A METHODOLOGY FOR GREENWAY PLANNING AND DESIGN BASED ON RÁKOS CREEK CASE STUDY



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

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

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.

Chapter1

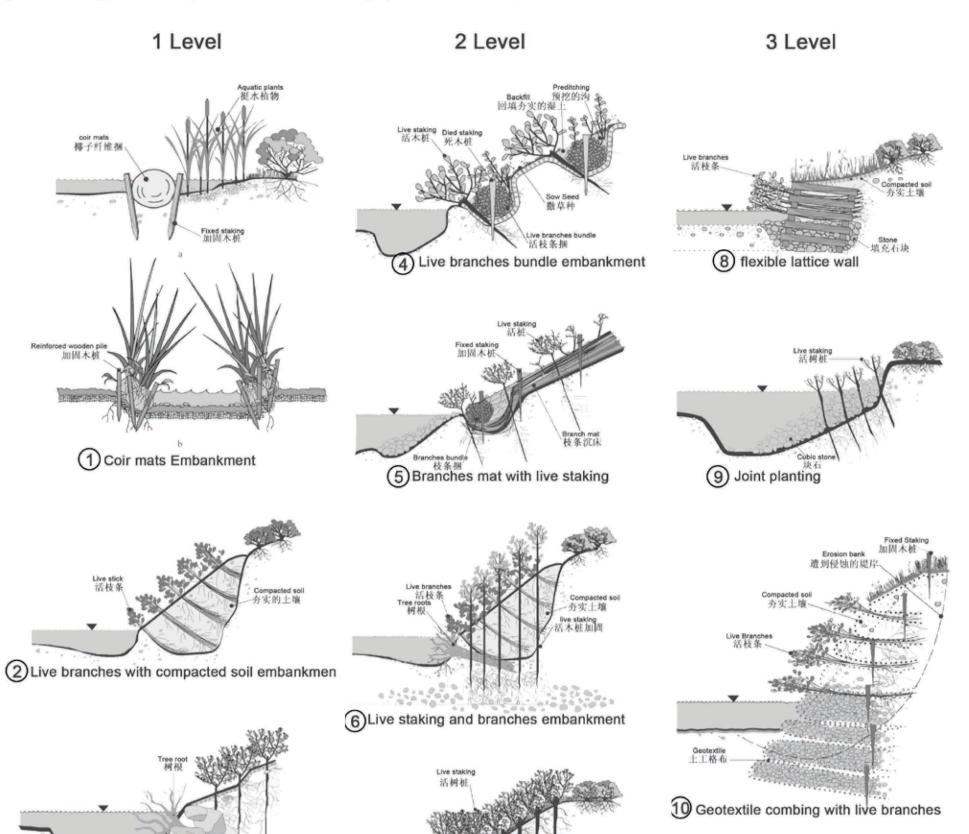
The basic principles and sustainable methodes applied for greenway planning and design

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 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)



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

Ensure water filter level 4. Slow down water flow

There is ten typical and efficient approach(See figure 1¹) 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	Infilatration 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

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



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

Generally, The principle for sustainable stormwater management can be regarded as three aspects 1). Ensuring water infiltration on site easily 2). Improving capacity for water storage 3). Improving water purification ability Based on the above, there are a variety of methods to manage rainwater. Generally, these include:

1. Permeable paving materials 2. Free runoff design

3. The Rain garden, bioswale

3. Rainwater collecting container 4. Rainwater purification

Permeable materials have an overwhelming advantage compared to impervious materials(See

To ensure that the rain on the paved surfaces can aspects: 1) concrete surface should be slightly higher than the green belt: 2) paved surfaces don't have the edge that can block rainwater runoff; 3) rainwater can be well diverted(see figure22).

When stormwater reaches the previous area, we

should try to keep the water on site and purify it. However, if the ground reaches the full level fast, the flood will happen, which can not give real benefit for ecology, so our principle is to improve the water keeping capacity of the ground. There are some sustainable methods applied for water storage(see

2. GVL, 'Sponge city design illustration', Jiangsu, Jiangsu Science and technology publishing(2017), p.10-31.

Figure 5 Vegetation zonation in water side

Chapter 2 Analysis of existing condition of Rákos creek

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

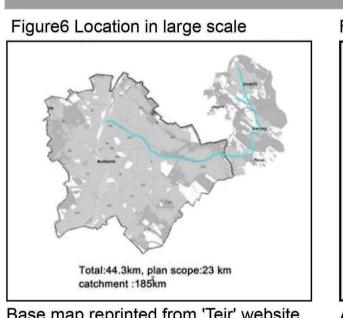
green open spaces, it is suitable for constructing a bio depression. Where there

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 Figure 3). The sites have thin subbases like an urban

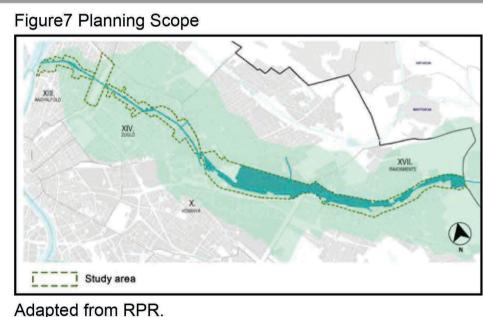
plaza with underground parking lot cannot hold much water where we can use bio

containers to store and purify the stormwater and then reuse them for water plants.



Base map reprinted from 'Teir' website

Figur8 Section A-A



Project context

(3) Log with live staking

The project of Rakospatak creek planning and design is located in north part of Budapest, which is about 15 km and almost whole of the creek was regulated into a straight line with the concrete dams, which faces an ecological problem that biodiversity is disappeared and water loss their value. Otherwise, public open spaces were rather quality than sufficient, and management between open spaces, traffic, facilities was not very well. The primary goals of this project are improving ecology and recreation conditions. Restoring the creek into the natural or semi-natural state and enhancing the biodiversity will be the main job for the ecological goals. For recreation goals, an increasing amount of public open spaces to cater for the different groups and ensuring the quality of it, moreover enhancing the traffic line will be the main focus point. The planning process was assembled by analysis and planning part, Which studies comprise ecology condition analysis which includes water management and biodiversity and analysis for recreation condition and traffic line, which planning part contain new water management, plants planning, public open spaces planning, and traffic line planning.

Biodiversity analysis

quite weak.

From the map, we know the distribution of trees

is out of balance. Moreover, in the city part, the

plants is none diverse, for example, Fraxinus

excelsior was over 10%, Which not good for

wildlife perch at there and it's also not good for

tree's self. The table4 list the main species of

the greenway, the figure 10 show the percentage

of plants layers and the figure 11 show the percentage of single species. Based upon, we know the diversity of plants in the Greenway is

The section(see figure 8) show that northern part of the river is in an excellent ecological condition, and there is good vegetation coverage, and vegetation

is diversified. However, the rate of invasive species

is quite high, which include Acer negundo, Celtis

occidentalis, Elaeagnus Angustifolia and so on

These invasive species pose a more significant

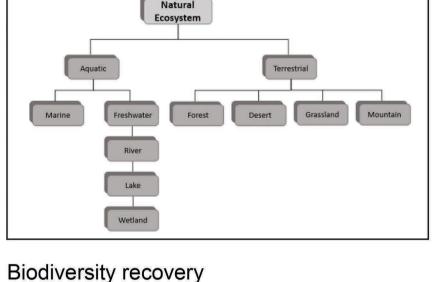
threat to native plants. The vegetation coverage

in the southern part of the river is low, and the composition of plants is single. Most of the plants

are mainly arbors. The grass is the only plants cover on the embankment. In the inner part of the creek,

there is no plants grow up.

7 Live staking embankment



Reprinted from website

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 2main 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

4. httpsupload.wikimedia.orgwikipediacommonsaa1USGS image cropped.jpg

Figure9 Green open spaces



able2 list	of main plants	
	Main species	Total Amount
Trees	Acer platanoides, Acer pseudoplatanus, Fraxinus excelsior, Fraxinus ornus, Tilia cordata, Tilia tomentosa, Platanus × hispanica, Celtis occidentalis, Crataegus × media, Kerria japonica, Koelreuteria paniculata, Populus alba, Populus nigra 'Italica', Prunus serrulata 'Kanzan', Robinia pseudoacacia, Salix alba, Salix purpurea. others	Appr. 60 species
Shrub	Berberis × media, Cornus alba 'Sibirica',forsythia × intermedia,Syringa vulgaris,Viburnum opulus,Rosa spinosissima,Cotinus coggygria,Lavandula angustifolia	Appr. 20 species

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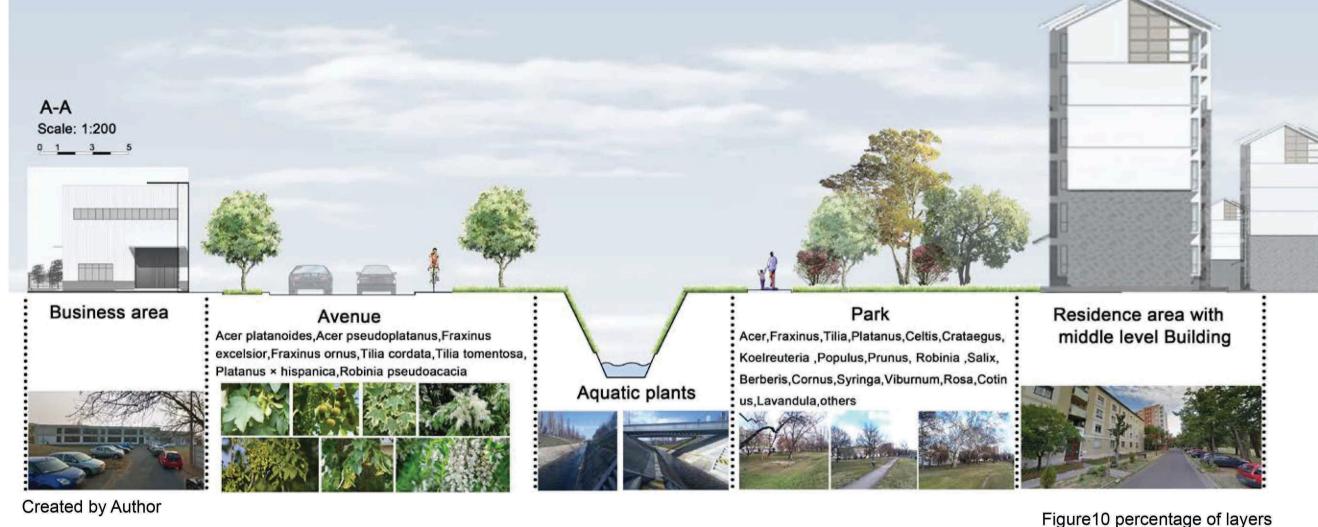


Figure 12 Perspective for typical section 1

*	80m	
Foot way		
Single lane		
Hedge		3
Bicycle way		1.5
Greenery strip		6
Multiple Footway		 ,
Greenery Bank		72
Water body	the within a series or	assidia a oa
arbion retaining wall		6
Greenery strip	THE PROPERTY OF THE PROPERTY O	1
Double lane		5
eceleration zone		6

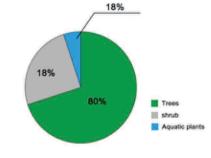


Figure 11 percentage of Species Created by Author

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.

Created by author

