Shared Mobility as a tool for natural Ecosystem services in the new H+ housing development area in Helsingborg harbor

– creating urban eco zones favored by decreased parking space

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Picture: Schønherr landskab (owner: HPL)

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Innehåll

Swedish summary

I samband med hållbar samhällsplanering inom H+ området och dess vision om bevarandet av ytor för vatten och grönska är det viktigt att grönområden och friytor kan bli multifunktionella. Detta innebär att de kan tjäna som rekreationsytor, men samtidigt även fungera som energineutrala filter för att fånga upp luft- och vattenföroreningar.

Vidare fungerar de blå och gröna ytorna som värdefulla biotoper för bibehållandet av en ökad artdiversitet samtidigt som de erbjuder ett mikroklimat, som fungerar som en buffertzon avseende lokalklimat samt för reduktion av stadsbullret. För att motverka den befarade 1-2 meter potentiella havshöjningen pga. klimatförändringar, har våtmarkerna även en tredje funktion det vill säga som buffert för potentiella extrema översvämningar.

Framöver planeras Ekosystemtjänstnyttorna som aktiva socio-ekologiska ytor i form av vattenspeglar och grönstråk, vilket ger ytterligare positiva nyttor ur ett estetiskt perspektiv och med rekreationsmässiga värden utifrån ett hälso- och socialt perspektiv. Ekosystemtjänstnyttorna, bestående av anlagda våtmarkspartier, anpassas så att de kan ta emot avrinningsvatten (dagvatten) från såväl hustak som från gator och hårdgjorda ytor. och kopplar således samman de hydrologiska cyklerna i den hållbara urbana metabolismen.

Studien visar således på innovativa ekologiska lösningar vad som skulle kunna arrangeras i H+ området istället för alltför mycket hårdgjord infrastruktur i form av till exempel parkeringsytor.

Summary

In the planning of Helsingborg's new urban housing development renewal project of H+ (Helsingborg+) and the envisioned local blue and green infrastructure, it is important for parks and open spaces to become multifunctional, i.e. serve as recreational areas, but also function as energy neutral organic filters to capture air and water pollution.

This multi-functionality of proposed Eco-zones can be integrated into the master plan by embodying open green storm water channels and thriving wetlands in the proposed H+ area. Wetlands are bio-diverse hotspots, since they serve as valuable habitats for a greater biodiversity of species, which are often endangered in the city context. Wetlands act as a micro-protective climate, by being natural refreshing buffer zones to the city's urban heat effects, noise and visual pollution.

Additionally, wetlands in the old port area H+ can also serve to mitigate the risks of a predicted 1-2-meter sea level rise due to climate change in the Helsingborg area. Furthermore, planned Eco-zones as an active socio-ecological surface, reflects calm for stressful urbanites who can benefit from the aesthetic values of wetlands for health and as a social function for enjoyable meetings. These Eco-zones, i.e. constructed urban wetlands, are adapted so that they can receive runoff water (storm water) from both rooftops and from streets and paved areas and are linking the hydrological cycles together for a sustainable urban metabolism.

This report evaluates experiences, results and best practices from similar urban regeneration projects in Shanghai and Los Angeles. These cases are categorized in five different services that wetlands provide, notably: a) climate adaptation (both urban heat and climate change); b) biological diversity; c) possible water cleansing (of grey, black, and storm water); d) social health; e) other values of urban wetlands. Finally, the report advocates for an organic Cleantech such as engineered wetlands and open green storm water channels, utilizing bio-mimicking technology that solves many urban environmental problems (10 of the 16 national environmental objectives) in coordination between sectors that manage energy, water, sewage and waste in the H + area.

The study thus shows innovative ecological solutions that could be arranged in the H + area in Helsingborg Sweden, instead of too much hard infrastructure in the form of, for example, parking spaces. Shared Mobility is a tool for reducing the need for unnecessary hard infrastructure.

1. Introduction

1.1. Background

As cities worldwide continue to grow at a rapid pace, sustainable development is seen as a key component in safeguarding the world and its ecosystems for future generations. Sustainable development has been defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Urban development should be guided by a sustainable planning and management vision that promotes interconnected green space, a multi-modal transportation system, and mixed-use development. Parking problems have always been an issue since the very first automobiles were invented. But it got even worse with the progressing urbanization and population expansion.

Today, there is a global trend in urban development that favors densification. Green spaces are increasingly becoming a smaller share of the city areal due to increased built environments and connecting parking infrastructure. Hence, it is therefore interesting to ask if open green storm water systems and urban wetlands can be part of sustainable urban planning blueprints and set a new trend in the development. Or it becomes obvious that densification processes make it difficult and challenging to solve storm water problems this way.

The second trend is that many municipalities have plans for wetlands and ponds for cleaning and equalization of surface water. This is considered a cost-effective way to treat storm water. Additionally, the engineered green infrastructures also serve as a "recreational resources" in the urban landscape, if they are integrated aesthetically and of course in tune with the surrounding settlement. A greater element of these green systems in cities means that social and economic issues linked to these ponds and canals will be interesting to study.

Integrated water management get a clearer understanding by citizens in that the objectives of these solutions include more than purely technical ones, such as biodiversity, recreation, education and aesthetics. It is increasingly emphasized about the importance of having accessible nature in the tougher and more concrete urban landscape where people rarely have access to nature. People need nature and outdoor recreation for their well-being. Wetlands are a way to create a diverse and varied landscape in the otherwise heavily cultivated Scania.

Figure 1. H+ green and blue alley through the old industrial area of Helsingborg (Schonherr Landsc.)

Helsingborg city profiles itself as the 'Green City' and not the least through H+, which advocates a holistic and sustainable perspective for its urban development. A development which should take account of the interconnection and dependencies of the city on its surrounding environment and where progress means that both spheres are integrated benefit both an urban and ecological versatility and diversity. According to Helsingborg‘s Master Plan 2021 the city strives for green structure values that promote recreation, biodiversity, climate, water, and air, areas with character, and cultural values.

According to these plans, accessibility to available public green spaces should increase and describe how ecosystem services and multifunctional surfaces can be optimized. In Helsingborg’s most marketed Urban Development Project, H +, is, water, greenery, and natural habitats of important issues in the sustainable society, while contributing to increased aesthetic values and recreation. Overall, increases the quality of life and the attractiveness of the area. In all these reports, the wetlands of the green structures mentioned for achieving these goals.

1.2. Aim and Purpose

The overall aim of this paper is to investigate how an urban space can be reinvented in a sustainable manner embracing its triple helix soul of notably, economic, environment and social processes that form the basis for establishing, restoring and recreating wetlands in the urban context. The approach is to analyze and discuss the functions and advantages of wetlands in an urban context, and specifically for the regeneration project of H+ in Helsingborg. The overall challenge is to reduce the future need for unnecessary parking spaces and by that overconsumption of hard urban infrastructure. Densification processes can have significant environmental impact if it is not planned properly. Hence, it is therefore significantly important to establish natural ecosystem services already in detailed development plans. The aim is therefore to:

- understand the proportion of living costs in public space that result from parking space construction
- illustrate the importance of natural ecosystem services (green and blue infrastructure) in new housing development areas
- show a blueprint on urban systems (environmental, sociocultural and functional aspects, together with technology, processes and site aspects) of planning strategies in new housing area

Hence, H+ has the chance here to practically implement the definition of urban regeneration and give new sustainable life and sparkles to urban concrete of the old industrial port. Furthermore, we wish in this report, to draw attention beyond the evident natural sciences the necessity of including social science and humanities perspectives in urban planning with focus on parking issues and regeneration projects. This is important if urban planners want to incorporate genuine sustainability in their blueprints. Here is also a chance to overcome the urbanizing trend and concrete expansion over nature, instead it is advocated a re-invitation of nature to cities in order to have both health, welfare and educational impacts and effects on its citizens.

Wetlands are an exciting and interesting phenomenon in our landscape to utilize as an anchor for nature in the cities, just because wetlands have been an important part of human life since prehistoric times and is a well-known cradle to biodiversity and life in general. Beyond the historical elements of wetlands, they are still important in many aspects such as nitrogen traps, biodiversity, for human recreation and wellness. In this report we investigate and advocate how wetlands could contribute to healthier urban and social environment in the City of Helsingborg, and in the hope to see it replicate in future urban regeneration. Nevertheless, this report also is set to indicate the importance of sustainable urban planning with a clear focus on the necessity of reduction of hard infrastructure. The purpose of this paper is therefore to create base of knowledge that can be used in further sustainable mobility research.

1.3. The challenge

Today, many of the world's cities are situated in coastal regions along the North Sea and due to the urbanization and the exploitation of new ground in city regions, large areas of urban public space are lost. Wetlands in the urban environment for example have the ability, through proper design, to offer a varied range of habitats with many valuable ecosystem services for the urban regenerative system. For example, urban wetlands can be used for water treatment, disposal of storm water, retention of nutrients in the soil and recreational opportunities in green environments for a city's inhabitants (Boyer, et al. 2005).

Water saturation in the soil in wetlands are a consequence of floods and/or ground water which under normal circumstances is close to the surface. The concept of wetlands include swamps, marshes, swamps, marshes, bogs and similar constructed areas. Wetland

Environments are all over the globe, from the tundra to the tropics, with the exception of Antarctica. Because the environment is greatly affected by both regional and local factors, wetlands can vary widely in their structure. Factors affecting the development of a wetland environment, such as soil conditions, climate, topography, hydrology, water chemistry, vegetation, wildlife, and human impact on.

2. Sustainable urban planning

2.1. Urban trends

The trend is very clear. Cities are becoming denser and more compact. The perhaps overall theoretical theme in this report is therefore about what makes a new housing development area attractive and liveable? This question is of course very difficult to answer but we believe that a city needs ecological qualities to attract citizens with solutions for a liveable environments. In comparison, we have the "same procedure as last year planning" which means no new innovations or sustainable strategies included in development projects.

The issue itself with different conflicts in urban planning is nothing new. Nevertheless, it is important to understand the possibilities shared mobility creates especially in making public space available in an urban context for other purposes than parking, streets and roads.

In most cities there is – and have been for a long time – a conflict of public urban space. A city must have different functions and qualities for all kinds of inhabitants and visitors. It can be for example restaurants, cafes, trees and green vegetation and of course place for mobility of people (and goods) like bicycle lanes, pedestrian streets and areas, bus lanes and city logistics.

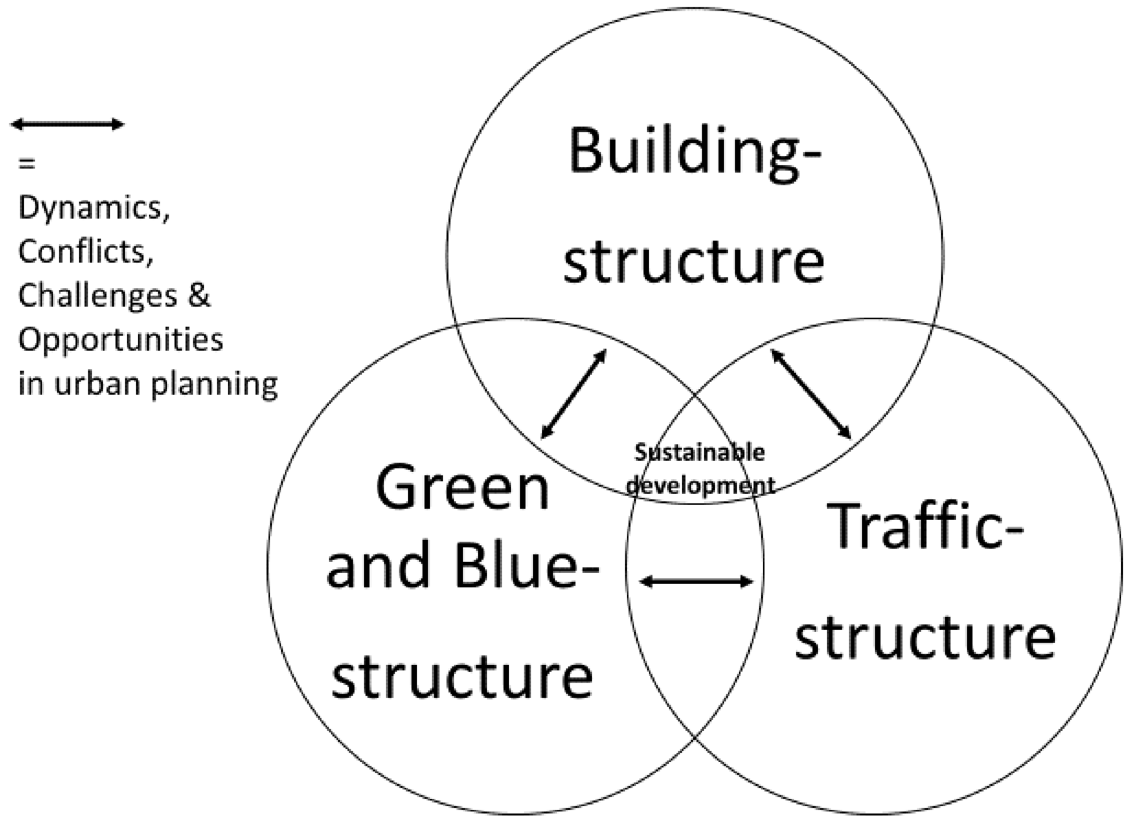

Figure 2. Simplified model over dynamics, conflicts, challenges and opportunities to reach sustainable development in urban planning.

In our research there is a couple of theoretical ways to look at the value of public space and its relation to sustainable development. Our research has pinpointed out three strategies for paradigm shift that we believe is essential: a modal share towards sustainable mobility, innovation and smart technology, and environmental strategies in urban planning.

A modal share towards sustainable mobility is per definition a paradigm shifts from car ownership to sharing mobility and sharing urban space. We believe that a change of the modal share is essential in developing sustainable transportation systems within a city or a region.

Innovation and smart technology are essential to make the modal share shift to reduce air, water, and soil pollution. And finally, environmental strategies for urban planning is considered as an important factor in building cities of tomorrow. What we build today will stand for at least 100 of years.

The provision of sidewalks, trails, and private streets connected to transit stops and an interconnected street network within these mixed-use developments provides mobility options and helps reduce pollution by reducing vehicle trips. Walking, bicycling, and other mobility options should be encouraged throughout the urban mixed-use core and mixed-use neighborhoods with easily accessed and well-defined centers and edges.

2.2. Parking issues in built environment

As more housing areas are being built, usually the more parking is built. And with parking comes several challenges for citites to handle. With parking makes it almost impossible to build great housing development areas. It therefore affects the quality of public urban space.

Parking also generates traffic. Hence, people try to be rational but are convenient witch makes every new parking space more attractive to use car. And the challenge is that in many cities streets are reaching capacity limits and there is no urban room for expanding the streets even more. By encouraging people to drive parking puts more cars on the streets which reduces the overall qualities in neighborhoods. Parking also takes up valuable space in an urban context. No matter if the space would be used for housing, parks or meeting places the parking itself takes a lot of unnecessary land.

Parking space also adds additional costs when building new housing development areas. Hence, the cost is passed directly to the residents, forcing people to pay for parking. Even if they do not own a car. This issue is a big challenge in Sweden when building new housing development areas. The money for parking could be used for other things, and the space could also be used for other things as well. So, it makes housing less affordable. In some Swedish cities the number of parking places increases when cities are growing due to densification processes.

2.3. Parking norms in Sweden

A traditional parking norm (parking standard) with a minimum level is a local enactment (law) which means that a developer has to build a certain amount of parking place per apartment or m2 of office space in order to receive a building permit for a new housing development project (still common with parking norm 2 / one apartment/house). And it is the elected leaders (politicians) of the Swedish local authorities that decide the certain level of the parking norm (i.e. traditional parking norms or flexible/adaptive parking requirements). And what does the Swedish building code say (about parking)?

Parking for new housing area developments is regulated by the Swedish Planning and Building Legislation (Plan- och Bygglagen, PBL). PBL (2010:900, Kap. 8, 9 §) determines *"an empty lot that shall be developed, must be handled in such way that it is appropriate with regards to the urban (or landscape) picture and to natural and cultural values at the area"* and should be designed that *"on the area or nearby in a reasonable extent is available and suitable place for parking, loading and unloading of vehicles"*

The local authority has in the detailed development plan (Detaljplan) the power to decide on what extent parking is reasonable, and also what is considered *"nearby in a reasonable content"* (PBL: 2010:900, Kap 8, 13 §)

It becomes more frequent using flexible parking norms and mobility measures which is a local strategy for municipalities to let the developer decide the total number of parking places in a new housing development area, other than what the local parking policy suggests, in order to promote sustainable mobility measures for accessibility to other transport modes and to reduce car dependency.

If the municipality doesn´t own the land themselves, they can´t force the developer to implement sustainable mobility measures. But, if possible, the municipality can have certain demands (not forcing) that the developer through land use agreements (markanvisningsavtal) can work towards reduced parking space and increased mobility measures. The dilemma is, that if the municipality already have a low parking norm, the incentives are low to even more reduce parking space. It is important with dialogue between municipality and developer (*byggherre*) in the detailed development plan process (*Detaljplan*) which is legally binding, in contrast to the Comprehensive Plan (*Översiktplan*) to make the right mobility measures from the beginning

Figure 3. Illustration over planned H+ area in Helsingborg harbor.

2.4. Importance of natural urban ecosystem services

An ecosystem can be defined as a specified number of interacting species and their local, non-biological environment that work together to sustain life. The boundary between different ecosystems is often blurred. In a city, it is both possible to see the city as a number of ecosystems or as a single coherent ecosystem. Wetlands in urban environment provides the city with several valuable ecosystem services. Ecosystem services are natural services that people find useful and which comes from an ecosystem function. Examples of ecosystem services that urban wetlands can provide are water treatment, disposal of storm water, retention of nutrients in the soil, biodiversity, with habitats for plant and animal species, and recreational opportunities in the aesthetic and rich green environment. Ecosystem services that wetlands can contribute to an urban environment obtained from wetland ecological and physical functions. The natural ecosystem services in a wetland can be partly linked to a wetland geophysical process.

Wetland ability to retain sediment in the soil and wetlands function as a buffer against flooding and storm water are examples of geophysical processes that humans can benefit from. Some of the natural services can also be linked to major climatic, biological and socio-cultural functions. Wetlands can help stabilize the local and global climate change and preserve an area's biodiversity. Wetlands also stands for ecological processes that enable the extraction of natural resources such as water, fish, wildlife, timber and energy from a wetland environment. The natural resources while creating environments with opportunities for recreation and activity for city dwellers.

Figure 4. Engineered green and blue nature in residential area (Helsingborg Stads Grönstrukturplan, 2013).

Wetlands provide both ecosystem services that humans consume and services that people do not consume directly, yet contribute to the greater ecosystem. Direct economic value can be obtained by extraction of a wetland goods and services. Examples of goods and services that people consume directly, wood and energy to building materials, water for irrigation and the natural environment for recreation. Indirect values are linking to the indirect services that are available in a natural wetland functions. Examples of such services are flood protection and storm water and retention of nutrients in the soils. Wetlands can also contribute to ecosystem services that are not consumed by humans directly, but needed to support ecosystem.

Examples of ecosystem services include pollination of plants and nutrient cycles. Cities today are dependent on large rural areas both for bringing in goods and services in the city and to take care of the city's waste. In a study of the 29 largest cities in the region around the Baltic Sea cities demanded a surface that was 500 to 1000 times larger than the city's surface to feed the cities. Although it is possible to produce some ecosystem services away from the city, there are reasons why some services should be produced locally. Most of the problems facing today's cities are problems also in cities. The most effective to solve these problems is often through local solutions, and these solutions can urban natural ecosystems play a large roll (Bolund, et al., 1999).

Ecosystem services can be significant both in the local and global scale. What are the benefits that humans get from an ecosystem service depends on the extent of the problem that the service is connected to and the ability to transport service from the place where the service is produced at the city where people can use the service. Transport of ecosystem services can both be done by man and by natural means, such as by atmospheric transport. Services that cannot be transported must be near the place where they will be consumed. Hence, the construction of wetlands in urban environments can lead to useful exchanges between humans and nature. However, there may be challenges around combining a rich biological environment with the urban environment and man's expectations of pleasing aesthetics and opportunities for recreation.

To ensure continuous restoration and construction of new wetlands in urban areas, it is vital that urban wetlands become an accepted part of the cities structures. In this paper we explore the definition of urban wetlands and why these environments are considered to be valuable in urban areas. How do the urban and the biological factors in an urban wetland affect each other? How can different design methods in wetlands be used to promote different services and functions in an urban wetland environment?

Based on the studied literature we have summarized eight factors which can be used to ensure a biologically rich environment in urban wetlands which is better adapted to the urban environment and the human need for recreation in urban areas. These examples are described and discussed as an attempt to answer the question how urban wetlands can be designed to enhance a city's ecosystem while they are still adapted to the particular site and the needs of the city's inhabitants. In Scania the right of public access to available land per person is the smallest in the country. It is important to focus on developing the accessibility of urban public green areas further out into the surrounding countryside but also back into the city centers. This is especially true in the larger population centers of big cities, where nature is always in a short supply. Trying to get wetland perspective in conjunction with other green structure in planning should be obvious. The experience of water is a supplement and an extra dimension in green and recreational areas.

Old quarries or engineered wetlands can sometimes provide excellent multi-functional zoning in the city and its vicinities. Fishing, hiking, and other nature-related recreational activities are important for urban dwellers, even in artificial environments, as we have seen in Råån near Helsingborg (Bramryd & Eriksson, 2013).

A wetland within walking or biking distance from a school is especially valuable also from an educational standpoint, where teachers use water and wetlands in teaching, clarifying both historical and biological processes. Today the urgent necessity for buffer zones in cities in the projections of changing climate for regulating eventual extreme events are found in bio-technologies such as engineered urban wetlands.

Figure 5. Wetland and wildlife in urban vicinity (Helsingborg Stads Grönstrukturnplan, 2013)

3. Ecological services provided by urban wetlands

3.1. Climate Regulating

In particular, the open oligotrophic2 wetlands have the ability to absorb and store more carbon from the atmosphere than they emit, thereby contributing to global climate control. It is during the oxygen-poor conditions in wetland as peat formation of dead plant materials leads to coal stored. Several processes occur in the wetland where gases (methane, carbon dioxide and nitrous oxide) are both delivered to and taken up from the atmosphere.

The peat formation under anaerobic conditions emits methane and has indeed a net emission of greenhouse gases as a result. Methane has a shorter lifetime in the atmosphere than carbon dioxide, and wetlands can in the long run have an important role as carbon sinks. Although overgrown wetland have an impact on the greenhouse gases net balances, but the effects of increased tree cover on peat formation is still unclear.

3.2. A natural purifier

The most important process for nitrogen retention in wetlands is denitrification. Once nitrogen enters the wetland in the form of biomass, ammonium and nitrate. The biomass is broken it down and converted into ammonium. Ammonium is then oxidized to nitrate by bacteria, called nitrification. Nitrification occurs only in oxygen-rich environments, and if it is too oxygen-poor in a wetland, the chain of nitrogen will stop before nitrification.

Nitrogen in the form of nitrite is not used as a nutrient by organisms but is converted by bacteria into nitrogen gas in an anaerobic environment and thus wont increase eutrophication as a result of the denitrification (Tonderski et al 2002).

Denitrifying bacteria are in the sediment but also in biofilms, in particular aquatic plants, and that is where the nitrification and denitrification occurs. The more plants, the larger the area for denitrification to occur in and varied vegetation increases the supply of organic carbon that favors denitrification (SBA, 2004).

3.3. Urban wetlands for purifying water

In cities where much of the ground surface is a hard surface remains large shares of rainwater left on the surface. It results in risks of flooding and water quality as the water collects pollutants from streets. Disposal and treatment of sewage involves large costs for cities. But developing wetlands are becoming increasingly common in innovative urban planning and storm water systems management. In several cities, attempts are made to large scale wastewater treatment in natural environments, particularly in wetlands.

At the municipal level advocated urban wetlands in water supply planning and to enhance the landscape ecological system. There are two types of urban wetland areas that are suitable for purifying water: wetlands where the water flows over the ground and wetlands where the water is visible on the surface. Marshes where the water is filtered underground surface is usually made up of sand and gravel filter. In wetlands with visible water flowing water on the surface in a planted marsh or swamp.

The advantage of the water flows under the ground is the need for smaller footprint for the treatment of water. These wetlands are often less suitable as habitat for plant and animal life. Wetlands with and without visible water have a different design and characteristics. Sometimes constructed hybrids between the two systems in order to have complementary functions and services. The effectiveness of a wetland's water use depends heavily on factors such as the size, vegetation, slope, and aspect and water saturation in the system. The project contributed to the improvement of water quality, with examples from the U.S., Sweden and China, wetland area was only about 2-7% of the basin area.

3.4. Urban wetlands for storm water management

Storm Water management is a common design feature in engineered urban wetlands. Because wetlands are a transition zone between land and water, they are a natural protection against flooding and storm water. Wetlands act as a sponge that absorbs water, rain and melting snow to then filter and slowly release the water away. Trees, roots and other vegetation helps to slow down the flow of water and distribute it slower and more evenly over the area. The storage and deceleration of water gives a lower water levels and reduces erosion. Storm Water Management in wetlands will be most effective if the area is downstream from the city because the area which can cater for the increased influx which is from buildings and paved surfaces, for example, heavy rain.

3.5. Recreation

The value of a wetland for unorganized outdoor activities and as a resource for research is largely due to the fact that certain types of wetlands are among the most productive and diverse ecosystems. Wetland has a great impact on recreation, tourism, and both knowledge incubator and knowledge transfer, are large assets in different ways that can be evaluated. Undisturbed wetland areas and wetlands are important reference areas for research, as they carry information about both vegetation and climate changes since the Ice Age.

Several unique and rare plants and animal species found for example in rich fens. Wetland's abundant insect production provide food for many species of both birds, bats and amphibians. Many terrestrial species are dependent on production from wetlands and increased knowledge of the wetlands' importance for complex species cooperation can provide opportunities to identify additional values, such as pollination and biological control that favors production in both agriculture and forestry.Main functions sought for engineered urban wetlands

Which ecosystem services that can be obtained from an urban wetland environment depends very much on the design of the area. In Haifengs et al. (2011), they take up the planning of urban wetlands from an urban planning perspective. By seeing urban wetlands from an urban planning perspective, wetlands can be customized and designed specifically for an urban need. The following are three main steps that should be included in the planning of an urban wetland. First, the desired wetland's main functions determined.

A survey of the local wetlands should then be done to see what components they consist of and how wetlands are geographically in relation to each other. Finally, there should be an appreciation of the ecological requirements of water quality. The article describes three types of common urban wetlands that give the city ecological values:

- wetlands for purifying water,
- wetlands management of storm and flood waters, and
- Wetlands as recreational areas.

There is more and more documentation of general support and direct efforts to protect, restore and create new wetlands in urban environments. Today, there are examples of projects with urban wetlands in everything from inner city environments to industrial parks. Urban dwellers often live a life of high speed and with much stress. All impressions and the hectic lifestyle often leaves few opportunities for rest and relaxation. In the urban ecosystem the recreational aspects become evident and essential, with the opportunity for play and rest, often amongst the most valuable ecosystem services in the city.

Accommodation near wetlands have been shown to appreciate the aesthetics and the diversity of habitats in urban wetlands. Wetland areas can be designed for many different activities such as fishing, bird watching, hiking and exercise and can therefore be aimed at people with different interests. All ecosystems also provide aesthetic and cultural values that provide structure in the urban landscape. Urban wetlands can be designed as a valuable recreational environments, but they also have historical, scientific and cultural values. In cities all over the world there are examples urban wetlands with historic and cultural world in which the areas have become destinations for tourists and some of the city's identity.

3.5.1. Factors in the design of urban wetlands for human recreation

To restore or build a wetland in an urban environment is always a major impact on the city's population. When the environment changes, it means that many people are changing environment in which they are used to live their lives and do everyday things like walking the dog, going to work or perform other everyday activities. In order for wetlands to work in an urban environment, man must accept these environments in their proximity. Man's acceptance grows with knowledge and understanding. Today, we have come a long way in understanding the ecological processes in wetlands, knowledge that we can make use of to see the benefits of wetlands.

However, the social and cultural research on wetlands has not yet come that far, even though it is just as important for it to be restored and created new functioning wetlands in urban environments. Knowledge of why we are interested in wetlands, why we value them is necessary to create a general willingness to have these areas in our close environment. The advocacy of wetlands cannot be based in the science of its ecological processes, but must also be based in its social, medicinal and economic values which may attract people to preserve and visit these sites and tolerate them in their environment (Nordstedt, 2012).

3.5.2. Opportunity for active or passive recreation

One way to get urban residents to appreciate wetlands is to customize the environment for active and passive recreation. Urban wetlands involves a variety of outdoor experiences that other infrastructures in the city cannot offer. For the residents of the city, and especially for the children, the little available places of nature and flora and fauna important for contact with nature's life cycles and biodiversity.

Urban wetlands can offer everything from the experience of endless marshes with reeds to verdant flood plains and chips with permanent ponds or ponds that vary by season. Generally there are a great appreciation when practical purposes is mixed with recreational and aesthetic values. Practical and recreational elements are often strongly linked to the wild nature of biodiversity and ecological processes while aesthetic values associated with qualities such as openness, wildness, variety, sense of singularity, strangeness and mystery (Nordstedt, 2012).

3.5.3. Recreation adapted to the sites cultural and residents' interests

The values estimated in a wetland may vary between cultures. In California, studies have shown that birds are one of the main attractions of wetland habitats. Environments that lack open water for large fish-eating birds have less opportunity to get community interest and support. The different habitats in a wetland can be assessed in different ways. It has been shown that marshes with salt water does not draw as many visitors as they lack green setting with spectacular plants and flowers. This does not necessarily mean that the marshes cannot be valorized environments in urban contexts. In a successful embodiment of a wetland, innovative design solutions make the design highlights the positive elements in the environment that humans believe are worthwhile.

The wetland environment is suited to a culture's traditions and current trends can do to the environment is perceived as more appealing. An attractive environment is easier to gain public interest and economic funding.

Hence a factor to consider for successful wetland design work may be based on surveys of what will attract future customers. A sustainable environment and place should perhaps also contain elements that do not become obsolete and can be developed in the future and recycled into new valorized trends (Nordstedt, 2012).

In urban context, an important component is both natural and constructed urban greenways between wetlands. Urban greenways are corridors of greenery in urban areas that can be used both for recreation and to protect and enhance the natural environment. There is a lot of work in many cities to protect the ponds at the side of the road. The aim is to link the natural structures and parkland in urban greenways and introducing urban wetlands in the built environment, both for aesthetic and practical reasons. As part of urban greenways are wetlands an important part of storm water management, enhancement of natural habitats and public spaces.

In order to allow a large variety of plant and animal species that live in the city requires the green areas of the city are connected in a network, which is also linked to areas outside the city. Many of the wetlands that remain today are threatened by problems with an increasingly limited area and an isolation from other natural systems.

When a wetland is isolated from other wetlands can lead to the environment may be a less rich variety of plant and animal species. Species capable of forming communities, spread and integrate with each other, for example pollination of plants, may be restricted or changed. Both animal behavior and the ability of plants to spread is strongly influenced by the size, shape and heterogeneity of their habitats (Nordstedt, 2012).

3.6. Adaptation to the environment's natural conditions

A sustainable wetland area should be the restoration and construction of new wetland areas mean that the ecological processes in the area adapted to the local climate, hydrology, topology, and geology. It is not necessary to recreate a copy of the historic landscape, but worth to have in mind in order to invite back lost species to the area, and remind citizens of peculiarities in their culture and history. However, it should be borne in mind that changes always affect the relationship between human and non-human components of ecosystems. It is not only the natural conditions in a place that affects a wetland design but also the urban conditions.

All cities are different because they are built in different environmental conditions and for different cultural traditions. Cities can vary from small towns to huge metropolises and residents' wealth may differ between poverty and luxury. The planning of a wetland environment affects the ecosystem services that the environment can offer and both the service itself and the value of the service can vary greatly between different cities. For example, the availability of water varies greatly in different parts of the world and through different designs can waters of wetlands used in different ways. By studying an urban master plans and plans for water and greenery, etc. can be planning the new wetland area tailored to meet the specific needs of the area (Nordstedt, 2012).

3.7. Protection of the biological environment

Urbanization impacts on wetland hydrology, geomorphology and ecology makes urban wetland functions differently than wetlands in non-urban environments. Urban wetlands can both be affected by temporary extensive changes in the geology and hydrology and on-going impact in terms of water pollution and littering. Major physical changes in the landscape form the road and house building gives geomorphological changes in wetlands and their adjacent areas. Physical changes, in turn, both biological and ecological changes in the natural environment.

A region's hydrology altered by urbanization and when that happens hydrological changes affect the wetland structure and functions. Often is the direct hydrological changes in wetland filling, drainage ditching and excavating ponds. Wetlands are also subjected to repeated stresses in the form of pollutants from roads and drains and littering. There are also invasions of alien plants and unwanted pets released into the wild. Giving people access to a wetland environment always comes at a price and on an environment gets a lot of attention to the demand on the environment become larger than the environment can sustain managers of urban wetlands must consider how the environment to coexist with an increasingly interested public.

Should the target for restoration moved from recreating what has been a system that is customized for changed hydrology and increased human use? Or will the environment be a compromise where part of the environment is open to the public, so that the remaining environment is better protected? To minimize the human impact on the environment, the outer parts remain open while other parts are more protected.

Planning of wetlands is important in order to prevent human intrusion and vandalism in places. To maintain the habitat value is important with buffer zones (Nordstedt, 2012). The restoration includes the removal of immigrated plants and animals, in order for the site natural plants replanted and the hydrological conditions can be restored. In a new wetland the planning and design of the wetland help reduce future problems and disturbances in the ecosystem. The fence is to some extent possible to protect particularly sensitive habitats of wild animals. Fences can also fulfill the function of creating a safe environment for visitors to the wetlands. Fences does not prevent disturbing factors debris, climate change and airborne contaminants. Often it is in open water in rivers and streams, as garbage collected.

Today lacks many urban wetlands buffer zones to filter water before it enters the wetland. By providing urban wetlands buffer zones and technical solutions, the water can be purified from heavy contaminants such as oil and debris before the water reaches the wetland (Nordstedt, 2012).

3.8. Dissemination of information on wetland habitats to the public

Urbanization is a major reason why many wetland areas today have disappeared. The biggest reason is the exploitation of commercial and residential buildings and expansion of infrastructure. A large part of the problem of preserving wetland environments is to find arguments to convince and engage politicians and the public. In response to many of wetland values are often overlooked in discussions of the protector of these lands have been many studies and experiments in finding the total economic value of wetland environment.

In Boyer et al. (2004), the report takes up the issue of valuation of urban wetland habitats. Many of the economically valuable components of a wetland will not be the owner of the land, which means that important values can be overlooked in negotiations surrounding the conversion of wetlands. Many of wetland values and services, such as wetland recreational environment or wetland habitat for plant and animal life, are difficult to value economically. When the natural services that urban wetlands perform as part of an ecological cycle disappears there will be costs for society to pay them on technical ways. Even if society is willing to pay the cost of replacing functions of such water will not refund the entirety of the lost ecosystem.

When cities grow over the next ten years, it is important to city planners, the public and politicians have knowledge and valuing natural ecosystems in urban environments. For cities to preserve and create new wetlands in an urban environment the public become aware of the wetland as a valuable environment. Understanding of the environment occurs through diffusion of knowledge and people's own experiences and involvement in the specific environment (Nordstedt, 2012). The following table compiles studies evaluating in monetary terms different wetlands and functions in the United Kingdom.

Ecosystem function and service	**Total value of service in wetlands of UK (million £/year)**	**Mean value of service (£/ha/year)**	**Marginal value (£/ha/year)**
Biodiversity	273	454	304
Water cleansing	263	436	292
Providing fresh water	2	2	1
Buffer to flooding	366	608	407
Aesthetics	204	339	227

Table 1. Monetary values of services found in Wetlands in UK (adapted from Morris,et al., 2011)

At the restoration or creation of a new urban wetland area, a designer can incorporate social values beyond the biophysical values and improvements being added. To achieve a good design for the social as possible, it may be advantageous to involve users in the process. To get different people to participate in planning, giving them an opportunity to communicate with local operators who may have quite different views on the local ecosystem. Users can take part in the planning, the implementation and the evaluation of results.

Work to create a community around the site. User participation is also an opportunity to scientifically gain knowledge of the interaction between man and nature in urban wetlands (Nordstedt, 2012). Ecological restoration and creation of wetlands enables people to directly experience nature with plants, water, wild life, fresh air and ecological processes along with other people in their immediate environment.

To that residents or visitors to the area are not able to reap the benefits from a wetland environment involves physical and cultural barriers. Successful restoration means that man physically, mentally or behaviorally fed back to the environment through activities or other changes in the landscape. Urban ecological restoration can help to restore social structures as well as upsetting tours of the local ecosystem (Nordstedt, 2012).

4. Good international examples of urban water-based ecosystem services

4.1. South Wetland Park, Los Angeles

Early 2012 Los Angeles inaugurated South Wetland Park. The park is located in a congested area five miles South of Downtown Los Angeles. The park began as a project to meet the water quality requirements of The Regional Water Quality Control Board as part of the Los Angeles River watershed. By purifying the storm water flowing creates the constructed wetland park a better water quality in the downstream areas of water in the Los Angeles River and coastal areas. The Wetland Park is a multi-functional green space that provides recreational opportunities for the public as well as being of benefit to society and the environment

The location where the new constructed wetland park is today used to be a paved parking space with storage buildings. Historically, the site has been a coach and rail yard and a large part of the surface had been previously raised by a historic building where vehicles were repaired.

The new wetland park is designed to reduce the presence of contaminants, such as bacteria, oil, gasoline, heavy metals and particulate-bound nutrients in storm water. Contaminants such as nutrients, metals, organic chemicals and bacteria follows the sediment in sewage waters. Purification of water in the wetland is enhance by a hydrodynamic separator that separates water from garbage and oil before it is pumped into the wetlands. The wetland water is filtered through wetland vegetation. By creating a lower flow velocity in the wetland, there is a greater proportion of sediment and water is purified thereby from more pollution. Some dissolved elements such as metals may form precipitates and is removed from the storm water. The process is dependent on several factors such as pH, dissolved oxygen and temperature. To reduce the proportion of bacteria in the water, it is important that the water is exposed to sunlight.

A certain part of the UV radiation in sunlight and helps to reduce the proportion of bacteria in the water. Filtration of water in the wetland park is by dense vegetation that helps to remove particles in storm water. Wetland vegetation and variety of species is based on local references of functioning wetlands. The plants in the wetland can absorb nutrients, heavy metals and other organic substances. Plant uptake occurs both from the soil by roots and rhizomes and from the water in dissolved form. Plant uptake may vary between seasons but are highest during growth seasons (Nordstedt, 2012).

The park has been designed to run-off from rain water to drain back into the area. Parking area is designed with a decrease in vegetation resulting runoff into the wetland area. Wetland design with islands in the water serves as habitat for birds while being aesthetically pleasing way to see wetland plant and animal life. The park provides habitat with open water, exposed marsh habitat, woodland habitats and the habitats on higher ground separated from the water.

Habitat with open water include the large water reservoir and the park's other channels and deep water dams. The areas with deep water helps partly to mix and redistribute water that flows from the marsh, prevent wetland is growing again and creating an environment which is less favorable for the spread of mosquitoes. Open water is exposed to the wind reduces the ability of mosquitoes to lay their eggs (Nordstedt, 2012).

In addition to the park's handling of storm water and surface water supplies area city with a green public space for recreation and education. In the park there are winding paths along the water that makes it possible for the visitors to take walks, jog and enjoy wetland environment with its flora and fauna. Walkways and bridges are fitted with fence to the park to be safe for the visitors while wetland's habitats are protected.

The paths are made of decomposed granite and in the park there are also two wooden bridges overlooking places in the form of decking, picnic sites and a naturalistic garden with stones and seating. The historic building has been transformed into a multi-purpose community center. Around the park there are several areas with shade that is specially designed for outdoor activity and education opportunities. The park is designed to be used both by society and schools in teaching about the wetland ecosystem, California's natural habitat and species and the physical and biological processes that are unique to wetland habitats.

Information signs in the park informing visitors about the park's wetlands function as natural habitats and features with storm water management and treatment and pollution reduction in sewage water (Nordstedt, 2012). The establishment of the actual wetland park is gradual. The wetland was calculated in the official final design report, take six to twelve months before the vegetation in the wetland can handle full water flow. Water is introduced gradually into the wetland until wetland plants have established their roots enough to prevent the float away at high water. During the first period, the wetland to irrigate to provide plants that grow higher up on the river bank with water (Nordstedt, 2012).

4.2. Shanghai Houtan Park

Shanghai Houtan Park is a park projects with a constructed wetland located in the city of Shanghai in Eastern China. The project was completed in 2010 and is built on a former area of vacant lots in a former industrial area.

The park's area is approximately 14 acres and has inspired much of China's agricultural landscape. The park wetland habitats for flood control, reclaimed industrial structures and materials, and urban cultures been linked to a design structure. The purpose of the park is to treat river water from pollution and restore the river in an aesthetically pleasing environment (Nordstedt, 2012).

The place where the park was designed a long, narrow strip extending along the Huangpu River in the city of Shanghai, China. The area was previously owned by a company manufacturing steel and a shipyard and was used largely for the disposal of industrial materials. The new park was to create a green area that would be unforgettable for visitors to the 2010 World Expo. The area was also to demons third green technology and for after the event become a permanent feature in the area of the Huangpu River. Before the new park could be built purified the land of debris that were both on the surface and buried in the ground.

The water in the river is in a poor state of pollution that makes people advised not to swim in the river and the water is unhealthy for aquatic animals and plants. The biggest challenge in the area's design was to transform the run-down and poisoned landscape into a safe and pleasant public space (Nordstedt, 2012). In the park there are three consistent elements: the ecologically built landscape, the urban agriculture and historic industrial influences. The place is designed to provide important ecological services such as food production, management of storm water, rainwater runoff and habitat for plant and animal species.

The design of the park is designed to both help give the place a pleasing aesthetics and inform visitors about the park's features. One of the features in the park that visitors are taught about the culture in urban areas. In the wetland grows crops and wetland plants that change with the seasons. In spring, golden flowers turn out to turn into fields of sunflowers in summer. In the autumn smells of ripe rice field and in winter growing green clover on the open green spaces (Nordstedt, 2012).

In the park's center is a linear constructed wetland area that is 1.7 kilometers long and between 5 to 30 meters wide. The wetland treating contaminated water from the Huangpu River. Cascades and terraces are used to purify water from an abundance of nutrients and to reduce the proportion of sediment in the water. Cascades is also designed to create an aesthetically pleasing trait in the park.

Various wetland plants were selected and planted specifically to absorb different pollutants from the water. The flood of concrete that previously existed along the river's edge was replaced by stone and vegetation that protects the shoreline from erosion. The purified water is extracted from the wetland can be used for various purposes, not for drinking, and is estimated to save about half a million U.S. dollars in comparison with conventional methods for the treatment of water.

Along with the wetland, it is a winding valley, creating a series of terraces. The terraces create an interesting design element at the same time as they are designed for recreation, education and research. The terraces of the park was created primarily to break down the difference in height of 3-5 meters between the city and the river's edge.

The terraces binds so together the city and the river and make it possible for people to easily and safely reach all the way to shore. The element in the park with terraces also has a historical connection because they resemble Shanghai agricultural landscape before the industrial development took place in the mid-1900s. In addition to the historical and cultural values helps terraces to slow down the flow of water in runoff from urban areas into the wetland environment.

Visitors to the park are reminded of the site's industrial past through recycled materials found as design elements around the park. Shanghai is the city where China's modern industry developed and the design of the park is the industrial elements was an important inspiration. Around the park are recycled steel panels used to frame views of Shanghai's skyline and enhance site's industrial past. The materials are transformed to create interesting shapes, new construction material, and protected room and space for maneuver (Nordstedt, 2012).

The park has a network of paths where visitors are taught about green infrastructure while getting a recreational experience. The network of paths is constructed around a vertical highway that leads visitors around the park. The aisles in the park are designed to lead and attract people to circulate in the park. The smaller aisles lead the visitor through the terraces, which in turn encourages visitors to go into the living system through the corridors. This way, visitors can experience the agricultural landscape and wetland environment in close and accessible environment.

The assets that are in the park are connected to roads outside the park to make the site accessible and facilitate the flow of people through the park. Around the park there are several platforms which are designed as nodes and viewpoints in the park. One of the major nodes is a hanging garden which is built from a factory structure and dock with a landscaped garden. The platforms aim is to create open spaces where small groups of people can gather. Forest Groves of bamboo and Chinese Redwood trees are planted as curtains in the park to break up the rooms and highlighting contemporary art and industrial relics are on display in the park (Nordstedt, 2012).

5. Discussion

The world's cities are becoming increasingly congested and polluted. Urban green space provides a wide range of ecosystem services that could help combat many urban ills and improve life for city dwellers—especially their health.

In the first place, parking in residential areas consists of more than merely providing an adequate number of parking spaces; it involves finding the proper place to park cars. Most of the newer residential areas are developed at a sufficiently low density to provide needed space along the street.

It has become increasingly obvious that the single most effective way for municipalities to control their parking costs is to reduce demand. While this was far more difficult in the years that preceded increased awareness of the negative impacts of single-occupancy vehicles, the idea is slowly catching on more and more. The most widely used commuting modes that reduce demand for parking include ridesharing, cycling, and public transit. For organizations, the key is to encourage as many people as possible to adopt these alternatives.

Nevertheless, instead of creating new parking spaces it is essential to create liveable cities with sustainable urban planning solutions depends on a combination of long-term visions and an integrated approach to planning. Ideally, cities should set out to have land-use plans that conserve as much natural setting as possible. The most sustainable urban plans are city designs with plentiful bike routes and walking paths near green spaces, along with roads that feature natural settings; thus, increasing the aesthetics and viability of transportation alternatives.

The first project with the urban wetland park in Los Angeles was designed in a location that is continuously influenced by the surrounding densely populated urban area, similar to the context observed in H+ area, City of Helsingborg. The park's urban water management has been a fundamental design goals together with the goal of creating an exciting and educational and recreational environment for visitors. Recreational use of the park is in turn based on an experience of nature that depends on rich biological environment of habitat for plant and animal species. Thus, the planning process has focused on combining the biological aspects of human recreation.

The park is designed to create a combination between the experience of the natural space and a designed park. The design of the park has tried to strike a balance between a biological environment that is as productive as possible, and an aesthetically pleasing environment for human recreation. The design is built around organic shapes that lead visitors around the park. Built bridges, clear walkways and the surrounding fence makes the park's layout is clear that separate humans from animals physically and plant habitats.

The fences also have a function in ensuring that visitors safely can take part of the experiential feeling of the place. The park contains several ecosystem services such as water treatment and disposal of storm water which causes the area to become economically valuable to the city. The area is also accessible for teaching and dissemination of knowledge, which means that it can be valuable for the opportunity in the future to develop effective and desired urban wetland habitats.

Linking education and experiences of an environment for a real place to promote an understanding of the environment's functions, values and potential. People can then begin to understand and appreciate the environment and create their own relationship and their own memories about the environment. The project has the potential to be the inspiration for other projects that promote a city where people take advantage of natural processes and ecological systems in the city's infrastructure (Nordstedt, 2012).

The second example of wetland park in Shanghai is a project in its design both started from the past, present problems and future ideas about the sustainable city. As in South Los Angeles Wetland Park and H+ Helsingborg, the project is laid out on a former industrial site, which is also reflected in the new park's design. The park in Shanghai has gone a step further to represent the entire city with its past in areas such as agriculture.

To incorporate a place's history and culture in a new wetland projects can be a way to get a stronger link between the new constructed environment and the existing surrounding areas. The new wetland park is designed to solve today's problems with water management and flooding and climate change in urban areas.

As the natural environment has become habitats for animals and plants in the city and a recreational area for both residents and visitors in the city. From the outset, the project was created in part to attract visitors and the park is an example of a wetland that can be used to advertise a city and generate economic achievements from ecotourism (Nordstedt, 2012).

6. Conclusions

6.1. Ecological value of urban space

Car parking is a major problem in urban areas. Following the rapid increase of car ownership, many cities are suffering from lacking car parking areas with imbalance between parking supply and demand which can be considered the initial reason for parking problems. This challenge is partially due to ineffective land use planning and miscalculations of urban space requirements during first stages of planning. Shortage of parking space, high parking tariffs, and traffic congestion due to visitors in search for a parking place are only a few examples of everyday parking problems.

In this report, we have described engineered urban wetlands' designs, services, and functions and discussed international case studies with potential replications into similar context of Helsingborg. We have found eight criteria to consider in the design of an urban wetland adapted for recreation in a rich biological environment:

- Ability to active or passive recreation

- Recreation adapted to the sites cultural and residents' interests

- Location of the town

- Adapting to the environment's natural conditions

- Protection of the biological environment

- Dissemination of information on wetland habitats to the public

- Ability to further research

- User involvement in urban wetlands

These factors are just some of the criteria used and taken into account in the design of today's urban wetlands. In common with many other green environments, there are many different ways to design an environment to create a certain feeling of the visitor. These points are more a summary of potential solutions to the problems that currently exist in the combination of rich biological environment with an urban context.

Certain measures are necessary to a natural environment to be used as recreational environment by humans while retaining their valuable biological values. In addition to these factors it is possible to adapt the environment to provide a number of desired functions. These functions can be ecosystem services as water treatment or disposal of storm water, as previously described in the report. All urban wetlands needs to be may not be adapted for all purposes. Sometimes maybe a few selected properties to suit a specific environment do to the environment becomes more valuable than if all functions would be combined in a single location.

An environment that is designed to meet all needs may ultimately not designed for anything. In the design of a new urban wetland environment, it is important to think through the potential site's desired functions and to find a balance in the number of functions and their respective scope. The environment should also be designed for a realistic goal and a purpose that is consistent with and reinforces the existing site context. By specializing some properties in an urban wetland environment, research on the environment in the wetland focus on a specific function that can be streamlined and developed in conjunction with other solutions. Real projects that provide examples of environments are important for urban wetlands should be experienced and evaluated in the effeminate life.

6.2. From parking zones to eco zones

The envisioned Eco-zones (engineered wetlands and green alleys) directly increase the quality of life for residents, students, professionals and tourists in the H + area, and are attractive to the rest of the city of Helsingborg accommodation and further national and international tourism.

The cross-sectoral concept characterizes not only the ecological conditions because wetlands create a holistic concept in its multifunctional strategic spirit from its aesthetic, economic and social perspective and fulfill the green area factor associated with the vision of environmentally conscious development. In this way, involves research to Helsingborg region's development, appears to be an innovation from an international perspective, as compiled urban wetlands in a modern laboratory such as H +, are rare in the harmonious interaction proposed here by the hybrid educational gain between the organic and technological developments. On this basis, the report will result in a variety of different case studies from different perspectives as a leading administrative competence in collaboration between business and society, and have open channels to the international through the Environmental Strategy and Service Management's diverse and secured global network.

The planning of urban wetlands should be based on the overall effect that wetlands can provide to the environment. One way to appreciate the big picture of a landscape is to start from a landscape perspective, the national strategy for wetlands suggests: ‘an ecological landscape perspective'. Such an approach includes understanding how we use the landscape today and how we have utilized in historical times, and how we can adapt and perform the practical to the vision of an integrated and holistic urban development.

Ensuring the entire landscape all content is desirable: it may relate to rural and population distribution, species distribution, cultural trails, environmental benefits. A landscape perspective can provide relief to find optimal locations for water restoration and wetland plants to priorities items for restoration and to adjust measures to local conditions in the City of Helsingborg.

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