Design Charrettes for Sustainable Building in China

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Chapter 10
Design Charrettes for Sustainable Building in China

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10.1 Introduction

In recent decennia, Chinese building efforts are incomparable. The pace of urban developments has been fast and serious amounts of new buildings have been built around the country. Due to the rapid developing processes, and this is not limited to Chinese practice, the sense of quality can be questioned. For the Chinese Ministry of Construction and Dutch Ministry of Housing it gave reason to adopt a Memory of Understanding about collaborating and exchanging knowledge in the field of Sustainable Building. Within the cooperation several demonstration projects in different cities in China, not only being the usual suspects Beijing and Shanghai, but also in Chongqing, Guiyang and Shenzhen. In order to increase the sustainability in some of the largest building developments in these cities, the Sino-Dutch collaboration provided the opportunity for Chinese developers to organise weeklong design charrettes in which Dutch and Chinese expert teams participated to support, advice and design sustainable options for the respective sites.

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10.2 Three Chinese Building Sites

In this Chap. 3 of the demonstration projects are discussed: the Longhu project in Chongqing, the Vanke Stream Valley project in Shenzhen and the Yu'an and Anjing project in Guiyang.

10.2.1 The Longhu Project, Chongqing

The Longhu project is located in the peri-urban area of Chongqing. The case study area is part of a widespread development zone, where residential areas are combined with amenities, infrastructure and recreation (Yu et al. 2006). The landscape patterns consist of a diffuse network of hills, slopes, flat areas and curving routes (Fig. 10.1). Elevation varies remarkably across the site and there is a large diversity in the steepness of the slopes varies largely. The water system in the area is highly differentiated and dense. Water flows down the hills and is captured and slowed down in many steps by opening or closing little dikes or stones to keep or transport water from one field to the next. This system allows for the water to be re-used over and over again for many different purposes, such as the production of crops, washing clothes or cleaning the house. Chongqing is located in the transition area between the Qinghai-Tibet Plateau and the Middle-lower Yangtze Plain. It is part of

Fig. 10.1 The landscape in the Longhu demonstration project, Chongqing

the humid sub-tropical monsoon climate belt. The annual average temperature is 18–20 °C with a low temperature of 4 °C in winter and a high temperature of 40 °C in summer. Chongqing is also a fog city that has about 100 foggy days a year usually in spring and summer. Chongqing receives abundant rainfall, averaging about 1,000–1,400 mm annually. It has plenty of evening rain all year round, but most of it falls in summer.

10.2.2 Yu'an and Anjing District, Guiyang

The Yu'an and Anjing district, near Guiyang City Centre, is sparsely inhabited. People living in the area – mostly farmers – are poor and live in bad conditions. There is hardly any sanitation and chemical factories and a polluted river dominate the landscape. Although the density of houses is relatively low, the entire landscape is in use for agriculture or living. It is nearly impossible to find a natural undisturbed landscape. The landscape is a hilly area with very steep slopes, cut through by the scenic, but polluted Nanming river. The views in the area change constantly. This 'scene-after-scene' sequence makes the landscape very rewarding. Because of the differences in slopes, hilltops and flat areas biodiversity is in potential high, but in practice very low. This is caused by a widespread pattern of many different buildings, small factories and small-scale agriculture (Atkins 2007). The intensive use of the landscape causes not only a low biodiversity it also decreases the visual quality of the landscape (Yu et al. 2008a). The climate in Guiyang belongs to the subtropical monsoon climate. It is temperate and humid without strong winters or hot summers, abundant rainfall and long frost-free periods, which last about 270 days. The annual average temperature is 15.3 °C. The hottest days in July are a moderate 24 °C on average and the coldest days in January 4.6 °C. The rainfall is 1,197 mm of which around 75 % falls between June and October. The relative humidity is high: 76.9 %. Droughts or waterlogging often occurs because of the rainfall unbalance among the seasons (Fig. 10.2).

10.2.3 Vanke's Stream Valley, Shenzhen

Stream Valley is located in the surroundings of Shenzhen in Southern China, not far from Hong Kong. The ecological values in the area are significant. These values developed during the period without human activities consisting of farming, before 1998, and, after 2004, when building rights permitted on the preparation phase of the building process. Water is an important element in the area, which caters for the ecological values and has therefore strict qualitative and quantitative requirements. Building in the area is subject of stringent regulations. Impact on

Fig. 10.2 The landscape in the Guiyang demonstration project

biodiversity should be minimized, both during and after the building activities and if a road needs to be built eco-crossings are demanded to ensure ecological richness (Yu et al. 2008b). Part of a subtropical marine climate, Shenzhen has plentiful sunshine and rainfall all year round. The average temperature is 22.4 °C. The area is subject to occasional typhoons, normally occurring between May and December, the heaviest between July and September. Annual rainfall is 1,900 mm, of which 75 % falls between May and September. Seasonal differences determine the growing circumstances in Stream Valley, which are abundant in summer with high rainwater runoff and steamy air, while a shortage of water characterises the winter period.

10.3 Objective and Assignment

The objectives of the design charrettes for the sustainable building demonstration projects in general are to improve the sustainability of each of the design proposals. More specific, the requirements to fulfil this objective need to be defined according green building standards derived from Dutch sustainable building experiences and the Chinese Guideline of Green Building Design. This implies an integrated evaluation of the preliminary design proposal and proposal of strategies and measures to improve the sustainability. In greater detail the objectives are to:

1. Analyse and recognise ecological impacts of the proposed building activities in the entire lifecycle;
2. Propose an ecological evaluation system, and analyse the proposed design accordingly;
3. Develop specific solution strategies to mitigate ecological impacts;
4. Propose an ecological design for the site, consisting of specific measures, which focus on land use, adjusting the proposed urban design, water and landscape design, traffic planning and greening building technologies.

These objectives need to be fitted in the context of the Chinese market and need to propose technical and economic feasible concepts.

The concrete assignment in each of the demonstration projects is to assess the preliminary design proposal and suggest sustainable improvements of the design, related to, at least, the topics of water and ecology, traffic and energy, land-use, and building materials, based on the best practices form Dutch and Chinese expert team experiences.

10.4 The Sino-Dutch Methodology

The methodology used to develop these design charrettes consists of a preparation phase, the actual charrette and the reporting phase (Fig. 10.3). In the preparation phase available data is collected, such as the preliminary design for the site, eventual former sustainability reviews or ecological analyses. In negotiation with the developer of the site and the Chinese ministry of Construction, the program and aim for the charrette are discussed and adopted. Third important element of the preparation phase is to identify and commit Chinese and Dutch experts to participate in the design charrette. These expert teams need to be composed in line with the specific assignment and typical problem of the demonstration project site. The design charrette itself consists of three steps. The first step is the official welcoming ceremony and exchange of expertise regarding the proposed preliminary design by the developer and preliminary findings of the Dutch and Chinese expert teams. The second step consists of the design work. In this step the participants are divided over several groups, each with a specific focus area, such as water and ecology, which often includes land use and urban design, energy and transport, and building materials. This step ends with formulating an integrated advice about the sustainability of the preliminary design by the Dutch and Chinese expert teams. The third step of the design charrette process is the sharing and presentation of the findings with the developer and ministerial representatives, including discussion of the results. After the charrette process the last phase is the reporting in the form of a TOR (Terms of Reference) project report.

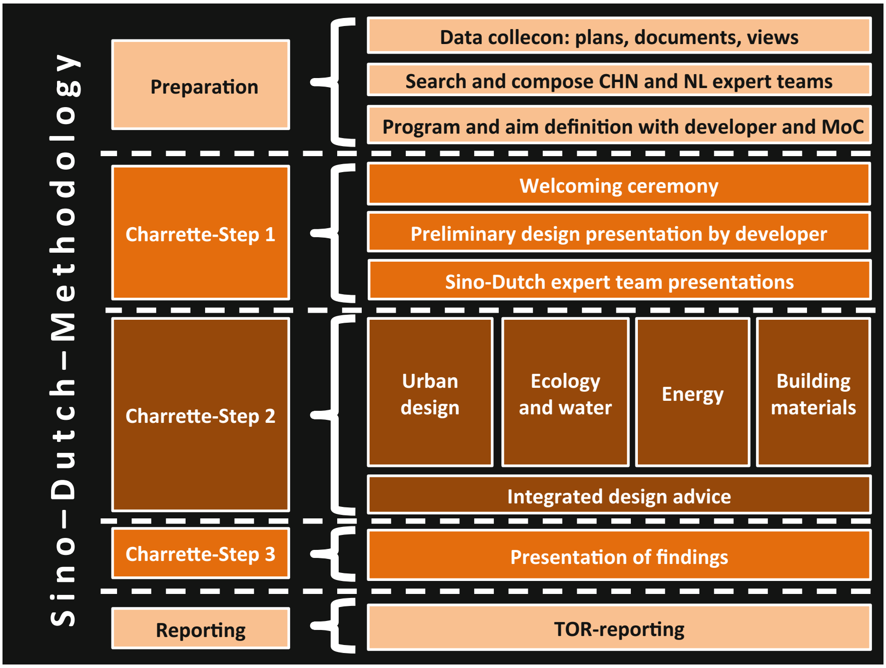


Fig. 10.3 The Sino-Dutch collaborative design charrette methodology

10.5 Program & Participants

The programs of the three demonstration projects (Fig. 10.4) are fairly similar and follow to a large extent the methodology described before. Each of the design charrettes lasts for 2–3 days and is preceded by a welcoming dinner. The three steps of the methodology are followed during each of the projects: opening ceremony, information provision, site visit, design teamwork and the presentation of findings. The charrette is closed with a joint dinner. The participants in the charrettes consist of the Dutch and Chinese expert team, ministerial representatives, a developer delegation and, often the design consultant responsible for the preliminary plan. The Dutch expert team consists of academics and consultants in the field of sustainable building and design. The Chinese expert team consists mainly of academics and students in the field of sustainable building, energy technology and water management.

10.6 Sustainable Chinese Precincts

In each of the demonstration projects the expert teams came to valuable and constructive advise how the preliminary designs could improve their sustainability.

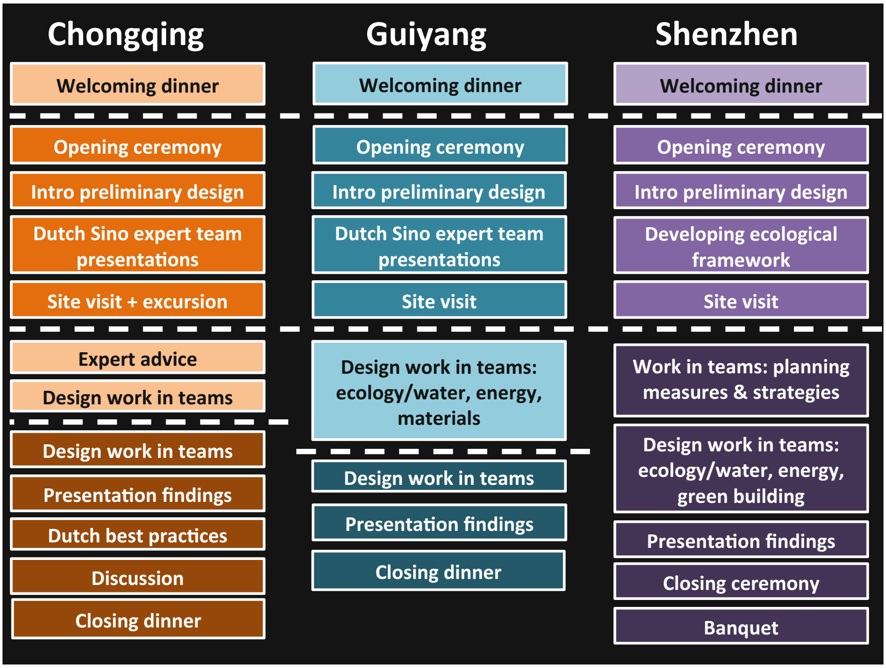


Fig. 10.4 The three charrette programs for Chongqing, Guiyang and Shenzhen in a nutshell

10.6.1 Longhu, Chongqing

The preliminary design for the Longhu site in Chongqing (Fig. 10.5), denies the existing topography as it drapes a field of compact dwellings over the site, to the eastern part aligned with a row of huge towers. An entirely new system of ponds and lakes is created for the site, which is provided with an oversized road system. The design increases heat island effects, especially in summer and decreases biodiversity.

Ecological values, a clean water system and cooling of the site are the major areas of sustainability the preliminary design can improve on. These areas are seen as combined problems. The existing natural system forms the basis for integrated solutions.

The topography determines the local circumstances and opportunities to intervene and increase sustainability. Therefore the first analysis is to categorise the differences in slopes (Fig. 10.6). Four distinct categories are defined: flat, gentle, moderate and steep. Each category has its own characteristics. In flat areas the water is stagnant. Here it can be captured and stored for longer periods. The quality of the water is at risk when standing still, and must be improved through a system of circulation. When water flows the gentle slopes it moves slowly. Therefore it is possible to direct the water where it can be captured and stored: in the flat areas. At the

Fig. 10.5 Preliminary urban design

Fig. 10.6 Categorising slope types: flat (*1*), gentle (*2*), moderate (*3*) and steep (*4*) (Yu et al. 2006)

moderate slopes water flows quicker. The streams in these areas must be lengthened where possible in order to slow the water down. The steep slopes are too steep to control the water. It often runs or even falls down the hill too rapidly. In this area it is difficult to modify the pace or direction of the water.

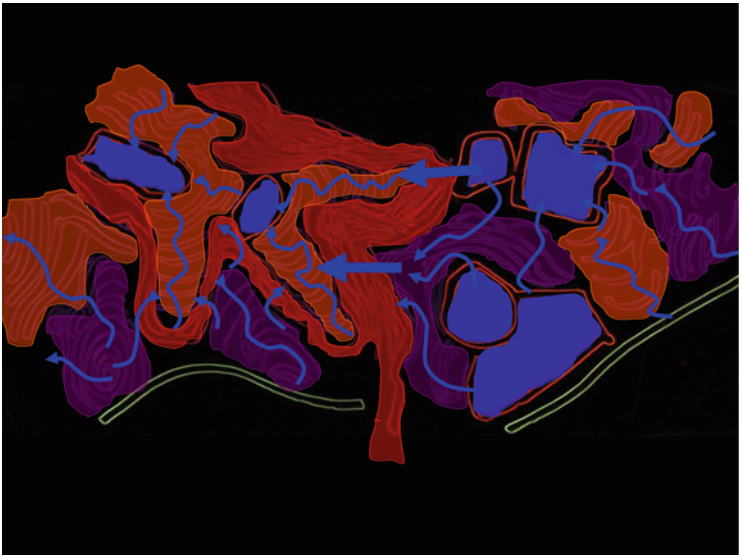


Fig. 10.7 Determining the water flows based on slope steepness (Yu et al. 2006)

Every category of slope-type is connected with a specific water type. The location of the different categories in the landscape determines the logical flow of water from one area to the next (Fig. 10.7). In certain places it is possible to keep the water for a long period (the flat areas, where existing ponds are located). Only when enough water is available or small dams are opened the water is transported to a neighbouring area. Other areas are able to direct the water in streams towards the flatter areas (the gentle slope types) or slow the water down (moderate slopes). The steepest slopes are the places where water runs down without stopping possibility.

The gradients and slopes determine where water can be kept or flows, but it also determines which ecological types can be developed where.

Ecological qualities and the water elements show a strong connection. The ecology of stagnant water differs largely from ecology belonging to gentle and moderate slopes or steep slope ecology. The availability of water, both in quantity as in length of period it stays in a certain location leads to different ecological typologies (Fig. 10.8).

1. The flat area: a balanced eco-aquatic ecosystem. Clean water provides fish and water-plants with enough air and water at flat plains. Water is stored here as much as possible to provide wet circumstances in dry periods;
2. The ecology of gentle and moderate slopes. Grasslands and small bush-lands are providing the ecological environment for a diversity of birds, small wildlife and a wide variety of insects and typical meadow, scrub and forest areas. In these typologies water is used in the plants for growing and only released in hotter circumstances;

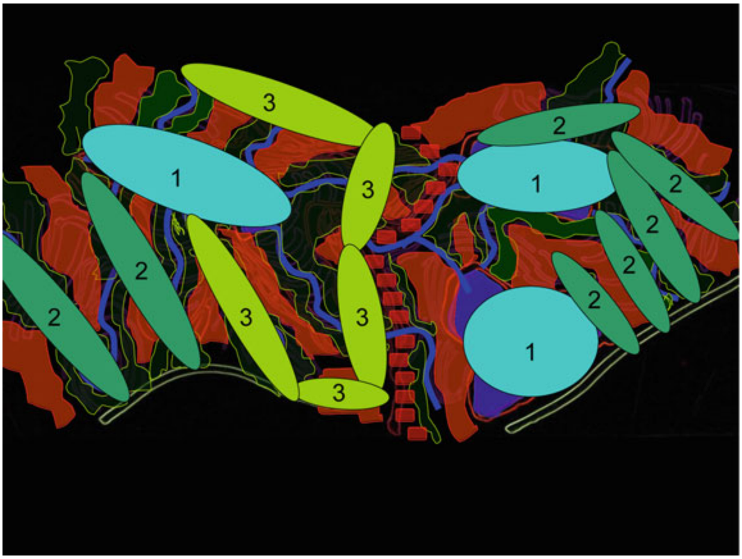


Fig. 10.8 Ecological typologies (Yu et al. 2006)

3. Steep-slope ecology: at the steep slopes the water is running down quickly in the form of waterfalls. Grasses and mosses fill the slopes with vegetation. Humid and fresh circumstances attract specific birds, reptiles and insects;
4. Future façades-ecology. Future buildings are provided with a green façade, creating a habitat for subtropical birds and insects.

The slope typology and according water flows also determines where and how to stimulate natural ventilation. During summer the site gets hot and sticky, which only is expected to increase in the future. Additionally, the urban heat island effect is inevitably introduced to the site when the urban design is realised. Existing water-bodies, where rainwater is stored as long as possible, will have a cooling effect on future urban spaces and are capable of mitigating the urban heat island effect. Further, the different slope expositions form the basis for an enriched ecology, which in itself has a cooling effect on the city.

The hills and plains are used to create natural ventilation, which minimise the effects of rising temperatures. The most natural way of cooling and ventilation to achieve this is to create winds and ventilation. For instance, in between buildings stronger winds occur, creating ventilation (Fig. 10.9). When high-rise buildings are positioned at the northern side of the area stronger ventilation occurs due to the predominant winds from the northwest. The same effect is achieved when buildings are situated at the edge central in the project site, creating ventilation, which cools down the lower parts of the area. When high-rise buildings are positioned in the lower plateaus a cool breeze occurs in the stickiest parts of the site.

Instead of situating buildings at this edge a green belt (Fig. 10.10) achieves the same effect and it also adds more humidity to the air.

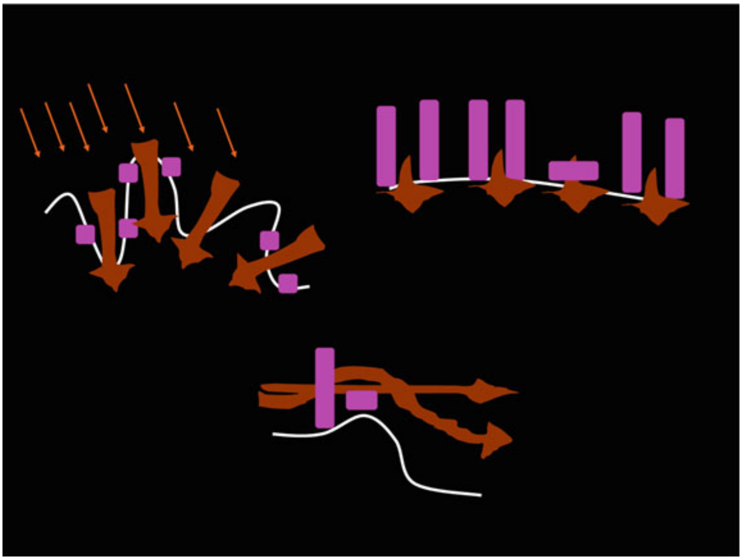


Fig. 10.9 Increasing the natural ventilation by positioning buildings (Source: Yu et al. 2006)

Fig. 10.10 Introduction of a *green belt* (Source: Yu et al. 2006)

Introduction of these natural ventilation interventions does not increase energy use, mitigates the urban heat island effect and creates a more pleasant urban climate.

Positioning of buildings not only improves natural ventilation but it also increases the readability of the landscape. When the tallest buildings are located at the highest

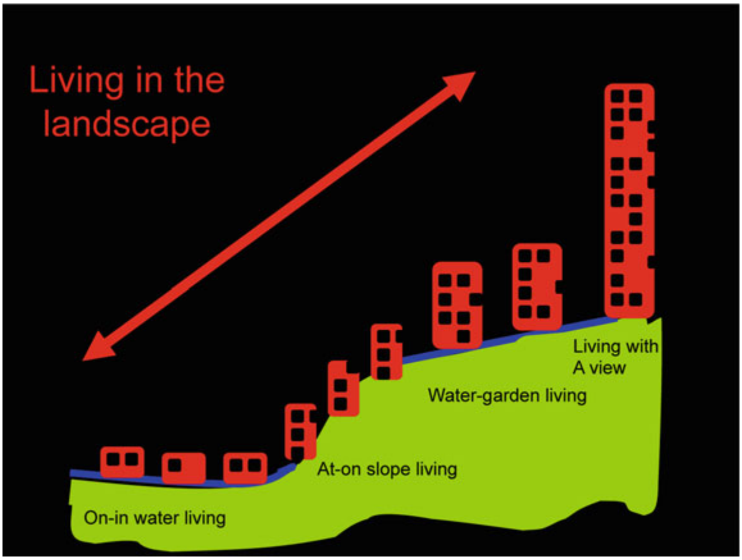


Fig. 10.11 Several residential typologies in the landscape (Yu et al. 2006)

elevation, and smaller buildings at the lowest places of the site, a difference between several residential typologies emerges: 'On-in Water-living', 'At-on Slope-living', 'Water-garden-living' and 'Living with a view' (Fig. 10.11).

Water bodies and streams, ecological places, and green belts and building blocks are positioned in relation with each other and are based on the differences the existing landscape has to offer. The existing water system is a very flexible system. When there is a lot of water available it is dispersed to many places and stored in the area. When the landscape undergoes urbanisation it is sustainable to minimal preserve the same amount of surface water in a connected way, but possibly in an adjusted form. Keeping the system connected is important because it is able to incorporate large amounts of water and the water stays for a long time in the area, which makes it available in dry summers.

Based on the slope typology and the water two models have been designed.

The first model 'Between the Streams' (Fig. 10.12) creates building sites in between the streams. A system is proposed, which emphasises the streams as the most vulnerable and precious. The streams, mostly part of the gentle and moderate slopes categories, are conserved and kept free of building activities. In order to slow the flow of water down, the streams are elongated through creating additional curves and turns. The streams are separated from the construction sites by brooks and urban green spaces, planned as a buffer between water and building. Skinny but tall buildings marquee the steep edge, forming an elegant ridge in the centre of the site.

The second model 'Arching the Streams' (Fig. 10.13) integrates the streams and small-scale buildings. This allows for a large green zone to be connected as one

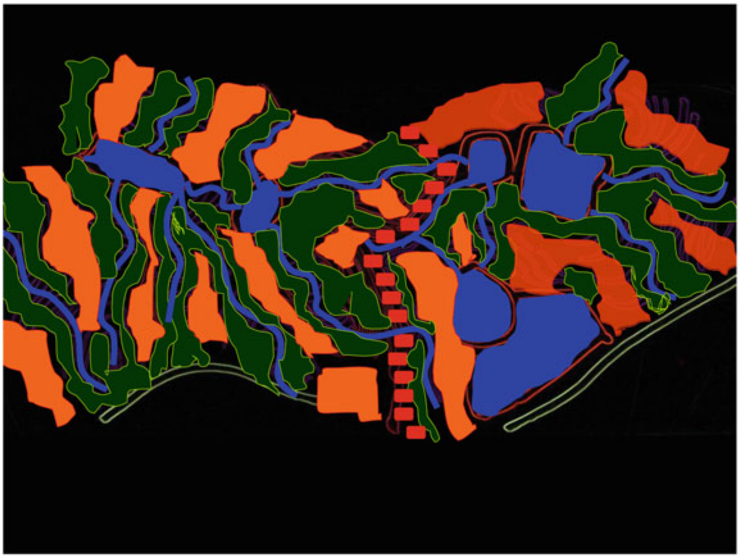


Fig. 10.12 Model 'Between the Streams' (Yu et al. 2006)

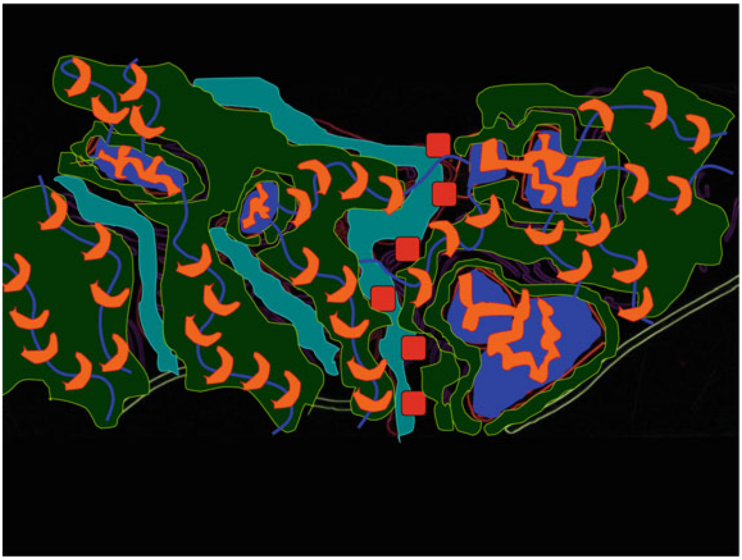


Fig. 10.13 Model 'Arching the Streams' (Yu et al. 2006)

green field of forests, within which small and moderately sized buildings are situated. The individual buildings are constructed as arches across the streams. The way these are constructed minimise the their footprint in the landscape, acknowledging the ecological values and biodiversity. The continuous green space, which is

Fig. 10.14 The 'bath-rain-surface' water system (Yu et al. 2006)

connected through the entire site, underpins this ambition once more. The steep edge in the middle of the site is used to locate six high-rise buildings in which different functions and amenities are mixed: shopping centre, offices and residential.

Both these models are able to react and anticipate on future changes in precipitation, natural conditions and rises in temperature.

Based on the natural water system a water-flow scheme is designed (Fig. 10.14). In this 'bath-rain-surface' scheme every water quality is separated from another and cleaned in a specific way. The rainwater discharged from roads (pink) is cleaned through a pre-cleaning filter after which this water is led through several wetlands. Water from baths and showers (orange) is pre-cleaned in a biological way, removing all soaps and other chemical substances, before it is lead through natural wetlands and enters the lakes. Water from ponds (green) is directly cleaned in wetlands, after which this water flows into the lager lakes. Every type of water-quality is brought to a quality level, which is suitable to re-use as grey water in households and in which swimming is possible. Should the water leave the site, the effluent is so clean it doesn't influence the water-quality of the subsequent area.

Previous models and ideas are integrated in one comprehensive integrated vision for a sustainable building development for the demonstration project (Fig. 10.15). In this scheme the choice is made to project buildings between the natural streams. The residential areas are located at the slopes between the streams, while high-rise buildings (in purple) are projected at the plains, connected by two car traffic roads: one through the higher northern part and one cul-de-sac in the lower southern area. At the central edge buildings with the major amenities are located and are combined with a green belt that provides the lower parts with natural ventilation. The site

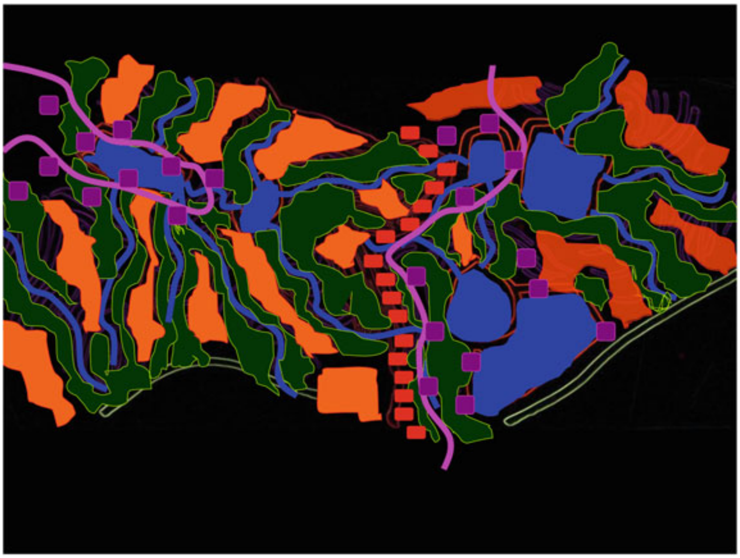


Fig. 10.15 The integrated model (Yu et al. 2006)

stores large amounts of water in a dense water system and the different slope types are used to create according ecological typologies. Natural ventilation, the ecological spaces as well as the water structures provide the area with cooling.

10.6.2 Yu'an and Anjing in Yunyan District, Guiyang

The preliminary design for the area (Fig. 10.16) shows the occupancy of the landscape with a diversity of buildings. The high-rise and smaller sized buildings flock over the hilly terrain as if elevations don't matter. The conceptual choice to put extreme high-rise buildings at the turns and in curves of the river is from a landmark perspective understandable, but disrespects the ecological potentials the shores of the river offer. Moreover, the main hill is built upon in a far from sensitive way, which neglects the ecological values of the mountain forests and doesn't make any difference between the places where buildings are situated and where they aren't.

The density of the area can be increased in certain areas and decreased in others (Fig. 10.17). When the buildings are concentrated along one major road (at 1,140 m altitude and 80 m wide) the total urban development program can be realised, while keeping the rest of the area free from any building activity.

When the mountaintops are kept free from building activities, these areas offer the space for water retention and biodiversity will increase. Moreover, the spatial quality improves, because the mountains stay visible as distinctive landscape

Fig. 10.16 Bird's eye view of the Master Plan (Atkins 2007)

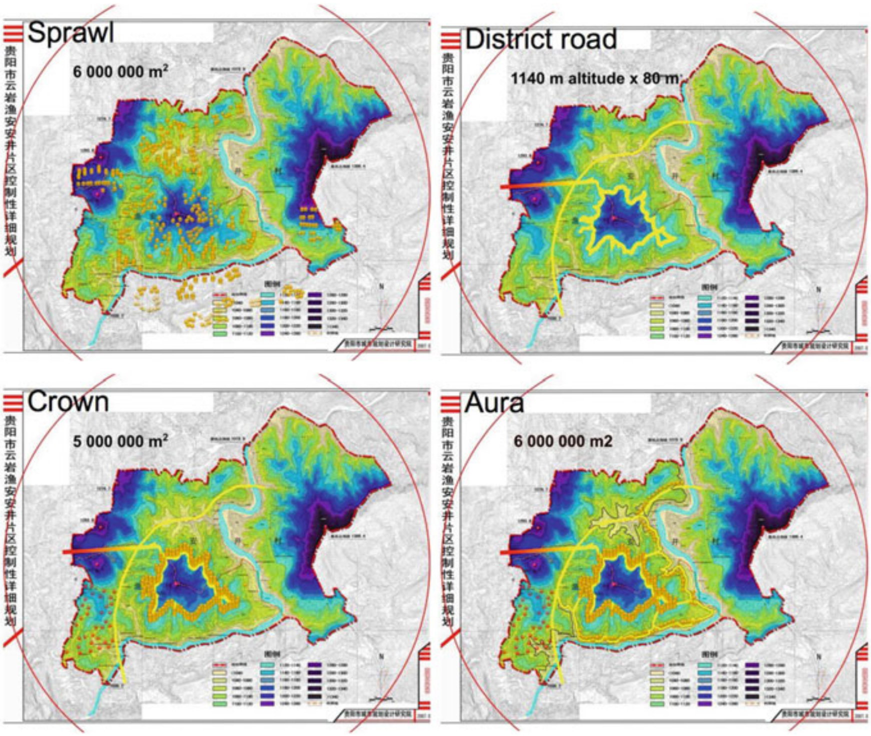


Fig. 10.17 Conceptual analysis of building capacity and the sensitive landscape by Prof. Teake de Jong (Yu et al. 2008a)

Fig. 10.18 'Living on top of the world: the concept of increased building densities and keeping the highest parts of the landscape natural (Yu et al. 2008a)

elements. This concept of keeping mountaintops free of buildings is called: 'Living on Top of the World' (Fig. 10.18).

The ambition is to increase the biodiversity on the hill and to provide enough water year round for drinking water and nurturing the landscape. The design proposes to minimise the impact on the landscape and realise the building program in a smaller area at the same time. An increase of biodiversity and harvesting enough rainwater can be reached if the available water is stored on the hills and the hillsides as long as possible. At every altitude level of the hill solutions have to contribute to cleaning and storage of rainwater (Fig. 10.19).

1. **Mountain Top**. The summits of mountains are excluded of any form of building. In these areas water is retained and the natural quality and biodiversity is contained and improved. Additionally, rainwater is stored at the mountaintops to enhance biodiversity.
2. **Edge1140**. At an elevation of 1,140 m an edge is created, where a central road is suggested. Alongside this road the high-rise buildings are concentrated. The use of the road is maximised and the length of roads, cables and pipelines is minimised. In this zone rainwater is collected and stored. In the summertime the water is stored in basins, where it can be used as grey water in the high-rise buildings. In the wintertime rainwater is used in the high-rise or flows further downhill. On top of the high-rise buildings green roofs are proposed to keep the water high on the hills.
3. **Slope**. The slopes, especially the steeper ones are not used for building activities. They are kept green in order to improve their ecological quality and biodiversity.

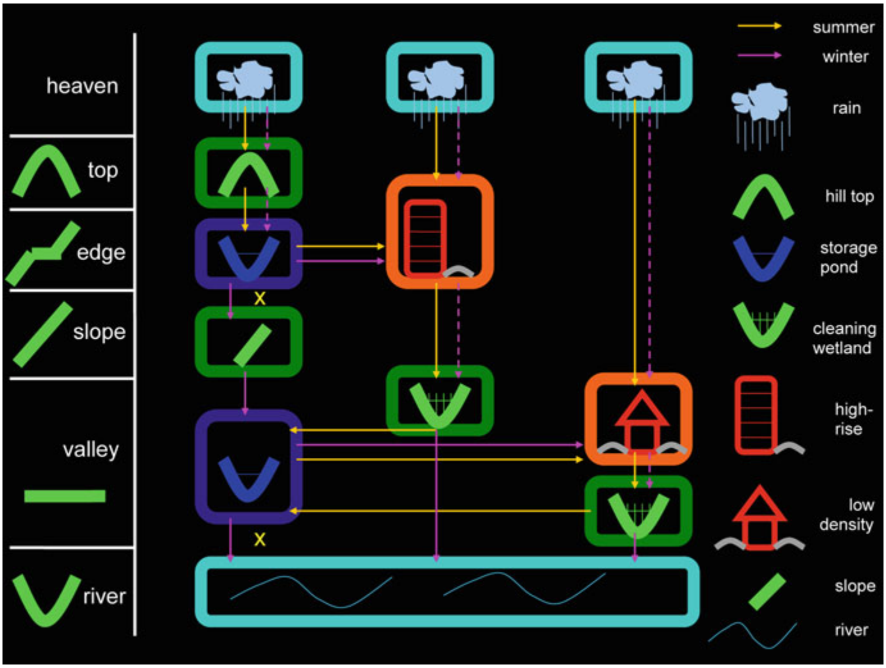


Fig. 10.19 Landscape typologies and appropriate rainwater measures (Yu et al. 2008a)

Green slopes are also able to clean rainwater from roofs and roads in 'vertical wetlands'. At the bottom of the slopes this cleaned water is collected in basins.

4. **Valley1060**. The edge of the valley can be used to store cleaned water from the slopes and collect all the rainwater, which is falling in this zone. In summer rainwater is retained and used as grey water in low-density buildings, which are concentrated at the edges of Valley1060. Water from roofs and roads is cleaned in wetlands. This clean water is in summer stored in basins, while discharged directly to the river in the winter. To keep the rainwater as long as possible in the area green roofs are applied, rainwater is infiltrated in the soil and the water is filtrated in sand-beds.
5. **River**. The edges of the river are the last chance to clean rainwater from roads and roofs before it flows in the river. When wetlands are located at the edge of the river the water is cleaned before it enters the river. Only in winter clean water flows into the river, while in summer the collected water is re-used in the low density buildings close by.

When these principles are applied (Fig. 10.20) high-rise buildings are concentrated and situated at Edge1140, while low-density buildings are located at the edge of the valley. This results in larger areas free of building activities and in an improved biodiversity and higher quality of green space. Moreover, it increases space for

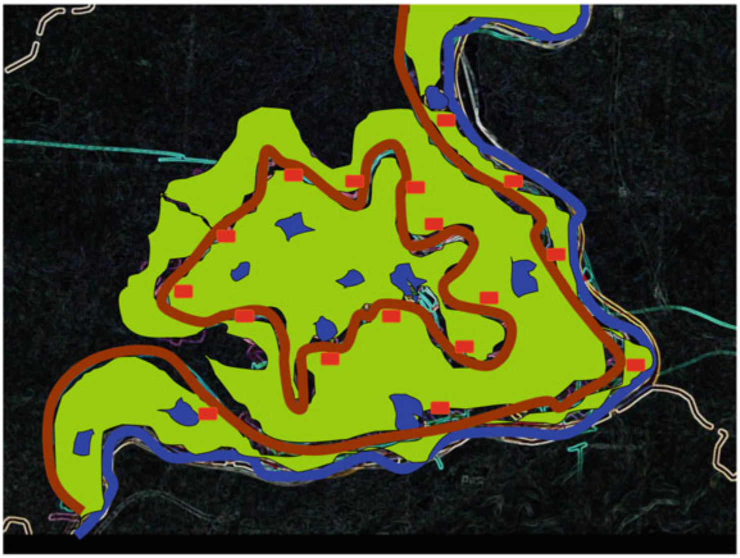


Fig. 10.20 The design principles applied in the site (Yu et al. 2008a)

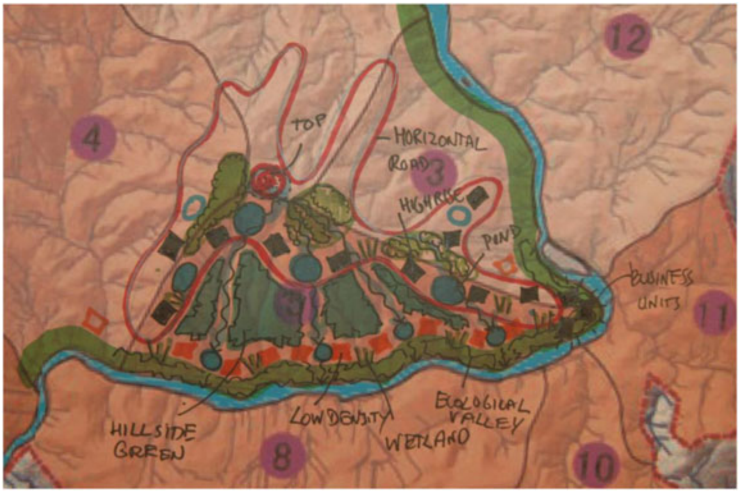


Fig. 10.21 Detailed design for one water catchment area (Yu et al. 2008a)

water retention and creates a open ecological zone alongside the river, which is extremely important as the basis for ecological development.

In greater detail, the same concept is applied in the design of one distinct water-catchment area (Fig. 10.21). The hilltop is reserved to grow a forest and rainwater falling in this area is stored to supply the trees. At ‘Edge1140’ high-rise buildings

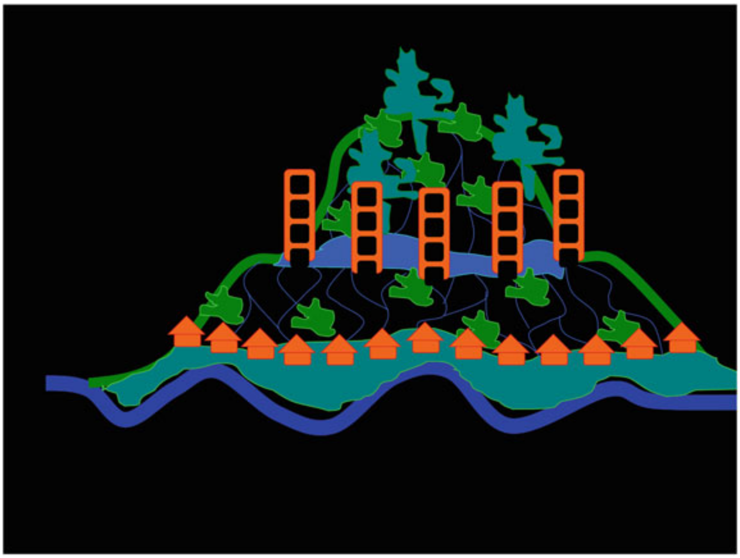


Fig. 10.22 The cake with crown and collar (Yu et al. 2008a)

are concentrated alongside the road and are surrounded by ponds to collect and store rainwater, and reed beds to clean roof- and road-water. The steepest slopes are planted with native plants and prevent the slopes from erosion. In the 'Valley1060' area low-density buildings are concentrated and accompanied by wetlands to clean roof- and road-water, and ponds to retain rainwater before it enters the river. The river valley is kept free of buildings in order to give room to ecological processes alongside and in the river. The ecological banks are functioning as a green zone, where native wildlife has the chance to develop. There is minimal co-use possible in this area, such as for instance extensive recreation, traffic on bikes or by foot and hot springs.

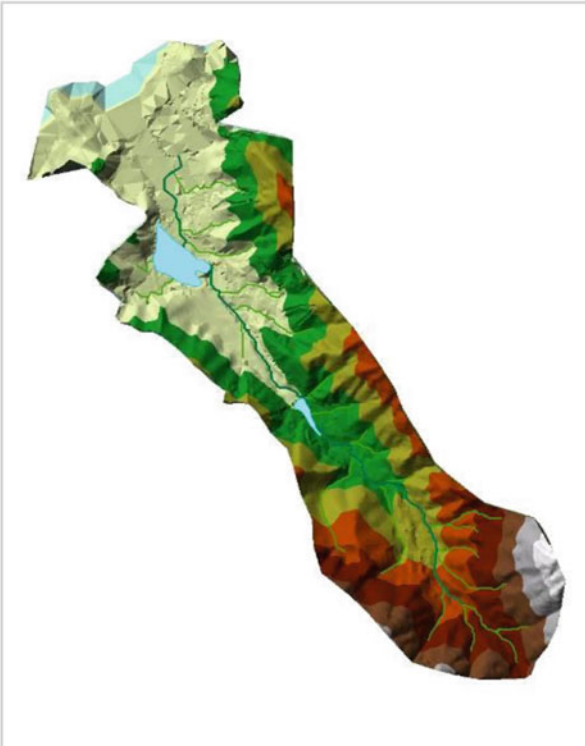
Implementing this concentrated building concept results in a landscape that regenerates its original quality and beauty. Distinct building zones are combined with but separated from specific ecological zones. The mountain looks as a cake (Fig. 10.22): it has a crown around the top and a collar at its base, an image that is currently already visible in parts of Guiyang (Fig. 10.23).

10.6.3 Vanke's Stream Valley, Shenzhen

The ecological system in Stream Valley differs in the southern, uphill areas and the northern, downhill area (Fig. 10.24). Ecological qualities are strongly linked to the water system and the availability of streaming water, which is required year round. Ecological performance differs between the northern and southern slopes. The

Fig. 10.23 Existing Cake-concept visible in Guiyang: hilltops free of buildings (Photo: Tracy Zheng)

Fig. 10.24 Slopes and elevation (Yu et al. 2008b)



northern slopes have a relatively low quality and are mostly degraded. Grassy plants of low ecological value overgrow the northern slope step-by-step, leading to a decreased quality. This process is difficult to stop and turn around into an ecological more valuable system. A simple removal of these grassy plants might not be a good idea because this leads to sliding down of the plants uphill, which diminishes all ecological qualities. Creating wet and stable habitats uphill might be the better

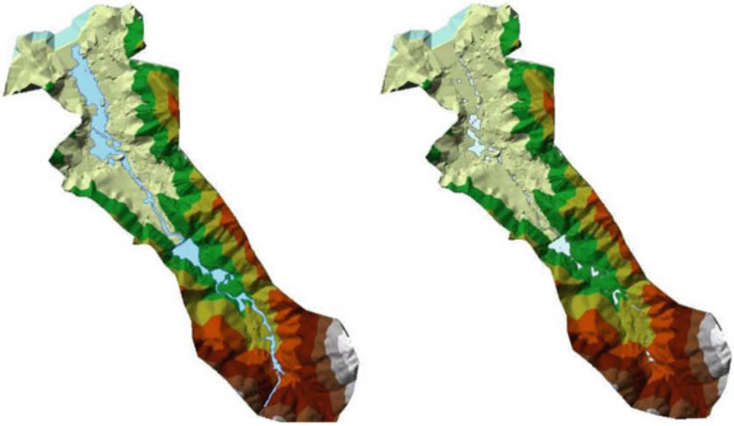


Fig. 10.25 Amount of water in summer (*left*) and winter (*right*) (Yu et al. 2008b)

solution. These newly created 'hotspots' are capable to function as new centres of dispersion and feed other areas downhill. The southern slope on the other side is ecologically much richer and more in balance. But even there, creation of these new hotspots supports the ecological system.

The water-function at the project level is based on the existing elevation and slopes (Fig. 10.24). Water storage and retention is most logical located in the lower and flat areas, while runoff water, feeding the streams, is naturally found uphill. This typology of natural functions is used to increase the future sustainability. The difference between the summer and winter period is evident (Fig. 10.25). The summer period is wet and humid and nearly all the rain falls in this period. The winter period is less warm and can be extremely dry. Precipitation in winter is minimal or even completely absent. This impacts the project area, as there is more water available in summer, which is currently discharged rapidly and leaves the area. To prevent the streams from flooding the water is discharged as quickly as possible. In winter period the water level drops considerably and nearly no water is discharged anymore. By the end of the winter period, in May, the water level is at its lowest and the area can no longer function as a resource for drinking water. The shortage at the end of winter leads also to a decreased water quality. There should be more water captured and stored in summer in order to keep enough water in the system for the winter period.

When more water is stored in summer and the overall biodiversity can be increased an interesting area with high qualities will be realised. The area is very vulnerable and therefore the strategy to restore the water and ecological qualities before any building activities take place is chosen. When buildings are realised they should be kept footloose from the underlying natural system of water, soil and ecology. The step-by-step strategy safeguards the main stream (Fig. 10.26) first and creates space for side streams (Fig. 10.27) and ponds (Fig. 10.28), which increase the storage capacity, slow down the discharge in summer and preserve water for the drier winter period.

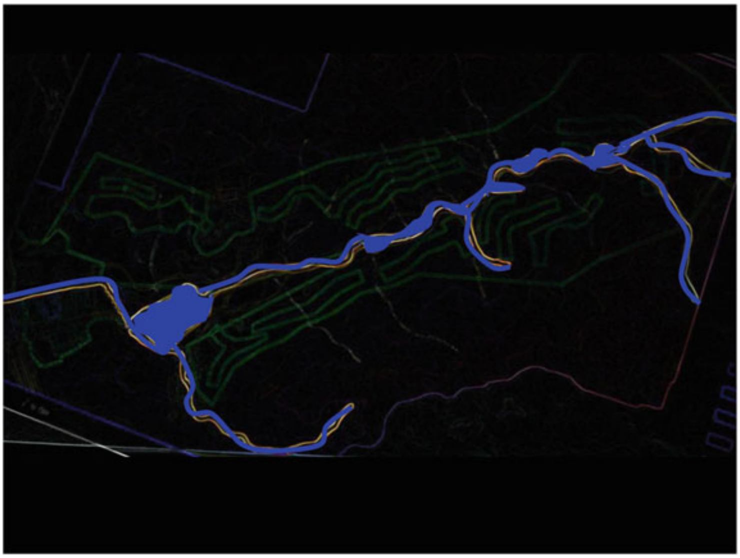


Fig. 10.26 The main stream and existing storage lake (Yu et al. 2008b)

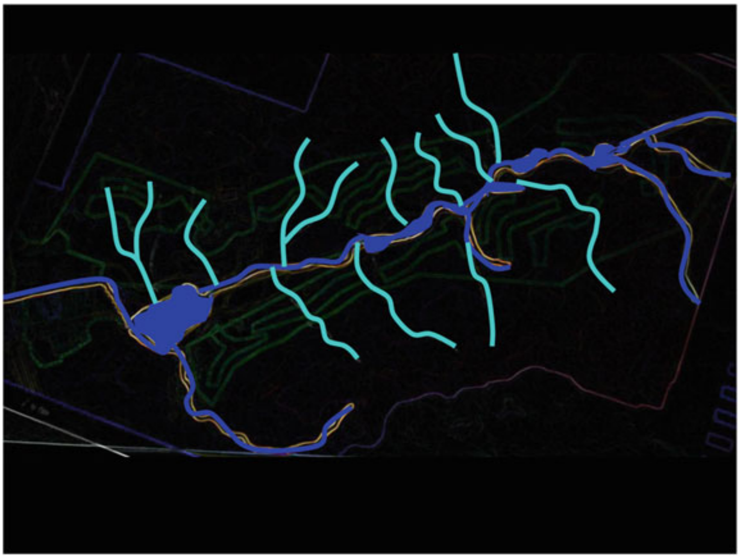


Fig. 10.27 The side-streams (Yu et al. 2008b)

The side streams should function undisturbed and this requires enough space at both sides around them. The many side streams and their required space are respected in every building. The side streams also store and slow down runoff water. In order to slow down the runoff, rocks might be placed in the streams (Fig. 10.29).

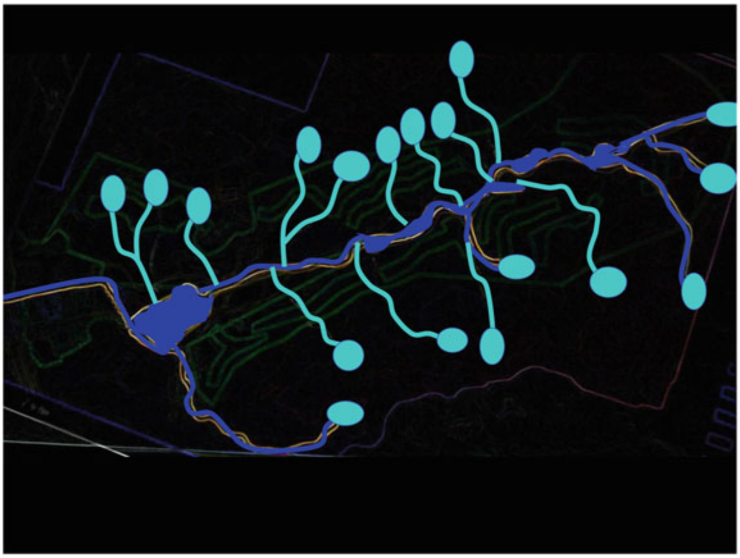


Fig. 10.28 Ponds situated at the higher ranges of the hills (Yu et al. 2008b)

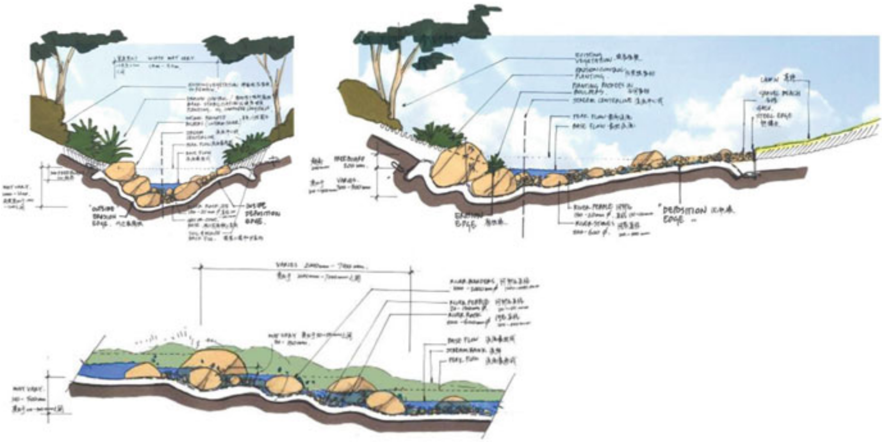


Fig. 10.29 Cross-sections of possible measures to slow down runoff water (Yu et al. 2008b)

Where-ever small flat spaces can be found half way uphill storage ponds can be realised. These ponds not only store water, but function also as ecological hotspots. Water is essential to increase biodiversity and especially in dry winter periods these ponds function as ecological cores. These ponds are realised by placing groups of rocks in the streams (Fig. 10.30).

Water running off the hill can be cleaned extra in a natural way. Even if the water is very clean already, the introduction of natural wetlands before water from side streams enters the central stream is encouraged (Fig. 10.31).

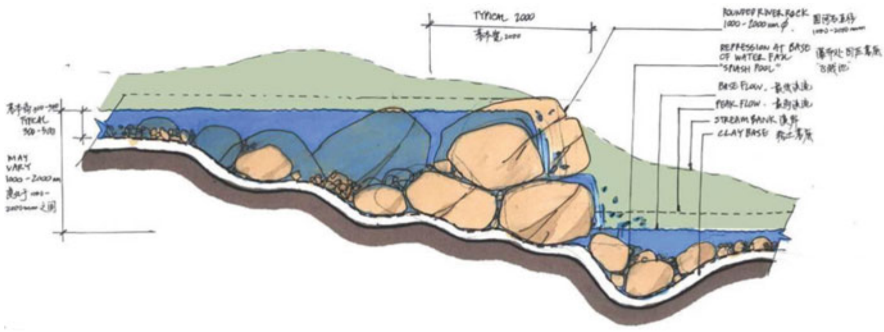


Fig. 10.30 Cross section of creation of ponds (Yu et al. 2008b)

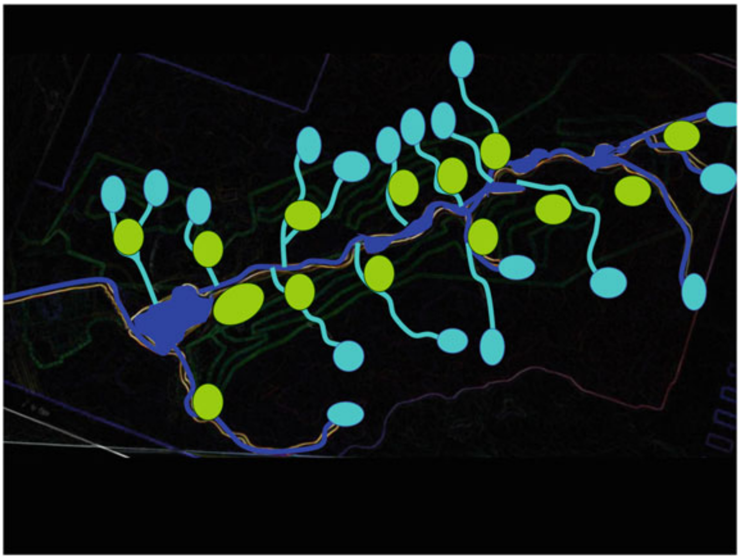


Fig. 10.31 Introducing wetlands cleaning the water before entering the side streams (Yu et al. 2008b)

When wetlands are created before any building activities take place, the water quality is increased anticipating developments later on that may influence the water quality. At a later stage, water from roads can be cleaned in these, already functioning, wetlands. This improved water and ecological system already operates before a first minimal impact road is constructed and the first houses are built. These houses are build with minimal impact on their environment, during building and afterwards by lifting the houses above the landscape (Fig. 10.32).

The first buildings should be built at the northern slopes, because the relatively low ecological values at that hillside (Fig. 10.33).

Fig. 10.32 Minimising the footprint of buildings on natural landscape (Yu et al. 2008b)

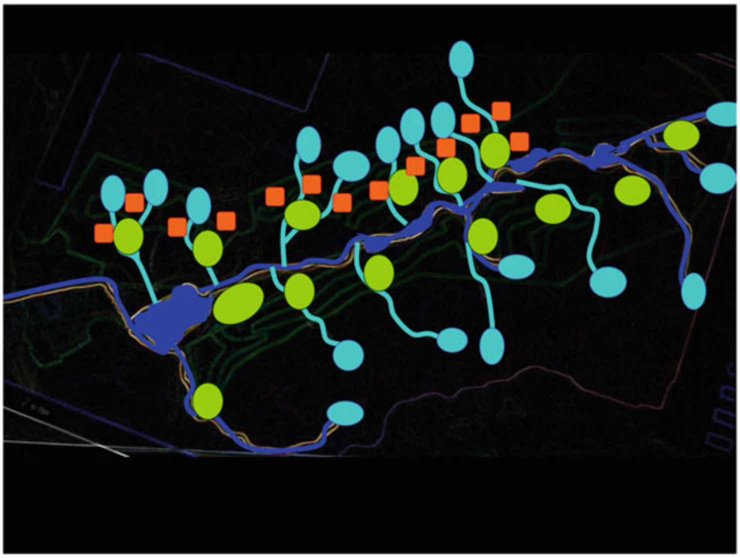


Fig. 10.33 First houses built at the northern slope (Yu et al. 2008b)

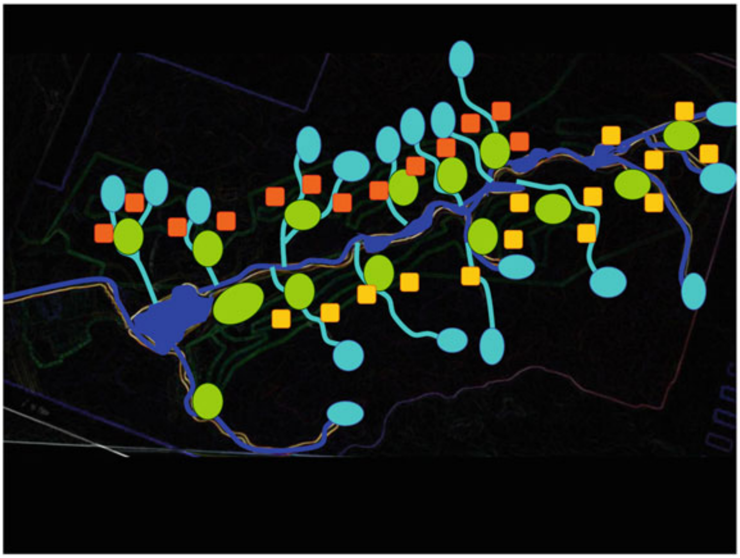


Fig. 10.34 The last houses are built at the most vulnerable southern slope (Yu et al. 2008b)

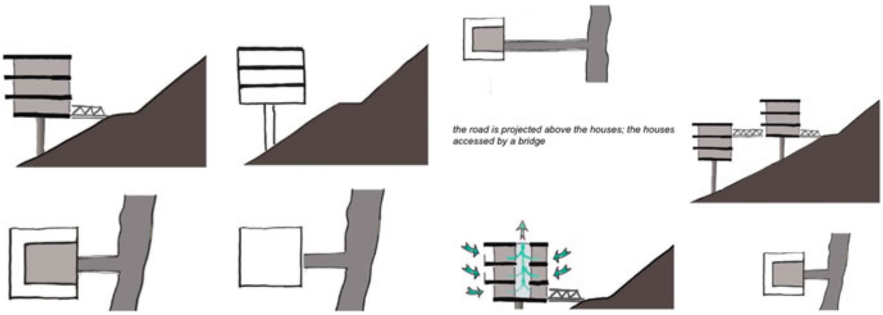


Fig. 10.35 The house designed like a tree in the landscape, connected by a bridge and ventilated through the chimney effect (Yu et al. 2008b)

Building in a piece-by-piece way, the building process can be stopped any time. The most valuable parts of Stream Valley are occupied latest (Fig. 10.34).

The construction of the houses with minimal impact on landscape and ecology, and improving sustainability in comfort and energy use at the same time can be visualised in several steps (Fig. 10.35). The house is built on one pole, just like a tree, and connected with the road with a bridge (Fig. 10.36). The house provides shade beneath it on the hillside. Within the houses natural ventilation is achieved through the so-called chimney effect.

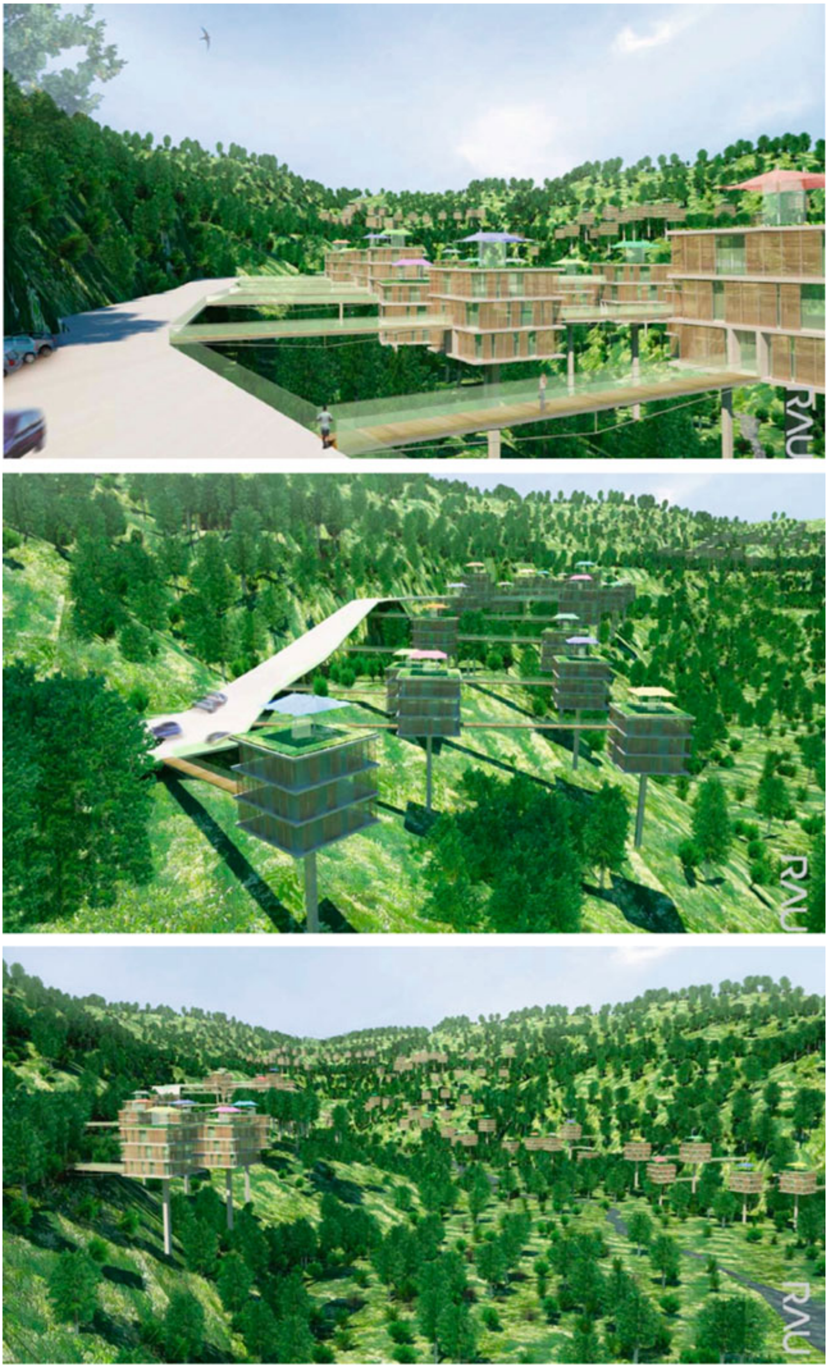


Fig. 10.36 Visualisations of the design for Stream Valley (Yu et al. 2008b; artist impressions: RAU & Partners Architektenburo BV)

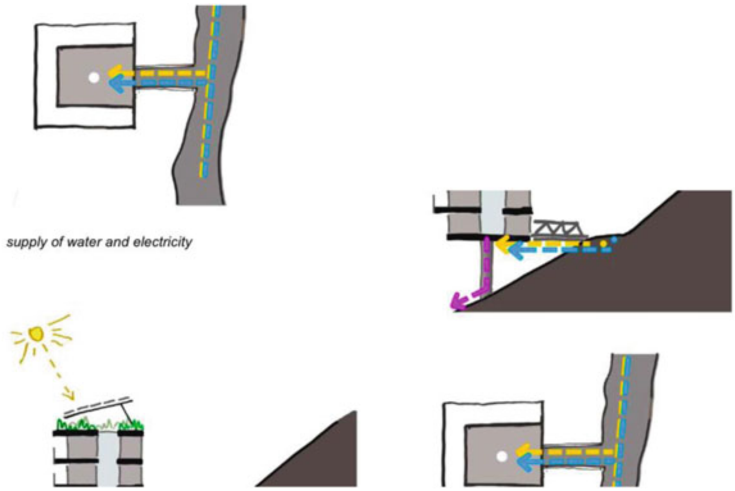


Fig. 10.37 The water, electricity and sewage solutions (Yu et al. 2008b)

Water and electricity is provided from the road and the sewage system is organized through the pole. The required amount of external electricity is minimised by the placing PV-panels on the roofs (Fig. 10.37).

10.7 Success Factors

The design charrettes that have been organised to improve the sustainability level of several demonstration-building projects in China have been successful because of several reasons:

1. There was a strong support from the Ministries from both countries and an active participation of representatives of the Chinese Ministry of Construction in the design charrettes.
2. During the design charrettes a broad pallet of expertise was combined. Experts both from China and the Netherlands brought different backgrounds to the table as well as specific knowledge about landscape and urban design, water and ecological systems, energy and transport as well as building materials. As far as backgrounds differed, also the range at which knowledge could be gathered could be derived from different scales.
3. The Dutch high standards of knowledge regarding sustainability in general and sustainable building in particular could be brought in very hospitable and receiving environment of Chinese developers and the government.
4. The fact that during the design charrettes an atmosphere of collaborative designing was created. This involved skills that go beyond explicit knowledge, but

	Individual or collective learning	Nature of learning domain	Kolb experimental learning cycle	Depth of learning impact
Distributive	Individual	Tame problems Technical challenges	Conceptualisa-tion only	First level learning
Interactive	Individual	Tame problems Technical challenges	Conceptualisa-tion and experimenting with new behaviour	First or second learning level
Collaborative	Collective and individual	Wicked problems Adaptive challenges	All stages of cycle (and multiple times)	Third learning level

Fig. 10.38 Learning level in the Sino-Dutch design charrettes

skills to make contact across cultures and a genuine interest in different contexts, cultures and background.

5. During the design charrettes there was the mental space to sketch and draw together with the designers of the preliminary design and the developers, without any preoccupation about the qualities of the preliminary plan. This meant that everything was discussable and new solutions were seriously discussed on the drawing board.
6. There were translators available with understanding and communicative skills, enhancing the communication process and the professional exchange
7. The mediation skills of the Dutch team leader, Bing Yu, who has Chinese roots is trilingual, speaking Mandarin, English and Dutch and is trusted by the two expert teams, the Chinese government and the developers.
8. The appearance of a spider in the web of Chinese academia, Dutch consultancies and academia, Chinese developers and the Ministry of Construction, Bing Yu again.

Learning during the design charrettes was collaborative and searching for new concepts and experiments. However, time constraints limited the space for reflective observations, and the major problems tackled focused primarily on the more technical challenges of sustainable building. The level of learning therefore is interactive, and at the second level depth (Fig. 10.38).

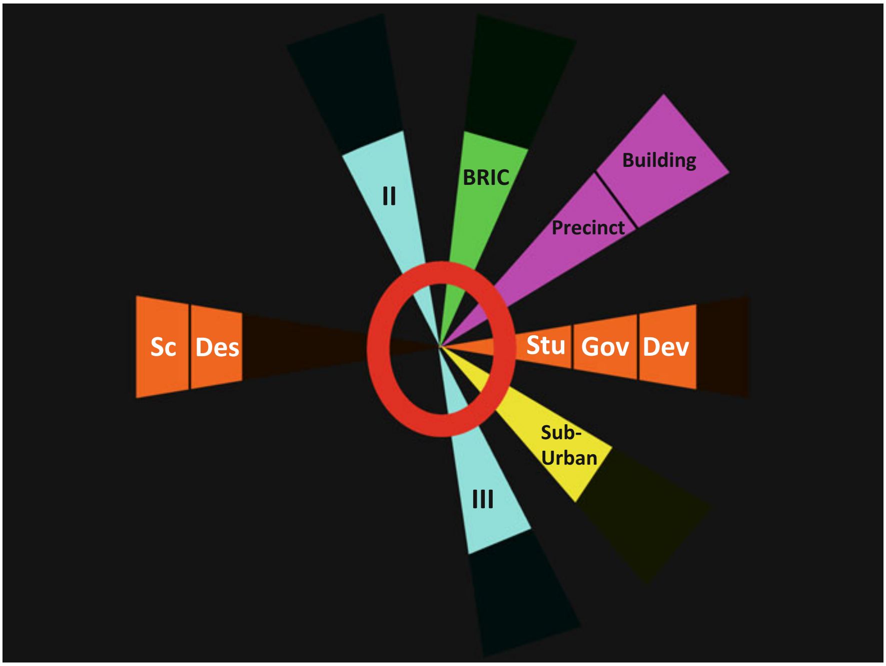


Fig. 10.39 The Sino-Dutch design charrettes positioned in the charrette wheel

10.8 Chinese TOR's in the Charrette Wheel

The Sino-Dutch design charrettes were all held in China, and consisted of assignment focusing on suburban precincts and the building level. The issues were complex and tame at the same time, as they focused on integrated designs for sustainability, but were also dominated by definition of simple rules, regulations and techniques for sustainable building. The variety of participants was wide, with academics from China and the Netherlands, Dutch consultants and designers, developers and government representatives and Chinese students (Fig. 10.39).

10.9 Conclusion

The three Chinese demonstration projects are sustainable building demonstration projects. This simple fact makes it not more than logical that these plans represent a relatively high level of sustainability. Through this it is not declared that all building projects in China perform high sustainability.

In executing and collaborating in the Chinese design charrettes the Chinese context is different from the Western.

First of all, the pace of developments is fundamentally different. The full continue workforce in the building sector leads to designing almost *during* the on-going building process. This offers chances, but contains difficulties too. The chances can be found in the fact that a design is never final until it is built. This means that until the very last phase of planning and design new, more sustainable measures can be integrated in the plan. The flipside of it is that processes are so fast it is hardly possible to propose changes because the actuality changes every day.

The second aspect of the Chinese context is the strong hierarchy. Central regulations will be carried out throughout the country and will be executed immediately. Until a certain measure is declared from the central government no one would think about these measures, set aside realising these. But as soon a declaration from Beijing is promulgated, everyone implements it. This results in a very effective implementation of measures once the National Congress of the Communist Party adopts them.

The last relevant contextual element is the competitiveness between Chinese project developers. These parties are conscious of the fact that they can profit from rapid developments, but in order to continue their building pace and selling schemes, they need to distinguish themselves from the others. This makes green building popular and the developers have a strong emphasis on becoming a demonstration project. This competing and scoring in trying to be the best developer leads also to immediate implementation of proposed measures. The three demonstration projects illustrate that incorporation of measures is relatively easily. The measures direct the character and layout of the design and contribute to the resiliency of the entire area. The problematic issues in these Chinese examples are unbalances in water availability and the decrease of biodiversity.

The Chinese projects show that if the natural circumstances, like elevation, slopes, water and ecology are taken as central steering elements in the design the sustainability of the project area can be improved. The designs for the various areas are integrated designs. It seems that in the Chinese context sustainability measures are not seen as new ingredient, which therefore have less difficulties to fit in an old fashioned planning tradition. Besides this, policy makers, designers and project developers are open to incorporate sustainability issues in the designs. Compared to the Dutch examples and situation, the Chinese attitude seems more susceptible to these issues. In the Chinese examples the project developer works together with the central government and scientific experts in a design project. This is not a regular practice in many Western contexts.

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