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TIDALELBEBOOK

Landscape and open space planning development study for the concretization and project-related implementation of the tidal Elbe concept

STUDIO URBAN LANDSCAPES

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Heinz Glindemann

LIVING WITH THE TIDE

LIVING, LIVING, WORKING: THE TIDAL ELBE CONCEPT OPENS UP NEW OPPORTUNITIES FOR HAMBURG AS A TIDAL CITY

The Tidal Elbe Book represents a step into a new dimension for the Hamburg Port Authority. Landscape and urban planning aspects have certainly been taken into account by the HPA in previous planning projects - but the fact that the HPA has commissioned an interdisciplinary team of architects, urban planners and landscape architects with such a far-reaching vision as the one now presented by STUDIO URBANE LANDSCHAFTEN is unprecedented.

And this is neither an omission nor particularly surprising, as the ideas and visions presented in this book concern topics and spaces that are often far outside the actual remit of a port administration.

And yet - in order to secure the future of the metropolitan region with its port of Hamburg, this step is now logical: in 2006, the HPA presented the basic tidal Elbe concept together with the Federal Waterways and Shipping Administration (WSV). This concept already considered the Elbe as a coherent system from its source to its mouth. The tidal Elbe concept for the sustainable development of the Tidal Elbe as the lifeline of the Hamburg metropolitan region is based on three cornerstones:

1) Damping of the incoming tidal energy through river engineering measures, especially in the estuary,

2) Creation of flood space in the area between Glückstadt and Geesthacht, and

3) the optimization of sediment management taking into account the overall system of the Elbe.

The second cornerstone of the action plan concerns Hamburg in particular, as it is here that the positive effect of new floodplains on the undesirable upstream sediment transport is greatest. In addition, the neighboring countries on the tidal Elbe also expect Hamburg to take on a pioneering role. However, the Hamburg conurbation, which is concentrated around the Elbe's current splitting area, is densely populated. and not only used intensively by the port. So it's a real challenge to find suitable areas here!

It is therefore all the more necessary to ensure that all plans involving larger areas - such as the creation of shallow water areas - to look closely at which issues are affected and which factors need to be taken into account. It is important to thoroughly to consider what synergies can be achieved in conjunction with other developments and existing uses. STUDIO URBANE LANDSCAPES' visionary approach, which was derived from the existing landscape factors in terms of urban planning, points far into the future of a TIDESTADT HAMBURG.

But this book is only the first step. As an incentive book, it is intended to be the basis for an interdisciplinary process that will continue in the future. A process from which successively implementable approaches will emerge, with which the tidal Elbe concept can be realized in such a way that as many other interests as possible can also benefit. For Hamburg, this results in a real PLUS, not only for the port, which cannot do without the implementation of the tidal Elbe concept, but also for the areas of nature (protection), leisure and recreation, housing, agricultural and energy production and flood protection. The great opportunities to find answers to the expected climate impacts at the same time

with rising sea levels and decreasing summer precipitation in the Elbe catchment area have a further, very special appeal.

Please accept this invitation and participate openly and constructively in shaping the future of our TIDESTADT HAMBURG.





TIDE + CITY of Hamburg

Transformation of a city through the changing tides

The tidal Elbe concept presented by the Hamburg Port Authority and the Federal Waterways Administration in 2006 has far-reaching consequences for urban and landscape development in the entire Hamburg area. The implementation of the tidal Elbe concept is a prerequisite for the future viability of the Port of Hamburg and

requires a city-wide paradigm shift in dealing with the tidal dynamics of the Elbe. Over the next few decades, large areas of Hamburg's Elbe marshes are to be developed as tidally influenced floodplains.

This is the only way to compensate for the dramatic increase in the tidal range in Hamburg over the last hundred years - i.e. the difference between mean high and mean low tide - caused in particular by the loss of floodplains.

low water - be reduced again. The ongoing development has led to more and more sediment being transported upstream.

The resulting increase in siltation jeopardizes the economic viability of the Port of Hamburg and at the same time the unique natural and cultural landscape of the Elbe estuary. The implementation of the tidal Elbe concept now opens up the opportunity to think the tradition of Hamburg as a tidal city into the future:

- How can the hydrological and economic necessities of the HPA's tidal Elbe concept be combined with the urban planning, ecological, cultural and social perspectives of Hamburg's urban development?
- What design and utilization options are offered by the creation of more flood space for the Elbe and the new tidally influenced landscapes?

On behalf of the HPA. STUDIO URBANE LANDSCHAF-TEN developed initial ideas for a holistic vision of the future of the tidal city of Hamburg. The Tidal Elbe Book presents possible strategies and future ideas for new tidal landscapes, tidal economies and tidal lifestyles. The Tidal Elbe Book is not a spatial mission statement or an urban development concept. The Tidal Elbe Book is not a spatial model or an urban development concept; it does not compete with official planning. It is an "incentive book" to convey positive visions of the future beyond the usual planning horizons and to encourage people to think in new directions. On an emotional-aesthetic level, the Tidal Elbe Book conveys the gualities of the area characterized by the Tidal Elbe in the Hamburg metropolitan region. The pictorially depicted vision of development with a future perspective of around 100 years serves as a starting point for discussions about the development of the Elbe estuary.

The aim of the book is to initiate a constructive dialog on the implementation of the Tidal Elbe concept. This discussion must be understood as an accompanying process and thus as part of an overarching development strategy for the city and metropolitan region of Hamburg. The exemplary possibilities for the interplay of different fields of action in urban and landscape development are intended to stimulate the discourse on viable and sustainable synergies and cooperations. In the last part of the book, exemplary selected scenarios show how these topics can be developed and what diverse design possibilities the tidal landscapes of the future offer. They serve to raise further questions, not to provide ready-made answers.

Through its clarity, the Tidal Elbe Book is intended to serve as a catalyst for the upcoming complex negotiation processes and help to form new coalitions to tackle upcoming future tasks. After all, the implementation of the Tidal Elbe Concept cannot be driven forward by the Hamburg Port Authority alone, but only in cooperation with a broad spectrum of players from politics, administration and business and together with the citizens. The aim is to stimulate the necessary social discourse of the Tidal Elbe Book. It calls on the stakeholders involved to start today to redesign the future of the tidal city of Hamburg and the Tideelbeland, which stretches across the entire Elbe estuary.

HOW WERE THE VISIONS OF FUTURE TIDELAND ECONOMIES DEVELOPED?

The motto of the Tidal Elbe Book is TIDE+. On the one hand, the tide needs more space in Hamburg, as this allows the tidal range to be sustainably reduced. On the other hand, more space for the tide and for the Elbe leads to conflicts of use in the densely populated and intensively used Elbe marshes of the Hamburg metropolis. The key question is therefore: How can a "plus" in space for the tide also be combined with a "plus" in landscape qualities, usage options and lifestyles in the tidal city of Hamburg?

To this end, the Tidal Elbe Book develops future visions for Hamburg's tidal landscapes in five chapters based on the following five questions:

1. TIDE+STADT Hamburg - Why is Hamburg a tidal city and what does that mean?

2. TIDE+LANDSCHAFTEN Hamburg - What utilization systems are offered by spatial development with more tide?

3. TIDE+RAUMBILD Hamburg - Where is there room for more tide in Hamburg's urban area?

4. TIDE+SZENARIEN Hamburg - How can concrete urban and landscape areas be designed as tidal landscapes?

5. TIDE+ELBELAND Hamburg Metropolitan Region - What does the tidal Elbe concept mean for the future of the Elbe estuary?

-> TIDE+STADT Transformation of a city through the changing tides





The first chapter presents the tradition, the unique feature, the challenge and the future strategy of integrating tidal dynamic processes into the city of Hamburg. Building on the existing spatial qualities and against the backdrop of global trends, the new tidal areas to be created could add new, unique qualities and offerings to the city.

In the second chapter, ideas for new synergies between the tide and different types of landscape are developed on the basis of the existing cultural landscapes of the Hamburg Elbe region, which have always been characterized by an intensive engagement with water.

The third chapter shows that the cultural landscape of the Hamburg glacial valley, which is characterized by a differentiated geological structure, offers very different possibilities for the creation of flood space. Natural spatial conditions, cultural transformations and current uses overlap to create a topological picture that reveals the character and suitability of the various areas for new tidal landscapes. The tidal potential map shows in which areas new tidal landscapes and flood space can be developed in the future.

The fourth chapter represents the core of the Tidal Elbe Book: Four specific areas in Hamburg's urban space are used as examples to illustrate transferable options for the design of future tidal areas. Based on the landscape conditions and current development trends, technical solutions, possible synergies of use and spatial design potentials within the respective urban development areas are visualized. These scenarios clearly illustrate the basic possibilities without making concrete design proposals for the various areas.

The fifth chapter ventures a look into the future of the Elbe estuary. The development of new floodplains in Hamburg is only a first step in the long and large-scale process of implementing the tidal Elbe concept, which aims to transform the entire Elbe estuary. The This large-scale vision represents an opportunity for coordinated action by the three federal states bordering the Tidal Elbe and the entire metropolitan region of Hamburg. Long-term concepts must be developed together with all riparians. The unique spatial qualities of the tidal Elbe contain development potential that can become the starting point for the future development of the Elbe estuary in line with the Tidal Elbe Book.



TIDAL CITY OF HAMBURG

Hamburg without the Tidal Elbe is unthinkable. The river, the city and the port are so closely interwoven as in only a few other port cities in Europe.

The skillful use of the tides has always been important for the development of the city and the port of Hamburg. It has shaped the way of life, the culture of settlement, land cultivation, irrigation and drainage techniques, fishing and shipping to a great extent. Sailing ships and non-motorized barges, for example, used to be gradually carried into the harbour by the tidal wave. Even today, the tidal wave still helps the large container ships to transport their cargo from the North Sea to the port.

The decision in 1858 not to build a dock port in Hamburg. but a port open to the Elbe, was a decision that continued this tradition. It was a commitment by the city to the tide with all its consequences. "The document is regarded as the 'birth certificate' of modern port construction in the Hanseatic city," writes Cornelis Rattmann. "It laid the foundation for an international cargo handling center that is now praised worldwide for its speed." The decision was preceded by decades of controversial debate. At the time, dock ports in Liverpool and London, whose water levels were regulated by locks, were seen as a model for port modernization. In this way, large seagoing vessels could be conveniently loaded and unloaded at the quay walls and did not have to transfer their goods to smaller barges first. The opponents of a dock port argued that this idea should be dropped for good because the then still small

tidal difference of 1.5 m did not justify the expensive construction of such a harbor. As before, it was decided to work with the tides, to use them for port development and not, as in many other cities, to regard them as an annoying and dangerous problem.

The tradition of Hamburg's tidal port and its inner-city location have been maintained to the present day and the decision taken in 1858 has so far proved to be a guarantee for growth and prosperity in the Free and Hanseatic City of Hamburg. Hamburg's tidal port was modernized and adapted to the requirements triggered by the dynamic growth of world trade and the integration of Europe. Larger port facilities with harbor basins that can be navigated at any time have been created and, in combination with highly effective operating systems such as the Container Terminal Altenwerder, set world-leading standards in productivity. And This is the direction in which the port needs to be developed. Its location in the middle of the city in particular requires a well-considered and particularly effective use of space that gives absolute priority to port uses on the scarce areas. The Port Development Act, which is decisive for the port, legally secures this prioritization.

The Port of Hamburg in its coexistence with the City of Hamburg shows how tradition and innovation, productive economic development and attractive urban development can promote each other. The Elbe and the tide, which is just as important for the port as it is for the lives of the city's inhabitants, will become a trademark of the Hanseatic City of Hamburg as a tidal city.

View of the port of Hamburg at the St. Pauli jetties around 1900

LIVING WITH THE TIDE AT LOW TIDE



At low tide in the Spreehafen, the houseboats lie on the silt.

Seen from the water, the buildings are high above the sea at low tide. the quay walls.

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LIVING WITH THE TIDE DURING STORM SURGES

The storm surge floods the fish market in St. Pauli, which opens its gates and lets the water through.



During storm surges, roads become canals and beaches where you can wade through the water.



TIDAL CITY OF HAMBURG A UNIQUE SELLING POINT

Even the Roman historian "Pliny the Elder" was amazed and described his impressions of his journey to the Hamburg Elbe region a few years after the birth of Christ: "Here the ocean floods an immeasurable stretch of land twice within day and night in a widespread tide and causes an eternal conflict of nature, so that one does not know whether this area belongs to solid land or to the sea. Without dikes, a large part of the coastal land would be under water at every higher tide." This strong impression of the tides still amazes many visitors to Hamburg today and gives the impression that it is a coastal city, even though Hamburg is around 120 kilometers from the coast. What is even more astonishing is that the tidal range in Hamburg, with a difference in height of 3.6 m between low tide and high tide, is around 50 cm higher than the tidal range in Cuxhafen directly on the North Sea.

The pronounced tidal fluctuations of the river, which raise and lower the water of the Elbe twice a day, give Hamburg a special rhythm and determine the pulse of the city. In the hourly

the changing width of the beaches, the rise and fall of the jetties, the floating residential and restaurant boats, the dynamics of the Elbe are always present. When the gates of Hamburg's fish market are opened during storm surges to allow the water to flow through unhindered, tourists from all over the world are impressed. The fact that adapting construction methods to the dynamics of the river is not only a tried and tested historical principle, but is also the basis for new and large-scale urban developments

is demonstrated by Hamburg's Hafencity. Located directly on the Elbe on former guays in front of the Hamburg dyke line. Hafencity is a unique example of the bold and innovative integration of city and river. Before Hafencity was built, living outside the storm surge protection line was not permitted in principle due to the risk of storm surges. With the terp solution and an innovative traffic and rescue system, a new structural and legal framework was developed that made the close relationship between new forms of housing and the tidal harbor basins possible in the first place. The harbor basins with their floating pontoons, the view of the Elbe, the large ships passing by and the connection to the port of Hamburg represent a unique urban quality. Many cities around the world have turned their derelict port areas into new focal points for urban development, such as the Docklands in London, Kop von Zuid in Rotterdam or the eastern port areas of Amsterdam. In all these cities. however, active port operations and the associated freight and shipping traffic disappeared from the cityscape - you will no longer see container ships from London's Docklands. The close urban relationship between the city of Hamburg and its port and its relationship to the tides of the Elbe is a globally unique situation that characterizes Hamburg as a tidal city.

View from the church tower of the Michel over the city to the port of Hamburg directly opposite



DELTA CITIES FAVOR AND DANGER OF URBAN DEVELOPMENT BY THE SEA

Delta cities are cities that are characterized by their location on a river estuary at the transition to the sea. This special location connects the delta and port cities worldwide and gives them a distinctive identity. Even if Hamburg is not located directly on the coast, the tidal influence is still a defining feature and the situation is comparable in many respects with the real delta cities.

Due to their favorable strategic location, deltas and estuaries are among the most densely populated coastal areas in the world, but at the same time they are also among the most endangered regions due to their deep location. Two thirds of the world's largest and fastest growing metropolitan areas with more than five million inhabitants are located in deltas and estuaries.

in the area of river estuaries, are less than ten meters above sea level and are vulnerable to climate-induced sea level rise and the strength of the sea level rise. The risk of flooding is particularly high with increasing storm

surges, hurricanes and tsunamis.

A number of human activities such as groundwater extraction, dam construction and the expansion of river courses have made deltas and estuaries highly sensitive to sea level rise. In addition, estuarine coasts are more difficult to protect than other coastal forms due to their long coastlines. The costs of effective protection measures are estimated to be two to four times higher.

Apart from the risk of flooding, agriculture in the deltas is also at risk in some parts of the world due to the deeper penetration of salinization inland. This often affects highly productive agricultural areas, such as the Mekong Delta in Vietnam, which produces 50% of all rice in the area. Many deltas and estuaries are at risk even without global sea level rise. If the rivers are not constantly replenished with sediment, these regions will slowly sink. By building dykes, humans not only prevent flooding, but also the natural growth of estuaries. As a result, some areas, such as in New Orleans, have sunk considerably and are partially submerged by the sea. In densely populated deltas, there are other problems as well: groundwater is often pumped from the deeper layers of the deltas and at the same time, industrial sites with many heavy buildings are built there. Both these factors cause the surface of the delta to sink even further.

Around the world, a whole series of cities on deltas and estuaries are developing new strategies to deal with these challenges, such as the "Rising Tides" competition in San Francisco or the

"Delta Awards" in the Netherlands.



TIDAL CITY OF HAMBURG

The Port of Hamburg, economic engine and landmark of the city of Hamburg, is once again facing major challenges today, as it did 150 years ago: On the one hand, international competitive pressure is increasing, while on the other, the Tidal Elbe is developing a dynamic that is pushing the port to its limits.

One of the most serious problems for the operation of most delta harbors is their siltation. If the harbor and navigation channel are not constantly dredged, they become so silted up that the large ships

with their draught can no longer reach the harbor basins. Dealing with the dredged silt is difficult: Whereas in the past the material was removed from the river and large silt flushing fields were created on land, today the relatively low-load dredged material is returned to the water system further downstream in the lower reaches of the Elbe or in the North Sea. The problem with this is that the sediments can return to the port with the tidal current and then have to be dredged again - a costly cycle. The biggest challenge for the Port of Hamburg is dealing with the ever-increasing quantities of sediment every year. In the last 20 years, dredging volumes have quadrupled from just under two million m3 in the years before 2000 to over eight million m3 in 2004. One of the main reasons for this is the increasing tidal range - the difference in height between low and high tide - which has risen by almost one and a half meters in the last hundred and fifty years. When observing this development, it became clear that the low tide in particular has fallen sharply. is. The Federal Waterways Engineering and Research Institute was able to

computer model shows that the tidal current, which transports the sediments into the port, has increased due to the increasing hydraulic gradient between the North Sea and Hamburg. At the same time, the force of the weaker ebb current is no longer sufficient to transport the sediments back towards the North Sea - the siltation of the harbor has therefore accelerated. This effect is known as "tidal pumping". For some years now, a gradual widening of the Elbe estuary at the expense of the mudflats and sandbanks has also been observed, allowing more tidal energy to penetrate the estuary. Experts believe that rising sea levels as a result of climate change will exacerbate this effect in the future. Serious scenarios assume a rise in sea level of between 50 centimetres and several meters before the end of this century.

The entire system of the tidal Elbe is currently characterized by an increase in dynamics, water fluctuations and sedimentation processes. These changes can have serious consequences for the port and the city. The costs of keeping the port free are increasing to such an extent that they could jeopardize the port's economic viability. At the same time, the risk of extreme storm surges in the Hamburg area is increasing.

There is an increasingly urgent search for solutions to restore the disturbed balance of the Tidal Elbe to a balance that is compatible with the port and the city.

Hydraulic engineering measures to keep the fairway clear

TIDAL PUMPING FFFCT

Twice a day, the tidal dynamics of the North Sea cause a tidal wave that rolls upstream through the wide estuary of the Elbe as far as Hamburg. The tidal current washes large quantities of sediment inland. At low tide, the water flows back towards the North Sea with some of the sediment.

Originally, there was plenty of space in the shallow Elbe estuary for the water to expand and for sediments to be deposited. An inland delta was created in the Hamburg area, as the tidal current of the North Sea and the outflowing river water meet here: The water partially comes to rest here, sediments are deposited, islands and tributaries are formed. Shallow water areas, side arms and vegetation dampen the energy of the tide, i.e. the rising water is slowed down and flows out more slowly at low tide.

Narrowing of the river cross-section, caused in particular by embankments, the blocking of tributaries and the filling in of water areas as well as a deepening of the navigation channel have changed this dynamic in recent decades. The daily tidal wave moves through the river channel with barely slowed energy. When the tide goes out, the wave moves downstream again. As there are hardly any floodplains left to absorb the water and release it with a delay, the low water level drops very low. The last remaining foreshore areas on the tributaries and tributaries are increasingly lost due to the large amounts of sediment washed in and thus lose their effect as floodplains. The low water level in turn increases the energy of the incoming tidal wave, as it is not slowed down by the countercurrent of the outflowing water.

For some years now, it has been observed that the tidal current has become significantly stronger than the ebb current. Sediments that were washed up from the North Sea with the tide can therefore no longer be fully transported back into the sea with the ebb current. This effect, whereby the sediments are gradually transported upstream with each tide, is known as 'tidal pumping'. Sediments are deposited in the areas where the current is calmed and lead to the increasingly rapid silting up of the Port of Hamburg and the remaining tributaries of the tidal Elbe.



before the settlement (ca. 1100)







EXCURSE



The North Sea tidal wave is slowed down and decelerated by islands and shallows along the course of the Elbe. On soft banks and in shallow water zones, it can run out and lose energy. Sediment can be deposited prematurely. During storm floods, the entire glacial valley can be be flooded. Outflowing Elbe water and water from the Elbe tributaries increases the low water level. Delayed The outflowing water that is stored in tidal f I a t s , tributaries and tributaries slows down the incoming tidal wave.

Low tide

The force of the flood wave is reduced by a wide and varied tidal I a n d s c a p e . Only small areas are still protected from the Elbe by low dykes. Large-scale diking of the marshland restricts the space available during storm surges. the room.

spor

There are still many mudflats and low-water zones available. However, the tributaries are being diked and the moors drained, which means that less water can be stored in the landscape overall and the water drains away more quickly.

The force of the flood wave is barely reduced. Large areas are removed from the Elbe as flood zones by high dykes. Large-scale embankments and embankments narrow the space available for storm surges. the room further and further.

Floo

Sed ansport

T h e r e are hardly any tidal flats and low-water zones left, and the tributaries have been largely diked. The headwaters of the Elbe and the ebb current have become so weak that they can no longer transport the sediment downstream.

Low tide





Sediment management

An understanding of the complex morphodynamic processes of the Elbe in c o n j u n c t i o n with the tides of the North Sea forms the basis of the tidal Elbe concept

TIDAL CITY OF HAMBURG A STRATEGY FOR THE FUTURE

In 2006, the Hamburg Port Authority, together with the Federal Waterways Administration, presented the Tidal Elbe Concept - a comprehensive concept for the sustainable development of the Tidal Elbe as the lifeline of the Hamburg metropolitan region. The concept includes a future strategy that aims to restore the disturbed balance of the tidal Elbe to an acceptable equilibrium. It is based on an approach that looks at the dynamic system of the tidal Elbe and the city of Hamburg as a whole and not just combating the symptoms of tidal pumping with individual technical measures. The proposed measures are intended to stabilize the system on a large scale, in the long term and sustainably, and to mitigate the consequences of the severe deformations of the last 100 years. The tidal Elbe concept formulates bundles of measures for the entire Elbe area from Geesthacht to the estuary in three major task areas. They form the cornerstones of the concept:

1. DAMPING OF THE INCOMING TIDAL ENERGY BY MEANS OF RIVER ENGINEERING MEASURES, ESPECIALLY IN THE AREA OF THE ESTUARY FUNNEL

2. CREATION OF FLOOD SPACE IN THE AREA BETWEEN GLÜCKSTADT AND GEESTHACHT TO DAMPEN THE TIDAL CURVE IN THE HAMBURG AREA

3. OPTIMIZATION OF SEDIMENT MANAGEMENT TAKING INTO ACCOUNT THE OVERALL SYSTEM OF THE TIDAL ELBE

The planning horizon extends far beyond 2100 and is associated with major financial expenditure. If one considers the comprehensive effect that would be associated with the reorganization of the concept, the expense is justified: For the city and the port, the implementation of the new strategy for dealing with the Elbe This means a long-term solution to economic, hydraulic engineering, ecological and urban planning issues at the same time.

As part of the tidal Elbe concept, the creation of more tidal space is planned for the Hamburg current splitting area. This will hold back the outflowing water at low tide and reduce the low water level.

This raises the water level, which has the effect of attenuating the incoming flood wave. Hydrological studies have shown that the provision of flood space in the Hamburg area is much more effective than further downstream or in the direction of Geesthacht. It is therefore also important to find areas within this relatively densely populated area to create new tidal volume. Possible measures include: the conversion of sedimented mudflats and foreshore areas into shallow water.

The main focus of the project is on the creation of new tidal areas, the reconnection of secondary ebb and flow systems and the clearing of sedimented harbor basins. It is important that areas are created in this way that participate in regular tidal activity. Shallow water areas that still carry water at low tide are more effective than dry tidal flats. Delaying the outflow of water also increases the effect. In order to implement the tidal Elbe concept, it is important to combine this strategy, which was developed on the basis of hydrological, economic and ecological considerations, with a strategy for the integrated spatial development and design of Hamburg's urban area.

PILOT PROJECT: TIDEPARK KREETSAND

The first project to create flood space is now to be realized with the rededication of the old Spadenlander Busch/Kreetsand dyke in the east of the island of Wilhelmsburg. Plans for reclamation have existed since the 1980s, but were only implemented at the end of the 1990s. However, the terrain is so high that the ground has to be excavated so that the tide can flow freely in and out of the future shallow water area.

The project is considered a pilot project: the interdisciplinary collaboration and diverse objectives make it an important reference project for the HPA's tidal life management. Hydraulic aspects were taken into account in the design, as were nature conservation objectives, design aspects and quality of experience. While the cooperation between nature conservation and the Hamburg Port Authority already has a long tradition, the consideration of the perception and experience aspect is still a relatively new approach.

The phenomenon of the tides defies direct observation. In its time lapses, it stretches the human capacity for observation. Inevitably, its landscape-shaping dynamics also remain beyond perception. In this respect, making the tide visible represents a landscape design challenge when it comes to communicating the tidal and ecological relationships as well as the hydraulic engineering and landscape cultural approach to Hamburg's tidal and water landscape to a large audience. This is precisely the intention of the Hamburg Port Authority (HPA) as part of its large-scale strategy to reduce the tidal pumping effect in Hamburg's Elbe estuary by expanding tidally influenced shallow water areas. The aim is not only to make the project context understandable, but also to initiate communication processes that are able to raise public awareness of the complex tidal dynamic processes.

-> EXCURS Tidepark Kreetsand





In June 2009, the STUDIO URBAN LANDSCAPES / OSP, the engineering office Melchior+ Wittpohl and the office Greuner-Pönicke (BBS) from the HPA with a concept to intensify the landscape experience and the experienceability of the tidal events at Spadenlander Busch / Kreetsand commissioned.

A new tide-influenced shallow water area is to be created there on the foreshore by removing the old flushing fields and at the same time developing habitats of high nature conservation value. Since October 2009, the landscape and open space planning design study entitled Tidepark Kreetsand has been available for the Spadenlander Busch/Kreetsand tidal landscape.

The design concept shows how the tidal dynamics and largescale interrelationships of this water landscape can be made tangible and legible as part of the pilot project, taking nature conservation concerns into account. Aside from text-heavy educational trails, the concept proposes to create and mark special references and points of comparison for the tidal courses and to open up and highlight tidal traces on site. The aim of this approach is to convey design rather than information. In addition, various dimensions of experience ("playing with water", "reference heights such as Wilhelmsburg Town Hall, one's own height, individual memories of outstanding flood events, etc.) are addressed, which easily connect with the visitor's horizon of experience. The Kreetsand Tide Park thus offers a tidal experience that is unique in Hamburg to date, combining natural processes, technical control and cultural design.





TIDE+ LANDSCAPES Hamburg

Utilization synergies of spatial development with the tides

Hamburg is a diverse, densely populated city that has been characterized by steady growth for years. For this reason, land here is particularly valuable and its use as flood space cannot be considered in isolation. They are located in a dense, lively urban fabric and must be integrated in an intelligent and multi-functional way. Numerous current visions for the future of Hamburg focus on the Elbe region: the development of the spatial model with the focus "Leap across the Elbe", the IBA Hamburg and the International Garden Show 2013 on the Elbe island of Wilhelmsburg, the port development plan, the climate adaptation strategy and the flood plan, as well as the integrated management plan for the Elbe estuary as an implementation instrument for Natura 2000 reflect the broad range of tasks for this region over the next 100 years. The port and the tidal Elbe concept can be an important driving force in the future to bring all these developments into synergy. The Tidal Elbe concept has already been anchored at various levels as a component of spatial development. For example, through the Senate resolution in 2007

for implementing the measures of the tidal Elbe concept, in cooperation with the Elbe Habitat Foundation and as part of the collaboration with the nature conservation associations in the implementation of the Kreetsand pilot and IBA project. The search for expandable synergies and their visualization is an important step on the way to implementing the concept and is therefore a focal point of the Tidal Elbe Book. In addition to the already proven partnership with nature conservation, many other synergies are conceivable. The topics are wide-ranging, but touch on all important issues of current urban development: flood protection, port development, new housing, qualification of the recreational areas as well as the production of renewable energies and the use of the areas for new forms of agriculture. The integrative approach represents a great opportunity for the planning, financing and realization of the projects to implement the tidal Elbe concept, which affect a wide range of interests due to the location of the areas in the middle of the city. The new tidal landscapes are an asset for the entire city.



+ HARBOR LANDSCAPES

For the port, the economic benefits resulting from the reduction in sediment volumes are paramount. The creation of new tidal areas helps to improve the conditions for the economic operation of the port on a permanent and sustainable basis. Against the backdrop of climate change, the importance of these measures will increase in the future. Of course, port use in the port area continues to have statutory priority. It is important to use the existing port areas as effectively as possible for goods handling and the port industry by promoting internal development and with the help of modern terminal concepts. However, the realization of the concept will also promote other desirable developments. Harbour basins, canals and canals that are no longer used, for example in the inland waterways, would continue to be maintained and could be used for recreational shipping, for example. Green connections could be created within the port area by creating tidal areas. In this way, a more diverse experience could be created.

of the harbor world, especially if the use of space were regulated flexibly. Habitats would emerge temporarily and then disappear again, only to re-emerge elsewhere as a result of use. These new tidal areas could be designed as publicly accessible spaces and ecological niches. These measures would positively change the public's perception of the port. Another possibility is the development of innovative designs for new buildings in the port area. rich. For example, tidal potential could also be created under modern pile dwellings. This would give the Port of Hamburg another opportunity to present itself as an innovative, sustainable company.

top left: Stand Up Paddling World Cup in HafenCity

top right: Houseboats, Hamburg

bottom left: Overseas container ship, Hamburg

bottom right:

Bathing establishment in harbor surroundings, Sydney



+ NATURAL LANDSCAPES

There are promising synergies with the interests of nature conservation. The creation of shallow water zones and thus also the expansion of the flooding and sedimentation area is an important goal of the Natura 2000 concept for the development of the Elbe estuary (see excursus). Freshwater tidal areas are very rare habitats worldwide. For this reason alone, the new areas are very valuable for nature conservation. Some species, such as the hemlock water fennel, can only be found on the banks of the tidal Elbe. Another important aspect is the restoration of an ecological connection in the river. Due to the numerous steep bank walls in the port areas and the strong currents, there are few resting areas in the water in the Hamburg area that would make it easier for fish to migrate through this section. In addition, in some summers the oxygen content of the water in the Hamburg area drops so low that the Elbe becomes impassable for fish at times. Alternative options or bypasses are to be created by

reconnecting old secondary lines.

The new shallow water areas will play a strategically important role in stabilizing the entire ecosystem by coordinating their location and design with the requirements of the fauna and flora of the tidal Elbe.

Although the focus of the HPA is primarily on the creation of new and the preservation of existing shallow water areas, the simultaneous development of freshwater mudflats, reed beds and riparian forests is of great importance for the creation of an ecologically valuable, species-rich landscape. This can be achieved through careful shoreline design. The implementation of nature conservation measures results in synergies with the measures to implement the EU Water Framework Directive, which are intended to contribute to strengthening the ecological potential of the Elbe. Cooperation between the port and nature conservation is very obvious. It is already being practiced today, for example in the development of the integrated management plan for the Elbe estuary.

top left: Grown trees in a riparian forest, Hamburg

top right: Elbe sandy beach, Hamburg

bottom left: Queller growth in the Wadden Sea, Elbe estuary

bottom right: Cycle route along the Elbe, Hamburg



+ RECREATIONAL LANDSCAPES

In the long term, the new tidal areas will take on the function of additional green spaces in the city. If they can also be used as areas for sport and recreation, this will create great added value for residents.

All of the new areas are highly dynamic spaces for experiencing nature. They are ideal for extensive, naturebased forms of recreation such as hiking, canoeing or birdwatching. However, more intensive uses are also conceivable here.

In general, water areas have a high recreational value. The dynamic flow conditions of natural landscapes shaped by water can be staged and used. Many types of water sports, beach use and bathing are conceivable. By utilizing the tidal range and the resulting flow gradient, rafting routes, waterfalls, tidal swimming pools or surfing waves represent opportunities to create unique recreational landscapes throughout Germany. In conjunction with the natural dynamics, filter systems can be developed that flow through the water to maintain bathing quality. The immediate surroundings of the tidal areas will be characterized by interesting topographies, as the excavated soil from the construction of new shallow water areas is best reused on site. Creative shaping can create interesting recreational landscapes with viewpoints, mountain bike trails or special playgrounds.

Targeted control of activities through clever zoning and a concentration of uses in certain areas would be helpful in reconciling nature conservation and recreation.

top left: Frozen canals, Netherlands

top right: Badeschiff, Berlin

bottom left: Bridge Harbor Islands, Amsterdam

bottom right: Eisbach surf wave, Munich

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+ FLOOD PROTECTION LANDSCAPES

In Hamburg, the measures to raise the dyke line for public flood protection have almost been completed. Consideration of further improvements to the protection system will be necessary, particularly in the context of climate change. Long-term planning with very uncertain climate forecasts will require the use of flexible packages of measures in the future.

The long-term creation of shallow water areas in diked back areas, which is also required by the tidal Elbe concept, is an important component of this.

The creation of new shallow water zones as flooding areas also creates retention areas that help to lower the storm surge level during high tides. The most effective use of the retention areas is as storm surge polders, which are only flooded shortly before the highest flood level is reached. For this purpose, the areas must be equipped with a specific control system. These systems are already in use on other European tidal rivers such as the Scheldt (Netherlands) or the Humber (England).

An important task for the future in the area of high water

The design and functional integration of flood protection facilities into the urban structure is a key aspect of flood protection. The development of multifunctional dyke landscapes instead of purely technical structures is an important field of action and experimentation. This will be a particularly important topic in the design of new dyke landscapes, as it is almost always a question of transforming existing dyke landscapes or even developing fundamentally new dyke types. This also opens up new fields of action for research.

Komhaus as an excursion destination on the Elbe dyke, Dessau

top right: Dykes along the Lühe, Altes Land

top left:

bottom left: Storm surge barrier on the Este, Hamburg

bottom right: Flood in the Speicherstadt, Hamburg



+ LIVING LANDSCAPES

"The Baltic Sea in front and Friedrichstrasse behind" was Kurt Tucholsky's wish. The new tidal areas can be used to realize innovative living close to nature in the middle of Hamburg. Over the last hundred years, living by the river has increasingly become living behind the dyke. New forms of housing in and around areas influenced by the tides, with a view of lively tidal landscapes, can enrich the range of housing on offer in Hamburg in an attractive way. Terraces in the middle of birdrich reed beds, a view of the open countryside and experiencing the tides on a daily basis can provide a very special experience of nature from your own terrace. The surrounding exciting open spaces by the water also make these residential areas attractive for families. Floating apartments, amphibious systems, pile dwellings or dyke apartments are just some of the possibilities here. The possibility of having your own boat directly behind the house is also very appealing. For many people, it is a dream to be able to go out on the Elbe directly from their own home. Water cabs as an alternative, fast means of transportation within

Hamburgs or boats as vacation homes, which are available for long tours on weekends, are just a few possibilities. Numerous research projects and competitions are currently underway worldwide in the search for new forms of housing that can adapt to climate change. In the Netherlands in particular, many innovative projects have emerged in recent years. Hamburg could make a name for itself within Germany as an innovative city in this area.

top left: Floating houses, Fraser River, Langley, Canada

top right: Pile dwelling on the beach at low tide, St. Peter-Ording

bottom left: Houseboat in harbor surroundings, Hamburg

bottom right: Housing estate in the harbor, Amsterdam



+ PRODUCTION LANDSCAPES

Another alternative to designing and financing the areas is their productive use. The creation of new tidal areas can be easily combined with the sustainable production of energy and food. For example, the installation of solar and wind energy systems or tidal power plants in the area of water surfaces represents an attractive dual use. Aquaculture for the production of raw materials or biomass offers further potential. The cultivation of reeds, bulrushes or other marsh and aquatic plants makes use of the nutrients in the water. In addition, the cultivated areas can provide a habitat for various plants and animals and, if properly organized, contribute to the purification of incoming and outgoing water. Existing, less productive agricultural areas could be used as test fields for the development of new productive tidelands. As the rewetting of land is an issue all over the world, a lot of research is currently being carried out into the productive use of such areas. The development of 'paludi' cultures (cultures of marsh

and reed plants) by the University of Greifswald is an example of this. Research and development of cultivation methods, taking into account the special conditions caused by tidal fluctuations, are promising fields of action and experimentation.

top left: Aquacultures, Hov on Suðuroy, Faroe Islands

top right: Salt marshes, North Sea coast

bottom left: Algae cultures, Israel

Bottom right: Floating solar fields



TIDE + RAUMBILD Hamburg

More space for the tide in Hamburg's urban area

Having established what types of synergies would generally be possible in tidally influenced landscapes, the aim is now to investigate where more space can be created for the tide in a densely built-up city like Hamburg. So which spaces are suitable for the new TIDE+ landscapes?

In order to find possible tidal potential areas in Hamburg, different perspectives were adopted. They should help to interpret the spatial situation with regard to its significance for the tide:

the topographical view, the geological view, the hydraulic engineering view and the urban planning view. The characteristic landscape of the Hamburg inland delta between the Geest slopes forms the basis of the view. The original tidal landscape

is characterized by low-lying marsh and moorland landscapes. A close examination of the heights, soils and population density provides information on which landscapes are suitable as potential tidal areas.

The water dynamics of the Elbe are controlled and limited by the dyke lines, barrages, locks and hydraulic engineering irrigation and drainage systems. These enable people to develop and build on the area as well as to manage and cross it. The consideration of the landscape and Settlement typologies and infrastructural development offer approaches for the use of new TIDE+ landscapes. The overlapping of these individual approaches results in a new interpretation of the space with regard to its tidal potential, a new urban landscape for Hamburg is created: the TIDE+spatial image. This image makes the existing spatial structure of Hamburg's Elbe landscape visible and at the same time outlines an idea for the development of future tidal Elbe landscapes that reflect the dynamic Giving more space to tidal events. The spatial image brings together natural conditions, artificial reshaping and dynamic water processes.

with buildings and infrastructural development into the focus of urban development. It serves as a starting point for interpretations and possible future developments. However, it is neither a classic model nor a master plan, but rather integrates the potentials of the Tidal Elbe concept into a coherent spatial picture.

The image shows the vision of a specific landscape character of the Hamburg Elbe region and its tidal landscapes: The TIDE+Elbe landscape with the river islands and the TIDE+Lakes landscape with the embankments.









TOPOGRAPHICAL VIEW

The topography plays a special role in Hamburg's current splitting area. It determines where and how the water flows and where it can expand. However, the forms of use that are possible depend not only on the height of the terrain, but also on technical and regulatory measures.

As a clear topographical edge, the Geest represents the natural boundary of the tidally influenced Elbe landscape and is therefore also the boundary for the future TIDE+ landscapes.

Large parts of the Elbe landscape are lower than the average tidal flood level (+2.09 m above sea level) and would not be able to cope without the protective dykes and locks.

are under tidal influence. This applies almost entirely to the Alte Land, the Elbe island and large areas in the south-east of Hamburg between the Bille and Elbe rivers. The areas colored blue mark the space that the water would occupy during a tidal flood without technical control and represent the maximum potential for new TIDE+ landscapes. Another characteristic topographical feature of Hamburg's Elbe landscape are the natural embankments along the main stream and the tributaries of the Elbe. Tides and storm surges have deposited sediments close to the banks, forming natural mounds along the watercourses.

Such higher-lying areas are found mainly in the area of the Port of Hamburg. They are washed up

Polder areas that have been removed from the tidal action. The highest elevations in Hamburg's Elbe landscape are artificial mounds of harbor silt and waste in the marshland, such as old flushing fields and landfills.

LANDSCAPE PRUNING AND RESHAPING

The character of the Hamburg inland delta and the Elbe marshes was originally shaped by shallow water zones and constantly changing islands and sandbanks. The forces of the Elbe current and the tidal range kept the erosion and sedimentation processes going and caused constant change and movement of the landscape. The daily fluctuations in the water level caused by the tidal range were only a few decimetres at that time, as the water had plenty of room to expand over the area. Artificial elevation of the land through the construction of polders and dykes, as well as stream-regulating measures and structures, made intensive cultivation and settlement in the marshland possible, but these measures not only changed the topography, but also the dynamics of the tidal Elbe immensely.



EXCURSE

The loss of tributary islands, shallow water zones and floodplains also meant a dramatic loss of tidal volume, which was initially offset by the construction and expansion of harbor basins. The result is an increase in the average tidal range from 1.90 m to approx. 3.50 m in the last 100 years. The landscape has changed rapidly during this period: Around 200 square kilometers of space have been taken away from the river. The topography has been extremely reshaped. This affects both the raising of outer dyke areas, areas completely cut off from the tidal Elbe such as that of the Doveelbe and the Alte Süderelbe as well as the Deepening of the Elbe as a navigation channel and straightening of dykes. However, due to the considerable problems that have arisen, a rethink is now taking place. The implementation of the tidal Elbe concept can change the picture in over the next 100 years and will develop a productive mixture of original and remodeled tidal landscape, which will be adapted to both the dynamic water system and the evolving

Hamburg as an evolving metropolis. The Tide+Spatial Image tells the story of these new urban tidal landscapes.







GEOLOGICAL VIEW

The geological view is closely linked to the topographical view, as the suitability of an area as a tidal landscape depends on the existing altitudinal, geological and topographical conditions.

and soil conditions and the associated water influences and reshaping processes. The geological nature of the alluvial land and its boundary by the Geestkante documents present and past sedimentation and erosion processes under tidal influence, while the artificial reshaping of the geology documents anthropogenic interventions. for protection from the tidal current and flood protection.

The soil types and transformation processes of the geological subsoil under the influence of the tide provide the creative possibilities for new TIDE+Landscapes: Different soil types have different natural

vegetation, are suitable for different uses and react differently to water fluctuations.

The highly simplified geological units shown are alluvial and river sands, moor belts, diked marshland and artificial polder and landfill areas. Due to their elevated location, river sand areas represent the historical settlement areas and are not suitable as large-scale tidal potential areas due to their height and use. Washed-up areas such as harbor polders and

Flushing fields, on the other hand, would involve massive excavations in order to redesign them for additional tidal volume. Due to their mostly commercial use, they are also often exposed to higher levels of pollution and have to be cleaned and disposed of at great expense. Due to their artificial drainage, moor and marsh areas are often below mean high tide and are therefore particularly suitable for creating new tidal volume. In addition, moors and marshes are mostly used for agriculture and are therefore sparsely populated. However, the occurrence of

of peat layers in combination with periodic water fluctuations and oxidation processes, that structural measures may be necessary here.

LANDSCAPE TYPES



PORT POLLARS



EMBANKMENTS/ RIVER SANDS



DEVELOPMENT:

Areas in the outer dyke area are raised by artificial embankments and fortifications to protect against storm surges, an old settlement principle in the Elbe region. Even in the early phases of settlement, single house mounds and village mounds were created to protect people and buildings from flooding.

USE:

The polder areas are mostly sparsely vegetated and characterized by port and industrial uses. A new interpretation of the elevation can be found in Hafencity: here, residential and office use was realized in the area of derelict port facilities by applying the terp principle.

DEVELOPMENT:

The sedimentation processes of the Elbe also lead to an increase in the tidal and storm surge influenced bank margins of tributaries, side streams and the Elbe main stream. Sedimentation takes place all the faster if the water surfaces are not well flowed through like

e.g. in harbor basins or oxbow lakes that are only connected on one side. Today, the embankments are no longer exposed to sedimentation due to the construction of dykes - this is limited to the narrow foreshore areas.

USE:

The embankments are one of the oldest settlement areas, as they offer protection from the daily water impact. In the foreland of the dyke, the embankments are characterized by pasture use and reed beds. In the dyke hinterland, land use has become more similar to that of the rest of the marshland.







GEEST



MARCH





DEVELOPMENT:

Marshes are alluvial deposits consisting of fine sand and silt on shallow coasts and river estuaries with strong tides. The areas removed from the floods by diking have to be intensively drained for agricultural use. As a result of the water regulation measures, the marsh sank by up to one meter, while the areas within the dykes grew due to sedimentation processes, so that today many areas of the marsh are below the tidal flood level.

USE:

Due to the nutrient-rich soil, the marshes are mostly used for arable farming, vegetable or fruit growing, sometimes in combination with livestock farming. The Vier- und Marschlande with its vegetable cultivation north of the Elbe and the Alte Land with its fruit cultivation south of the Elbe are particularly characteristic marshland landscapes.

DEVELOPMENT:

MOOR

Fens are formed when nutrient-rich water bodies silt up, as here in the floodplain. Aquatic plants die and are piled up as a result of inhibited decomposition. This creates an increasingly thick and stable layer of organic dead material, which gradually penetrates the water surface and is colonized by larger plants. Moors are important water reservoirs in the landscape.

USE:

Any agricultural use of fens requires extensive drainage measures. The cultivation of cereals, fruit and vegetables is hardly possible due to the excessive moisture - use is limited to grassland cultivation and forage maize. Settlement activities are rare due to costly foundation measures. Similar to the marshes, there is strong subsidence in the moor due to the drainage measures.

DEVELOPMENT:

The Geest is a hilly moraine area of the Saale Ice Age, which was formed by sand deposits. The two geest ridges to the north and south of the Elbe form a clear boundary to the post-glacial alluvial plain - the Elbe glacial valley.

USE:

The Geest was well suited as a settlement area along the glacial valley, particularly because of its rich drinking water resources. The Geest offered protection from storm surges and at the same time access to the navigable and fish-rich Elbe and its tributaries. Here lie the origins of the two towns of Hamburg and Harburg and the focus of their settlement development. Due to the sandy and less fertile soil, the Geest was mainly used for grassland farming and potato cultivation. It was only with the advent of artificial fertilizers that intensive arable farming was possible on the Geest.

MThw+ 2.09 m MTnw - 1 53 m





HYDRAULIC ENGINEERING VIEW

Hydraulic engineering is one of the most significant landscape designers of the Hamburg Elbe region. Hydraulic engineering measures such as river regulation, dyke construction, the erection of barrages and locks and the construction of irrigation and drainage systems determine what the Elbe landscape can be used for and how it can be used. Hydraulic engineering measures provide safety, but they also pose risks in the event of malfunctions and disasters: If a dyke breaks, the water in the low-lying hinterland cannot drain away naturally and has to be pumped out.

At the same time, hydraulic engineering measures have a major impact on the overall system of the Elbe and the tidal dynamics.

Dike construction is probably the most lasting intervention in the Elbe landscape (see EXCURSE p. 24). The dykes determine the maximum area of influence of storm surges and the tide. With the help of dykes, the majority of the original marshland was reclaimed from the sea.

influence of the tides. Today's secondary dykes along the tributary Elbe and behind the main dyke line represent former dyke courses that no longer have any function. The main dyke line has moved closer and closer to the main stream of the Elbe. This dividing line between the dike foreland and the dike hinterland has been

closed by storm surge barriers and sluices. Different dike types represent different potential areas for the tide due to their heights and boundaries. Tidal potential areas behind the main dyke line are areas in which the tide can be delayed by control structures. Appropriate measures could further increase the effectiveness in terms of tidal range reduction. At the same time, these areas can be operated as flood relief polders in the event of a storm surge. Potential areas in front of the main dyke line, on the other hand, are more suitable as uncontrolled tidal landscapes, as in the pilot project "Tidepark Kreetsand" (p. 28).

DEVELOPMENT OF DIKE HEIGHTS

Dykes before 1693

Dykes from 1693



The first dikes are STACK DIKES with relatively steep banks and a vertical wall of wooden piles. The crown of the dikes serves as a road in the wet marshland. This therefore has a width of between three and five meters. The houses are accessed directly from the dyke. 4 m Las

Gradually, the dikes become higher and the embankments flatter. The base of the dyke is covered with turf and Thatched, these dikes are called LEKDEICHE.



-> EXCURSE Development of the dike height

Dykes from 1825

Dykes from 1962

Dykes 2008



Later, STONE DIKES with a stone layer at the foot of the dike became established. The profiles of the dikes are narrow. The top of the dyke is part of the public road system. Trees and houses stand along and on the dykes.



The dikes are now calculated according to modern foundation engineering rules and built by machine. The embankments are flatter, the dykes become very wide. The dyke road is now on the inside. New houses must be built at a distance from the dyke, planting on the dykes is no longer permitted.



The dyke bodies will be raised once again. They will be widened into the dyke foreland. You can no longer see over the dyke from the dyke road.







URBAN PLANNING VIEW

Not every area that appears suitable from a geological and topographical point of view can become part of the tidal potential area. Population density and intensity of use are further important criteria for the selection of areas in the Hamburg region. According to these criteria

the existing situation must be reviewed. On the one hand, settlement density and infrastructural development depend on the natural suitability of an area for certain uses; on the other hand, they are determined by cultural factors, such as the structural transformation over the course of history. The map shows existing settlement, economic and infrastructure areas that are

are dependent on hydraulic engineering measures and therefore do not qualify as potential areas. However, existing uses can benefit from the proximity to new tidal landscapes. Another

Settlement-related use and development will not be ruled out in future tidal landscapes either, but can include new synergy effects and spatial qualities.

To this day, the main settlement areas are the two floodsafe geest areas to the north and south of the Elbe's glacial valley, as they have access to the Elbe and its tributaries. The origins of the two towns of Hamburg and Harburg also lie here. The prehistoric and early historical settlers adapted to the unpredictability of the Elbe in the area of the flood-prone marshes and built on the natural embankments, on terps and along the dykes. These linear and punctual settlement structures can still be seen in the marshes today. With the qualification of dyke construction and

of hydraulic engineering regulation techniques have been used in marshland and, more recently, in moorland. This made it possible to create the comprehensive settlement typologies that make up the majority of modern settlement structures. However, the technical achievements also brought with them increased public safety requirements. The prerequisite for settlement forms in the marshes is therefore regular investment in dyke safety. Industrial and port-related uses are mainly located on the artificial port polders outside the main dike line and are protected by their own ring dikes and their artificial elevation.

SETTLEMENT STRUCTURES









SETTLEMENTS ON THE EMBANKMENTS

MThw+ 2.09 m MTnw - 1.53 m

> If you follow the history of settlement in northern Germany, it becomes clear that the Geest was settled much earlier than the Marsch. It offered protection from storm surges and access to the rich drinking water resources at the fish-rich Elbe. This is why large stone graves from the Stone Age can only be found in the Geest area. The origins of Hamburg and Harburg also lie in this area. The Geest-Marsch border also represents a boundary in terms of settlement and cultural history. The density and linearity of settlement activity along the edge of the Geest can still be clearly seen today between Harburg and Cuxhaven and between Hamburg and Glückstadt. For generations, the principle was that people lived on the Geest and only worked in the marshes. Due to the very different soils, very different settlement typologies developed, which was reflected in the separation of farming cultures on the Geest and on the Marsch: Until well into the 20th century, it was considered unseemly for marsh dwellers to marry someone from the Geest, as this meant that no fertile land came into the family.

The oldest settlements within the glacial valley are located on the slightly higher marshland, the banks of the Elbe. These places, inhabited by a population of Saxon origin, were often located at the mouths of small watercourses (Flethe), which is still indicated today by the place names ending in -fleth.

Due to their slightly elevated location, these settlements were often flat clustered settlements without terps and dykes, later they were often additionally protected by ring dykes. Livestock farming and fishing were predominantly practiced here, with only a few isolated cases of arable farming in the form of summer cereals. Today, these settlements are protected from the Elbe by the main dyke and have expanded into the low-lying Sietland with their new development areas, making them dependent on the protection of the dykes.



SETTLEMENTS ON YARDS OR WORTS



SETTLEMENTS ALONG THE DIKE LINES AND ROADS



INDUSTRIAL PLANTS ON YARDS







Another old form of settlement can be found on the terps (also known as Wurten). They were built in particular until the marshes began to be embanked in the 11th century and until then offered the only protection from the wind. Protection from storm surges. On the Halligen, they are still the only flood protection today. Mounds are mounds of earth artificially heaped up for settlement

with individual farmsteads or even entire villages. They served to protect people and animals during storm surges. Mounds are usually circular, but sometimes also elongated. They are found in the northwest German marshlands and in the North Sea on the

Halligen. The mounds, which were created as early as the 3rd century BC, were the only effective flood protection long before the dykes were built. Their origin often goes back to adaptation measures to the

The rise in sea level is due to the fact that shallow settlements that were built during periods of low sea level had to be protected from storm surges. A marshland village has the settlement form of a row village, extending along roads, canals or dykes. This village form is a typical element of Dutch colonization, which settled the low-lying and marshy marshland areas of the Sietland early on. To make these areas arable, Dutch drainage experts were hired from the 12th century onwards, who introduced dyke construction as a prerequisite for settlement and built a Holler dyke towards the riverbank. The hinterland was closed off by a back dike, which kept the water running off the Geest away from the settlement areas. The marshland villages were aligned along a central axis, either a dyke, a road or a ditch. Settlers were given strip-shaped pieces of land the size of a hoof, which they

could now be used for agriculture. Farms were built along the path and main ditch and farming was carried out on the land behind them. The industrial operations in the Port of Hamburg are located on port polders, i.e. artificially raised areas outside the main dyke line. Although large parts of the port are protected by private flood protection systems, the unpoldered and lowlying port areas are flooded during storm surges. It is up to the companies in the Port of Hamburg to decide which protection is possible and economically viable. Low parts of the harbor already flood when the water level exceeds 5.00 m above sea level.

The evacuation of the port must therefore be coordinated in good time with the expected storm surge height and closed to through traffic. Detailed closure and evacuation zones have been designated for this purpose, which are affected by the various water levels. Only at a water level of 6.50 m above sea level is the entire port cleared. However, a new interpretation can be found in Hafencity: here, residential and office use was realized in the area of derelict port facilities by applying the terp principle.





THE URBAN LANDSCAPE

A synopsis and overlay of the perspectives presented initially result in a very complex picture. It depicts the key aspects of Hamburg's Elbland in terms of their suitability as tidal areas. The topographical map shows which areas The geological map shows which landscape types, vegetation and uses are suitable. The hydraulic engineering view shows where protective measures need to be taken in order to develop new tidal potential, while the urban planning view excludes particularly densely populated areas as tidal potential areas and, conversely, shows open spaces and their urban and infrastructural connections.

This analytical superimposition of the decisive thematic complexes and their consideration with regard to their suitability as tidal potential areas forms the URBAN LANDSCAPE IMAGE specific to the project. It shows the maximum extent of possible flooding areas and their qualitative classification.

By connecting low-lying and uninhabited areas in the dike hinterland, new tidal areas can be gained that are bordered by higher, infrastructurally developed and/or populated areas. The reconnection of tributary dikes, dike relocations and the conversion of sedimented mudflats and foreshore areas into shallow water areas make it possible to widen the tidal Elbe and thus provide more tidal areas in the dike foreland. Equally essential for the creation of new tidal potential areas is the clearing or connection of harbor basins. Populated and infrastructurally used islands can be connected by bridges.

At the same time, the URBAN LANDSCAPE provides the basis for the design of a coherent TIDE+spatial image and the development and opening up of new TIDE+scenarios.

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TIDE+RAUMBILD

The design of the TIDE+ spatial image defines the boundaries of the tidal potential areas and their interplay with the existing spatial elements.

The potential areas are summarized in two different spatial units:

The TIDE+Elbe spatial unit with the river islands comprises the islands in the Elbe river that are surrounded by the tidal Elbe, i.e. the islands are either outside the main dyke line, such as the port polders, or are protected by ring dykes, such as the Elbe island of Wilhelmsburg. In the TIDE+spatial image, this spatial unit is referred to as an island archipelago. in the Elbe's current splitting area, based on the original image of the Hamburg inland delta, which consisted of a large number of islands before it was diked. In this spatial unit, the additional tidal potential lies in the spaces between the river islands, i.e. the tributary islands that are currently separated from the Elbe, such as the Süderelbe, could be reconnected and flowed through by the Elbe. Harbor basins such as the Billwerder Bay could also be connected on both sides and This makes peninsulas such as Kaltenhofe a real Elbe island. The storm surge protection of the Strominseln is not provided by ring dikes or terp solutions.





The spatial unit TIDE+Lakes with the embankments comprises the tidal lakes surrounded by embankments that lie "next to" the Elbe river, i.e. these areas are characterized by protected against storm surges by the main dyke line and barrages. The TIDE+ spatial image shows a tidally influenced lake landscape for this spatial unit, which is surrounded by protective embankments. The additional tidal potential al lies in the low-lying and unpopulated marsh and moorland areas; this means, for example, that existing lakes such as Lake Neuland or the Billwerder gravel pond could be connected to the Elbe. This would create new tidal lake landscapes. Additional space for the tide could also be created within the dykes of existing tributaries such as the Este or separated tributaries such as the Doveelbe.

By recognizing and interpreting the tidal potential spaces and combining their special features into two different spatial units, it is possible to create a new spatial image: The TIDE+spatial image. It is the basis for the design of a new TIDE+City of Hamburg.

The use and design of the river islands and tidal flats, embankments and tidal lakes as well as the hydraulic engineering control of tides and storm surges form new TIDE+ landscapes that lend the Hamburg cityscape completely new qualities. The TIDE+ spatial image shows that numerous smaller and larger areas within Hamburg's urban area are potential tidal areas.

The TIDE+ scenarios below explain how these areas of potential can be developed and what productive synergy effects this has for the city.





TIDE + SCENARIES Hamburg

Design options for the tidal landscapes of the future

The large-scale consideration of potential floodplains and their integration as part of a spatial image provided information in the previous chapter on which landscape areas in Hamburg's urban area are suitable as floodplains and what their basic spatial characteristics are. In this chapter, scenarios are developed for four exemplary project locations that show how the various locations and landscapes can develop under the influence of tides.

Different ideas and possibilities are developed for each location as to how the tidal dynamics can be integrated into the spatial design. The

The existing qualities of each location are worked out, as well as opportunities to develop these further through the new tidal influence. Synergies will also be sought: Where could the tidal concept be used as a catalyst to promote desired developments or resolve existing conflicts?

The TIDE+ scenarios are developed on the basis of detailed explorations, analyses and interpretations of the respective locations derived from these. For this

the geological, hydrological, topographical, urban structural and usage-related framework conditions were examined in more detail.

The TIDE+scenarios do not show conclusive spatial concepts for each location. Rather, the aim is to use design tools to create the widest possible range of spatial concepts. to develop and visualize different design options for the various spatial situations. These tide-related design scenarios can serve as a qualifying basis for future discussions in the development of the areas.

Sketches, photos and collages as well as excursions with realized project examples from all over the world help to develop an idea of possible new tidal landscapes. The scenarios also serve as examples of possible design approaches for the very different types of areas in the Stromspaltung region. In this way, site-specific TIDE+ landscapes are created whose basic principles can be transferred to comparable project sites in the Tidal Elbe region.



SCENARIOS FOR TIDAL FLATS AND TIDAL LAKES

In the tidal potential area map, all areas suitable in principle as tidal areas are shown in an overall picture. presented. For the in-depth analysis, four potential areas were selected by the HPA as suitable for implementing the tidal Elbe concept, which differ fundamentally in their character. Two of these belong to the potential area type TIDE+Elben, the other two to the potential area type TIDE+Seen.

As an example of the TIDE+Elbe type, the Alte Süderelbe was selected as a former tributary Elbe and the areas of Spadenlander Spitze, Spadenlander Ausschlag and Billwerder Insel were combined to form a potential area. As former Elbe floodplains, these areas lend themselves spatially to being reclaimed as tidal areas.

The area of the Neuländer Baggersee and the extended area of the Billwerder Kiesteich were examined as examples of the creation of tidal potential of the TIDE+Lakes type. Decisive for the selection of these areas are the large, existing water areas and their location in the lowlying marshlands.

In addition to the differences in the landscape, all project areas are characterized by extremely different framework conditions. For example, each area has different development perspectives and spatial qualities due to its different location within the city of Hamburg. In this respect, each area offers different possibilities for suitable strategies for combining tidal potential, existing and new uses. The different types of TIDE+ landscapes are presented and described in relation to the different spatial situations in the potential areas.

Together, the scenarios for the four areas provide an overview of the key factors, issues and design options for creating flood space in conjunction with new uses in Hamburg's urban area.

TECHNICAL FRAMEWORK CONDITIONS

HEIGHTS

The main framework conditions for planning new flood areas result from the height of the water levels and the protection systems. The average water levels, which are reached twice a day at St. Pauli due to tidal fluctuations, are 2.09 m above sea level at high tide and 1.53 m below sea level at low tide. The height of the main dyke line, which protects Hamburg from storm surges, is now between 7.50 m and 8.35 m above sea level, depending on the position of the structures.

New flood areas to raise the low water level can be partially located behind the main dike line. These areas are protected by barrages during storm surges. They are surrounded by dikes, but these do not have to be as high as the main dikes. Their only function is to protect the hinterland from daily tidal flooding. Taking safety aspects into account, the HPA has calculated a necessary height of 4.20 m above sea level in the event of a possible build-up of water due to wind and waves.

The water should still be at least one meter deep in the future floodplains, even at low tide, in order to achieve an optimal effect. To prevent rapid siltation, approximately one meter is added to this value. The HPA therefore recommends that the bottom of the new waters should be approximately 3.50 m below sea level.



FLOOR BALANCE

Another important starting point for planning is the consideration of a closed soil balance. When creating flood space, large earth movements will be necessary depending on the conditions on site.



As removing the soil multiplies the costs, it is important to ensure from the outset that the soil can be reinstalled on site. Depending on the type of soil, this can take the form of dykes, mounds or raised areas.

EFFECTS

The effect of creating shallow water areas on reducing the tidal range depends to a large extent on the tidal volume created and the relative expansion of the inlet and outlet openings.

Delayed outflow and high bed friction are desirable (sponge effect). The aim of the tidal Elbe concept is to reduce the tidal range

by up to 50 cm in the medium to long term. The creation of 1 million ^{m3} of additional tidal volume will raise the low tide level by around 1 cm.



CONTROL PRINCIPLES

The most important task of the new areas is to contribute to dampening the tidal range. It is particularly important to raise the water level at

Low water. The creation of new water areas is important for this. The new floodplains increase the capacity of the inland delta to absorb and store water at high tide. At low tide, they slowly release the water again and thus ensure that the low water level does not drop too much. In this respect, every newly created area of water has a positive effect on the overall system. The increased low water level also has a dampening effect on the incoming tidal wave.

The effectiveness of the areas can be artificially increased by delaying the outflow of the stored water. If the water only flows back into the Elbe shortly before the lowest water level, this has the greatest effect. There are two ways of delaying the outflow: targeted control of the outflow and inflow and artificial throttling.

In the case of a controlled outflow and inflow, the new water surface is only connected to the Elbe on one side, i.e. against the direction of flow. This has the effect of slowing down the outflow, but does not require any technical structures to regulate it.

With a throttled discharge, the flowing water is artificially held back with the help of a technical structure and only flows out slowly. As a result, the river is fed with water when it already has a very low water level. In this way, the same amount of water has a greater effect in terms of optimizing the low water level.





TIDE+port landscapes TIDE+natural landscapes TIDE+leisure landscapes TIDE+flood landscapes TIDE+residential landscapes





SCENARIOS FOR THE OLD SOUTHERN ELBE

The Alte Süderelbe potential area is located in the western part of the river splitting area in the so-called Harburger Südelbmarsch, where agriculture and fruit growing characterize the sparsely populated landscape around the former tributary. To the east of the Alte Süderelbe, the character of the urban area is dominated by large areas of harbor.

Until the storm surge of 1962, the Süderelbe was influenced by the ebb and flow of the tide. In the past, it was even used by ships as a direct connection to Harburg harbor. Today, it is cut off from the main river by the main dyke line at the Airbus plant and is a standing body of water apart from slight water movements caused by pumps. The relocation of the dyke meant that Finkenwerder to the north became part of the mainland. A silt dump and commercial areas now occupy large parts of the former river area.

As a former branch of the Elbe, the Alte Süderelbe can be classified topographically and geologically as a TIDE+Elben tidal potential area type. Old dike lines are still exist in the area. They could serve as tidal dikes once their historical substance has been restored.

Synergy effects between the tidally influenced course of the river, nature conservation, housing and leisure uses are to be expected through the targeted redesign of the landscape.

Alte Süderelbe,

View of the Francop landfill site in the direction of Mühlenberger Loch / Airbus plant



TIDAL ELBE IN THE OLD RIVERBED

The Alte Süderelbe is completely cut off from the Elbe by the main dyke line at the Airbus plant. The former Elbe estuary is very suitable as a floodplain. Large areas in the surrounding area on Finkenwerder and Moorburg have been artificially raised to a height of more than 8 m above sea level in some places and are therefore flood-proof.

The dykes at rest have a height of approx. 5.7 m. They would only need to be restored and minimally adapted to serve as tidal dykes. With a level of approx. +1 m, the areas in front of the dikes would be completely flooded during a medium tidal flood. In order to create a maximum tidal volume and fill the shallow water areas even at low tide, up to four meters more would have to be excavated.

Different expansion variants and connection options are conceivable. Without protective devices, the orchards and gardens in front of the old dyke line would be flooded during high tides. Two large sections could be realized independently of each other: The connection of the old side arm from the Finkenwerder outer harbor to the southern Elbe and an opening of the section from the Mühlenberger Loch to the Finkenwerder outer harbor. The Francop silt landfill is clearly visible at a height of approx. 30 m above sea level as a high inselberg in the middle of the flood area. Protection from storm surges would have to be be guaranteed by the construction of a new barrage on the Süderelbe.


NATURAL AND RESIDENTIAL LANDSCAPE ON THE GREEN RING

As an area of potential, the Alte Süderelbe is strongly influenced by various developments in the immediate and wider surroundings. The Airbus plant in the north was recently expanded. The new relief road for Finkenwerder and connection to the A7, which runs directly through the potential area, has already been decided and planned. It overlaps with the course of the planned second green ring in Hamburg's open space concept. It includes the area to the south of the landfill and provides for a path connection to Finkenwerder.

In Finkenwerder, new small-scale residential areas are being designated for rural living close to the city. Two nature reserves with different types of biotope border the Süderelbe. The Westerweiden nature reserve is extensive grassland of great importance for bird conservation. To the south is the Finkenwerder Süderelbe nature reserve, which protects the area of a former Elbe estuary. From a nature conservation point of view, the expansion of the Süderelbe is being considered as part of the Natura 2000 development planning. as an ecological bypass for fish, as there is a severe lack of oxygen in the harbor areas in summer.

In the east of the Süderelbe, a strong expansion of the port and commercial areas is to be expected. Port development planning plays an important role in Moorburg. Ideas for a knowledge park have been discussed for this area. The south and south-west are characterized by intensive agricultural use with a long tradition.









Nature reserve with wide meadows



The joys of sailing



Hollerhaus on the dike







A NATURAL OASIS IN THE MIDST OF INDUSTRY AND ORCHARDS

The Süderelbe is really beautiful - but first you have to overcome a few hurdles to get there, discover the place and find access to the water.

"Hey, get down, that's my property!" Unfortunately, the chosen footbridge was probably not public after all. Once you've made it, you're greeted by a true natural idyll: dark expanses of water with dead tree trunks, lined with dense reed banks and alluvial forest, seemingly untouched by humans. Only a sailor quietly makes his rounds. You only notice that you are standing on a lake and no longer on part of the Elbe when the tide stops. The Francop silt dump rises on the horizon. Unfortunately, access is still prohibited here. Later you will certainly have a good view.

At both ends of the Alte Süderelbe, there is no longer any sense of idyll. To the west, its course is radically cut off by the extended Airbus runway; to the east, the expanding port areas form a barrier.

In the south and on Finkenwerder, on the other hand, you are reminded of the Alte Land when you look out over the

orchards, farmhouses and pastures with cows and horses.

These contrasts make up the lively character of the landscape: Natural oasis, large-scale industry and High-performance agriculture is located in the immediate vicinity.







TIDAL LIVING AND TIDAL NATURE AT THE AIRBUS PLANT

In close proximity to the village of Finkenwerder and connected to the second green ring road, the area will play an important role for local recreation in the future. The plans,

making the Francop landfill site accessible to the public will make the area even more attractive.

The new tidally influenced Süderelbe can develop into an eventful, extensive local recreation area.

develop. Paths, footbridges and entry and exit points for canoes can make it possible to experience the water. It has finally been possible to create a continuous cycle connection along the banks of the Elbe from Harburg to Cuxhaven.

At the same time, it is a natural area worthy of protection, which is one of the rarest natural landscapes in Europe due to the influence of the tides. Zones that serve undisturbed natural development will continue to be indispensable in the future. An expansion of the extremely rare freshwater tidal area will against the preservation of the grassland conservation areas. As an Elbe bypass, the area is also of strategic importance for the passability of the entire Elbe region. In some places, new The project aims to develop residential forms in and on the water close to existing developments and integrate them into the natural character of the Elbe embankment.

In an area that is currently under heavy commercial pressure, the development of the southern Elbe as a green link within Hamburg is a strategically important urban development task that can be realized through the implementation of the tidal Elbe concept.



Bird paradise on the tidal dike

The existing nature and bird sanctuary of the Westerweiden is protected from the floods of the Alte Süderelbe by a naturally designed tidal dyke. The former still waters of the Alte Süderelbe are being transformed into a freshwater tidal landscape with changing water levels.



Green tidal dike

Bird sanctuary

New shallow water area as a bird paradise

Cultivation of the Westerweiden pastures will be abandoned and the drainage system will be restored in order to reintegrate the meadows into the unique freshwater tidal landscape of the Tidal Elbe. A large-scale shallow water and riparian forest landscape is being created that is not accessible to visitors. Very rare plants and animals can settle in this unique habitat.







Ecological diversity through interlocking with the tidal Elbe

By creating a varied topography, diverse habitats are being created along the southern Elbe. Parts of the existing wet meadows and valuable copses will be preserved and interlinked with new water-influenced locations. Ornithologists and recreationists will be granted access to viewpoints in the area.



Fruit growing on the tidal dike

Fruit growing is part of the cultural landscape in the Elbe valley. The old fruit tree areas along the Süderelbe will be protected by a new tidal dyke. It can also be used as a new recreational and excursion route along the Alte Süderelbe, which has been reopened to the tide.



New living on the Alte Süderelbe

Fruit growing is being relocated in favor of a large freshwater tidal landscape. Historic settlement structures along the former dykes are being supplemented by new forms of housing on the dyke. Living in the middle of the reed fields of the Tidal Elbe will be possible, with a view over the entire southern Elbe from above. The existing dyke road can be used for access. Floating houses

Living on the tidal dike



Recreational hill in the tidal river

A recreational mountain in the middle of Hamburg! Views, downhill runs, circular paths, sports and play areas -Francop is an attraction in the middle of the tidal Süderelbe. With sailing boats, canoes and water cabs the mountain can be reached via the Elbe. The new connecting road is hidden in the landfill. Viewing terrace Freeway feeder road



Living on the dyke with tidal gardens

In the past, residents of the Süderelbe used to sit in their gardens by the Elbe and look out over the greenery. They watch the play of the tides there every day. In addition to their floating garden houses and water gardens, parts of the site are laid out as raised gardens where they can continue to grow vegetables and lie in the grass.



Tidal

gardens





New open spaces in the tidal harbor

The port will be integrated into the city as a lively part of it. The reconnection of the Süderelbe to the river will create an open space corridor within the otherwise inaccessible harbor world. Cycle paths and footpaths along the water will be integrated into the newly developed harbor areas, and the entire Elbe area will once again become a place to experience.



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Floating houseboats on a side arm in Beneden Leeuwen



Attractive residential area. Flood-protected houses in Maasbommel



Floodplain and horse pasture

TIDE+LIVING LANDSCAPE BENEDEN-LEEUWEN AN DER WAAL (NL)

In 1992, the WWF (NL) in the Netherlands launched a program for the ecological development of heavily modified river landscapes. The nature conservation organization recognized that tangible changes are only possible in close cooperation with the stakeholders in the river basin. The clay and sand extraction that took place in the foreland of the large rivers was seen as an opportunity to create new, more natural landscapes. The 'Living Rivers' program in Beneden-

Leeuwen an der Waal has created a near-natural river foreland with tributaries, beaches and riparian forests through intensive cooperation with the mining companies. The area now serves as a recreational and nature reserve. Moorings for residential boats and floating houses have been designated in an area of the tributary near the village. This generates income for the municipality and enables attractive living close to nature on the water.

Today, the Dutch authorities work according to a similar principle as part of the "Ruimte voor rivieren" program. They assume that more flood space is needed to protect against flooding.

The foreland must be extended or dug up. In the "Waalwelde" sub-project, financial incentives are used to stimulate integrative project development from below. Local stakeholders work together to develop projects that provide more flood space and at the same time contribute to the sustainable development of the communities. Nature conservation associations, tradespeople and the municipalities work together to develop visions for their locality. New recreational, residential and natural landscapes are created. A team monitors the spatial and

social quality of the projects presented. In Beneden-Leeuwen, the "De Doorbraak" plan was developed in this context. In addition to creating more flood space, new housing will be built on the dyke and on the water and a better connection will be created between the village center and the Waal.

The Waal with its islands, tributaries, beaches, riparian forests and houseboats







View over the Spadenländer Spitze towards Hamburg



SCENARIOS FOR BILLWERDER ISLAND AND SPADENLAND

The potential area of Spadenland and Billwerder Insel is located in the eastern part of the river splitting area. The main dyke line removes both parts of the landscape from the influence of the Elbe. More than 100 years ago, the former Elbe islands of Billwerder and Kaltehofe were separated from the Elbe's main stream by diverting the Norde- relbe to the western side of the island. Facilities for drinking water extraction were built on the former Elbe islands, which now lie fallow. Billwerder Island is part of the Moorfleet district and covers an area of approx. 25 hectares. The Dove Elbe flows into the Nor- derelbe between Billwerder Insel and Spadenlander Ausschlag. Spadenland comprises approx. 65 ha of potential floodplain. It is located in the wet marshland and is sparsely populated. Arable land and horticulture characterize the area. Due to the favorable topographical and geological conditions as well as the expansion possibilities

The area was classified as a tidal potential area due to the fact that it is located within the settlement structures. Areas within existing tidal elbows, such as the tributary of the Dove Elbe or the Spadenlander Spitze, could be used to create more flood space by excavating the foreland. In addition, new tidal elbows are conceivable, for example by opening up the original course of the Norderelbe east of Billwerder Insel.

New tidal lakes could be created in Spadenland by connecting existing water areas or opening up low-lying marshland.

On the other side of the river, the Kreetsand tidal park will soon be created as a comparable tidal nature area through the excavation of flushing areas, so that the entire Elbe area can be developed as an ecological hotspot.



Potentially tidally influenced areas due to altitude

TIDEELBEN BETWEEN INDUSTRIAL CULTURE AND MARSH

Billwerder Bay is protected from flooding by a barrage, but at average water levels it is exposed to the fluctuations of high and low tide. Today, the Dove Elbe is completely cut off from the dynamics of the tides by a lock. Large parts of the dyke foreland in the area of the Spadenlander Spitze are overgrown with alluvial forest.

The industrial facilities for water purification were artificially heaped up to a height of 5 meters. The basins themselves would still be affected by the tide if they were opened. The adjoining area to the east was also artificially raised as a flushing field. A restoration of the "island location" would be possible through a tidal channel between the Doveelbe and Billwerder Bay with storm surge protection.

With a level of approx. +2 m, the Spadenland would be almost completely flooded at a mean high tide, so that a tidal dyke or a relocation of the main dyke would be necessary to limit it. In the low-lying marshland, old dike lines and terps are still recognizable. In order to create a maximum tidal volume, almost 5 meters would have to be excavated.

Both potential areas are relatively easy to connect due to their proximity to the Elbe main stream.



RECREATIONAL LANDSCAPE WITH HISTORICAL RELICS

The potential area of Spadenland and Billwerder Insel is part of a chain of open spaces in the extension of the northern Elbe riverbank axis. The Entenwerder Park and above all the Kaltehofe water art island are already being planned and will become important leisure destinations in the near future. A golf course and the leisure harbor in the old Hozhafen already attract many recreation seekers to the island. Cyclists use the path along the main dyke as a link between the city center and the Dove Elbe recreational area.

The project being built on the other side of the Elbe in Wilhelmsburg "Tidepark Kreetsand" will form an important counterpart as an excursion destination and valuable natural space. The second green ring of the city of Hamburg's overarching open space concept runs south of the potential areas and meets the green Elbe riverbank axis here. It includes the Eichbaumsee lake and large areas of the Dove Elbe.

The settlement structure of old farmhouses and smallscale commercial buildings in the Moorfleet district, in combination with the timber harbor, offers great potential as a residential and working location. Intensively farmed land traditionally characterizes the adjacent Spadenland to the south.

Overall, the area offers great potential to develop into Hamburg's largest contiguous inner-city nature and recreational landscape in the future.

Spadenländer Spitze Doveelbe confluence

- 1,8 m







Water art on the Kaltehofe peninsula



hidden pump house on Billwerder Island

Windy view over the Billwerder Bay







dense alluvial forest







agricultural expanse

INDUSTRIAL CULTURE, AGRICULTURE AND NATURE ON THE ADVANCE

In the north of Billwerder Island, next to the timber harbor, the Elbe has already reclaimed a small piece of land from humans. Where previously scrubland grew on a heaped-up area, rare bird species now stalk through the shallow water. It must have been like this in the past, when the Norderelbe still ran east of Billwerder Island. All around it, buildings from the industrial and commercial city of Hamburg from different periods now dominate the area. On the nearby

The trucks with their colorful containers rush past in an endless line along the highway, a power plant rises strikingly on the horizon, and a solar system manufacturer has erected model systems along the timber harbor.

Billwerder Island is an enchanted place. Through the meter-high fence with its "no entry" signs and a mostly impenetrable green

Idyllic stretches of water with water lilies and fallen trees can be seen from time to time in the basins of the former pumping and pre-treatment plant. The Elbe water used to be pre-cleaned in the outlet basins before it was pumped to Kaltehofe. The beautiful clinker brick buildings and impressive domes of the well pits are evidence of Hamburg's historic water management. A new era has also begun - with "Just pay and play jeans allowed", the 'Red Golf' course is attracting customers.

South of the Dove Elbe, fresh vegetables, cereals and sunflowers thrive on the farmland. Rows of poplars and drainage ditches structure the landscape of Spadenland. The Elbe can only be glimpsed behind the high dykes. Only sheep enjoy the view of the river and the floodplain forests of the Spadenländer Spitze.

productive greenhouses

Golf empire

Month Ph.





TIDAL BATHING AND TIDAL ISLANDS AS NEW WATER ART

In conjunction with the nearby Kreetsand, Ellerholz and the northern Holzhafen, a tidal park is being created on a huge contiguous area in which the unique landscape of the Elbe's current splitting area can be experienced again. A chain of tidal areas along the Norderelbe will create an important open and natural space for the whole of Hamburg, embedded in the green system of the entire region through supra-regional cycling and hiking routes. An island landscape surrounded by water forms the center of the tidal park. The wooden harbor is developing into a lively water sports center. Valuable examples of Hamburg's industrial heritage, such as Kaltehofe and the waterworks on Billwerder Island, are being integrated into the dynamic tidal area and converted into new forms of use. In the natural pool in the historic water basins, you can finally swim in purified Elbe water again without any danger!



Natural pool on Billwerder Island

The original use of the historical sedimentation basins for water purification is conceptually resumed. Elbe water is let into some basins at high tide. This water can be drained again after a delay. The Elbe water is purified via Elbe water purification terraces, which also serve as sun terraces, and ultimately fed into a natural swimming pool. The historic structure of the waterworks can thus be repurposed for contemporary use.

The entire Billwerder Island will become part of a coherent network of open spaces to complement the water art in Kaltehofe.



not tide influenced

Tide influences



Cleaning stairs



Aquaculture within historic walls

The historic outlet basins are being repurposed for innovative urban aquaculture. The inlet channels are under tidal influence, but the basins are not. Elbe water is channelled through a chamber system using the tidal dynamics, in which fish farming or algae cultivation can be carried out. Those seeking relaxation can enjoy the view over the historic water areas. Some of the basins are used to purify the water before it flows back into the Elbe.



Tidal channel

to the wooden harbor

Bird sanctuary

Breeding tank



Water art with tidal basin

To maximize the tidal volume, the historic pools are connected to the tidal action via a tidal channel. The water can be experienced via floating platforms and footbridges despite the large level fluctuations. The enchanted character as a valuable natural space is preserved.



Island kingdom Spadenländer Spitze

The Spadenländer Spitze and the Spadenländer Ausschlag will be dredged to the maximum. The resulting tidal area will be structured by artificial islands. The result is a unique, tidally influenced island archipelago in the inland delta of the Elbe. The islands structure the course of the river.

A paradise for water sports enthusiasts is being created. Some islands have jetties and serve as leisure and bathing islands, others are reserved for nature development. A tidal arch as an adventure jetty is the counterpart to the tidal arch opposite. in the Kreetsand Tide Park. Island kingdom of Spadenland Tidal arch

Relocated main dike





New main dike as a tidal experience dike



Shallow water area



Current branching in Spadenland

After maximum embankment, a constantly changing dynamic landscape of reed beds, extensive shallow water zones and freshwater mudflats is initiated. The dynamics of the Elbe shape the space. A valuable natural space is being created in the urban area of Hamburg. The surrounding dykes will become part of the recreational landscape with hiking trails on the crown, seating areas and vantage points.

Selective interventions stage the tidal action and make it perceptible to passing visitors.

Spadenland storm surge polder

The new flooding area is designed as a potential storm surge polder. Storm surge peaks can thus be controlled and better intercepted. At the same time, the control option can also delay the inflow and outflow of the tide, which has a positive effect on the low water elevation. The old main dyke will remain in place and a second dyke will be built in the hinterland. The area will be developed as a nature reserve with many low-water areas.





Reed-covered water areas and dykes characterize the landscape



Waterways that can be crossed by boat



Footbridges through wet meadows and alluvial forests

TIDE+NATURAL LANDSCAPE BIESBOSCH NATIONAL PARK (NL)

The nature reserve 'De Biesbosch' is one of the rare freshwater tidal areas. The tides of the North Sea cause high and low tides twice a day in the national park. The area is one of the largest nature reserves in the Netherlands. The island kingdom with its many branching watercourses, some of which can only be explored by boat, is also a magnet for recreationists from all over the country. The large drinking water catchment basins with their high dykes are technical elements in the middle of the alluvial forest and give the nature reserve a special accent. They serve as landmarks and vantage points in the area. Clear zoning divides the area into protected zones and accessible areas. There are now many marinas, hotels and vacation villages in the surrounding area.

As part of the 'Ruimte voor de rivier' program, new tributaries up to 100m wide are being created in the north of the area, the former Noordwaard agricultural polder. Large parts of the area are available as floodplains in the event of flooding. Some families and businesses were relocated for this purpose. The expansion of the national park by 600 ha was made possible by a strong alliance between nature conservation and flood protection interests. A mosaic of different biotope types of low water areas to wet meadows and a sophisticated maintenance concept offer the greatest possible ecological diversity. Important is to keep the landscape open in order to ensure optimal drainage in the event of flooding. At the same time, new cycling and hiking trails are being created and new recreational landscapes with land art, new marinas, vacation apartments and restaurants are being created outside the national park. By enlarging and upgrading the national park, the entire region will receive an economic development boost.

The daily change of high and low tide influences the island kingdom of the Biesbosch National Park





landscapes TIDE+production landscapes



TIDE+Lake with embankments



SCENARIOS FOR LAKE NEULAND

Lake Neuländer See is located in the south of Hamburg in the Neuland district of Harburg. It was created by the extraction of gravel and is now an important recreational lake for the people of Harburg. The 37-hectare lake is up to 20 meters deep.

The geological conditions are characterized by a transition from deposited river sands along the main stream, marshy soils in the area of today's lake area, moor or fen soils in the southern area to the edge of the Geest.

To the north of the lake, a residential area stretches along the Elbe dykes, while to the west there is a commercial area adjacent to Harburg's city center. Heterogeneous uses lie close together. Agricultural areas dominate the landscape to the south and east of the lake. They are mainly used as grassland. The A1 highway cuts through the formerly extensive agricultural areas.

Due to its favorable topographical location, the large undeveloped areas and above all, of course, the presence of the water surface, the area is suitable as a tidal potential area. As these are low-lying areas behind the main dyke line, the area is classified as TIDE+Lake in the tidal potential area map. Due to its proximity to the Süderelbe, the water body can be connected to the river via a tidal channel parallel to the highway. In addition, an extension of the tidal area beyond the lake area to the south or east would be conceivable.

Lake Neuland,

on the A1, view towards the Elbe island



Potentially tidally influenced areas due to altitude

TIDAL LAKE BETWEEN MARSH AND MOOR

The ground level in the area of Lake Neuland is between + 0.7 m and 1.1 m above sea level. The entire marsh and the moor in the direct vicinity of the lake would be exposed to tidal action without dikes. Deviating from the natural level, the artificial topographies are primarily the backfilled areas behind the main dike line in the north and in the area of the western commercial areas, as well as the embankment along the highway.

Due to its depth, Lake Neuland could be connected directly to the Elbe via a tidal channel and serve as a tidal potential area. If the lake is to be extended further to create additional tidal volume, the existing terrain would have to be excavated by up to 3 meters. This would make it possible to achieve a maximum tidal area that never dries out, even at low tide. In order to turn Lake Neuland into a tidal lake, a storm surge barrier would have to be built in the main dyke and new tidal dykes would have to be constructed around the body of water. The excavated soil material could be used for this.



RECREATIONAL LANDSCAPE IN THE GREEN RING

Urban developments in the area around Lake Neuland are influenced by the growing Hamburg metropolitan region. Different land uses and spatial requirements come together here.

New residential and commercial areas are being created on the outskirts of Harburg. As part of the second green ring in Hamburg's open space concept, the potential area of Neuländer

Lake Zurich, local recreation in particular is a sustainable development focus.

Existing leisure facilities are highly frequented due to their proximity to Harburg city center and offer further development potential.

Lake Neuländer See is also one of the few still waters in Hamburg that can be used for water sports and therefore attracts visitors from all over the metropolitan area.

To the east of the highway, agriculture is the dominant use within a landscape conservation area. The course of the highway can be seen from afar due to a parallel row of wind turbines.

In the northwest, part of the moorland is to be rewetted as a compensation area.

Within the development of this dynamic urban fringe, the Tidal Elbe concept can contribute to the preservation, qualification and networking of the green systems, and recreational and nature development aspects can be strengthened in relation to other aspects of use and the patchwork landscape can be sustainably structured through a large-scale design concept.

南水 165 HAMBURG HAFEN ENTWICKLUNG RI LANDWIRTSCHAFT ENTWICKLUNG WOHNEN



Mixed forest

Lake Neuland





400 74









WAKEBOARDING, MOORLAND AND OTHER CONTRASTS

Industrial area, rural idyll, water ski facility, highway and wind turbines - the landscape around Lake Neuland is a place of contrasts. Walkers, anglers, divers, rowers and canoeists have discovered the lake for themselves. The lake is only suitable for swimming to a limited extent due to its murky water. However, a water ski facility attracts many sports enthusiasts from near and far to the area. Word is getting around about the easy accessibility and central location - Further leisure uses such as an allotment garden and a new golf course (driving range) are being planned.

There is not much left of the marshy landscape that originally stretched as far as the horizon. Meter-high artificial embankments along the freeway as well as artificial embankments for the industrial estate and behind the dyke add new levels to the landscape.

However, valuable nature is also developing in this patchwork: the banks of the Elbe in front of the main dyke, with their extensive reed beds, tidal creeks and alluvial forests, are protected. Canals, ditches, hedges and a rewetted moorland landscape are refuges for diverse animal and plant species in the suburban area.

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LEISURE AND ENERGY LANDSCAPE ON THE HIGHWAY

Hamburg is getting a new leisure hotspot. The tidal concept will transform the Neuländer See landscape into a diverse leisure and recreational landscape of regional importance.

As before, the existing water ski facility will be operated in a leisure and bathing lake without tidal influence. This in turn is to be embedded in a dynamic tidal lake. The water in the separated lake will be pre-cleaned and will be of bathing quality. The tidal dynamics of the water flowing in and out of the tidal channel can be used for new tidal sports, e.g. tidal rafting. The excavated earth is used to model "tidal dyke leisure landscapes". In this way, the artificiality of the anthropogenically reshaped landscape is made visible.

The exciting contrast between the artificial structure of the tidal dyke and the natural moorland landscape gives the landscape a special charm.



Living between the dykes

In future, the existing apartments on the main dyke will be located between two dynamic waterscapes: The Elbe main stream with the Schwanensand nature reserve and the new tidal landscapes. The new tidal dyke protects the existing gardens and creates viewing terraces with sweeping views over the

new tidal landscape. A densification of this attractive street development is conceivable.



Adventure dike on the tidal river

The water must reach the new tidal lake from the Elbe. This can be done either through a new tidal canal or an extensive tidal landscape next to the highway.

A white-water channel, which is fed by tidal floodwater, offers new and unique sporting opportunities. The excavated earth will be used to create "adventure dykes" along the highway. They offer opportunities for new recreational uses such as walking and mountain biking trails with good views of the water landscape.

Swan sand

Gardens on the tidal dike



-> TIDE+ SCENARIES Lake Neuland

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Tidegolf

Golfing in a new dimension! The trend towards a varied golfing environment is taken up. Twice a day, the water flows through the new golf landscape to the Tidesee and back. "Tidegolf" is the name of the sport in the diverse island landscape, which changes with the rhythm of the tides.



Tidal canal with power station

The current force of the tide is used by a tidal power plant. It is located in the tributary area of Lake Neuland and complements the existing wind turbines - a park landscape of renewable energies is being created along the highway.



Recreational lake in Tidesee

The tidal dynamics are staged through the direct juxtaposition of a tidal lake with a fluctuating water level and a recreational lake with a constant water level. The existing water ski lift can continue to operate and new potential uses for the two types of water can be optimally integrated. In the separated area, the water achieves bathing quality as it is purified by plant filter areas.



Tidal dam

Tidal lake

Water ski lift

Tidal dike with sun terraces

The new tidal dyke is not designed as a separating element, but as a versatile and connecting element between the two water areas. Large sun terraces offer a view of the sporting activities in the leisure lake and the dynamic water landscape in the tidal lake.




Tidal lake Dyke with a view Moor



Tidal dike with a view

The new tidal dykes should be recognizable as new, manmade elements in the former landscape. The artificiality of the tidal dyke is set in contrast to the adjacent renaturalized moor landscape. The new dyke offers views and insights into two completely different natural areas. The south-facing wall is a habitat for special animal species.

Tidal lake Shallow water zone

Landscape dike



Landscape dike at the Tidesee

A large area of shallow water influenced by the tide creates valuable habitats for animals and plants. Where sufficient space is available, the tidal dyke is gently modeled from excavated earth. A circular path with an observation tower allows visitors to experience the new TIDE+ landscape.





Black Head Rock Pool, Black Head, Australia at low tide



Bondi Icebergs Pool, Sydney, Australia



Tidal swimming pool on the coast of Australia,

Wylies Baths ocean pool, Sydney

TIDEPOOLS AS A TIDE+ LEISURE LANDSCAPE REYKJAVIK (IS), SYDNEY (FROM)

When swimming on the Australian coast becomes risky due to currents, shark warnings or swell, those seeking relaxation take refuge in the rock pools. These artificial pools set into the rocks of the bays can be found on almost all beaches. There

At high tide, the water level in the pools is almost identical to sea level, giving you the feeling of swimming in the sea. At low tide, the water depth in the pool remains the same. When the waves are strong, the pools are flooded with seawater and the water is renewed. The pools offer ideal training conditions for athletes. The rock pools are centers for club life, sun terraces and gastronomy. The creation of protected zones in the midst of a very dynamic environment makes it possible to experience the forces of nature directly, without putting yourself in danger. The strictly designed, artificial basin stands in sharp contrast to the wild coastal landscape. The dynamics of the sea are thus even more clearly visible, as if staged on a stage.

Another example of pools in a tidal landscape can be found in Reykjavik. Here, the dynamics are used in an even more targeted way: Hot thermal water is fed into bathing pools located directly by the sea. At high tide, cold seawater flows into the pools twice a day and cools the water. This means that the temperature of the water is constantly changing, but remains within a comfortable range. The natural dynamics of the sea are used to regulate the water quality and quantity in the separate areas.

The targeted use of and play with the dynamics creates extraordinary spatial qualities and recreational spaces. Natural processes can be utilized through intelligent design, to solve problems in a way that conserves resources and creates new recreational opportunities.

Nauthólsvík Geothermal Beach, Reykjavík





TIDE+Lake with embankments



SCENARIOS FOR THE BILLWERDER GRAVEL POND

The gravel pond is located in the east of Hamburg, in the district of Bergedorf and in the Billwerder district. It was created by the extraction of gravel and low-lying sands. By 2009, gravel extraction had created water areas covering a total of 18 hectares.

The gravel pond is located in the Vier- und Marschlande landscape area, which - characterized by agriculture and horticulture - is also known as the "Garden of the Hanseatic City". To the west, the area borders directly on man-made harbor facilities. In the north, there are valuable natural areas in front of the Geestkante with the Elbe tributary Bille and the Boxberger Niederungen. The area of the gravel ponds is located in the low-lying marshland areas and is hardly built on due to the predominant agricultural use. Settlement structures are either oriented towards the poldered areas or extend along the dyke line of the Elbe tributary Bille.

The extensive area lies far behind the main dyke line in the marshland and is assigned to the TIDE+Lakes type in the tidal potential area map. A connection to the tidal Elbe is possible via the Billbrook tidal canal.

View of the Billwerder gravel pond with NDR radio masts

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TIDESEE BETWEEN BILLE AND RAILROAD

The area of the Billwerder gravel ponds lies at an average height of -0.4 m below sea level, so that it would still be influenced by the tide even at medium high tide if it were connected to the tidal canal 200 m away. The water depth of the lakes is around 20 meters due to the gravel excavation. The Billwerder Bay barrier already provides protection against storm surges. The low-lying marshland areas are protected from flooding by the Bille dykes, but these are too densely built-up to serve as tidal dykes. An additional dyke line for protection

of existing buildings is required. The noise barrier of the highway embankment in the southwest, on the other hand, is well suited as a protective structure.

The artificial topographies are primarily the filled-in polder areas of the port, industrial and railroad areas in the north and southwest as well as the silt dumps in the north and south. As a result, there is already an artificially elevated frame around the low-lying undeveloped areas.

Potentially tidally influenced areas due to altitude



URBAN PRODUCTION LANDSCAPE

Different development dynamics influence the environment of the gravel ponds.

The City of Hamburg's open space concept plans to develop the Kiesteich area in conjunction with the Boberger Niederung nature reserve to the north-east as part of the 2nd Green Ring. A campsite for people passing through and the development of the gravel pond as a bathing lake are being considered as additional leisure uses.

To the north and southwest of the gravel ponds, there are signs of increasing urbanization and to be expected. This is primarily due to the establishment of large-scale commercial uses such as IKEA or the H&M temporary warehouse, but also due to largescale residential developments such as in Allermöhe.

The landscape is characterized above all by agricultural land. Even if established farming structures have come under structural pressu due to international competition, agriculture close to the city will continue to offer potential in the future.

Agricultural fields

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Gravel quarrying idyll



Towering transmission masts



Linear weather and trench structure



Billwerder gravel pond





Busy pastureland

St Nicholai

COWS, EXCAVATORS AND UNIMAGINED EXPANSES

Anyone who has driven past here on the freeway or train has probably noticed the three hundred meter high NDR transmission masts. And the beautiful St. Nikolai church with its cemetery by the field? The idyllic allotments in the shadow of the railroad line or the farmhouses on the Billedeich? The lake behind

the mounds. A few minutes with the S-Bahn from the main train station and with direct highway

access, there are still many hidden gems to discover here.

The mounds of earth, excavators, caterpillars and trucks still tell the story of how the quarry pond was created - even if this will come to an end at some point in the future. Unfortunately, the charming water features can only be viewed from afar, with fences and fencing everywhere blocking access, so swimming in the lake is out of the question.

If you find your way over the meter-high embankments of the freeway, a vast area of unimagined dimensions opens up. In an urban structure otherwise fragmented by linear infrastructures, commercial buildings and housing estates, a coherent wide open space opens up here. Cows graze on the meadows interspersed with ditches and ditches.

Residential houses, farmhouses, horticultural businesses and small commercial buildings line the Billedeich. Time seems to have stood still. There is no longer any sign of metropolitan development here. Only the new prison, which stands like a fortress in the middle of nowhere, disturbs the idyll.





TIDAL TERRACES AND TIDELAND FARMING IN THE VIER- UND MARSCHLANDEN

Floating jetties and bathing jetties open up the dynamic Tidesee lake to local recreational guests and vacationers. The excavated material was used to create a huge terraced landscape on the edge of the tidal lake, with space for a camping site and allotments.

Beyond the highway, the production of energy and food will continue to determine the image of the place in the future. However, farmers have recognized their opportunity and have relied on new forms of production in conjunction with the influence of ebb and flow. set. Organically grown wild rice, pork steaks from Turopolje pigs and Billwerder fish sell well in Hamburg's restaurants and markets. It pays off that solar power, short rotation plantations, algae and wind turbines produce clean energy locally.

In addition to the land and energy farmers, new residents are moving to the Billedeich to enjoy modern city life.

Characteristic image of the future for the entire Kiesteich Billwerder area



Promenade on the tidal dike

The new tidal dyke on the lake will be designed as a dyke park with a dyke promenade. Various open space uses can be integrated at different levels of the site. From a dyke restaurant, you can enjoy the view over the wide Tidal Lake and the new production landscape. Floating terraces allow direct contact with the water.





Camping and allotments on the tidal terraces

The excavated earth from the tidal areas will be used to create a terraced landscape. The site with a view is well suited for the desired campsite and the new allotments.

The new tidal lake can be explored from floating jetties.



-> TIDE+ SZENARIES Billwerder gravel pond

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Tidal living on the Billedeich

The attractive residential area close to the city between the natural-looking river Bille on one side and the agricultural expanse on the other is being densified. New buildings are being constructed in the second row behind the existing street development on the tidal dyke. Living by and on the water opens up new views over the open expanse.



Tidesee



Energy dyke along the A1

The dyke landscape along the A1 will take on a variety of functions. In addition to its current use as a noise barrier and its future use as a tidal dyke, the earth sculpture will also be used to generate renewable energy.



Tideland farming on the Billedeich

Today's farmers are tomorrow's tide farmers. The transformation into a TIDE+ landscape is based on current local conditions. The

The tidal dyke can be integrated into the properties and also used as a garden for residents. Direct access for farmers to their land remains guaranteed.



Paludiculture in the marshlands

The field structure of the new TIDE+ production landscape consists of trenches and embankments. The excavated material to create flood space is used on site to create raised fields. Different site conditions can thus be created for a range of crops or forms of use. Tidal volume is created by a network of permanently water-bearing channels.

Bille

Tidal fields



Tidal dike







Experimental late summer mowing of reeds in north-western Poland



Briquettes from fen biomass

TIDE+PRODUCTION LANDSCAPE

The rewetting of agriculturally used fenland areas is desirable for nature conservation and climate protection reasons. Physical-chemical processes lead to permanent bog decomposition, which results in the continuous release of large quantities of carbon dioxide. The University of Greifswald has been carrying out research for more than 10

years on the development of 'paludiculture', production methods on wet land. The production of biomass through the cultivation of reeds was the main focus. There are already research projects where agricultural areas on former fenland have been rewetted and planted with cattails. The cattails are regularly harvested and utilized. The areas are permanently 20 to 30

cm overstowed. Harvesting is carried out with a 'wetland truck', a tracked vehicle with a cutting device. An agricultural use adapted to the fen ecosystem has been developed. At the same time, nutrient-laden ditch water from the surrounding agricultural land is cleaned on the areas. They serve as flood protection and provide a habitat for many rare plants and animals. For energy recovery, briquettes can also be produced from raw tall grass, for example to heat biofuel plants. The use of the raw material as a biodegradable insulating material is also being researched,

to generate a further sales market in addition to its function as biomass.

In addition to pure research projects, there are also examples, particularly in energy production, of farmers taking the initiative to use their wet land sustainably with wind and solar power plants. For example

In California, for example, the winegrower Far Niente in Napa Valley has installed the first floating photovoltaic system on his irrigation pond.

The research work and projects are the first signs that the productive use of rewetted areas will increase in many countries around the world in the future and that the research and development of adequate methods will find a broad field of application in the future.

Rewetted polder Johanneshofer Wiesen, View of the lower Peene valley between the island of Schadefähre in the estuary area and Anklam





+ ELBELAND Hamburg Metropolitan Region

Outlook for the future of the Elbe estuary

The tidal Elbe concept signals a rethinking process in dealing with the dynamic change of the tidal Elbe. The Tidal Elbe Concept was developed as a holistic and long-term overall concept for the Tidal Elbe in cooperation between the Hamburg Port Authority and the Waterways and Shipping Administration so that the habitat of the Tidal Elbe region with its diverse functions can be developed as the lifeline of the Hamburg metropolitan region. The Parliament of the Free and Hanseatic City of Hamburg approved the concept on November 21, 2007.

The Federal Government approved the pursuit of this strategy with its resolution in printed matter 18/6207 "A tidal range management to permanently secure the deep-sea access to the Port of Hamburg". In their coalition agreement on April 17, 2008, the coalition partners agreed to implement the tidal Elbe concept together with the neighbouring states and the federal government, thereby reducing the tidal range by up to 50 cm in the medium to long term. The creation of additional flood space on Hamburg's territory is an important component of this - but it is not enough on its own. The entire Elbe estuary must therefore be in order to sustainably develop the Hamburg metropolitan region as a whole.

The integration of the hydrological and ecological concerns of the dynamic Elbe estuary creates new economic utilization opportunities for the Tidal Elbe as a transport route and ecological qualities of the Tidal Elbe as a natural area. The qualities of the location on the Tidal Elbe for the Hamburg metropolitan region and the anchoring of the concept as a component of spatial, regional and urban development planning and its key projects represent a significant goal for the concretization and project-related implementation of the Tidal Elbe concept.

This requires a visual representation of the spatial qualities of existing and future landscapes

of the Tidal Elbe. This is intended to help organize a dialogoriented process with all stakeholders. The TIDE+spatial image for Hamburg as well as a spatial image for the entire TIDE+Elbeland serves as a communication basis for projects to implement the Tidal Elbe concept.







Saxony-Anhalt

VISION TIDE+ELBELAND - SPACES OF OPPORTUNITY AND SYNERGIES

TIDE+Elbeland refers to the area of the Elbe estuary's glacial valley, which is influenced by the tides and bounded by the geest slopes. The qualities of the TIDE+Elbeland as part of the Hamburg metropolitan region are determined by its relationship to the Elbe river.

As the lifeline of the Hamburg metropolitan region, the Tidal Elbe enables access for large container ships from the world's oceans to the Port of Hamburg, making it one of the most important building blocks for the Hanseatic city's economy. The Tidal Elbe is bordered by the three federal states of Lower Saxony, Schleswig-Holstein and Hamburg. Maintenance of the Elbe waterway is the responsibility of the Federal Waterways and Shipping Administration; only the Hamburg area is exempt from this due to the historical development of the port and is maintained by the Hamburg Port Authority.

In addition to industry and agriculture, the most important uses in the low-lying marshes include housing, leisure and tourism.

TIDE+Elbeland. As the largest contiguous fruit-growing area in Central Europe, fruit growing in the Altes Land even has an international reputation. The Vier- und Marschlande region is known for its vegetable cultivation. The irrigation and drainage of the cultivated land plays a central role in the sometimes highly specialized agriculture. Apart from the economic importance of the Tidal Elbe, TIDE+Elbeland is also an attractive place to live. It is a good place to live, as both the residential area with its close connection to the landscape and the diverse recreational opportunities on the water offer a high quality of life. Large parts

of the Elbe estuary have been designated as a Natura 2000 site for the protection of flora and fauna. Areas influenced by the tides are ecologically very valuable habitats with a highly specialized, unique flora and fauna. Numerous bird sanctuaries offer valuable retreats for rare breeding and resting birds and

in the area of the estuary, the tidal dynamics can be experienced at first hand by walking on the mudflats. The charm of TIDE+Elbeland is already known beyond the region and is becoming increasingly popular with numerous tourists.



2 -> EXCURSUS NATURA 2000

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NATURA 2000

Natura 2000 is the official name for a coherent network of protected areas for the transnational protection of wild plants and animal species that is being established within the European Union. The network includes areas that have been nominated by the member states as FFH areas as well as EU bird sanctuaries.

In order to achieve the defined conservation and development goals, the responsible administrations generally draw up management plans.

A framework concept was developed for the Elbe estuary back in 2005. Although this concentrates on the reported Natura 2000 areas, it also always considers the tidal estuary system from the North Sea to the Geesthacht weir. The framework concept has an integrative and developmentoriented approach: it explicitly refers to the opportunity that interdepartmental partnerships offer for the implementation of Natura 2000 and refers to experiences in the Netherlands, Belgium and Great Britain. The aim of Natura 2000 is not to turn back the clock on history at the expense of current land uses. Rather, the aim is to reconcile the needs of endangered species and habitats with the requirements of economically and socio-culturally sustainable development.

Two different guiding principles apply to planning in the Elbe estuary: on the one hand, the development of a near-natural tidal system with near-natural transitions between land and water, and on the other, the guiding principle of the cultural landscape with its open, extensively used meadows and pastures criss-crossed by ditches. It must be clarified at the site level where which model is to be applied.

The concept is based on systemic thinking when formulating conservation and development goals: An important prerequisite for planning is an understanding of the hydraulic and hydromorphological system of the tidal section of the Elbe. The formulation of the measures is described as a dynamic process. It is not the preservation of the current spatial pattern of individual elements of the estuary landscape that is important. The central task of protected area management in the future will be to preserve and promote the essential functions of the Elbe estuary for Natura 2000 in a changing landscape (Framework Concept 2005, p. 5).

To preserve biodiversity, the expansion of the flooding and sedimentation area is named as an overarching goal. Synergies with the tidal Elbe concept therefore arise almost automatically. The concept explicitly points out the need to utilize these synergies. In addition to synergies with the general

In addition to the need for action with regard to the development of tidal dynamics and the current activities to develop a comprehensive concept for the development of the Lower Elbe region, reference is also made to the implementation of the Water Framework Directive.

The framework concept also lays the foundation for transnational cooperation in the development of the Elbe estuary: a transnational

A steering and working group for the coordination of concrete conservation and development goals as well as suitable measures for implementation has been established. Joint organizational structures of the states of Hamburg, Lower Saxony and Schleswig-Holstein have been created as a result of the concept. Today, measures of the individual states are coordinated against the background of the joint framework concept.

Work is currently underway to concretize the concept. An integrated management plan is to be drawn up by the end of 2010, in which both overarching measures for the entire Elbe estuary area and elaborations for individual sections, so-called functional areas, are proposed. Due to the overlapping objectives, Natura 2000 represents an important framework for the HPA to implement the measures of the tidal Elbe concept and the HPA can, for its part, promote the implementation of Natura 2000 with the support of economic interests.

above:

Nature 2000 scenery of the states of Hamburg, Schleswig Holstein and Lower Saxony in the Elbe estuary (green: FFH areas, hatched: bird sanctuaries)

below:

Typical plant species of the Elbe estuary's riparian herbaceous meadows: stiff celandine, hairy willowherb, angelica, fleabane



ELBOW



Wadden Sea

LOWER TIDAL ELBE



Power islands

CURRENT SPLITTING AREA

UPPER TIDE LEVEL



Current branching



Elbe currents

In order to identify the existing spatial qualities of the TIDE+Elbeland as a potential area, four sub-areas were identified based on the morphological characteristics of the tidal Elbe: The Upper Tidal Elbe, the current splitting area near Hamburg, the Lower Tidal Elbe and the Elbe estuary.

The overall area was viewed in the same way as the TIDE+ spatial image relating to Hamburg and interpreted in terms of its relationship to the dynamics of the Elbe. The four subspaces can be characterized as follows: The Upper Tidal Elbe stretches from the weir in Geesthacht to Bunthäuser Spitze and is characterized by a strong overlapping of headwater inflow and outflow.

Tidal movement. The spatial image for this area is primarily determined by the old Elbe currents, a system of tributaries that used to flow through the marsh and is no longer connected to the main river.

The processing of the current splitting area near Hamburg was essentially the task of the Tidal Elbe Book. It extends from the Bunthäuser Spitze to Nienstedten and is characterized by the division into the North and South Elbe. As the tidal and Elbe currents meet here, the water has long residence times. Due to the intensive influence of the Port of Hamburg with its deep harbor basins and navigation channels, the Elbe in this area has a low specific water surface area with a large water volume. The multitude of harbor polders and harbor basins as well as tributaries of the Elbe paint the picture of a Current branching. The TIDE+ spatial image for Hamburg derived from these characteristics was placed in the overall context of the Elbe estuary.

The Lower Tidal Elbe stretches from Nienstedten to the estuary of the East and is characterized by an increasing widening of the Elbe river with several large river islands. They divide the Elbe into a main stream and a secondary stream. In this area, the water levels and currents are essentially characterized by the tidal movement and the saltwater influence of the North Sea reaches as far as Lühesand-Nord with low headwater inflows.

The Elbe estuary is a wide estuary funnel with sands and mudflats, a deep main river channel and shallow marginal areas. The brackish water zone with strongly fluctuating salt content merges into the marine conditions of the North Sea.

Heights / Floors

Settlement /

Infrastructure

Hydraulic engineering

"Landscape-specific tidal potential map"



INTERPRETATION SPATIAL IMAGE	ELBOW	LOWER TIDAL ELBE	CURRENT SPLITTING AREA	UPPER TIDE LEVEL
CONCEPT				
I POWER CONSTRUCTION	Attenuation of tidal energy through sandbanks/ guide dam in the estuary area	Conversion of sedimented foreshore areas into shallow water areas		
SEDIMENT MANAGEMENT				
	Creation of sandbanks/subaquatic deposits	Connection of secondary albums	Creation/maintenance of shallow water areas and harbor basins	
III CREATION OF FLOOD SPACE				
	Provision of additional water areas in the floodplain between low and high tide		Provision of additional water areas in the flood zone between low and high water	
DESIGN OPTIONS AND SYNERGIES				
-> TIDE+Elbeland Outlook				

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INTERPRETATION SPATIAL IMAGE



OUTLOOK

The Tidal Elbe Book as a landscape and open space planning development vision for the next100 years shows the various appearances, qualities and potential uses of different TIDE+ landscapes in the Hamburg metropolitan region. The tidal Elbe concept includes various Modules of measures relating to the various spatial units of the entire tidal Elbe.

The focus was placed on the development of scenarios for the creation of flood space in the urban area of Hamburg. Appropriate scenarios can also be developed in relation to the other components of the measures, such as the creation of sandbanks to dampen the tidal energy in the estuary area or the creation of additional dyke foreshore areas and the connection of side arms in the area of the Lower Tidal Elbe, in order to identify design options and synergies of use. The spatial vision for the urban area of Hamburg and the Elbe estuary presented in the Tidal Elbe Book serves as a framework for understanding the spatial Opportunities in the tidally influenced estuary. The unique spatial qualities of the tidal Elbe show development potential in the sense of the tidal Elbe concept and can become the starting point for the further development of the Elbe estuary.

The Tidal Elbe Book is both an idea and a communication tool for the TIDE+ landscapes of the future. The pictorial representation is intended to help find a positive, crossnational and cross-municipal understanding for a jointly designed future for the tidal Elbe.

The special features, potential and challenges of this space become visible and create a shared awareness. The vision serves to promote understanding between the spatial planning disciplines: Water management, engineering, nature conservation, urban, regional and landscape planning. The relevance of the argumentation of the Tidal Elbe concept as a holistic integrative approach to spatial development and design is the prerequisite for the sustainable development of the valuable habitat of the Tidal Elbe into the future.

TIDEELBELAND

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Above: Nature 2000 scenery of the states of Hamburg and Schleswig Holstein in the Elbe estuary (green: FFH areas, hatched: bird sanctuaries) (from: IBP 2009)

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THE TIDEELBEBUCH TEAM

Hamburg Port Authority - Department Tidal Elbe S-21

The Tidal Elbe Department, together with the Hydrology Department, is part of the Strategy Division at the Hamburg Port Authority and is committed to the sustainable development of the Tidal Elbe as the lifeline of the Hamburg metropolitan region. Driven by detrimental natural and anthropogenic developments which, among other things, have led to increased sediment levels in the Hamburg The department's aim is to develop and implement concepts that are suitable for counteracting these developments, while also realizing as many synergies as possible with other uses and developments. To this end, the Tidal Elbe Department is in close contact with other local, regional and international expert and interest groups.

Information is available at www.tideelbe.de

Project team:

Heinz Glindemann, First Director of Construction, headed the power engineering division at the Office for Power and Port Construction (now HPA) from 1995 to the end of 2008. Until his retirement in mid-2010, he focused on the future design of the tidal Elbe as head of the newly founded Tidal Elbe and Hydrology department at HPA.

Manfred Meine, Director of Construction, with the Office for Power and Port Construction (now HPA) since 1989, initially responsible for the development of the METHA and later for the Altenwerder container terminal, has headed the Tidal Elbe project group at HPA since 2007.

Boris Hochfeld, Dr. rer. nat., geographer and soil scientist with a focus on planning soil evaluation systems, since 2005 at the Office for Power and Port Engineering (now HPA), responsible for natural landscapes and communication concepts in the Tidal Elbe department.

STUDIO URBAN LANDSCAPES

The TIDEELBUCH was produced by STUDIO URBANE LAND-SCHAFTEN in cooperation with OSP Ohrt von Seggern Partner. STUDIO is an interdisciplinary network for teaching, research and practice, with members from the fields of landscape architecture, urban planning, architecture, civil engineering, biology, sociology and water management. It was founded in 2005

by Hille von Seggern and Julia Werner at the Institute for Open Space Development at Leibniz Universität Hannover. The studio team works within and outside the university - nationally and internationally - on questions of perception, planning and design of urban landscapes, from regional strategies to local projects.

Project team:

Antje Stokman, Prof. Dipl.-Ing., landscape architect, was a junior professor at the Institute for Open Space Development at the Faculty of Architecture and Landscape and at the Faculty of Civil Engineering and Geodesy at Leibniz Universität Hannover from 2005 to the beginning of 2010 and will move to the University of Stuttgart as head of the Institute and Professor of Landscape Planning and Ecology in the summer semester of 2010. Her research focuses on process-oriented and large-scale design strategies for urban water, infrastructure and production landscapes.

Hille von Seggern, Prof. Dr.-Ing., urban planner and architect, taught until 2008 as a professor for open space planning, design and urban development at the Institute for Open Space Development at the Faculty of Architecture and Landscape, Leibniz Universität Hannover and is the owner of the office Ohrt - v. Seggern - Partner in Hamburg. She founded STUDIO URBANE LANDSCHAFTEN in 2005. Her research focuses on systemic, situational, research-based design as an innovation strategy. Topics include humanspace relations and sustainable urban landscape development with a focus on water and transportation systems. **Gerko Schröder**, Dipl.-Ing. for Landscape Architecture, is coowner of TH treibhaus Landschaftsarchitektur in Berlin and was a research associate at HCU Hamburg in the SWITCH research project from 2008-2009. The research and design of urban landscapes in port cities are a focus of his practical and scientific work.

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Timo Thorhauer, graduate engineer for landscape and open space planning, studied at the Leibniz University of Hanover, worked for realgrün Landschaftsarchitekten in Munich and is now a freelancer in Hamburg.

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TIDEELBOOK

Landscape and open space planning development study for the concretization and project-related implementation of the tidal Elbe concept

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