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Analysis and Research on the Current Situation of Waterfront Landscape in Xuchang

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Abstract

The purposes of this research were as the most popular part of urban landscape, urban waterfront landscape reflects the vitality of a city's landscape. Since the construction of urban water system in Xuchang City in 2014, the urban waterfront landscape has developed synchronously with the water system construction. This paper will take the waterfront landscape of Xuchang City as the research object, analyze the plants, topography and other aspects of its current landscape through field investigation, and put forward the existing problems and solutions. It is hoped to provide reasonable suggestions for the development of urban waterfront landscape in the future.

Keywords: Xuchang, waterfront landscape, urban waterfront

Introduction

Continuous development of urban landscaping has contributed to diverse forms and objects. The focus has been transformed from traditional land landscaping to waterfront landscape. The advantages of waterfront area can be fully taken to make landscape effect different from land plants.

"Waterfront" usually refers to bordering areas like rivers, lakes, beaches and so on, namely, areas nearby waters. "Urban waterfront area" refers to the range of water in a city, including water area, water border line and land area. Its spatial range includes water space of 200m to 300m as well as adjacent urban land space, and its temptation distance appealing to people is about 1 km to 2 km equivalent to a walking distance of 15 to 30 minutes (Sun Xinyuan,2018). The waterfront area serves as the middle zone connecting the city and the water area. In terms of climate environment, it can

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adjust the urban micro-climate; in terms of landscape, it presents the urban beautiful posture. The waterfront environment enjoys islands, gentle slopes, sandbars, rocks and other natural landforms. In addition to that, it also includes some other interference factors like influence of natural environment, human environment and artificial facilities.

In the second issue of Urban Planning in 1998, a column named “Waterfront Area Planning” was added. In 1999, a large number of relevant articles were published in the second issue of “Planning and Development of Waterfront Areas”. In the 21st century, China is in the development stage by leaps and bounds. Urban Planning also fully embodies its vanguard in the academic field with the magazine title of “Waterfront Planning”. Meanwhile, “Foreign Urban Planning” of the same period also published considerable articles of urban waterfront area. Since the 18th National Congress of the Communist Party of China in 2012, Comrade Xi Jinping has always stressed that we should join ecological environment protection campaign with a far-reaching vision and comprehensive approach. He pointed out that we must not pursue temporary economic development at the cost of environment. He repeatedly put forward that while we hanker after “gold mountains”, we cannot do without green mountains. In addition to social development, he emphasized the restoration of river ecosystem, the construction of a ecological model, and the building of waterfront space with strong cultural landscape and sustainable water resources development strategy (Han Lihong, 2019) .Therefore, the construction of ecological civilization has been a hot research topic.

Through field research of six waterfront landscapes including Furong Lake and Donghu Garden in Xuchang, the paper makes an analysis of the plant configuration and design methods of waterfront landscape and summarizes the existing problems, thus putting forward the corresponding solutions. The research results have guiding significance for the design of waterfront landscapes.

Research’s objective

To study of urban landscape, urban waterfront landscape reflects the vitality of a city's landscape analyze the plants, topography and other aspects of its current landscape through field investigation, and put forward the existing problems and solutions

Methodology

This thesis uses literature analysis, field research and data analysis to carry out research on the selected topic, and its specific methodological analysis and application are as follows:

Literature analysis :

Through reading the documents and materials of relevant research at home and abroad, and accumulating the data of waterfront landscape design, natural ecology, human history and other aspects, we can do theoretical support for the research direction. According to our own research needs, under the condition of multi-disciplinary content arrangement, we can purposefully select and classify, and finally accumulate the preliminary background analysis and basic knowledge of Xuchang waterfront landscape.

Field research method

Personally investigate the scope of the study, combine the on-site observation method, investigate the on-site situation, pay attention to the terrain, climate, vegetation and other factors of the research object by means of manual identification or camera equipment, and record and sort out the real situation. It can well collect the relevant information of the research object, that is, the waterfront landscape of Xuchang City, and do the preliminary data collection for the later analysis. For example, for the species of plants in the waterfront landscape, we can first investigate the information of mobile phones through field research, and determine the adaptability and impact of plants on the environment through classified statistics in the subsequent research and analysis.

Data analysis methods

Data analysis is the process of analysing large amounts of data collected using appropriate statistical analysis methods, summarising and understanding them and digesting them in order to maximise the functionality and usefulness of the data. Data analysis is the process of examining and summarising data in detail in order to extract useful information and form conclusions.

Results

Data analysis of waterfront landscape plant configuration in Xuchang

In the design of water landscape, the reasonable application of plants can play a complementary role. The harmonious existence of plants and water body can present a compelling landscape effect. Therefore, in the aspect of plant selection, we should not merely follow garden landscape with plants as furnishing. Instead, we should take specific characteristics like climatic and hydrological conditions into

consideration. Meanwhile, our attention should be paid to plants practicability. In the selection of revetment plants, plants which can clean water quality should be used as far as possible. In order to create the durability of the overall environment, we should also emphasize the matching of plants in the aspects of color and season. In terms of diversity, various plants can play a certain role in regulating the urban micro-climate, and flexible choice of plants can also enrich visitors. To sum up, the plant selection of waterfront landscape should be considered from many aspects.

In this project, through a field investigation on six waterfront landscapes in Xuchang , the author makes a statistical analysis of plant furnishing. There are 53 species of plants along the Qingyi River, accounting for 49% of the total number of plants; there are 17 species in Donghu garden, accounting for 15%; there are 25 species in Luming Lake, accounting for 23%; there are 37 species in Beihai, accounting for 34%; there are 31 species in Furong Lake, accounting for 28%; there are 25 species in Autumn Lake Wetland, accounting for 23%. Detailed classification of plant species is shown in Figure 1.

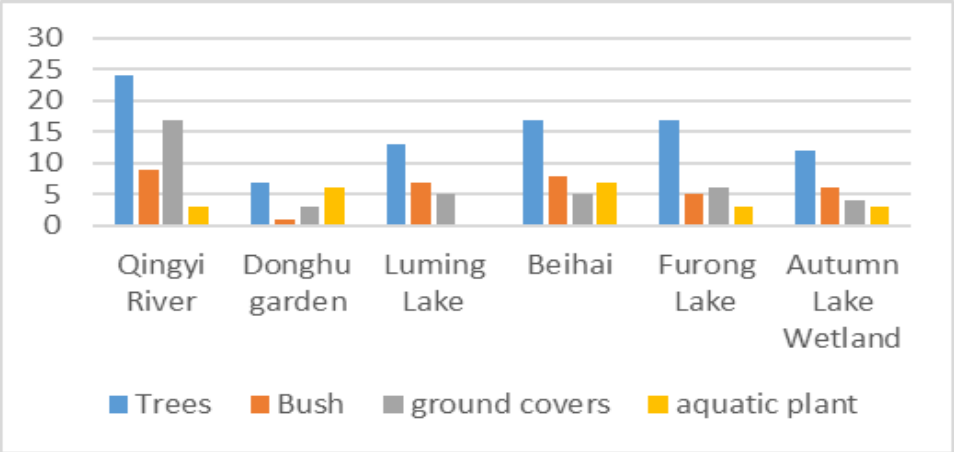

Figure 1 Detailed classification diagram of plant furnishing in Xuchang waterfront landscape

According to the growth mode of plants, the plants in the research area are classified into four categories: arbors, shrubs, ground covers and aquatic plants, including 106 families and 108 classes of plants. See Table 1 for details.

Table 1 Waterfront landscape greening plants in Xuchang

Category	Family	Class	Latin Name
arbors	Rosaceae	purple-leaf plum	Prunus cerasifera f. atropurpurea
		pyracantha	Pyracantha fortuneana
		Cherry blossom	Cerasus × yedoensis
		flowering peach	Amygdalus persica 'Duplex'
		begonia	Malus、Chaenomeles
		Photinia serrulata	Photinia × fraseri
		Tree rose	Rosa chinensis
		moor besom	Photinia serratifolia
		Flowering plum	Amygdalus triloba
		Malus halliana	Malus halliana
	Pinaceae	cedrus	Cedrus deodara
	Oleaceae	Fraxinus hubeiensis	Fraxinus hupehensis
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		Flowering plum	Amygdalus triloba
		Malus halliana	Malus halliana
	Pinaceae	cedrus	Cedrus deodara
	Oleaceae	Fraxinus hubeiensis	Fraxinus hupehensis
		Osmanthus fragrans	Osmanthus fragrans
		Privet	Ligustrum lucidum
		Chinese ash	Fraxinus chinensis
		Clove	Syzygiumaromaticum
	Cupressaceae	Cedarwood	Cupressus funebris
		Arborvitae	Platycladus orientalis
		Metasequoia	Metasequoia glyptostroboides
	Magnoliaceae	yulan magnolia	Yulania denudata
		Lotus magnolia	Magnolia grandiflora
	Platanaceae	Chinar	Platanus orientalis

Table 1 Waterfront landscape greening plants in Xuchang (Cons.)

Category	Family	Class	Latin Name
	Arecaceae	Palm	Trachycarpus fortunei
	Ginkgoaceae	Gingkgo	Ginkgo biloba
	Tamaricaceae	Chinese tamarisk	Tamarix chinensis
	Salicaceae	weeping willow	Salix babylonica
		Salix	Salix matsudana
	Arboraceae	Bamboo	Bambusoideae
	Apocynaceae	Oleander	Nerium oleander
	Moraceae	paper mulberry	Broussonetia papyrifera
		Banian	Ficus microcarpa
	Sapindaceae	goldenrain tree	Koelreuteria paniculata
		horse chestnut	Aesculus chinensis
		Acer palmatum	Acer palmatum
		Maple	Acer miyabei
	Lauraceae	camphor tree	Cinnamomum camphora
	Cannabaceae	Hackberry	Celtis sinensis
	Lythraceae	Crape myrtle	Lagerstroemia indica
		Pomegranate	Punica granatum
	Meliaceae	chinaberry	Melia azedarach
	fabaceae	Chinese scholar tree	Styphnolobium japonicum
		Chinese redbud	Cercis chinensis
shrubs	Oleaceae	winter jasmine	Jasminum nudiflorum
		Fuchsia	Forsythia viridissima
	Buxaceae	Ovatus Aureus	Euonymus japonicus var. aurea-marginatus
		Chinese littleleaf box	Buxus sinica
	Berberidaceae	nandin	Nandina domestica
	fabaceae	Wistaria	Wisteria sinensis
		Cassia bipod	Senna bicapsularis
	Rosaceae	Kerria japonica	Kerria japonica
		Rosa banksiae	Rosa banksiae
		meadow sweets	Spiraea salicifolia
		Chinese rose	Rosa chinensis
	Aquifoliaceae	Holly	Ilex crenata

Table 1 Waterfront landscape greening plants in Xuchang (Cons.)

Category	Family	Class	Latin Name
ground covers		Chinese ilex	Ilex chinensis
		Abelia	Zabelia biflora
	Arboraceae	Chinese pennisetum	Pennisetum alopecuroides
	Araliaceae	Fatsia japonica	Fatsia japonica
	Pittaceae	Pittosporum	Pittosporum tobira
	cannabis	scandent hop	Humulus scandens
	Sericaceae	Mosaic aoki	Aucuba japonica var. variegata
	Lonicerae	Honeysuckle	Lonicera japonica
	Vitaceae	Euphorbia humifusa	Parthenocissus tricuspidata
		Woodbind	Parthenocissus quinquefolia
	Asparagaceae	Astragalus	Ophiopogon bodinieri
		jade hairpin	Hosta plantaginea
	Arboraceae	Bermuda grass	Cynodon dactylon
		green bristlegrass	Setaria viridis
	fabaceae	Trefoil	Trifolium Linn
		Aeschynomene indica	Aeschynomene indica
	Iridaceae	Iris tectorum	Iris tectorum
	caryophyllaceae	Dianthus	Dianthus chinensis
	Oxalidaceae	creeping oxalis	Oxalis corniculata
	Amaryllidaceae	Zephyranthes candida	Zephyranthes candida
	Labiatae	Coleus scutellarioides	Coleus scutellarioides
		Salvia	Salvia japonica
	Asteraceae	Senecio cineraria	Senecio cineraria
		Cosmos bipinnatus	Cosmos bipinnatus
		Rudbeckia	Rudbeckia hirta
		Wedelia	Sphagneticola calendulacea
		Marigold	Tagetes erecta
		Sticktight	Bidens pilosa
		golden wave	Coreopsis basalis
	Lythraceae	Cuphea	Cuphea hookeriana
		willow herb	Lythrum salicaria
	Verbenaceae	Lantana	Lantana camara
	geraniaceae	Geranium	Pelargonium hortorum

Table 1 Waterfront landscape greening plants in Xuchang (Cons.)

Category	Family	Class	Latin Name
	Hydrangeaceae	Hydrangea	Hydrangea macrophylla
	Nitrariaceae	Harmel	Peganum harmala
	Cannaceae	Canna indica	Canna indica
	Pontederiaceae	Barracuda	Pontederia cordata
	Asphodeloideae	day lily	Hemerocallis fulva
	Berberidaceae	Barberry	Berberis thunbergii 'Atropurpurea'
aquatic plants	Cyperaceae	Scirpus	Schoenoplectus tabernaemontani
		Sedge	Carex tristachya
	Arboraceae	Reed	Phragmites australis
		Pampasgrass	Cortaderia selloana
		Mushroom	Zizania latifolia
	Arboraceae	Digitaria sanguinalis	Digitaria sanguinalis
		awn	Miscanthus sinensis
		Panicum crus	Echinochloa crusgalli
		ditch millet	Paspalum thunbergii Kunth ex steud
	Nelumbonaceae	Lotus	Nelumbo nucifera
	Nymphaeaceae	water lily	Nymphaea tetragona
	Typhaceae	oriental cattail	Typha orientalis
		Typha angustifolia	Typha angustifolia
	Hydrocharidae	black algae	Hydrilla verticillata
	Marantaceae	Thalia dealbata	Thalia dealbata
	Asteraceae	Aster	Aster subulatus

The above information shows that arbors enjoy the largest proportion. The commonly used plants include cedar, chinar, ginkgo, Chinese redbud and other plants, which not only have good ornamental value, but also have strong adaptability and cold-resistance. In addition, the cedar can contribute to noise reduction and virucidal bacteria release. As a green plant in the city, it has the cutting edge in coping with environmental noise; Chinese redbud has strong sprouting and dedusting ability, and are resistant to pruning and chlorine; The ginkgo is suitable for planting under the climate of the North China Plain due to its lifespan and resistance to cold and drought. In order to enrich the landscape, a number of shrubs and groundcovers were planted, including Hosta, Southern bamboo and other ombrophytes. Considering that shrubs

and groundcovers will be shaded by arbors, ombrophytes are chosen. As the research object is the waterfront landscape, aquatic plants are indispensable, reeds, Typha orientalis and other plants suitable for marshes, wetlands or shallow water are chosen to increase the diversity. As early as the Song Dynasty, Xuchang was known as the "City of Lotus", therefore, up until now, the lotus remains to be an essential plant in the waterfront landscape.

Waterfront Landscape Design Approach in Xuchang

1.Landscapes

There are many types of waterfront landscape designs in Xuchang. A flexible combination of water-friendly platform, wooden boardwalk and landscape bridge brings visitors different tour experience.

As one of the most frequent design techniques used in the urban water landscape, the water-friendly platform, takes its own advantages, narrowing the distance between visitors and the water landscape, so that visitors can better experience the different waterfront environment from the ordinary land landscape. The water-friendly platform in Xuchang waterfront landscape is mostly in the form of a jetty. With the change of the water barge, the jetty changes, straight and open or quiet and winding. Besides, the jetty serves as the observation deck. See Figure 2.

Figure 2 East Lake Park Boardwalk

Water can be inevitably relied on to design water landscape. The fluid water and different topography changes the speed of water flow, thus affecting the sound of the water flow to some extent. The waterfront landscape in Xuchang, through water flow, the stacking water and different topography, presents different water impact. Walking through the waterfront environment, visitors can not only enjoy a visual feast through watching the waterfront, but also experience nature's power aurally. See Figure 3.

Figure 3 The Stacking Water in Furong Lake Garden

The waterfront embankment plays an important role in the waterfront landscape, both stylistically and functionally. Different embankment forms have different impact on water body. The artificial embankment is mostly made of concrete or bionic stone, which is more functional to the water body. While the natural embankment can make full use of the purification of plants by choosing the right plant. Stylistically, the design of the embankment also affects the visiting experience. The embankment on the shore of the Qingyi River is made up of rectangular geometries of different heights, which is refreshing in shape and function. Several parasol pavilions provide a more comfortable environment for visitors, which can be considered as a finishing touch to waterfront landscape. The primary color, white, contrasts sharply with the surrounding environment.See Figure 4.

Figure 4 Partial embankment on the Qingyi River

2. Topography

As the space range of waterfront landscape consists of 200m to 300m water space as well as the adjacent urban land space, the area accessible to plan and design does not belong to large overall. Therefore, the vivid and intriguing space design relies on the rise and fall of topography instead of layout. The design of the micro-terrain in the land area of the waterfront landscape is based on the "reshaping" of the terrain structure and the mastery of the position, height, size and scale(Meng Zhaozhen, 1996). The traffic flow line is based on the terrain, and higher and lower slopes enrich the overall traffic flow line. The terrain height difference can also help create more entertainment programs, for instance, in the park design of Autumn Lake Wetlands a slide program is built to take advantage of the terrain, thus appealing to more kids. See Figure 5.

Figure 5 Application of micro-terrain

The advantageous topography not only gives a more interesting touch during the tour, but also plays a certain substantial role in environmental protection. The research found that rain garden design in Qingyi Lake and Deer Lake Park with the topographic difference, can better utilize the rainwater. Those plants in the higher terrain can be the first to be irrigated, and the remaining rainwater can be absorbed by the soil from top to bottom. The rain gardens and grassed ditches can contribute to storing rainwater, reducing surface runoff to some extent, and the remaining rainwater then drains into the river along with embankment. During the processes, the topographic difference expands the rainwater-irrigated area, and the rain gardens also lengthens the duration of rainwater.

Figure 6 The grass ditch along Luming Lake

3. Pavement material

The materials for the diverse functions of the waterfront landscape are different. In Luming Lake Park, due to the jogging track by the lake, plastic material is used to provide a more professional venue for the exerciser. The antiseptic wood is adopted in the waterfront boardwalk because of the experience of the visitors, which can help them commune with nature. Besides, the water vapor requires strong wood corrosion resistance. In the design of the rain garden, more pebbles or other gravels are used to cover, and the stone gap can purify the water washed by the rain and block the silt or dry branches. The embankment materials are mostly grass tiles, not only reshaping embankment but also adding natural elements with plants and water, thus reducing the destruction of ecological microcycle.

Existing problems of waterfront landscape in Xuchang

1) The shortage of immersive landscape

In the waterfront landscape design, there are a variety of landscape forms, but immersive landscape seems to be rare. Although the current landscape effect will leave visitors an impression of beautiful environment and pleasant scenery, it fails to bring people the immersive experience. Simply speaking, immersive landscape is not disturbed by the external environment. A combination of plants, landscape and water bodies can help create an environment with “fragrant flowers, green willows and gurgling water”. The wonderful mix of vision, smell and hearing improves the landscape to a high level, thus further enhancing the experience of visitors. In this regard, the waterfront landscape in Xuchang is devoid of immersion landscape.

2) Inadequate post-maintenance

Among the current problems, the lack of post-maintenance seriously affects the overall effect, especially the waterfront landscape. Apart from failure to immediate cleaning of common dead branches and dry grass, the maintenance of the cleanliness of the water body can be considered as an indispensable part. On one hand, the cleanliness of the water will affect viewing effect; on the other hand, if long-term water pollution will emit unpleasant odor, making visitors unbearable. This research finds that the poor post-maintenance of the plants has had negative impacts on the environment, ranging from a loss of plant vitality to the emergence of barren land. See Figure 7.

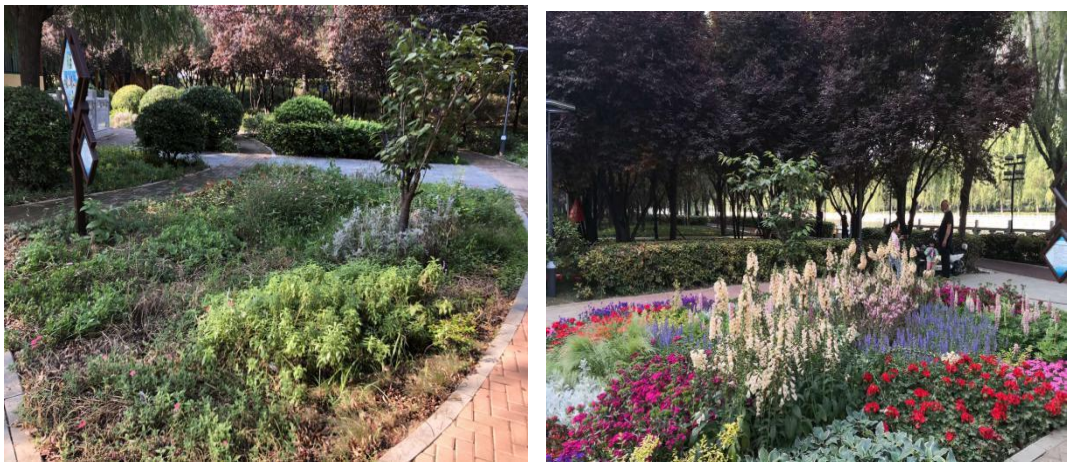

Figure 7 Comparison of the same location along the Qingyi River

3) Planting issues

Xuchang has a warm temperate sub-humid monsoon climate and is rich in heat resources, with more rainfall, sunshine and long frost-free period. The city enjoys four distinguishable seasons. In spring it is dry, windy and sandy; in summer it is hot and rainy; in autumn it is sunny and cool with long light period; in winter it is cold with less rain and snow. four distinct seasons. The research finds that the current plant species of waterfront landscape in Xuchang is rich, basically meeting the standard of four evergreen seasons. Considering the plant seasonal changes, we can choose fruit trees like pomegranate, which can satisfy the demand of appreciating the leaves and viewing the fruit, but there are still certain deficiencies. In the autumn and winter, more evergreen plants can be an option, and further adding more plant colors can show the vitality of nature in each season.

Solutions to existing problems

1) Enriching landscape forms

In order to address the above-mentioned problems, the form of landscape can be diversified. Apart from subjective appreciation of the environment and improvement of the atmosphere created by the environment, we need to enlarge the subjective output from the objective aspect, making tourists the recipient of the environment. In the landscape we can design the cherry blossom avenue and ginkgo promenade from the perspectives of visual and olfactory senses, appealing to visitors. The fishing platform can be set for fishing enthusiasts, thus making the waterfront landscape more popular. The richness and variety of landscape forms will also allow the viewers to fully experience the picturesque beauty of the landscape.

2) Strengthening post-maintenance

For post-maintenance, manual actions need to be taken to solve the problem. The competent department should be equipped with reasonable arrangement of work schedule, timely discovery of waterfront landscape problems so as to solve them. In particular, in the autumn and winter, more patrol inspection should be made. In terms of long-standing problems like fallen leaves and dry turfs, solutions should be made in advance. As to rain garden in waterfront landscape, inspection and cleaning should be done so as not to block the channel and affect its use in the rainstorm or snow weather.

3) Reasonable plant furnishing

(1) Choice of plant species

In the selection of plant species, plants should adapt themselves for what the local conditions are. The analysis of climate and hydrology in Xuchang can help us select the tree species suitable for climate growth and pest-resistant. Besides, the native plants can also be adopted, which not only have significant advantages in adapting to the climate, but also can reduce cost and ensure survival rate to a certain extent.

(2) Functionality of plants

The waterfront landscape plants require aquatic and water source plants to have certain decontamination, purification and rainwater retention capacity. In addition, they should also have high ornamental value featuring graceful posture, brilliant colors, and rich seasonal phases(Lu Yuhuan,Luo Min,et.al.2017). The plants' characteristics can help solve the problem of oxygen content in the water and inhibit the growth and growth rate of algae, thus playing a positive role in water cleanliness and having a better impact on the ecological micro-circulation of the embankment.

(3) Ornamental value of plants

The ornamental nature of the plants is directly tied to the landscape. The selection of plants should take the seasonal phase and color into consideration, thus different characteristics showing in four seasons—flowers in spring, leaves in summer, fruit in autumn, fragrance in winter. In addition, changes should also be made in landscape layers. Different plant height can contribute to multi-layer design so as to increase the visual changes and avoid monotony due to similar scenery.

Discussion and conclusions

As an indispensable and irreplaceable source of life, water is essential for production and serves as the basis of ecology. Water ecological civilization based on the integrity, beauty and deep culture of water ecological system is the resource base, important carrier and significant symbol of the ecological civilization construction. Nowadays, the living standard is improving, so that everyone requires more on the city landscape and puts focus on transferring urban water system. The waterfront landscape, as an important part of the city landscape, not only bear ordinary urban greening, but also play a bigger role in climate micro-circulation within the city and the integrity of the ecosystem.

Through the field investigation of waterfront landscape in Xuchang, this paper makes an analysis of the current situation from many aspects. And a summary of the shortcomings during the existing stage can help provide research ideas for the future design of Xuchang waterfront landscape.

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