Effects of the reconnection of the Dove Elbe to the tidal Elbe and local stakeholders

Executive summary and lessons learned from a feasibility study

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Content

1. Introduction

Understanding the problem

The Elbe estuary, located in Northern Germany, is a valuable natural area and protected by European environmental laws. At the same time, the estuary is economically important for the region: it is the artery of the Metropolitan Region of Hamburg with Germany's largest seaport and the most important shipping route for international maritime traffic in Germany. The shore areas of the estuary are densely populated and intensively used by smaller ports, industry, agriculture, power stations, fishery as well as for recreation and tourism. Human activities have changed the natural estuarine system of the Elbe for centuries: e.g. land reclamation, construction of dikes and barriers for flood protection, and deepening of the fairway. Consequently, the natural estuarine system and its sedimentation and erosion patterns is out of balance. Tidal pumping, a force resulting from unbalanced flood and ebb currents, in combination with today's lower freshwater discharge, has become more severe during the last years enhancing the upstream sediment transport and deposition in the upper estuary.

One solution to address the pressure of unbalanced flood and ebb currents is to create more space for the estuary, e.g. reconnecting former anabranches of the estuary, which are nowadays cut off by weirs, dams and dikes. This additional flood space enhances the estuary´s size and creates a more balanced shape and structure (i.e. improve the hydrological and morphological conditions). For instance, when the tide wave flows in and out the additional flood space, more water is moved as before along the estuary. The water movement lowers the tidal energy so that the amount of sediments transported to the upper part of the estuary might reduce. Such a solution not just counteracts the tidal pumping pressure but also create new areas for intertidal habitats and may improve the ecological conditions. In search of such a solution, river engineering measures have been investigated for the tidal Elbe using advanced hydrodynamic-morphodynamic numerical modelling systems (BAW 2006, 2007, 2014a, 2014b).

Within the stakeholder consultation process "Strombau und Sedimentmanagement Tideelbe" started in 2013 (FOSUST, 2015), 23 potential locations within the estuary were identified to implement river engineering measures that could improve the sediment management in the Elbe estuary. In 2016, the estuary partnership "Forum Tideelbe" that consisted of representatives of all relevant stakeholders along the Elbe estuary received the task to identify the most suitable locations for measure implementation and to provide recommendations to the responsible authorities for further implementation.

Research question

To address the unbalanced tidal dynamics and increased sediment transport towards the upper estuary, the partnership Forum Tideelbe considered the reconnection of the Dove Elbe, an anabranch located in the south-east of Hamburg and separated from the estuary in 1952, as one of three most suitable locations to address both, the estuary pressures that led to an increase in the sediments transported upstream, and an improvement on the ecological status of the estuary. The potential measure required further development and an evaluation about the impacts and benefits of implementation, for nature and society. The feasibility and effectiveness of a concrete measure layout to reconnect the anabranch were asked.

IMMERSE partners at the Elbe estuary, HPA and BAW (Federal Waterways Engineering and Research Institute), decided to support the estuary partnership at the feasibility phase by

1. developing a measure layout to reconnect the Dove Elbe with the participation of stakeholders of the estuary partnership "Forum Tideelbe",
2. assessing the hydromorphological effects and measure effectiveness (BAW) of the developed measure layout through numerical modelling, and

3. tendering a feasibility study (HPA) that should investigate the ecological effects of the measure as well as the measure acceptance by the local groups of interest.

In this document a summary of the study set-up and main results of both studies, the assessment conducted by BAW (2021) and the feasibility study (BBS Greuner-Pönicke, Planung & Moderation and Ingenieursbüro Dr. Lehners + Wittorf, 2020) tendered by HPA and subsequent conclusions will be provided. Both are written in German due to the anticipated audience of the members of the estuary partnership "Forum Tideelbe" and local stakeholders. At the end of this document key messages and lessons learned will be provided.

IMMERSE aims, how the measure contributes to develop sustainable Estuaries

This measure addresses three aims of IMMERSE:

- Develop solutions that address one or more pressures of the partner estuaries, here conducting a feasibility study and an impact forecast study with sophisticated numerical models that provide understanding of measure effectiveness and lay realizable groundwork to implement river engineering measures that create additional flood space.
- Further transnational knowledge-exchange within the Nord Sea region by sharing and discussing key messages and lessons learned of the studies through Transnational Estuary Exchange Labs (TEEL).
- Contribute to the measure progress and acceptance through stakeholder engagement, here providing an approach for involving local stakeholders and setting management targets going beyond the requirements of EU directives.

Local stakeholders and members of the estuary partnership were actively involved in an early stage of measure development to receive their opinions and proposals for adjustments to further the acceptance for the measure.

2. Approach

Study area

The Dove Elbe is a former anabranch of the Elbe located in the south- east of the city of Hamburg that was separated from the tidal influence by a sluice ("Tatenberger Siel") in 1952. The study area considered 10.8 km of the 18 km long Dove Elbe (Figure 1). The adjacent area to the Dove Elbe has considerably changed due to the artificial stowage that followed the tidal cut-off. Since then, drainage and irrigation systems, artificial shore constructions and urban development have changed the landscape. The water level is artificially hold at +0.90 m and no natural tidal hydrological conditions influence the anabranch anymore, the system has been modified by humans into a stagnant water body colonized by flora and fauna that is adapted to these conditions.

Current uses of the water body and enterprises established in the region hang together with the present environmental conditions. The anabranch is currently a place for shipyards and ports, touristic shipping, waterborne recreation and watersports, with a training center for Olympic rowing competitions. The land area is intensively used by agriculture.
In relation to the social aspects, the stakeholder interviews conducted within the feasibility study evidenced a close living community and strong cooperation of the locals in the concerned area.

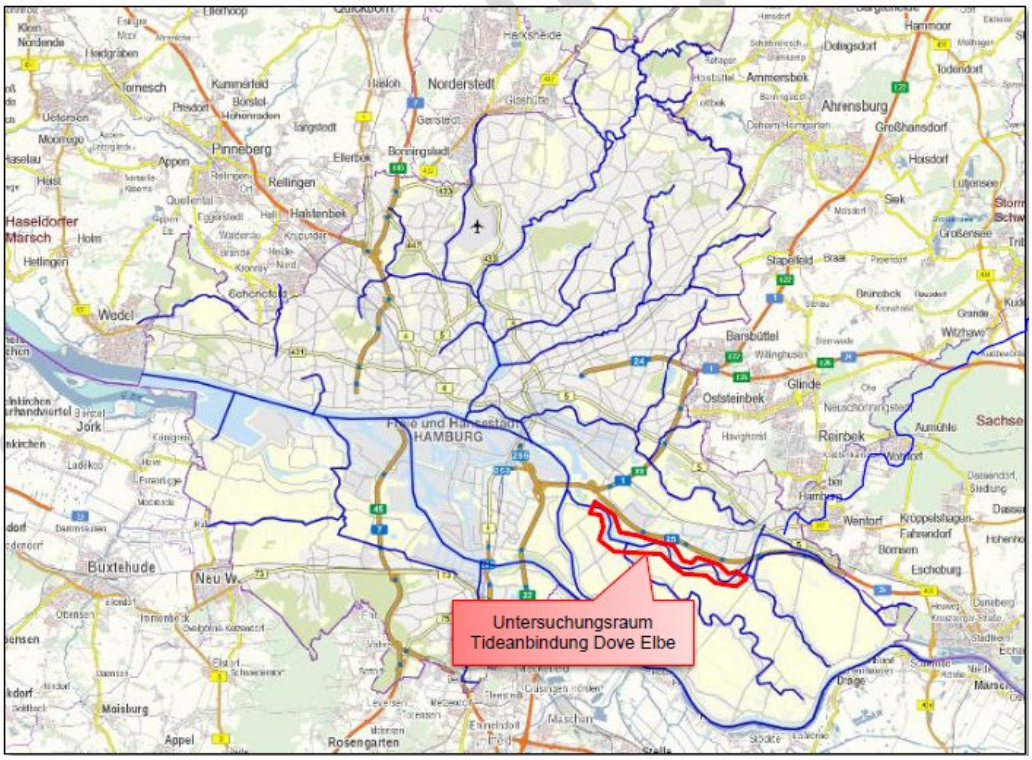

Figure 1: Location of the Dove Elbe (Untersuchungsraum Tideanbindung Dove Elbe= Investigation area) in the south-east of the city of Hamburg

Study set-up

The current state of the study area was analyzed concerning its hydromorphology, ecology, water management and anthropogenic uses. The consortium of three consultants *BBS Greuner-Pönicke, Planung & Moderation and Ingenieursbüro Dr. Lehners + Wittorf* investigated the technical feasibility, costs and implications of a possible reconnection of the Dove Elbe, evaluating both, a basic, and optimized measure layout, in terms of: ecology (i.e. related to the targets of the Water Framework Directive and Flora-Fauna-Habitats as well as Birds Directive), flood protection, water management (drainage and irrigation), groundwater, infrastructure (stability of buildings, bridges, barrages, harbors, quay walls and wharfs) and diverse (current) uses, such as agriculture, shipping, watersports, and recreation. The impact forecast and hydraulic effectiveness of the (optimized) measure was investigated by the BAW through a numerical model (3D-HN model) that calculates the flow conditions and sediment transport in the tidal Elbe.

The **main target of the measure layouts** was to positively influence the estuarine tidal dynamics of the Elbe by creating additional flood space in the Dove Elbe. A second aim was to create more valuable tidal habitats. At present, protected freshwater nature (habitats and their flora and fauna) does already exist in the study area. Estuarine habitats and related species are however considered more valuable due to their rareness, their development should be therefore supported.

Given the current uses and services of the anabranch, a free (natural) tidal oscillation within the anabranch was neglected by stakeholders and locals and the measure layout must consider limitations on the maximum and minimum water level. This implied less measure effectiveness, since the additional tidal volume (5 Mio. m3 theoretical useable tidal prism) decreases when the water level is constrained. Members of the estuary partnership “Forum Tideelbe” developed first a **basic scenario** (basic measure layout) to allow a tidal influence

between +0.90 mNHN[1] mean highwater (to maintain the current normal water level) and -0.60 mNHN mean low water, resulting in a tidal range of 1.50 m within the Dove Elbe. Other water levels above or below were not considered and a new barrage or sluice to regulate the water levels became necessary in the measure layout.

Within the feasibility study the effects of this scenario on the parameters above mentioned were investigated and local stakeholders were asked to react on the outcomes. They rejected the basic design of the measure because of its implications on the current uses of the water body. At the same time the positive effects on the ecological conditions were only little on this scenario. This basic measure layout implied extended shore stabilization in the Dove Elbe causing unnatural conditions that would hinder the development of tidal habitats. Also, no characteristic estuarine zonation would develop when the sluice must close for long times to damp the high-water level from the tidal Elbe.

The consortium of consultants with support of HPA and BAW, as well as experts of the office of the estuary partnership discussed and determined the adaption of the technical conditions to integrate the concerns of the stakeholders in the measure design and optimized the basic layout. The working group developed a measure layout (**optimized scenario**) to connect a tidal volume of 2,7 Mio. m^3 to the estuary allowing in the Dove Elbe a greater tidal range of 2,10 m by decreasing the mean low water level to -1,20 mNHN. One barrage/sluice at the reconnection should control the water level between +0.90 mNHN and -1.20 mNHN, and a second sluice in the middle part of the study area should further enable existing uses like for example touristic shipping, harbors and shipyards, and watersports (see Figure 3). In addition, a symmetrical tidal oscillation in the Dove Elbe should be induced at the sluice Tatenberger Siel , simulating the water course of an ideal tide.

The necessary technical adjustments of the optimized design were analyzed and described for a new sluice in the middle part of the investigated area (=Mittelschleuse, “M” in Figure 4), the barrage, a channel to further allow touristic shipping and facilitate the entrance of the harbors (=Sohlververtiefung, “B” in Figure 4), infrastructure of bridges, water pumping stations and harbors, adaptions of the shore area (=Abgrabungen im Uferbereich, “A” in Figure 4) to create more natural habitats, reconnection of a lake that is currently separated from the Dove Elbe More details can be found in the feasibility study report.

Figure 2: Technical adaptions of the optimized scenario and its effects on tidal rage (=Tidehub, “H”), currents of rowing course (=Regattastrecke, “R”), enlarging the barrage (=Sperrwerk, “U”) and lowering of the harbor and shipyards entrances (=Sohlvertiefung, “B”)

[1]NHN (*Normalhöhennull):* vertical datum used in Germany, it is a reference plane for the normal height above mean sea level.

This new approach intended to:

- exploit the maximum hydraulic capacity of the connection at the sluice, given the restrictions in the upper and lower limits of the water level within the anabranch;
- reduce the time of no water movement in the Dove Elbe and the sedimentation that this evokes, e.g. during closing times of the sluice gates;
- improve the ecological conditions of the estuary by creating new intertidal habitats in the Dove Elbe by lowering the shores;
- further intertidal habitats through the equal ebb and flood duration times.

Stakeholder participation

The adjacent area to the Dove Elbe is intensively, and differently used by residents, citizens of Hamburg and tourists. The consultants produced an inventory of all current uses and interviewed residents and the representatives of the following stakeholder organizations:

- Shipping line
- Watersport associations
- Rowing club and regatta organization
- Tourism and watersports
- Fishing club
- Commercials (shipyards, harbors)
- Agriculture & gardening
- Nature & environment NGO´s
- Water management
- Private households

The survey questions related the potential measure effects on ecology and flow conditions as well as on infrastructure (the following are examples, related to specific organizations or stakeholders):

- How will the measure affect your business or uses?
- How will social structures be affected?
- What kind of effects do you expect for infrastructure, e.g. quay walls, bridges, barrages and sluices?
- How will changes in current velocity affect watersports?
- What kind of maintenance works do you expect?

3. Results

In spring/summer 2020 the results for the optimized scenario, including an estimation of the costs, were presented to the estuary partnership “Forum Tideelbe” and to the locals. The studies revealed a clear improvement in the knowledge of large-scale, and local effects of connecting flood space into the tidal Elbe through the Dove Elbe anabranch. The results were further used by the estuary partnership to weight up the benefits of implementing at the Dove Elbe this type of measure, i.e. connecting former flood areas into the estuary, in comparison to other two potential locations in the tidal Elbe, where it might be also feasible to create more flood space.

Specific questions of the locals, especially concerning the effects on certain uses such as tourism, but also for ecological aspects could not be answered by this investigation. Further and more detailed studies are necessary before the next step – planning phase towards implementation – could be made.
The final reports are provided on the IMMERSE website (BAW, 2021; BBS Greuner-Pönicke et al., 2020).

Hydromorphology

The effects on the water level and sediment transport of the reconnection in the optimized scenario were assessed by the BAW with help of the numerical 3D-model-system UnTRIM-Sedimorph. The main results of the assessment (BAW, 2021) are here briefly summarized.

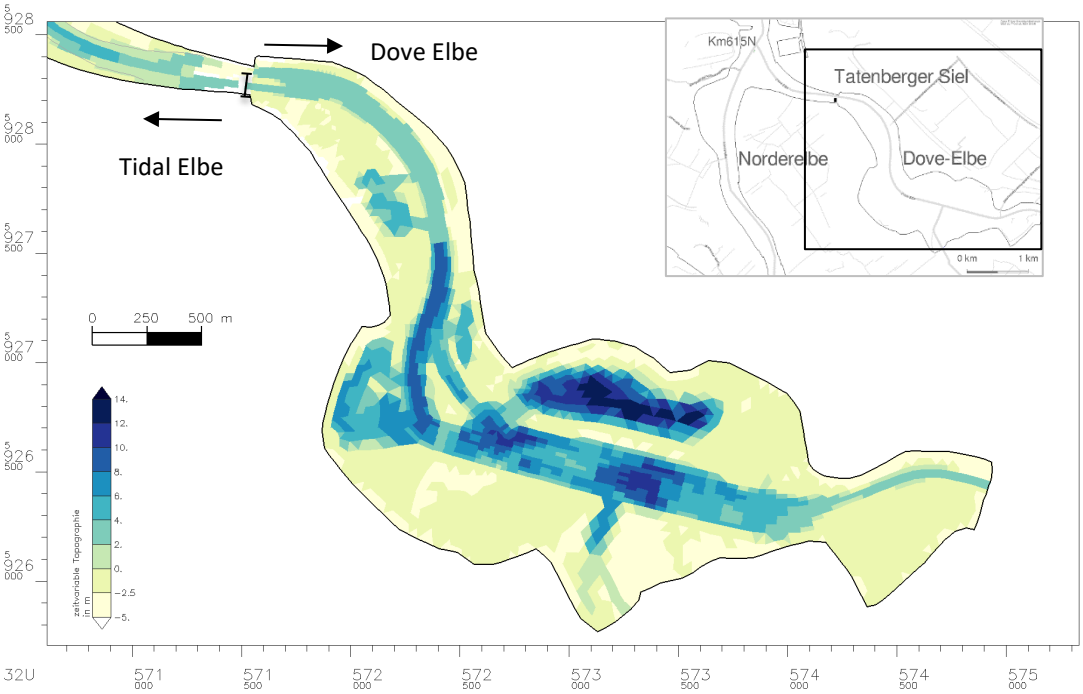

Figure 3. Location and topography of optimized measure layout. Extract of the model domain at the Dove Elbe (BAW, 2021).

The measure effectiveness **on flow conditions and sediment transport** at large-scale was constrained, given the boundary condition on the maximum high tide level allowed within the Dove Elbe. The results obtained depicted beneficial effects within a local extent, principally in the side arm Norderelbe (Northern Elbe) in the Hamburg area.

The model simulated a gate control at the sluice Tatenberger Siel to regulate the low- and high tide in the anabranch. The mean tidal range in the Norderelbe, at the mouth of the Dove Elbe, was within the simulated period 3.9m (see km 615N in Figure 4), whereas the mean tidal range within the Dove Elbe was regulated to 2.1m. This regulation on the water level, constraining the tidal range, lowered the water volume (i.e. tidal prism) that could potentially pass through the reconnection. The less amount of water flowing through the connecting sluice, the less influence had the transport of this additional water on the tidal dynamics of the Elbe.

The additional tidal prism connected from the Dove Elbe to the estuary lowered the tidal range in average 2 to 3 cm in Hamburg (Figure 4). Next to the mouth of the Dove Elbe (km 615N), the reduction reached approx. 10 cm (beyond the scale depicted in Figure 4).

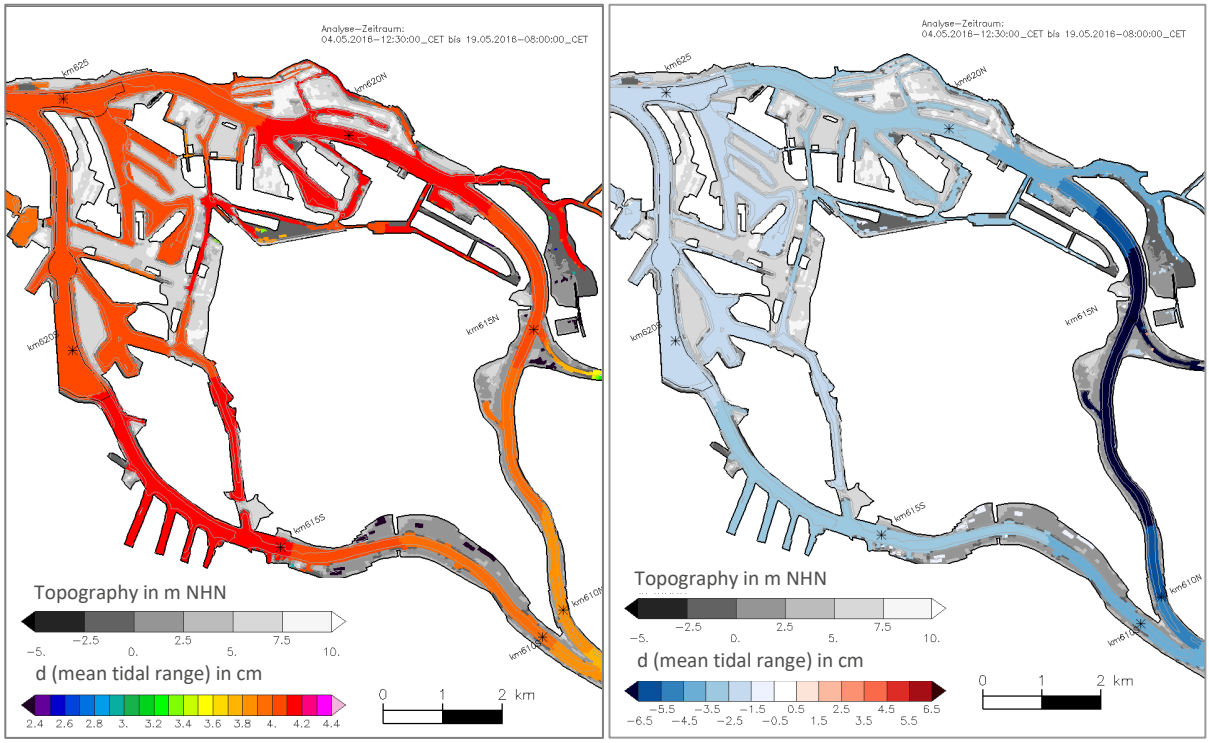

Figure 4: Reduction on tidal range in Hamburg due to the reconnection of the Dove-Elbe (left: absolut values, right: difference with respect to the reference scenario)

The current velocity increased at highest close to the sluice ("Tatenberger Siel") with a mean value of 1.4 m/s. In the rowing course area ("Regattastrecke") the mean value remained less than 0.2 m/s.

The mean advective residual transport of suspended load lowered approx. 300 t/tide, a relative reduction of maximal ~2% of the upstream sediment transport (within the analysis period here investigated). The sedimentation rate in the Dove Elbe was estimated to approximately 5 cm/year depending on freshwater discharge and control of the sluice.

From a hydraulic engineering point of view, the investigated measure at the Dove Elbe can help counteract the historically unfavorable developments of the tidal Elbe and improve the ecological potential of the tidal Elbe.

However, it alone cannot bring the tidal Elbe back into balance. That was not expected either, since the current hydromorphological condition of the Elbe is the result of 150 years of hydraulic engineering measures, port constructions, fairway adjustments and coastal protection. Further, it is assumed that pressures such as climate change will have also a negative impact on the salinity and sediment transport regime. Thus, the combination of several measures that create additional flood space at different locations in the estuary could have in total a major effect reducing the tidal range and the net transport of sediments upstream. It is recommended to examine the combine effects, for instances, of the measures separately evaluated within the estuary partnership Forum Tideelbe and in current development (BAW, 2020, 2021).

A significant reduction in dredge volumes cannot be achieved through the investigated measure at the Dove Elbe. For that, improvements on the practices for maintenance dredge, and relocation are necessary. The requirement of maintenance dredging could be effectively reduced by procuring a fluent transport of fine sediments from the upper estuary to the mouth, and advancing towards an adaptive estuary/sediment management. Future investigations might address the question: how a long-term measure like the reconnection of the Dove Elbe could be impacted or improved by flexible practices for the dredge and relocation of sediments at the Elbe.

Ecology

The effects for ecology and anthropogenic uses are related with the tidal flow conditions and sediment regime expected in the Dove Elbe after the reconnection. Those effects were analyzed by the consultants on behalf of HPA, considering for the ecological assessment several aspects: effects on single flora and fauna species, habitats in general, and more specific on protected species and habitats, i.e. Birds Directive and Habitats Directive, as well as flora, fauna and biotopes being protected under the national §30 nature legislation.
Due to the reconnection, the environmental conditions that determine the fauna found in the anabranch will change. The creation of tidal conditions will displace species and habitats being typical for still standing freshwater habitats, such as certain insect and macrozoobenthos species, reptiles, beaver, and plant species. Also, current places for certain breeding birds would disappear, because these areas will be partially flooded.

Species being typical for tidal habitats would gradually settle and develop. Through the implementation of the optimized scenario, a total development of 134 ha of new tidal habitats will be created, plus additional 8 ha of habitats protected by §30 of the national nature law. This is a bit lower compared to results obtained by the basic scenario, but the quality of the habitats would be higher due to the formation of rare shallow water areas, riverine tidal flats and reeds. Here, a typical tidal zonation would develop (see Figure 5). The optimized scenario still included a large amount of artificial shore stabilization, and the planned sluice could hinder fish migration. To lower this impact, technical solutions for more natural shores were proposed could be found.

The consultants concluded that the estuarine ecology in the Dove Elbe would benefit from the implementation of the measure. The potential benefit for the optimized scenario resulted higher than in the basic one, but still, further advancement might be required. Some compensation measures for replacing the existing protected habitats by new estuarine habitats would be necessary.

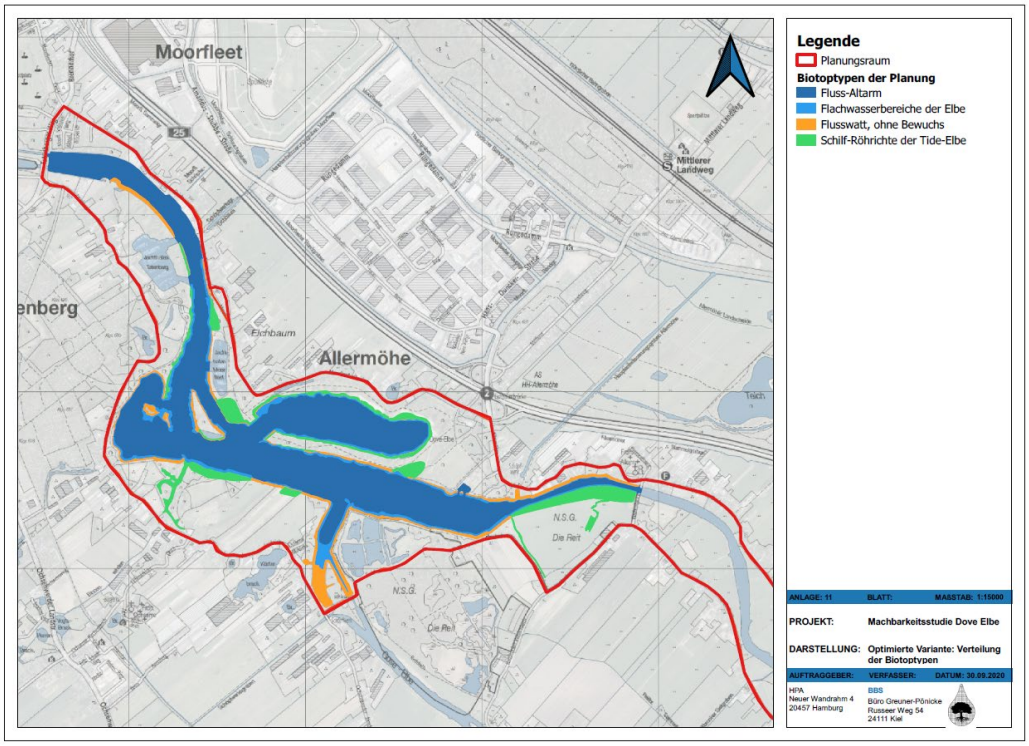

Figure 5. Biotopes of the optimised design (Fluss-Altarm= river area, Flachwasser = shallow water, Flusswatt= freshwater tidal flats, Schilf-Röhricht = reeds)

Regarding the effects on water quality in relation to the Water Framework Directive, it had to be assessed whether the measure would lead to change the water quality of the Dove-Elbe especially for oxygen, nutrients and pollutants. A deterioration in water quality due to the introduction of water from the tidal Elbe would be in conflict with the target of the Directive. The assessment revealed that no significant differences arose concerning water quality neither between the two designs, nor in comparison to the current state. Also, no change concerning the water body type would take place and the biological quality parameters would not be affected with the exception of fish, as the construction of a sluice would hinder fish migration.

Anthropogenic uses in the Dove Elbe

Concerning **anthropogenic uses**, the impacts of the optimized scenario are less severe compared to the basic scenario, due to the major technical works integrated in the optimized measure layout, namely the construction of a sluice in the middle of the concerned area, and digging of the shipping channel. Those would enable navigation during low tide and further operation of touristic shipping, watersports and rowing competitions (for the deepening of the shipping channel, extensive soil movements of potential partially contaminated soils are to be evaluated).

The integrated features in optimized scenario further minimized the potential impacts on the velocity of water course in the rowing course area (“Regattastrecke”) that could affect watersports. Time restrictions for the use of the regatta course and touristic shipping are still expected.
Effects on water management infrastructure and ground water level could be almost excluded. Drainage and irrigation would even benefit from the new measure design. Additionally, new solutions were proposed for the harbors, for example flexible, instead of fixed mockingbays. For the shores, extensive construction measures will be necessary in order to either stabilize, for example the existing quay walls, or to remove artificial constructions

in favor of natural shores (doing so, the positive ecological effects would be enhanced). During the works of infrastructure adaption, stakeholders were afraid of a loss of income. The upgrading of a more natural landscape, i.e. due to the creation of tidal flats, did not play an important role for the locals to approve the measure. Stakeholders were concerned about whether the tourists will value the ecological upgrading on the landscape. These effects on tourism as a result of changes on the landscape could not be clarified.

Negative effects were anticipated such as restrictions of using the area for swimming or as a livestock watering place. Overall costs of the measure were estimated to reach approximately 500 Mio. €.

Regarding the quality of (shore) soils and sediments that could be transported in the Dove-Elbe during flood events (when contaminated sediments of the middle Elbe might be remobilized), no significant risk is expected, then the sluice at Tatenberger Siel is to be closed during flood events.

Local stakeholder acceptance

The setup of the optimized measure's layout aimed to find a trade-off between the impacts related to the current human activities in the area, and the expected benefits on the tidal dynamics, sediment transport and ecological status in the estuary. Local stakeholders were informed during workshops organized by the office of the estuary partnership "Forum Tideelbe". During the workshops, the scenarios and effects for the area were presented and discussed, and locals got the opportunity to answer questions and provide advices for improvements of the basic scenario. During the stakeholder interviews, time was taken for a more detailed discussion of specific issues, and the locals could give their opinion concerning the investigated measure.
The **basic scenario was firstly rejected** because the implications for the uses were too high, for example:

- touristic shipping, the functioning of harbors and shipyards, training and competition conditions for watersports, e.g. trips with tourist boats and rowing would not be possible anymore or severely restricted by the introduction of the tides (to low water level for tourist boats at ebb tide) and newly appearing currents (hinder of rowers)
- people were afraid of higher sedimentation rates in the Dove Elbe system and input of contaminants from the estuary,
- a change of the landscape, e.g. creation of tidal mudflats was not appreciated for touristic and agricultural aspects.

Therefore, the **scenario was optimized**, its effects analyzed and the analysis results again presented to the locals. Despite the transparent process, early involvement of the locals, and although the optimized scenario could minimize the effects on human uses, the existing **resistance of the locals** from the beginning against the measure **remained**. However, differences between stakeholder groups could be recognized: approximately 10% of the residents and the representatives of environmental NGO´s (being member of the estuary partnership) were in favor of the potential measure. On the other hand, most of the locals of this suburb area of the city of Hamburg were suspicious towards the Hamburg city administration due to bad experiences made with authorities in the past. They protested several times, for example in front of the city hall of Hamburg or in the Hamburg port area. They assumed that the implementation of the measure was already decided in the city hall, because this process was the first time that locals have been involved in such an early state.

Another explanation for the resistance could be that only representatives from a higher organization level were involved in measure selection process of the estuary partnership, who represent the interest of the whole estuary area as for example the chamber of commerce and tourism, environmental NGO´s and agriculture organizations. The local inhabitants of the concerned area Dove Elbe did not participate in the partnership. They were not informed on the ´broader picture´, i.e. they did not follow the whole communication process on indicating

locations for measures to improve the state of the whole Elbe estuary. The inclusion of those, potentially affected by implementation on the broader process might have contributed to enhance the sense of common environmental responsibility. Locals and stakeholders of the Dove Elbe claimed about why "their" surroundings - also ecologically valuable - that has developed since the cut-off of the anabranch in 1952, should be used to reach goals for "somewhere else" at the estuary, i.e. creating more tidally influenced habitats and reducing sediment transport towards the upper estuary and the port of Hamburg. The local disapproval could be considered as combination of a ´not in my backyard´ phenomenon, and the fears about personal existences and social structures at stake.

Within the estuary partnership Forum Tideelbe, the acceptance became also low after the investigation on the estuary dynamics for the optimized layout, modelled numerically, showed that the measure benefits would impact principally a part of the estuary, rather than the whole estuary. The expected improvement at large scale on the pressure tidal pumping and sediment transport resulted constrained to the area next to the measure, and the measure effectiveness for the whole estuary resulted less than expected.

Not all questions of the locals could be answered by the partnership and the feasible study, like for example:

- What will be the consequences of the changes of the landscape, i.e. from a river branch without tides with always easily accessible shores to a tidal water body with extensive mudflats and therefore less space for watersports and touristic shipping? Will tourists still come, or will it mean a loss of income?
- Will the city take over the high costs for the implementation of ca. 500 million € or do the locals have to pay a share?
- What will be the consequences for the social structures and daily life, e.g. for farmers and shipyard owners?

4. Key messages and lessons learned

The studies of the IMMERSE partners BAW and HPA provided an important contribution for the progress of a) identifying the effects of connecting flood space at the Elbe estuary on ecological and hydromorphological conditions and **b) stakeholder communication**.

The investigations supported through the IMMERSE project **describes the modelling approach, the necessary technical works and adaptations for reconnecting the anabranch Dove-Elbe to the estuary.**

The studies demonstrated the positive effects of this river engineering measure for hydromorphology, ecology and the related impacts on current anthropogenic uses at the concerned area. Given the adaptions to limit the maximum water level in the anabranch, **the potential measure benefits on the tidal dynamics were constrained**. The measure will significantly reduce the tidal range locally, but the large-scale effect on the water level and tidal dynamics in the estuary will be minimal. It became clear that **additional measures are necessary to address the impacts of longtime anthropogenic changes.**

The process of developing the measure delivered important insights on the relevance of stakeholder participation and adequate communication to achieve acceptance of a measure. The study, especially the part on the stakeholder involvement, can be of interest for other estuaries as **it showed the significance of investing time and economic resources in conflict resolution and group decision-making,** a process that starts by communicating the pressures and functions of the estuary effectively and raising the awareness of that, to be able to engage local residents, general public, stakeholder organizations and estuary managers in developing

alternatives, identify solutions and take responsibilities. This is a long-lasting process that at the Elbe estuary has just started (in 2013) and must be further developed.

The new approach tested here, i.e. involving stakeholder in an early phase and interviewing them to receive their opinion on the potential measure, did not lead to more acceptance in the short term, as the stakeholders and residents might not have trusted the estuary partnership financed by the City of Hamburg. **More efforts to develop a trustworthy cooperation between stakeholders, residents, experts and authorities are necessary in this stakeholder process**.

Also, **the way of transmitting scientific knowledge on the process**, not only to the locals but also to the press and politicians, can contribute to establish a common understanding of the challenges and options for action.
Measure development becomes difficult when single interests are paramount and a collective awareness and responsibility on estuary uses/functions is lacking. At the Elbe estuary, improvements on the ecological state of the whole estuary might not have represented a priority for some groups of interest of the Dove Elbe who were afraid by the potential changes in their area.

External factors beyond the scope of action of estuary managers can affect measure acceptance. Political plans and processes at the concerned area in the south-east of the City of Hamburg influenced the local measure acceptance. The potential reconnection of the anabranch became part of a discussion used for political maneuvers not related to the measure itself or an issue of estuary management.

Finally, **emotions and mentalities have to be considered,** as they may play a more important role than rational explanations in particular cases.

Due to the specific characteristics of every estuary, a measure being successful at one estuary cannot directly be transferred as a solution for other estuaries. Similarly, a measure that is less effective or not feasible at one estuary might have high potential at another place. **Site- specific characteristics must always be considered**. **Additionally, a long(er) lasting stakeholder process should be conducted in order to achieve a common understanding and potentially a compromise between the different interests.**

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