (2015) | 36 | 2 | 14, 24/F | ● | | | | | | ● |
| | SkyTerrace at Dawson (2015) | 40-43 | 2 | 19,33/F | ● | ● | | | | ● | |
| | Sky Habitat (2015) | 38 | 3 | 14,26,38/F | ● | | | ● | ● | ● | ● |
| | Robinson Suite (2016) | 42 | 2 | 7, 19/F | ● | ● | | | | | ● |
| | Scotts Tower (2016) | 31 | 1 | 25/F | ● | | | | | | ● |
| The Tembusu Kovan (2017) | 18 | 3 | 6,12,18/F | ● | ● | | ● | ● | ● | ● | |
| City Gate (2019) | 30 | 2 | 6,24/F | ● | | ● | ● | | ● | ● | |

Psychological

- Stress reduction
- Attention restoration
- Soft fascination
- Others

Physiological

- Mood and heart rate variability
- Blood pressure
- Others

Social

- Neighborhood
- Community building
- Sense of belonging
- Others

Environmental

- Microclimate
- Urban ventilation
- Outdoor thermal comfort
- Others

Ecological

- Urban biodiversity
- Humans' affinity to nature
- Others

Light & Air

- Location
- Orientation
- Floor height
- Openness

Distant View

- Site planning
- Location
- Orientation
- Openness

Greenery

Quantity & Quality

- Vegetation volume
- Green coverage
- Vegetation structure
- Flowering

Interaction

- Visual amenity
- Sensory exposure
- Gardening

Species

- Native vs exotic
- Non-invasive
- Richness

Communal Spaces

Spatial Design

- Covered outdoor space
- Spacious
- Flexible

Connectivity Accessibility

- Purposeful interactions
- Serendipitous / casual interactions

Safety & Security

- Sense of being safe at high Under supervision
- Management restrictions

Amenities

- Active vs passive
- Individual
- Family
- Neighborhood
- Public

Contributing factors to promote health & well-being of urban living with sky gardens

1
2
3
4

Public all public

controlled public

all towers

several towers

one tower

several floors

each floor

doorsteps

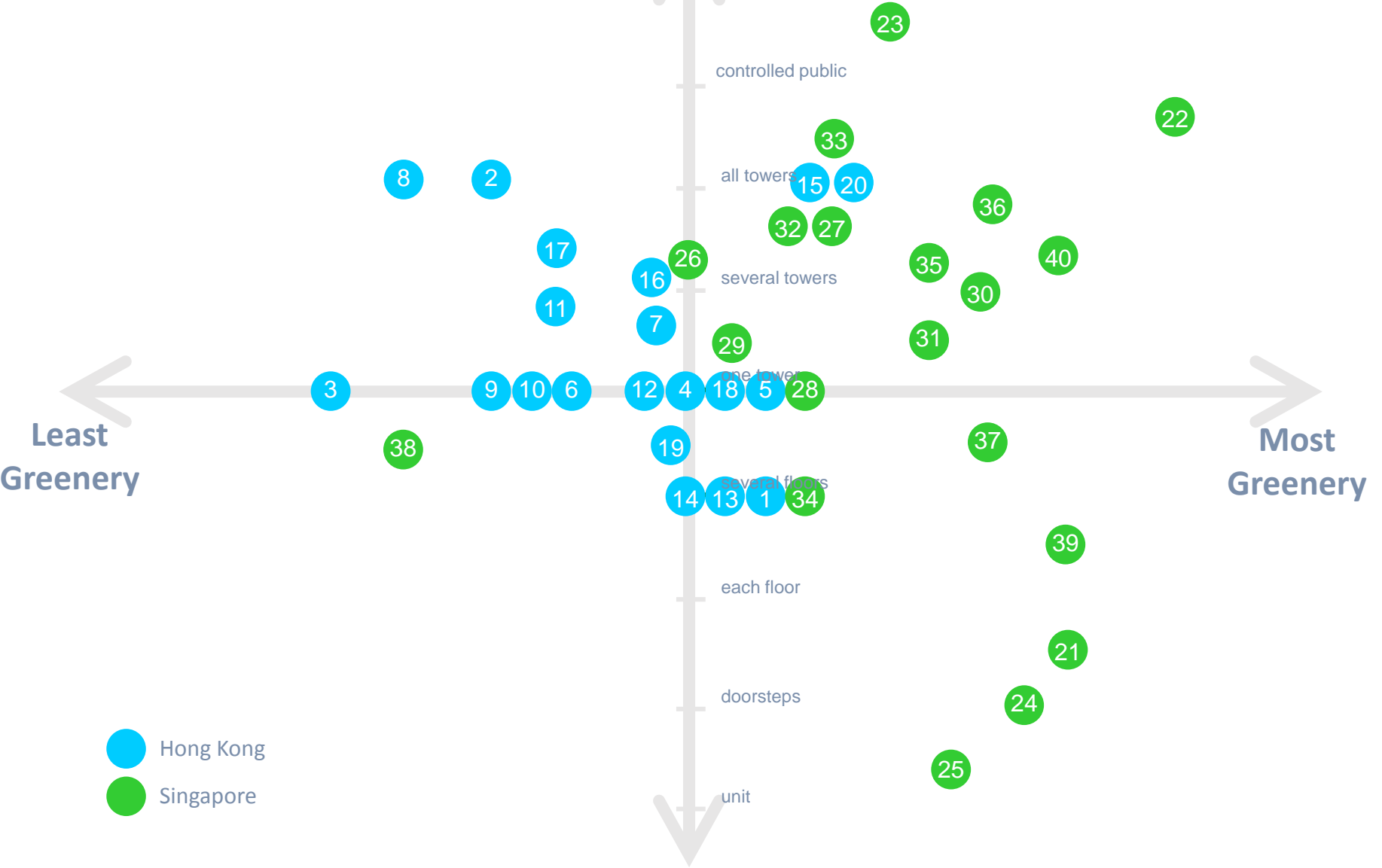
unit

Private

Least Greenery

Most Greenery

- Hong Kong
- Singapore



One mid-level sky garden



One low-level & one mid-level sky gardens



One high-level sky garden connecting to sky clubhouse



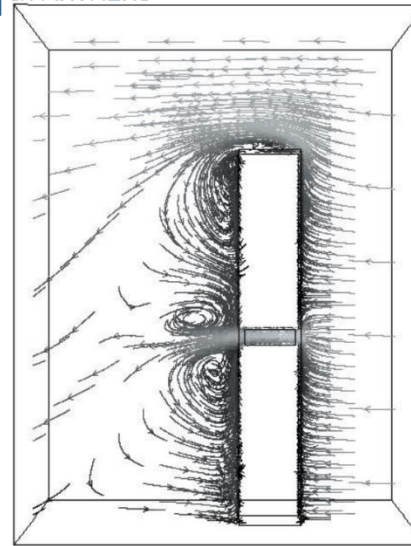
┌ sunlight and air for health and enjoyment



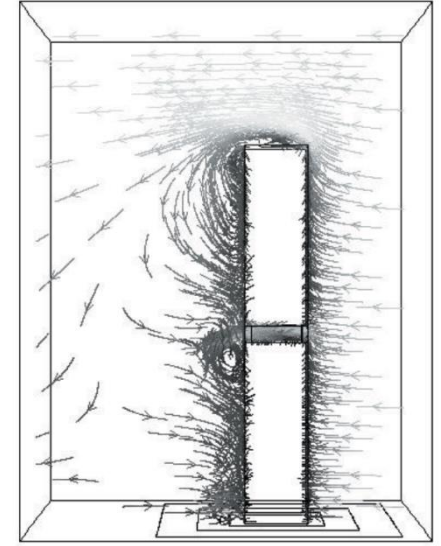
Sky garden

Daylight penetration

- Headroom
- Ceiling design
- Orientation



Case 1



Case 2

Wind [Marco] : urban ventilation

- Effective at low zone for street ventilation, then high headroom and fully permeable [less windy]

Wind [Micro] : outdoor thermal comfort

- At mid/high zones, wind breaking design by using parapet and vegetation
- Opening size, configuration and orientation

Our psychological need to be around life and life-like process is recognized. The direct experience of nature or nature-derived patterns can improve experience, mood and happiness.

(WELL, 2012)



Extensive greenery in a deliberately designed vegetation volume creates desirable outdoor thermally comfortable environment and visual buffers from the densely populated surrounding.

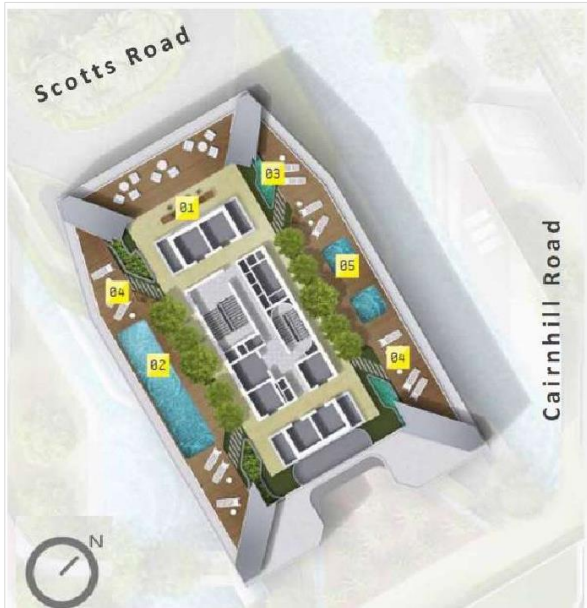
Greenery



45R/F Sky Garden

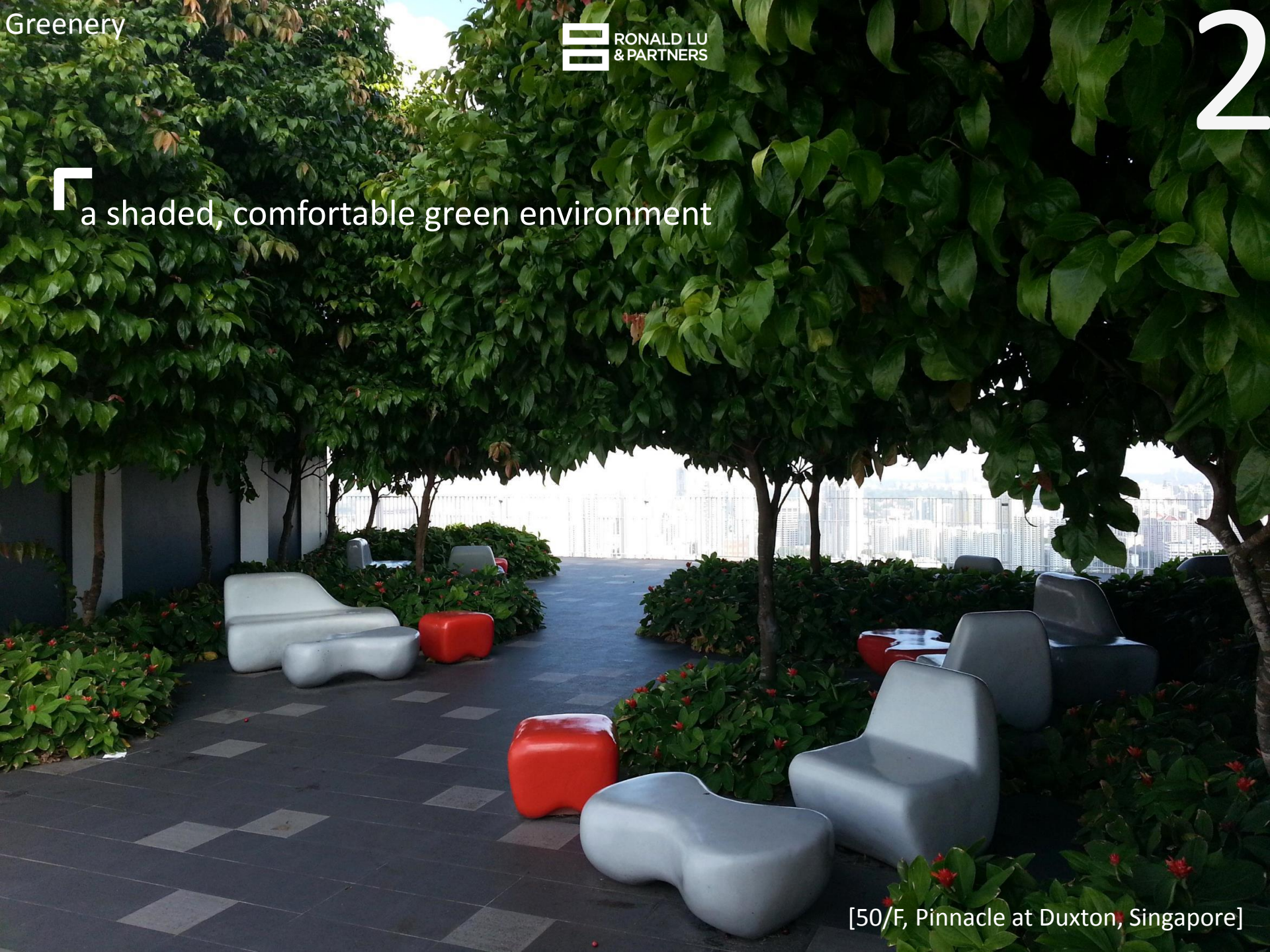


Edges



Core

┌ a shaded, comfortable green environment



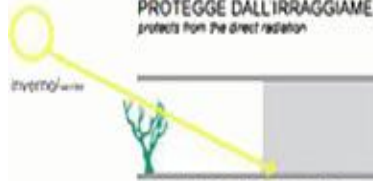


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IL BOSCO VERTICALE:



PROTEGGE DALL'IRRAGGIAMENTO
protects from the direct radiation



LASCIA PASSARE LA LUCE
lets light in



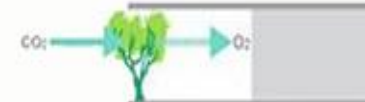
RIPARA DAL VENTO
protects from the wind



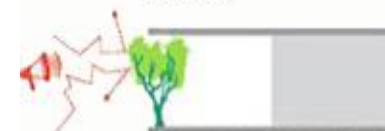
RILASCIAM UMIDITÀ
release humidity



CATTURA LE POLVERI SOTTILI
captures small dust particles



PRODUCE OSSIGENO
produces oxygen



MITIGA L'INQUINAMENTO ACUSTICO
reduces acoustic pollution

CO2

inquinamento acustico
acoustic pollution

H2O

O2

polveri sottili
dust particles





Vegetation @ Sky Gardens

- Wind tolerant
- Ability to grow under shade
- Less irrigation
- Diversity for different functions (wind break, visual, smell, edible, seasonal etc.)



科 Family: 夾竹桃科 Apocynaceae
 學名 Scientific Name: *Plumeria rubra* 'Acutifolia'
 英文名 Common Name: Frangipani
 中文名 Chinese Name: 雞蛋花

本土 Native
 常綠 Evergreen
 外來 Exotic
 落葉 Deciduous

可忍受的生長環境 Tolerance:



強風 Wind 鹽霧 Salt Spray 乾旱 Drought 污染 Pollution 陰暗 Shade

喬木 Tree

應用例子 Applications



位於政府總部平台的平台花園
Podium planting at Central Government Offices Podium



位於添馬公園的平台花園
Podium planting at Tamar Park



位於大角咀匯豐中心的平台花園
Podium planting at HSBC Centre, Tai Kok Tsui

技術資料 Technical Information

灌溉要求 Irrigation Demand 建議泥土深度 (mm) Recommended Soil Depth

| |
|-------------|
| 100 - 200 |
| 200 - 300 |
| 300 - 450 |
| 450 - 600 |
| 1200 - 1400 |

肥料要求 Fertilising Demand 觀賞季節 In Season

| | | | | | | | | | | | | |
|----------|---|---|---|---|---|---|---|---|---|----|----|----|
| 月份 Month | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 花 Flower | | | | | | | | | | | | |
| 葉 Leaf | | | | | | | | | | | | |
| 果 Fruit | | | | | | | | | | | | |

有關樹木管理和護養的資料，請瀏覽 www.trees.gov.hk 內「樹木護養」及「全民監察」的部分。
 Information on tree management and maintenance is available at www.trees.gov.hk under "Tree Care" and "Community Surveillance".

特點 Features



突出的葉脈
Prominent leaf veins



中心為黃色的芳香白色花朵
Fragrant white flowers with yellow centers



Sky gardens purposefully improve neighbourhood and social interactions by creating spacious, scenic, entertaining and safe green areas with children and elderly friendly amenities and good accessibility; meanwhile, vegetation offers joyful visual amenity

Accessibility



Connecting all towers

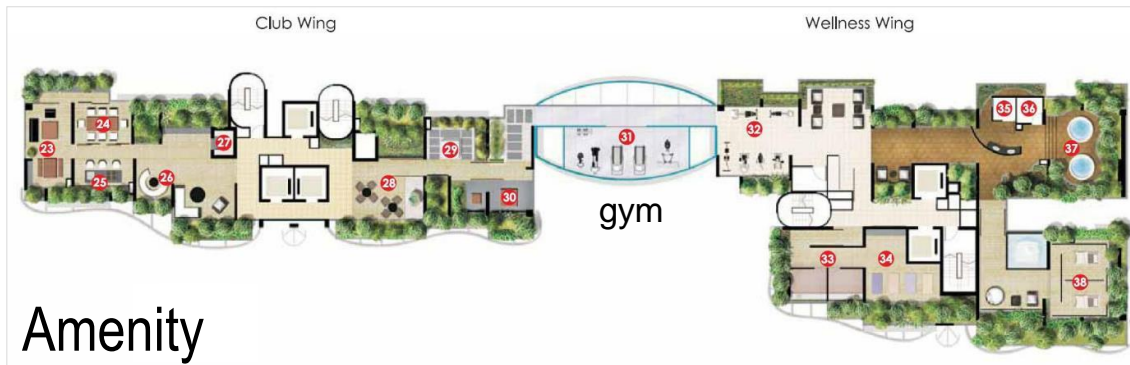
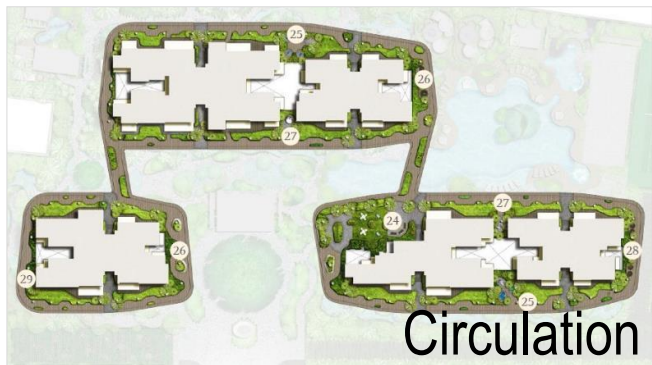


At a separate floor



Doorstep gardens

Connectivity



Improved extension of living spaces may facilitate daily activities and incidental or causal interactions

Communal Spaces

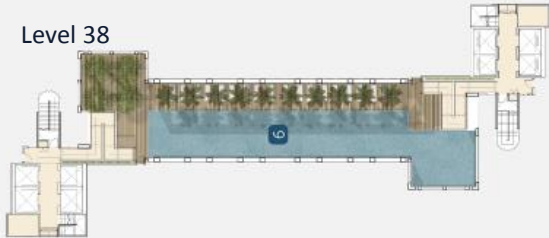
Level 14



Level 26

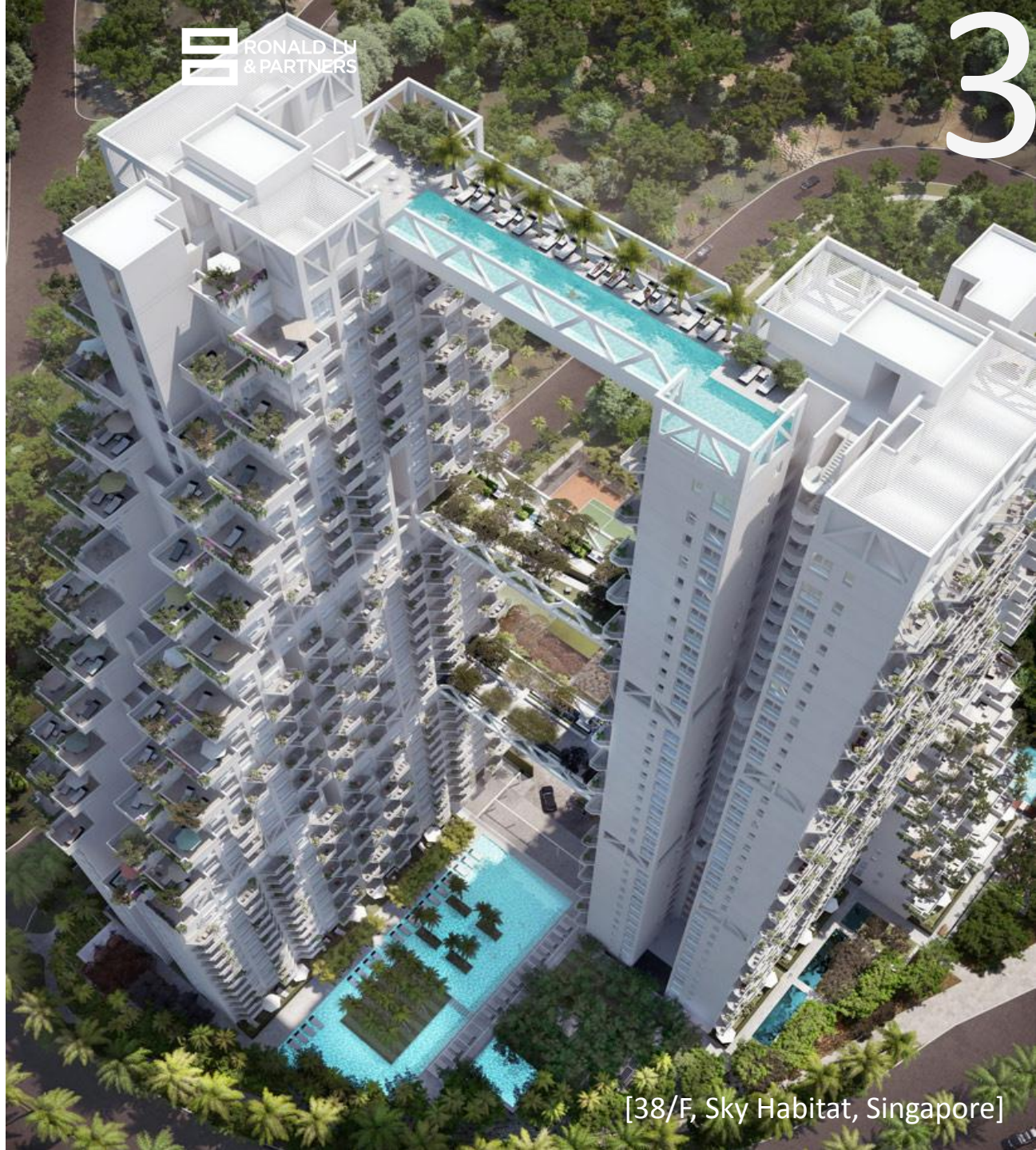


Level 38



RONALD LN & PARTNERS

3

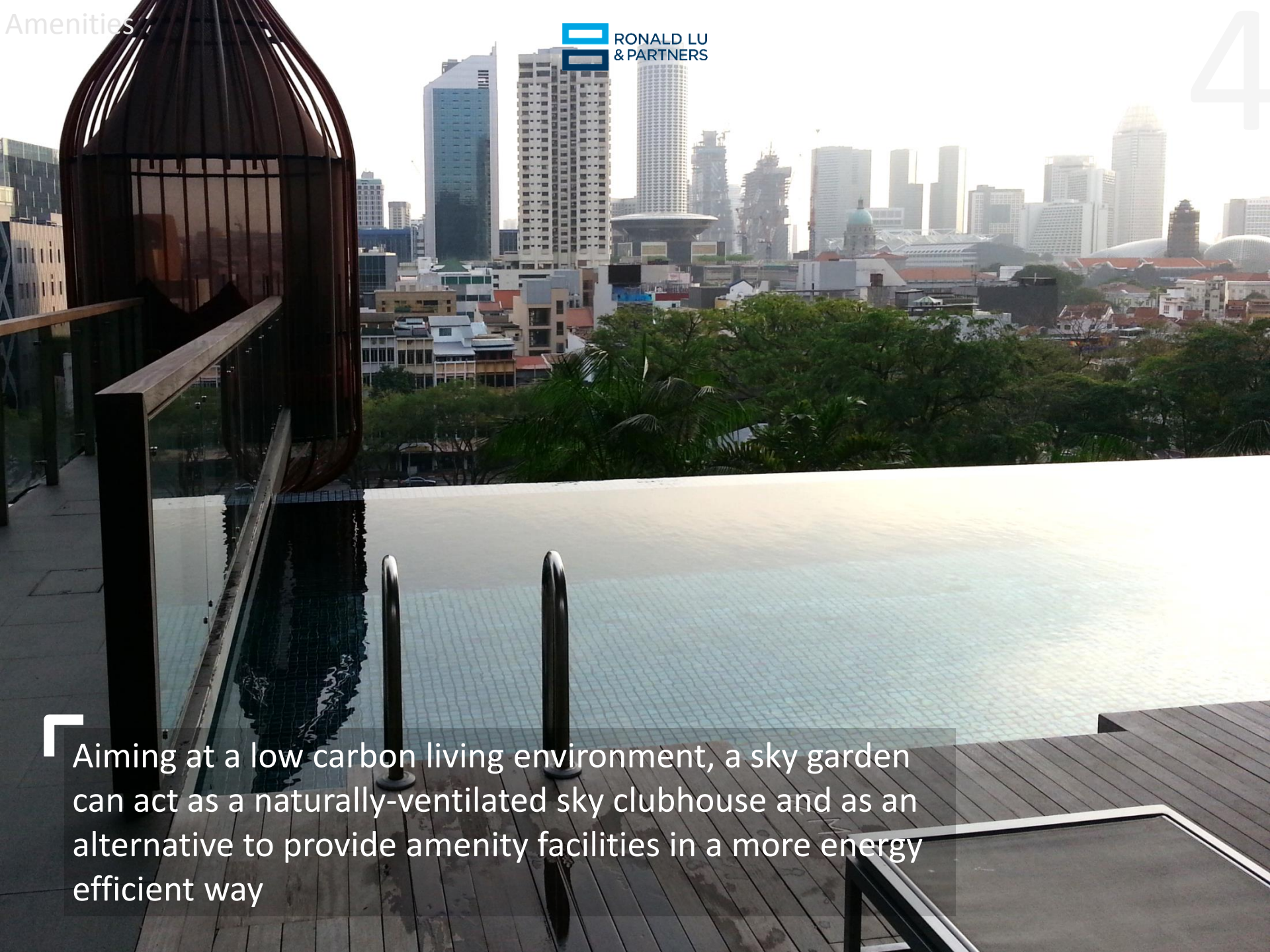


[38/F, Sky Habitat, Singapore]

Physical inactivity is attributable to 9.4% of all deaths worldwide, or 3.5 million people every year. (WELL, 2012)



| Amenities / Features | Popularity in sky garden provision | Facilities requirements | Spatial requirements | Appropriateness in green areas |
|---|------------------------------------|-------------------------|----------------------|--------------------------------|
| Landscape garden with scenic views | | | | |
| Water features | • | ••• | •• | •• |
| Sculpture / Artwork | •• | • | • | • |
| Audio devices | • | ••• | • | • |
| Lighting effect | •• | •• | • | • |
| Feature paving | ••• | • | • | •• |
| Planting | ••• | • | • | ••• |
| Self-retreat / seating / reading in a peaceful environment | | | | |
| Sitting area | ••• | • | • | ••• |
| Reading | •• | • | • | ••• |
| Swinging beds | • | ••• | • | ••• |
| Leisure walk with family and friends | | | | |
| Strolling path | ••• | • | • | ••• |
| Viewing platform | ••• | • | • | • |
| Doing exercises and stretching | | | | |
| Children play facilities | • | •• | ••• | ••• |
| Elderly exercises facilities | • | •• | ••• | ••• |
| Foot massage trail | ••• | •• | •• | ••• |
| Taichi square | ••• | • | ••• | ••• |
| Meditation studio | • | • | •• | ••• |
| Yoga zone | • | • | •• | •• |
| Aerobic area | • | • | ••• | •• |
| Chatting and social gathering with neighbours and friends | | | | |
| Tea leisure | ••• | • | • | ••• |
| Lounge | •• | • | • | ••• |
| Other amenity facilities | | | | |
| Barbeque | • | •• | ••• | •• |
| Gym facilities | •• | ••• | ••• | •• |
| Golf putting green | • | •• | •• | ••• |
| Swimming pool | • | •••• | •••• | • |



Aiming at a low carbon living environment, a sky garden can act as a naturally-ventilated sky clubhouse and as an alternative to provide amenity facilities in a more energy efficient way

Covered landscape is good for provisioning semi-outdoor spaces on rainy or hot summer days



Luxury on top of the world



Luxury knows no bounds at Nouvel 18. Elevating from ground level and rising high to the sky, a lavish flow of relaxation and recreational selections await your exclusive indulgence. Be spoiled for choice by the 8 themed sky terraces that grace the residential towers, each uniquely different in its offering of facilities. Nouvel 18 has so much to proffer, one need not have to leave home to truly live it up.



Sky Terrace - Level 14

Aqua Veranda

Immerse in the tranquility of lounging in the leisure pool amidst lush foliage. Let the beauty of nature inspire you, and emerge freshly rejuvenated after a relaxing swim.



Sky Terrace - Level 10

Forest Conservatory

In the company of towering trees, this is the perfect place to meet and bond with friends and loved ones for idyllic conversations and gatherings.



Sky Terrace - Level 11

Therapeutic Patio

Escape from the hustle and bustle of the city into the intimate garden. Tall trees and tropical flora create a relaxing hideaway where you can immerse in the rejuvenating waters of the whirlpool jacuzzis.



Sky Terrace - Level 11

Fitness Arena

A gymnasium and fitness area in the sky, this is fitness elevated to new heights. Work out to the rhythm of rustling leaves and take in the breathtaking views of the city below.



Sky Terrace - Level 14

Wellness Terrace

Take to the waters high above the city for a unique workout in the Aqua Gym surrounded by nature. Here, you can tone, sculpt and challenge your body with high-energy, yet low-impact exercises in the water.



Sky Terrace - Level 14

Gourmet Pavilion

Invite your guests to an extraordinary party at this exquisite all fresco venue that comes with an open kitchen for a gourmet showcase, and a magnificent city backdrop to bring your dining experience to an all-time high.



Sky Terrace - Level 19

Sky Botanique

By day, enjoy the verdant greenery with an inspiring book in hand or catch up with friends over afternoon tea. By night, create a perfect party setting where cocktails and cognac complement the sparkling views of the city.



Sky Terrace - Level 24

Meditation Garden

Discover inner peace at the highest garden of Nouvel 18. Embrace the captivating views of the city and be one with the world as you enjoy your yoga, tai chi or meditation session.



Can do and Can't do!

NOTICE

ALL VISITORS



**NO SMOKING
FOOD OR DRINK
DOGS OR OTHER PETS
ON SKY GARDEN**

TANJONG PAGAR TOWN COUNCIL • PINNACLE @ DUXTON RESIDENTS' COMMITTEE

SKY GARDEN HOUSE RULES

Residents and visitors shall observe the following when using the Sky Gardens :

- No pets
- No food and beverage
- No smoking or gambling
- No touting or soliciting
- No playing of loud music
- No setting up of tents or camping overnight or barbecue
- No social events at any part of the Sky Gardens.
- No littering, marking or painting of any part of the Sky Gardens
- No storing of personal property or blocking of any entrance or exit
- No hanging of any wet items, towels, bedding, clothing or any other article
- No activities such as biking, skateboarding or other similar games or the use of any sport equipment
- No damage shall be caused to any lawn, garden, trees, plants, or flowers or any other facilities
- Children must be accompanied by supervising adults
- Everyone must leave the Sky Gardens when there is rain and thunderstorm
- Everyone must seek refuge at the 26th storey storey Sky Gardens or ground floor, via staircases in the event of any fire or other emergency

[50/F, Pinnacle at Duxton, Singapore]



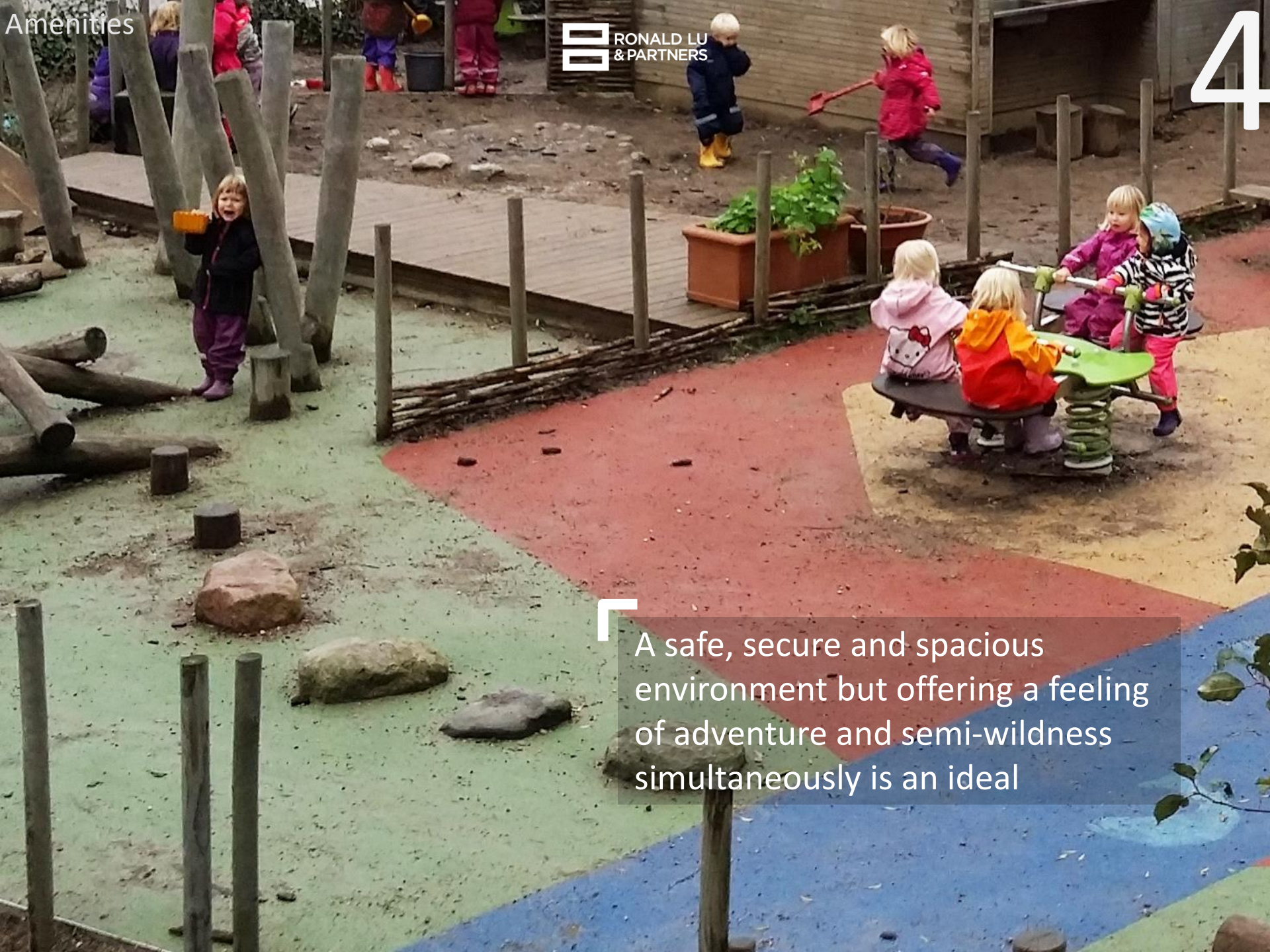
The most frequent users are
CHILDREN + ELDERLY




┌ Less than one-fourth cases have amenities for kids

Apart from this, any other design considerations of advocating children-friendly living environment?



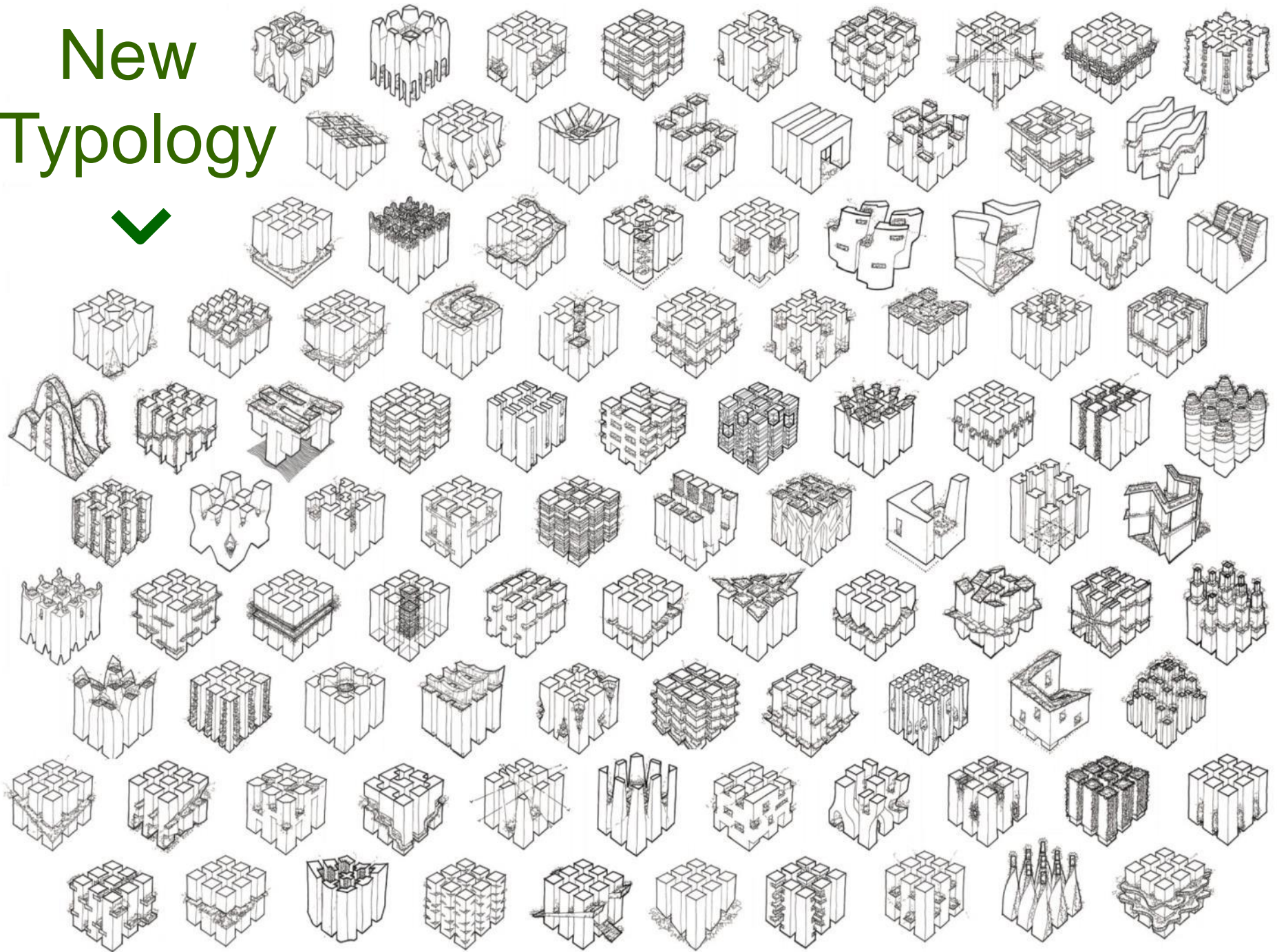


A safe, secure and spacious environment but offering a feeling of adventure and semi-wildness simultaneously is an ideal



Garden-based activities with nature, such as picking fruits, planting seeds or taking care of vegetables, nurture positive, ecologically responsible attitudes

New Typology



The higher the building,
the more the liveable green
spaces




my

1st

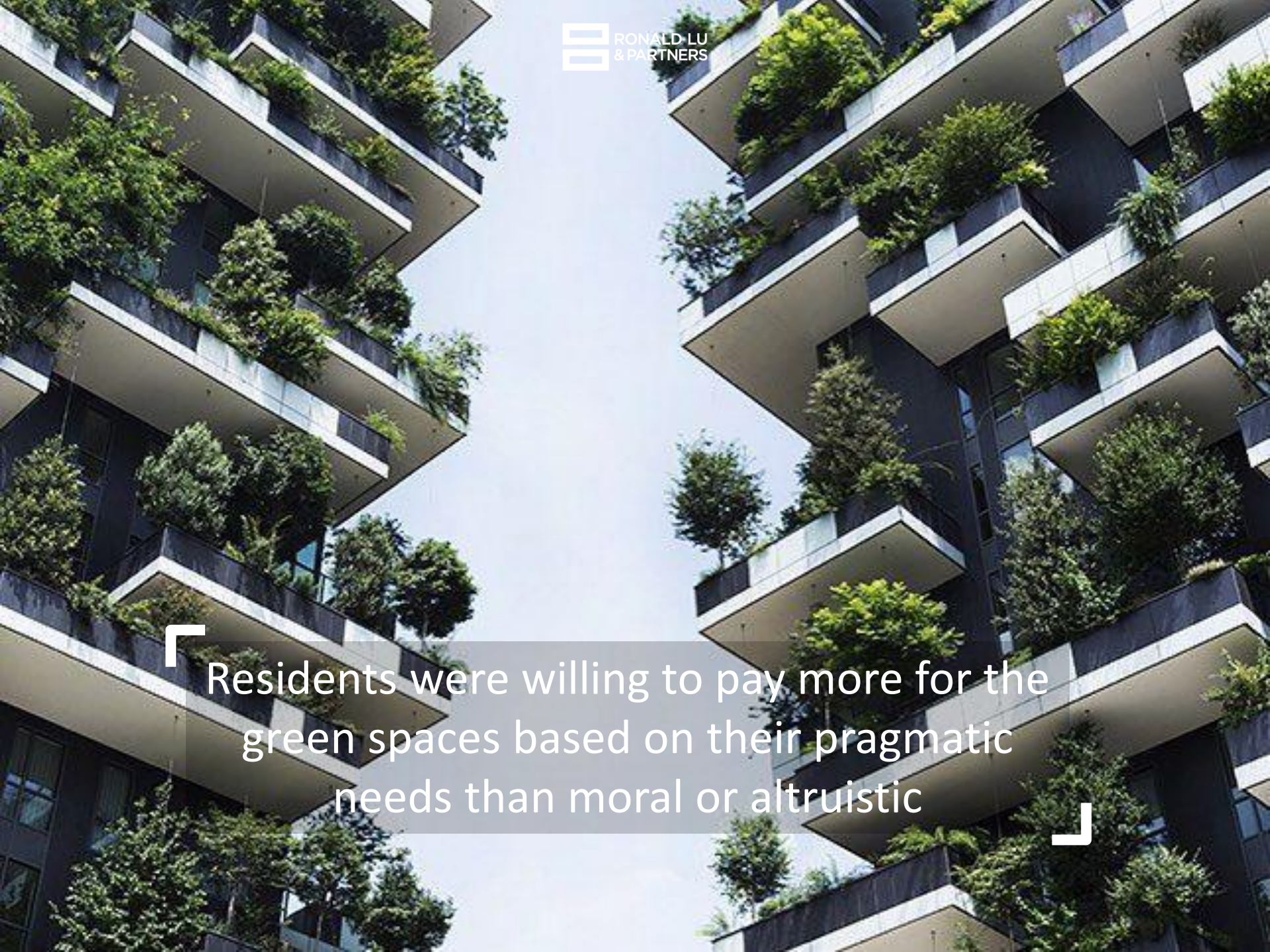
garden



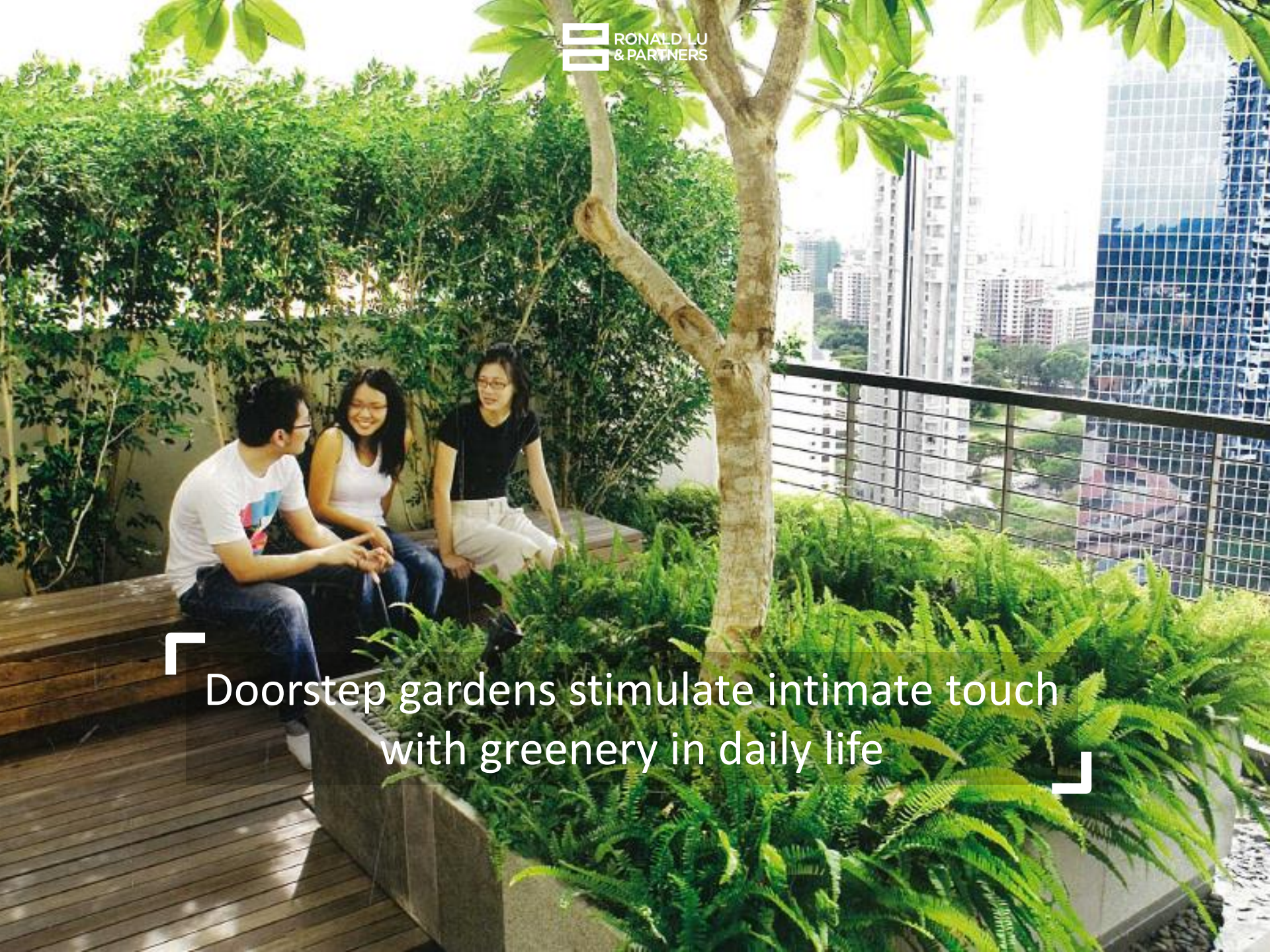
Environmentally-driven considerations,
including light, air and view



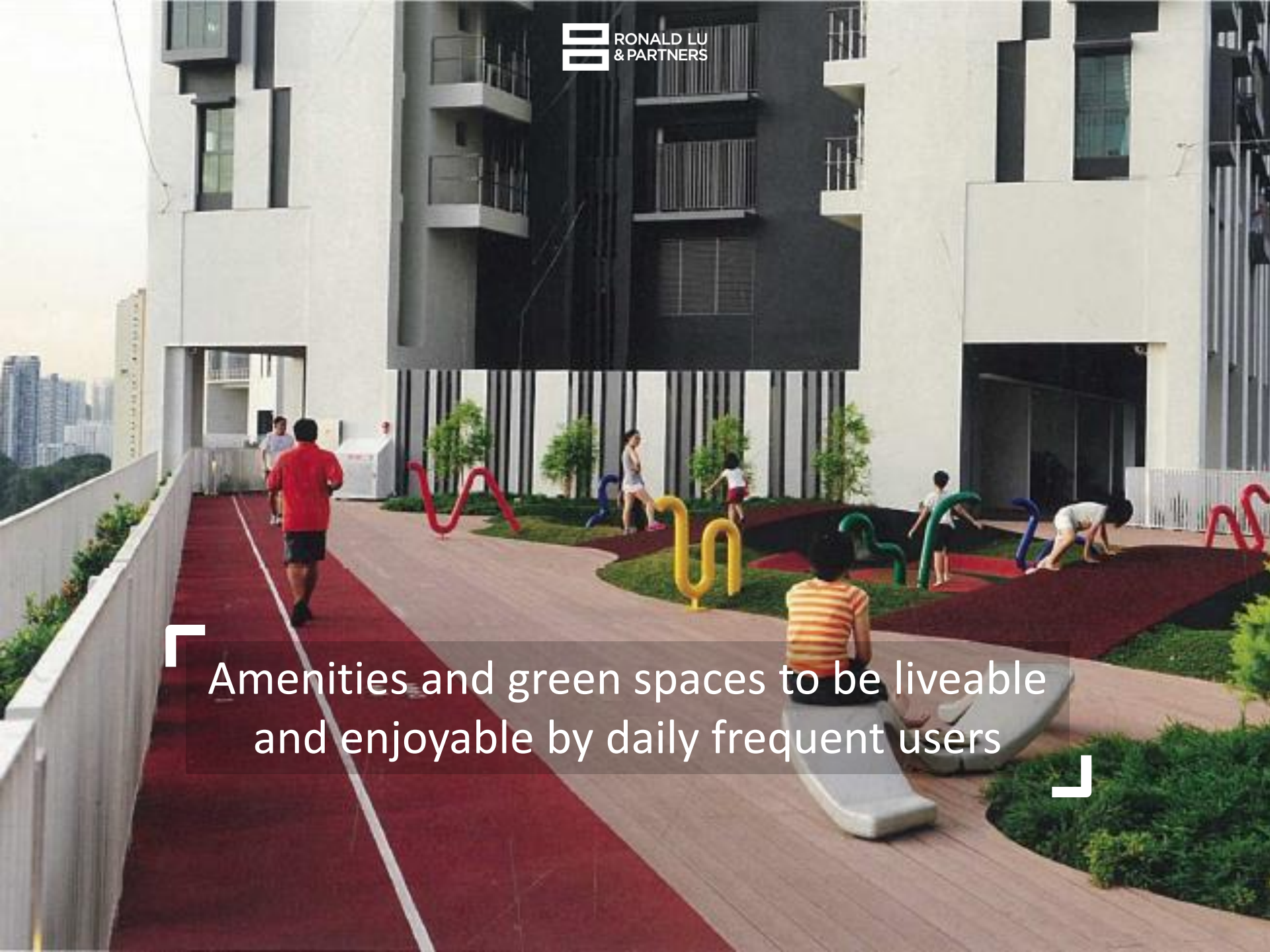
Socially-oriented considerations, creating sense of neighbourhood with good accessibility and connectivity




Residents were willing to pay more for the green spaces based on their pragmatic needs than moral or altruistic



Doorstep gardens stimulate intimate touch
with greenery in daily life



Amenities and green spaces to be liveable and enjoyable by daily frequent users

A photograph showing four children playing on scooters in an outdoor courtyard area. A girl in a white floral top and purple leggings is on a green scooter. A boy in a green shirt and striped shorts is on a blue scooter. Another boy in a black shirt and blue shorts is on a teal scooter. A girl in a pink shirt is on a pink scooter. The background shows a modern building entrance with a glass door and a bicycle parked nearby.

More importantly, children are allowed to play outdoors with their neighbouring friends and nature



Thank you!



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