

Tengah Forest Estate: Planning and Designing a Neighbourhood Landscape of High-density, High-rise Residential Estates in Singapore

Text by Hwang Yun Hye, Baek Chungseok, Lucia Choi, and Shih Pei Yin
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The landscapes of high-rise residential estates (“*neighbourhood landscapes*”) are important spaces that impact a large population of residents through everyday experiences. Yet, these are spaces that are often neglected, unused, or underused.

Three international design studios from Taiwan, Korea, and Singapore developed design proposals to explore how neighbourhood landscapes in dense tropical cities could better achieve higher ecological quality for the benefit of the environment and urban dwellers. This article offers an interdisciplinary perspective on the three design solutions offered.

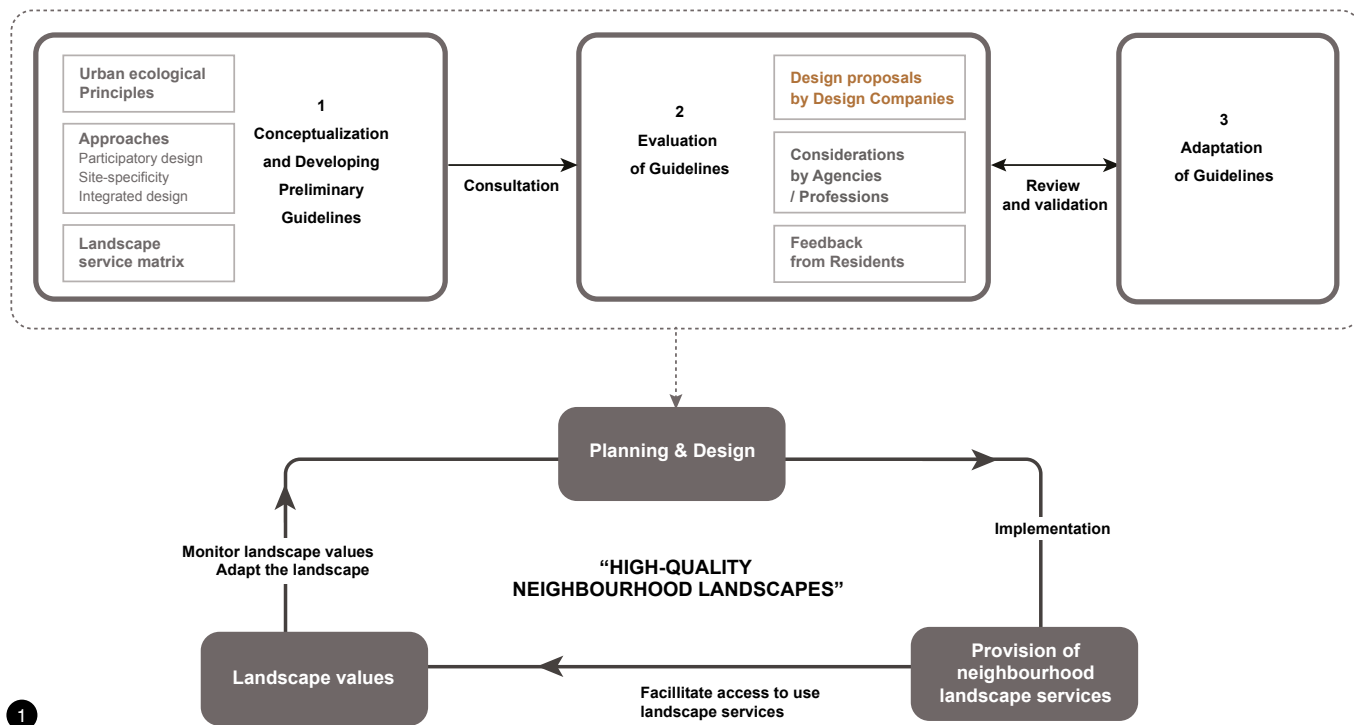
Background

More than 70 percent of the population in developed countries live in urban areas. In this increasingly modernised era, Asian metropolitan areas are particularly dense, at 1.5 times the average of the world’s urban areas. Cities such as Singapore exemplify the fast-paced and high-density Asian city. In the perpetual contest for growth, development often happens at the expense of preserving green spaces. The landscapes of high-rise residential estates (“*neighbourhood landscapes*”) are important spaces that impact a large population of residents through everyday experiences. Yet, these are spaces that are often neglected, unused, or underused. In collaboration with the Housing and Development Board (HDB), the Urban Redevelopment Authority (URA), and the National Parks Board (NParks), the research team from the National University of Singapore sought to explore the potential of neighbourhood landscapes to integrate physical and biophysical processes, to contribute to individual and community well-being, to ecological quality of living spaces, as well as to broader agendas of urban livability, sustainability and resilience of cities.

The framework

The research project “Biophilic Town¹” is a framework for landscapes to enhance the environment of high-density towns, that can be used to realise the potential of neighbourhood landscapes in the high-rise, high-density public housing estates of Singapore. The framework is conceived as a closed-looped process comprising three key components: (1) landscape planning and design, (2) provision of neighbourhood landscape services and (3) accumulation of landscape values. As the first component, planning and design are in themselves an iterative process that is shaped and guided by the conceptualisation and development of a set of guidelines by the research team. To test and evaluate the guidelines, three international design teams were invited to use the guidelines to develop design proposals for the study site. The proposals were then reviewed by agencies, professionals, and residents; and the reviews are then used to improve the guidelines. The development of design proposals is part of the evaluation of guidelines in the research process as shown in Image 1.

1. The development of design proposals by design companies as one of the major steps in the research project.



References

- ¹ The research project 'Biophilic Town: A framework for landscapes to enhance the environment of high-density towns' is conducted by the National University of Singapore (NUS), School of Design and Environment (SDE), and is funded by the Land and Liveability National Innovation Challenge (L2NIC) in collaboration with the Housing and Development Board (HDB), the Urban Redevelopment Authority (URA), and the National Parks Board (NParks).
- ² Information retrieved from <http://www.hdb.gov.sg/cs/infoweb/press-releases/corporate-pr-unveiling-the-masterplan-for-tengah-08092016>
- ³ Urban landscapes are functioning ecosystems connected at nested scales; Social and ecological processes are intertwined in such an ecosystem; Urban landscapes are nested in a dynamic urban ecosystem; Urban landscapes are nested in a heterogeneous urban ecosystem; Urban ecosystems have an enduring context.
- ⁴ Site-specificity, participatory design, and integrated design.
- ⁵ Provisioning services (Fresh produce. Water for irrigation); Regulating services (Heat mitigation, Erosion control, Stormwater and domestic waste water treatment, Abatement of noise pollution, Vector control, Flood hazard mitigation); Socio-cultural services (Mental and physical health, Sense of place, Aesthetic appreciation, Social relations, Educational values, Recreation, Heritage landscapes and specimens, Spiritual and religious fulfillments); Supporting services (Maintenance of soil quality, Provision of habitat for species, Nutrient cycling, Water cycling).

Design site

Transforming secondary forests into new residential towns is a common land development pattern in Singapore. These developments typically do not account for the ecological, biophysical and socio-cultural values of these forests. The designated study site (1°22'12.4"N 103°44'31.2"E) is a 720ha forest patch in Tengah; it was a former village that had grown into a young secondary forest since the 1980s.

While the extensive green patch is currently used as a military training ground, it remains one of the largest forested areas, and the fairly undisturbed greenery has become an important stopover for wildlife moving between more established nature areas. However, according to the city development plan, the Tengah town will be rolled out in three to five years, and is designated to supply up to 42,000 housing units². The design teams were given a brief to develop the master plan at the neighbourhood scale (a site of 90ha with 7,000 dwelling units) and the detailed designs at the precinct scale (30ha with 2,000 dwelling units).

Design requirements

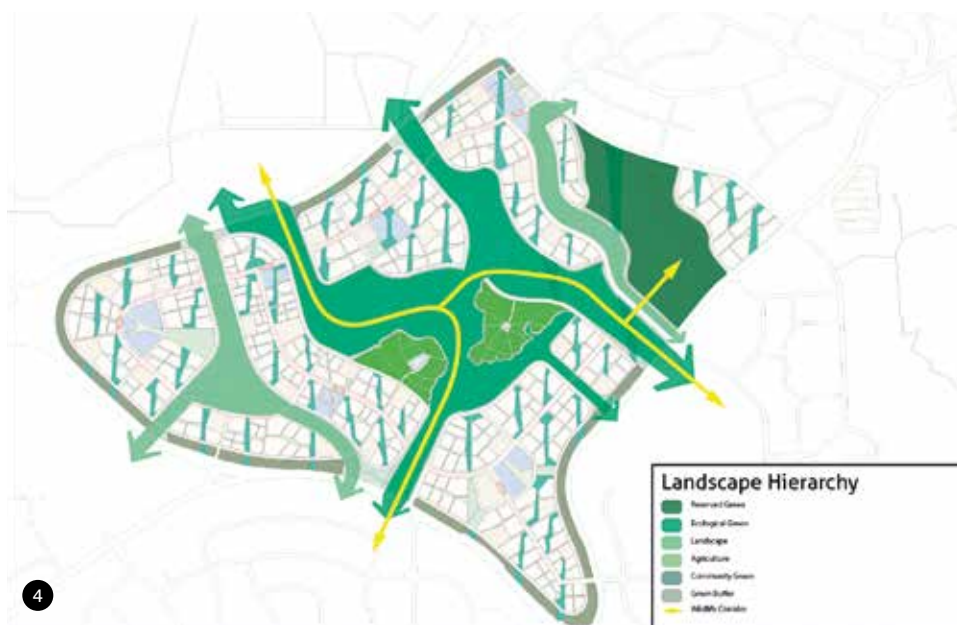
The three key points within the design call are: tradeoffs are necessary; both ecological and socio-cultural benefits from the landscape must be considered; and that the process of design and engagement of stakeholders are important. Three types of inputs and approaches were given to the teams as a part of design guidelines to be fulfilled: 1) five urban ecological principles³, 2) three core approaches⁴, and 3) twenty landscape services matrix⁵.



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- 2. A conceptual diagram of Ramboll Studio Dreiseitl envisions enhancing biophilic life as a stronger and more visible green community.
- 3. Dongsimwon suggested to preserve hilly areas above 35m and to utilise as various types of parks.
- 4. Classic Design proposed to allocate large forests and permaculture livelihood area in the centre of the site for the new kampong community.

Grouping proposals by subthemes

A wide range of proposals from the design teams have been grouped into seven subthemes of landscapes;

- The Tengah landscape: responding to the existing site character
- Ecologically responsive landscape: accommodating dynamism
- Functional landscape: optimising biophysical functions of open space
- Biophilic landscape: connecting humans and nature
- Multi-purpose landscape: intensifying land use
- Integrated landscape: blurring boundaries
- Participatory landscape design

The Tengah landscape: responding to the existing site character

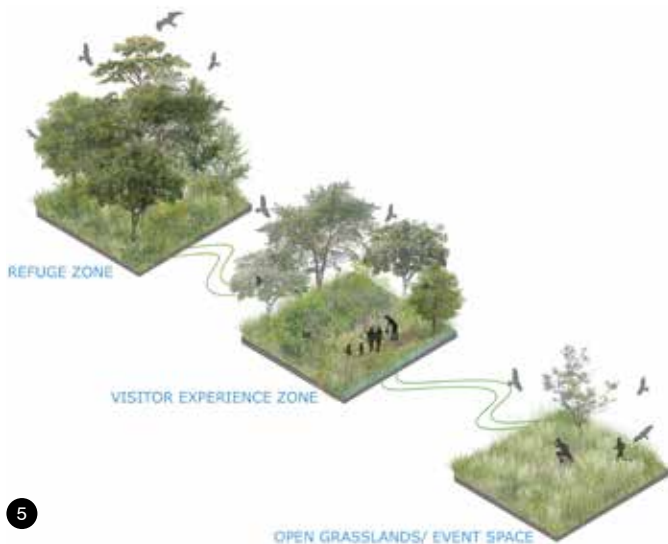
The titles of the projects were derived from distinctive landscape characteristics. “Tengah West Heart” (Ramboll Studio Dreiseitl) was inspired by the local communities and strategic positioning facilitating the ecological network connecting the western and central catchment areas. The proposal creatively responded to a representative biophilic community on the west side of Singapore. “Standing on the ground” (Dongsimwon) is a compelling statement that respects the original topography and utilises existing natural resources against conventional development practices of flattening land for high-rise construction. “From Kampong to Community” (Classic Design) promotes the kampong spirit in Tengah, where a neighbourhood and a community with people coming from diverse cultural backgrounds can work, play, cultivate and live together.

**Ecologically responsive landscape:
accommodating dynamism**

Urban ecological design approaches provide promising solutions for deforestation management in a tropical city. Larger clusters of forested areas are preserved to support existing wildlife and to maintain existing natural resources such as habitats for various species and soil nutrients, while minimising ecological impact on the site. In addition, strategic planting to reintroduce biodiversity in built-up areas and an ecological rehabilitation plan for existing channelised waterway were also proposed. Many design schemes contained heterogeneity and the ecological succession of vegetation growth over time. At the same time, newly proposed greenery have been placed in ecologically strategic locations to connect preserved forests, as well as to protect low valley areas which are potentially nutrient enriched.



Urban ecological design approaches provide promising solutions for deforestation management in a tropical city.



5. Ramboll Studio Dreiseitl proposed over 60% of vegetated area to be designated as habitat, of which at least 30% to be kept natural or semi-natural to allow spontaneous vegetation growth. The three types of ecological landscapes include a refuge zone, a visitor experience zone, and open grasslands or event space.

6. Classic Design proposed a large wetland for ecological habitat recovery.

7. Dongsimwon proposed a linear park system to create ecological corridors, which could facilitate inserting new local habitats in built-up areas.

MAIN GREEN CORRIDOR DESIGN



- 8. Team Dongsimwon's diagram indicated biophysical functions of each type of landscape.
- 9. Prevailing wind study became a basis of structure and infrastructure configurations in Team Classic Design.
- 10. Team Ramboll Studio Dreiseitl showed how the proposed landscape achieved 100% of the irrigation water for the landscape is supplied by rainwater and/or surface water on site.

**Functional landscape:
Optimising biophysical functions of open spaces**

As a heat mitigation strategy, wind corridors and large canopy trees were generated at nested scales by altering microclimatic patterns. Water Sensitive Urban Design (WSUD) played a core role in leading towards a more flood-resilient neighbourhood by shaping infrastructure and landscape development. Major existing waterways have been naturalised, and several detention reservoirs were also suggested to provide stormwater management service. Other regulating services including the abatement of water pollution, noise pollution, erosion control, and disease vector control were also realised through the addition of greenery and open-space design.

Biophilic landscape: connecting humans and nature

With an awareness of the importance of everyday landscape as social capital, the neighbourhood landscape is used as a medium for communities to interact with nature in various capacities, such as in education or food production. Vibrant outdoor space in neighbourhoods can enhance the biophilic life for residents by allowing them to be in closer contact with nature. The space provides an increase in psychological well-being, through experiencing an aesthetically pleasing and therapeutic environment. Environmental workshops, engaging events, and community gardening contribute to forging community bonds. Existing heritage trees were kept for aesthetic appreciation as well as for reviving a sense of place.



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11. Team Ramboll Studio Dreiseitl proposed farming areas for residents to grow their own crops at home, and a farmer's market to trade grown crops, all of which will help bring the community closer.

12. Team Dongsimwon transformed a 1.5km long concrete canal into a natural stream. The open spaces along the stream could become populated water front parks.

13. Team Classic Design placed 100-year-old banyan trees in a community node.



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Multi-purpose landscape: intensifying land use

A series of flexible and incremental stages of land development ensures the harmonious balance between habitat restoration and housing construction. Most importantly, urban greenery in this project possesses multi-layered functions. For example, public parks and building roofs are implemented for both recreational purposes and for the ecological connections throughout the nature ways of Singapore. Topographical differences allow for a variety of housing types and decking spaces for community facilities and parking, while the top layer provides easy access to main streets and public parks. The boundary of the neighbourhood parks are used as an apiary, a community farm, a forest playground and more.



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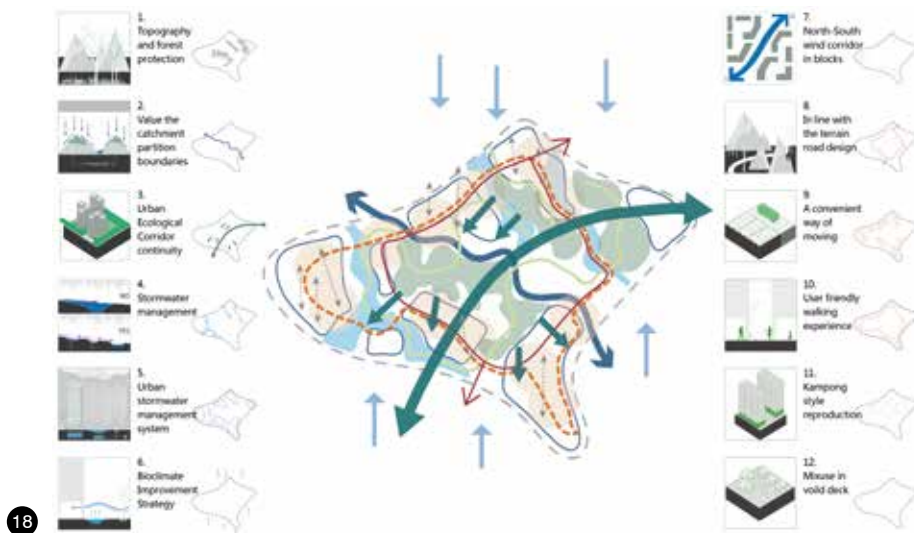


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14. Team Ramboll Studio Dreiseitl introduced an interesting approach of "net multi-use area" where six percent of the total land are used for multiple functions, combining features like educational institution, water bodies, sports field, or open spaces.

15, 17. Team Dongsimwon connected natural knolls, artificial slope, sunken green, and terrace housings at multiple levels.

16. Team Classic Design left the building podium open to provide thermal comfort on the ground level, with balcony gardens working as local habitats.



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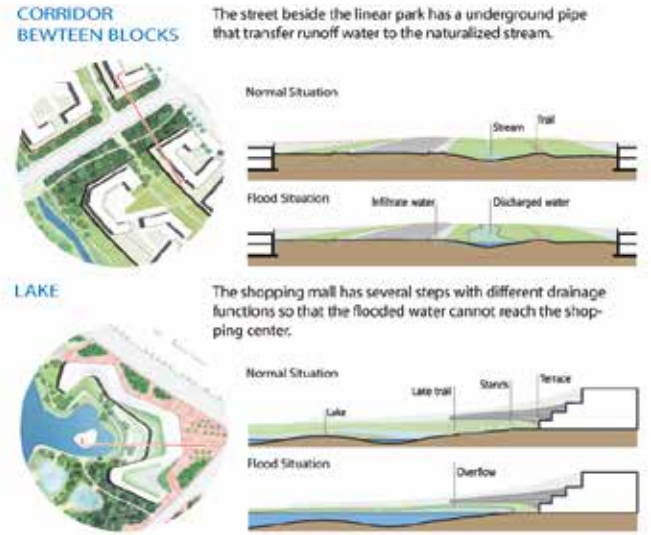
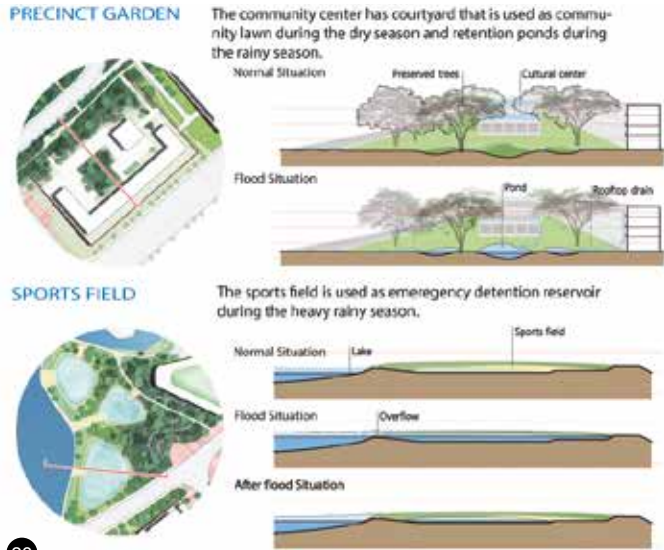
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18. Designed microclimate flow interconnects landscape elements in Team Classic Design's conceptual plan.

19. Team Ramboll Studio Dreiseitl demonstrated a method of integrating green concepts through a section to connect green roof, terrace houses, streetscape, and forested parks.

Integrated landscape: blurring boundaries

Proposed greenery liberally penetrates the entire town—they weave through important green patches, amenities, and residential districts. Well-connected greenery in the form of shaded promenades and linear parks transport cool and fresh air. Proposed landscapes act as the elements that bind the building to the ground—along with the environment and the community—creating a seamless, green connection throughout Tengah. The diverse yet balanced range of landscape with gardens, terraces, collective meeting spaces and facilities produce accessible communal spaces for every household.



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Participatory landscape design

In collaboration with multi-disciplinary stakeholder groups, a participatory planning approach was used to prioritise users' demands and the decision-making of site positioning in Team Classic Design's proposal. Two core design concepts—a kampong living neighbourhood and diversifying the lifestyles of communities—also came from participatory planning. A wide range of community perspectives on the existing neighbourhood and ideas on the liveable landscape were embedded into the site design and strategies development.



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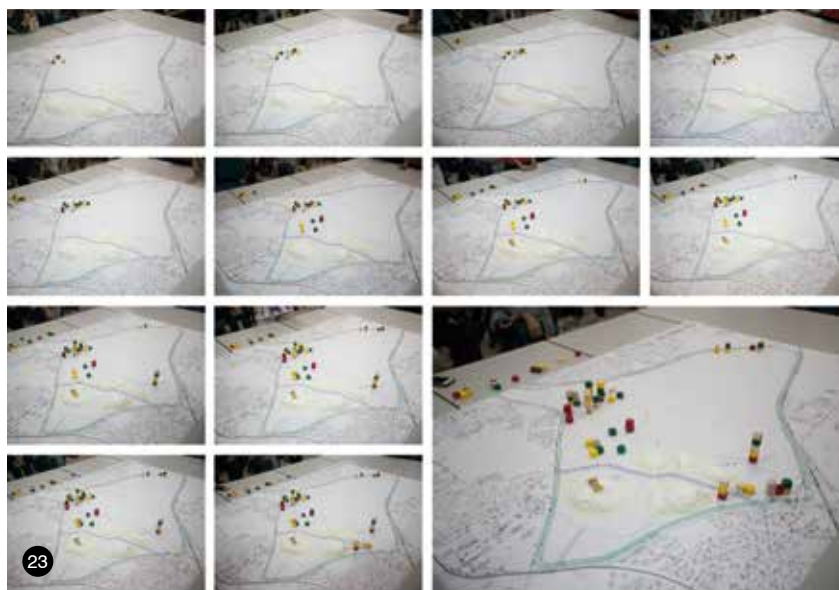
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20. Team Dongsimwon actively used linear parks to blur the boundary of the waterfront, building edges, and infrastructure while increasing accessibility towards public open spaces.

21. Team Ramboll Studio Dreiseitl prioritised participants' ideas using their own method of ideas selection.

22. A community activity plan highlights how closely proposed socio-cultural programmes connect with spatial plan in Team Dongsimwon's design.

23. Results from planning workshop with residents conducted by Team Classic Design. The results was a series of decision-making planning process which also required professional evaluation.



Acknowledgements

The National University of Singapore research team consists of faculty members and researchers of different backgrounds working on the project “Biophilic Town: A framework for landscapes to enhance the environment of high-density towns” for over a period of three years. The team members are Tan Puay Yok (PI), Hwang Yun Hye (Co-PI), Liao Kuei-Hsien (Co-PI), Vincent Chua (Co-PI), Agnieszka O. Guizzo (Research Fellow), and Chan Zi Ching Jane (Research Assistant).

Ramboll Studio Dreiseitl (RSD) is a multidisciplinary team specialising in the synthesis of landscape architecture, art and urban design, environmental technology and urban hydrology. With a total of four studios located in Germany (Überlingen and Hamburg), Singapore and China (Beijing), our 90 multicultural experts are landscape architects, urban planners, engineers, architects, and artists working on the daily reality of transforming our cities into resilient homes. 35 years of experience led to a portfolio of outstanding projects with high aesthetic and cultural value. The scope of the practice’s work includes water sensitive urban design, streetscapes, master planning, parks and plazas, and down to the applied scale of swales, biotopes and building-integrated rainwater recycling systems. The team members include: Leonard Ng (Director, Landscape Architect), Lucia Youngran Choi (Landscape Architect), Dionne Lim (Landscape Architect), Dixi Mengote (Urban Planner, Environmental Engineer)

Dongsimwon has been among the leading design groups for over 20 years in South Korea and has won numerous local and international awards in landscape architecture and urban design. With a high level of understanding in detail design, the office has been awarded for its accuracy and completeness of detail design in Gyuneui Line Park in Seoul. Most recently, the office won the Queen Hur Memorial Park International Competition. The work varies in program and scale from projects that require wide professional experience—from planning scale residential complex, resort—to small place-making projects like gardens, urban squares, memorial parks. The team members are Gyedong An (Director), Youngah Kim (Deputy Director), Chungseok Baek (Landscape Architect), Wonyoung Ahn (Landscape Architect), Jinah Hong, Inhwa Kang, Doyoung Ahn.

Founded in 1990, **Classic Landscape Design and Environmental Planning Ltd** is reputed for their innovative design methods to solve environmental problems. As a leading participatory planning and design company, it has successfully established various partnerships with public sectors, including the Taipei City Government. Classic Design has solid experience in programming social spaces, designing and planning in different scales, including urban design, urban regeneration, community design (Open Green), parks, and pedestrian-oriented boulevard design. The Tree-lined Boulevard Improvement Design project was selected as a signature project to lead Taipei City achieving the goal of 2016 World Design Capital Taipei theme “Adaptive City – Design in Motion”. The Open Green project, on the other hand, has helped 45 community spaces in the past three years (2014–2016). Team members: Po-Hung Liu (Director, Landscape Architect), Ming-Yi Chen (Urban Designer), Pei-Yin Shih (Community Designer), Ching-Yu Tu (Environmental Planner), Ko-Chun Liu (Assistant Architect).

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Conclusion

Overall, the design proposals produced independently by the three design studios largely validated the goals of the framework. Through establishing connections not actively considered by the landscape profession, this research project hopes to increase the collective consciousness of the benefits of a sensitively designed neighbourhood and to radically change the way neighbourhood landscapes are construed and constructed, in order to bring future neighbourhoods closer to the vision of a “biophilic estate”, where landscape services have the potential to become of value to residents and improve the ecological quality of the environment. 