

Agnieszka Matusik (agnieszka.matusik@pk.edu.pl)
Institute of Urban Design, Faculty of Architecture, Cracow University of Technology

RIVER VALLEY AS A HYDROLOGICAL/URBAN DYNAMIC SYSTEM
IN THE STRUCTURE OF THE CONTEMPORARY CITY

DOLINA RZECZNA JAKO HYDROLOGICZNO-URBANISTYCZNY UKŁAD
DYNAMICZNY W STRUKTURZE WSPÓŁCZESNEGO MIASTA

Abstract

Contemporary tendencies in shaping river valleys in cities constitute a clash and overlap of numerous aspects of contemporary urban planning. The range and diversity of interventions depict the whole array of new urban landscapes, the superior quality of which is constituted by the ecological aspect. Growing climatic changes, as well as limits of the natural environment within urban structures, pose special requirements for urban sections of river valleys. Urban strategies and projects proposed for these sections must face problems related to water resources management, and at the same time, they need to be activators of the new quality of the city in the context of its competitiveness. This paper focuses on two fundamental tendencies in designing river valleys in cities: anti-flood control, and increasing the share of the natural environment in the urban structure.

Keywords: river, watercourse, hydrological/urban system, city landscape

Streszczenie

Współczesne tendencje kształtowania dolin rzecznych w miastach to zderzenie i nałożenie się wielu aspektów współczesnej urbanistyki. Rozpiętość i różnorodność interwencji ukazuje pełen wachlarz nowych krajobrazów miejskich, których cechą nadrzędną staje się aspekt ekologiczny. Narastające zmiany klimatyczne, a także ograniczanie środowiska naturalnego w obrębie struktur miejskich, stawia przed miejskimi odcinkami dolin rzecznych szczególne wymagania. Proponowane dla tych odcinków strategie i projekty urbanistyczne muszą sprostać zarówno problemom dotyczącym gospodarowania zasobami wodnymi, jak i jednocześnie być stymulatorem nowej jakości miasta w kontekście jego konkurencyjności. Artykuł skupia się na dwóch podstawowych tendencjach w kształtowaniu dolin rzecznych w miastach: ochronie przeciwpowodziowej oraz zwiększaniu udziału środowiska naturalnego w strukturze miejskiej.

Słowa kluczowe: rzeka, ciekii wodne, system hydrologiczno-urbanistyczny, krajobraz miasta

1. Introduction

Transformations of the course of river valleys in cities have been a permanent, continuous, and dynamic process for centuries. The very fact of locating an urban system at the edge of a watercourse sentences it to periodic transformations.

Questions concerning tendencies in shaping river valleys can be deemed to be simultaneously questions concerning the shape of the cities of the future. The river, the determinant of the establishment of cities, the stimulus for their development, takes place in a symbiotic relation: the built space – the natural landscape. The process of shaping its system within the territory of the city conditions the city life in the future, just like general urban actions determine the life of the river. Dynamic urbanisation processes make cities face the necessity to provide an answer to the structural form of this growth. Extreme densification of urban areas in their central parts is simultaneously connected with the excessive city sprawl, necessary in order to maintain its existence. At the same time, progressing climatic changes and flood risk connected with them, as well as the increasing temperature within urban structures, are linked with the need to take care of the natural system of the city.

What place and scenario in the process of forecasting and planning is occupied by corridors of river valleys? What will be the landscape of the river within the city and outside its limits in the reality of sprawling cities – regions? Sławomir Gzell poses a question: “Will (the city) have its suburban areas, will it have its urban areas, will we differentiate between urban and suburban (and rural) areas of the city at all, using landscape-related criteria?” [5, p. 31] What role in such a reality will be ascribed to corridors of watercourses, and what are the options for their protection? The more and more strongly marked need of coexistence of urban and open (rural) landscape and of their reciprocal overlapping, was emphasised already by Ildefons Cerdà. On the basis of experiences deriving from the extension of Barcelona, he observed that urbanisation is strictly connected with changing of the rural to the urban, and simultaneously with ruralisation [5, p. 29]. This assumption can serve as a base for formulating foundations for designing the shapes of watercourses to be keystones between the urban and the natural.

The search for something we call a ‘good’ city is still an open question. “It can be stated that cities combining an economic approach to the future with the protection of spatial values stand a bigger chance for desirable transformations”. One of the desirable qualities of such a city is its spatial originality, uniqueness [5, p. 28]. Defining the relation between the built structure to the space of the urban section of a river valley slowly becomes an answer to the issues referred to above – how to make use of the originality and uniqueness of the system so as to succeed in economic terms? What is the role and meaning of urban strategies and projects connected with the river development in the city (and in the open landscape) for processes connected with issues of competitiveness of cities based on ecological aspects?

It can be recognised that two leading tendencies will be of key importance for the functioning of cities in the future [7, p. 97]. These are:

1. Urbanisation of waterfronts of urban sections of river valleys;
2. Naturalisation of waterfronts of urban sections of river valleys.

These two tendencies occur in their pure form extremely rarely – they usually complement each other, to the benefit of the urban structure. This interdependence can be dubbed a hydrological/urban dynamic system, where individual factors exhibit variable behaviour, and simultaneously maintain a reciprocal balance. The paper presents cities and projects in which the tendencies referred to above can be demonstrated in a clear way.

The first trend concerns predominantly the phenomenon of recovery and transformation of post-industrial sections of river valleys, located in the direct vicinity of city centres. The second trend comprises a whole spectrum of solutions aiming to maintain or recreate the natural ecosystem of the river valley in the city, whereas the term ‘naturalisation’ refers to the processes of recreation, revitalisation, and extension of the natural hydrological system of a river valley in the city. Both these tendencies entail the need to address problems connected with providing anti-flood protection with the simultaneous high-quality urban structure, the quality which is conditioned by the new hydrological/urban system of the city, operating and reacting to the variability of conditions in a dynamic way.

2. Urbanisation of waterfronts of urban sections of river valleys

Strategic projects implemented within the area of urban sections of river valleys have a determining effect on the shape of the urban model and are closely connected with the need to regulate the edge of waterfronts. The specificity of the location, resulting from low altitudes above sea level, and consequently entailing a high level of flood risk, also causes the need of far-fetched transformations within the urban structure, based on building a coherent water and greenery system. This fact, which is often an aspect that reduces the city attractiveness, may become a fundamental element of the process of creating its identity and potential. This need of structural transformations often entails a growing tendency of giving water bigger possibilities of penetrating the city structure. Contemporary metamorphoses of cities based on the dynamic relation between water and the city structure can be defined as new attractors building the position of cities in competitiveness rankings.

This is the case in Rotterdam. The structure of the city, located in the delta system of the river Meuse, has been conditioned by the water situation since its very beginnings. The historical layout of the city was already determined by water canals (Fig. 1). The contemporary Rotterdam has developed this typology, creating a water/greenery skeleton of the model of the city.

The strategy of Rotterdam was to address the problem of the excessive pressure of water coming from four potential sources: the sea, the river, precipitation, and waters drained from the surface of the land. The answer consisted in building a system of canals, which were to take over the excessive inflow of water. At the same time, this system, implemented in the form of blue-green corridors, becomes the fundamental skeleton of the urban structure, conditioning high-quality residential environment. The entire strategy has been described as ‘Rotterdam – Watercity’ (Fig. 2), and it is planned to the time horizon of 2035 [13]. The implementation of the anti-flood system at the same time provides grounds for the creation of an original urban structure.



Fig. 1. Rotterdam in 1650 and Rotterdam – Watercity 2035 (diagram: A. Matusik)

Looking at the city in a closer scale and considering the relations referred to above in the context of urban projects, it is possible to observe the continuation of the characteristics of the hybridity of the water/urban system. Simultaneously, the clash of climatic, ecological, and economic aspects becomes a foundation for urban marketing and promotion of the city. Addressing these needs, cities create spectacular engineering projects, allowing to introduce new types of space in the urban structure – attractive spaces, offering a high-quality living environment for their residents. This phenomenon is gradually becoming a determinant of the quality of life of a contemporary metropolis, operating with new tectonics and entering areas which so far have been impossible to inhabit.

2.1. HafenCity Hamburg: new tectonics

An example which has become the classics of including the floodplain in the public space of the city is the HafenCity Hamburg project. Elevating the level of the ground within the entire territory of the investment by 8 metres on average towards the set water surface allowed for the safe functioning of the new structure. At the same time, an incredibly important element of this strategy, or even the essence of the way in which the public space functions in this area, were designing assumptions pertaining to solutions in the scope of details of the waterfront edge, which define the quality of the contact point between the built structure and the water level. Building three additional levels of anti-flood protections entailed the application of specific typologies of public spaces, as well as typologies of development, which allowed to introduce full protection of the internal structure.

An element, which proved to be an essential assumption in this respect, was combining these two components – through gradually increasing water levels the fluidity of contact with water was made possible, simultaneously blurring the considerable difference in the altitude of the public space associated with entrances to buildings fulfilling residential and service functions.



Fig. 2. HafenCity Hamburg. The development plan of the former port area (source: [15])



Fig. 3. Fragment of the structure of the waterfront – Magellan Terrassen (photo by A. Matusik)

2.2. Sluseholmen, Copenhagen: to live by water

Life 'on water' is the domain strongly bound with the way the Danish society functions, and how its customs and sense of identity are stimulated. The example of Copenhagen illustrates how the use of plans to regulate the shoreline – its incredibly deep modification – has allowed for the traditional functioning of the new residential structure. The post-industrial peninsula Sluseholmen, located in the southern part of the city, has been subjected

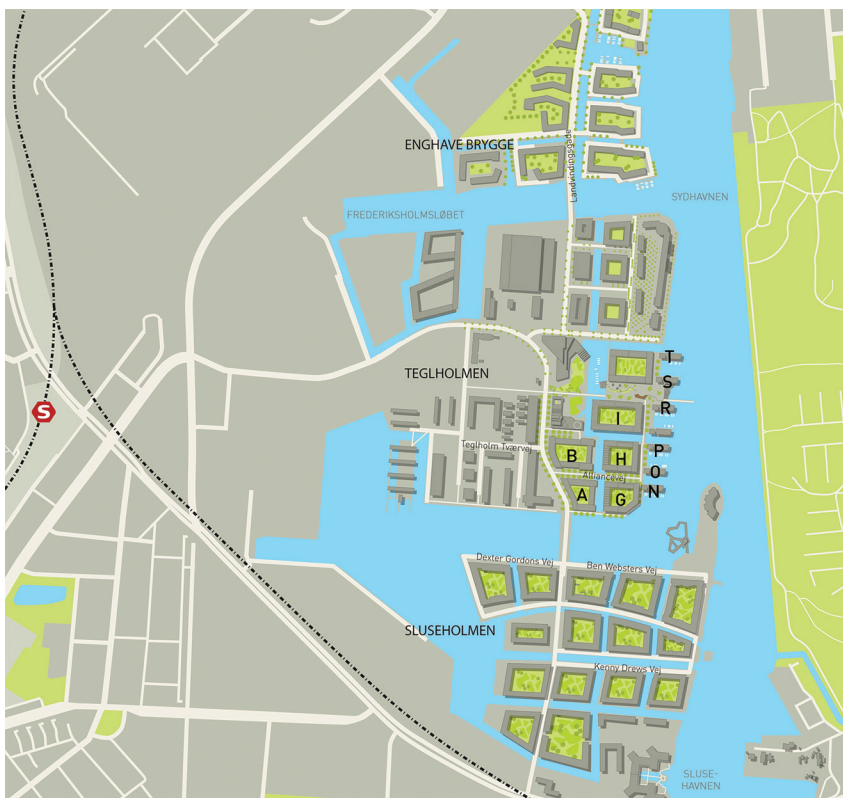


Fig. 4. Copenhagen, Sydhavn. Land development plan (source: [16])



Fig. 5. Copenhagen, Sluseholmen – view on the urban structure (source: [17])

to such modifications¹. A strategic assumption was to adopt the principle of cutting the land and preparing the infrastructure in a way that would enable each of the urban blocks to have direct contact with the water space. The water canals, embedded deeply into the structure, become a natural extension of the public space connected with the publicly accessible squares and pedestrian routes, as well as of the semi-public/semi-private space, connected with the interiors of the development blocks.

3. Naturalisation of waterfronts of urban sections of river valleys

Protection of the natural landscape of the river within urban zones becomes a prerequisite in the situation of more and more dynamic urbanisation processes. This trend remains in close relation with the model of an ecological city, the importance of which in the contemporary urban planning has been constantly growing. Maintaining the natural landscape, often connected with the leading framegenic elements for the city, constitutes a fundamental part of this model. Simultaneously, the natural system of the city the essential part of which is a river and watercourses accompanying it, becomes a subject of attempts of aggressive city sprawl processes to take it over. Its protection is connected with not only local policies, but also – or even most of all – with supralocal ones.

The element that becomes a prerequisite in this respect is forming a clear natural (hydrological)/urban system, guaranteeing safe co-existence of these two layers of the city [14, pp. 80–87]. This forming takes place in the macro scale, covering the entire urban structure, as well as in the micro scale, which constitutes a solution of structures in the local context.

4. Macroscale – systems of river parks

One of the possibilities of moulding a coherent system is the creation of a system of river valleys linked with a system of green corridors. Such practices were adopted e.g. in Cracow and Warsaw, where the Vistula became the axis for a system of parks, combining urban areas of the city with the open landscape [14, pp. 82, 85]. The system of parks based on the restored natural river ecosystem is also proposed in the strategy of the transformation of Zaragoza. Protection of the natural system becomes not only a tool that moulds the internal structure of the city. A very distinct form of this tool being applied is shaping peripheral, nearly border areas.

A classic example of such transformations is the project of a park along the river Besos in Barcelona. Recultivation of the river itself, and next organising a natural park along its entire urban section was a huge success. Restoring the natural corridor of the river had its economic as well as ecological consequences. The park, with the clearly separated tidal frame, became an element of special and social/functional integration of the north-eastern suburbs of Barcelona and its neighbouring communes. High-quality public recreation spaces had their effect on increasing the economic values of adjacent areas. At the same time, in the

¹ Sluseholen, Copenhagen: urban planning design – Arkitema Architects + Sjoerd Soeters, 2008.

supralocal scale, this park is included in an ecological natural system linking mountainous areas which constitute natural limits of Barcelona from the north-east, with the seashore closing it from the south-west. Recultivation of the valley of the river Besos brought about an increased interest in the surrounding areas. Previously perceived as suburban, associated with a disadvantageous situation of being locked between a degraded watercourse and huge road infrastructure, today these areas are an extremely desired location in the city. The example in this respect is a project of a big residential complex La Catalana².

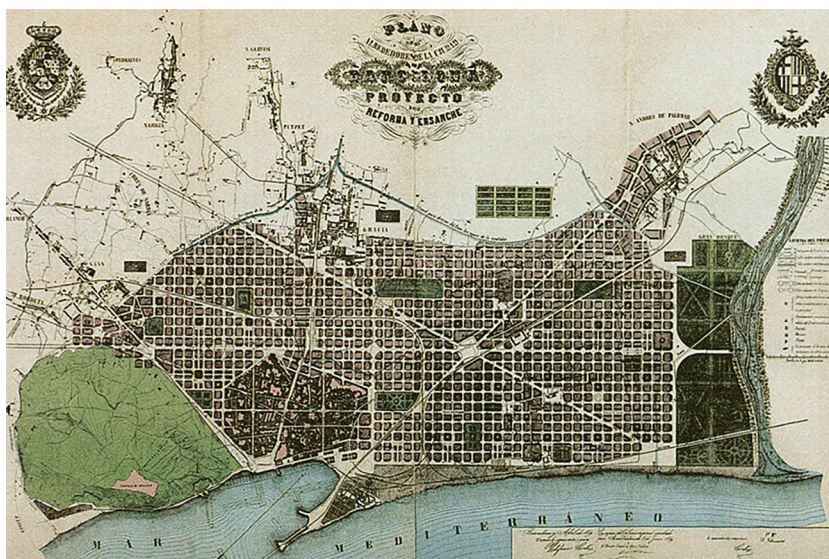


Fig. 6. Barcelona 1859, a map of Ildefons Cerdà – visible canal of the river Besos along with the park (source: [2, p. 127])



Fig. 7. Barcelona, 2001 – design of the transformation of the valley of the river Besos (source: [10, p. 96])

² This complex has contributed to a considerable change of the image of this part of Barcelona. On one hand open to natural spaces of the water park of the Besos, on the other it is closed with a linear park separating it from the city ring road [cf. 10, p. 96].

5. Microscale – green waterfronts (Hunters Point and Houtan Park)

The awareness of the need to protect the river landscape and building an urban model on its basis is not only the domain of the macro-scale policy. More and more cities conduct operations focusing on the renewal and recovery of natural water edges along selected sections. These tendencies can be particularly clearly visible against the background of such dense urban structures as New York, or Shanghai.

Both cities referred to above bear traces of their industrial past. Despite the fact that the cities have different geopolitical conditions, both New York and Shanghai can be proud of similar projects devoted to the ecological protection of waterfronts. The definition of a new edge in these two cities, so culturally different, is surprisingly similar. The waterfront of Hunters Point in New York, as well as the waterfront within the limits of Houtan Park in Shanghai, demonstrate a new ecological standpoint, and for this reason, they have become a specific urban manifesto.

The vision of the spatial development of New York 2020 defines the basic directions of the urban policy, aiming to demonstrate natural values of the urban structure deriving from its location. The flagship example of this direction is the project of Hunters Point. The structure of the waterfront, once dominated by railway infrastructure servicing the port and generating the export-related ‘to be or not to be’ of New York, was transformed into a wild municipal garden. The very area of Hunters Point is a place of predominantly dense residential development. The new waterfront, based mainly on natural forms of greenery, with the ecosystem playing the main role, was designed predominantly to serve this area as a kind of counterpoint. In line with the key assumptions, the post-industrial past represented by preserved relics and remains of the old infrastructure clashes here with the water edge, restored in its natural form. Along with it, a system of greenery was organised, embedded in the structure of the city and linking the waterfront itself with it.

A similar approach to shaping the waterfront line is proposed by Shanghai, making use of the potential offered by a great event of EXPO 2010 [1, pp. 104–133]. An integral element



Fig. 8a. Hunters Point New York. Waterfront development concept of the green waterfront, 2010 (source: [18])



Fig. 8b. Hunters Point, New York. Waterfront's view (photo by A. Matusik)



Fig. 9a. Huntan Park, Shanghai (source: [19])



Fig. 9b. Huntan Park, Shanghai. View on a fragment of the green – water structure of the waterfront (source: [19])

of the exhibition grounds is the project of a waterfront park – Houtan Park³. The strategy of the project is based on the recultivation of polluted banks and waters of the river Huangpu through the creation of a boggy ecosystem filtering rainwater, and at the same time acting as a buffer zone of the anti-flood protection. This very attractive solution of technical issues is also connected with the introduction of new forms of use of urban public spaces, such as e.g. urban agriculture.

6. Summary

Urban planning measures implemented in areas of river valleys in their urban sections become a stronger and stronger driving force in the process of creating visions for the future of urban structures. Their special meaning needs to be perceived in their position described by Anna Januchta-Szostak as “a keystone of anthropogenic and biocentric systems” [7, p. 92]. As spaces inseparably associated with the effect of climatic changes, they become a testing field for projects interpreting and predicting threats resulting from them. At the same time, the increasing ecological awareness imposes new forms of waterfronts, never encountered so far. All these factors, interconnected and dynamically harmonised, created contemporary hydrological / urban systems. The dominating meaning of such systems is their ability to transform – a desired aspect, allowing to mould the image of the contemporary city creatively and flexibly.

The constantly growing dynamics of transformations of urban structures are accompanied with the need to control the relation between the built and the natural: “balancing the needs of man and nature, defining relations between developed and open areas, including green areas, and finally, an appropriate attitude towards hydrological issues when designing cities” [11, p. 8] – these are ones of key issues for spatial and urban planning, as well as for architecture itself. Focusing on contemporary ways in which urban sections of river valleys are developed,

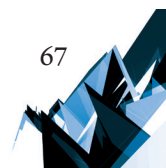
³ Design: Turenscape, 2010.

one can clearly see a reflection of tendencies referring to the problem of the co-existence of the urban structure and the matter of the natural environment.

Referring to the aspects described above, one can conclude that their fulfilment becomes a prerequisite for the functioning of the city of the future, perceived as an eco-city. Regarded through the prism of competitiveness, the city faces a challenge of taking care of its 'skeleton' – the hydrological/urban system, which is a guarantee for stable water management, as well as for the high quality of life of the contemporary man.

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