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## Research on the integration between hydraulic project and urban leisure landscape

Weihua Liu

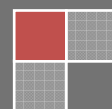
Chengde Petroleum College, Chengde, 067000, (CHINA)

### ABSTRACT

Hydraulic engineer and urban leisure are closely connected; from the perspective of urban development, integrated landscape design becomes the cultural symbol for urban development. Furthermore, design plan for hydraulic building has more and more influences over the overall development of the urban landscape. According to the design plan for hydraulic building, leisure in English city and urban landscape are coordinately developed with each other, which promotes the urban quality, and in the meantime, which has positive effects on enhancing the leisure and recreational life of urban crowd as well as guaranteeing the more sufficient use of hydraulic resources. From this perspective, it can be reflected that construction and design of hydraulic building play a crucial role in establishing the foundation for friendly and harmonious development of urban ecological environment as well as providing strong support to the improvement of natural environment. This also symbolizes that design idea and philosophy of hydraulic building have gradually moved toward scientific and sustainable development.

### KEYWORDS

Hydraulic project; Architectural design; Urban leisure; Landscape construction; Integrative development.



## INTRODUCTION

During the process of urban development, as the key elements of development, urban humanity and regional culture embody the major melody of urban construction. During the process of urban hydraulic construction and design, coordination and integration of urban ecological environment is the top priority. From the viewpoint of social development, construction of ecological civilization has permeated from different angles, which has significant impacts on the gradual change of urban quality as well as the promotion of urban crowd's spiritual and cultural level. Therefore, the integration of hydraulic building, urban leisure and landscape design represents the general trend in social development in the contemporary era. Based on this subject, this article will respectively make corresponding research and discussion on four issues, including the relationship between hydraulic building and urban leisure landscape, general principles for hydraulic building and landscape construction, integration of hydraulic building, urban leisure and landscape, integration of revetment and landscape.

### RELATIONSHIP BETWEEN HYDRAULIC PROJECT AND URBAN LEISURE LANDSCAPE

#### Summary on types of urban hydraulic projects

During the construction of urban hydraulic building, original single hydraulic system has been gradually transformed into ecological system, in which basic types of numerous hydraulic buildings are included. However, in the research and discussion of this article, relevant research are conducted over the major types of urban hydraulic buildings so as to perform corresponding effective feasibility analysis and summarize the types of hydraulic buildings.

In urban life, major types of hydraulic buildings have gradually developed towards diversity and humanity; however, major functions of the construction, instead of being limited to the hydraulic development and application, pay more attention to the active transformation of city people's life<sup>[1]</sup>. However, construction and building of some hydraulic buildings correspond with the buildings in other cities, which provides strong supports for the integrative development of the urban construction. TABLE 1 summarizes basic types of the hydraulic buildings. The details are as follows:

**TABLE 1 : Inductive analysis on major types of hydraulic projects**

No.	Project	Types of Hydraulic Constructions	Major Features and Descriptions	Hydraulic Type
1	Barrage	Water Retaining Construction	According to relevant standards of the country, dam refers to the hydraulic construction built to control the water flow as well as to develop and utilize the water resources of the river by adopting the engineering measures. It is one type of water gate with water retaining function.	Dam
2	River Sluice	Water Retaining Construction	Water gate refers to a kind of low-head hydraulic construction built at channel, river course or lake, seaport to regulate water level and control water flow.	Water Gate
3	Embankment	Water Retaining Construction	As the primary hydraulic construction for flood control, embankment is a kind of water retaining construction built along the edge of seashore, lake, river, channel, or flood way district, flood diversion area, reclamation district.	Embankment
4	Cofferdam	Water Retaining Construction	As a temporary construction, cofferdam refers to the temporary maintenance structure built for the construction of permanent hydraulic facilities during the construction of hydraulic project.	Cofferdam
5	Overflow Dam	Water Outlet Construction	It is one type of riverbed spillway, which is also known as rolling dam. It refers to hydraulic construction on the top of the dam, which is used to release the flood. It is combined with water retaining constructions by means of spillway in the concrete dam and built in the river bed.	Spillway
6	Outlet Gate	Water Outlet Construction	It is one type of water gate with water releasing function. Water gate refers to a kind of low-head hydraulic construction built at channel, river course or lake, seaport to regulate water level and control water flow.	Water Gate
7	Riverside Spillway	Water Outlet Construction	Riverside spillway refers to the flood prevention facility of hydraulic constructions such as water reservoir. It is generally built on one side of the dam.	Spillway

As can be seen obviously from summary of the above table, features of urban hydraulic building can be divided into two basic types. The first type is that basic forms of the buildings are basically the same, but their corresponding functions

and purposes are not the same; the second type is their forms and functions both have certain differences<sup>[2-3]</sup>. Basic types of the urban hydraulic buildings can be classified in a more intuitive manner. The specific types are displayed in TABLE 2.

**TABLE 2 : List for types of hydraulic projects**

No.	General Types	Specific Types	
1	Embankment	Embankment Diversion Embankment	
2	Dam		
3	Revetment	Revetment Spur Dike Longitudinal Dike Submerged Dike Water Retaining Gate	
4	Water Gate	Outlet Gate Inlet Gate	
5	Pumping Station		
6	Hydraulic Tunnel	Diversion Tunnel Outlet Tunnel	
7	Spillway	Riverbed Spillway Riverside Spillway	Overflow Dam Weep Hole
8	Channel	Channel Water Delivery Tunnel	
9	Aqueduct		
10	Water Inlet		
11	Cofferdam		
12	Water Pipe		

**Feasibility analysis on the construction of hydraulic project and city leisure landscape**

During the process of collecting and organizing the materials related to types of hydraulic buildings, it can be concluded that, types of urban hydraulic buildings display the features of diversity because of their different functions. Regarding to this feature, based on urban ecological environment and features of landscape construction, research on the basic contents of the constructions for corresponding types of buildings shall be conducted. As for this, basic functions and features of hydraulic construction are effectively collected and organized in TABLE 3, which is specifically shown in TABLE 3 as follows:

**TABLE 3 : Table of construction contents and requirements for different hydraulic projects**

No.	Types of Hydraulic Projects	Construction Contents and Requirements
1	Embankment	As the primary hydraulic construction for flood control, embankment is a kind of water retaining construction built along the edge of seashore, lake, river, channel, or flood way district, flood diversion area, reclamation district.
2	Dam	According to relevant standards of the country, dam refers to the hydraulic construction built to control the water flow as well develop and utilize the water resources of the river by adopting the engineering measures.
3	Revetment	Revetment refers to the construction built with rock or concrete on bank slope of the river course to protect the bank.
4	Water Gate	Water gate refers to a kind of low-head hydraulic construction built at channel, river course or lake, seaport to regulate water level and control water flow.
5	Pumping Station	Pumping station is the generic term for the constructions such as intake construction, pump house, outlet construction.
6	Hydraulic Tunnel	Built by excavating the rock mass, hydraulic tunnel is a type of hydraulic construction

		surrounded by wall rock.
7	Spillway	Spillway is generally built on the dam or built on one side of the dam.
8	Channel	Channel is divided into open channel and closed channel; closed channel is under the ground, and open channel can be located in accordance with other hydraulic constructions.
9	Aqueduct	Aqueduct is the overhead water channel running through river, valley and road etc. to transport the water.
10	Water Inlet	Water inlet is generally built under the water level.
11	Cofferdam	Cofferdam is a temporary construction.
12	Water Pipe	Water pipe is generally buried under the dam base or under the ground.

Based on the information organization of the above table, the following points can be concluded:

Firstly, Cofferdam can only work as a temporary building; during the construction of hydraulic project, it has protective effects. After the construction of hydraulic project, it will be dismantled, which does not mean that all of it should be dismantles, and which specifically means that most of it will get dismantled. During the construction of hydraulic project, part of the cofferdam can be effectively combined with main part of the project, which therefore can be permanently reserved<sup>[4]</sup>.

Secondly, the so-called water pipe is the water channel that can effectively dredge the water, which can drain the water to higher geographical position by generator set in water reservoir, at the same time, which can also drain the water to the same geographical position by burying it under the ground. However, in the actual urban life, water pipes buried under the ground are quite common; therefore, it can be classified as the auxiliary hydraulic building for pumping station and dam.

Thirdly, spillway is mainly used for the construction of flood-proof dam. This hydraulic building should be integrated with water retaining buildings. For this purpose, as an important building item of water retaining dam, the construction of spillway must be designed scientifically.

Fourthly, during the construction of urban hydraulic project, water inlet is mainly located at the pumping station. Its function is to send the water to water pipe through the pumping station so as to guarantee the basic requirements for urban water supply. This hydraulic building is mainly above the ground or under the ground. However, considering the features and requirements of the development of urban hydraulic project, water inlets are mainly placed under the ground, which has no relevant connection with the urban landscape, and which therefore should not be considered excessively

Fifthly, as the basic component of hydraulic building, water channel is mainly divided into open channel and closed channel. Closed channel is mainly buried under urban ground, which does not have necessary connection with urban landscape; however, open channel is the intermediate link connecting the hydro-junctions, and thus the design of the open channel in hydraulic building should be combined with urban overall landscape. For this reason, during the design process for this part, open channel and construction of urban landscape should be both taken into account; closed channel does not need to go through relevant design process.

Sixthly, basic purpose of hydraulic tunnel is hydraulic dredge, through which the basic needs for urban water supply can be satisfied. However, this hydraulic building can be divided into two types, which are respectively used for water delivery and water release<sup>[5]</sup>. This hydraulic building is established to coordinate with the related hydraulic buildings such as pumping station and spillway. The requirements for its site selection are quite strict, which shall not be excessively adapted to the urban landscape; therefore, it is generally very hard to reflect the effect of its landscape construction.

Seventhly, embankment and revetment play important roles in the construction of hydraulic project; in the meantime, they are also important parts for the construction of urban landscape. Moreover, their functions are not limited to their positive effects on the urban flood prevention; their more important functions are display by their special positions in the urban watery body, which have positive effects on the optimization of urban landscape. Therefore, these two aspects should be both effectively taken into consideration and provided with scientific design during the construction of hydraulic project.

Eighthly, among the elements of hydro-junction, aqueduct, hydraulic dam, water gate and pumping station are connected with each other, which help the hydraulic project meet the demands of water supply from different cities. The design process of these hydraulic buildings is more target-oriented. During the design and construction of hydro-junction, coordinated development of urban landscape holds strong plasticity, which therefore has positive influences on the demands of urban ecological development and landscape construction; as a result, urban landscape construction can achieve integral development.

According to the above conclusions, we can clearly observe major features for the integration of hydraulic building and urban landscape, which are specifically displayed by TABLE 4 in a more intuitive manner as follows:

**TABLE 4 : Integration of hydraulic building and urban landscape**

Integration with Landscape	Type of Hydraulic Project
can be integrated with landscape	dam, revetment, embankment, pumping station, aqueduct
can not be integrated with landscape	water pipe, cofferdam, water inlet, tunnel

In the research and discussion of this article, hydraulic buildings such as dam, embankment, and revetment will be explored and studies, which ensures that hydraulic project and urban landscape are closely connected with each other, and which therefore makes their connection and direction of coordinated development more clear.

## GENERAL PRINCIPLES OF HYDRAULIC PROJECT AND LANDSCAPE CONSTRUCTION

### Integration of hydraulic building and natural environment

Under the situation that construction and development of current hydraulic project are constantly accelerated, concepts for the construction of hydraulic project are gradually enhanced. As a result, single demand for urban water supply gradually moves towards harmonious development of society and nature, which highlights the importance of harmonious development of ecological environment. Based on the development tendency of modern hydraulic project, construction of hydraulic building should adhere to the basic development law of natural environment; hydraulic project should harmonize with the surrounding environments so as to achieve the coordination of hydraulic building and urban integral development. Water is an essential element for human existence; however, harmonious development of ecological environment can not go without water too. Therefore, water resources have corresponding controls over the change of social environment. During the construction of current hydraulic project, friendly development of ecological environment should be followed; scientific management should be conducted over the construction and design of hydraulic building, which gives full play to the value of hydraulic project, and which have positive influences over the construction of urban landscape.

### Integration of hydraulic building and urban humanism environment

During the process of urban development, different cities have their own culture. However, during the construction and development of hydraulic project, the existing cultural environment should be taken into account so as to display the integrity and integration of urban development. During the design process of urban hydraulic project, humanism environment, concepts for construction and development, and development direction of ecological environment in the city can be effectively integrated so as to improve the landscape value of urban hydraulic project.

### Integration of hydraulic building and urban recreational leisure

According to the development speed of the modern society, the social demands for hydraulic project are not simply limited to the single purpose of flood control and disaster prevention. Besides, meeting the demands of people's spiritual life also becomes the focus in the construction and design of hydraulic project. "Binhe Space" is a major recreational place for city people to play with water, get relaxed and have fun; in accord with this, the design of hydraulic project should meet the basic needs of city people's leisure, vacation and recreation so as to provide a broader water-playing platform<sup>[6]</sup>.

## INTEGRATION OF HYDRAULIC PROJECT, CITY LEISURE AND LANDSCAPE

### Flood control dam with ecological and landscape effects created by plant cultivation and landscape accessories

Based on the growing characteristics of the vegetation, flood control dam can be effectively designed, which can effectively improve the landscape effects of flood control dam. However, the vegetation on the top can be properly allocated according to the natural growing characteristics of the vegetation; during this process, according to natural condition of the city, the corresponding vegetation species and types should be selected so as to endow landscape of the vegetation with hierarchical structure. Aesthetic nature could be highlighted during the landscape effect design for hydraulic project; in the meantime, scientificity and effectiveness of hydraulic project design could be enhanced, which is fully displayed by Figure 1 in detail. However, during the transformation of flood control dam for urban river, trailing plants can be scientifically allocated so that growth of the plants can have certain sheltering effects on the original hydraulic building; at the same time, the bottom of the flood control dam can be equipped with revetment, and aquatic plants can be effectively allocated within the specified range, which can bring positive changes for the landscape effect.

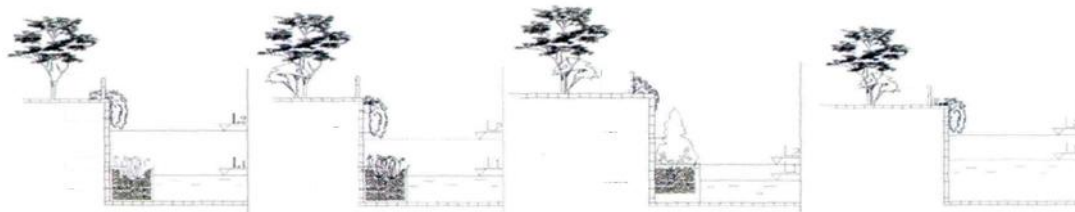


Figure 1 : Ecological greening embankment

### Use water level difference, enrich water-playing space landscape

Before the arrival of flood, platform of the dam can be divided into two layers according to the difference in water level. The top layer should remain at the same height with flood control dam, and the bottom layer should be below the

water; as for the intermediate convergence, the effective connection can be achieved through the slope. However, as for the design of these two layers of platforms, if urban waterfront land is quite narrow, the top layer can be used as water-playing platform, and the bottom layer can be used as the basic dock for ships as well as for the construction of other public water facilities. In this way, resources along the river can be fully exploited, which meanwhile can improve the landscape effect of flood control dam and bring people a visual impact. During this design process, close connections between hydraulic project and urban life are fully displayed; meanwhile, with the constant improvement in utilities of water-playing platform, the value of flood control dam and other hydraulic project is continuously improved.

## RESEARCH ON THE INTEGRATION OF REVETMENT AND LANDSCAPE

### Reduce visual height difference of revetment, increase water-playing activities

When the revetment as is considered as a landscape, what we need to consider in the first place is its height in integral landscape of the river channel. The height of the revetment in integral landscape of the river channel refers to the visual height of revetment related to overlook distance, which has little to do with absolute height of revetment, It is easy to make the revetment stand out abruptly, which will cause certain pressures to the surrounding landscape; therefore, visual height of revetment should be controlled as best as possible in the design, and it should be slightly lower.

### Soften water border line of revetment, create variety of forms

In the construction of hydraulic project, as the boundary of city and water body, revetment may cause significant effects. However, in daily life, construction of urban revetment is mainly embodied in linear type, which can work as the boundary of city and water body. However, with the change of time, there will be real-time changes in water level of the river; the water mentioned in daily life is not stationary, and it is usually displayed in front of people in the non-water and non-land form, and therefore a vaguely defined spatial state come into being<sup>[7]</sup>. From the viewing perspective, urban revetment is displayed in front of people in rigid form, and water border line is also quite simple. However, from practical perspective, it should be designed into vague and rigid form, which is conducive to the direct manifestation of the change displayed in water meter.

### Combined with design of facilities for plant greening and landscape leisure, enrich the landscape effect of revetment

Traditional design of revetment should gradually go through effective transformation, which actively develops its landscape elements; design of revetment in hydraulic project is based on eco-environmental protection and value manifestation of landscape. Corresponding planters should be set on the retaining wall, selection range for species is so large that good landscape atmospheres can be created, which is shown in Figure 2 in details.

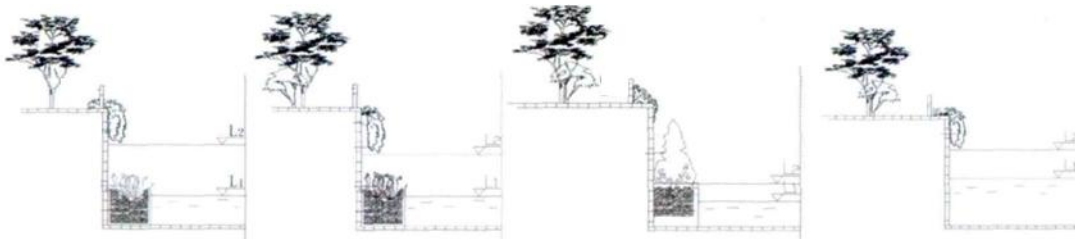


Figure 2 : Revetment with trailing plants and planters

## CONCLUSIONS

The above is the relevant research done on the integration of hydraulic project, urban leisure and landscape. In this paper, according to the relationship of Hydraulic project and city leisure landscape, types of hydraulic buildings are effectively classified. Then general principles for hydraulic project and landscape construction have been discussed in a comprehensive manner, which provided the effective preconditions for the integration of hydraulic project, city leisure and landscape. At last, effective research over the integration of revetment and landscape have been conducted, which endow the research and exploration in this paper with powerful scientificity and rationality.

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