

A STUDY ON SUSTAINABLE RIVERFRONT LANDSCAPE DESIGN: ON DESIGN
STRATEGY BASED ON ECOLOGICAL RECOVERY AND CONTEXT PROTECTION

By

CHEN CHEN

A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN
ARCHITECTURAL STUDIES

UNIVERSITY OF FLORIDA

2011

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To my family and friends

ACKNOWLEDGMENTS

I would like to give my fondest regards to my parents. They are the ones who imbued me with a philosophy of living that made this research possible. They provided hope and encouragement to me during my moments of despair.

For their concern and attention, my utmost respect goes to my professor Tilson, William L. and Carr, Margaret H. Without their great care, precious advice and responsibility, my thesis could not have been successfully finished.

There are others as well who assisted me greatly: those teachers who lectured over the past academic year and authors, whose works furnished me with critical information that made this research possible.

Once again, a heartfelt thanks to the afore-mentioned people, who have nurtured and inspired me.

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Abstract Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Master of Science in Architectural Studies

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Chen Chen

December 2011

Chair: Tilson, William L
Cochair: Carr, Margaret H
Major: Architecture

Rivers are the cradle of civilization and, as such, are indispensable features of urban history. Riverfronts are not merely unique spaces in a city, but also the most representative region which reflect the local character. Since the Industrial Revolution, urban population and the need for land have increased rapidly; a good many riverfront spaces have been occupied, resulting in the deterioration of water quality. Over time, urban riverfronts have become undesirable, and even detested places. In recent years, urban transformation, improved technology and the adjustment of industrial structure have provided many opportunities for the redevelopment of riverfront areas. Urban riverfronts have become an important resource for development, and have for many cities have because the dynamic of districts. Meanwhile the social, economic, and aesthetic values of riverfronts have been reexamined. The aim of this research is to explore an urban riverfront landscape design approach that meets the needs of sustainable development. The research also examines the natural evolutionary process through which the harmonious coexistence of man with the environment can be maintained. Therefore, this research is of a vital importance to the sustainable

development of the urban environment, economy, and society. To that end, I have chosen six distinctive cases from North America, Europe and Asia for comparative analysis. With pictures, charts and diagrams, each case is systematically categorized, analyzed and then summarized by the findings.

Urban redevelopment strategies along a river would be sustainable with three measures: ecological river system restoration, historical context protection, and the humanistic extension of urban open space. To restore natural ecological functions, a design layout must be functionally optimized, respect natural forms, foster river biological communities and encourage natural purification capability. To protect historical sites, a design must maintain the city's cultural heritage, create a spirit of identity and a sense of belonging, and improve the city's aesthetics. To extend public recreation spaces, a design must create diversified and recognized spaces, generate and improve functions, develop more places near the water, for human use, promote more people-friendly spaces and promote harmonious and healthy developments for both society and the environment.

CHAPTER 1 INTRODUCTION

Water gives birth to human life and civilization; accordingly, a unique fascination emanates from the riverfront. Many famous cities all over the world are generally located at the junctions of rivers and seas. These last two features allow for convenient transportation and multi-cultural integration, which imparts its unique charm to these cities. Among seventy-five large scale cities in the U.S, sixty-nine cities are located near rivers and lakes, which provide drinking water, convenient transportation, abundant natural landscapes and moderated temperature, thus riverfronts are those cities' most valuable natural resource (ICE, 2003). The city becomes a poem because of its rivers, such as Paris near the Seine, London near the Thames, Berlin near the Spree, and Vienna near the fabled Danube. Some remote, seemingly insignificant cities attain fame because of their legendary waters, like Lijiang and Phoenix of China, and Heidelberg and Lubeck of Germany. However, with technological renovations and industrial transformations, the scale and structure of cities change. The central city industries have moved to suburban regions. The original riverfronts with nearby industries have declined in recent recessions. This has resulted in outdated and even obsolete machinery, and sub-segment deterioration of the environment. The imbalance of the natural systems due to excessive industry has forced riverfront regions to compromise environmental quality for industrial productivity. Some rivers become little more than city sewers and garbage dumps.

Research Objective and Scope

A unique space in a city, the riverfront is a general term for a land and water interface. Consisting of water regions, water lines and land, it acts as a transitional

space from the city to the water, with both the edge of the land and the water, including certain water and the adjacent urban lands (Liu, 2005). It is also an urban public open space with natural and cultural systems, including not only abundant natural landscapes but also material spaces and cultural landscapes. It is also an urban landscape node, an important location for tourism and the paragon of city development. It is an historical carrier of the city soul, and also a spatial location for the spiritual meditation of the citizens. According to the aquatic character of different regions, the urban riverfront can be divided into riverfront, lakeside, and seaside, etc. Urban riverfront landscape design is an analysis on the city's water systems itself and the overall environment landscape design, which includes the landscape layout, landscape restoration, environment protection and management strategy. This work is to find some efficient way to resolve the problems and explore design methods by way of scientific, reasoned analysis.

Background of Riverfront Landscape Design

In recent years, urban industrial transformation has provided many opportunities for the redevelopment of riverfront areas. At the same time, successful cases of previous riverfront development earlier in Europe and America make people realize that riverfront development has enormous social and economic value. Meanwhile, the riverfront has plenty of urban landscape and historical value, which makes it an energetic ecological and landscape region. Due to the limitation of understanding and the disconnection between government departments, the majority of transformations in riverfront areas of today have been attended by different departments: for instance, the water conservancy department, which only stresses flood control and irrigation; the transportation sector, which emphasizes water transport function; and tourism, which often only considers the value of sightseeing. These departments perceive the water as

an engineering entity, rather than an urban public space. Unfortunately, these official bodies tend to fail to consider the psychological and physiological needs of the people. For my native of China country, one with extensive urbanization, we lack of not only large scale continuous landscape renovation and old city recovery, but also improvement of urban environmental quality, especially, riverfront ecological systems. The arrival of the landscape architecture discipline in China is late; while short term benefits, rather than long term benefits are always considered, ecological benefits are frequently ignored (Han, 2010). There are some typical problems in riverfront landscape design; these are listed as follows:

Lack of Ecological Awareness

In the reconstruction process from a natural river channel to an artificial one, only the issue of safety has been taken into account, while the impact of engineering and construction on the ecosystem, flora and fauna, and microbes is not considered. With the diversity of river morphology much reduced, the ecosystem has changed and the ecological balance has been destroyed. Although large-scale drainage is advantageous to flood control and management, the city's capability of restoration, self-purification and self-recovery has been reduced, followed by the disappearance of natural wetlands and water pollution.

Generally, in engineering, technique has applied to urban riverfronts include straightening, stone revetments and removal of sand bass and after naturally occurring obstacles that filter water and create micro habitats. Whereas, as an important component of urban public space, the technique may cause imperceptible negative impact either. The artificial riverbank has broken the initial nature character of the riverfront and made the river diversity into singleness, which changed the original forms

of the eco-system. Meanwhile, the vertical steep artificial masonry and revetment makes the riparian zone into cold space, which lacks interest, thereby isolating people from water.

Because of the lack of effective scientific means of governance, river water pollution is becoming more and more serious. Many cities pour industrial and domestic sewage into rivers, without strict management; rivers have become drainage ditches. If this practice is not curtailed, the environment will falter and new sources of pollution will eventually threaten humans as well as native flora fauna.

At present, China has made great achievements in the control of water pollution though the use of riverfront plantings. The Water Park in Chengdu is a success story. The Fu River and Nan River, which located in Chengdu, have been transformed a large area of shallow water and planted a large number of aquatic, marsh plants to filtrate the pollutants. Compared with common sewage treatment, the water purification method of wetland plants is a relatively inexpensive and a long term multi effective approach. It could be further used for transformation of green space along urban riverfronts.

Ignorance of the Historical Context

Because of the difference of climate, hydrology and geography in different regions, the world forms abundant cultures and landscapes. At present, many landscape design projects, blindly following the beautification movement, and simply pursue modernization. This approach lacks individuality and character, preferring homogeneity over the innate quality that makes a place distinct. It tends to ignore local characteristics. Some city's riverfront projects are hastily design square green spaces along riverfronts without thorough planning guidance, strong concept and clear design themes. They

ignore the potential conflict between modernism and national and local culture, and moreover lose spatial legibility.

Riverfronts typically have rich historical resources and heritages; however many current riverfront projects have ignored traditional culture and local characteristics in the application. Meanwhile, the urban riverfront design and planning cannot be well combined with traditional culture. Some buildings are repaired, rather than removed from the original material carriers, which damages a large number of old buildings. Moreover, existing buildings or sites are not taken into consideration by local people who design large scale project, which seriously destroys the original riverfront features and profiles, and artificially separates the city's spatial form.

Narrow Public Space

With the expansion of macro scale and middle scale cities, land resources have become more and more valuable. And efficient utilization of land resources has become more pronounced, which has always been the target for reducing urban land pressures. In the documentation of urban planning, there are no indicators about public leisure space proportion and area, etc, which makes some projects hard to be completed. Secondly, riverfront developers often try to appropriate riverfronts for their own private areas, which reduce public and leisure space as well.

Meanwhile, riverfront public space design lacks humanistic considerations. This deficiency can be subdivided into three aspects: firstly, lack of a public footpath along the riverfront region. Secondly, cases hardened which cuts the relationship between the people and the water. The hydrophilic form was singleness, which lacks of absorption. Thirdly, it lacked the transition and connection between the riverfront and the other public spaces. It also lacked of open space and many big-scale buildings and walls

have hindered the view lines, which broke the links between the people and the riverfront regions.

Backward Hydrophilic Space Design

Hydrophilic space is a riparian edge and adjacent open space. In some middle scale and micro scale cities, the lack of funds and general underdevelopment impedes effective riverfront reforms. Due to insufficient research, hydrophilic space is less. The best outcome here is that people can just be bystanders, contemplating the view, but never feel a sense of being part of it.

The riverfront space environment is a combination of a series of relevant elements and human relationships, the most important of which is the human centered principle, which means: constructing high quality cultural environment, lively urban building groups and open spaces, constructing fine and comfortable riverfront environment, regulating fine keeping locations, accompanied by some relevant installations, enhancing the urban cultural environment and giving enough respect to the environment. The landscape designer should be cognizant of all these features, and stand in the stead of the viewers, considering hydrophilic aspect of the landscape design; he should facilitate the sense of communion and intimacy with nature. An impression that might even impart makes a sense of identity and belonging on the part of those contemplating the riverfront.

The Significance of Research

After the review of relative theoretical research and practical case studies, it is evident that a lot of riverfront landscape designs are focused on function and form. In the development of riverfronts in China and Western modernism landscape models are copied. The result is monotonous landscapes styles, alien to the region's individuality.

Furthermore, the lack of customized design in modern landscape results in environmental damage. This aping of the West lacks systematic research from ecological, cultural, and humanistic standpoints. The aim of this research is to explore a kind of riverfront design landscape model which meets the needs for sustainable development. We also examine the natural evolutionary process, by which it maintains the harmonious coexistence of both man and the environment. This research is of vital importance to the sustainable development of urban environment, economics, and society.

Eco-situation Improvement

Riverfronts are the typical interacting area of a city. Ecologists term a space with two different kinds of environment an interacting area. The energy, matter flow and exchange are very frequent near water, which results in bio-diversity and high production (Feng., & Zhang. 2002). Like this eco-process, river plants consist of a variety of species and form a complex natural structure. Different kinds of riverfront terrains provide a livable habitant environment for different kinds of creatures. This is landscape basis for bio-diversity. As the city veins, rivers can improve both the climate and environment. It can be accurately styled the “urban lung”. Therefore, when we design riverfront landscapes, we need to consider the eco-balance of riverfront environments and try our best not to damage riverfront ecosystems and bio-structures.

Maintaining of Historical Context

Lewis Mumford thought that the city is not just a place for living, working and shopping, it also reflects the urban context and cradle for a new civilization (Mumford, 1961). Protecting the continuity of urban landscapes, the local characteristics of architecture, and people’s memory of individual streets meets the need of civilization

development. In other words, it is the practice of sustainable development. Riverfronts are usually the origin of human civilization in the historic context. In riverfront design, we cannot only focus on short-term interests and material managements; the protection and cultivation of urban culture is likewise of profound relevance.

Modulation of Micro-climate

In a riverfront area, as land and water have different underlying surfaces, the degree of absorption and reflection of solar radiation differs. Riverfronts with a large area of water can capture and store much more solar radiation. As the heat capacity of water is greater than that of land, its heating and cooling rates are much slower than those of land. Air circulation appears above both elements, resulting in the cool, fresh, moist "surface wind" that we usually feel near water. On the one hand, the process of air circulation between land and water, through the solar heat into latent heat, plays a role as natural air conditioner. To the summer and low latitude area, the climate process is a most obvious advantage different from other parts near the riverfront. On the other hand, the adjacent bodies of water adapt and promote the exchange of air between water and land (Dreiseitl, 2001).

Riverfront city regulation is usually an important means of urban micro-climate. The quality of maintenance for a riverfront is to be assessed by city planning's dedication to the continuation of life, not only perpetuating the water cycle, soil conservation, water flood, water conservation features, adjusting the temperature, air purification, dust noise reduction, ease the urban heat island effect, effectively adjusting the city's climate and environment; in a word, promote sustained and healthy development of the city.

Development of Public Space

As Lewis Mumford said, "the first city is home to gods, but at last city transformed itself into the main site for human" (Mumford, 1961). He believed that the city is not only a creation of human society, but, in turn, the city also regulates, shapes people's thinking and behavior. The city can have a transformational influence of the very mind and soul of both its inhabitants and visitors. Urban riverfront as part of urban public space, has important functions like providing a comfortable, safe space, with pleasant hydrophilic aspects, which encourage recreation, learning, exercises, and enhance interpersonal communication between citizens, City Bin water area should be designed to provide a wide range of activity, to meet people at different levels, different needs; the environment must be close to people's daily lives, to facilitate contact and make people feel warm; it should attract participants to activities and induce them to their creative potential, and thus a greater range of social interaction, exchange of ideas and cultural sharing. Through the riverfront, people can have more exposure to nature, to new friends, influence people's habits, shape social trends, enhance a sense of social awareness, and foster the modern, yet traditional, way of life, promote social harmony.

Promotion of Tourism and Motivating Local Economy

Riverfronts are a gift of and a valuable resource for humans. Whether it is a traditional water city like Venice, Suzhou, or a modern coastal city like Dalian, Qingdao, distinctive waterways become the most agile and vivid parts of a city which attracts many people. Riverfront landscape is a good carrier reflecting city's character, conveying very local charm to people. A riverfront is not only rich in natural landscape resources, but also maintains abundant cultural landscape resources. Riverfronts provide entertainment venues for swimming, fishing, rowing, water skiing, skating and

other water activities in a city. Landscape planning of riverfronts can revitalize the local economy and promote the development of tertiary industry.



Figure 1-1. Seine River in Paris. (image by Jinlon Sun. Posted on July 1, 2010. Source: <http://www.nipic.com/show/1/73/63f210d485084098.html>) Edit by author.



Figure 1-2. Heidelberg of Germany. (Image by Zhuxitianxiang. Posted on September 16, 2011. Source: <http://www.nipic.com/show/1/38/5121210ka70bcb5b.html>) Edit by author.



Figure 1-3. Lubeck of Germany. (Image by Tom Galvin. Posted in 2006. Source: http://www.tompgalvin.com/places/de/schleswig_holstein/luebeck.htm) Edit by author.

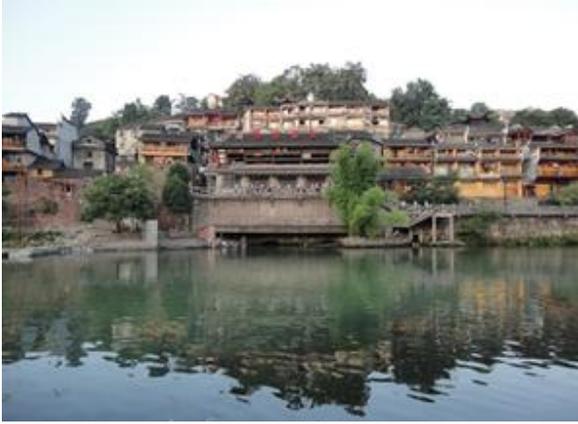


Figure 1-4. Phoenix of China. (Image by Wuhan Views Film. Posted on August 20, 2011. Source: <http://www.nipic.com/show/1/48/4986832k0aeffc1e.html>) Edit by author.



Figure 1-5. Lijiang of China. (Image by Yunqian Pan. Posted on March, 31, 2010. Source: <http://www.nipic.com/show/1/62/2a1d6ecb36d0d4b4.html>) Edit by author.



Figure 1-6. River canalization separates people from water. (Image by China Five Circles News Net. Posted on May 31, 2010. Source: <http://roll.zjol.com.cn/09rollnews/system/2010/05/31/016649644.shtml>) Edit by author.



Figure 1-7. River sclerosis damages the ability of water renewal. (Image by Jiguandong Travel Net. Posted on July 20, 2011. Source: <http://luoyang.lotour.com/jingqu/02102956/article/6672.shtml>) Edit by author.



Figure 1-8. Lack of local characteristics by copying western styles. (Image by China Travel Net. Posted on October 13, 2009. Source: <http://photo.aiutrip.com/pic/2007-12-17/17408986.jpg>) Edit by author)

CHAPTER 2 LITERATURE REVIEW

Relation Concept of Literature

Sustainable Design Concept

Yu, Kongjian. *Go Back to Land*. In this book, the author has mentioned both the character and the contents of the sustainable landscape design. The essence of sustainable landscape design is to respect the natural evolution process, use nature's regulative ability to the utmost, utilize the natural recovery ability to the utmost, utilize and protect the natural resources to the utmost and lastly utilize nature's ability to purify itself to the utmost. There are three contents in sustainable landscape design: firstly, when dealing with the impact of non living phenomena, make full use of the natural resources; secondly when dealing with the impact of the living things' natural process, call for plant and animal diversity, protect the living spaces' diversity; thirdly, when dealing with culture protection, propound that the cultural heritage become a part of the regional culture. Protecting the regional culture heritage can help to maintain the culture's continuity and also supply consultations for future development.

Concept and Category of Riverfront

Liu, Bingyi. *Urban Riverfront Landscape Space Design*. In this book, the author has systematically introduced us to the concept of riverfront landscaping, the characters, the construction styles, elements, history background, development trends, planning principles, guidance principles and planning methods, etc. It is also a universal textbook. , Liu has proposed the ecology is one of the most important guides in modern environmental landscape design. The target of urban riverfront landscape design is to

reach a high level of harmony between human beings and water, creating an energetic and healthy urban riverfront landscape environment.

Aesthetic in ecology is guaranteed by the continued movement of life, which follows the law of the cycle of matter and the energy balance. It is not harmonious if the riverfront landscape is destroyed, the resources are lost and the environment is polluted. The concept of harmony in design means that human beings and the ecological system can receive benefits at the same time, creating a harmonious environment between the artificial landscape and the nature landscape, satisfying the needs of the body and the mind; these are also characteristics of sustainability.

Ecological Design

McHarg, Ian L. *Design with Nature*

MacHarg has extended the research range of the traditional “rule” and “design” to a large extent, raising it to the height of ecological science. The author thinks that human beings and nature exist mutually. According to the Landscape Recovery Program, ignorance or disregard for natural laws will have dire consequences for humanity if unchecked. Nowadays, humans are faced with the environment crisis, which is produced largely by people's neglect and exploitation. We must give up the concept that humanity is the center of existence. In the process of design, we should respect natural conditions, ecological conditions and reduce humans' interference.

MacHarg argues that all and plans should be an integration of history, physical, and biological development processes, which is dynamic and a process of nature evolution. We need understand the inner mechanisms of these e evolutions before we make decisions on how to utilize natural the nature resources. By practicing this, we can utilize the land more effectively and adequately, and raise the social value of the lands

as well. That means that we need know the inner ecological adaptability of every piece. Plans are needed to consider the requirements of land composition before commencing utilization. The ecological adaptive research is providing resources about this aspect so as to build the ecological data base.

Before design, we need consider natural resource sufficiently, which includes the natural evolution process, local natural resource styles and the layout character, etc. The design should be based on the natural resource category and valuation, and then propound the exploring projects style and levels, according to different environments. While investigating some New York riverfront regions, the design had divided the land resources to 8 kinds, and then sorted out all the varieties, according to the projects' adoption. And then the most favorable land style to be explored was chosen, which optimized natural resources; this endeavor seems to hold promise for similar future projects.

Macharg's main contribution is that he has assisted in changing the human centered interpretation of the world, and raised landscape design to the height of international awareness, as well as spearheaded a series of methods about land resources category, valuation and classification. With the implementation of these methods, we have optimized the natural resources and guaranteed land resources' sustainable utilization. When the methods are used in the riverfront planning, we can expect scientific planning that considers natural resource styles and t layout characters.

Yu, Kongjian. *Landscape: Culture, Ecology and Perception*

Yu, Kongjian embraces the traditional planning mode that pursues the artificial order and influence, emphasizing the ecological adoption of all kinds of lands, reflecting the intrinsic value of nature resources.

He has also proposed the basic design principle: Natural privileged principle “protecting the nature resource, defending the nature is the premise of utilizing and reforming of the nature” (Yu, 2009). Total design principle: Ecological landscape design is an overall design that aims at a total ecological system, not a single design that aims at just one landscape element. It’s a multi-target design, designed to meet the need of humans and animals both, and designed for both high production and aesthetics. Adoptive design principle: nature landscape has its own harmonious and stable construction and function, thus, artificial design must adopt the inherent law of the natural landscape, making the side effects of the landscape element, brought by human beings minimum, and guarantee the integrity of the total landscape construction and function. Multi-subject integration principle: All kinds of nature landscape are the resource target for natural sciences and social sciences; by combining the multi-subjects can we design an ideal ecological landscape, and guarantee the harmony and stability of the total ecological system. In the process of modern riverfront region reconstruction, Yu rejected the method of hardening the river channel and straightening the river line, intended to respect the natural shape of the channel and utilize its natural conditions to store and purify water, while reducing the artificial elements to a minimum.

Forman, R.T.T. *Landscape Ecology*

In this book, the author has mentioned a flexible landscape structure layout mode and basement-corridors-plaque. This kind of layout mode has considered not only the diversity of ecological resources, but also the landscape resources scales. In our daily lives, there may be many kinds of styles, forms of the ecological resources in the region, some of them are centralized, which possesses the scales to be protected; some of them are decentralized, and have therefore not reached the level to be protected

(Forman, 1986). However, these micro-ecological regions have typical values on the other hand, so the method to divide them into plaque forms, and diffuse them onto the basement is a fine choice. Then all the plaques are joined together by the corridors, which guarantee the smooth transitions of the biological cycle and increase heterogeneity and abundance.

In riverfront planning, a river can cross different regions, and different regions have different resources layout characters, as well as groups' styles and the scales. Therefore, by using the method of corridors and plaque, the efficiency and continuity of ecological resources' abundance can be guaranteed.

Landscape and History Context

Mumford, Lewis. *City in History*

Mumford, Lewis combined the activities of the cities' religious, political, economic, and social qualities, with the evolution of the urban scope, construction, forms and establishment,; and reveals the inter-relations and transactions between the two aspects. Meanwhile he also revealed the layout of a city's constructional function relevance to the city's culture (Mumford, 1961).

In this book, the author has emphasized the relationship between the city and culture. In Lewis Mumford's opinion, the city can not only provide physical space for living people but also t conveys, converts and gestates the culture. He proposes that the city is the target for the research of the politician, philosopher, economist, historian, artist, ideologist, geographer and urban planners.

In Mumford, Lewis's opinion, people themselves create cities and the cities regulate and influence, in various ways, the thought and activities of people. In this book, there is a sentence: the "city is the family of the god initially, but at last, the city itself

becomes the main place that reforms the human.” Humans enhance their environs, enrich their lives by urban development, and even supplant the god themselves (Mumford, 1961).

Riverfront regions, usually the first choice for human location, are the birthplace of all civilizations. It is also the depository of the history of city development. Therefore, the protection of historical elements can help supply many consultations for future development, which are also important measures to raise city recognition levels. So, when planning the urban riverfront, it is better to consider it from the height of urban development history and enhance urban culture fascination.

Yu, Kongjian. *Go Back to Land*

In this book, the author states that the regional land utilization pattern and the regional residents themselves are the summation of the natural ecological and culture processes. The land pattern and building forms are tested by the natural environment; the basic forms adapt to the regional nature. Environment where there are regional ecological experiences, which reflect the ecological evolution process in local culture (Yu, 2011).

Wang, Xiaojun. *Western Modern Landscape Design in Theory and Practice*

Wang, Xiaojun analyzes the character and history of western classical landscapes; this includes examining the modern garden, its style formation, the main gradient of modern landscape design briefly, and introduces conceptualism and ecological design. The book has mentioned that “reading about the conceptualism deeply need to deep into a spatial spirit area, and focus on the traditional cells” (Wang, 2003) To some extent, every design is just creating a space, but the designer can comprehend the real location spirit only by experiencing the inner character implied in the location; this intimacy

reveals both the culture or natural physics sufficiently, making the design itself a aesthetic textbook, concerned with the process of the location's nature, history and evolution.

Rapoporz, Amos. *House Form and Culture*

In this book, the author speaks of the simple ecological technology of traditional house styles and structures. The adaptability of the traditional house is formulated according to three typical climate backgrounds: thermal region, wet-thermal region and cold region (Rapoporz, 1969). Rapoporz's analysis reveals that traditional houses are the result of the natural optimization choices.

Humanistic Riverfront Space Design

Dreiseitl, Herbert. *Recent Waterscapes - Planning, Building and Designing with Water*

Dreiseitl, Herbert thinks that water is becoming an increasingly important element in urban design. Water is not only the in the architects' interest, but also has enormous attraction to the public, whether pumping water to the building system or looking at the cooperate elements in urban regions. The attraction force was revealed by dramatic water design. Meanwhile the application of water in urban design is not only artistic, but is also present in landscape and the architecture. These successful experiences have great values in enhancing community activities in the riverfront space.

Simonds, John O. Influential *Landscape Architect*

Simonds, John O addresses the importance of climate in design with brief and practical terms. He also creates some guidance for living conditions that are more agreeable with the background of urban and regional settings. In this book, he combined the humanity's water loving psychology with the regulation of methods of

riverfront space, and proposed a series of entertainment installations to satisfy people's curiosities and the spirit of exploration (Simonds, 2005).

Liu, Bingyi. *Urban Riverfront Landscape Space Design*

In the book, the author has mentioned some kinds of riverfront active spaces, according to human psychology: Leisure activities, aesthetic activities, science and technology activities, entertainment sports, health care activities and community activities, etc. influence citizens' lives. That means that designers should consider all the requirements of the communities, protect the public benefits, raise the citizens' awareness of environment protections, and create a riverfront space that is enjoyed by the citizens (Liu, 2005).

Tang, Zhengyu., & Zhang, De. *Urban Riverfront Landscape Design*

Basic road traffic principle: urban riverfront areas are often a collection of underground traffic, water traffic and ground traffic. It is also a location for citizens' leisure. Supplying the convenient traffic line, it also constructs the relationship between human beings and nature (Tang., & Zhang. 2006). Therefore, the riverfront landscape should follow the principle of continuity, accessibility and stop-ability.

Riverfront Classification

Urban Industry Layout and Functional Types

As cities' industrial layout and functions, the hydrological characteristics of rivers and geological conditions are different, urban riverfronts throughout the world face different problems. To remedy various problems, methods and strategies relevant for the transformation of certain riverfronts may not be applicable to others. In order to analyze and compare, the results of the study must be both universal and specific. According to the reality of the city's industrial structure and function, we divide the

riverfront city into four types: political or cultural city, economical or regional city, old heavy industrial city and new small or middle city. We perform some comparative analysis research on the status quo and problems confronting different types of riverfront cities (Liu, 2005).

Political or cultural city riverfront landscape planning

Paris, London, Berlin, Vienna, and Budapest are belonged to this type. The Seine River Project in Paris is a typical case. Original city's industrial layout and functions: Political, economic, cultural center administration management, transportation, commerce and manufacture. Original river improvement measure and functions: River dredging, sectional curved and straight, canal building the dam, ensuring flood control safety, ensuring free shipping, and providing domestic water.

Current city's industrial layout and functions: Political, economic, cultural center, Pillar industry: Financial Service, administration management, transportation, culture and education, medical and health work, scientific research, information business, exhibition and tourism, etc.

Challenges: Because of the adjustment of industrial structure, the original more polluting, energy-intensive industry moves to suburban areas, while urban centers now have some clean and green industries. Urban pollution is not as serious as what it used to be. Due to the limitation of original urban patterns and municipal engineering and conservation regulations, the problems riverfront management face include narrow spaces, poor public green spaces and aging of service facilities. Inaccessibility and poor continuity are encountered in some cities as well.

Goals: Develop different kinds of riverfront, improve humanistic service facilities, improve vertical greening rate, water quality monitoring and control tourist traffic flow,

improve the continuity of the riverfront space and accessibility. However, riverfront transformation is limited by many factors, like the pattern of the old city and municipal facilities. And municipal facilities are limited by the Cultural Relics Protection Law. Therefore, riverfront landscape design is basically an improved strategy. On the basis of the original riverfront, we should try to expand riverfronts as much as possible, and strengthen the axis of the river as a tourist line and enhance the link between the surrounding tourist attractions and public space.

Economical or regional city riverfront landscape planning

Brooklyn Bridge Riverfront in New York is a typical case. This kind of city has a complex function. Pillar industry includes transportation, commerce and trade, mechanical processing, metallurgy, chemicals, textiles, fisheries, and also some essential services: education, health care, food and beverage services. Therefore, environmental conditions are more complex. People need to consider limiting factors more comprehensively.

Original river improvement measure and functions: River dredging, sectional curved and straight, canal building the dam, ensuring flood control safety, ensuring free shipping, providing domestic water and industrial water.

Current city's industrial layout and functions: Economic or cultural center. Pillar industry: financial service, transportation, culture and education, medical and health work, scientific research, information business, etc.

Challenges: Traditional processing industry and manufacturing are generally located on the riverfront for the convenience of industrial water and transport. These industries cause large-scale, long-term pollution for the riverfront area and serious damage to ecosystems. The migration and decline of these industries provide

opportunities for the transformation of the riverfront. But due to historical reasons, these sites generally have a more complex terrain environment. They are an intersection of old industrial sites, water and land transportation centers and downtown businesses. Transport networks get together, municipal engineering networks stagger, high-rise buildings ubiquitous, green rate is low, and narrow public spaces abound.

Goals: These space are very difficult to design, so we must consider not only the environmental transformation of abandoned industrial sites and ecological restoration, but also provide public recreational open spaces for bustling business districts; and then adapt to the complex transport network. To save space, the main goal of the transformation of riverfronts is to make full use of the remaining industrial infrastructure, the integration of terrain, open public space, restoration of ecosystems, iconic industrial facilities, and retain historic features that impart character and individuality.

Old heavy industry city riverfront landscape planning

The Emscher River Project of Germany is a typical case. A heavy industry is the heaviest polluting business in cities. It consists of such things as refineries, cement factories, etc. It is considered a low-tier business, because it requires relatively easy finding resources, such as fuel and offices, and it employs mainly unskilled and skilled workers.

Original city's industrial layout and functions: Regional energy center: Pillar industry includes some high energy consumption and high pollution industries like mining, metallurgy and machining.

Original river improvement measures and functions: Provides industrial water and domestic water, river management mainly includes flood control and navigation flow.

Current city's industrial layout and functions: Due to technical updates, industry restructuring, these areas are generally in the process of decay. However, if the government's preferential policies and reform measures are effective, it will bring the vitality of economic development to these areas. The development of tertiary and light industry is generally a wise choice in these cities.

Challenges: Serious environmental pollution includes water, soil, and air. serious damage to ecosystem, vegetation reduction, biological disappearance and degradation of natural regeneration. However, these features transform riverfront landscape and have less constraining factors compared with some historical and cultural cities. Riverfront space tends to be more spacious with low population density. Urban land resources are not as frenetic as the central city.

Goals: The planning goal of the industrial urban riverfront emphasizes ecological restoration and designing with the respect to natural self-regulating system and renewable ability. Digestion of artificial factors within nature and restoring the river's natural form will entail nurturing the natural biological communities and restoring natural habitats. A pragmatic public space design and an energy efficiency and aesthetic-oriented strategy, aiming to minimize the damage of nature would be an ideal approach in this case. We need to consider the balance of both ecological and social benefits, as well as the integration of coastal restoration construction, moderated so as to provide public space.

New small or middle city

Original city's industrial layout and functions: Urban function is local administration management center. Pillar industry includes agricultural trade and traditional manufacturing.

Original river improvement measures and functions: River dredging, sectional curved and straight, canal building the dam, ensuring flood control safety, ensuring free shipping, providing domestic water and industrial water.

Current city's industrial layout and functions: Local Administration management center with financial service, medical and health work, economic or cultural center, agricultural trade.

Challenges: Two phenomena confront the cities of China. The city that underwent transformation, because of limitations of awareness level of the executive leadership, experienced some general problems like hardening of the river, drainage, lack of local characteristics, damage to ecosystems, and monotonous forms of water. The city which had not been transformed experienced narrowed public space is narrow and serious water pollution.

Goals: Restore natural river form, cultivate ecological communities, ecosystem restoration, and protection of riverfront historic features, maintain contextual heritage, providing a comfortable and pleasant public riverfront space.

Different Riverfront Styles

According to the city's geographic conditions and the relation of riverfront, we divide riverfront cities into four types: Cross-shape, Net-shape, Circle-shape and Linear-shape. There are different explain to each type as below. Different types have different features as below.

Cross-shape

Water cross-shape: The River flow across the city center and this kind of shape in an urban riverfront takes on corridor-like layout. River cross from the city center, such as the Seine in Paris, Los Angeles River, the British Thames, Jinshui River in

Zhengzhou, Neckar River of Heidelberg. This is a corridor-like distribution of urban riverfront, in which the river flows through the center of the city area with frequent human activities, high building density, complex transportation networks, and the riparian space is generally narrow. Moreover, rivers are easily to get contaminated. Because of the need for urban flood control, the levee form is a commonly used method like hard drainage; one single form design style, one single form green space, and rivers can't meet the function of biological purification.

The effective way to manage riverfront space is to transform the landscape design form as the river flows through the different sections. According to different forms of urban centers, we need rich green forms of riparian zones, which will improve the green rate, expand riparian public space, improve public facilities and the link with surrounding buildings and create ecological and cultural corridors in the riparian zone for the city. For rivers in suburbs, people should restore the natural river morphology; enhance biodiversity, and restore the function of the river as an ecological corridor.

Net-shape

Water net-shape: This kind of riverfront is scattered throughout urban space; either part or the entirety is distributed by a network, and the river divides the city. For example: the Spree River in Berlin, the Havel River, the Teltow Canal and the Rand Weil Canal. This kind of riverfront space is dispersed, and either the whole or part is a grid-like distribution. The river splits the downtown with frequent human activities. The environment is easy to pollute, and based on the need of river flood control and navigation, high dams are generally used; the river retains less natural habitats and landscape continuity is poor. So riverfront is in a hierarchy based on the size of the river, thus distinguishing their functions. According to the need to establish different forms of

dams, people can effectively control the water level, flow, and flow speed. For some non-shipping rivers, we should provide different forms of riverfront space; enhance the links among patches, greenery and rich green form, to create a comfortable and pleasant public space.

Circle-shape (or semi-circle-shape)

Water circle-shape: The relationship between city and river is that the city is encircled by the city-water system or semi-encircled, which includes peninsulas located in rivers. The relationship between these cities and water is that the city is surrounded by waters, or half surrounded like the river around the city, or city is located in the peninsula riverfront lots; such as Germany's Luebeck which is surrounded by the Trave River, a park in Manhattan which is surrounded by the Hudson River. Such city forms are patchy with open vision. As the riverfront is located on the city's edge, in the transition zone from artificial landscape to natural landscape, the design is more flexible, and easier to produce more lively forms. This kind of riverfront landscape design strategy is the mutual penetration of natural and cultural landscape, creating a natural transition effect. In the natural basement area, the introduction of artificial elements should be moderate, development of public space should be moderate minimize the destruction of nature and maintain the balance of natural regeneration and artificial losses. The introduction of natural elements in artificial landscape should be used as much as possible to improve the micro-climate by eco-means.

Linear-shape

Water linear-shape is formed when the river flows by, but not across the city. Rivers flow from the city suburbs, not through the city, such as Vienna, Charleston, etc. These cities have the same advantages as circle-shape riverfronts, like open vision, for

instance; they are in a transition zone from artificial landscape to natural landscape, so the design is more flexible, and it is easier to produce a more lively form. And such a riverfront space also has an advantage, because it maintains a certain distance away from the city, experiences the less pollution and less human activity, it features low building density, fewer design constraints, small difficulty of construction and low cost of engineering and construction. The design of such riverfront generally shows a progressive style of landscape structure. According to the frequency and intensity of residents' activities, the landscape undergoes a gradual transition, from cultural to natural; this form of distribution along the original riverfront area reserves ecological restoration for natural areas. There is also a dumbbell-type structure in the middle of the city and the river lot, to develop protected areas; this layout produces a staggered approach to the rhythm of the landscape, but the riverfront area of human space development should follow the principle of proportionality, so as to avoid the destruction of natural regeneration and pushing the limitation of human balance.

River Location within the City

The same river, because of the different reaches it flows across, has a different landscape presentation and construction; in order to research and analyze the general principle deeply, it is necessary to introduce all the reaches one by one.

Outer suburb

Outer suburb riverfronts define the landscape reaches out of the established city. Its character is the original ecological landscape, the shape is relatively natural. The protection of natural ecological resources for the suburban riverfront is beneficial. People should designate these places as ecological protection areas, with as little as

possible development of public space, thereby minimizing the interference of human activities with nature.

Boundary

The water boundary riverfront defines the region where urban and the suburban join together. The character of this type is that it accommodates industry, and has a low population density. The interface between urban and suburban areas is generally industrial, with a low population density and a high degree of environmental pollution. People should plan it as an ecological buffer or ecological transition zone, which means that it serves as a transition area from cultural landscape to natural landscape. Riverfront management plans emphasize ecological restoration, while taking into account citizen activities and appropriate developing projects for the public.

Downtown

In the region that flows across the city center, of both the population and building density is high. The river flows through downtown, with both banks dominated by cultural landscape; this is known as the cultural landscape zone. The riverfront is generally around downtown, like city business district or administrative office, with high building density and passenger traffic flow, and narrow riparian space. Plans focus on the improvement of function facilities along the river, increasing the green rate and creating a comfortable and pleasant recreational environment.



Figure 2-1. Seine River in Paris. (Image by Lixing Yan. Posted on March 1, 2011. Source: <http://www.nipic.com/show/1/73/4282962k69c68156.html>) Edit by author.



Figure 2-2. Thames River in London. (Image by Jinlon Sun. Posted on November 24, 2010. Source: <http://fsecity.com/show.php?id=100480&cid=392>) Edit by author.



Figure 2-3. Brooklyn Bridge Riverfront in New York. (Image by Zusheng. Posted on October 9, 2010. Source: <http://www.nipic.com/show/1/38/3763519ka1e7b5ca.html>) Edit by author.



Figure 2-4. Suzhou River in Shanghai. (Image by Jinlon Sun, Posted on February 20, 2011. Source: <http://www.nipic.com/show/1/62/4250940k4dcf62d8.html>) Edit by author.



Figure 2-5. Pairs water systems. (Image by Xinghui, Posted on July 8, 2008. Source: <http://mural.uv.es/vsilescu/IMAGENES/plano-paris.jpg>) Edit by author.



Figure 2-6. Berlin water systems. Image by author. Take on October 12, 2011.



Figure 2-7. New York water systems. Image by author. Take on October 12, 2011.



Figure 2-8. Luebeck water systems. (Image by Ylib blog. Posted on October 26, 2009. Source: <http://blog.ylib.com/jimyang/Archives/2009/10/26/12512>) Edit by author.

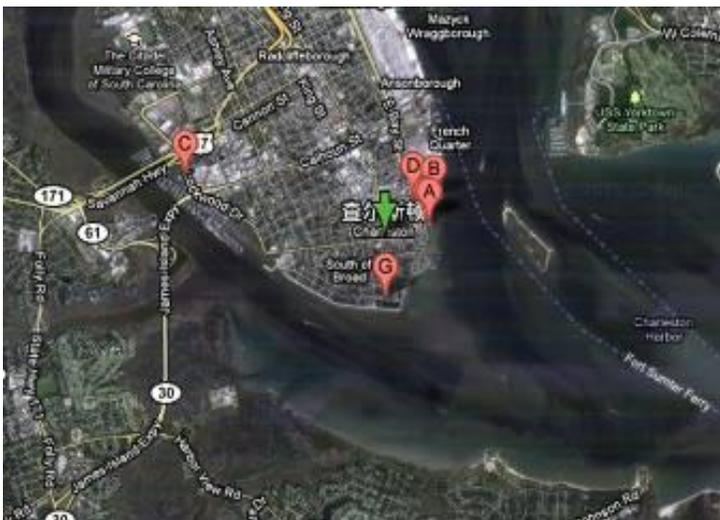


Figure 2-9. Charleston Cooper River in South Carolina. Image by author, Take on October 12, 2011.



Figure 2-10. 31 River reconstruction project in Dallas. (Image by Meixun Online Net, Posted on June 5, 2009. Source: <http://gardens.m6699.com/content-14302-1.htm>) Edit by author.



Figure 2-11. Cheonggyecheon suburban riverfront in Seoul. (Image by Divine Land Online Travel Net. Posted on June 14, 2005. Source: http://www.tour168.cn/sights/sights_des.php?sights=1074) Edit by author.



Figure 2-12. Emscher river industrial park in Ruhr. (Image by PATTY HUME. Posted on January 4, 2010. Source: <http://whereintheworldispatty.com/?p=490>) Edit by author.



Figure 2-13. Cheonggyecheon downtown riverfront in Seoul. Image by author, Take on April 19, 2009.

Table 2-1. Comparisons of conditions and planning goals of different riverfront styles

	Old industrial distribution	Current industrial distribution	Challenges	Planning goals	Typical cases
Political or cultural city	Administration management, commerce, transportation, financial service, science and health, light industrial	Administration management, commerce, financial service, science and health, exhibition and tourism, etc	River canalization, riverfront single form, low greening rate, limited by law on the protection of cultural relics, etc	Develop different kinds of riverfront space, increase vertical greening rate, monitoring water quality	Cheonggyecheon in Seoul
Economical or regional city	Transportation, commerce, financial service, manufacturing, chemical textile, science and health	Electronic information, transportation, commerce, financial service, manufacturing, science and health	Disorder transportation, narrow fields, serious pollution	Integration of terrain by riverfront industrial land, develop public recreation space, repair eco-system, protect industrial landmarks	Brooklyn Bridge Park in New York

Table 2-1. Continued

	Old industrial distribution	Current industrial distribution	Challenges	Planning goals	Typical cases
Old heavy industrial city	Mining and metallurgy, refinery coke, heavy machinery, etc	Electronic Information, science and Health, tertiary industry	Serious river pollution, damaged eco-system, disorder transportation, chimney and mine pits everywhere	Release the human effect to nature, cultivate different natural groups	Emscher River Project in Ruhr
New small or middle city	Administration management, manufacturing, trade of fruits	Administration management, light industrial, manufacturing, trade of fruit	River canalization, riverfront single form, no local personality, etc	Restore river natural form, cultivate different natural groups, protect riverfront history	Lijiang of China

Table 2-2. Comparisons of different riverfront conditions and planning strategies

	Cases	Form	Negative elements	Planning strategies
Cross	Seoul, Paris, London, Prague, etc. Houston Buffalo Riverfront Green project, Los Angeles River Improvement Project	Corridor-shape	Rivers cross downtown, frequent human activity, too many buildings, serious river pollution, riverfront single form	Improve riverfront space and public facilities. enhance connection with other sites
Net	Berlin	Net-shape	Rivers divide downtown, frequent human activity, too many buildings, serious river pollution, poor landscape continuity	Build different forms of dam to control river, develop different kinds of riverfront space, create green space form and livable public space
Circle	Manhattan Battery Park, Seattle Gas Works Park	Plaque-shape	People can have good sight views in both natural and human landscape, free to design, flexible forms	Match natural and human landscape, improve urban climate by eco-ways
Linear	31 River Reconstruction Project in Dallas, SC Charleston Riverfront Green Space	Linear-shape	People can have good sight views in both natural and human landscape, free to design, flexible forms	Make the landscape change from human to nature by progressive way, make riverfront a natural space

Table 2-3. Comparisons of different landscape conditions and strategies for river location within the city

	Conditions	Planning Strategies	case
Outer suburbs	Good protection of eco-resource, wide river, natural form	Planned as eco-protection area, minimize human influence to nature	Cheonggyecheon in Seoul
Boundary	Industrial area, small population, serious environment pollution	Planned as eco-buffer zones, focus on eco-renewal, consider the needs of citizens	31 River Reconstruction Project in Dallas
Downtown	Near CBD, High Building Density, Mass Traffic Flow, Pollution, Narrow Riverfront Space	Improve functional facilities, high greening rate, create livable recreational environment	Seine in Paris

CHAPTER 3 METHODOLOGY

When addressing research on methodology, it is necessary to talk about the research target briefly, for the character of the research target can affect the methodology we would choose. The target of the thesis is urban riverfront landscape. Because of the different geological conditions in different regions and different water conditions, the urban riverfront relationship will also be different. The reason we choose so many cases concerning the different kinds of riverfront styles is just for that reason.

Description of the research process: introduce a question, ascertain some related materials, use some academic view point, collect some representative cases, compare categories comparison and then summarize the general principle for the different riverfront landscape construction. The way and the method to obtain the materials will be described as follows. There will be some detailed descriptions about the research method. The thesis uses three methods: literature review, cases analysis and comparative conclusion.

Literature Review Method

Before the creation of this work, I examined many written sources about riverfront landscape, introduced and referred to some view points and research results which could help my research, and collected and collated all the viewpoints to play an important role in my choice of cases.

The ways and the methods I collected the materials include: borrow some books on urban riverfront landscapes, collect some related messages from the Internet, as well as some practical projects. Then, I induced and systematically categorized some useful viewpoints from the materials I had collected.

Cases Analysis Method

The practical cases have an irreplaceable function in the thesis, especially some of the more successful cases that have regional character. The target is to enhance the scientific aspects of the research and the work has chosen many representative riverfront landscape cases.

Firstly, we should underline the case analysis method, which is very important because it has an intuitive and vivid character. Meanwhile, different cities have different regional and water characters, so the riverfront regions will be faced with different problems. Also the strategy to construct the riverfront space is very distinct. In order to analyze and compare conveniently, and impart the research results with universality and uniqueness, the work has chosen the six distinctive cases from North America, Europe and Asia as subjects.

The six cases have been chosen circumspectly, with a scope that encompasses three continents: Europe, Asia and North America. Choosing different regional riverfront cases to analyze can help results to cover more different riverfront characters, thus making the work more comprehensive. Secondly, the point of emphasis in the six cases is also different; some of these emphasize the historical protection, some emphasize the ecological recovery and some emphasize the hydrophilic space construction. At last, considering that each case has its own character, the work has made many charts to categorize all the cases from different viewpoints, making the research results clearer and more representatives.

The method to obtain the cases include: through a highly professional network, look for some regional representative riverfront landscapes. When encountering some representative cases that are not all-inclusive, I had gone to the library in order to

perfect the cases in the work. Collecting and looking for materials is also an indispensable process in the research, which seeks to make this work as clearly as possible.

Comparative Induction Method

Different cases have different characters, according to the regions and the characteristics of the water. By comparison, we can deeply realize the uniqueness of each case and obtain both the relevant results and the construction strategy. Meanwhile, we can also analyze the cases by comparison, which will allow a more intuitive familiarity with the case's character, and then analyze the target from multi-aspects. In order to make the work clearer and the research direction more definite, I have categorized the six cases systematically.

Category method is very useful in summarizing and inducting. Six different cases have six different characters; if analysis is not careful, we can hardly grasp the character of each case. With comparative analysis, we can more easily judge urban and riverfront landscape characters, so I can introduce a relevant construction strategy. Only by this way, can we summarize the different relationships among all the kinds of the cities and the riverfront landscape. Therefore, the comparative induction method is very important to the research, which can help to shape the final research results and simplify the complicated cases.

Applying the comparative induction method also needs some high academic viewpoints to support. For example, the reason and method I chose to categorize the cases and analyze the relationship between the urban functions and the riverfront is supported by relevant academic points and theories. Therefore, I had look up plenty of academic materials to guarantee the theory's specialty.

Chapter two of the work mainly used the literature review method, chapter four and five have used cases' analysis method and comparative induction method respectively. On one hand, the theory has been analyzed and researched only through the theory analysis; on the other hand, the thesis uses the method of combined practice and theory t, in order to make the work point more systematic and comprehensive.

CHAPTER 4 CASE STUDY

Brooklyn Bridge Park in New York

New York City belongs to the economic-center city model according to its functions, and Brooklyn Bridge Park belongs to a circle-shape in riverfront relationship. Each function and each riverfront relationship has features itself.

Foundation Condition

Brooklyn Bridge Park is located in the south of Manhattan Island's east river, New York, next to Brooklyn Bridge, the area of which is about 26 hectares. The new exploited city park's land was the former port. This park will be an important supplement in New York City Park systems. It will also promote the revival of Brooklyn Bridge Riverfront regions. The project occupies about 85 acreages, owns a 1.3 miles river line, which is also one of the most beautiful natural dwelling places in New York. And there are many famous historical and natural landmarks around it, such as the Manhattan landscape.

Challenges

However, the present situation is bad: the 200 industrial developments have destroyed the east natural river lines and configuration, most of which were covered with architectural structures and hard pavement. However, because of the diminishment of industry in recent years, many buildings and the structures were in a state of disrepair. There were many vast industry ports in it, each occupied about 5 acreages. The Brooklyn-Queens freeway has cut off the traffic and visual relationship between this location and the adjacent communities. For example, when you enter the location from Cobble Hill, Boerum Hill, DUMB and Brooklyn downtown, you just have three ways, the

Atlantic way, Fulton ferryboat port and John Street, which is a significant social problem in attracting the tourists. Brooklyn and Manhattan Bridge also go across the place, leaving shadows and the noises. The micro-climate here was also a challenge, such as the noise of the freeway, the cold wind coming from the port and the excessive sunshine because of the lack of sun-shade installation. Therefore the designers should reconstruct the location in order to create a pleasant environment for human beings.

Design Strategies

After serious-minded investigation and analysis, the design groups discovered that the most important resource of the location was that its proximity to the river; that is to say, it was located at the site that conjoins the river, port and city. The group proposed a design methodology, combining the social diversity, planning flexibility and the environment psychology, and then importing them to a beautiful but unpleasant place in order to convert the ruined industrial region into a city park, which has social effects and ecological effects. The project has integrated many targets, such as experiential complexity, environment sustainability, economic benefits, city connectivity and social vitalities.

Landscape layout design

The design group has come to realize that whether a park can produce the best economic results and social public values depends on the joint level between city texture and water. Because there are many changes in the Brooklyn Queen freeway's relief, it is difficult to combine the city texture and the riverfront regions. Therefore, this total planning has also enhanced the greening process and makes the park extend into the city texture, while the city elements, such as small hotels and conference centers make the city extend to the park. The planning intends to combine with the renewable dwellings, remote regions, outer sport place and cultural places.

Communal activity project design

In order to enhance the contact of each entrance of the park to the city, a group of creative designs, called “city intersections,” were executed. The entrance region is an important node that guides people to the park, so it better suited to the city marina, dog area, community stadium and public space, etc. However, the organized athletic sports area and the private port used for the small boat and the active space are set in the deep park that people cannot reach immediately. Meanwhile, because of the park’s unique location, it also provides many water activity projects, such as the fishing port, water bus-stop, hydrophilic footpath and the beach, etc.

Ecological rebuilt design

When talking about the location ecological environment, the design group explored many strategies of a “post-industrial nature” in order to create “nature in breaks civilization” aesthetics. The plant disposition and the flood management strategy in the park has four guidelines as follows: constructing different nature regions, which are individual when viewed alone, but a new ecological system when viewed in their entirety; disposing of the flood by itself as much as possible; increasing the sun-shading places and wind withstanding places to a maximum; and keeping the open space. Different plants can bring people different sensations.

History context protection

This project should follow the sustainable principle; seek the chance that can ensure that the location has “structure efficiency”. Keeping and reusing the water architecture to the fullest extent is paramount, as well as choosing relevant applications according to different regions. For example, the No.1 port can sustain the thick soil, so it is better to inhabited by plants; the big freighter port’s bearing capacity is relative low, so

it is fit for some lighter items. By the illumination of these examples, some of the ports' ceilings have been reused, and some discarded materials, coming from the removed buildings and the cities, have been universally used again. In the No.2 port, all the metal construction is kept, using the stilts of some framed timber. In some other ports, the main beam is re-packaged. These simple and artless details reduced the maintenance cost, while also retaining the character of the industry.

Micro-climate and the human comfort

The plants can help the park become more comfortable. The plants in the park can be regulated according to the sunshine and the wind direction needed to be shielded, so to ensure comfort ultimately. Different landscape elements were chosen, according to different seasons and the given location: south-north path and tree-walls can dodge the sunshine reflected from the water in summer; the configuration and the buildings guaranteed the sunshine in winter and can dodge the wind from different directions in the winter too; the artificial hills can supply the higher landscape point, while it can also absorb the noise coming from Brooklyn Queen freeway, guaranteeing the relative quietude and comfort of the park.

Total Access to the Project

Brooklyn Bridge Park's total planning has considered many elements of the current condition and the expected target, all of which has its functions in the forming process. The opened port and Manhattan's skyline have given people a sense of deep space and a moving visual experience. It will become a paradigm of design and reconstruction, because of the complexity of the location and the design tools' specificity used by the design groups.

River way Revival Planning in Los Angeles

Los Angeles belongs to the regional center city according to the city function. Los Angeles' riverfront belongs to cross-shape. This river flows across the center of Los Angeles, and this kind of shape in the urban riverfront takes on corridor-like layout.

Planning Target

The Los Angeles River Way Revival Planning encourages public organizations and the some relevant groups to combine together to achieve the same target. The target of the planning is obvious, to change the river way, which is used to control the flood and transport, and to make it as an important entertainment and ecological region. This project has brought Los Angeles into a new age, in which public green passage ways replace construction infrastructures once used for the cars the real estate investment.

River Current Situation

The Los Angeles River way is fifty-one miles long, eventually emptying i into the Pacific Ocean. The river way crossing Los Angeles is thirty-two miles long. Plenty of residents moved to Los Angeles, resulting in a burgeoning population density and ever rising house prices; even the old immigrant community, located along the Los Angeles river way, are faced with economic pressures. The aim of the plan is to change the thirty-two miles river way, crossing Los Angeles, into an urban public green space. Seventy years ago, the US Army Corps of Engineers, considering the prospect of a flood, designed the concert riverbank. If this continued, the natural river configuration would be forgotten by the populace. In 2005, the river way revival plan received the support of the community. Meanwhile, there are also many investigations on land

utilization, water quality, ecology, water culture and population statistics, etc. At last, the Los Angeles River revival plan has emerged.

The river flows over different regions including the high-income communities, commercial center, and low-income communities. The former river way didn't consider distinguish among different regions. However, the revival plan has considered different conditions, and received the opinions from the government, community, public organizations and the developers, so that it can supply plenty of entertainment open space for the city and promote local economy.

Design Strategies

Revival planning contains: revealing the river; greening the community; grasping the opportunity; creating values; developing the community based on the river ecology; and constructing the management outline.

Revival planning general view

The Los Angeles River way revival planning was composed of four main principles: restoring the river's original appearance; greening the regions around, grasping the community culture; and creating added value.

Systemic strategy

Three main systemic strategies will be used as follows: constructing new open air entertainment places, improving the river quality, constructing city green nets and connecting it to the river.

Ecological reconstruction method

The main method is disposing of the water, which includes improving the water quality, public entrance and restoring the ecological system. For example: we can change the riverbank into landscape stairs, which can not only supply animals habitats,

but also be beneficial to improving water quality and public security. And the long-term goal is creating habitats for plants and animals both hand recovering the riverfront ecological system.

Specific Strategy- Partition Planning

Different regions should be treated respectively, according to the riverfront ecological system conditions, and choice the priority revival region. To contract more green regions in the ecological better areas, more roads safety, and riverfront and animal habitats close to nature is the major aspiration here. River way revival panning also contains collecting and disposing of the rainwater, constructing a region that adapts to the high density communities and is an avenue leading to the river.

Glen prior development region: glen river prior region is located at the confluence of the Verdugo and Los Angeles Rivers; it reveals a possible mode to restore the high industrial region rivers. It also reveals the values in regional water quality treatment and the possibility in enhancing the project's ecological functions. Glen prior development region: this region reveals the treatment strategy in the main tributary joint point, the reconstruction of the riverfront environment and the safe entrance to the regional natural parks for the public.

Meanwhile, the river flowing over the heavy industrial regions can also be restored. The river revival includes: disposing of the branch of a river and rebuilding the riverfront environment. This region's revival has certificated the possibility of improving the ecological function and the environment value, while as the potential of disposing of the water.

For some traditional regions, such as Chinatown, glen prior development region: Chinatown – corn field prior development region reveals plenty of restorative actions in

the condition of the requisition of land. This region has also taken venturesome measures to recovery the ecological system, expand the water environment and create some active opportunities related to water. Chinatown prior development region: Chinatown – corn field prior development region will supply leisure and water sports. It will also create an important water environment for animals and birds. It has constructed a green belt for wild animals coupled with other green places.

It used an adventurous method for the revival of the original ecological system. It also constructed habitats for wildlife- a green region for all kinds of the birds and wildlife. Meanwhile, there were also riverfront entertainment installations (Shanglin International Culture Ltd, 2006).

Gas Works Park in Seattle

Seattle belongs to the declining heavy industry city pattern. According to its function, the riverfront in Gas Works Park belongs to circle-shape landscape. The relationship between Seattle and the river is that Seattle is encircled by the city-water system or semi-encircled, which includes peninsulas located in rivers.

Project Overview

This park is located in the north line of the Unite Lake in Seattle. The park occupys 8h square meters. The location was once a gas works plant, which was seriously polluted over time. Many lottery installations can be seen from anywhere in the riverfront in the city, which is a negative feature. The original plan was to change the old location into a traditional natural urban style with trees; however, it would cost much because of the necessary treatment of widespread pollution. In 1970, Richard Harg's office received the tasks for total planning; they chose the opposite method to the former planning. They kept some old installations. In Harg's opinion, in dealing with the

old industry, it was no need to remove them from the new city landscape entirely; on the contrary, it was better to combine the present condition, respect the initial character of the location and preserve some history for the city. This concept had been seriously contended, but was received by the government for its economical efficiency and operability (Wang, 2003).

Design Strategies

Ecology restoring strategy

At first, the main task is was to remove the soil which was seriously polluted and take out the damaged pipe. The most important task was to deal with the polluted soil. The surface soil can be easily removed, but not the deeper soil which was tainted with Benzodrine and Xylene. Soil pollution is an enzyme and other organic substances should be imported to digest the oil. These techniques can remove the pollution by chemical and biology methods. As a result, the chemical pollution which accumulated for half of century was finally destroyed by the bacteria in the soil. Although it took a long time, this process obviously saved funds. As life and death is a fundamental aspect of nature, we should follow them. So, it was not necessary to finance an elaborate, manmade remedy; instead natural phenomena performed a tremendous service for us. This design took the ecological principle as guidance in bringing about positive effects on the environment and fulfilling an important function in urban life (Wang, 2003).

Dispose of public leisure space and protection on history context

In the north-east, there are a group of granary buildings, used to deposit old instruments, and in the east slope, there are camp sites Facing Lake. In the east of the park, there is a gable, where there is a sundial; this location is the best popularized place in the park. In the middle of the park, there is a gas production line. The space

between the tower and the installation has been confirmed after carefully analysis and design. The most important landscape is a group of cracking towers. The rusty façade of the towers indicates the history of the factory. The design of the park is different from the traditional style and form. The designer kept the initial character of the factory, simplified the design, and consequently saved cost. This design concept has brought noteworthy effects on the restored old factories and parks after that.

Emscher Riverfront Management in Ruhr of Germany

The Ruhr belongs to a declining heavy industrial city pattern, according to the city function, and the Emscher River belongs to a cross-shape landscape. This river flows across the center of Berlin, and this kind of shape in the urban riverfront takes on corridor-like layout.

Project Overview

The Emscher Park is located in Ruhr, Germany. It is seventy miles from east to west and twelve miles from south to north. It has an area of eight-hundred square kilometers. And it has a population of two and half million. The Emscher Riverfront region was once an important industrial base in Germany; after about one hundred and fifty years' development, this region became an industrial base, where mine exploitation and the steel production were the main estates. The criss-cross railways, roads, canals, high voltage transmission lines, mine instruments and industrial materials composed the topical landscape here. However, after 1960s, mine and steel industries have irretrievably declined as the main industries. Many fine buildings have also never been used again, the population fell, and millions of jobs have also been lost.

Planning Target

The problems of the economy, society and environment have prompted the government to take actions to restore the region. To remedy these ills, the government opted to construct an international architectural exhibition at the Emscher Park. The main content consists of the establishment of three-hundred and fifty miles long the Emscher Riverfront, ecologically renewable projects, purification the polluted rivers, restoration of the nature landscape along the two sides of the rivers, constructing a three-hundred square miles the Emscher Park, improving the ecological environment, rebuilding the present houses and reconstructing new houses, resolving the dwelling problems, constructing many kinds of technological and commercial center, resolving the problem of employment, reusing the old industrial buildings and so on. Many famous architects and landscape designers have taken part in the planning. Because of the many highways, railways, light rails, drainage canals and high voltage wires, the park's planning is very complicated. The government desires the following: transforming this region into a residential and office zone, with closed green areas that must be ecological, functional, and has industrial marks in it (Wu, 2009).

Design Strategies

Ecology restores planning

A three-hundred square miles green landscape system is formed by reconstructing the ecological cover way, integrating the planning and protecting the plants. It also contains reconstructions of the old sewerage and renews many individual sewage treatment plants in order to guarantee all the sewage can be efficiently purified before pumped into the Emscher Riverfront. According to the newest concept, along with the sixty miles of the Emscher Riverfront, the largest mixed communities' riverfront regional

sewer and the rainwater management system will be governed comprehensively (Dreiseitl, 2001). The detailed measure is to dispose of the escape canal in the Emscher Riverfront, dividing the sewage and the clean water. Now, after reconstruction, the sewage drains along the underground sewage pipe, while the clean water flows along the water channel to prevent contact with the polluted soil. And the rainwater collected from the roof and the ground, channels into the cooling pond and is then purified by precipitation; at last, it is then purified further in the water channel and finally disappears into the Emscher Riverfront.

Context protection strategy

The designers have taken a method that has the least impact on the location. They protected and reused the deserted remains. Also, they viewed the remains as a witness and an important resource. They utilized the industrial culture, and gave them new functions, imbuing them with new vigor. The design of the park has revealed the designers' respect for the natural evolutionary process. Indeed, natural evolution often proceeds not at one stroke, but over a long stretch of time that spans many human lifetimes.

Public space exploitation

All the structures are retained, parts of which are even incorporated into new functions. For example: the high furnaces can be used by visitors to climb safely; the discarded elevated train way can be rebuilt to a walking trails in the park and can also be treated as art; some iron stands in the park can also be used as the supports for climbing, and the high concert walls can be used as the training places for climbing. The disposal of discarded items does not to cover up the dilapidated scene, but gives them a new explanation and life.

Total Evaluation of the Project

The Emscher Park linked the city, factory and other individual parts together, and helped to construct a new law on city architecture and landscape, which made it the green center of the city groups. The Emscher Park's most special character is the transformation of old industrial regions into public entertainment places, and the re-utilization of the initial industrial installations, almost creating a unique industrial landscape. This restoration project has resolved a group of problems about employment, dwellings and the economy, which was brought about by the decline of industry in this region. These changes have instilled this former industrial base with a new vigor and vitality. And the project has also become an example for the other restoration projects throughout the world.

Cheonggyecheon Restoration and Reconstruction in Seoul

Seoul belongs to the political and cultural center city according to the city's function, and the riverfront relationship belongs to the cross-shape landscape. Cheonggyecheon flows across the center of Seoul, and this kind of shape in the urban riverfront takes on corridor-like layout.

Project Overview

In 1397, the capital of Korea moved to Seoul, thereafter Cheonggyecheon has been become the main axis of the city morphology. As the city's center river, it has become primary sewer for the populace. During the 1950s and 1960s, because of economic growth and the urban development, Cheonggyecheon was once slated to become a drain, the water of which also deteriorated. From July 2003, the government restored the river with the support of mayor; not only did they remove the high level bridge, but also re-dogged the river channel, and then re-beautified, irrigated and grew

many plants. Meanwhile, they constructed many special bridges crossing the river, constructed the riverbed to prevent the loss of water, and then guided the Han-river to Cheonggyecheon, in order to facilitate constant flowing. And also, they divided the channel into channels, one for clean water, and one for sewage, to keep the water quality pure. The project cost about nine-hundred billion, and was completed in May, 2005. Cheonggyecheon has become the primary leisure place in Seoul center.

Design Strategies

Lively greening design

Cheonggyecheon restoration project is an important step in constructing “ecological city” in Seoul. Landscape design imparts people some ecological and harmonious sensations directly. In the aspect of river greening, it emphasizes not only on the format changes horizontally, but also the diversity of the plants in a vertical direction. In the horizontal, according to different configurations and the land conditions, they divided the river to different ecological parts, each of which has taken different greening forms. By this way, they have reached the optimum ecological effects design and satisfied the needs of landscape diversity as well. In the vertical direction, they chose the platform in the riverfront, growing different plants in different river sections. For example, in the basement of the river way, they cultivated water-plants, but on the riverbank, they have grown arbors for sun shading.

Humanistic water-lively space design

The river way design is a double-section form, which always has two to three steps. The sidewalk is closed to water surface in order to reach the target of water-appeal. The middle steps are always seen as the riverfront, the top step is for cars. The fountain flows into the river directly from tunnel. When you are walking on the riverbank,

it is like walking in a water curtained cave, with the rainbow above the head; water crosses the foot and clean water is easy to touch. The landscape along Cheonggyecheon has formed a space sequence. Although the river way is long, there are landscapes everywhere. The dispersion is fifteen meters from up to bottom, which are linked by the drop water. In part of the lower stream, they set one or two drop waters; they set many drop waters to form a nature river landscape. The drop waters are constructed with large pieces of stones, which are, in layout, evenly spaced. The stones used for drop water are flat, fixed in the river way with the vertical wood. You can get across the river by the stone lined in the river.

Context protection strategy

Cheonggyecheon has fourteen bridges, differing in shape, which are the symbols of context implied in the substance. Guangtong Bridge is the only old bridge, which is also the dividing point between the west commercial regions and the middle commercial regions. Located among the modern buildings on the upstream, the bridge is seen as a exciting point reminding people of the past, while facing the present and conceiving the future. The Cunzhi Bridge located in the low stream is the monument representative of the Seoul industrialization.

Total Valuation of the Project

The successful experience of Cheonggyecheon's restoration is inspiring many kinds of public activity spaces to form a leisure movement cover way, where there are no interferences among city traffic. And then according to different river way geological, water and plants characteristics, they have used different methods to enhance greening. Meanwhile, they also set different water landscape forms according to Korean folk customs, which have increased the landscape perception feelings.

Hankou Beach Riverfront Landscape Park in Wuhan

Wuhan belongs to the regional center city type; the riverfront relationship belongs to the net-shape landscape. Three parts in Wuhan Beach include Hankou Beach, Hanyang Beach and Wuchang Beach. And Hankou Beach is the typical one.

Project Overview

This Park is located between the prosperous Hankou commercial street buildings and the Yangtze River. Before exploitation, the riverfront region was a port, the configuration was complicated, and the space utilization rate was low. From the late 1970s, Wuhan beach park occupied 1.84million square meters, where were covered with rubbish, plenty of buildings that blocked up the water and raised the Yangtze River water level. In recent years, Wuhan commenced the promotion of city construction, improving the city environment and increasing the city functions. From this century, Wuhan has renovated the flood control and improved the environment.

Planning Target

The design groups have considered the development prospects of Wuhan and the present conditions adequately, and coordinated the economic effects, the social effects and the flood controls. And then they reconstructed the beach park as a riverfront landscape region, where ecological reconstructions and the citizens' entertainment, etc. can be found.

Design Strategies

When sweeping away the buildings and rubbish blocking the water and enhancing flood controls, designers have constructed three steps according to different seasons: the first of which is twenty meters high, ten meters wide; the second twenty-five meters high, thirty to fifty meters wide; the third twenty-one meters high, ten meters wide. On

one hand, it has swept away the illegal buildings and water-blocked buildings, making the river more fluent and helping to the flood controls, according to the four seasons; on the other hand, it makes the citizens feel the beauty of the riverfront landscape, whether in the dry seasons or in the flood seasons.

The new constructed Hankou Beach Park not only features widespread green regions, but has also supplied the citizens with riverfront landscape and public entertainment space. The new beach park has three functions: the city landscape greening, the citizens' entertainment and the water-loving activities.

Meanwhile, while satisfying the need for flood controls, it also supplies the citizens with entertainment, leisure and assembly places. It has also become a new cultural center of Wuhan, with the help of special sculptures in the park.

The character of Hankou Beach Park is its water-appealing flat line, which on one hand satisfies the need of the flood controls and cleans the river way; on the other hand, supplying citizens with water related recreations. The topical landscape layout and the combination of traditional and modern styles has also made Wuhan's culture condensed into the lines of the park, making citizens not only sensitive to nature's charms, but instilling a sense of communion as well.

Total Evaluation of the Project

The implementation of the project has been integrated within lottery land resources, optimized the city's configuration and ecological structure, and coordinated the relationship of water-land traffic and historical commercial streets. And it has also set a cushion region between the two prosperous regions, supplying citizens with a place of leisure. Plenty of activity installations have supplied the multi-experience modes of the population. From the visual sense, the green regions of the park have

integrated the bases of the modern buildings in the park, and also enhanced the comparison between the different elements of the riverfront landscape. Therefore, the park's green basement and artificial landscape of the modern buildings can complement each other.



Figure 4-1. North plan of Brooklyn Bridge Park. (Image by Michal Van Valkenburgh and Associates. Posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.



Figure 4-2. South plan of Brooklyn Bridge Park. (image by Michal Van Valkenburgh and Associates. Posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.



Figure 4-3. Aerial view of Brooklyn Bridge Park. (Image by Michal Van Valkenburgh and Associates, posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.

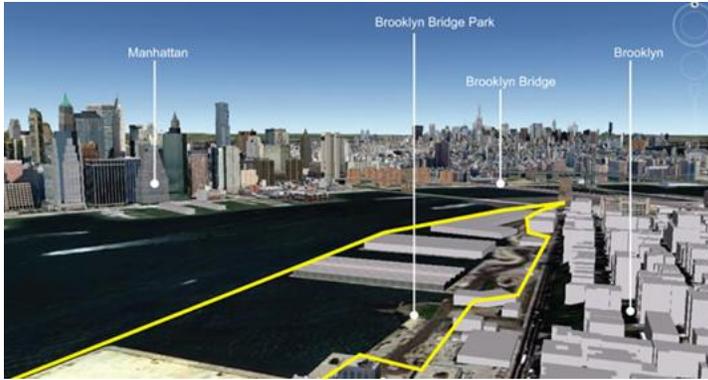


Figure 4-4. Location view of Brooklyn Bridge Park. (image by Huicheng Zhong. Posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.



Figure 4-5. Ecology rebuilt- multi-habitat. (Image by Elizabeth Felicella. Posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.



Figure 4-6. Public space- multi-experience. (Image by Elizabeth Felicella. Posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.



Figure 4-7. Public space- outdoor-theater. (Image by Elizabeth Felicella. Posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.



Figure 4-8. Context continued- post industrial landscape. (Image by Huicheng Zhong. posted on January 10, 2011. Source: <http://www.youthla.org/2011/01/brooklyn-bridge-park-the-evolution-of-a-new-new-york-tradition/>) Edit by author.

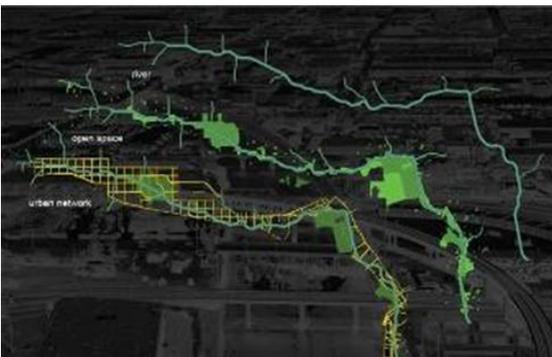


Figure 4-9. Three systemic strategies for river revival in Los Angeles. (Image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://www.chla.com.cn/html/c185/2009-05/36915p2.html>) Edit by author.



Figure 4-10. Water quality improvement planning. (Image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://www.chla.com.cn/html/c185/2009-05/36915p2.html>) Edit by author.



Figure 4-11. River ecology construction. (Image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://gardens.m6699.com/content-14261-3.htm>) Edit by author.

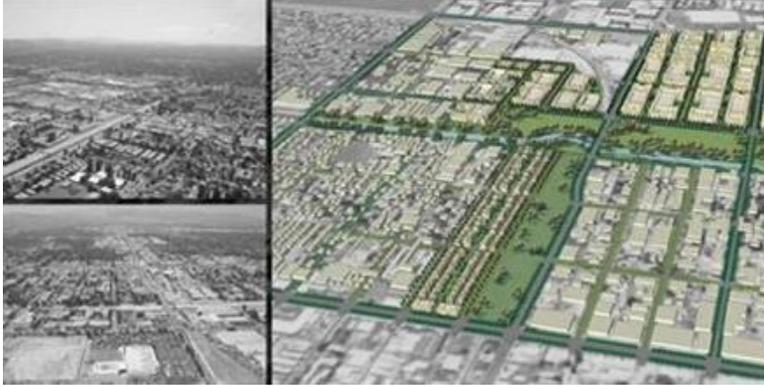


Figure 4-12. Canoga Park precedence to revival plan. (Image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://www.chla.com.cn/html/c185/2009-05/36915p3.html>) Edit by author.



Figure 4-13. Glen River precedence to revival planning. (Image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://www.chla.com.cn/html/c185/2009-05/36915p3.html>) Edit by author.



Figure 4-14. Chinatown precedence to revival planning. (Image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://www.chla.com.cn/html/c185/2009-05/36915p4.html>) Edit by author.



Figure 4-15. Glen River precedence to revival rendering. (image by Mia Lehrer + Associates, Los Angeles, posted on May 25, 2009. Source:<http://www.chla.com.cn/html/c185/2009-05/36915p3.html>, edit by author)



Figure 4-16. Canoga Park precedence to revival rendering. (Image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://www.chla.com.cn/html/c185/2009-05/36915p3.html>) Edit by author.



Figure 4-17. Chinatown precedence to revival rendering. (image by Mia Lehrer + Associates, Los Angeles. Posted on May 25, 2009. Source: <http://www.chla.com.cn/html/c185/2009-05/36915p4.html>) Edit by author.



Figure 4-18. Aerial view of Gas Works Park in Seattle. (Image by Chen642221. Posted on October 11, 2009. Source: <http://www.ddove.com/picview.aspx?id=154984>)
Edit by author.



Figure 4-19. Ecology recovery- nature configurations, non-modified grassland, promote nature's recoverability. (Image by Shuangxuemingming. Posted on February 17, 2009. Source: http://blog.sina.com.cn/s/blog_4b49c4be0100ck56.html)
Edit by author.



Figure 4-20. Context protection- discarded industrial installations are seen as symbolically significant art. (Image by Chen642221. Posted on October 11, 2009. Source: <http://www.ddove.com/htmldata/20091011/d58294fe237a2722.html>) Edit by author.



Figure 4-21. Context protection- discarded industrial installations reconfigured as public activity spaces. (Image by Chen642221. Posted on October 11, 2009. Source: <http://www.ddove.com/htmldata/20091011/d58294fe237a2722.html>) Edit by author.



Figure 4-22. Open view- free forms supplying comfortable leisure places. (Image by Shuangxuemingming. Posted on February 17, 2009. Source: http://blog.sina.com.cn/s/blog_4b49c4be0100ck56.html) Edit by author.



Figure 4-23. Visitors can sunshine and enjoy the beautiful scenery. (Image by Shuangxuemingming. Posted on February 17, 2009. Source: http://blog.sina.com.cn/s/blog_4b49c4be0100ck56.html) Edit by author.



Figure 4-24. Phoenix of Emscher Landschafts Park in Ruhr. (Image by Phoenix Dortmund. Posted on 2011. Source: <http://www.phoenixdortmund.de/de/leben/natur.jsp>) Edit by author.



Figure 4-25. Emscher Riverfront Park plan. (Image by letzte Änderungen. Posted on November 2 2008. Source: <http://www.lpb-berlin.de/sites/1322-1.html>) Edit by author.



Figure 4-26. Aerial view of Emscher Riverfront Park. (Image by Super Stock. Source: <http://www.superstock.co.uk/stock-photos-images/1848-493561>) Edit by author.



Figure 4-27. Emscher Riverfront Park wetlands. (Image by EMSCHER GENOSSENSCHAFT LIPPE VERBAND. Source: <http://www.eglv.de/en/waterportal/river-basin-management/ecological-waterways-development/the-example-of-laepkes-muehlenbach.html>) Edit by author.



Figure 4-28. Emscher Riverfront Park landscape. (Image by cb_ aus_ re. Posted on September 9, 2011. Source: <http://photo.blog.sina.com.cn/list/blogpic.php?pid=53abb2a1g77a5c50f9a64&bid=53abb2a10100wbx5&uid=1403761313>) Edit by author.



Figure 4-29. Emscher Riverfront Park postindustrial landscape- purifies the water channel. (image by Fuyin Liu. Posted on June 20, 2011, Source: http://www.chla.com.cn/hm/2011/0620/88816_3.html) Edit by author.



Figure 4-30. Emscher Riverfront Park postindustrial landscape- part of the sub-station transformed into dining-rooms. (Image by Fuyin Liu, Posted on June 20, 2011. Source: http://www.chla.com.cn/hm/2011/0620/88816_3.html) Edit by author.



Figure 4-31. Seoul map- Cheonggyecheon location. (Image by Look At Korea. Posted on July 15, 2010. Source: <http://lookatkorea.com/blog/wp-content/uploads/2010/07/Seoul-map-English.jpg>) Edit by author.



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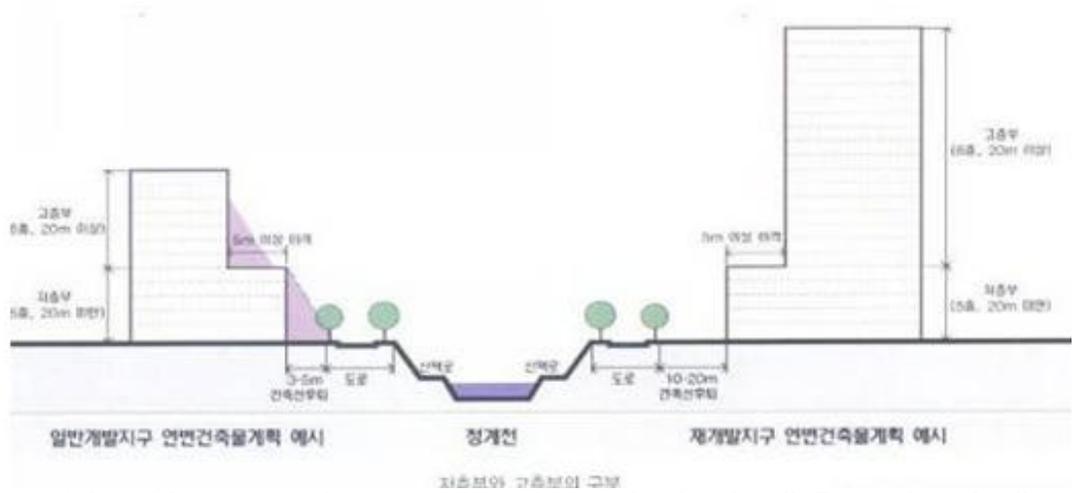


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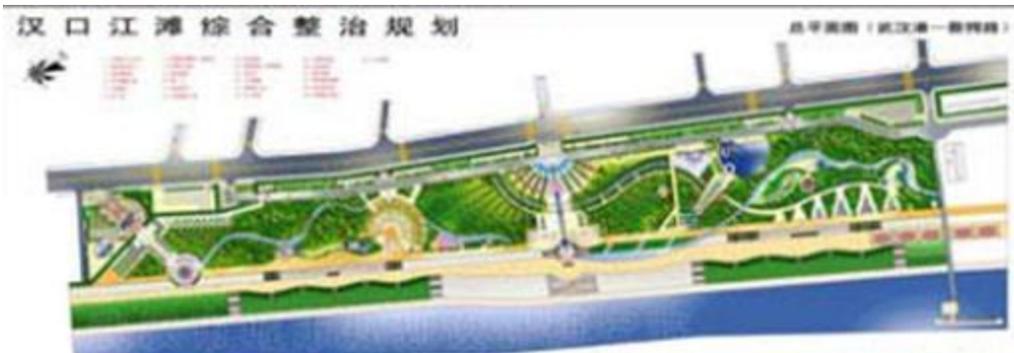


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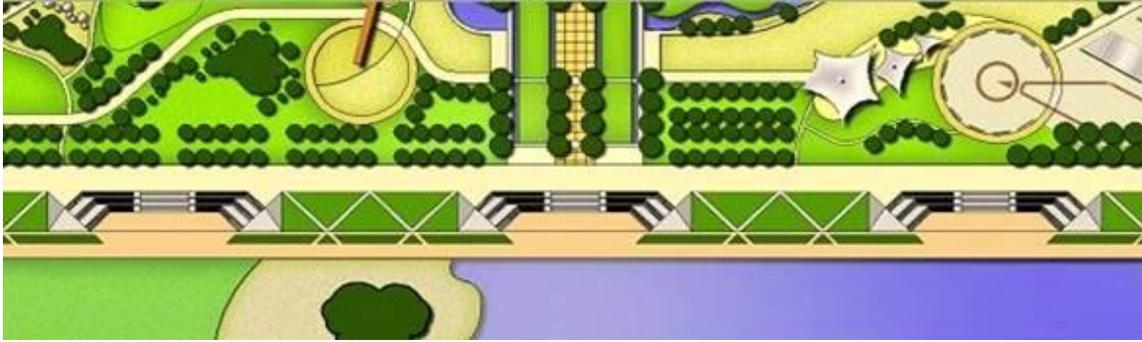


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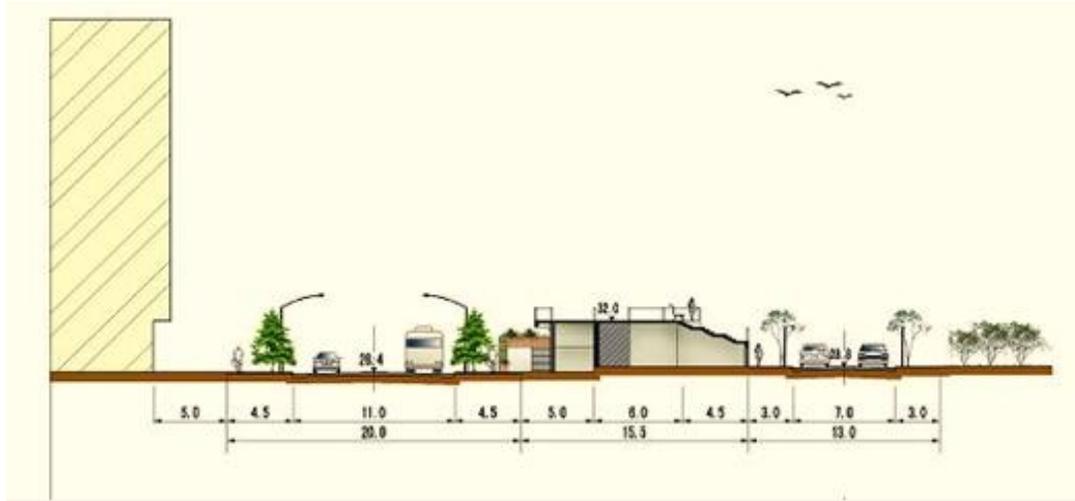


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Table 4-1. Cases comparison

	Main function of rivers	Water characters	Location environment	Riverbank forms	Green characters	Public activity spaces	Blowing down strategies	scale
Brooklyn Bridge Park	Travelling, shipping, urban industry, water for life	Anti-seasonality, water level stable	Port, industry remains, river, city	Combined with artificial riverbank and natural water environment	Different forms according to different conditions, natural plant are artificialized	Connected with the environment, high accessibility, diversity water forms	Water animal and plants purify, rain and sewage separation	Small, particular spot in the city
Los Angeles Rivers	Flood discharge	Branches, water level stable	Center, suburbs	Natural and artificial combined	Nature biology groups and artificial greening	Homogenization, diversity of water-loving forms	Pebbles filtering, water animals and plant purify	Large. across the whole city
Gas Works Park	Travelling, shipping	Anti-seasonality, water level stable	Lakes, industrial discarded places	Natural riverbank	Nature biology groups	Environment individual, free water-loving forms	Biology, organic matter degradation	Small, particular spot in the city

Table 4-1. Continued

	Main function of rivers	Water characters	Location environment	Riverbank forms	Green characters	Public activity spaces	Blowing down strategies	scale
Emscher Riverfront Park	Flood discharge, Travelling, shipping	Flow rates table	traditional industrial regions, discarded regions, rivers	Nature forms	Nature biology groups	diversity of water-loving forms, homogenization, ecological	Pebbles filtering, water animals and plant purify	Middle. some region in the city
Cheonggyecheon	Flood discharge, traveling	Seasonality, little discharge	City center	Multi-platform stairs	Artificial greening combined with nature ecology	open view, diversity activities	River and sewage pipe separation	Large, across the whole city
Wuhan Beach Riverfront Park	Travelling, shipping	Anti-seasonality, Water level stable	City center commercial region, port	Artificial riverbank, stairs	Artificial greening combined with nature ecology	Open view, diversity activities	Nature	Large, across the whole city

CHAPTER 5 CONCLUSION

Through the analysis of the effects of riverfront, landscape cases both in my own country and at abroad, we find that a number of ecological, humanized landscape design strategies can optimize environmental resources and maintain the ecological balance, improve the quality of the environment and regional economy, inject new vitality into the city, promote good community construction, promote social atmosphere enhancements, improve the relationship between humanity and nature, and achieve the goal of sustainable development.

From this, we can determine that the nature of sustainable landscape design is based on the self-renewal capacity of natural regeneration system design. This natural regeneration system design includes reducing interference and damage to the natural system self-regenerative capacity; repairing the damage to the landscape's natural regenerative ability with the help of minimal designs by nature's regeneration ability, and reducing the impact of human activity space. In the treatment of non-biological impacts on the natural processes, we recommend full and effectively use of natural resources, natural systems of self-regulation and self-regeneration. In biological processes, regeneration system design includes the maintenance of native diversity of habitats. In human processes, sustainable landscape design reflects the cherishing of cultural heritage and a respect for human history (Yu, 2011).

Before commencing with riverfront landscape planning, we need to assess the landscape resources of riparian areas and river development suitability. Based on evaluation, examine short-term development goals and long-term development objectives, and then consider the specific development and reform measures. Specific

strategies include three aspects: ecological river system restoration, historical context protection, and urban open space expansion.

Ecological River System Restoration

This strategy includes functional layout optimization, transformation of river morphology, the comprehensive management of rivers, riparian green system construction and other ways of ecological design.

Functional Layout Optimization

The Los Angeles River Revitalization Plan is a successful case that proves riverfront space layout design has an urban riverfront landscape ecological focus. Before design, we should research the ecological conditions and surrounding cultural environment of the river. Ecological conditions include the hydrological characteristics, geological features, river morphology, and vegetation characteristics. Surrounding human environment along the river can relate to different urban land uses, such as the business district, cultural district, financial district, residential areas and industrial areas. Based on the investigation, we need to determine the functions of different sections achieve natural and social resources' optimal allocation, achieve ecological and social benefits, short-term benefits and long-term benefits to be in win-win advantage. Away from the urban area of the river, the riverbed is often broad, flat water; the natural vegetation coverage is high, less manual intervention. The theme of landscape in this region should be natural (Wu, 2009). The landscape of this region should be based on floor tile, improve public facilities, where people can open up space for various forms of leisure activities. The river flows through the industrial area, the general area is in the city's edge. In these areas, cultural landscapes gradually become the natural landscape, the region's ecological environment is fragile, but the river's population density is small,

the space is relatively spacious. These areas can be opened as ecological demonstration zones, mainly in the green belt, interspersed with a small number of public sports facilities.

Transformation of River Morphology

Under the principle of minimum intervention, combined with the terrain and surrounding environment, rivers with a flat shape move gradually closer to nature. We can use design methods to refine natural channel's morphological characteristics and bring these characteristics into the river cross-sections' design. In Height and width of the river, regional landscape node designs should be diverse (Yi, 2010). It will make water landscape more fashionable and dynamic. Most of the rivers should retain their current form. In some upstream areas of the river, we should cultivate aquatic plants; build rich aquatic plants systems with submerged plants, emergent plants and floating plants and construct wetland landscape environments.

Dealing with the relationship between security and hydrophilic is a revetment design focus. Under the premise of ensuring safety, planning and design should consider the beauty of the landscape and the ecological balance. With the different profile shapes, revetment can be divided into three types: vertical, slope type and ladder-type. Vertical revetment saves space, but is rigid, daunting, and often used to the narrow part of the river. The other types are used for wide areas. It is easy to produce hydrophilic space for the riverfront, create a variety of bio-technology environment, and improve the effectiveness of the use of rivers. In the dry and wet season, we should develop and use of the river rationally. Make the upper river plans with safety, leisure, hydrophilic and other functions, and the lower river with flood control, drainage features. Cheonggyecheon in Seoul is among the more successful examples. By revetment

design, provide people with a relatively independent green recreation corridor; isolate the downtown hustle and bustle.

According to different materials, revetment can be divided into green revetment, stone revetment, sand shore revetment and concrete revetment, etc. River bank design should respect the natural form, use the natural materials and reduce human transformation. Even in the case of artificial construction, it should create a natural ecological embankment. As a new concept of river bank, it is to "protect, to create the natural landscape of bio-good" as the premise (Xia, 2011). Considering a certain strength, safety and durability, we must also give full consideration to ecological effects, changing the concrete embankment for the natural slope. This is a combination of water and plants, and is suitable for biological growth.

The Comprehensive Management of River

Parts of the polluted river appear dry. Urban sewage should be prohibited from entering rivers. We should carry out water quality control monitoring. After transformation, we should ensure that the river has no floating debris, not smell, but good visibility. The successful experience of the Emscher Park proved planting riverfront plants is an important way to control the water pollution. We could use wetland plants to absorb, filter, degrade contaminants, purify, and improve water quality. This method, as compared with ordinary treatment, has a low cost and long and multifarious effect. Common wetland plants include reeds, iris, cattail, lotus, water chestnut, alisma, scirpus tabernaemontani, bamboo, water lily, lythrum salicaria, brandy bottle and so on. During the design, try to preserve the city's water bodies and wetlands (Zheng, 2011). According to the habits of plants, we can choose appropriate plants. This will not only form a good visual effect, but also yield a high ecological value. We can learn rainwater

management from the Emscher Park. It separates the water pipes and sewage pipes, and makes rainwater runoff into the wetland or flood storage reservoirs, thereby maintaining the balance between surface water and under groundwater. Gravel can improve water quality with filtering, precipitation, purification and added river water reserves (Zheng, 2011).

Riparian Green System Construction

Urban riverfront green space and landscape ecological functions are mainly achieved through plants. Riverfront green space is more abundant natural features of the landscape green type. Natural riparian zones usually are species-rich, natural communities form a complex structure (Gao, 2011). In the design, plant landscaping should be primary, according to the principles of landscape ecology to simulate natural river ecosystem community structure, and so should be dominated by native species. Insist on the principle of suitable tree and biological diversity, increase landscape heterogeneity, and create a stable plant community. Achieve the sustainable development of the landscape through restoration of degraded urban riverfront green functions.

The design of urban riverfront green should be naturalized. Vegetation and landscape design should be combined with terrain and water phases, they should be in accordance with the characteristics of natural vegetation distribution plant configuration and reflected the characteristics of the natural evolution of plant communities. For aquatic, wetland and woodland plant communities, a combination of design should be used to form a multi-level, cross inlay, species-rich ecological landscape and enhance landscape heterogeneity to improve the resistance to external damage and interference. This is conducive to the restoration and formation of ecosystems. We can bring natural

vegetation into ecologically sensitive areas, such as planting trees in appropriate areas. In estuaries and the division of the rivers, create wetlands, change maintenance mode to cultivate natural grassland and establish a variety of wildlife habitat lands. The imitation of natural ecological communities has high productivity, self-maintenance, are easy to manage and have social and aesthetic benefits. Meanwhile, they are more efficient in the consumption of energy, resources and manpower.

During the green design, attention should be paid to local native plants. Vegetation landscape design should be combined with terrain, water and shown local regional natural landscape and cultural landscape features fully.

Vegetation in the design of the riverfront should increase plant diversity. The species diversity is large, and can adapt to the urban wildlife habitat. They not only play an important role in improving the urban climate and maintaining ecological balance, but also provide a diversity of landscape and urban entertainment.

Other Ways of Ecological Design

Eco-design tools also include changes in energy consumption patterns. We can use the river and building layout to improve urban air corridors and the natural lighting conditions. We can also promote the city's cold and warm air, dry and wet air circulation; optimize urban micro-climate. Meanwhile, we should fully use natural energy, such as the use of photo voltaic power generation and the use of wind power to provide electricity for lighting riverfront public space. Through landscape design control erosion, we can reduce runoff velocity, retain the surface organic matter and keep the soil from erosion. In the landscape planning process, we can use local renewable and recyclable materials preferentially.

Historical Context Protection

Focus on modern and traditional communication and interaction (buildings, plants, vehicles, and folklore), the historical context includes the harmony between man and nature. It provides for the future development of the human reference system. It is to promote ecological sustainability and cultural heritage, the evolution of methods and means. Accumulate, analyze, summarize the experience is one of effective sustainable development; it's an important way to experiment, accumulation, analysis and the summarization of experiences are essential acts to usher in effective sustainable development; it's an important way to experiment. Riverfront context of landscape planning protection measures include four aspects: architectural pattern and shape, transport and other production facilities, native plants, non-material forms of cultural heritage.

Historic Patterns of Land Use and Historic Buildings

In traditional riverfront houses, layout and shape are an important historical context. We must remember that, from time immemorial, ordinary people have learned, often very successfully, to survive under the most inhospitable conditions. Their contribution to understanding sustainability is invaluable to us. We must recognize the lands natural processes (Yu, 2009). The local residential areas are the most suitable form for the local natural environment; buildings with regional personality must be preserved, residential areas found with potential for sustainable development. Riverfront landscape plans fully respect the local ecological experience, experience in the home, landscape patterns and customs, to protect the image and highlight the characteristics of historic buildings. In general, refine the form of local traditional houses, while maintaining the typical symbols, geographical and cultural heritage.

The maintenance of traditional houses cannot just stay at that level, but be updated through the shape and structure analysis of the underlying eco-technology, ecological experience, combined with modern materials engineering and energy technology to improve its function (Ding, 2010). The classical architecture of Japan has demonstrated itself to be an efficient model.

Bridges

In Brooklyn Bridge Park, the bridge has become an important landscape feature. The original negative factors become powerful factors. The existence of the bridge shows the iconic landscape, geographical and historical features. Landscape-level space has become more abundant. The original plane of the riverfront landscape is more multi-dimensional space to form a composition. Riverfront landscape imagery is more vivid and rich. The bridge is the most unique riverfront landscape element. Bridges will link both sides of the landscape.

Bridges should be unique architectural forms. Different times and regions have different styles of bridges. We can say that the bridge and the local residential areas have experienced natural evolution at the local test. Bridges attuned with the local natural environment are the most suitable form. It also reflects the cross urban environment, combined with natural landscape features. Extensions will have a strong sense of the level of the bridge and the terrain. Along with buildings and the unique combination of the surrounding environment, a multidimensional landscape is created. The importance of bridge design is far from its basic function from all directions and angles give the sculpture a sense of the bridge. Each design of a bridge should be clear and simple so as to express their material, structure and use. Each of the local bridges will have personality emanating from their natural features (Simonds, 2005).

River Transport and Rivers as a Source of Energy

In urban riverfront space, transportation is an important part of the design. So many cities still retain the traditional means of transportation. In ancient times, rivers were used mainly for transport traffic purposes; it is mainly for entertainment and travel tours. Boat imparts the flow point of view. Transport modeling is also very important. According to the riverfront neighborhood, style has different forms. Only the characteristics of the tools give people a sense of distinctive images. Living in Shaoxing, people will think about Wupeng Boat. Venice's urban area is only 5.9 square kilometers, car and carriage cannot be found, and transportation just depends on "gondolas." (Zhang, 2008). In addition, to the people of Venice the gondola is more of a symbol. It is a nostalgic medium. In addition to transportation, a number of daily productions also have contextual value, such as the ancient stone windmills and so on. These items can also arouse people's historical memory and cultural identity.

Native Plants

Some native plants not only have a green ecological function, but also are a prominent local feature, and strengthen the role of the landscape theme. Especially, in some of the histories of the region, after a long history and culture steeped in baptism, some plants have attained a number of poetic and historical allusions. Native plants are interpreted as signs of the local landscape. This is not only a natural evolution to optimize the result of choice, but also the result of historical and cultural heritage. Native plants affect people's historical memory and emotion. Native plants can maintain the people's land, identity and belonging. The use of native plants can reduce landscape maintenance costs, improve the adaptability of the landscape and maintain favorable regional ecological security.

Post-Industrial Cultural Heritage

The Emscher Park in Ruhr is a successful transformation which brought us some new inspirations. Some abandoned industrial sites also have historical and cultural value. It represents a certain period of development of the technological level and production capacity, and also reflects a certain stage of development for human understanding of the extent and nature of ideas. They are also crystallizations of human wisdom. Some of these places have typical industrial equipment. Industrial facilities shall be maintained, processed, transformed into recreational facilities, fitness facilities, and popular places. On the one hand, it can save investment, enhance the utilization of waste and reduce energy consumption during construction and restore the natural regeneration capacity; on the other hand, we can turn to the descendants of modern industrial technology for the popularization of knowledge, promote awareness of environmental issues and reflect the direction of social development while providing a reference system.

Non-Material Forms of Historical and Cultural Heritage

From a non-physical form and extract historical context, some cities, according to folk legends, have magic power. The history of the legend is a part of urban culture. Many buildings and monuments no longer exist, but the legend remains. In the planning and management and urban construction, urban design can be used as historical legends, and may penetrate into all aspects of urban construction. In addition, it also includes folk, local festivals, and is also an important part of urban culture. Folk customs are the city's history and culture of non-material form; they constitute elements of a city's character. And characteristics of geographical environment are the relationship between soul and body.

Urban Open Space Expansion

Urban riverfront design should meet people's social interaction needs. An environment must be close to people's daily life and accessible to them. Environmental scales and facilities should make people feel warm. Such an environment can attract participants to fulfill creative potential in their own activities, which carry a wider range of social interaction, exchange of ideas and cultural sharing. Urban riverfront space should be designed to provide a wide range of activities, and meet people at different levels and different needs.

In the minimum intervention principle of the natural evolutionary process, public spaces must be open. Based on assessment, rationally plan initiative riverfront recreation areas and passive recreation areas, achieve the win-win situation of the social value and ecological values in riverfront space. Humanized riverfront space design includes: hydrophilic form and providing a wide range of activity, convenient transportation system and complete functional facilities.

Space for Diverse Activities

Urban riverfront is within the public space whose design should reflect the people-oriented principle. According to the river front's natural capacity, different locations and sizes, layout diversity, multi-functional public space and facilities provide the public with a variety of possible forms of public activity. These include tree-lined trails, shaded resting sites; children's play areas, viewing areas, fitness activity areas and water platform areas. With the organization of space activities, create biological symbiosis of man and riverfront open space; meet the needs of a variety of activities and the spirit. For ordinary people, the riverfront is usually intended to meet the next requirements: morning exercise; elderly sitting, chatting, sunning, children frolicking; evening walk and

a short stay; lovers meeting at night; street performances and street markets in holidays. Therefore, the fixed facilities cannot be set up too much, and should be moving through the facility to support and make space for variability and diversity of functions.

Firstly, in the design, we should survey the number of surrounding residents, age level, and occupational structure. Then, based on environmental psychology principles, we should analyze its behavior; determine the activities of the project site. According to the characteristics of the project activities, the size distribution of space, design space layout. Combination of different forms of design activity space facilities should be in various forms, with suitable scales and attractive appearance. Activities are not only functional but also have aesthetic value. They are also landscape elements, such as pavilions, leisure chairs, fitness facilities, landscape walls, sculptures, cultural stone, viewing platform and shade bar racks. The same kind of landscape elements can be a variety of themes and a variety of modeling languages, such as the realistic sculpture, abstract, animal themes, characters and other themes. But the seat can be morphological, such as cartoons. Wuhan Marshland Park have a reference value in this respect, the use of artistic means provide a variety of leisure activities, so that people have education, leisure, increased knowledge and civilized community civilization.

Diversified and Hydrophilic Space

Besides survival, people also need water. We need to view water, be close to water, live at the water's edge. It is an instinctive longing for water. People want a leisurely stroll along the river or lake, the water's edge to enjoy the sound of the water breaking through the river on the other side. Site plans will meet these desires. Arrange some sport routes in order to provide a range of landscapes, provide opportunities for visual exploration of lakes and river (Simonds, 2005).

Revetment is designed to create an important means of hydrophilic space. This is the key to security and hydrophilic contradiction. The key to design is how to deal with the contradiction between hydrophilic and security. Revetment design should first meet the flood control requirements. Planning should be fully investigated before the flood period. In the riverfront, the hydrophilic agent is human nature. The hydrophilic shoreline depends on the surface and cross section shape. Water has plasticity. By the shoreline treatment, surface water can form a rich, enhanced hydrophilic. Straight shoreline can be designed recessed or surface-water platform. Recessed shoreline give people a source of warmth around the water, hydrophilic feelings. Protruding shorelines will give people a natural feeling. According to the hydrological characteristics, a shoreline's form can be a natural form of the sandbar or a rock group, or the geometrical form of ladder.

Water forms can be designed according to the depth of water level, such as waterfalls, streams, etc. Water facilities and water sports program also provide diverse experience. In shallow water, set jump stone. In deeper and large water areas arrange bridge, plank and so on (Ding, 2010). Activities can be designed to include fishing, swimming, swimming, rafting and so on. Cheonggyecheon reconstruction project is a very good example. Ladder-type channel is designed for people to open up a space for leisure. Rich hydrophilic forms meet the aspirations of the people.

Convenient Transportation Design

Riverfront transportation system designs are divided into external transportation system design and green space transportation system design. Based on the nature system, it can be divided into walking system design and driving system design. The riverfront's external traffic design requires a combination of real situations. Design can be the road traffic; public transport, the site, pedestrian traffic, water transport and

terminals are organically integrated. Water facilities are strengthened with the surrounding.

Internal road system is a framework for the riverfront green space. It is linked green space and water and surrounds the main form of urban public space. Modern riverfront green road design should be user-friendly in design. In addition they can provide the public with convenient and efficient transport but also provide human space scales, a variety of spatial transformation and spatial sequence.

Design the road system for people and vehicles separately which include interlinking entrances and exits, the square, landscape nodes and linking internal open space with the street space. Planning should be based on environmental characteristics and requirements of each organization to use to avoid mutual interference. Generally, the main road system needs to meet the visitors walking and dynamic viewing functions. It includes the tour trail, step stone, plank and so on. Road systems include non-motor vehicle roads. Motor vehicles road mainly connect with the surrounding streets and green space, Non-motor vehicles need to meet the use of bicycle, rickshaw tours and varieties of training.

Walking systems constitute riverfront traffic organizations. Riverfront promenade form the pedestrian area. We need to promenade around the outdoor space to link up. It is also a place overlooking the water landscape. We can design air corridor near the water, form multi-level, three-dimensional pedestrian network. Visitors are free to walk on the different plane and get a variety of height, multiple angles of view of water, to make space for walking more lively. Convergence along the trails and bridges should maintain overall fluency. Trail design can take advantage of topographic features and

create a variety of venues, such as riverfront tour trails, stretching from the surface of the platform, pier, and boardwalk, visit the road, rest plaza, so as to enhance interpersonal communication and the creation of personal space.

Trail design should follow the convenient, comfortable and aesthetic principles. Road alignment need be designed conveniently, increasing the accessibility of the venue. Local roads should be relatively flat, in line with visitors using the scale. Beautiful green road design is the basic requirement. We should focus on the choice of pavement materials and design of the decoration. With this decorative design, create a variety of venues and road landscapes.

Complete Functional Facilities

According to the characteristics of human activities, we choose a reasonable allocation for the riverfront facilities, such as toilets, rubbish bins, water points, telephone booths, bus shelters, seating, book kiosks, trash, lighting, etc. According to visitors' occupation, gender and age structure, we can determine the types of public facilities. The scale of public facilities should meet the ergonomic principles, taking into account the different needs of different age groups.

Shape and layout of public facilities should be harmonized with the surrounding environment in order to achieve the unity of the visual style. The general layout of public facilities should conform to the following principles: environmental facilities identity - the identity can be used to strengthen the regional identity of; a combination of environmental facilities layout – the repeated layout of the environment package often has a strong sense of rhythm in street space. Equidistant arrangement of environmental facilities - meet the service requirements of the radius; environmental facilities individually decorated -strengthen the nodes to form the visual center.

By the contrasting analysis on the riverfront landscape construction strategy in the cases mentioned above, we have learned about the general disciplines that should be followed on the implementation process. According to the differences in city functions, riverfront relationships and reaches, we have emphasized general disciplines in design strategies, which can help to achieve harmony and bring about a real sustainable concept for riverfront landscape design.

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BIOGRAPHICAL SKETCH

Chen Chen was born on July 23, 1987 in Wuhan, China. She has been living in Wuhan since childhood and has graduated as a design major from Huazhong University of Science and Technology, Wenhua College in 2009. She has pursued a master's degree in urban planning since the fall of 2009 at the Huazhong University of Science and Technology. In 2010, the University of Florida and Huazhong University reached an agreement on a sustainable design project, thus Chen Chen was allowed to continue her architectural studies abroad. She hopes to enrich her professional knowledge by learning more about landscape, planning and construction and the content of sustainable design.