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# Urban Waterfront Regenerations

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## 1. Introduction

*“Cities seek a waterfront that is a place of public enjoyment. They want a waterfront where there is ample visual and physical public access – all day, all year - to both the water and the land. Cities also want a waterfront that serves more than one purpose :they want it to be a place to work and to live, as well as a place to play. In other words, they want a place that contributes to the quality of life in all of its aspects – economic, social, and cultural”.*

*Remaking the Urban Waterfront, the Urban Land Institute  
(Seattle Department of Planning and Design, 2012)*

Water is an indispensable natural resource that is a renewable, but limited. It uses the aims of agricultural, industrial, energy generation, household, transportation, recreational and environmental. Kılıç (2001) as cited in Hamamcioğlu (2005), water resources which have played an important role in most parts of the world throughout history in the establishment and formation of the settlements and through their getting their own identities (Pekin, 2008). Sairinen & Kumpulainen (2006), waterfront identifies the water's edge in cities and towns. Moretti (2007), in pre-industrial cities, waterfront areas were intensely used and thriving with people and activities. Also, during this period, a close relationship was between waterfront and cities. With industrial era, this relationship was interrupted due to some uses, such as huge ports, commercial, industry, warehouses and transportation (Pekin, 2008). Through the evolution of containerization technology, port activities moved to outside the city. Accordingly, industrial plants were abandoned and forms of transportation changed (Wrenn *et al.*, 1983). Also with the increasing environmental awareness and as a consequence of the pressure for upgrade in a urban areas, waterfronts were rediscovered in the city. So, phenomenon of waterfront regeneration emerged. Urban waterfront regeneration projects has become an effective tool for urban planning and politics an international dimension since 1980's (Sairinen & Kumpulainen, 2006; Goddard, 2002).

This chapter discusses waterfront, urban waterfront, its development phases, typologies of urban waterfront regenerations, advantages and disadvantage of urban waterfront regenerations, principle of sustainable and successful development for waterfront and also case studies in the world.

## 2. Waterfronts and urban waterfronts definitions

The word meaning of waterfront get through as “*the part of a town or city adjoining a river, lake, harbour, etc.*” in the Oxford American Dictionary of Current English in English Dictionaries and Thesauruses (Dong, 2004).

Moretti (2008), the word “waterfront” means “*the urban area in direct contact with water*”. According to the author, waterfront areas usually is occupied by port infrastructures and port activities. Yasin *et al.* (2010) indicated that waterfront is defined generally as the area of interaction between urban development and the water. Hou (2009), described the waterfront area as the conflux area of water and land.

Although the vocable of waterfront is clear, also it has been met using some different words instead of the term waterfront in the literature. Hoyle (2002), Hussein (2006); Mann (1973), Tunbridge and Ashworh, (1992), Vallentine (1991) and Watson (1986), these words are a city port, harbourfront, riverside, river edge, water edge and riverfront (Dong, 2004; Yassin *et al.*, 2012).

Breen and Rigby (1994), Sairinen and Kumpulainen (2006) and Morena (2012) imply the same thing with waterfront and urban waterfront. According to these, waterfront identifies the water’s edge in cities and towns or urban area of all sizes. The water body may be “*a river, lake, ocean, bay, creek or canal*” or (e.g. in Shaziman *et al.*, 2010) artificial.

## 3. The effects of water as a planning element in urban area

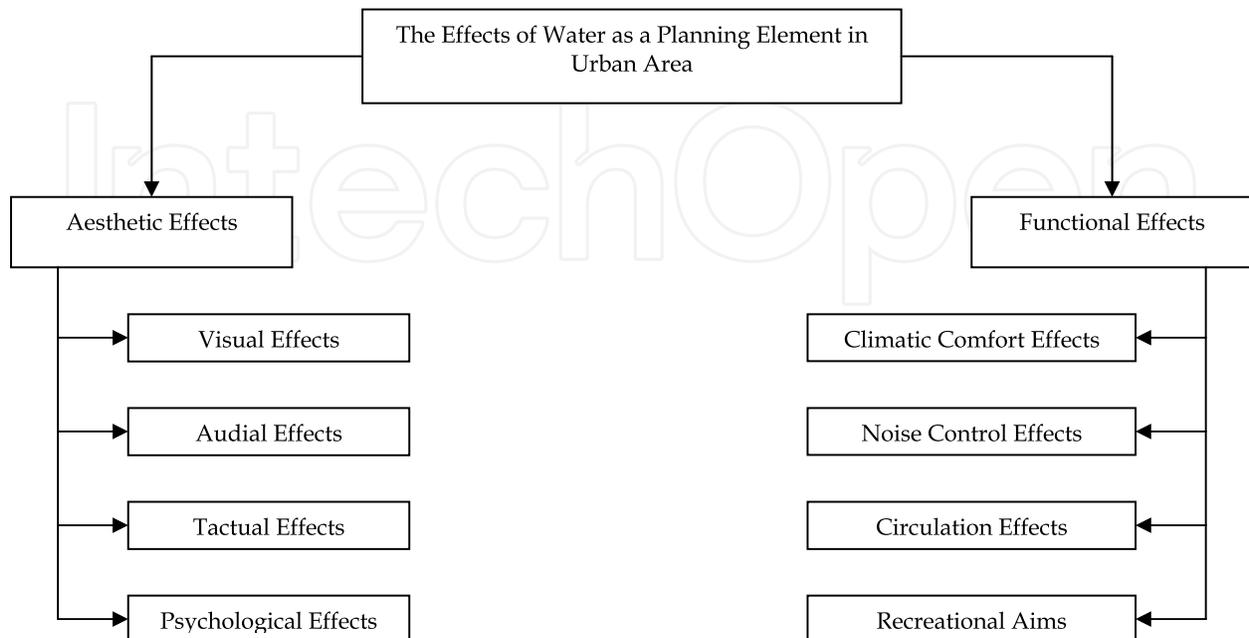
The balance is established between nature and social life for a sustainable development of cities. Urban natural water elements play an important role in the establishment of this balance. Water is the most important planning element which is comfort of human physical and psychological. In addition, it brings existing environment in a number of features in term of aesthetic and functional (Figure 1) (Önen, 2007).

One reason for the importance of natural water source in urban area is aesthetic effects whose creates on human. This effects are visual, auidal, tactual and psychological effects.

The primarily power of attracted people on waterfronts is visual landscape effects of water on relaxation. Throughout, designs related to water takes over motion and serenity factors. Moving water (Figure 2a) (waterfall, cascade rivers and etc.) adds vibrancy and excitement to a space. Stagnant water (Figure 2b) creates the mirror effect in its space as a visual (Önen, 2007).

Aksulu (2001), water is used commonly as reflection element by means of the optical properties. Wide and quiet water surfaces bring in serenity and deepness to its surrounding

or a space. Beside deepness effect of water gives more widening feeling of in living area. Also, the various light games is formed on this surface (Hattapoğlu, 2004).



**Figure 1.** Adapted from Önen (2007), the effects of water as a planning element in urban area



**Figure 2.** (a) The mirror effect of water, (b) The vibrancy effect of moving water (Önen, 2007).

Aksulu (2001), the sound of water as an audial, a symbol is in a state which exhibits continuity of life whereas it gives vibrancy and joy (Hattapoğlu, 2004). Stagnant water as an audial creates a serenity sense while moving water adds vibrancy to a space and also creates music effect (Önen, 2007).

For the tactual effects of water in planning varies from rain dropping to our face, getting wet with splashing water of waterfall to being completely submerged in pool, lake or the sea. Diving in to the water is a kind of escape from the world. Touch with water is a symbol that reach the religious serenity for many belief systems (Hattapoğlu, 2004).

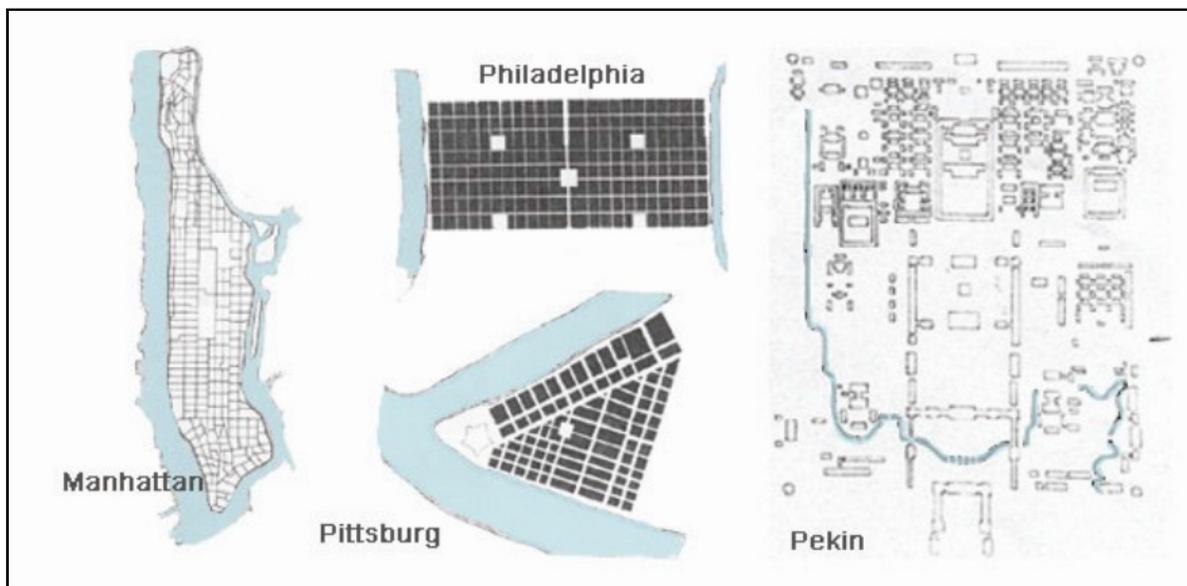
It is possible that an important effects of the aesthetic effects are psychological ones. In fact, these effects are the emotional result which is perceived with senses. In addition, there is also psychological reactions towards water which comes from people's spirits. Human being trends psychologically to water as an element which provides the continuity of life. Sound and freshness of water relax people (Önen, 2007).

Water in urban areas is aesthetic effects as well as functional effects. These are climatic comfort, noise control, circulation effects and recreational aims.

Water surfaces cool air by means of increasing the amount of moisture in an environment. Especially with continental climate, that is a great importance. Also, water is used to freshen up the outdoor's air. Wide water surfaces in regional-scale regulate air's temperature surrounding areas (Önen, 2007). Water element is an important in urban areas where is in this regions, because of its visual and climatic effects (Gençtürk 2006).

In addition, water areas in urban spaces are composed of a barrier to artificial sounds with its creating the natural sounds (Önen, 2007).

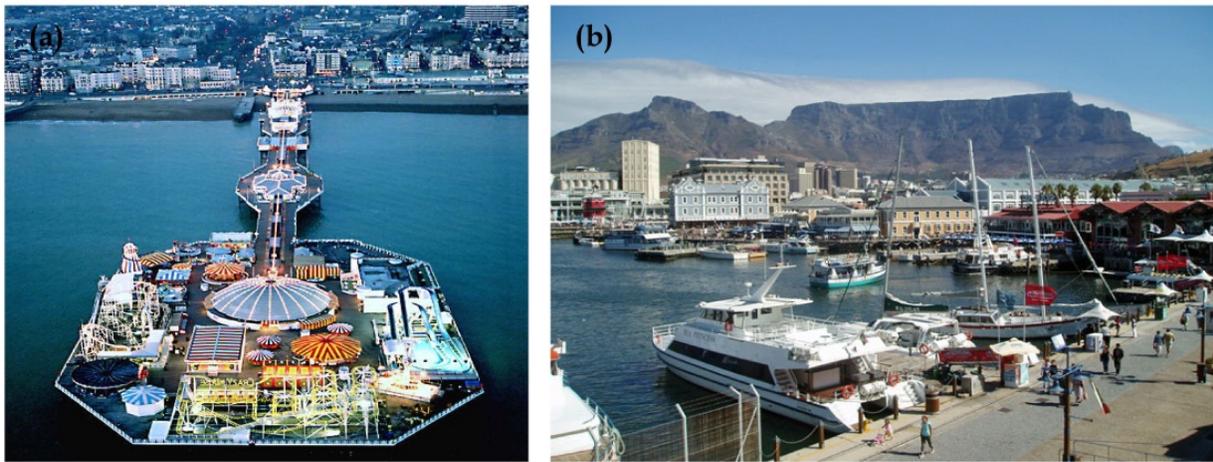
Eckbo (1950), water is in the organization of space as a limiting and concealer element. Because person has to walk around in suitable direction (Gençtürk 2006). It is possible to see mostly this effect at the riverfronts.



**Figure 3.** Moore, Lidz (1994), urban schema of Manhattan, Philadelphia, Pittsburg and Pekin (Hattapoğlu, 2004)

Rivers taked on a spine task which is established cities and in the formation of streets, parks and other urban spaces have become a major factors. For example, (Figure 3) in Manhattan, Pittsburg, Philadelphia and Pekin (Hattapoğlu, 2004).

Recreational use of water element is too varied. Natural and artificial water surfaces and its surrounding can be serve many recreational uses (Figure 4), such as swimming, fishing, boat tour, entertainment, walking etc.



**Figure 4.** Recreational uses (a) ([http://www.aerialarts.com/db\\_B\\_ton\\_Pier\\_Night1.jpg](http://www.aerialarts.com/db_B_ton_Pier_Night1.jpg)), Brighton Pier, (b) ([www.thelances.co.uk/SA/CT12.jpg](http://www.thelances.co.uk/SA/CT12.jpg)) The Victoria and Alfred Waterfront (Andini, 2011)

#### 4. Urban waterfronts categories

According to Wrenn *et al.* (1983), urban waterfronts have been distinguished five categories to location with water. Explained below the first two line symbolize coastal cities and the latter three line symbolize inland ones (Al Ansari, 2009).

- a. Urban area located on peninsula,
- b. Urban area located on a bay,
- c. Urban area located on banks of a river,
- d. Urban area located on banks of intersecting rivers,
- e. Urban area located on a large body of water.

Wrenn *et al.* (1983), regardless of that separation, the shoreline shape is a major influence on how the location of the city in reference to the water impacts the city-water links. Cities which are located on peninsulas, headlands or small islands benefit from longer waterfronts at a short distance from the city centre. The same could be said of cities located on the banks of intersecting rivers, estuaries and deltas. They have many long waterfronts, which increases the chance of public spaces located on the waterfront and also of these being connected to other hinterland public spaces (Al Ansari 2009).

#### 5. Urban waterfronts features

Akköse (2007), three factors are more important in forming the cities. The first of these is the natural structure of the city, the second of these is physical structure of the city, and the other one is social structure of the city. These three factors constitute system of the city in interaction with each other. In the natural structure of the city, the water element of presence or absence influences the process and the image of the city. Water resources such as sea, river or lake are added value in different ways. According to Dong (2004), Yassin *et al.* (2010) and Seattle Department of Planning and Design (2012), certain features of waterfront is represented to below:

- It is become an urbanized area, a important land,
- Water and land are the two essential elements of waterfront, so this area an aquatic and terrestrial features,
- The “water” may be a river, lake or sea,
- It has uncertain spatial boundaries and dimensions which change from place to place,
- The waterfront area may be a historical port area or urban area for other usages close to water,
- An essential structure of mixed land uses characterizes this essential area of the city,
- It supplies oppurtunity for interaction between human settlement and nature and water,
- As an edge environment, it is a dynamic place which changes biological, chemical and geological charachter,
- It is a special area because of being productive and biologically diverse ecosystems,
- It is a natural defense area for flooding, erosion with plant cover,
- The waterfront area is a pollution moderator.

## 6. Waterfront development

Dong (2004), indicated that the meaning of the waterfornt development has differents in terms of understandings. Also he/she emphasized that the content of waterfront development varies greatly with respect to the characteristics of sites and cities. For example, in Japan urban waterfront development is one of the interrelated three water-related development concepts. Its location is between waterside and coastal development. Also, these development levels are comen up different field. In here, waterfront development is evaluated urban planning field.

According to Morena (2011), *“the urban waterfront development is widely regarded as a frontier on contemporary urban development, attracting investment and publicity. Sydney, London, Amsterdam, Hong Kong, Tokyo, Toronto, Osaka, Kobe and Dublin are examples of cities developed through the waterfront development process “.*

Yassin et al. (2012), defined ideally as *“a development directly fronting on water for any purposes and the water components can include river delta, coastal plains, wetlands, beached and dunes, lagoon, and other water features”.* Beside, the boundary of where the water and land meet is difficult to determine and this boundary usually differ the laws and the administration of the countrys.

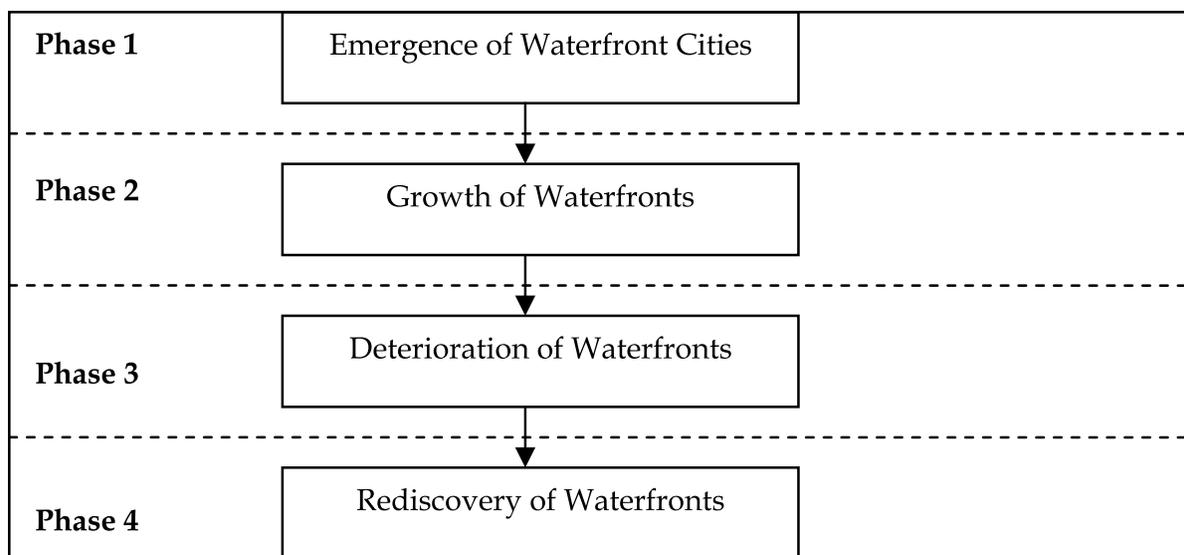
Wrenn (1983), the waterfront development stimulated modern development in the cities. Therefore, understanding the historical milestone of waterfront development is important (Yassin *et al.*, 2010). This subject has been explained in the following topic.

## 7. Typical pattern of waterfront development

Throughout history, waterfronts are the most ideal living area for human being to be able to provide food, settling, reproduction, defence and learning etc. So, the many cities or towns

are established water's edge from the history of civilization to until today. Uruk, Erudu, Ur and Babylon are an examples for early settlement about 6000 years ago (Hamamcioğlu, 2005; Morena 2011). In case nowadays, the many cities or towns in China, England, Italy and America can be given as an examples of waterfront settlement (Zhang, 2002).

Urban waterfronts have historically been the hub of transportation, trade and commerce (Letourneur, 1993). Rafferty and Holst (2004), they are always connected with close by means of reflecting immediately any change in social, economic, industrial environmental. Historically, waterfronts aren't planed carefully and consistently. Growth had been inceasing and disconnected as a result, synthezis of numerous enterprise, activities and decisions of political authority. Thus, every urban waterfront has its special history (Akköse, 2007).



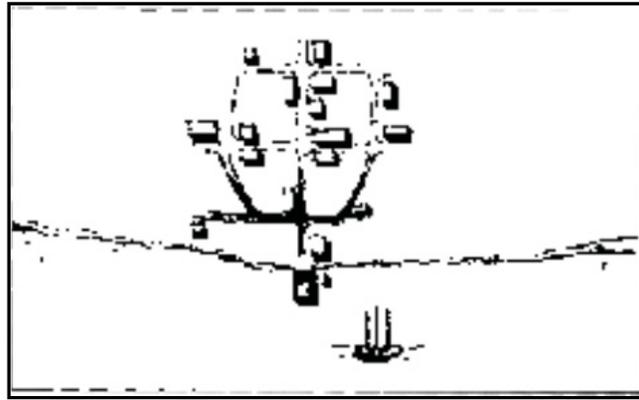
**Figure 5.** Adapted from Wrenn *et al.* (1983), typical pattern of waterfront development phases

Wrenn *et al.* (1983), indicated the historical evolution of waterfront into four periods (Figure 5). These are explained briefly as follows:

a. Emergence of Waterfront Cities

The early American settlements, the waterfront and the city was directly contact. Waters plays an essential role for trade activity and water tranportation. Settlements were established and European immigrant colonies arrived. The movement of production and people is provided between the two continent by sea route. A settlement's waterfront served to link the necessities of Europe with a familiar and predictable environment (Zhang, 2002; Akköse, 2007; Yassin *et al.*, 2010).

These settlements were established around a port with safe harbor suitable for cargo and passenger ships (Figure 6). At this time, the waterfront has only a few trails converging at a jetty. After, a street pattern was slowly installed. In this period, a larger wood pier was usually established for ship. Also, buildings began to develop on the street pattern. Though the rapid growth and development, the settlement still connect with the waterfront a shoreline road (Akköse, 2007; Wrenn *et al.*, 1983).



**Figure 6.** Typical pattern of waterfront development (Phase 1) (Seattle Department of Planning and Design, 2012)

b. Growth of Waterfronts

The first period of ports has converted contain of many functions ports with increase of economic activities. At this time, the settlement became a city and maritime trade stimulated urban development (Figure 7). The shoreline road turned into a busy street providing services, supplies, and officespace for commercial activities. The waterfronts became more important state and commerce escalated with the use of steamships. Warehouses were constructed along the waterfront and these rows of warehouses blocked the water's edge from the street. Also, in the former period used of wooden piers replace by bigger docks made of stone and fill material. By filling out into the water to expand docking and storage facilities. The rapid development waterfronts as a port facility caused the formation of a port authority for managing the port activities (Akköse, 2007; Wrenn *et al.*, 1983).

At this period, railroad was introduced as a new mode of transportation. This required some space from waterfront to service docks and install tracks. As a result of this change, effectively severed the central city from the waterfront. Also, the waterfront became increasingly congested. Since 1930's, elevated highways and interstate freeways was built the shoreline to decrease this congestion. Offices and stores along the old shoreline road were converted to warehouses (Wrenn *et al.*, 1983; Zhang, 2002).

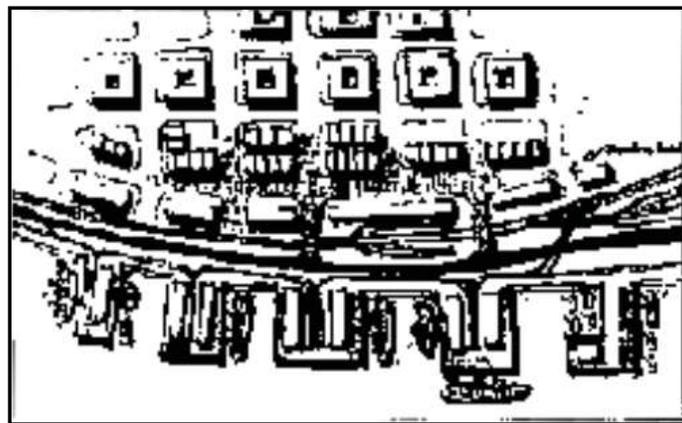


**Figure 7.** Typical pattern of waterfront development (Phase two) (Seattle Department of Planning and Design, 2012)

At this time, transportation and industry become the only use of the waterfront. Beside, in the previous period contact directly with water is lost as construction of warehouses, railway and highway create a barrier to public access. In the meantime, the waterfront environment deteriorated because of the industrial pollution. The water became dirty and the waterfront began to lose its natural attraction to many urban residents. (Wrenn *et al.*, 1983; Letourneur, 1993).

c. Deterioration of Waterfronts

Rafferty and Holst (2004), until World War II, the loading-offloading activities of ship was carried out in along time in a port areas (Figure 8). After the War, the amount of load and speed of the loading-offloading increased with the development of containerization technology (Akköse, 2007).



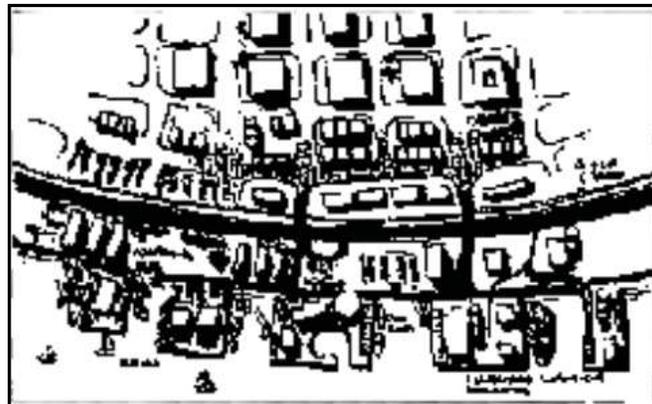
**Figure 8.** Typical pattern of waterfront development (Phase three) (Seattle Department of Planning and Design, 2012)

Zhang (2002), the old port areas were too constricted for modern container ships and equipment to maneuver easily, also Rafferty and Holst (2004), as cited in Akköse (2007) water depth was not enough for approaching the ships. Millspaugh (2001), after World War II, as a result of developments in maritime industry, thereby growing port activities started to need new areas (Akköse, 2007). Thus, port activities moved to outside the city. So, the old ports lost the role as the transportation and industry center. With the construction of highways largely changed the transportation patterns and this contributed to be abandoned the waterfronts areas. Also, people preferred the highways to railroads because of their freedom of choice. Due to fewer people chose railroad, the waterfront became even deteriorated (Zhang, 2002).

Beside these changes, increasing public interest over pollution contributed to the waterfronts demise. With the introduction of stricter air and water pollution controls, manufacturers began to leave the city. As a result, many ports fell into disuse. Also, the railroads suffered because of decline of manufacturing plants and disinvestment. Railroad yards on the waterfront were neglected. The waterfront virtually became a deserted, inaccessible and unsafe area, further separating the urban core from the water (Zhang, 2002; Wrenn *et al.*, 1983).

d. Rediscovery of waterfronts

In the waterfront areas of abandoned old ports was available several problems. The first of these was caused pollution by the port and industrial activities. Second problem should be obsolete infrastructure of the industrial areas which is surrounded by abandoned warehouses and other port structures. In addition, the railroad and the highway broke off the link between urban center and waterfront area and also prevented interaction each other (Akköse, 2007). Also, in the 1960's, people became more concerned about environmental-city health and the misuse of natural resources. Locals wanted to recover the aesthetic scenery of the waterfront which had been neglected for years. As a result, the port's commercial failure caused reevolution of waterfronts by private developers and city governments (Zhang, 2002). So, U.S. Department of Commerce, NOAA and OCZM (1980), it was at this time that an opportunity exists for the public use and a mix of recreational, residential, and commercial uses were developed (Figure 9). The lost intimate connection was provided again between the city and its waterfront. In the meantime, a new port to respond to new technology was established outside the city where space was plentiful (Wrenn *et al.*, 1983; Letourneur, 1993).



**Figure 9.** Typical pattern of waterfront development (Phase four) (Seattle Department of Planning and Design, 2012)

Waterfronts vary depending on many interrelated factors. These are a city's history and size, its location, land structure and climate, the diversity of water-related uses and city's management status. For this reasons, each waterfronts may be some variance in the typical waterfront evolution pattern. But, one fact is common, urban waterfronts dramatically changed because of the influence of social and technology factors. Finally, much more area has been regained public use and access (Wrenn *et al.*, 1983; Zhang, 2002).

## 8. Urban waterfront regeneration

With the rediscovery of the urban waterfronts, Sairinen and Kumpulainen (2006), as cited in Pekin (2008) new laws were enacted to govern the structural changes in there and for this goal, new planning methods were developed.

As most of the waterfront development projects arise in the larger context of urban renewal, for these projects a number of other expressions are used similar to this phrase. But most of these projects concentrate on the regenerating function. Such expressions include “*waterfront regeneration*” (e.g. in Wood and Handley, 1999; McCarthy 1996), “*waterfront revitalization*” (e.g. in Goodwin, 1999; Hoyle, 2001), “*waterfront rehabilitation*” (e.g. in Hoyle & Pinder, 1981: 83), and “*waterfront redevelopment*” (e.g. in Gospodini, 2001; Gordon 1999) (Dong, 2004). Also, the terms which is used in their development may vary according to study’s border and as a regional domain (Koca, 2011).

The interest of waterfront regeneration phenomenon emerged from North America in the mid 1960’s, with a rehabilitate of Baltimore’s Inner Harbour (Figure 10), a project that transformed the degraded harbor zone to an urban leisure centre (Papatheochari, 2011; Al Ansari, 2009; Goddard, 2002; Tastsoglou & Dimitra, 2012). Breen & Rigby (1996), Hoyle (2001a), Shaw (2001), this phenomenon is characterized as a Baltimore Syndrome, is still in full swing (Al Ansari, 2009).

Many factors are considered more as the sources of the phenomenon, except those mentioned previously. But the two most essential are Connors (1986), Meyer (1999), Norcliffe *et al.* (1996), Tunbridge (1988), the economic transition from industrial to post-industrial service base and Clrake (1972), Cohen *et al.* (1997), Pinder and Witherick (1993), Vitousek *et al.* (1997), the high concentration of population at waterside (on the riverine, lacustrine, estuarine, and costal zones) locations (Al Ansari, 2009).

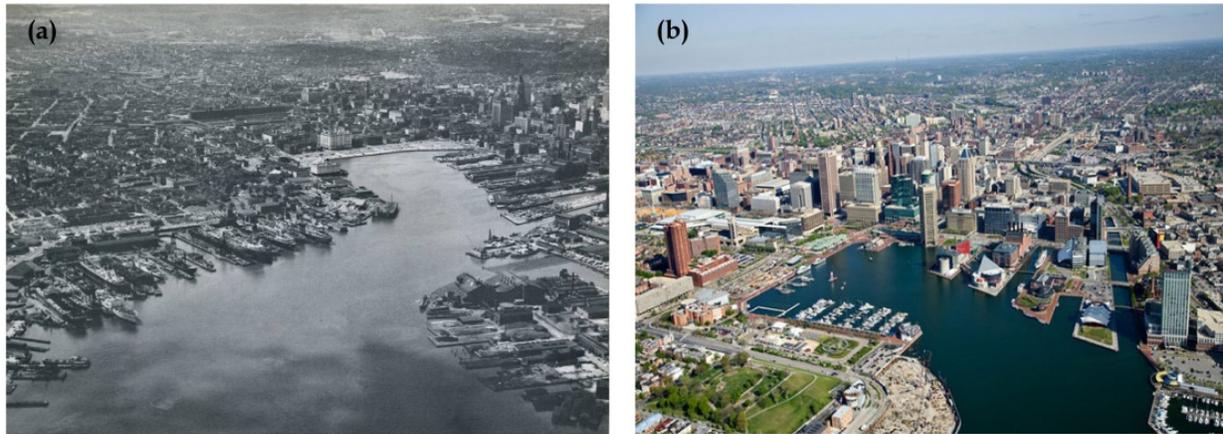
Tunbridge (1988), remarked that prompted a general revitalisation of US port-cities based on several factors among which are changing demography, availability of cheap, residential property, increasing heritage awareness, increasing quality of life awareness, the desire to live closer to work and the increasing importance of urban tourism (Jones, 1998).

Also Jones (1998), indicated that the movement of waterfront in US is attributed to a few of factors which have involved the following:

- The increasing amount of leisure time and the need for more recreational area,
- The need to conserve historical and architectural heritage, because of being found old dockland areas of the first American ports,
- According to Breen & Rigby (1998), US Federal Government support by means of urban regeneration action grants and other development tax incentives.

*“Tunbridge (1988), and Malone (1996), pointed out that the movement provides a parallel thread to the overall urban regeneration process. Also, Wood (1965) suggested that waterfronts are naturally prone to renewal and regeneration because they are usually in the oldest parts of the city”* (Al Ansari, 2009).

According to Shaw (2001) the regarding theoretical work has always followed the practical part of the process. Hoyle & Pinder (1992), Hoyle *et al.* (1988b), explained that the main bulk of the regarding research started to accrue in North America in the 1970’s and in Europe in the 1980’s (Al Ansari, 2009).



**Figure 10.** (a) 1960's in Baltimore Inner Harbour (Kilduffs Baltimore's Harbor, 2013), (b) Present day (Anonymous, 2013a)

The first examples of waterfront regeneration came in the 1970's from cities in the North America (Papatheochari, 2011). In case its applications became widespread in the 1980's in there (Jones, 1998; Goddard, 2002). Generally, the waterfront regeneration varied to urban interventions and politics of countries. For example, in North America Hoyle (2000), the waterfront is considered to be part of the urban renewal process in North America, whereas Hoyle (2000), (2001a), Tunbridge (1988) in Europe, it is regarded as a mere side-effect of the changes in maritime transportation, however, in the UK, it is a component part of post-industrial urban regeneration.

The American waterfront regeneration is consist of mixed uses including residential, recreational, commercial, retail, service and tourist facilities. Mainly residential, recreational and tourist-related uses were often the predominant than the others in this model. Also this largely became the typical development model within the US. and this model was widely accepted by other countries. The experience of Amerikan waterfront regeneration, especially Baltimore's Inner Harbour regeneration, influenced many in Europe (from Scandinavia, UK and the Netherlands to Spain and all southern Europe) and worldwide (Australia, Japan, Latin America, the Middle East and South Africa (Papatheochari, 2011; Jones, 1998).

English Tourist Board (1988), Hoyle *et al.* (1988), indicated that the most influential examples of the US waterfront regeneration projects in worldwide are The Inner Harbour Baltimore, Quincy Market Boston, The Pierhead Building New York, San Diego's waterfront village, Giradelli Square and Pier 63 San Francisco (Jones, 1998).

To Jones (1998), *"since the mid 1980's the vocabulary of urban waterfront regeneration has been clearly established in the minds of developers, local authorities and national government departments"*.

Beside, waterfront regeneration is viewed as a standart catalyst of inner area regeneration for any city or town in the mid 1980-1990's (Goddard, 2002).

The widespread recognition of the phenomenon and its importance brought about the establishment of research centres, such as The Waterfront Centre - Washington D.C. (1981), Association Internationale Villes & Ports - Le Havre (1988), The International Centre Cities

on Water - Venice (1989). Aim of these enhance scientific studies and research about the planning and design stages necessary for an effective development of waterfront area. According to Waterfront Expo (2004) it is guessed that £55 billion is going to be spent on waterfront projects between 2004 and 2009 (Al Ansari, 2009; Giovinazzi & Giovinazzi, 2008).

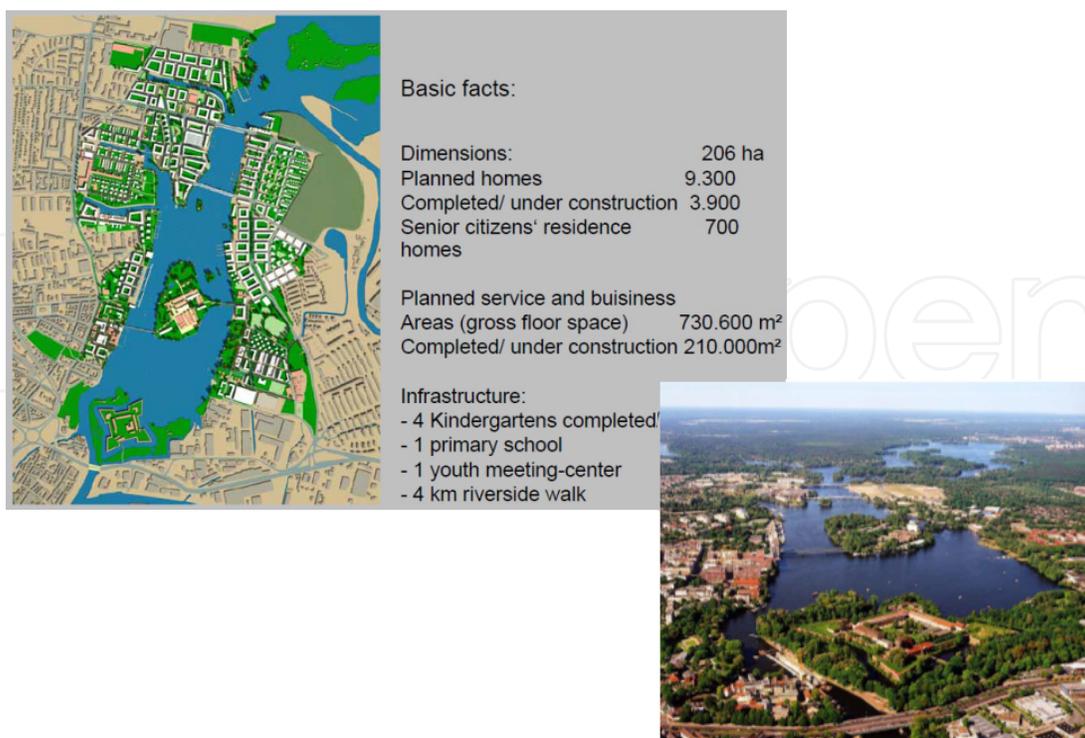
As a result, this phenomenon which began about fifty years ago, has been applied vigorously in recent years on many waterfronts around the world (Tastsoglou & Dimitra, 2012).

The intensification of waterfront regeneration is really remarkable during the last decades as waterfront cities began to develop postindustrial urban development strategies throughout the 1970's, 1980's, and 1990's (Λουκαδάκη, 2011).

## 9. Different typologies of urban waterfront regenerations

Hoyle (2000), urban waterfront regenerations are't just met a phenomenon which is in post-industrial port cities. They are possible to see all kinds of waterside settlements which includes waterfronts created on reclaimed wet or foreshore lands (Al Ansari, 2009). With respect to aims of their classification is very difficult. Because, one regeneration has a few aims at the same time. Moretti (2008) indicate different typologies of waterfront regenerations as follow:

- a. New Urban Expansion: This typology contains the waterfront areas which is built all over again in available areas; and reclaimed old industrial or port areas. Some examples of it can be given a Hafen City in Hamburg, and (Figure 11) on Lake Spandau and the Bay of Rummelsburg, in Berlin (Moretti, 2008a; Giovinazzi & Giovinazzi, 2008).



**Figure 11.** A view of Lake Spandau in Berlin (Hellweg, 2013)

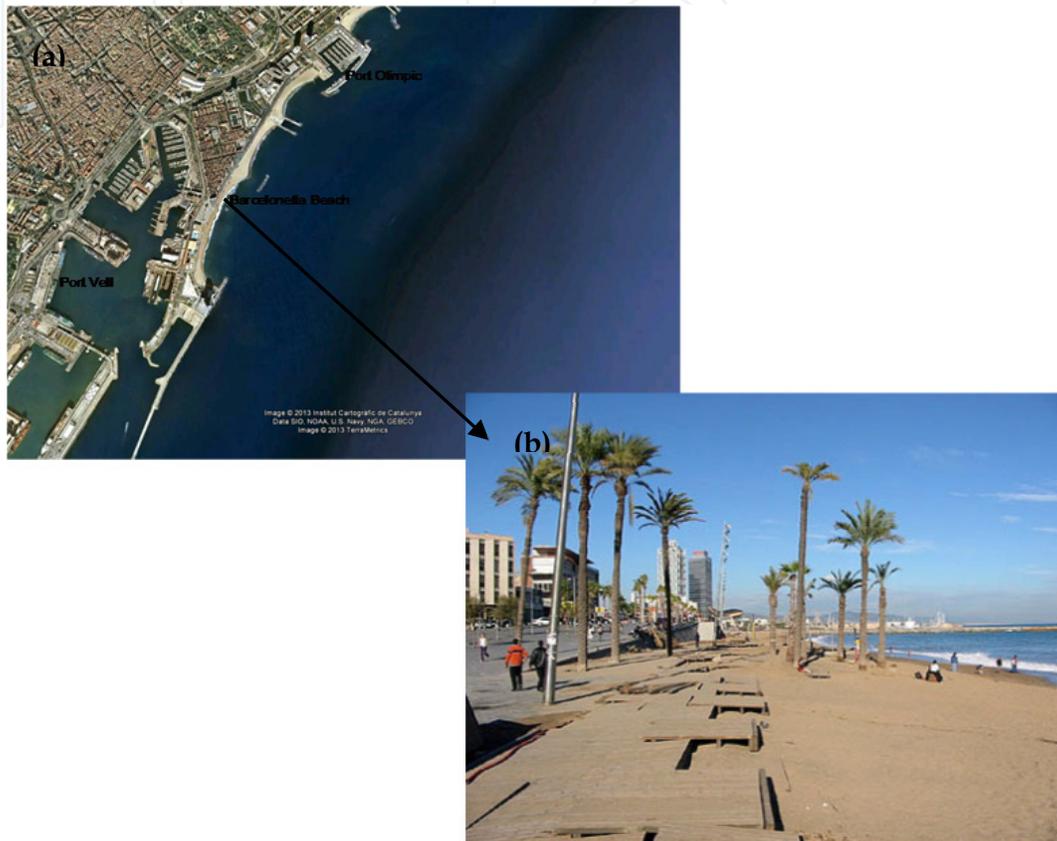
- b. **Waterfronts and Great Events:** In this one is established as a consequence of important temporary events in the waterfront area such as the *Expos* (Figure 12): in Seville (1992), Barcelona (1992, 2004), Genoa (1992 and 2004), Lisbon (1998), London (2000), Zaragoza (2008). Afterward, new urban areas are developed around these areas like residential and production area (Moretti, 2010).



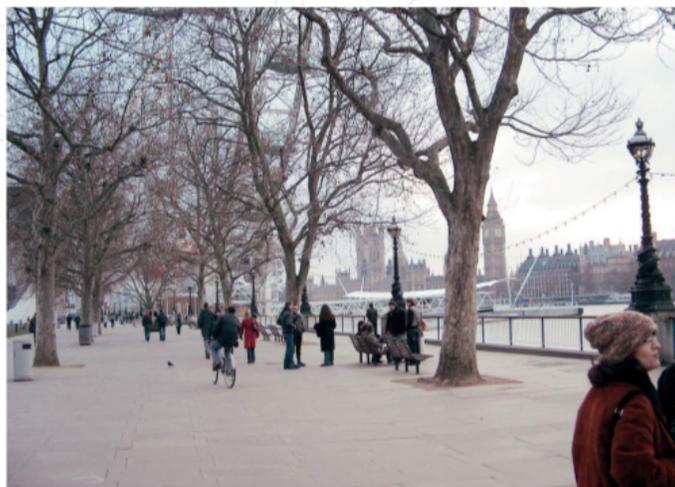
**Figure 12.** Example visions of Expos (Moretti, 2008b)

- c. **New Urban Waterfront Itineraries:** The waterfront regeneration implies innovative consequences along the banks and in the surrounding areas. It provides public uses along pedestrian paths. For example, Barcelonetta Beach and its environs (Figure 13) which connects the port areas and river bank along the Thames in London (Figure 14) with public uses like a jogging, walking and cycling etc. (Aksoy, 2006; Moretti, 2008a).
- d. These settlements were established around a port with safe harbor suitable for cargo and passenger ships (Figure 6). At this time, the waterfront has only a few trails converging at a jetty. After, a street pattern was slowly installed. In this period, a larger wood pier was usually established for ship. Also, buildings began to develop on the street pattern. Though the rapid growth and development, the settlement still connect with the waterfront a shoreline road (Akköse, 2007; Wrenn *et al.*, 1983).
- e. **Reuse of Port Areas:** This typology includes waterfront areas which is regenerated former port areas. With re-use of these areas, the water is regained the heart of cities. For instance, (Figure 15) Rotterdam (Moretti, 2008a).
- f. **Flood Defence:** Some structures which is established for river flood defence can represent a new opportunity for city expansion and for the establishment of new urban uses. Three examples of this can be given. The first one is with green areas and

recreational uses like an open air festival and sport activities etc. The Donauinsel (Danube Island) in Vienna (Figure 16a), as a created barrier island (Moretti 2008a). For over 20 years at the end of June a couple million people gather at the Donauinsel for to visit the biggest open air festival in Europe, the Donauinselfest (Anonim, 2013c). The others are Guadalupe River (Figure 16b) in San José, California, USA and Porsuk Stream in Eskişehir, Turkey.



**Figure 13.** (a) View from above Barceloneta Beach in Spain (Anonymous, 2013), (b) (www.leatherdevil.com) public uses in the beach (Aksoy, 2006)



**Figure 14.** Thames River Bank provides public access to the river and cultural sites (Donofrio, 2007)



**Figure 15.** Reuse of port areas such as Rotterdam in Holland (Moretti, 2008a)



**Figure 16.** (a) The Donauinselsefest in Vienna (Anonymous, 2013d), (b) Guadalupe River in San José, California, USA (Önen, 2007)

- g. **Urban Beaches:** Urban beaches are described by urban planners as an artificially created environment in an urban areas. They show a distinctive and alternative mode of reusing of waterfronts. Urban beaches are relatively unfixed due to temporary and mobile. Their locations and uses may be change. They may be a seasonal (especially the warmer months) installation over a roadway or a parking lot or a public park or a site cleared by demolition. Urban beaches have a view of urban waterfronts, also in this areas sometimes can be possible access to the water. These areas are compared with to natural beach environments by using thematic objects such as a large volume of sand, beach umbrellas, setting elements, palm trees and thatched huts. The first urban beach in contemporary was created in France. Use of urban beaches spread rapidly to major city centres throughout Europe and in North America and Australia (Anonymous, 2013e; Stevens, 2011). Urban beaches not only provide a lot of recreational and sport activities but also represent social activities as a sort of 'piazza' (Moretti 2008). For example, Strand Pauli in Hamburg, The Badeschiff on the Spree River in Berlin, Porsuk Plage in Eskişehir, Paris Plage in Paris etc.



**Figure 17.** (a) Strand Paulion the banks of the Elbe River in Hamburg (Anonymous, 2013f), (b) The Badeschiff on the Spree River, in Berlin (Anonymous, 2013g), (c) Porsuk Plage in Eskişehir (Original, 2010) Street beaches, (a) Paris Plage (Anonymous, 2011)

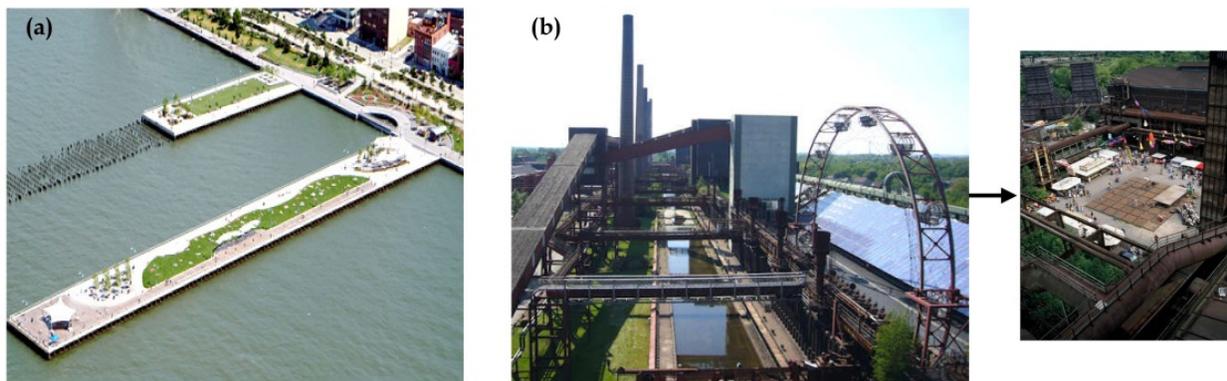
Urban Riverfront Regeneration: *s the intersection between different aspects of urban life, the river represents a community heritage and its riverfront demonstrates a great potential for becoming a central axis in a new and articulated public space.* Some examples of it can be the Cheong Gye Cheon canal in Seoul, Houtan Park Shanghai in China (Figure 18), Brda River in Poland (Figure 19a), Dark River Irwell in Manchester (Figure 19b), Hudson River Park in New York (Figure 20a), Emscher Landschaftspark in Germany (Figure 20b).



**Figure 18.** Houtan Park, Shanghai (Landscape Architecture Foundation, 2013)



**Figure 19.** (a) Brda River in Bydgoszcz in Poland (Original, 2012), (b) Dark River Irwell in Manchester (APEM and Environment Agency, 2010)



**Figure 20.** (a) Hudson River Park, New York (Anonymous, 2013h), (b) Emscher Landschaftspark in Germany (Anonymous, 2013i; Cabe, 2010)

## 10. Benefits and risks of urban waterfront regeneration

Urban waterfront regeneration, which is a phenomenon in global dimension, has social, economic and environmental benefits to the community. According to Papatheochari (2011), Jones (2007) and Goddard (2002), the most pronounced benefits of urban waterfront regeneration are:

- The increase in real estate property values,
- The preservation of historical and local heritage also re-use of historic buildings,
- The improvement of water quality and water ecology by means of advanced management processes,
- Providing opportunities for new uses and activities,
- Representing new economic regeneration opportunities for declining inner city areas,
- Attracting tourists not only at the regional level, but also nationally and internationally,
- The provision of many new homes,
- Providing new jobs,
- The improvement of environmental conditions,

- The advancement of better services of transport and social service,
- Providing of relationship between water and the city,
- Encouring of economic investment on degraded areas,
- With the improvement of the city's image which causes right marketing strategies.

Urban waterfront regeneration may also have some of the risks and the negative effects as well as mentioned these benefits. The risks and negative effects of waterfront regeneration explain as follow according to Morena (2011).

- **Standardization of the invertensions;** When a regeneration invertension is a planned, one of the greatest risks is to select. In short, models can be unconnected with area under evaluation. The result often leads to a kind of disorientation where the identity of the place is lost.
- **Little room to real estate logics;** *"Sometimes, the final outcome does not correspond to the project's initial objectives, and the the 'common good' in terms of spaces, enjoyment and access, is partly neglected in favour of property interests"* (Morena, 2011).
- **An excessively commercial-tourist functions;** Domination of these functions over residential and productive ones are an important risk. Because, these areas are usually used a few hours a day and in the weekends. While about the project area is done planing, in order to provide long term use of this area should be also added residential use as an extra commercial-tourist (Morena, 2011).
  - The surrounding of residential areas should be mixed both functionally and socially (Giovinazzi & Moretti, 2010).
- **Aim of high profit level;** The achievement of high profit level is considered important rather than the quest for a high quality (Moretti, 2008a).
- **Free access to the waterfront;** The aim in this project is provided relationship between people and waterfront. So access of this areas should be free and indiscriminate. Recently, such transformation have produced new bans and new areas reserved for just a few categories (Morena, 2011).

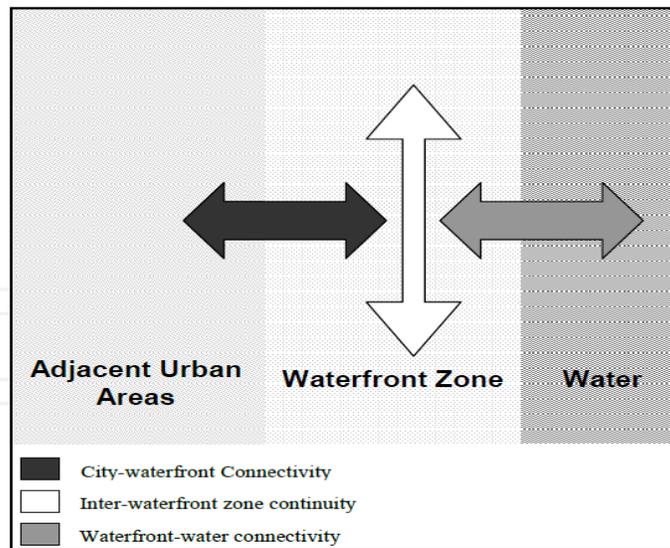
#### *Principles for successful development of urban waterfront areas*

Waterfront plans are of vital importance to waterfront developments. According to Acosta (1990) while the plan makes, three elements are considered: public access, walkways and open spaces; urban design and landscaping; and land uses along the river's edge (Dong, 2004).

The base of waterfront regeneration are integrated with water and city. So, public access and open spaces more important for successful development of urban waterfront areas.

Accesibility of the water can be evaluated three formats: City-waterfront connectivity, inter-waterfront zone continuity and waterfront-water connectivity. These were presented in Figure 21.

Acosta (1990), urban design guidelines can protect the public interest by spelling out basic standards for private development. In addition, criteria that are given out for urban design guidelines should be simple and clearly stated; fully illustrated; remain consistent over time. Adair *et al.*, (2000) maintained that a master plan approach is essential so that investors can realize the long-term commitment to a particular scheme (Dong, 2004).



**Figure 21.** Figure 20. Accessibility of the Waterfront (Al Ansari, 2009)

Furthermore, aesthetic and functional effects of water should be gotten rich with plantal and structural designs in urban waterfront regeneration plans.

Lynch, Spence, and Pearson (1976), land uses in urban waterfront areas should be categorized by degree of integration with water (Dong, 2004). In this context water dependency is also important. Sairinen & Kumpulainen (2006) and Erdoğan (2006), indicated that a threefold classification of it is dependency is possible:

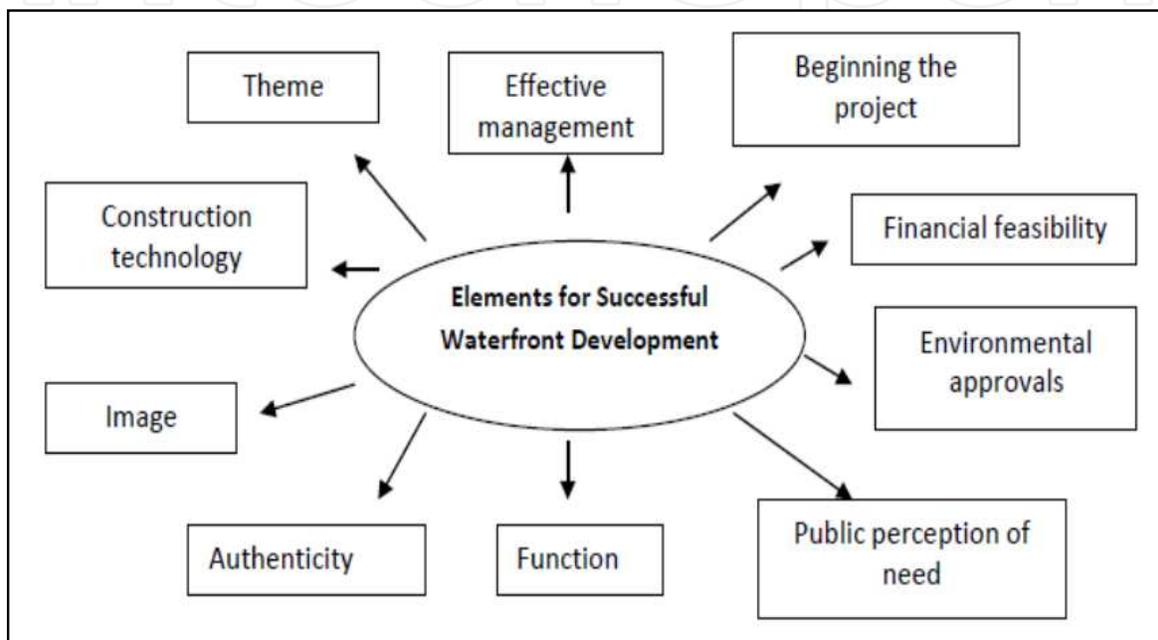
1. Water-dependent uses: Waterfront location is indispensable. Like a field of ferryboat, marine terminals, ship repair and construction works, commercial huntings can be given examples to this group.
2. Water-related uses: Because of in waterfront areas are uses that are in the condition of advantageous. For example, industrial production fields, some storage facilities and public spaces.
3. Water-independent uses: This group uses are neither dependent nor related to waterfront. For instance, public parks, some commercial and service complexes.

Torre (1989) identified that the success of a waterfront development is only achieved once it can function on all levels and benefit all stakeholders. Also, he/she point outed that 10 elements recommended to be taken into consideration while planning a waterfront development to achieve the specific aims of a successful waterfront development (Yassin, Bond and McDonagh, 2012). These were presented in Figure 22.

In addition, Bertsch (2008) recommended several principles that must be included while developing plans for waterfront areas: (i) accessibility, (ii) integrated, (iii) sharing benefits, (iv) stakeholder participation, (v) construction phase (Yassin *et al.*, 2012).

Also Wang (2008), have examined samples of waterfront regeneration in USA, UK and Europe. According to this, he/she suggested that the waterfront regeneration will be succeeded if the following aspects have been followed:

- i. Waterfront should be define and the future role of waterfront in the city should be think,
- ii. The master plan should be make, the participation of the communities and developers in the earliest stage,
- iii. Physical and economic conditions should be fostered for the waterfront regeneration,
- iv. Public authorities, private organisations and community groups should be worked together,
- v. The master plan should be reviewed in order to to respond the market change and to reduce the financial risk.



**Figure 22.** Figure 21. Torre (1989), elements for successful waterfront development (Yassin *et al.*, 2012)

#### *Principles for a sustainable development of urban waterfront areas*

In the present day, to Thomas (2003), 2.8 billion people worldwide live in urban areas. They are great magnets to most humans with offered social and economic opportunities as well as facing several problems such as air, water and noise pollution, lack of open and green areas and inadequate transportation. It is predicted that by the end of the 21st century three-quarters of the world's population will be urban. There is no doubt that this demographic trend will increase more the existing negative effects on urban environment. These urban issues are handled within the framework of sustainability (Vasconcelos Silva, 2006).

Water is basic source of life for the living. At the same time, it is an ecological, economic and social benefits for the cities.

Areas which is seen these benefits are waterfronts. To be benefited from those should be provided a sustainable developments in these areas.

Sustainability is evaluated three dimensions: economic, environmental and social. These three dimensions must be combined at all levels (Vasconcelos Silva, 2006).

Giovinazzi & Moretti (2010) indicated the 10 principles, which were developed by Cities on Water in collaboration by Wasserstadt GmbH, Berlin, in the course of international seminars, were approved in the context of the initiatives for the Global Conference on the Urban Future (URBAN 21) held in Berlin in July 2000 and in the course of the EXPO 2000 World Exhibition, for a sustainable development of urban waterfront areas. Also, Benson (2002), highlighted 9 lessons, which were experience of the Waterfront Regeneration Trust in The Lake Ontario Waterfront Trail, for success in regeneration. The some of these lessons overlaped with sustainability principles.

According to them, principles for a sustainable development of urban waterfront area were explained as follow.

### 1. Secure the quality of water and the environment

Bruttomesso (2001), Krieger (2004), Locklin (1999), White (1991), the quality of the water is an important dimension that could affect the waterfront, particularly its accessibility and the variety of its uses (Al Ansari, 2009). For this reasons, the quality of water in the system of streams, rivers, canals, lakes, bays and the sea is a prerequisite for all waterfront developments. So, the water need to be treated to achieve good water quality and also, create better sense of smell for the public. Aspect of quality environment is an important element in dealing space for public comfort and health (Giovinazzi & Moretti 2010; Shaziman *et al.*, 2010).

The municipalities (local managements) are responsible for the sustainable recovery of derelict and neglect banks and contaminated water (Giovinazzi & Moretti 2010).

### 2. Waterfronts are part of the existing urban fabric

Waterfront development plans must ensure that waterfronts are reconnected to urban fabric. That is to say new waterfronts should be considered as an integral part of the existing city and contribute to its vitality. So, these plans should be based to develop on overall urban planning and also conserved the qualities of public areas (Benson, 2002; Giovinazzi & Moretti, 2010; Hou, 2009). Beside, waterfront green areas should be considered whole city system (Kaynak!!)

Furthermore, water is a part of the urban landscape and should be used for specific functions such as waterborne transport, recreation, culture and aesthetic etc. (Giovinazzi & Moretti, 2010).

### 3. The historic identity gives character

Collective heritage of water and city, of events, landmarks, existing architecture and nature should be utilised to give the waterfront redevelopment character and meaning. Especially, the preservation of the industrial past is an integral element of sustainable redevelopment for in post-industrial port cities (Giovinazzi & Moretti, 2010). So, natural and cultural landscape should be conceived together.

With these aims, while waterfront green areas plan, they should be combined with cultural landscape. In this manner, continuity of urban historical context will be provided. Beside, the vitality of waterfront landscape will be enhanced (Anonymous, 2013i).

#### 4. Mixed use is a priority

Urban waterfronts are the interface between water and land (Wrenn *et al.*, 1983). While apply uses select, uses that require access the water should be priority as water function is in the foreground. Waterfronts should celebrate water by offering a diversity of cultural, commercial and housing uses (Giovinazzi & Moretti, 2010).

#### 5. Public access is a prerequisite

Bertsch (2008), as cited in Yassin *et al.* (2012), the urban waterfront should not be isolated or separated from the development, so that the public can access the waterfront easily.

Waterfronts should be both physically and visually accessible for locals and tourists of all ages and income at any time. Visual access to the waterfront area is enhanced by providing series of view corridors. The accessibility to the waterfront for pedestrians is maximized by providing physical linkages from the urban core areas. Also, public areas should constructed in high quality (Figure 23) to allow intensive use (Giovinazzi & Moretti, 2010; Al Ansari, 2009; Shaziman, *et al.*, 2010). As technology develop, it is subject use of lots new kind of material (Figure 1) in this area (Hou, 2009). So, that should be considered in planning and designing phase.



**Figure 23.** An examples of innovative designs, Dark River Irvel in Manchester (APEM and Environment Agency, 2010)

#### 6. Make the waterfront a community priority

Once a vision for the waterfront is determined and development (or regeneration) should be handled not just for local residents and businesses but essentially for the community as its priority (Benson, 2002).

#### 7. Planning in public private partnerships speeds the process

Waterfront development connects people and spaces. It requires cooperation to reach a common objective (Benson, 2002). So, new waterfront developments should be planned in

form of public-private partnerships. *“Public authorities must guarantee the quality of the design, supply infrastructure and generate social equilibrium. Private developers should be involved from the start to insure knowledge of the markets and to speed the development”* (Giovinazzi & Moretti, 2010).

#### 8. Secure strategic public investment and attract private resources

Preservation of strategic public investments and luring private resources would have an increasing effect on utilization of waterfronts in long term. Entrepreneurial leadership, and strong, strategic planning attract investment of private sectors (Benson, 2002).

#### 9. Public participation is an element of sustainability

Sustainable waterfront development should be developed not only in ecological and economical aspects but also socially. For this reason, the planning processes must be transparent and they must provide meaningful opportunities for the involvement of people. In other words the community should be informed and involved in discussions continuously from the start (Figure 24). Such an approach should be necessarily taken into consideration as an important element for sustainability and good planning of waterfront development (Giovinazzi & Moretti, 2010; Benson, 2002).



**Figure 24.** Public involvement in Newark Riverfront Regeneration Plan (Booker, Pryor and Rich, 2010)

#### 10. Waterfronts are long term projects

*“Waterfronts need to be regenerated step by step so the entire city can benefit from their potentials. They are a challenge for more than one generation and need a variety of characters both in architecture, public space and art. Public administration must give impulses on a political level to ensure that the objectives are realized independently of economic cycles or short-term interests”* (Giovinazzi & Moretti, 2010).

#### 11. Regeneration is an ongoing process

All master planning must be based on the detailed analysis of the principle functions and meanings the waterfront is concerned. Plans should be flexible, adapt to change and incorporate all relevant disciplines. To encourage a system of sustainable growth, the management and operation of waterfronts during the day and at night must have equal priority to building them (Giovinazzi & Moretti, 2010).

## 12. It requires a multidisciplinary work

The regeneration of waterfronts is a highly complex task. For this reason, participation and collaboration of several occupational disciplines is required both in its planning and application (Giovinazzi & Moretti, 2010).

## 13. Look beyond your boundaries

According to Spirn (1994), although problems caused by urbanization may differ from city to city and from country to country, they have a lot in common (Arslan 1996). Approach of the countries and cities which succeeded in solving those problems should be examined and considered. Accordingly, when waterfront regeneration is also concerned, data, service and products at both national and international level should be shared and exchanged by means of a vision overreaching the borders. This reality means that the waterfront has become a place of international interest and significance. That's a vital economic reality and also a huge opportunity for the country or city to attract new investment, and to continue to learn from others engaged in regeneration (Benson, 2002).

# 11. Case studies

## 11.1. Porsuk Stream, Eskişehir, Turkey

According to Anonim (2005), Ulu (2005), Eskişehir which was only a small settlement with under 30.000 residents until the period of the Republic increased the number of its population to 706.009 by 2000 with a rise of 4,5 times. Until 2001, Porsuk Stream and its banks within the city of Eskişehir has been exposed to intensive pressures because of the increasing number of the city population, and the following inaccurate use of the related lands. As a result, the stream has become almost an open sewage running through the city (Pekin, 2008).

Eskişehir Greater Municipality took into consideration the fact that a city with a river running through is always under threat of possible floods and also the recent earthquake disaster (August 17, 1999) the city experienced and so initiated the Project of Porsuk Stream in 2001 (Figure 24) with the support of European Investment Bank with the aim of protecting the city from the damages of natural disasters and also minimizing the effects. This project is performed as the Project to Lessen the Damages of the Natural Disasters (Component 2) which is part of the Urban Development Projects with three main components (Büyükerşen & Efelerli, 2005). This project includes the 12 km long part of Porsuk Stream running through the city center.

This project is basically project of flood defence, river rehabilitation was done to get over flood in a manner safe. The issue of floods in Eskişehir was examined by State Water Affairs in the frame of Porsuk Basin Water Administration Plan. In addition to this study, Porsuk Stream Urban Transition Rehabilitation Project was prepared. The according precautions may be summed up as follows (1) Building Sarısu Flood Detention Dam since Sarısu Stream which flows into Porsuk Stream within the city has an increasing effect on flood risk, (2)

Construction of Sarısu and Porsuk sand traps in order to detent swept down dregs and dirt and also cleaning of these traps before and after the flood season (3) Restoration of 9.6 km part of Porsuk Stream bed (4) Building nine bridges for vehicles, examination of four bridges for pedestrians against earthquake risk and building four new bridges for pedestrians (5) Construction of eight buildings for controlling water level in order to render the regulation of the river flow uniform in the restored parts and maintain full flow (6) Equipping water level buildings with automatic sensors which make them mobile in order to prevent those buildings to become any handicap during floods, (7) Rehabilitation of main irrigation canals that consists 3408 m. left bank and 5100 m. right bank (Büyükerşen & Efelerli 2005). Anonim (2006c), Beside, the stream flow is regulated by Porsuk Dam (Pekin, 2008). Also, it has been necessary to equip the water level buildings with boat transfer shutters in order not to prevent the waterborne transport within the stream (Büyükerşen & Efelerli 2005).



**Figure 25.** Porsuk Stream in Eskişehir in Turkey Porsuk Çayı (a) before; (b) in application; (c) now (Eskişehir Greater Municipality, 2006)

Smooth parts revived after the restoration process made waterborne transport on the stream possible. In addition, a comprehensive landscape project was prepared to accommodate the restoration to the very surrounding of the stream (Figure 26). According to this, a footpaths, recreational areas and parks was done on the banks and its environs (Büyükerşen & Efelerli 2005).

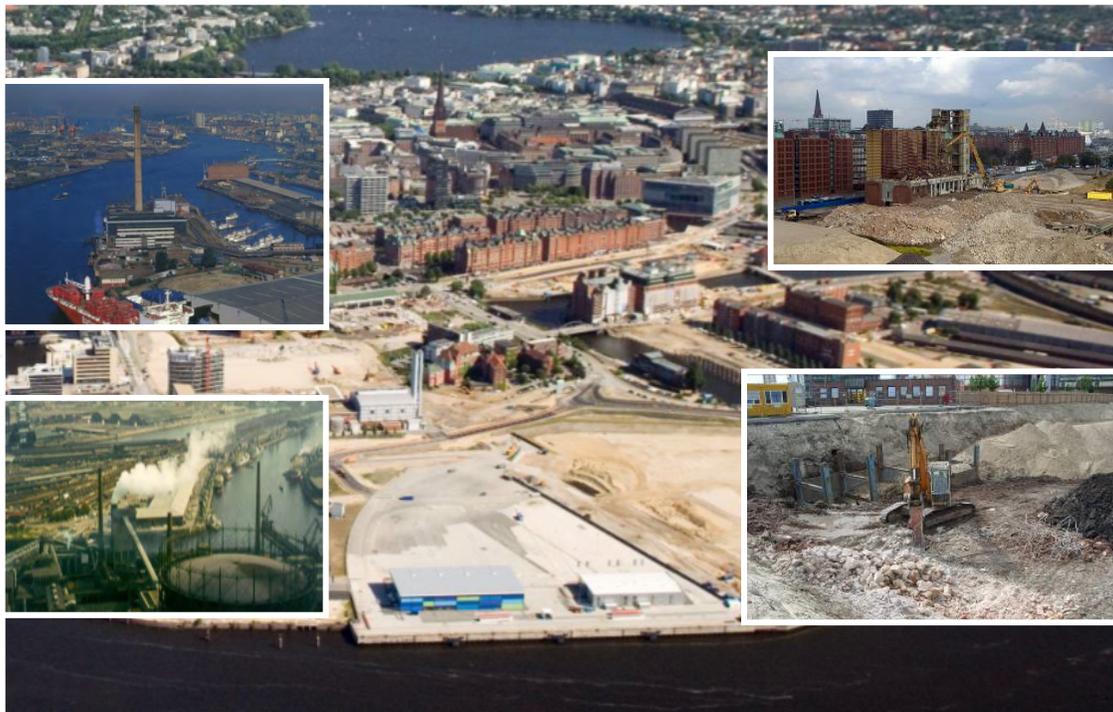


**Figure 26.** (a) The water transport (Eskişehir Greater Municipality, 2006), and (b) Canoe competitions on the Porsuk Stream (Anonymous, 2013j), (c) Footpaths Eskişehir Greater Municipality, 2006).

## 11.2. Hafen City, Hamburg, Germany

The city of Hamburg is located on the river Elbe which flows into the North Sea as Germany's second largest city and host to Europe's second-largest port (Waterfront Communities Project, 2007). While the important parts of the port are now located on the south bank of the river Elbe, most of the northwestern bank has become disused for port functions until 1997 and has thus been regenerated for urban use (Hans, 2008; Erkök, 2009).

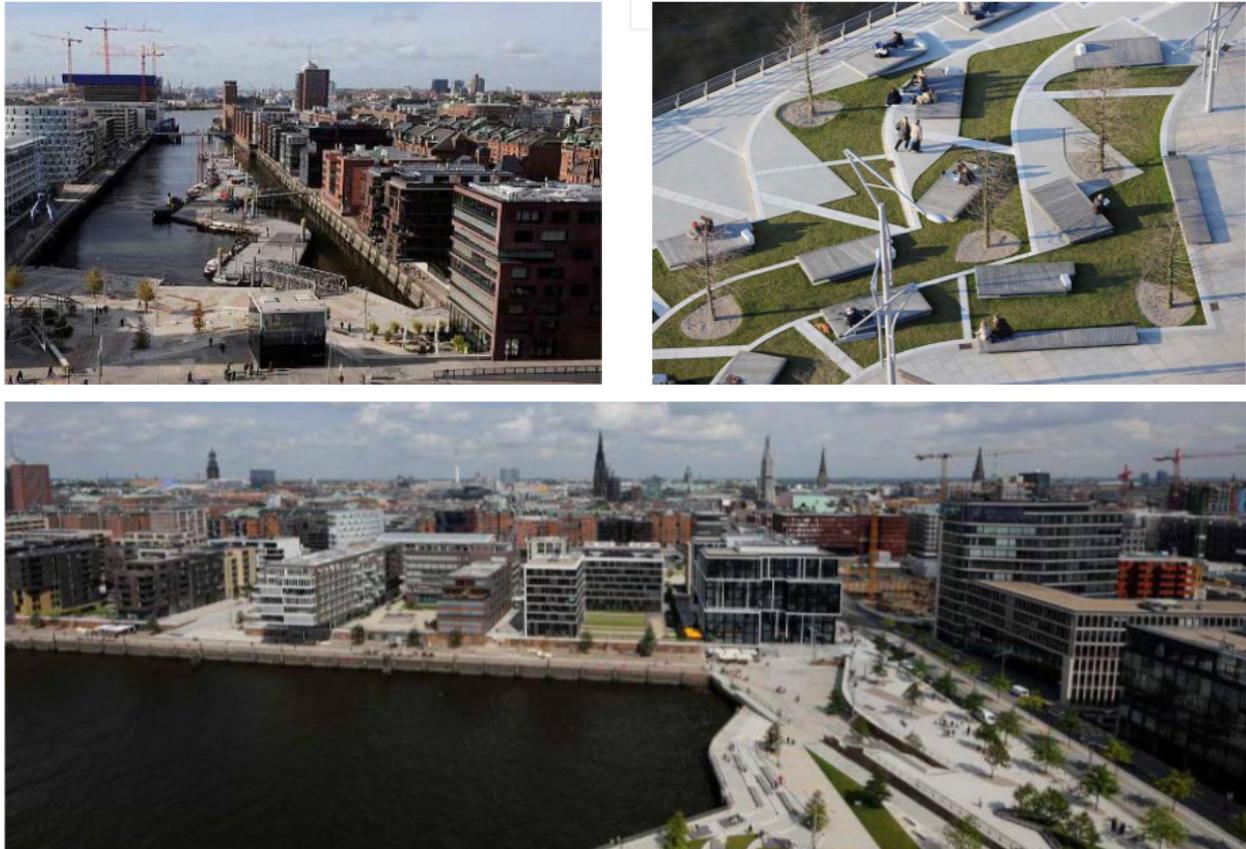
This regeneration area described as Hafen City. The Hafencity or harbour city Project (Figure 27) offers an amazing opportunity on the banks of the river Elbe. Because of its proximity to the central area, the project has the potential to become a comfortable extension to the city centre (Appleton, 2005). This project area (<http://www.hafencity.com>) takes place between the historic Speicherstadt warehouse district and the River Elbe, there will be a new city with a mixed uses. According to Hafencity Hamburg GmbH (2006), the area occasionally getting flooded required a smart solution for this problem, not cutting off land from water by high defenses. With the exception of the waterfront promenades, the entire area will be raised by 7.50 to 8.00 meters above mean sea level, creating a new and distinctive topography while preserving access to the water (Erkök, 2009). Beside, residential areas and promenades will be fixed on concrete piles (Mimdaporg, 2008). In the Project area, elevated footpaths, waterproof parking basements and the accessible waterfronts, as part of the new emergency infrastructure, have provided a successful combination of safety and spatial quality of urban spaces. As a solution for the accessibility of water at all tides in the very high quays, Enric Miralles designed a descending 'landscape' of surfaces (Figure 28, 29) (Erkök, 2009).



**Figure 27.** In application River Elbe, Hafencity in Hamburg (Bruns, 2012)

The project which includes an area of 155 hectares, is currently under construction and application of it includes an ambitious 25 years period. When it is fully realised, Hafencity will have 5,500 apartments, 20,000 work places, 20 hectares of public open space and major cultural facilities to this waterfront. Also it involves approximately 10 km of quayside promenades (Appleton, 2005; Erkök, 2009).

It is the largest inner city development project in Europe. With Hafencity project will be enlarged city center by 40 % and also it will be home 10000-12000 inhabitants (Erkök, 2009; Hans, 2008).



**Figure 28.** A waterfront terraces and the descending 'landscape' of surfaces (Schneider, 2010)

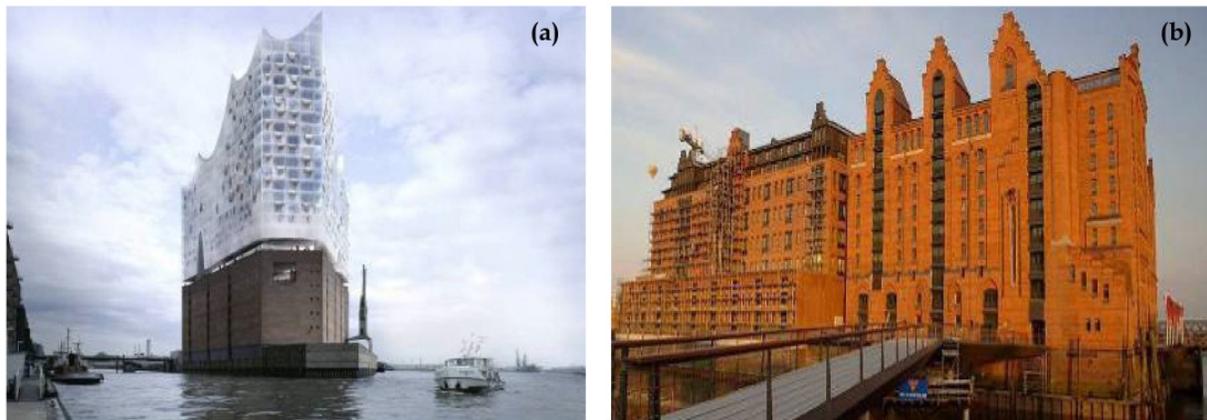


**Figure 29.** A views of public uses in Hafencity (Bruns, 2012)

Beside, in Hafencity Project points out with a highly attractive public transport system. According to this, pedestrian ways (Figure 29) are more dominant than vehicle ways. Also 70 % of pedestrian ways are away from the streets and bicycle paths take place in the area (Hans, 2008; Mimdaporg, 2008).

In this project was considered sustainability principles. There was noticed economic use of energy. In this context, eco-friendly building materials were used (Mimdaporg, 2008).

Numerous Projects which are developed by different architects, are together in Hafencity (Mimdap, 2008). Cultural highlights of the project range from the striking landmark Elbphilharmonie Concert Hall (Figure 30a), to International Maritime Museum of Hamburg (Figure 30b) and the new urban plazas being used for smaller events (Erkök, 2009). Beside, with reuse of warehouse, bridge and cranes were provided to integrate the historical texture and waterfront (Waterfront Communities Project, 2007).

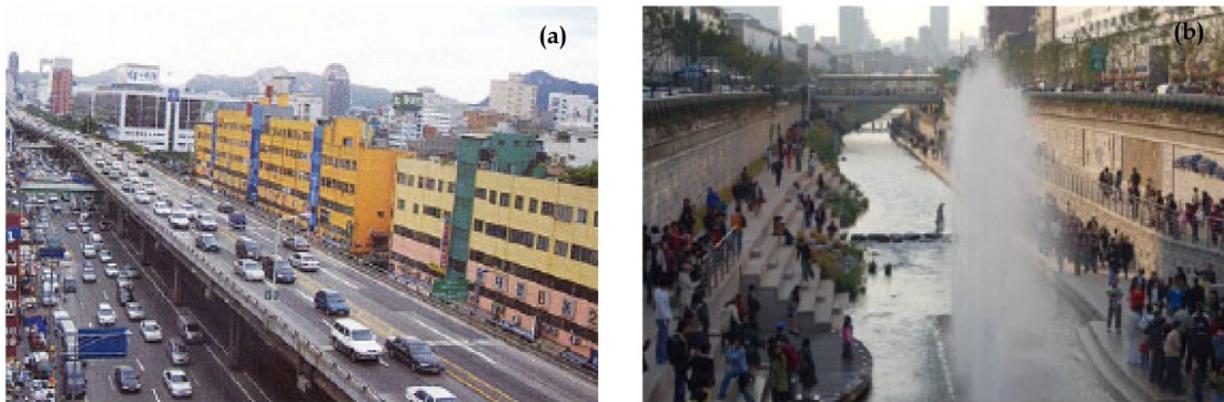


**Figure 30.** (a) Elbphilharmonie Concert Hall, (b) International Maritime Museum of Hamburg (Schneider, 2010)

### 11.3. The Cheonggyecheon Canal in Seoul

Cheonggyecheon (“clear valley stream”) (Figure 31) is a former seasonal waterway in the city center of Seoul, South Korea and fallen into Han River. Between 1958 and 1976, the stream was covered and Cheonggye Road and Elevated Expressway were built above it. Per day, combined traffic counts on both roads were approximately 168000 vehicles and stream have continued to exist as a sewage canal (Seattle Urban Mobility Plan, 2008; Önen, 2007).

In the year 2000, a study by the Korean Society of Civil Engineering discovered that serious repair works should be done for three years to adress deficiencies of the road and elevated structure. Also the Cheonggye area become the most congested and noisy part of Seoul. When Lee Myung-bak was elected Mayor of Seoul in 2001, one of his key campaign promises was to remove this freeway and restore the Cheonggyecheon Stream. So, instead of repairing the elevated highway structure, the politicians at the time decided to restore the historical stream underneath the structure. Thus, a project studies was begun in July 2003 and it became the largest urban renewal project undertaken in Korean history (Martires, 2007; The Preservation Institute, 2007).



**Figure 31.** Before (a) and after (b) Cheonggye Expressway (Seattle Urban Mobility Plan, 2008)

According to Martires (2007), Seoul Metropolitan Government (2009) the aims of the Project are as follow:

- Creation of environment-friendly urban space,
- Restoration of historicity and culture of Seoul,
- Solution for safety problem of deteriorating structure over Cheonggyecheon,
- Balanced regional development between north and south of Seoul,
- To improve the city's water quality,
- Stimulate economic growth.

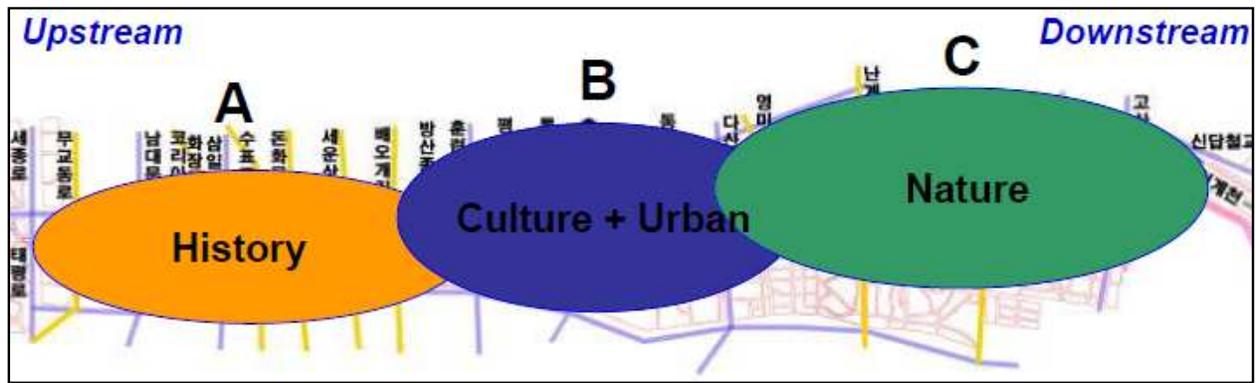
There was a two problem related to in application the Project. One of the problem is being lived congestion in North Seoul with the replacement of roads which is in position of main artery. And the other that closed stream is dry except during summer months (Önen, 2007).

Between 2003 and 2005, the highway was removed and stream recovered. As a result, the problem of drought was solved by bringing water from Han River and water depth was 40 cm. The stream is the center piece of a 5,8 km linear park. New two lane, one-way streets are on each side of the park (Önen, 2007; Seattle Urban Mobility Plan, 2008).

The Project divided into three sections (Figure 32) and planning each section with specific themes, history (tradition), culture-urban (present age), and nature (future). Also, Three each teams which was civil engineering, landscape architecture and other disciplines worked together in the each sections (Seoul Metropolitan Government, 2009; Lee, 2006; Önen, 2007).

New Cheonggyecheon provides an uninterrupted tract of green space covering 276650 m<sup>2</sup> along 5.8 km of the stream. The Project based on technology and creativity. The basic concept of the landscape design is to implement the image of 'Urban Stream with Nature'. Main Concepts of Landscape Arragments are considered as follows (Önen, 2007; Lee, 2013).

- To create green areas with concept of continuous space along 5.8 km of the stream,
- To transform from urban landscape to natural structure as gradual,
- To create thematic areas like ecological parks, fountain and waterfall,
- To provide the optimal balance between exploitation and ecology,



**Figure 32.** Three sections of the Project (Lee, 2006)

A number of 22 bridges take place over stream. The seven of them are only pedestrian way, the others are mixed as pedestrian and vehicle way. And also historic bridges (e.g. Gwanggyo Bridge) were restored. The bridges that span the restored waterway have been designed to reflect the character of their neighborhoods ((Martires, 2007; Önen, 2007).

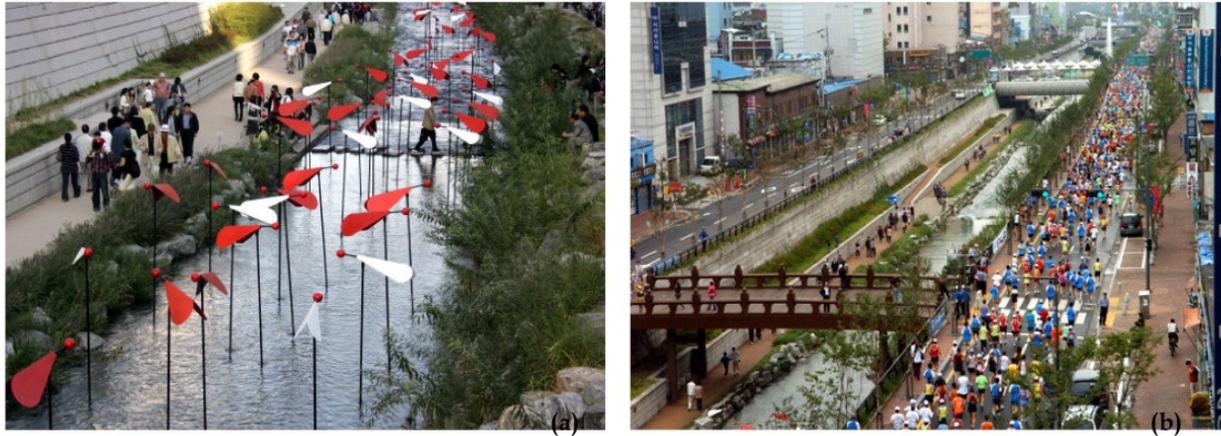
The lighting scheme has been designed to give the stream and neighborhood a distinctive character (Figure 33) at night (Martires, 2007).



**Figure 33.** The Cheonggyecheon Canal at night (The Preservation Institute, 2007)

Along the stream (Figure 34), small squares, art works, waterfront decks were built for citizens and biotopes were introduced for plants, fishes and birds. The streambed of upper reach is mostly built with stone to resist scouring. Slope walls of 41,889 m<sup>2</sup> separating roads from the stream with a height of 2 to 6.5 m were newly built, and the surface of the wall was covered with granite plate to recreate the past image of masonry wall.

The construction cost was 386 million (USD). In the 15 months after its opening, the park attracted approximately 90,000 visitors per day, 30% of them from outside the metropolitan area (Lee, 2013; Seattle Urban Mobility Plan, 2008).



**Figure 34.** Cheonggyecheon: (a) Art installation, (b) Marathon (Martires, 2007)

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