

Abstract

This article will explain the method of sustainable Greenway planning and design through a detailed description of a specific project, from the basic principles of the project and the goals to the analysis of the site to the final planning and design, each step will be in-depth elaboration, trying to reveal the basic framework of sustainable Greenway planning and design and landscape planning and design. The first chapter of the thesis is the elaboration of the fundamental principles of sustainable landscape planning and design and some methods to realize these principles; these fundamental principles are ignored in many project elaboration. Most of the times, designers making some planning and design based on some original design thinking rather than the fundamental principle of design. So many times when we read a book or a project will encounter much confusion, can not find the basis, this chapter of this article will try to explain the emergence of the

principles and point out the main tenets of sustainable greenway planning and design. The second chapter is the interpretation of the analysis method of sustainable Greenway planning and Design. The second chapter is the interpretation of the analysis method of sustainable Greenway planning and Design. When we know the principles and objectives, then we will analyze according to the policies and goals. There will be many methods of analysis, the author based on personal experience to give an analysis method for reference. The third chapter is about the practical application of sustainable Greenway planning and design. From the first chapter, we can see that there are many ways to achieve sustainable greenway planning and design, the author will apply a variety of methods to achieve sustainable goals according to the actual situation of the site. As the author attended Budapest, he chose a green road in Budapest as an example to facilitate field visits and to obtain the assistance of a mentor.

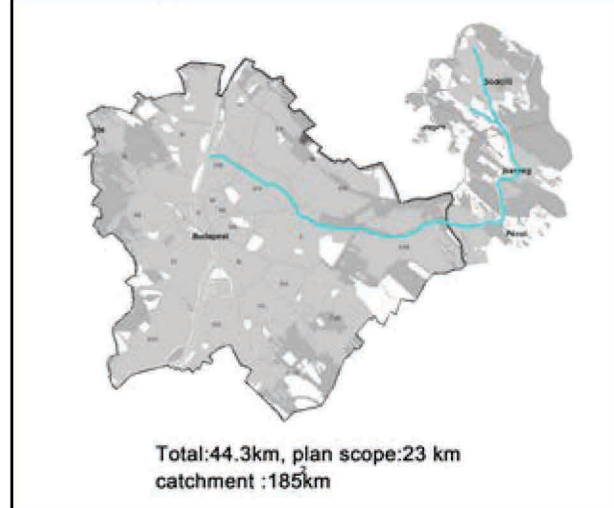
Figure 3 Rain garden (GVL, Iv quijie, 2017)



Bioswale is a cheap and straightforward solution to collect the stormwater which is fit for some places where they don't have big green spaces. For a land with enormous green open spaces, it is suitable for constructing a bio depression. Where there are enough places to arrange the stormwater container, the container can be used when the ground is saturated. A rain garden can be used for a variety of places that do not only have a functional capacity for water keeping and purification but also have an aesthetic function (see Figure3). The sites have thin subbases like an urban plaza with underground parking lot cannot hold much water where we can use bio containers to store and purify the stormwater and then reuse them for water plants.

Chapter 2 Analysis of existing condition of Rákos creek

Figure6 Location in large scale



Base map reprinted from 'Teir' website

Figure8 Section A-A

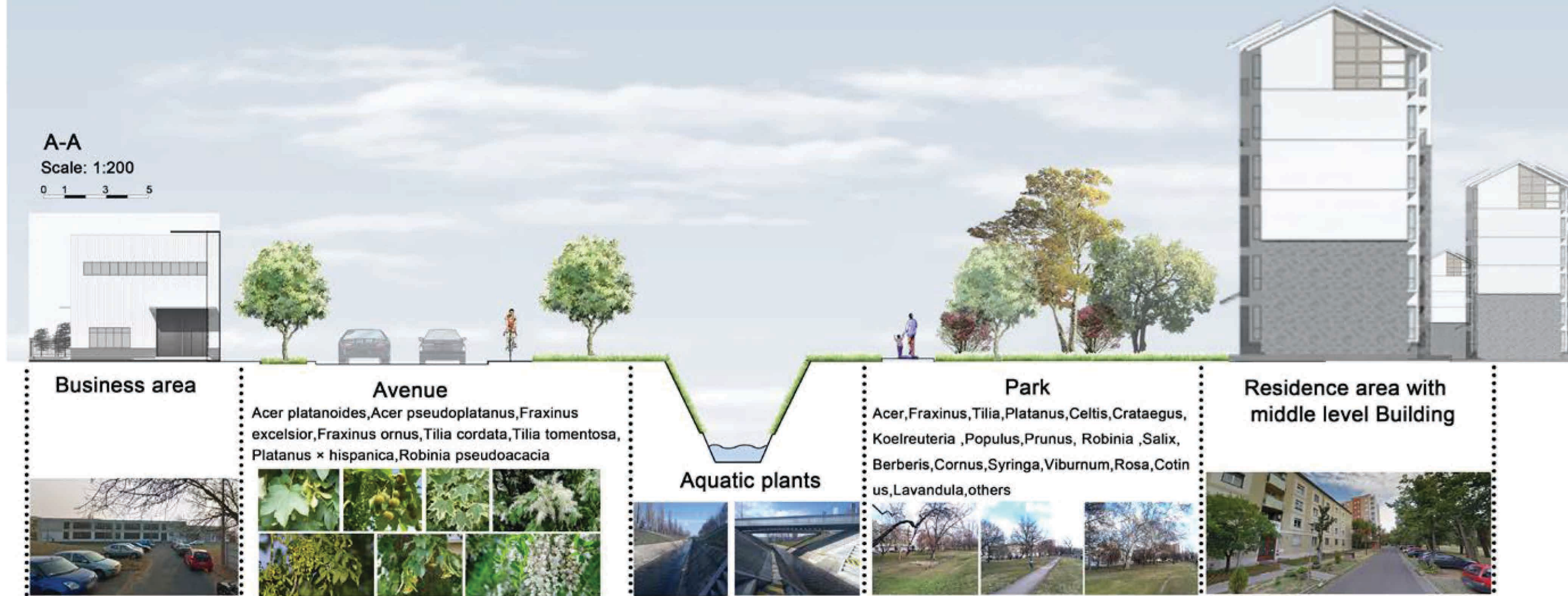
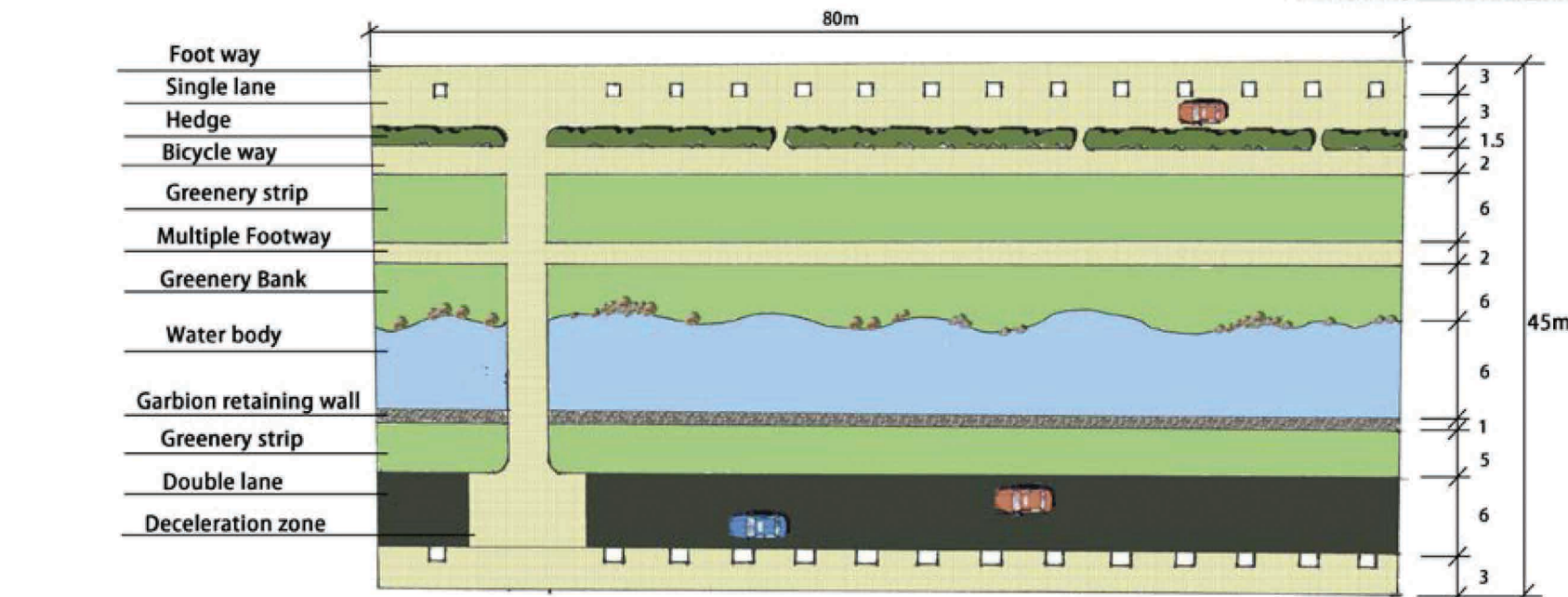


Figure12 Perspective for typical section 1



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Figure13 Master plan of typical section 1



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Chapter1.

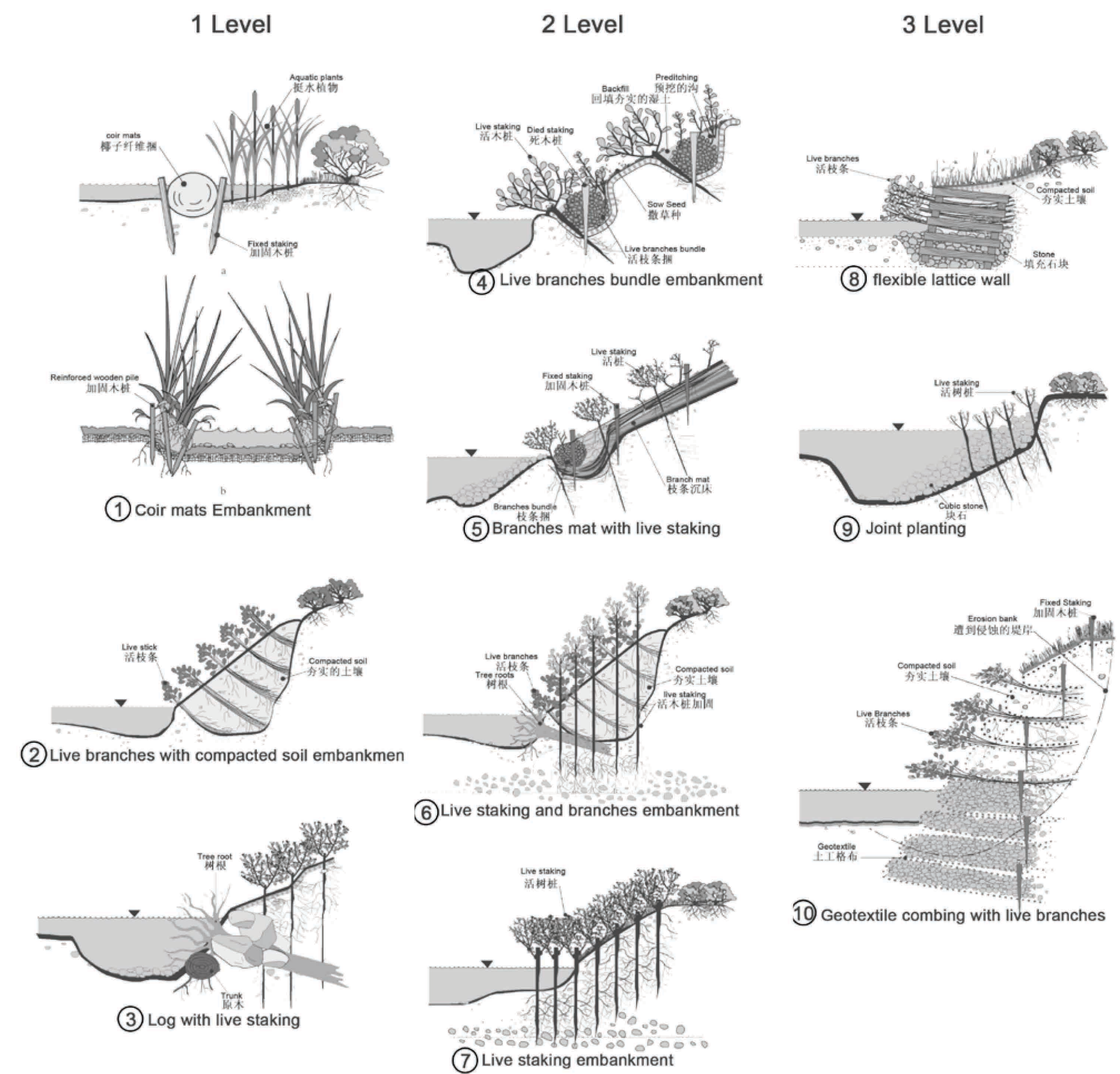
The basic principles and sustainable methodes applied for greenway planning and design

Water management

1. The basic principles for water management

The basic principles of water management are to ensure the overall circulation of water. In the global flow of water, the flow of groundwater is the most important part. In the field of landscape architecture, water management mainly involves two aspects. The first part is about the water management of rivers and lakes. The second part is about the control of rainwater. The general principle is to ensure the infiltration of rain and the ability of surface water conservation. At the same time, the ability to purify rainwater and the efficient utilization of rain should be improved. The water management of rivers and lakes is more complicated. We need to consider the risk of flood control and the protection of animal and plant habitats while ensuring that the river remains seepage.

Figure 1. 10 Typical ecological embankment design(Zhao hua, 2010)



2. Sustainable way for water management

Ecological engineering for Embankment controlling

The key point for embankment controlling can be separated into four parts:

1. Maintain the habitat of wildlife
2. Ensure the water infiltration
3. Ensure water filter level
4. Slow down water flow

There is ten typical and efficient approach(See figure 1') was listed by scholar Zhao Hua2. The ten different approaches are fitted for different conditions. Usually, we can separate it into three levels according to their ability to bear erosion.

1. Z.P.Z(2010), 'Design of Ecological Embankment for Urban Water Systems', Journal of Beijing Forestry University(2010), P.1-7.

Table 1. Runoff factor of different pavement surfaces

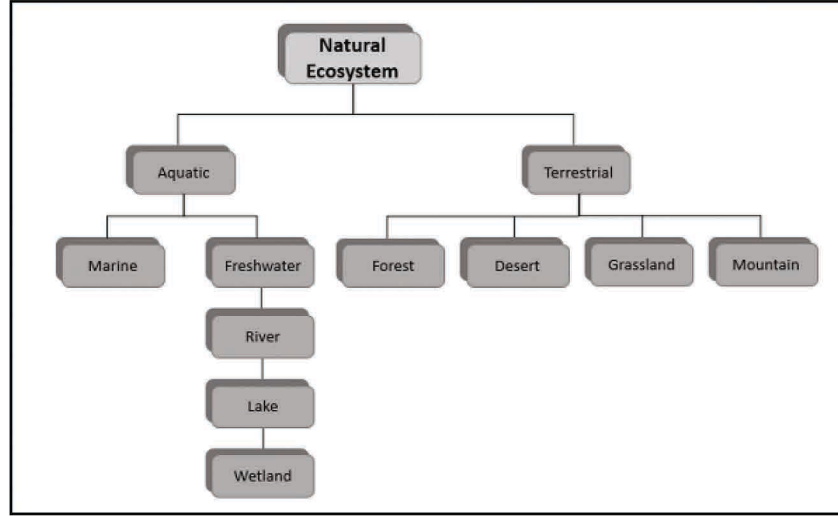
Land Cover	Infiltration Rates in./hr (mm/hr)	Curve Number CN	Runoff Co-efficient, C
Permeable Interlocking Concrete Pavement	Up to 50 in./hr (1270 mm/hr) with maintenance 3-4 in./hr (75-100 mm/hr) with no maintenance	45 - 80	0.00 - 0.30
Impervious Asphalt or Concrete Pavement	0 in./hr (0 mm/hr)	95 - 98	0.90 - 0.95

Reprinted from website:https://projects.ncsu.edu

Figure 2 Opened edge (GVL, Iv quijie, 2017)



Figure 4 Type of nature ecosystem(Steven, Kim 2013)



Biodiversity recovery

Main principles for biodiversity recovery

Biodiversity is a comprehensive concept that hard to be evaluated unless we transfer the abstract idea into specific quota, for instance, the number of plants and percentage of one type of plants(According to the standard of 'Lafitte Plan' the single kind of species cannot exceed 10%). Typically, the more diverse of habitat the more diverse of vegetation and animals that the habitat can be classified into 2 main types: Aquatic(Marine, Freshwater) and Terrestrial(Forest, desert, grassland, mountain)(see figure 4³), for example fishes can alive only from watercourses and frog can alive only from moorland. All type of the land has their completed vegetation layers. Figure 5⁴ shows the completed vegetation layers of Riverside. Apart from the diversified habitat, we should also ensure the diversity of animals. From food chain, we will know which type of animals should be introduced. Aside from completed structure of one type habitat, inner connection and external connection of habitat are critically important, which give the opportunity for animals to migrate from one land to another so that they can get enough of food and diverse of the gene.

3. Steven I. Apfelbaum, Kim Alan Chapman(2013), 'Ecological Restoration: A Practical Approach', Research gate(2013), P.4-9.
4. https://upload.wikimedia.org/wikipedia/commons/aa/USGS_image_cropped.jpg

Figure9 Green open spaces



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Table2 list of main plants

	Main species	Total Amount
Trees	Acer platanoides, Acer pseudoplatanus, Fraxinus excelsior, Fraxinus ornus, Tilia cordata, Tilia tomentosa, Platanus x hispanica, Celtis occidentalis, Crataegus x media, Kerria japonica, Koeleruteria paniculata, Populus alba, Populus nigra 'Italica', Prunus serrulata 'Kanzan', Robinia pseudoacacia, Salix alba, Salix purpurea, others	Appr. 60 species
Shrub	Berberis x media, Cornus alba 'Sibirica', Forsythia x intermedia, Syringa vulgaris, Viburnum opulus, Rosa spinosissima, Cotinus coccogryia, Lavandula angustifolia	Appr. 20 species

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Chapter 3 Planning and design

Green open spaces structure planning

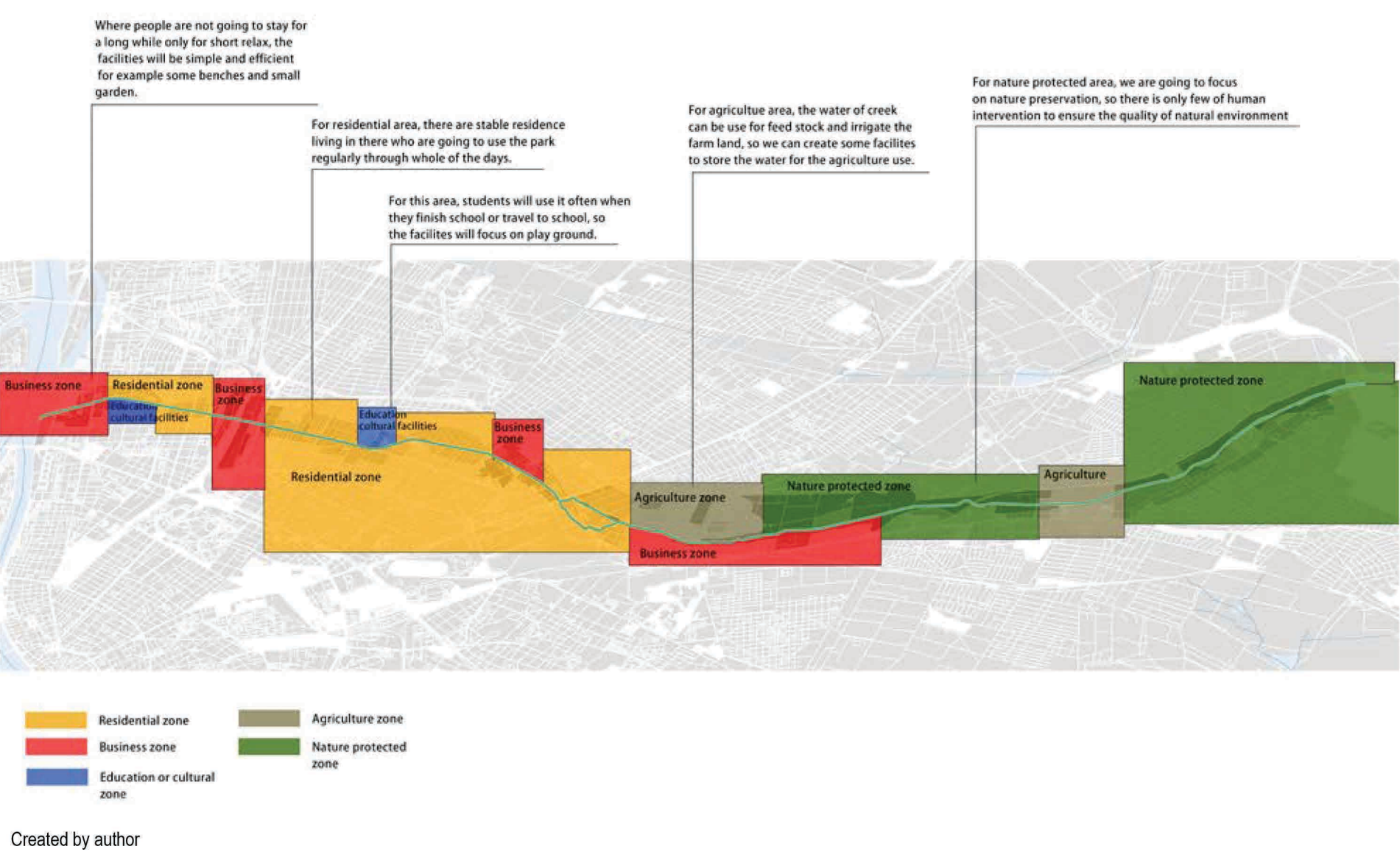
According to the previous analysis of land use and population, we know the situation of land use in the corridor and the structure of population distribution. The overall strategy of structural planning of public open spaces follows the principle of trying to meet the interests and needs of different groups while taking into account the protection of the ecological environment.

At the end of the greenway, between Pesti Street and Mo Highway, the original ecological condition is in high level, the plant coverage is high, and there are more diversified habitats. It is a principal aquifer, which plays a crucial role in improving the climate of the whole region. At the same time, the population density of the area is low. Therefore, this area is mainly based on environmental protection and less involvement in human activities, but we also need to do so, as far as possible to meet the needs of residents.

Design for typical section 1

It's a typical section between Jász street and Csömöri street where both sides of creek have traffic lines, and a moment at one hand, cars were limited to use the area only the residents who live in the creek site who can drive car into the creek which means that there is heavy traffic at one side and another side is free. Otherwise, the depth of the river is not rooted in this area. Based upon, we know there is an opportunity that we concentrate all of the recreation zones on one side and turn the steep slope into a gentle slope, which create a big open spaces for people approach water, while the south part of the bank was planted density of plants to decrease noise and in north part the two-way street was modified to one way and lift the road into the same level with footway, which is convenient for pedestrian crossing the street. Bicycle route, footway and motorway was separate by plants.

Figure 14 Public open spaces structure planning



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