SUSTAINABLE DESIGN APPROACHES FOR LIVEABLE WATERFRONTS

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Abstract

The purpose of this paper is to discuss potential ways to create sustainable waterfront environments. Sustainable design approaches for waterfronts raises issues concerning planning, transportation, economic activities, recreation, tourism, and cultural considerations as well as enhancing the image of the city. Dramatically fast developing cities of the new era cause some waterfronts to have limited access by the occupants of the city. High ways, industrial zones, factories, private housings, commercial buildings like hotels, shopping malls and office buildings or abandoned areas adjacent to the waterfront prevents public access and full enjoyment of the space. Therefore, it is significant to gain waterfronts to society as both natural and cultural heritage sites. Commissioning sustainable approaches and utilizing them for waterfront design, may create a change toward an environment that actively experienced by users continuously. The paper reviews the historical use of waterfronts and meaning of them for the city and the people today. Besides, this explanatory research tries to investigate the process of urban waterfront design through examples worldwide, and reveal systematic ways to make these designs successful and sustainable over time.

1. INTRODUCTION

Water has always been a crucial natural source in the establishment and formation of settlements. It hosts various features to use as advantages such as agriculture, transportation, industry, energy generation, household, leisure and recreation activities. Therefore, there is an integrated and close relationship between the water and the city. Throughout history; cities have been founded at the intersections of transportation routes, or at points where goods needed to shift from one mode of transportation to another. For centuries, oceans, lakes, and rivers – has provided a significant type of transport. Historically, communities located on the waterfront were generally based upon water-dependent uses of their shorelines, such as commercial fishing and shipping as economic activity. Besides economic value and it's being a transportation hub of the city, human activities on the waterfronts were quite alike of todays'. Waterfronts were utilized as commercial places, walking routes, recreation areas, sites for temples, theatres or other cultural activity places.

In pre-industrial cities, waterfront areas were intensely used and thriving with people and activities [1]. Together with huge ports, commercial and industrial facilities, warehouses and transportation purposes, waterfront uses were interrupted and become limited during the industrial era. After the decline of waterfront-related industry, the rapid change of economic conditions and new transportation technologies, cities with waterfronts all around the world have gone through broad changes. These changes have made waterfronts to turn into derelict and desolate areas that could not sustain their previous functions anymore. After early successful waterfront redevelopments with the increasing environmental awareness in the 1960s, waterfronts areas have begun to be observed around the world; especially in the second half of the 20th century, there has been an intense effort to redesign abandoned waterfronts [2].Waterfronts were rediscovered in the city, so the phenomenon of waterfront regeneration emerged. Waterfront design projects, aiming at reuniting abandoned harbour areas into the urban fabric, therefore became a global phenomenon of urban renewal.

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A waterfront literally refers to the land alongside a body of water or the dockland district of a city or town [3]. Waterfronts are the areas where the land attains to a river, canal, lake, sea or ocean; therefore, they represent uniqueness and an opportunity for improvement and enrichment of the community. Waterfront development has a great significance for many cities all around the world, because of its invaluable function, to amend their socio-economic position both at the national and international field.

Waterfronts are not only simple coastal lines but also the network of places, functions, activities, events, meetings, and hinges between water and city. These areas are also a source of productive, cultural, interpersonal, recreational, commercial, entertaining, public and residential activities with no certain limits or boundaries but with a permeable interface. Therefore, an urban waterfront may be considered as a dense and hybrid place where aspirations, chances, prospects, and ambitions fed by the city convert into visions and strategies for projects that have the capability of creating new urban forms and landscapes by making the city more interactive and competitive at the same time. Waterfront design including the planning, development and revitalization process requires multidisciplinary co-operation which may need to conceive the economic, cultural and social development of the society altogether while respecting and conserving the historical, social and urban conditions as well. Besides, waterfronts are significant public domains which have wide open natural settings thus their psychological impact on humans inevitable. Waterfronts are also unique in their potential to provide diversified opportunities for economic development, public enjoyment, and civic identity [4]. Today, waterfront design is a global trend that enriches the meaning of cities, so, many projects have been carried out from large metropolis to small towns all over the world. Whereas examples of historic waterfront areas focused mainly on leisure, recreation, retail and transportation uses, contemporary schemes have to face complex urban development facilities that include mainly culture as a regeneration tool [5].

Figure 1. The Historical Model for Port-City Development from Hoyle et al (1988).
http://www.oecd.org/cfe/regional-policy/49456486.pdf

Successful waterfront redevelopments require consistency and variety of uses integrated with urban planning. Each city, even different waterfront areas in the same city may have different backgrounds and stories, therefore may be in need of divergent solutions. Sustainable design is supposed to maintain the image and value of the waterfront ever. Sustainable design approaches that protect the existing while considering the future at the same time; will be discussed in this paper and conducted a way to boost the character of the waterfronts. Here, the potential pros of sustainability in the design process, and the results of uniting revitalized waterfronts with them will be examined through selected examples.

2. SUSTAINABILITY AND WATERFRONTS IN URBAN ENVIRONMENT

The industrial revolution, which began in the United Kingdom during 18th and 19th centuries and expanded most of the Western countries in a short time, made use of fossil fuels and coal to generate electricity more

common over time. However, "Environmental Movement" that flourished in the mid-20th century demonstrated there were environmental costs associated with the many material benefits that were now being enjoyed. At the end of the 20th century, so many environmental problems have emerged on a worldwide scale. Especially, 1973 & 1979 energy crisis demonstrated how much the world depended on non-renewable energy sources. Besides all, the developments in science and technology areas have caused some problems lately. The environment which becomes a giant concrete mass gradually started to eradicate natural sources, exterminate some animal species and harm human health substantially. Therefore, the enhancements that aim to provide a better life for humanity actually may cause damages both naturally and economically. Due to these issues, today the "sustainability" concept that was first used during the 1980s has become much more significant; and there is an increasing global trend and awareness towards it.

The world is going through a critical period, where the global supply of natural resources and ecosystem services are declining dramatically, while demand for these resources is escalating. So, it is significant to create change toward a sustainable future – for the survival of the planet. Sustainability is a long-term approach to environmental protection and process improvements. The sustainable design tries to minimize human impact from the start and provides systematic thinking, which acknowledges the connections between the economy, the environment, and social responsibility.

Basically, urban sustainability may be examined as four circles as ecological, economic, political, social & cultural [6]. In terms of the combination of these four elements, it is quite possible to accomplish city systems which satisfy the occupants and environment at an optimum level. Briefly, the first one, ecological circle covers land, water and air use, materials and energy, flora and fauna, sustenance, habitat and settlements, built environment, transportation, emissions, and waste management. Besides, it aims to form healthy city ecosystems that provide vital goods and services for humans and other organisms by reducing negative human impact. Secondly, the economic circle of sustainably includes the set of actions to be taken by present authorities to transmit sufficient levels of consumption, wealth, production, resourcing, utility and welfare to the future generations to enjoy [7]. The challenge for sustainable economics is to control and manage human consumption while ensuring them raised living standards in the developing world and not increasing environmental impact and the sources utilized. The third circle, politics, is about practices and meanings associated with basic issues of social power, such as organization, authorization, legitimation, and regulation. It includes issues related to organization, governance, law, justice, communication, security, dialogue, accord, reconciliation, ethics, and accountability. The last one, social & cultural sustainability occurs when the formal and informal processes; systems; structures; and relationships actively support the capacity of current and future generations to create healthy and liveable communities. Socially sustainable communities are equitable, diverse, connected and democratic and provide a good quality of life [8]. This circle expresses continuity in identity, engagement, creativity, recreation, memory, projection, beliefs, ideas, inquiry, learning, wellbeing, health and social meaning. There is a tight relationship between human rights and development, social power and justice, poverty and social-responsibility matters and besides, personal consumption and our environmental impact on nature might be considered as a moral choice of people.

All these urban sustainability strategies and today's technologies might be followed up to achieve an improvement in waterfront areas, use them efficiently in a regular process without environmental damage and resource depletion. According to "World Urbanization Prospects Report" by UN (2014), fifty-four percent of the world's population lives in urban areas, a proportion that is expected to increase to sixty-six percent by 2050 [9]. Also, the report notes that in 1990, there were ten "megacities" with around 153 million inhabitants, which means less than seven percent of the global urban population at that time. In 2014, there are twenty-eight mega cities worldwide, home to 453 million people, equals to nearly twelve percent of the world's urban inhabitants.

Although it sounds tough to create totally self-sufficient cities today, there are so many crucial measures which have to be taken into consideration in the city context. A successful urban planning system requires attention for settlements of all sizes. If well managed, cities offer important opportunities for expanding access to basic services, such as health care and education, providing public transportation, as well as

housing, electricity, water and sanitation for a densely settled urban population in a cheaper and less environmentally damaging way.

The sustainable urban design basically aims to make cities healthier, more attractive, and liveable places. Recently, urban immigration is a challenge and it has negative impacts on the environmental, social and economic balance. To fulfil global sustainability goals, urban development has to respect and consider environmentally friendly and liveable urban areas. Creating a sustainable urban design means examining every detail carefully for each project because the solutions can be different for each one. The sustainable urban design also requires a deep understanding and vision of social, cultural, ecological and historical context. Sustainable development in city context includes many aspects such as; air quality, pollution from noise, light and land contamination, waste storage & recycling facilities, solar design & renewable energy, efficient use of land and buildings, using sustainable materials, sustainable drainage & water conservation, well-designed landscape, biodiversity & ecological heritage, conservation areas & built heritage, views, open spaces & public art, accessibility, transportation, pedestrian-bicycle friendly design, affordable housing, education, health & other social infrastructure, leisure & cultural activities, public transport and so on [10].

Urban designers use various principles and techniques today to achieve sustainable development in the city scale. These strategies include "smart growth theory", "transit-oriented development", "sustainable urban infrastructure" and "new urbanism". Smart growth is an urban design theory which explains growth of sites within the existing urban fabric to avoid urban sprawl, and supports compact, pedestrian or bicycle friendly land use with different range of housing types while transit-oriented development aims to optimize access to public transport and minimize the number of private cars [11]. Sustainable urban infrastructure approach gives more importance to energy efficient designs, systems and buildings, green corridors, renewable power generation, and wastewater treatment. New urbanism is similar to transit-oriented development which focuses on walkable communities, but it is much more a social and aesthetic urban design movement. Sustainable urban design is important because conventional methods usually ignore the natural arrangement of the land during planning so it may cause ecological damages such as flooding or pollution [12].

Basically, waterfronts are the main hubs of the cities, because from the early history mankind started to developed cities on the waterfronts. Today, as for the many cities of the world, waterfronts are places for various activities, transportation, commerce, culture, recreation, and tourism. While the world is going to a future which sustainability concepts will be much more popular and in need, the cities are developing and high-rise buildings are increasing every day, however, the public awareness of a greener environment increases correspondingly. Cities aim to have two different faces, one with a new, developed, concrete & steel blocks, and the other with green spaces, clean water, and a blue sky. Of course, cities with waterfronts have an advantageous situation to foster their image and identity in world-wide. Particularly those cities can be considered a great place full of many different activities, a rich commercial life, lively social & cultural activities and recreation facilities. Besides, it has a generous capacity to have all those which will totally change the image of the city.

Figure 2. Waterfront, Helsinki, Finland. http://www.mimdap.org/?p=672

Waterfronts are valuable lands and generally allow developers to decide what kind of spaces happens there. It may not be right to claim that private developments are unwelcome and should be discouraged, however, the best solutions for revamping waterfronts put public goals first, not private short-term financial objective. In terms of equal use, waterfront areas should have various places for activities like, eating, walking, sitting, exercising, playing or just to spend their free time all people from different backgrounds should have similar activity patterns on the waterfronts. Waterfronts should be designed user-based first, roads for vehicles, industrial zones or factories should be considered in the second phase. Instead of closing and locking people into malls, underground markets or high-rise towers, creating a green waterfront line full of sustainable activity areas for people is a better choice to enrich the living quality of the city.

3.POTENTIAL USE OF WATERFRONTS

Human civilization and life are connected somehow that most settlements established along waterfronts throughout history. Therefore, the development of cities and sustaining human society cannot be parted from each other. Sixty percent of the world's population already lives in coastal areas, while 65 percent of cities with a population above 2,5 million are located along the world's coasts [13]. Water and waterfronts are not only considered as an apparent link between the city a society but also they have significant roles in creating a social and cultural public domain in the urban environment.

3.1. Transportation

One of the most essential roles of waterfronts was the transportation of people or freight before. Recently, ports are generally built outside of city centres, however, some small ones for ferries or tour boats may have piers on the main waterfronts areas. This kind of transportation can be regarded in the scope of tourism activities. As well as its transportation function, waterways as one of the various street patterns [14]. That means, waterfronts can function like urban streets, which are used for walking, cycling, sightseeing, jogging or connection routes to other directions. For example, waterfronts of cities like Istanbul, Venice or Helsinki, utilize those valuable areas in many respect such as transportation, tools of communication, commercial activities and sharing social&cultural life.Because of its natural setting, the waterfront is an aesthetically enriched street type compared to inland ones, so, using a watercourse as transportation - river, canals, and coastline - provides a high-quality urban passage for users [15].

Figure 3. Waterfront, Istanbul, Turkey. https://www.projepedia.com/sehir-rehberi/istanbul/kadikoy

3.2. Economic Aspects

Waterfronts possess an important position in cities economic development. Besides its port function, these places have been used for economic activities of locals in the past. Although ports are located away from city centers in today's cities, waterfronts are still favorite places for economic activities such as market places or service business which supports domestic and foreign tourists as well. Therefore waterfronts have significant capital value in addition to the environmental one. Any kind of water sources like rivers, sea, canals and artificial fountains or pools helps to create supreme environmental value in the built environment if they maintained well. This environmental impact also causes an increase in real estate prices. According to research conducted by Commissioned for Architecture and the Built Environment –CABE- water features have become important elements to enhance the socio-economic value of good urban design [16]. The proximity of these real estates, scenery or views may be also considered prior factors that determine the value.

Figure 4. Waterfront, Hamburg, Germany. https://www.victoria.ca/assets/Default/HarbourDialogue_Boards_v2.pdf

3.3. Leisure and Recreation

Waterfronts provide proper and favorable settings for leisure and recreational activities. Besides its natural convenience, the potential use of waterfronts for leisure and recreational purposes may rise up dramatically with historic richness or buildings for essential functions. Waterfronts can be utilized for many social/cultural events, festivals, sports, concerts, shows, free-time activities, sightseeing, or water-related sports such as sailing, canoeing, boating, fishing, etc. Throughout history, civilizations generally established in locations close to water, due to the need for water to sustain life and society. Therefore, many examples of historical built environment sites are located along or close to waterfront areas. This richness makes waterfront area a bridge between past and present, a valuable space full of appreciation and enjoyment for different kind of activities.

Figure 5. Waterfront, Toronto, Canada. http://www.harbourfrontcentre.com/thewaterfront/

3.4. Historical Richness and Place for Tourism

Waterfronts with historical heritage sites are significant tourism spots. When people come to visit historical areas, they can enjoy the waterfront and the attractions it has together.The emergence of new tourism-related land uses in cities with historical waterfronts has brought a range of physical, economic and social benefits [17]. These benefits make cities brand with their waterfront image. For instance, the historical peninsula of Istanbul has attracted many visitors every year with a combination of waterfront, historic buildings, market places, and open space, surrounded by the sense of historic place experience. A historical surrounding highlights and emphasizes the waterfront line while creating a joyful place for tourists.

Figure 6. Waterfront, Chongqing, China. https://www.flickr.com/photos/bermuda_orange/14038868503/

3.5. Socio-Cultural Value

Waterfronts are places where cities were established first, therefore they offer spaces for people to gather, spend time and join life. Water is an important element in sustaining and improving cultural and social bonds. It encourages people to create society and put out socio-cultural activities. Water manifests a strong social meaning for the community through a sociological process, which are changes in the degree of congruency among institutional sources of social honour in a community, variations in the flexibility of social organisational forms to respond to eco-system signals, and adaptability in the mechanisms for maintaining social solidarity [18]. Waterfronts cannot be considered only as physical spaces that basically go along the water source, because they also have intangible attributes in the production of social space. Water implies a series of connectivity betweenfluidity and rigidity, social and biophysical systems, the evolution of water networks and capital flows, the visible and invisible dimensions to urban space [19]. Waterfront areas have an overwhelming potential as a catalyst for people and socio-cultural life of the city. They form unique environments and create symbolic places as amenities that increase people's comfort, enjoyment, and participation in social life.

Figure 6. Waterfront, Chongqing, China. https://www.skyscrapercity.com/showthread.php?t=1393356&page=21&langid=5

Figure 7. Waterfront, Portland, USA. https://www.pressherald.com/2018/02/05/summer-concert-series-to-continue-on-portland-waterfront/

3.6. Enhancing the Image of the City

Waterfronts may determine images of cities. A successfully developed waterfront area increases the quality of urban space and socio-cultural life which has anenchanting impact on the image consideration. The water's edge is an open placefor everyone; and the zone between the water and the city is often a symbolic place, an emblem of the city's beauty and richness [20]. Because the economy of most cities depended on the service sector rather than industry today, a major aspect that makes a city a favorable place is quality of its urban space. Waterfrontis asignificant areafor the development of a city and also the quality of its urban expression. It is a place to reflect visions of the city and values contribute to culture.

Figure 8. Waterfront, Copenhagen, Denmark.

https://www.globtroter.pl/zdjecia/104753,dania,kopenhaga,nyhavn,kolory,kopenhagi.html

4. URBAN DESIGN APPROACHES FOR SUSTAINABLE WATERFRONTS

Urban design is a tool to represent the density of urban activity, population and habitats; and also emphasize the city as a centre of wealth, business, culture, education, and trade where the urban dynamism pulsates, and economic activities are unstoppable.

As sustainability issues are so much engaged with most of the design areas today, it has also a lot of aspects which are quite profitable and advantageous regarding the urban design of waterfronts. Urban design describes the physical character and built environment of a city [21]. The efficient urban design considers relationships and connections between the city and its occupants by giving a character to the city as well as concerning the development and conservation. The urban design integrates the cultural heritage and new way of living; it helps to create a safe, healthy, efficient, enjoyable city.

Urban waterfronts are generally considered as a hub and heart of the cities all over the world, mostly because they can greatly influence the identity of the city. In the past, city or town centres were typically located nearby waterfront areas, due to their traditionally being the hub of local economy and industry. Today, besides these, different cities' waterfronts obtain different functions and uses, usually as a port, or for the social, cultural and commercial purposes. Urban waterfront design is a contemporary phenomenon; recently, with the rising interest to sustainability, different assessment tools and criteria has been developed to measure the efficiency of urban waterfront designs [22].

There are several sustainable design strategies for designing a waterfront which is discussed in this paper. Besides its port function, waterfronts often derive their unique character from rich urban activities, different kinds of views and open spaces, historical context, topographic incomparability, significant structures around and lively culture. Therefore, a sustainable design has to ensure and enhance these features by a comprehensive approach to identify how public access and open spaces could be maintained and improved considering existing urban patterns and sources.

What makes the process of urban waterfront design successful and sustainable over time? As generally known, sustainable vision uses several aspects to save and protect the existing urban texture while improving it with future-oriented perspectives. Sustainable design strategies for the urban environment encourage efficient use of renewable energy resources, compact design, proximity to transit, green building design, mixed housing types, and pedestrian- and bicycle-friendly pathways and passages. In urban design of waterfronts, by integrating all these aspects there are several goals that aimed to be achieved, such as integrating the city with the waterfront, recognizing the unique identity of waterfronts and enhancing it, expanding public access to the waterfront, enliven the waterfront with a range of attractive uses, support economic development activity on the working waterfront, improve water quality through measures that benefit natural habitats, supporting public recreation, restoring destroyed natural waterfront areas and protecting wetlands and shorefront habitats and enriching the existing waterfront facade and landscape, allocating space for cultural, social and public uses. Some key approaches to sustainable waterfront design are:

Secure the quality of water and the environment: The quality of water is a fundamental and prior requirement for a sustainable waterfront design. Although, government organizations are responsible for the sustainable recovery of the water, river banks, and abandoned lands; non-governmental institutions may also arrange events to educate locals through free public conferences, workshops or performances on the importance of environmental awareness. Public participation is an element of sustainability, so cities should benefit from sustainable waterfronts not only in ecological and economic terms but also in a social way. The community should be informed and involved in discussions continuously from the beginning. They should be included in the process of waterfront planning and should be in cooperation with ideas, expressing their needs and demands.

Waterfront is a part of existing urban fabric: Waterfront area is an integral part of the city and it has to contribute to its vitality. Because water is a crucial part of the urban landscape and it should be utilized for various functions, such as recreation, entertainment, and culture. Waterfronts can be used for festivals, events, meetings, sports tournaments and shows to attract people's attention and make them use the area more. Regardless of climatic conditions, waterfronts should be designed with a creative program including smart use of amenities and protection from inclement weather.

Public access is indispensable: Waterfronts should be not only physically but also visually accessible for locals and tourists from different ages and income. Public spaces should be designed in appropriate quality

to allow different types of uses or activities. For over-populated cities, sometimes it becomes impossible to make a visual connection to the waterfront from all points of the city when it is full of high-rise buildings on downtowns and on the waterfront, which blocks the direct view and access. The access problem to the waterfront can be solved through designing connection ways and spaces, such as green parks between downtown areas and the waterfront. For cities in which waterfront is firstly for the use of cars or vehicles, it should better be the opposite. It is hard to change all the directions of the high ways and roads in fast developing cities or developed ones, however, through encouraging pedestrian access and supporting more sustainable transportation, like bicycles to the waterfront, or designing underpasses or overpasses for the vehicles and blocking their direction by some public spaces like green parks, waterfronts can be much more accessible and attractive, and open to the use of people.

Historical identity emphasizes the characteristic features: Collective heritage of water and city, of events, landmarks and nature should be utilized to give the waterfront a character and meaning. Waterfront design should create a more positive environment and easy access to historical areas if there are any around. The sustainable urban design may encourage forming public spaces in front of the historical spaces or their surroundings that protects and fosters the identity of the values. Besides, it is better if waterfront destinations truly orient themselves to the water. Reflecting the local identity, history and culture stimulates people's interest in the waterfront and creates a unique sense of space. Opportunities that appreciate local art, music, craft or any other kind of performance or demonstration helps to gather a community around the waterfront.

Wastewater management should be considered as a new irrigation system: In terms of sustainability, the wastewater of the buildings around the waterfront can be re-interpreted to use for irrigation of the green areas of waterfront after a chemical purification system. Also, this system can be considered as a sustainable step in the development of the whole city, so can be applied to other similar uses.

Urban lighting should be planned in an efficient way: Urban lighting quite helps cities to gain a specific identity and a lively atmosphere, so it may be considered as a reason of preference for the living or touristic visits. Urban lighting is not only a tool to provide a better night-vision for the occupants (and for security reasons), also a practice which reflects and emphasizes the history, culture, significant events, activities, monuments, buildings, and spaces. This crucial practice needs to be in accordance with the urban planning and design of the city, geography and the topography of the space, and emphasize what deserves to be highlighted. For urban lighting design, selection of the most suitable lighting fixtures which contains the best available technology for energy conservation, the maintenance works in longer term and integration of urban design to the lighting system through a proper way (convenient design), regarding the surface materials, geometries… etc. are quite significant stages in terms of sustainability strategies. Besides, lighting fixtures that help energy generation for themselves via solar panels, etc. may be preferable.

Waterfronts are long-term projects: Waterfronts should be developed step by step; therefore, 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. The control and improvement mechanism and plans should be prepared by local governments and municipalities to maintain the sustainability goals and strategies for the waterfront. It would be quite helpful in sustaining a variety of activities and events throughout the year; and introducing programs that can be used to generate income that benefits the waterfront as a whole.

4. RESULTS

This paper is motivated by the aim of contributing to a better understanding of how to provide a sustainable design approach for waterfronts. Waterfronts are unique places that should unite the city and people through proper urban design. Because of the fast development of cities recently, waterfronts still have some problems with planning or design, such as lack of amenities for people to enjoy, accessibility preventions, insufficient public spaces or environmental concerns. These issues can be solved by sustainable approaches which include statements and proposals about environmental quality, protecting and enriching the existing

urban features, increasing public access, emphasizing historical heritage, culture and local identity on waterfront area, environmental-friendly lighting and water management systems. Considerations of waterfront designs should cover different views, connections, pathways, green parks, public spaces, habitat and arts, culture & entertainment. Waterfront developments should also be designed with a comprehensive mission which considers creating the area for all people; putting the shoreline at the forefront, reconnecting the city with water, embracing city's past, present and future while improving access and mobility. Most importantly, waterfronts designs should undertake to create a bold vision of sustainable design approaches that are adaptable over time.

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