WP 4 EMOVE: “ how did we try to get stakeholders to become shareholders?”

WP 4 EMOVE: “ how did we try to get stakeholders to become shareholders?”

Gerald Jan Ellen (Deltares)
Dr. Frank Ahlhorn, Dr. Jürgen Meyerdirks (KuR)
Dr. Reiner Schubert, Holger Rahlf (BAW)
Yvonne Andersson-Sköld (COWI)
Delilah Lithner (COWI)

1208932-000

Title
WP 4 EMOVE: "how did we try to get stakeholders to become shareholders?"

Project	Reference	Pages
1208932-000	1208932-000-VEB-0010	51

Version	Date	Author	Initials	Review	Initials	Approval	Initials
	March '15	Gerald Jan Ellen		Marcel Taal		Rosalie Franssen	

State
final

Contents

1

1 Introduction

This report is a product of Work package 4 (European Estuarine Governance Vision and community led strategies) of the "Estuaries on the MOVE" (EMOVE) project. Within EMOVE four partners from four different North Sea Region countries work together to exchange knowledge and improve insight (what do we know and what do we need to find out), by research or pilots, to maintain the estuaries and ports accessible, flood safe and ecological resilient. The goal of EMOVE is to turn the stakeholders – representing the relevant organizations and communities around the focal estuaries of the Schelde, Weser and Göta älv – into a committed community with shareholders, in which they jointly maintain the estuaries sustainable and accessible and jointly find suitable adaptive strategies and measures. For more information on EMOVE and its results we refer to: http://www.emove-project.eu/

The aim of EMOVE to turn stakeholders into shareholders means getting shareholders, acting more reflective / reactive, into active participants. They should contribute to the realization of ideas and plans, by contributing either: knowledge, time, means (money, land, facilities) and their network (contacts/short cuts).

To realize this ambition the EMOVE project worked on different building blocks:

1. WP 3: European Joint Fact-finding: reported on in WP 3 based on the DPSIR approach – the results are not to be discussed in detail/repeated in this document. Only the different results from the three estuaries can be used to tap into. As this should be described in WP 3. Aim of this work package was to identify the most urgent problems in the different estuaries. This WP 3 will not be discussed in this report. For the results we refer to: EMOVE Project, 2014 and EMOVE Project, 2015.
2. WP 4: European Estuarine Governance Vision and community led strategies:
    - Create Business ideas[1]: the second building block are the identification of potential business cases. In this report we would like to ask the partners how they identified the Business Ideas. Which steps did they take to do so.
    - Create Joint Business Models: developed together with stakeholders business models to let them become committed shareholders And develop an implementation strategy for the different business cases (either in idea, pilot or implementation stage)
    - European Estuarine Governance Vision: which will not be discussed in the report, as this is a separate deliverable that will be available on the http://www.emove-project.eu/ website from 1st of April 2015.

[1] *The EMOVE project speaks of business ideas and shareholders. Both might indicate that the project uses an economic perspective on adaptive and sustainable management of estuaries. And that economic profit is the main goal of shareholders in an estuary. This is not the case: this project addresses adaptive and sustainable management of estuaries from the perspective of people, planet and prosperity. This means that shareholders have a share in the estuary which benefits both the estuary and themselves, from a societal, ecological and economical point of view. In this, business ideas should be beneficial for the participants and other stakeholders from these three perspectives as well. Business ideas generate advantages for people, planet and prosperity, and are focused on common, short term actions that generate these profits. The approach of ideas as business ideas should enhance the viability of these ideas and get stakeholders into real action.*

In this report we will describe the results for the different building blocks of WP 4 for the three estuaries. although the approaches in the estuaries were different (types of workshops, number of workshops etc.) we think that this should be described and analyzed so we can also learn from these different approaches.

2 Schelde Estuary[2]

2.1 Introduction

The Schelde estuary covers a surface area of approximately 33,000 hectares and lies in the Flemish Region of Belgium and in The Netherlands (Figure 1). Based on its physical characteristics and administrative differences, it is often divided into several areas (which are marked on the figure with red dots). Starting at the sources of the Schelde:

1. The Upper Sea Schelde (stretching from Gent to the confluence with the Rupel);
2. The Lower Sea Schelde (from the confluence up to the border), forming the tidal river, in Flanders;
3. The Western Schelde, in The Netherlands, from the border to Vlissingen, which is a multiple channel system;
4. The mouth, with distinct channels, but without intertidal areas, stretching North and South along the coastline. The towns of Zeebrugge and Westkapelle delineate the outer boundary.

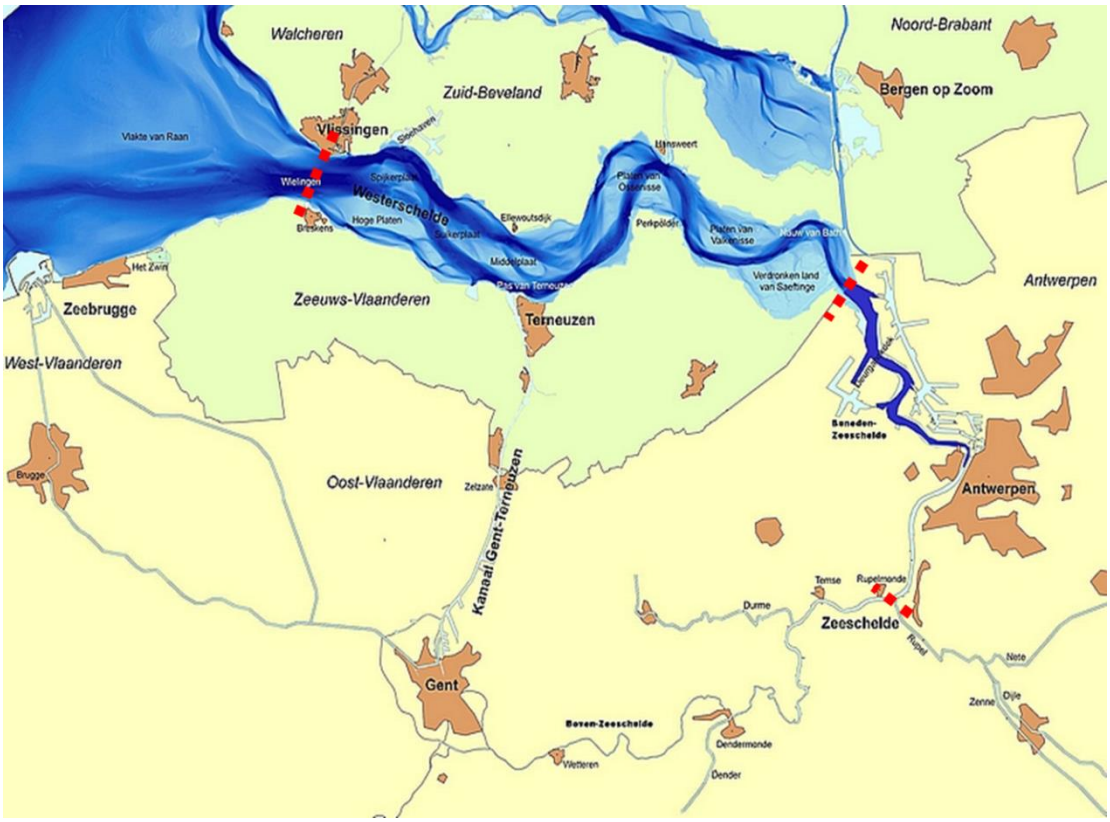


Figure 1 The Schelde estuary. As border between the mouth and the Western Schelde usually the line Vlissingen-Breskens is used. The federal border of Netherlands and Flanders is also the border between Western Schelde and Lower Sea Schelde. The Upper Sea Schelde starts at Rupelmonde

[2] *This is a copy paste from WP 3 to make the reading easier, the goal of this is that it is just a 'refresh' to make the reading of this chapter easier. The same goes for the other estuaries*

For a more elaborate description of both the physical and social system of the Schelde we refer to the report of WP 3(EMOVE project, 2014 and EMOVE project, 2015).

2.2 Problem description (drivers + responses from WP 3)

The pressure with highest relevance for the Schelde estuary is 'tidal intrusion'. The tidal regime has strong impacts on the prioritized user functions by both Flanders and the Netherlands: safety against flooding, accessibility and ecological values. More tidal intrusion increases the boundary conditions for design of flood protection works, due to higher water levels and changes in the 'forelands'. The navigability depends on the duration of high and low water and dangerous local currents (during spring tide). The ecological values of the Schelde estuary are strongly related to the available habitat area, gradients between these and small scale patterns. In the Western Schelde one can find a clear influence on the ecological value of the maximum flow velocities that occur on intertidal areas (e.g. Ysebaert et al, 2009). The impact of tidal intrusion is present all over the estuary, but it is the strongest in the upper and lower Sea Schelde.

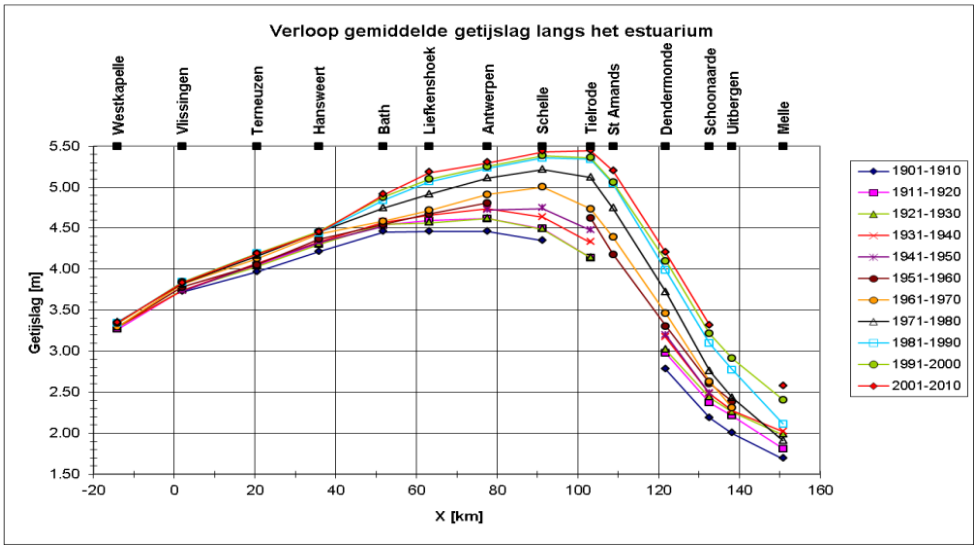


Figure 2 Tidal evolution in the Schelde estuary through the years

In 2011 a study (Deltares, 2011) gave an elaboration of all possible physical measures to reduce tidal intrusion in order to come to nature restoration based on changing large scale estuarine processes . This study showed that large scale measures can be focused on three levels:

1. Reducing the effect of amplification due to funnelling by (a combination of) enlarging the tidal prism and restoring intertidal areas (more space for the river / estuary). A in Figure 3;
2. Increase the resistance for the tidal movement in the channel(s) B and C in Figure 3;
3. Changing the balance between main and secondary channels B and C in Figure 3;

At the same time measures will be needed to restore estuarine processes on the smaller scales, i.e. shoals and connecting channels (second order changes). This relates to D, in Figure 3. It is expected that for proper restoration both large scale measures as 'a push in the right direction on the smaller scales' are needed. The latter can be both by adding sediment (e.g. smart disposal along shoals) and by local distraction of sediment (e.g. enlarging secondary channels or restoring connecting channels).

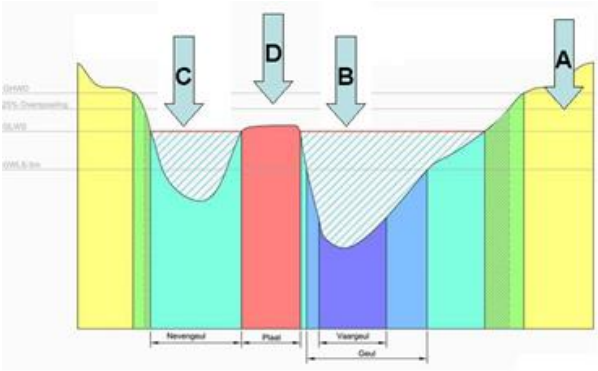


Figure 3: Four types of measures influencing morphology and geometry. One can interfere with the embankments (A), the main (B) or the secondary (C) channel or in the intertidal areas (D)

The possible measures to influence large scale estuarine hydrodynamics (hence: tidal response) was elaborated distinguishing (i) 'Soft measures' (working with sediment, especially applicable in B, C and D and (ii) 'Hard' measures (structures, dams, embankments; construction or removal) .

	Mouth	West and central part of Western Schelde	Eastern part of Western Schelde (and Lower Sea Schelde)
Soft	• Large scale sediment supply • Spatial developments	• Flexible disposal: - Disposal in deep parts or along channel face of main channel - Adapt disposal in secondary channel - More on intertidal area • Creating connecting channels • Lower intertidal area to reduce tidal range	• Flexible disposal: - Disposal in deep parts or along channel face of main channel (though little space) - Adapt disposal in secondary channel - More on intertidal area - Remove fine sediments • Creating connecting channels • Lower intertidal area to reduce tidal range
Hard	See 'soft, but with structures instead of sediment	• Space for the estuary / river • Increase resistance by specific elements in the channels	• Space for the estuary / river • Increase resistance or adjust hydrodynamics by specific elements in the channels or at harbour docks • Remove structures

Connection between the main drivers and the possible business cases

The main driver that was identified for the Schelde is the tidal intrusion, was identified based on previous research and joint fact-finding processes in the past. As there are a lot of smaller challenges connected to this main driver we did not want to focus only on this driver in the Schelde case of the EMOVE project. Although tidal intrusion is an indicator for sustainability/system behaviour and the result of the DPSIR analyses, the EMOVE project did not have the intention to solve solemnly on this issue. The objective was to get stakeholders into action. To achieve this it was necessary to not only bring them together, but also to establish a joint view concerning system knowledge and long term challenges.

2.3 How did we create and select the business idea(s)?

With our approach we aimed to identify business cases for which the stakeholders would be willing to become shareholders. For the Schelde it is important that, before we start this description, we also sketch the societal situation in the Schelde Estuary the past years, which was characterized by severe discussion on nature restoration plans. The 2005 treaty between the Netherlands and Flanders also included depoldering along the Westerschelde. This caused severe tension between different groups of stakeholders. The last court appeal to stop the depoldering of the 'Hedwigepolder' was dismissed in 2014. Furthermore an official advisory board for the Ministers of Water Management of Flanders and the Netherlands has been (re-)established (Schelderaad) in April 2014. This council includes a large part of the stakeholders along the Schelde estuary. These changes created opportunities to bring stakeholders together in a more constructive atmosphere than the previous years.

With this situation as a starting point – including the fact that stakeholders are actually willing to get together - and the absence of a really jointly accepted view on how sustainability must be achieved[3], the EMOVE project started with two important – and closely connected – steps: (i) convening assessment and (ii) a 'pressure cooker' on joint fact-finding. These steps are introduced below.

Step 1: convening assessment

A (light) convening assessment was held by means of rounds of interviews with organisations representing three important user groups Harbours, Nature and Agriculture. Each time an organisation from Flanders as well as from the Netherlands was interviewed. Within these interviews we did not focus on a 'problem' but rather we asked them questions that were as 'open as possible', trying to open up for the really important issues for them and to prevent that EMOVE would 'push' the discussion in a direction that is felt undesired or irrelevant or unimportant or not urgent by the stakeholders. Furthermore we asked them in the interviews whether they thought it would be possible for them to identify projects/business cases together, and what those could be. Finally we also asked them under what conditions (like process rules and amount of involvement of stakeholders) they would be willing to work on the identification of potential business cases and how they could contribute to this.

Because the goal of EMOVE was to create business cases in which stakeholders could and wanted to become shareholder we also wanted to create or tap into (potentially) vital coalitions. We also tried to incorporate this aspect into the convening assessment. We asked the stakeholders about potential projects, but also used a diagram showing a set of spatial functions – relevant for deltas and asked them to identify possible cross-sectoral opportunities. As it turned out, the use of the diagram was ambiguous: sometimes it was difficult to use for the stakeholders, some stakeholders found the diagram not relevant, but in other interviews the diagram showed new relations.

[3] *Even though in 2001 the Long Term Vision on the Scheldt estuary, with an outlook to 2030, was formulated.*

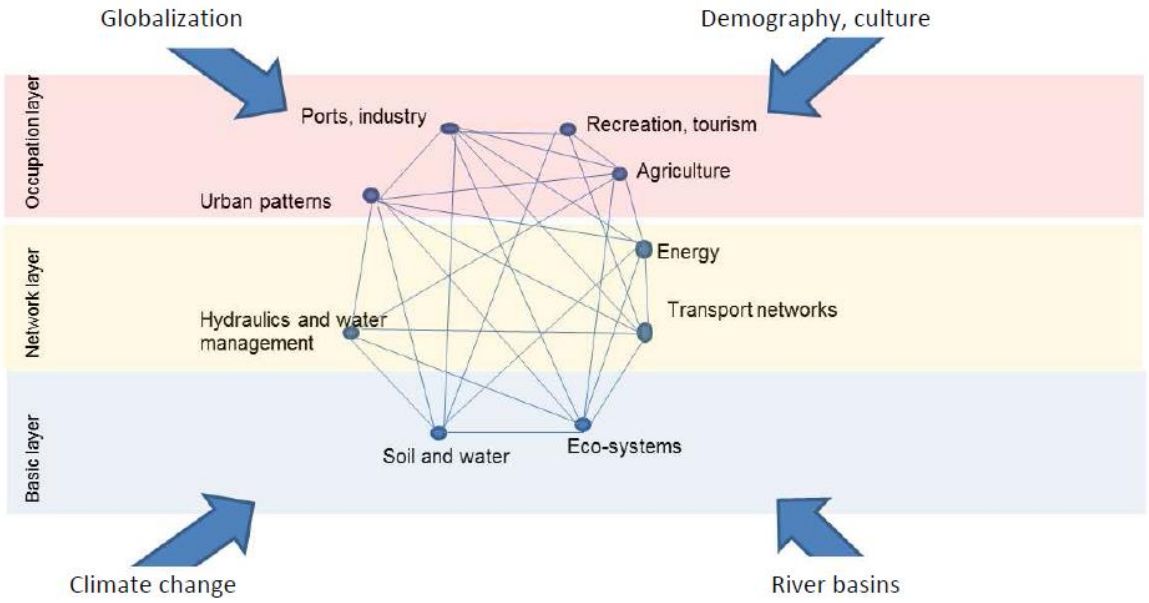


Figure 3. The delta as a complex and layered system

Figure 4 Integrated Planning and Design for Delta areas (IPDD) system diagram (IPDD.verdus.nl)

The results of the interviews were used as input for the second block, described below: joint fact-finding.

Block 2 'pressure cooker' Joint Fact Finding

Joint-fact-finding is described as "a process in which separate coalitions of scientists and policy-makers and other stakeholders with differing viewpoints and interests worked together in order to develop data and information, analyse facts and forecasts, develop common assumptions and informed opinions, and, finally, use the information they have developed to reach decisions together (Van Buuren et al. 2007).

However, due to time restraints and the fact that (i) a large joint fact-finding process concerning physical, and ecological functioning had already taken place in the Schelde and (ii) the institutional aspects had been recently evaluated (the formal evaluation of the 2005 treaty on cooperation on policy and management), we decided to create a 'pressure cooker approach'. This consisted of a summarizing memo of the results of the processes sketched above and a summary of the current governance situation on treaties (Taal, 2014).

The building blocks were used as input – and were further developed in three different workshops that are described below.

Workshop 1: Getting on the same page: first round off business cases

As described, the situation was tense when we started with the EMOVE project. This was also our concern when it came to the identification of possible business cases. This is why we started the workshop with the ambition to 'get people together'. To do so we started the workshop on a personal level and asked all the participants to bring a picture of what the Schelde Estuary symbolized for them and asked them to 'speed-date' with the other stakeholders that were present. They were representatives from both Dutch and Flemish organisations:

1. Agricultural organisations.
2. Nature organisations: bird and environmental
3. Government organisations: regional (provinces), local (municipalities), national (ministry of economic affairs in the Netherlands);
4. Harbours (Antwerp, Gent, Vlissingen and Terneuzen)
5. Independent citizens organisations.


This worked very well to break the ice. The next step was to share/present the state of the art memo to the stakeholders and the results of the interviews. Which we then discussed with them in 4 smaller subgroups asking them:

1. What do you miss?
2. What would you like to add?
3. Which things would you like to change?

The participants were free to reflect on both the physical functioning of the estuary, but also the institutional and other governance aspects.

After the stakeholders discussed the above we wanted to make the step to business cases and started generating and collected ideas. To do so we first wanted to let the stakeholders find their mutual gains by identifying in duo's what the Schelde Estuary helped them, and where it 'obstructed' them. Below are a excerpt of the answers.

Question	Input from the stakeholders
1. How does the Schelde help?	Silt Recreation: Agriculture & river Accessibility Area for developments (nature and agriculture) Area for Birds Economic engine Identity Zealand: green + location + recreation
2. What troubles/bothers you?	Spatial requirements : 'depoldering' and port development Safety : floods and disaster Dynamic vs. fixation (static targets) Perception of the population
3. Suggestions that might help	Efficient use of space Goal reached? Then finished. Training of farmers who want to change profession, that fits with the character of the Schelde Estuary New crops – nature management Integral thinking: also looking over the levees More trust in each other's arguments and take note of these arguments as well. Limits to growth? A vital, dynamic, respecting ecology, system is the precondition for other services (economy, harbour, recreation, nature, social functions, etc.) Ports working together: having a shared vision / sustainability plan Research the opportunities for a more attractive landscape.

Based on the opportunities and 'troubles' we asked the stakeholders to define projects (business cases) together. As we were still in a diverging phase of the project, we did not want to put any constraints on the projects, so there was no direct link with the main drivers that were identified.

The following initiatives were suggested.

Types of initiatives	Input from the stakeholders
Measure	• Room for the River experiment: the role that nature/natural dynamics can play in this case, what is possible? • The Schelde as a source of energy (connecting to the PRO-TIDE project) • A walking route next to the Schelde were people can walk and can recreate and experience nature and the landscape. • Creating income in a creative way, such as salt crops but perhaps also from a fisheries perspective. • Possibilities to let underused harbour land be (temporarily) be used by agriculture.
Strenghtening Governance	• Cooperation between harbours on their sustainability plans (and subsequently also taking them by the hand concerning Natura 2000 measures: creating space for development). • Quantify and communicate the values of the Schelde and the connected functions (recreation, nature, agriculture). • Make a roadmap how the just installed Schelderaad can be helped: step 1 creating a link between the decision makers by means of covenant. • Create a project were the area outside the levees is combined with the area inside the levee to create more sense of place and understanding between these areas. • Use agriculture in the maintenance of levees.
Enlarging system knowledge	• Research into the possibilities of agriculture on changing sweet and salt soils • Research on areas that are low in dynamics (by means of experiments) • Research into the value of agriculture for recreation, landscape and nature
Others	• Growing land: bringing back estuarine dynamics on agricultural land and changing this with nature functions. • Small projects that have energy • The realization of a new sea slues will create 10 million M3 of dredged material what kind of innovative application can we find for these masses. • Communicate with the citizens: make 'experiment areas' were the citizens can experience the relation between the Schelde and the land behind the levees.

Workshop 2: Selection of Business cases

There was almost a gap of 2 months between the first and second workshop. Furthermore we wanted to increase the chance for a shared context for the business-cases. Therefore we started the second workshop with 'a step back' and did not directly go to the selection of business cases. We feared that we would surprise the stakeholders otherwise too much. Instead, we took extra time for sharing facts, visions and ideas between the stakeholders. We did so by creating 3 groups that worked on:

1. The Interactive Virtual Communication Platform – a way of communication and visualisation: the EMOVE project also wanted to know whether the original ideas of the IVCP were also what the stakeholders expected: discussion platform etc. And could also test preliminary results/visualisations.
2. Inspiration: Show successful projects that sought a sustainable and system approach on fresh water in Zeeland. An expert outside of the EMOVE consortium showed to the stakeholders how – previously – parallel projects had been connected to a cluster of projects with a systemic approach.
3. Joint Fact-Finding: based on the results from the interviews, the state of the art document and the input from the workshop a causal diagram was constructed by the project team and used as a starting point for a group model building process.

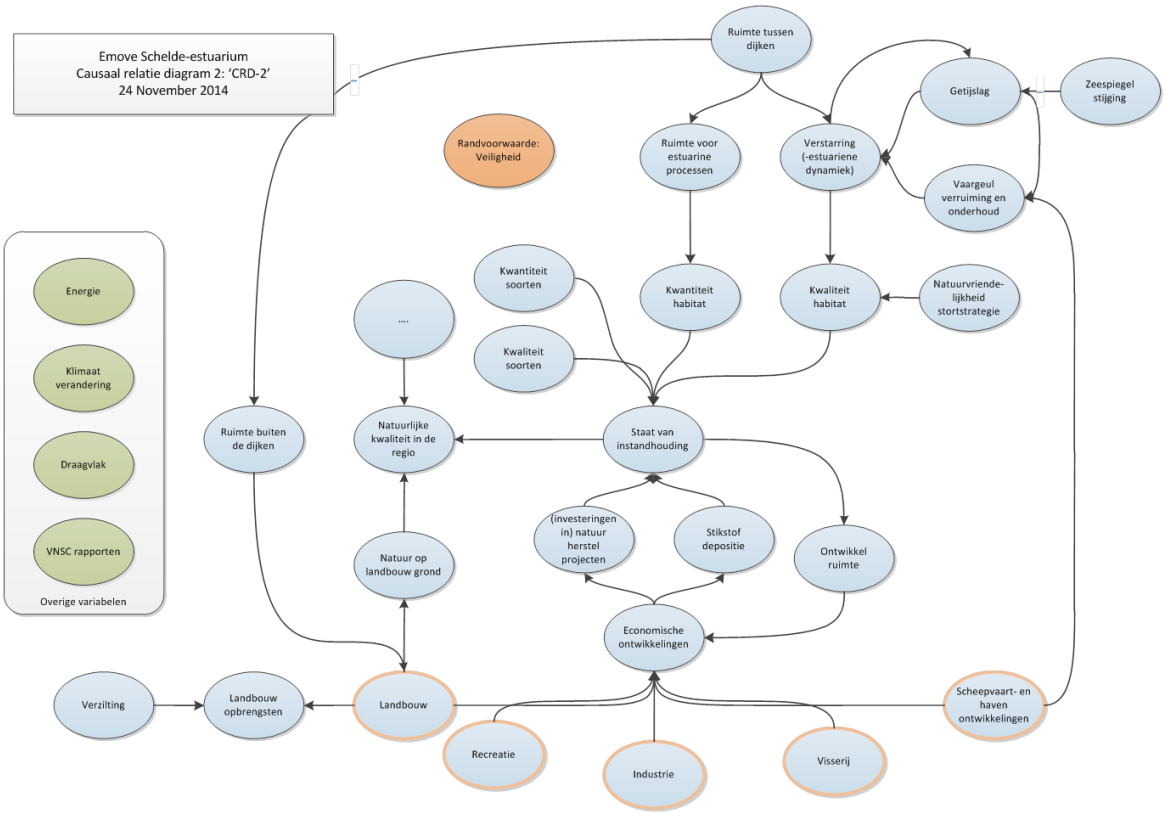


Figure 5 Causal diagram for the Schelde (in Dutch)

During the second part of the workshop we showed the stakeholders the list of ideas / business-cases they wrote down the first workshop. After that we gave them the opportunity to change or add to this list. This was also necessary because new stakeholders had joined the workshop. They needed an opportunity to give input / react on the existing ideas.

We continued by giving all participants three green and one yellow stickers, to let them vote. The green stickers were placed at projects they were most willing to put their time and effort in. The yellow sticker could be placed on the project idea that they felt to be 'not such a good idea'. After the vote we discussed which initiatives had been selected and why people voted for them.

Finally we wanted to let the stakeholders take up the ideas/initiatives that they came up with themselves. This was a crucial moment, as they would make the step from stakeholder to active shareholder. For this reason we gave instructions for the next step and asked the stakeholders who wanted to go on with one of the projects to take these instructions and invite others to form a coalition. We also stated that if they picked up the instructions they could join us for an additional working session. Eventually 5 groups picked up the instructions resulting in in five initiatives/business-cases

Initiative /Business-case	Stakeholders involved
1) 'Growing land': bringing back dynamics into agricultural polder areas and thus heightening the land, and creating nature areas. At the same creating agricultural polders from nature areas.	Agriculture Nature organisations Harbours Recreation Government (waterways)
2) Creating hydro morphologic measures that contribute to the strengthening of eco system services concerning nature, accessibility and safety in the Schelde Estuary.	Government (waterways) Harbours Civil organisations Research
3) Creating a cross boundary nature park including recreational functions.	Municipalities Regional government Nature organisations Agricultural organisations Local recreation entrepreneurs
4) The support engine for the Schelderaad: more a process business case in which the newly formed Schelderaad would be supported by a – activity and agenda setting based – help team.	Governement (waterways) Nature organisations Schelderaad members
5) Silt agriculture: growing salt resistant/allowing crops on areas that were influenced by salt intrusion.	Agriculture Nature Municipalities

This result was reached after only two workshops.

Workshop 3: Working on the business cases

As we felt that the newly formed coalitions needed help in the start-up phase, we offered them the opportunity for a work-session that was facilitated by the project team. It was a facultative extra opportunity for their business cases . During this extra session the people worked as a coalition on their initiative. We used the implementation canvas [figure below] for this working session. The canvas was used because it quickly brings together important challenges when it gets to the implementation of measures or the realisation of business cases.

Implementation Canvas

Proposed Measure: …

Organisation:

1. Problem 1A What is *my* problem? 2. Solution 2A How is the proposed measure contributing to solving *my* problem? 2B Which (side-) effects (+/-) does the solution have?	3. Opportunities … 3A How can it contribute to the organizational mission? 3B How can you improve the multi-functionality? 3C It it possible to link up with planned investments in the region? 4. Threats 4A What are the most important threats?	5. Proposition to improve measure	6. Benefits 6A What are the revenues? 6B Which societal benefits are generated?	7. Costs 7A What are the costs of the investments? 7B What are the costs of maintenance? 7C What are the cost of personnel?
8. Stakeholders 8A Which stakeholders benefit? 8B Which stakeholders are possibly against?	9. Partners 9A Which persons do you need within your own organisation for implementation (name + dept.)? 9B Which persons do you need outside your organisation for implementation (name + dept.)?		11. Activities 11A What should your organisation do to implement the measure? 11B What should other organisations do?	12. Instruments 12A What kind of (policy-) instruments could you apply? 12B How do they contribute to the Implementation of the measure?
10. Relationships 10A Are there any sensitive issues between stakeholders that compromises implementation??			13. Agenda 13A What are for you important preconditions for implementation? 13B Which agreements do you want to make with whom? 13C. What are critical decision moments?	14. Monitoring 14A What do you want to monitor? 14B What will happen with the measurements?

Workshop 4: Presenting the results and taking a step.

In the first part of the final workshop we asked the coalitions to present their ideas and work together with the other stakeholders that were present. Objective was to add to the format of the implementation canvas: improving and filling in the blanks.

In the second part of the workshop we brought back the joint fact-finding results by presenting a ‘narrative’ of the Schelde, where we also included the pictures that the stakeholders took with them for the first workshop.

Because we wanted to make sure that the business cases did not stop after the last workshop we also made sure that the business cases were presented to the chairman of the Schelderaad. Also we ensured that the business cases would be on the agenda of the next meeting of the Schelderaad, with a request for an official reaction towards the Flemish-Dutch Schelde Committee. By doing so, we wanted to safeguard that the business cases would also be brought to the next step of decision-making.

2.4 How did you try to get the stakeholders to become shareholders of the business idea?

As described above we tried to get the stakeholders to become shareholders through a number of ways:

1. To start with the energy/enthusiasm of the stakeholders instead of a large problem or with a strategy that the stakeholders could react upon. We put them a bit off their feet – and also got a lot of questions from the stakeholders like ‘where are the solutions we should react on’.
2. Give the stakeholders the opportunity to bring in the issues that they thought were important for Sustainable Development of the Estuary. We did this in the interviews, but also in the first workshop, in small groups, letting them tell each other what was important for them: where did the Schelde help them?
3. By getting the stakeholders to actually put down their own ideas they also feel responsible for those ideas. They were also able to use the group dynamics to create a coalition.

4. Timing: in our case taking advantage of a 'window of opportunity': the fact that there was recently a new stakeholder platform in the Schelde, which was also looking for activities to undertake, helped us in the EMOVE project substantially. The stakeholders also felt an urgency to act after years of relative impasse.

What we learned from our approach was the following:

1. Working in very small groups takes a lot of effort, but does create a closely connected group. It also gives people who would otherwise not participate a chance to contribute.
2. We wanted to go too fast:
   a. When the ideas/business cases were on the table we pushed almost too hard for stakeholders to become shareholders. By doing so we almost crushed the process we so carefully built up.
   b. This also happened when the 'narrative off the Schelde' was presented in the last workshop. Such story was perceived very important within the project team to get a 'joint view on the estuary'. Such need was, however, hardly present at the stakeholders and they actually lost some of their positive energy, needing to listen to 'another story'. This did, however, not induce a risk of 'crushing the project'.
3. We did not go fast enough:
   a. We took too much time to 'broadcast' (one way information) during the second workshop to take the stakeholders to the next step. Although some useful input was collected, there was not so much possibility for input for the stakeholders.
4. We got people interested: when you've persuaded people to join the process and step into the workshops, they spend a lot of time in 'acquiring knowledge', 'meeting people' etc. They have implicitly committed themselves to an effort in 'becoming a team with the other workshop-members'. Hence, you start your process with an advantage. It is important to harvest this implicit positive attitude and make people leave every workshop with the feeling that 'it was really worth attending' and 'that there's something in it for them'. To do so, it is important to make sure that the workshop has elements in it that 'fit' with the participants.

2.5 Develop an implementation strategy for the different business cases

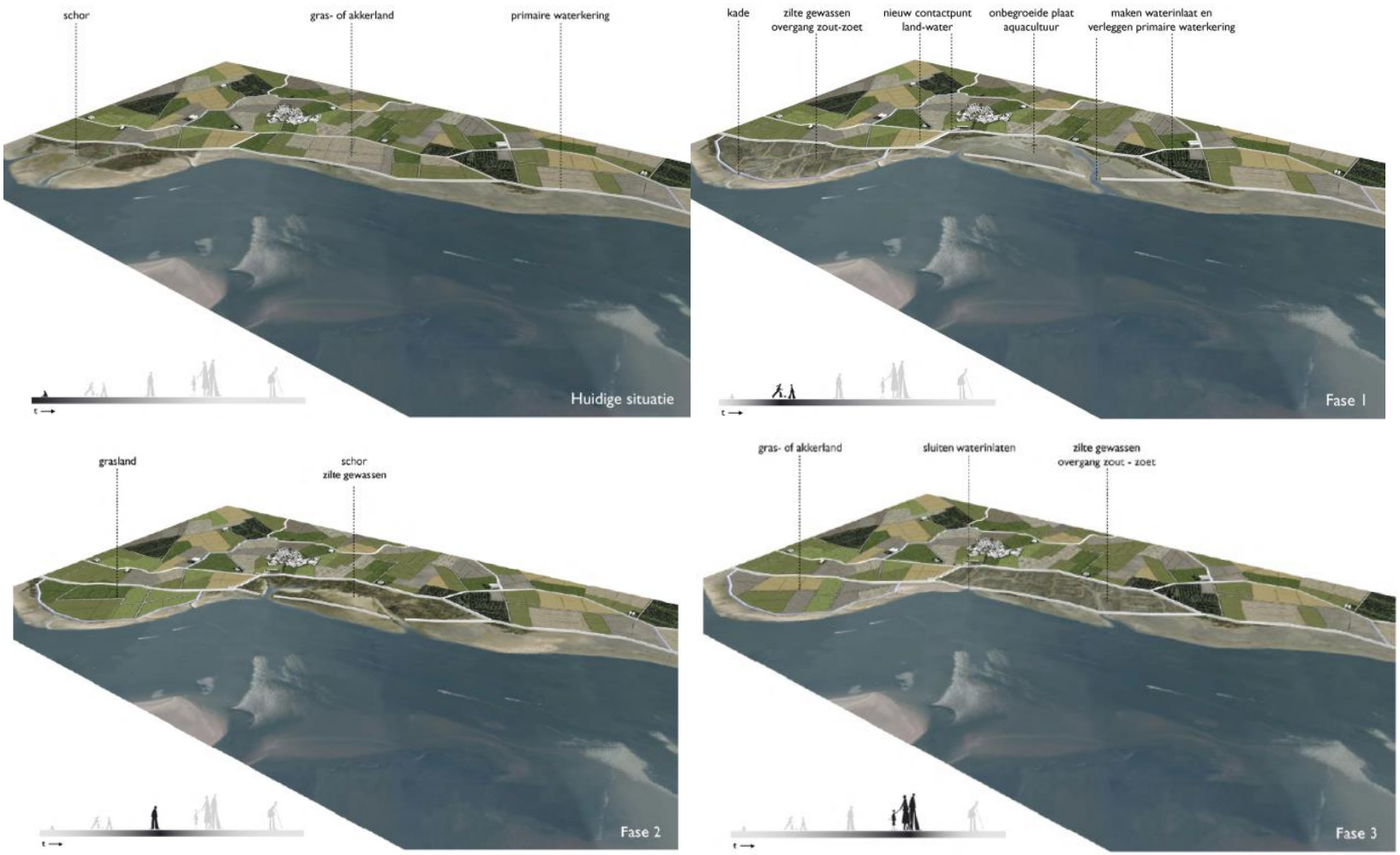
Although there were five project ideas. We want to use one of the cases (Growing Land) as an example. We describe below how we designed an implementation strategy for this business case

2.6 Problem

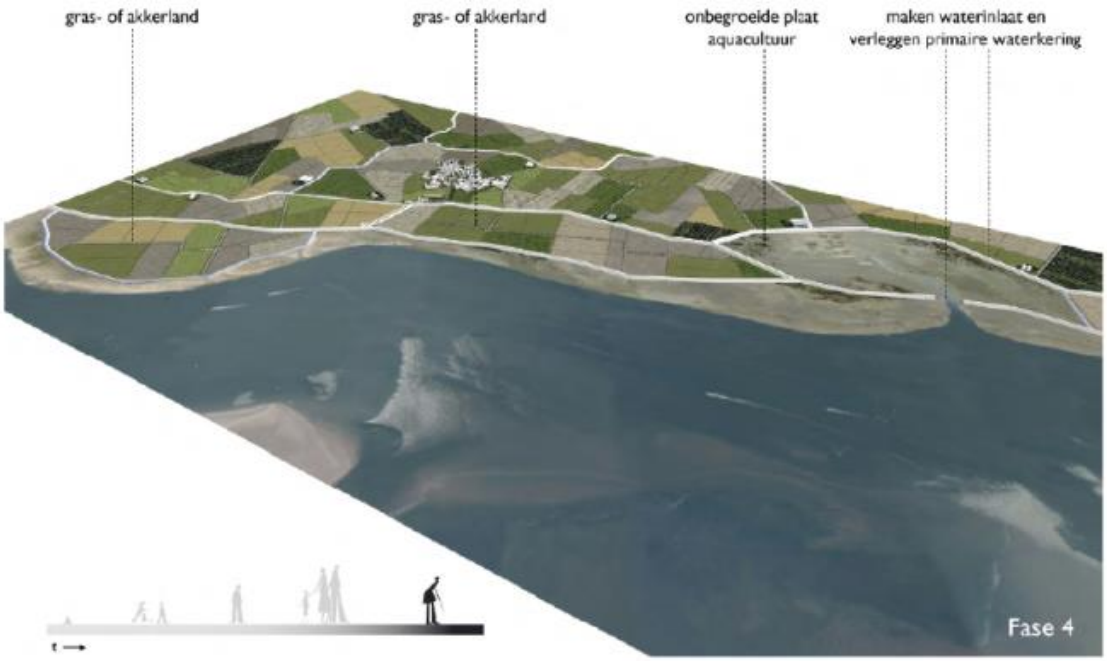
The main problem that the business case 'Growing Land' addresses is the decreasing sustainability and robustness of the physical system because the estuary is 'fixed' between its embankments. This has long term negative impacts on the functions of water management, agriculture, nature and safety and recreation and other forms of land use. The fact that agricultural land is losing its fertility due to the disruption of estuarine dynamics is also part of this.

2.7 Solving the problem and side effects

The concept of 'Growing Land' contributes to solving these issues by bringing back – in a controlled way - the estuarine dynamics in a zone that also includes land 'behind' the levees. This would – possibly and for example - mean that the polders lying on the edge of water and land would become part of the estuarine dynamics for 50-100 years and during this period will 'grow' because of sedimentation processes with about 50 – 100cm of clay soil and after that can be used again for a long period of time as agricultural land. During the 50-100 years that the land is exposed to the estuariene dynamics they could become nature areas with fitting other (secondary) spatial functions, such as salt agriculture, aquacultures and recreation. Such a (higher) area of growing land on the edge of water and land would make the land less vulnerable for salt water intrusion and flooding. In this way, nature could be used as a buffer against flooding. Furthermore this could also be used to create space for the harbours, as harbour land could also be used as nature compensation. For a visual explanation of the concept based on earlier studies (http://library.wur.nl/WebQuery/hydrotheek/2035310) see the next page



The visuals on this and the following pages are from the following document: http://library.wur.nl/WebQuery/hydrotheek/2035310



2.8 Which positive and negative (side-) effects does the business case have?

The most challenging negative side effect is that there is always a lack of space in the Netherlands. This causes conflicts between functions like nature, agriculture, living, recreation etc.

Positive side effects are that not only safety, agriculture and nature would benefit in the long term, but also recreation and furthermore fishery (mussels and fish) could benefit from the nursery function that the growing land could have.

2.9 Opportunities (also see WP 3 report)

The following strengths and opportunities have been identified – although they are not only fitting for the Growing land case, and can also be applied to other business cases.

Strong coalition: The Port of Antwerp wants to cooperate on knowledge, finances and planning. Furthermore this would also be an acknowledgement of the available knowledge at harbour organisations. Recreation is used as an opportunity in relation to agriculture. By investing together in the creation of a plan by the Schelde (stakeholder) Council the legitimacy is increased.

Setting clocks in motion: There is a strong wish for follow-up projects on ecology and the physical system after the discussion on the HedwigePolder, in order to get clarification on the state of the systems concerning N2000 and on realistic goals in agreement with the EU. The reason for this is also that a healthy system also has ‘space for development’. Furthermore ‘growing land by shifting reclamation’ brings estuary management back to the natural processes of land-creation that had been going on for ages.

Looking over the barriers and connect land and water: Involve the reclaimed land of the estuary on the other side of the embankments. Also the values for local economy and landscape of agriculture are taken into account: added values in derived products and also other ecosystem services.
Furthermore the project could be an example of working with nature - showcase and could show that Flanders and the Netherlands are able to deal with complex long term challenges, not only by building dikes and levees, but by building with nature.

2.10 Threats

The most important threats of the business case are:

- New solutions give changes that lead to fear and uncertainty among inhabitants and politicians, even though 'business as usual' may induce even larger changes in the long run. Therefor support of the people and their representatives of Zeeland is necessary, as the approach of growingland means a transition in thinking of keeping the Dynamics of the estuary out, and now letting them in again. The challenge is to prevent a situation of distrust, for this it is very important to make the historical connection (how did Zeeland come to into existence and how growingland brings back history).
- Legal and policy guidelines: just as fashion and architecture, we also see that policy guidelines are connected to a certain -stream- of thought which changes through time, in a way guidelines use available information/knowledge of a certain time to be constructed, and are thus confined by bounded rationally (Simon, 1955): it is impossible to know everything. Very often legal standards and concepts are not always flexible, which could mean that they become goals rather than means to an end. For example the inflexibility of 'Natura 2000' was regularly mentioned during the workshops. The same goes for other legislation on flood risk management, especially the Dutch legislation is used very often in a very strict way.
- The time scale: This isactually very closely linked to the previous point, and has been proved by economic psychology theory (amongst others Nobel prize Winner Kahneman, 2011): it is very difficult for people to realize long term planning. For growing land this is a threat as first changes are needed to be made in the land to – over 50-100 years – receive the revenues that were anticipated. This is a very different timescale from what was done in the past.

2.11 Proposition to improve the measure/solution

Although no clear propositions to improve the measure were made the following issues were raised that need to be dealt with concerning Growing Land.

- Knowledge of the process of 'Growing Land' (amounts and method of water inlets , sediment load in the water); where are the suitable areas ?;
- Knowledge of the soils that remain and how suitable these are for agriculture (composition and can it be optimized?);
- Understand how the areas can be safely managed with levees and passages that are periodically open and closed; what are the costs?.
- Knowledge about the natural history of these areas and how they can contribute to optimal growing of the land;
- Knowledge about the constraints and opportunities for development of saltwater crops and aquaculture;
- How to start with the 'poldering' and 'depoldering' process;
- How to deal with increased saltwater intrusion during the changing process;
- Knowledge about the process to allow agriculture to start when switching from nature to agriculture.
- Knowledge of the necessary measures and costs to reclaim an area, and examine who would finance such costs, perhaps using a cost-benefit analyses;
- Legal knowledge of controlling the changes in destinations / functions (also due to European regulations);
- Consider whether leasing land instead of buying land is more fitting for the area that is temporarily attached to the estuary to ' grow';
- How to provide the current inhabitants of the potential growing land with alternatives that are 'fitting';

2.12 Benefits and Costs

As the case is not yet in place and questions have to be answered it is not clear what the revenues and costs will be. For a start-up of the project the costs are estimated on 100 KEuro. This would create a feasibility study on the concept. This money would be evenly invested in research and communication. The social benefits and the costs of investment, maintenance and personnel will be taken into consideration.

2.13 Stakeholders

There are a number of stakeholders that could benefit from growing land, but also stakeholders that perceive possible negative sides. They are displayed in the table below.

Stakeholder	Impact	Critical position
National Government (execution of Schelde-treaties)	• Possibility for nature compensation	• Flood risk safety might be a point of discussion, because of the need to change the primary levees. • Trade-off between nature and agriculture has a long term focus, this might not fit with political/decision-making cycles.
Regional government	• Possibilities for economic development and recreation • Possibilities for the compliance with nature development goals	• Agricultural interests and cultural aspects might cause a critical position.
Local government	• Possibilities for economic development and recreation • Possibilities for spatial development/housing	• Difficulty with spatial development/housing
Shipping / Transport	• More space for harbour activities or compensation measures • The space for disposal of sediment may increase	• …
Water boards (Coastal protection)	• Alternative for foreshore protection.	• Investments in new levees.
Nature conservation	• Changes in habitats with their natural biodiversity, • Increase in dynamic natural habitats. • Increase of species and habitats.	• Changes in habitats with their natural biodiversity. • Increase of species and habitats
Industry	• Compensation measures for spatial claims.	• reduced expansion possibilities when ‘state’ in terms of N2000 is ‘not good’
Agriculture	• More fertile agricultural land • Less saltwater intrusion.	• Change of function: roots with the area/change of the landscape. • Initial decrease in agricultural land.
Tourism, recreation	• Increase in recreation possibilities	• …..

2.14 Partners

To be able to make the business case work, the following partners and resources are needed. We make a difference in partners that are needed for the feasibility study and the partners that are also needed when a pilot-area needs to be found.

Partners	Resources	Conditions
Individual farmers and agricultural interest groups	• Landowners/property rights • Lobby resources • Knowledge about agriculture/salt and freshwater crops. • (Access to) Financial resources	• Compensation • Timing • Property rights • ….
Individual land- and property owners	• Property rights • (Access to) Financial resources	• Compensation • Timing • Property rights • ….
Nature conservation	• Property rights • Lobby resources • Knowledge • Increase of species and habitats. • (Access to)financial resources	• No reduction of nature areal • ….
Tourism, recreation	• Property rights • Financial resources • Lobby resources	•
Shipping / Transport	• More space for harbour activities or compensation measures • The space for disposal of sediment may increase	• No negative consequences for navigational capacity of the Schelde.
Water boards (Coastal protection)	• Legislative power • Asset management	• No endangering of flood risk safety standards.

2.15 Relationships

There have been some very fierce discussions between native (often agricultural) inhabitants of Zeeland and the Nature conservation organisations. This relation is improved by working together (being nearer to each other in the Schelderaad) and a mutual feeling that there is an urgency to do so. The subject of ‘depoldering’ (in dutch: ontpoldering) is, however, still very sensitive

2.16 Activities

With the building blocks described above it is important that, when the step to the feasibility study will be made, enough support has been established. This means that not only the representatives have been taking part in the ongoing discussions that are triggered by EMOVE, but also other members of interest groups. In this way a team of ambassadors that can work on the feasibility study together is established, as well as a lobby network. With this objective extra meetings will be organised, to work together on the proposal of the 'growing land'. These meetings have two goals: improve the proposal and make an inventory of questions that could be asked on the subject of 'growing land'. These questions can be used in two ways:

1. Building blocks for communication: the questions posed will also be asked by stakeholders.
2. Building blocks to write an project proposal as input for the feasibility study: the questions need to be answered, within a certain timeframe/limited resources

2.17 Instruments/Resources

For the feasibility study the most important thing are resources (time, attention, budget), as the feasibility study will probably be mainly on the drawing board. This means that mainly time, lobby resources and perhaps some financial resources (to hire communication experts) will be required from the partners. It is very important to tap into the resources – including the resources that are not monetary in nature – from the start of the business case. Very often financial resources are perceived as limiting, however, some resources such as local knowledge and networks can be more important.

2.18 Agenda

When it comes to the agenda, it is first importance that preconditions for implementation are met. Concerning the feasibility study this would entail that there is legitimacy in exploring the options of the 'growing land' business case. This can be verified by asking the question whether the realisation of 'growing land' is a case of 'being willing' or 'being able'?
The most important agreement that has to be made is between the landowners (agricultural or not) and the government organisations that are responsible for the flood risk management. The critical decision moments still have to be established.

2.19 Monitoring

Monitoring is very important for 'growing land' because the initiative is aimed at the very long time scales. This means that it is a challenge to keep the initiative concept in 'the public eye'. Monitoring can create this, especially when it is done not only by experts, but also a form of participatory monitoring is created. The main reason for this is that monitoring does not have the function of accountability, but instead of learning. It is very important for the legitimacy of the concept to make sure that learning is safeguarded. Therefore the measurements should be used also as input for the policy making process.

3 Business Case Weser

3.1 Introduction

The German section of the EMOVE 'Estuaries on the move' project focused on the identification of responses (i.e. business cases) for counteracting of salt incursion in the Weser estuary (see EMOVE Project 2015).

A regional consortium comprising representatives from different societal sectors (administration, agriculture, nature conservation, water management, researchers and others) identified the issue of water management as being both the most threatened and the most fundamental domain in terms of salt incursion in the Weser estuary. These representatives jointly identified current problems and analysed future challenges regarding water management in the region adjacent to the river Weser.

Based on regional workshop held in September 2014 the attending representatives agreed upon a plethora of responses (see EMOVE Project 2015).

This report shortly outlines a subsequent business case for the drainage boards of the northern part of the county Wesermarsch on how to manage temporarily shortages of fresh water in the area. This business case describes a favoured response out of the different responses identified and listed in the interrogation process of the German section in the EMOVE project.

This report is a contribution to Work Package 4 of the EMOVE project developing a European Governance Vision for European estuaries. This report outlines the selected business case according to the CANVAS approach (van der Brugge & Ellen 2013).

This report is written from the perspective of the farmers' association and water boards in the county of Wesermarsch; and is based on the discussions within the EMOVE consortium (December 2014).

3.2 Focus Region – County of Wesermarsch

An introducing description of the hydrological and geomorphological situation of the Weser estuary can be found e.g. in Lange et al. (2008). Furthermore, in the framework of the Water Framework Directive an Integrated Management Plan has been developed for the Weser, see FGG Weser (2009). In Figure 1 the estuarine zone are shown for the Weser estuary up-stream from Bremen.

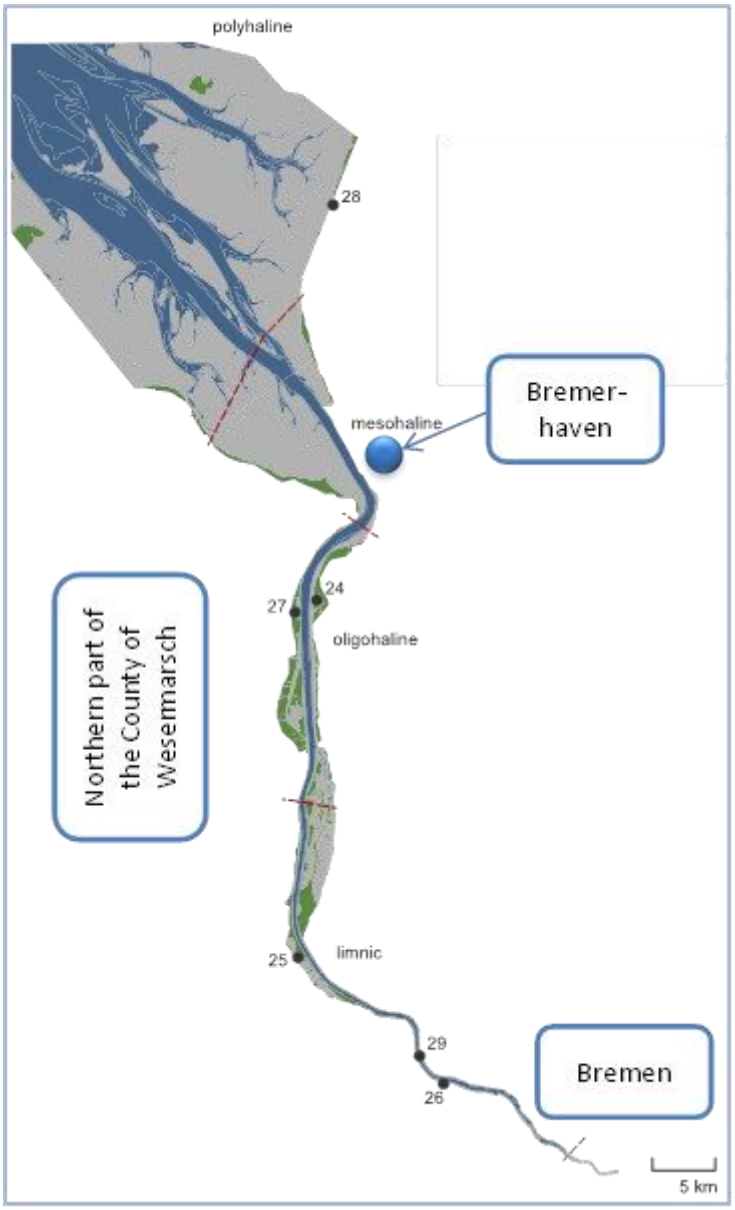


Figure 1: The Weser estuary from Bremen to Bremerhaven. The map is showing the different estuarine zones: limnic, oligo-haline, meso-haline and polyhaline (classification according to the EU Interreg IVB project TIDE, source: HPA et al. (2013)

The pilot region for the business case within the EMOVE project is the northern part of the county Wesermarsch (Figure 2), i.e. the municipalities Butjadingen (~129 km²) and Stadland (~113 km²). Within the county of Wesermarsch more than 91,000 citizens live in 9 local communities (3 small cities and 6 rural municipalities, see LSKN, 2011). The region comprises two types of land-marine transition zones (i) the Weser estuary and (ii) the Wadden Sea with the unique Jade Bay. Surrounded by the North Sea and the river Weser, especially in the northern part, and with a coastline of 160 km the Wesermarsch is characterised by water.

Two-thirds of the whole county area (822 km^2) are situated below mean high tide water level, which requires coastal protection by dikes and a comprehensive drainage system consisting of ditches, canals and pumping stations to enable living and working in the county.

Nearly 80% of the Wesermarsch is characterised by agricultural use, besides tourism and harbour industry it is one of the most important economic sectors in this region. Due to the soil conditions, marsh and peat soils occur predominantly, 90% of the agricultural land is under grassland farming (meat and milk production, see LSKN, 21010).

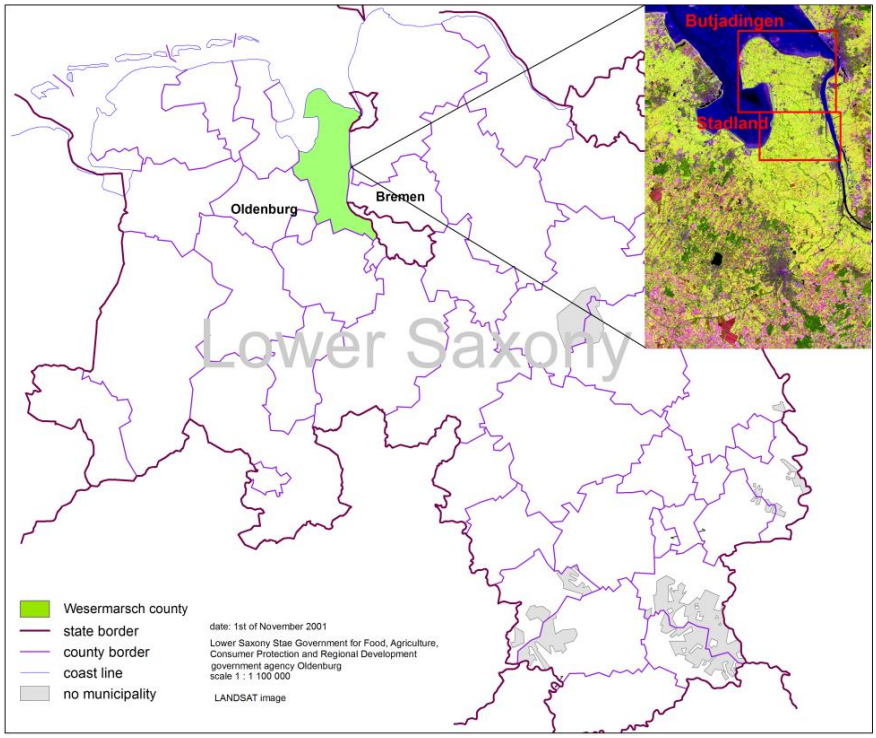


Figure 2: Location of the Wesermarsch county and the business case areas Butjadingen and Stadland

3.3 Problem Description

Over centuries water management in the region Wesermarsch was affected by alternating flooding events and land reclamation, shaping the current coastline. Today's coastline has been established by building dikes over the last centuries while flood protection by dwelling mounds became less necessary simultaneously (e.g. Kramer 1992a). Dikes function as an artificial barrier between land and sea, which makes a natural water exchange impossible.

The importance of the protection of people against storm surges, however, requires an efficient drainage and watering systems consisting of ditches, canals and pumping stations (e.g. Kramer 1992b). Accordingly, the Wesermarsch region is drained during winter time to discharge the surplus of rainwater and watered in the late summer months to water the fields and cattle by ditches.

Water boards are responsible for the maintenance of this water management system in the Wesermarsch. The drainage board's ´Stadlander Sielacht´, 'Braker Sielacht' and ´Entwässerungsverband Butjadingen´ are three of them (Figure 3).

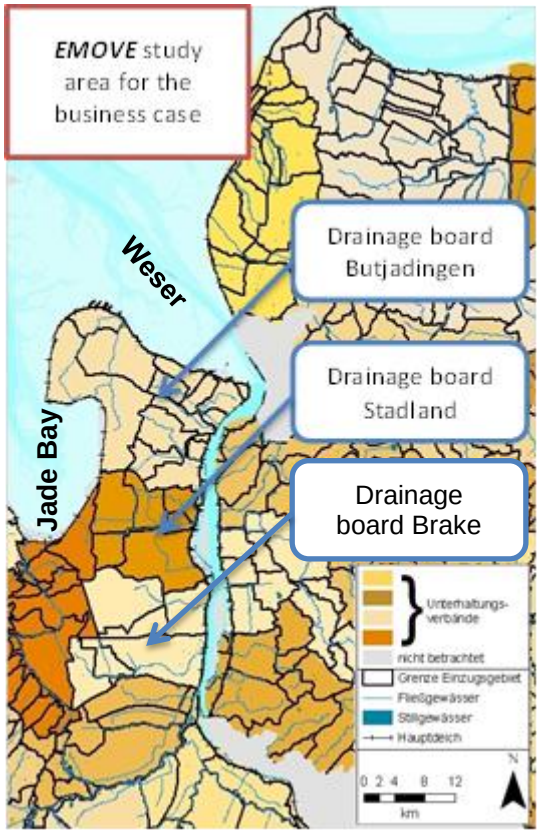


Figure 3: Study area of the German EMOVE project. Source: modified after Ahlhorn et al. (2010)

They comprise 11,600 ha and 23,200 ha, respectively. The area of the drainage board Stadland is drained by ditches via the Strohauser canal and discharges the water directly into the river Weser. Pumping stations in the area of the water board are necessary to drain low lying areas. In Butjadingen six tidal gates are used to drain the area. The water is discharged into the North Sea, the Jade Bay, and the river Weser (Figure 4). Depending on the water level, the water has to be pumped or can be drained freely into in the coastal water bodies. The watering of the agricultural land in both regions is performed by extracting fresh water from the river Weser.

Over the last decades problems regarding the drainage capacity in winter time and the quality of fresh water in late summer occurred (see e.g. Ahlhorn et al. 2010; Umlauf et al. 2011; Ahlhorn et al. 2011; Bormann et al. 2012). More often the drainage system has not been sufficient enough to store and discharge the amount of rainwater. In summer time the salt concentration in the Weser exceeds the threshold for watering due to an upstream movement of the salt and fresh water frontier, especially caused by deepening of the Weser and an increasing sea level (Kunz 1995; Lange et al. 2008).

In future, it is assumed that the water management in the Wesermarsch has to cope with an intensification of the present problems (Bormann et al. 2009). Climate change simulations for the Wesermarsch region project an increase of water scarcity in summer, an increase of runoff formation in winter, and a rising sea level. Consequences may presumably be a longer watering period in summer and higher drainage demand in winter with concurrently less discharge ability due to sea level rise.

The deepening of the river Weser, accompanied by a further upstream salt incursion of the river water, might ***reduce the availability of fresh water***. Consequently, the watering and drainage system has to be adapted and alternative solutions to solve these problems have to be discussed.

Different sectors are influenced by changes in water management such as agriculture, nature conservation, and tourism, feasible measurements and activities have been discussed with relevant actors within the German part of the EMOVE project to develop a comprehensive list of responses.

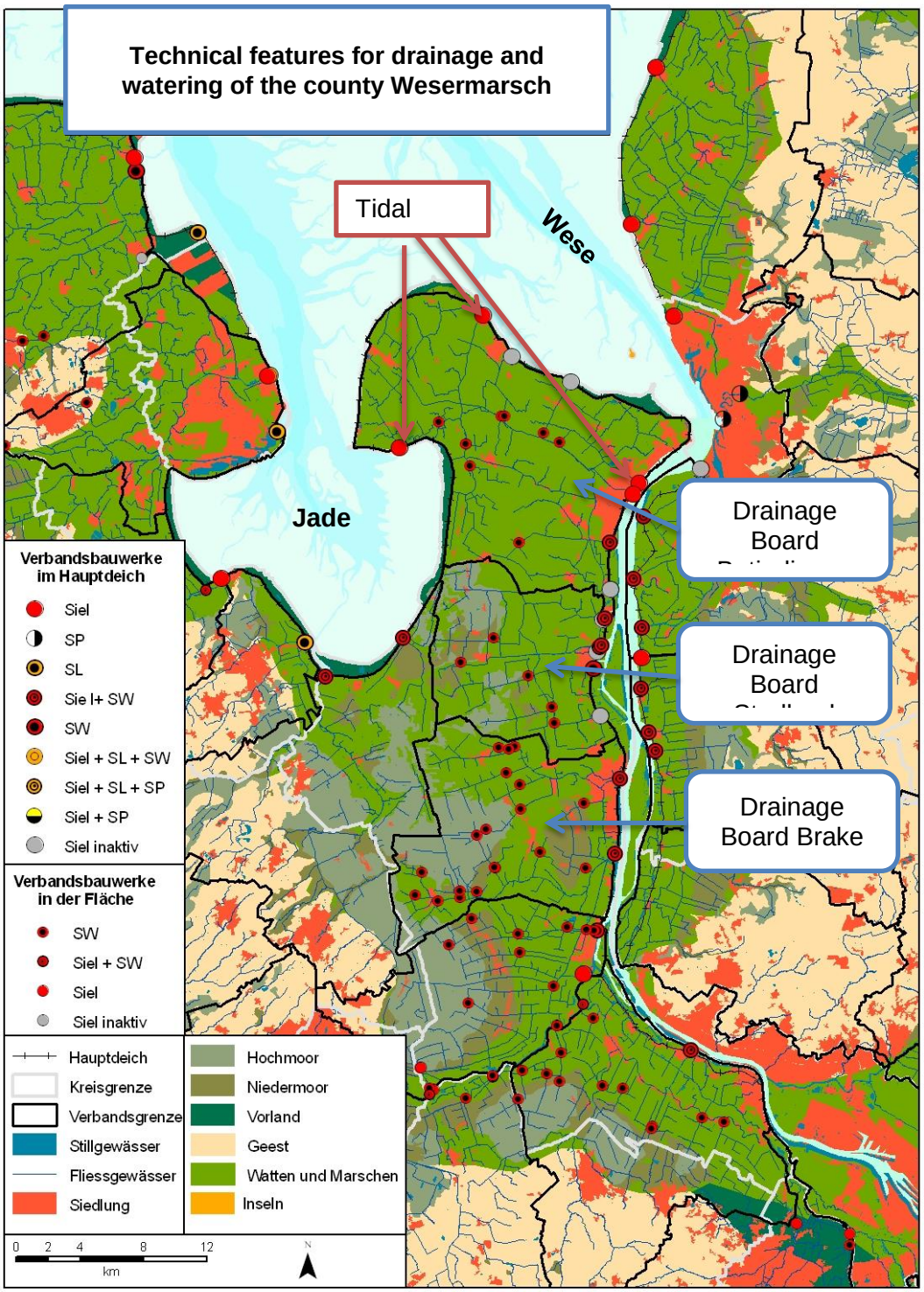


Figure 4: This map shows the water boards and the technical features to ensure the drainage and watering of the northern part of the county Wesermarsch. Source: modified after Ahlhorn et al. (2010)

3.4 Solution Options

Based on the results of the EU Interreg IVB project “Climate Proof Areas (CPA)” in **Error! Reference source not found.** solution ideas jointly developed by the regional forum Wesermarsch are shown. The map shows a collection of different ideas which are aiming at solving the identified problems and challenges in the Wesermarsch. These solution ideas do not reflect a joint consensus between participants of the regional forum. Some of the ideas have to be discussed in more detail between participants because the analyses of risks and benefits of each idea are needed.

Based on these results in the EMOVE project an investigation was started to enhance the list of possible solution ideas for the watering problem in the county of Wesermarsch. In the context of the EMOVE project this investigation has been conducted by applying the DPSIR approach. According to the DPSIR approach the identified solution ideas were named responses. The outcome of the investigation of Work Package 3 within the EMOVE project and the entire list of responses can be found in EMOVE Project (2015).

The main focus to improve and ensure watering and drainage is on technical solutions. One solution could be the extension of the Butjadinger canal using existing watercourses (blue line). The water could be stored, distributed, and transported over a longer distance and could be available for a wider area for watering purposes.

It can be drawn from the map of the CPA project that these measures would affect different drainage boards, which supports the idea to re-organise the watering and drainage system across the northern drainage boards and to have transboundary cooperation between these boards. In the meantime, a joint venture has been established between the three drainage boards of Butjadingen, Stadland and Brake (Figure 3) called “Planungsverband Wesermarsch” (Planning Association Wesermarsch).

To guarantee the livestock drinking water supply in summer time the existing drinking water system could be adjusted to the increasing demand (black ramified lines). This means, using high quality water to feed the cattle and increasing rates of drinking water supplied by the supply rate of the water works adjacent to the south western parts of the Wesermarsch. A combination with water storage in winter time in reservoirs, for example constructed close to the Beckumer Siel (orange box in the east), might be a possible solution for having enough water in summer.

Associated with the currently planned fairway deepening of the Weser is an avoidance solution for the northern drainage boards in the Wesermarsch. This avoidance solution comprises an improved steering of the watering features and the heightening of the dikes around the Butjadingen canal which is feeding the fresh water into the drainage board areas.

The adaptation of the water management system in the Wesermarsch region to climate-induced changes should aim in an effective and efficient watering and drainage system. To preserve the characteristics of the landscape as formulated in the development targets for the Wesermarsch region (see Ahlhorn et al. 2011), the development of these possibilities have to be intimately connected with the future use of the rural landscape and should not have a negative influence on the environment.

Finally, this report concentrated on two solution options as follows:

a) Getting fresh water out of the Weser more upstream in the southern part of the county of Wesermarsch: Master Plan Wesermarsch

b) Implementing the avoidance solution after the final approval of the currently planned fairway deepening of the Weser

As the second solution option is going to be implemented when the fairway deepening has been approved, the preliminary most promising solution option for the watering problem seems to the Master Plan Wesermarsch.

In the course of this report, the Master Plan Wesermarsch is the favoured business case for the EMOVE Work Package 4.

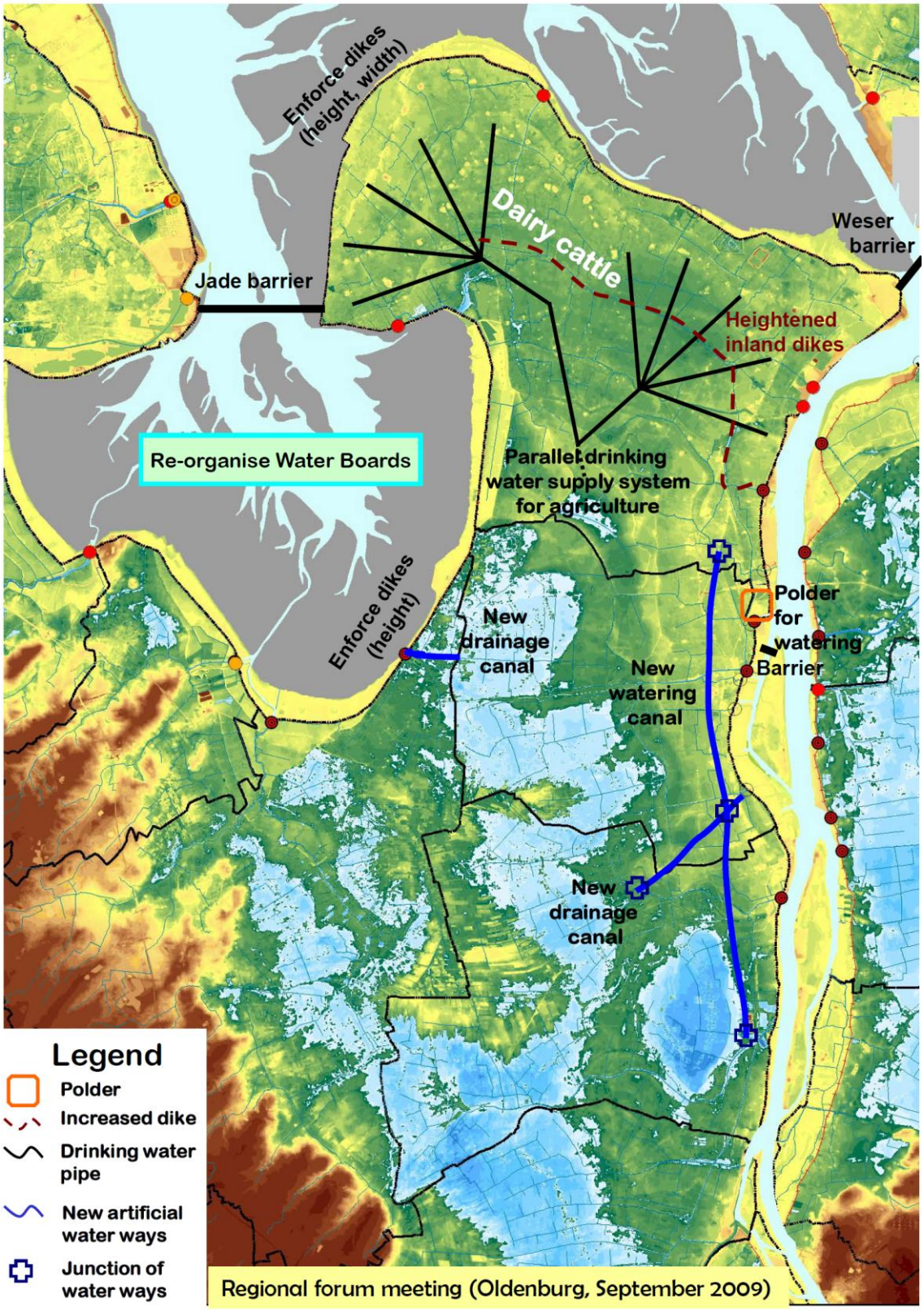


Figure 5: Sketch of solution ideas collected by the regional forum Wesermarsch during the participation process within the framework of the EU Interreg IVB project Climate Proof Areas. Source: modified after Ahlhorn et al. (2011)

3.5 Opportunities

The original idea of the Master Plan Wesermarsch was to improve the watering and the drainage system of the northern part of the Wesermarsch.
The envisaged improvement should be benefiting for two major types of land use water management and agriculture. The agriculture sector is the main driver for the improvement of the watering system. The implementation of the Master Plan Wesermarsch should provide different positive effects:

- Getting fresh water into the agricultural used areas of the drainage boards of Butjadingen and Stadland (and to some extent for Brake)
- Enabling a continuously flushing of the ditches and canals to avoid standing water bodies (deterioration of the water quality by e.g. private sewage features)
- Maintenance of the existing ecological status of the ditches and canals with fresh (respectively brackish) water species for both flora and fauna
- Preservation of the existing NATURA 2000 sites in the county of Wesermarsch
- Preservation of the existing cultural landscape shaped by men in the last centuries

The implementation of the Master Plan Wesermarsch will entirely contribute to the mission of the drainage boards. Nevertheless, it is mainly concentrated on the watering item which is a special task of these drainage boards in northern part of Lower Saxony.

3.6 Threats

The current version of the Master Plan Wesermarsch has mainly been developed by representatives of the agricultural sector, but the original idea is much older.[4] The water boards adopted this solution option, because, in the first draft, it provides benefits for the drainage tasks of these boards. Politics took the idea of the Master Plan Wesermarsch over and published information on funding issues via public press. It has been written that approx. 50 Mio. € will be available for the implementation of the Master Plan Wesermarsch.

The main threats for the implementation of the selected business case are as follows:

- On political level the avoidance solution and the Master Plan Wesermarsch are closely connected, although these options have been separately developed. The avoidance solution is linked to the current planned fairway deepening and, therefore, has after the approval a legal status. The current planned fairway deepening of the Weser is at the court and politics might use the situation to ***postpone or delay the implementation process*** until a judgement has been rendered
- The established Planning Association Wesermarsch and the representatives of the agricultural sector might fear that the active attendance in a participation process of the EMOVE project ***hamper or even freeze the funding*** of the Master Plan process.

[4] *The original idea of getting fresh water of an adequate quality from out the Weser is much older, e.g. Tenge (1912); Diesing (2008).*

- ***Main funding*** of the Master Plan Wesermarsch will be ***spread over three different levels and institutions***, i.e. Federal Waterway Administration and the Federal States Lower Saxony and Bremen. The Federal Water and Shipping Administration is responsible for the implementation of the fairway deepening in the Weser. The Federal States Lower Saxony and Bremen applied for the deepening to improve and maintain the accessibility of harbours.

3.7 Proposition to improve the measure

The proposition of improvements for the current situation of the Master Plan Wesermarsch could hardly been done, because not all information is available to get a clear picture of the status. Nevertheless, in line with the description of the problem and the proposed solution option the following improvements might help to get a step further within the implementation process.

- Develop an integrated long-term vision
- Broaden the scope of the current project, try to incorporate other sectors and types of land use
- Assess future boundary conditions, to be prepared for future developments so that the proposed solution has long-term perspective
- Develop an alternative solution together with the involved parties from out the area, e.g. enabling multiple purposes or/and get support by other parties
- Initiate a participatory integrated planning process to incorporate and merge the previous aspects
- Try to build new coalitions

3.8 Benefits

The benefits of the previously mentioned improvements might be as follows:

- If the Master Plan Wesermarsch is successfully implemented the Federal Water and Shipping Administration won't get further actions at the court for the next fairway deepening
- A successful implementation of the Master Plan Wesermarsch might lead to the prospect that farming can be as it was. Consequently, the local inhabitants might be pleased
- If future developments, especially regarding climate change, will be taken into account for the implementation, the region might be well adapted.

3.9 Costs

The costs for the implementation of the Master Plan Wesermarsch have been set by politics with 50 Mio. €. This amount of money has to be split up through the three institution mentioned in section 3.6.

Currently, it is not clear if this amount of money is only for the planning and implementation phase of the Master Plan Wesermarsch or if parts could also be saved for maintenance issues in the long-term.

The first draft of the Master Plan was much more expansive than expected. The necessary improvements to reduce the costs have been conducted by the Planning Association Wesermarsch within the last year.

In total, the Planning Association Wesermarsch has also to provide co-financing for implementation of the Master Plan Wesermarsch. Finally, the amount is not yet clear.

3.10 Stakeholders

This section should enumerate the stakeholders that have to be involved into an integrated planning process.

Currently, the participation process is based on the legal requirements of the planning approval process (German: Planfeststellungsverfahren). Organisations, institutions and public affected will have the chance to get informed about the planned fairway deepening within public hearings or the scoping meeting.

Regarding a participatory integrated planning process which is not based on legal requirements more stakeholders could be invited and engaged with the development of integrated solution options.

The entire list of stakeholders which have been approached and interviewed during the EMOVE project for the German study area could be found in EMOVE Project (2015). An overview of types of land use and their representative organisations or institutions are shown in Table *1*.

Type of Land Use	Organisation/Institution
Agriculture	Farmers Association
Harbour	Port Authority
Water Management	Drainage boards
Trade and Industry	Private companies
Nature Conservation	Non-governmental Organisations
Tourism	Leisure shipping
Sector of Administration	**Institution**
Agriculture	Chamber of Agriculture
Shipping	Federal Water and Shipping Administration, Project Groups for Fairway Deepening
Preservation of Landscape and Nature	Federal State of Lower Saxony
Coastal Protection and Nature Conservation	Federal State of Lower Saxony
Planning	Federal States of Lower Saxony and Bremen, County Administration of Wesermarsch and Cuxhaven

Table 1: Overview of the approached stakeholders within the German part of the EMOVE project

3.11 Partners

The question about the necessary partners to bring forward and to implement the Master Plan Wesermarsch are the responsible administrative bodies in Lower Saxony, i.e. the ministry of environment and the ministry of agriculture. Furthermore, it necessary to convince the Federal Water and Shipping Administration for the next steps of the implementation phase.

3.12 Relationships

If the process of implementation has been fully adjusted and is jointly agreed between all parties concerned, relevant relationships can be identified.

3.13 Activities

The Planning Association Wesermarsch and the Farmers Association should take actions to overcome the current deadlock. Several activities have been done so far, a technical and economic feasibility study and a laser scan survey of the area of concern. Recently, hydraulic calculations were made to determine the necessary technical features for the water course, e.g. to be able to bring the water to the northern part of the county Wesermarsch.

Although, there is a supporting political statement for the implementation of the Master Plan Wesermarsch some actions have to be taken (***the following items are neither comprehensive nor obligatory recommendations, they should be understood as compilation of ideas developed in a discussion process of the EMOVE project***):

- If the deadlock is lasting longer, than the Planning Association Wesermarsch should think of trying to convince the local politicians, as representatives of the county Wesermarsch in the Federal State parliament
- When the representatives of the Farmers Association as well as the Planning Association Wesermarsch are observing that the political support for the Master Plan Wesermarsch is not progressing, than they should think to increase the public perception
- Furthermore, it could be important to broaden the scope of the Master Plan Wesermarsch because focusing on engineering knowledge might be leading to shortcomings in other sectors or disciplines, e.g. taking into account the requirements of nature conservation or tourism development
- By broadening the scope of the Master Plan Wesermarsch new coalitions could be built and a wider basis could be founded (stakeholder -> shareholder)
- Try to convince the head of the county administration
- Try to convince the state secretary of the ministry of environment

3.14 Instruments

Nothing has been said about additional instruments to support or to accelerate the process.

3.15 Agenda - Stepwise Approach to Implementation

First steps towards an implementation plan have been made during the participation process of the CPA project, in the *regional forum* Wesermarsch (Ahlhorn et al. 2011). The informal process was organised in the sense of an participatory integrated assessment process.

In Table 2 the stepwise approach for the implementation of a selected solution option for the water management problems and challenges are drawn.
The first steps (Step 1 to Step 3) have been done within the *regional forum* of the CPA project from 2008 until 2011. It ended with the final conference of the *regional forum* where the solution ideas have been presented to a wider audience.

In parallel to the CPA participation process in the Wesermarsch, a process to find a solution for the problem of increasing salt incursion in watering water took place on the political level. The Federal State government of Lower Saxony has agreed on a resolution on how to solve this problem.

The resolution of the State government comprises two items: a financial frame work and an estimated timeline for the Master Plan Wesermarsch. The results of the technical and economic feasibility study have been published in October 2011 (Step 4 and 5).

Currently, Step 6 is due, because the ministry's budget planning for the next three years has been done. The currently adopted extent of the budget comprises expenses for further investigations, but not for implementation of the Master Plan Wesermarsch.

The steps 7 to 11 will follow as logical sequence of the final decision for the Master Plan Wesermarsch.

Step	Item	Status	Time horizon
1	Stakeholder Analysis	✓	**2008**
2	Informal discussion process on identifying most important problems in the county Wesermarsch	✓	**2008**
3	Joint collection of solutions ideas and documentation	✓	**2008 - 2011**
4	Selection of one or a set of options from out the solution ideas	✓	**2011**
5	Feasibility study to investigate the technical and economic feasibility of selected options	✓	**2011**
6	Finally calculate and adjust the expenses for the solution option and include them in the budget of the responsible ministry	To be done	**postponed**
7	Installation of an implementation group consisting of relevant stakeholders	To be done	**??**
8	Building consensus on the execution and management on the implementation phase	To be done	
9	Evaluation of the results of the feasibility study and decision on schemes and measures	To be done	
10	Implementation phase (including the consideration of mandatory regulations, e.g. SEA, EIA, soil functions, etc.)	To be done	**?? (duration approx. 10 yrs.)**
11	Monitoring of effectiveness and impacts of the selected option	To be done	**?? (start after completion)**

Table 2: Draft timeline for the implementation of the Master Plan Wesermarsch

3.16 Monitoring

If the Master Plan Wesermarsch has once been implemented the effectiveness and efficiency as well as impacts have to be monitored and compared against existing thresholds and legal Directives.

4 Göta älv and Nordre älv estuaries

4.1 Introduction

The North Sea Interreg project EMOVE (Estuaries on the move) aims to identify and describe what we know today, what we need more knowledge about and what needs to be developed to maintain available, flood safe, economically and ecologically sustainable estuaries. The project is based on results from pilot studies in the estuaries of Weser in Germany, Schelde in the Netherlands and Belgium and Göta älv/Nordre älv in Sweden.

Another major aim of the project has been to contribute to increased cooperation between stakeholders from relevant organisations. In the Göta älv and Nordre älv estuaries, stakeholders have been involved in the project through interviews and workshops. The stakeholders were identified based on contacts taken with the municipalities of the estuaries and the county administration board of the region, through the interviews and stakeholders already identified in the EU-project Arch. In order to increase the common knowledge and cooperation, the stakeholders have been involved in all parts of the project from the identification of drivers, pressures, state, impacts, and responses (DPSIR) to the identification of solutions.

The interviews and workshops were made with representatives from different societal sectors (e.g. administration, strategic municipal development, nature conservation, water management, researchers and others). The main issues identified through the interviews were increased sea level and flood risk due to climate change, and problems with management of storm water and other "additional" water due to increased precipitation caused by climate change.

Climate change is a complex issue, with long-term impacts on both the existing central parts of Göteborg in the Göta älv estuary and the Nordre älv estuary. In the two workshops, 4 September 2014 and 30 January 2015, solutions and potential business ideas for climate change with regard to sea level rise and increased precipitation were identified.

This report is a contribution to Work Package 4 of the EMOVE project that includes developing a European Governance Vision for European estuaries. This report outlines the selected business cases according to the CANVAS approach (van der Brugge & Ellen 2013) based on the results from the interviews and the two workshops of the Swedish pilot.

4.2 The estuaries of Göta älv and Nordre älv

The Göta älv and Nordre älv estuaries are located in west Sweden as indicated in Figure 1. The Göta älv (the Göta River) is the largest river in Sweden. It flows from Lake Vänern to the city of Göteborg where it reaches the sea. A few miles upstream of Göteborg, the river splits into two parts: Nordre älv (which takes two-thirds of the flow), and the Göta älv (which takes one third of the flow).

The Göta älv runs through the central parts of Göteborg. Kungälv municipality is located in the north and Göteborg is located in the south of the Nordre älv estuary, as can be seen Figure 1.

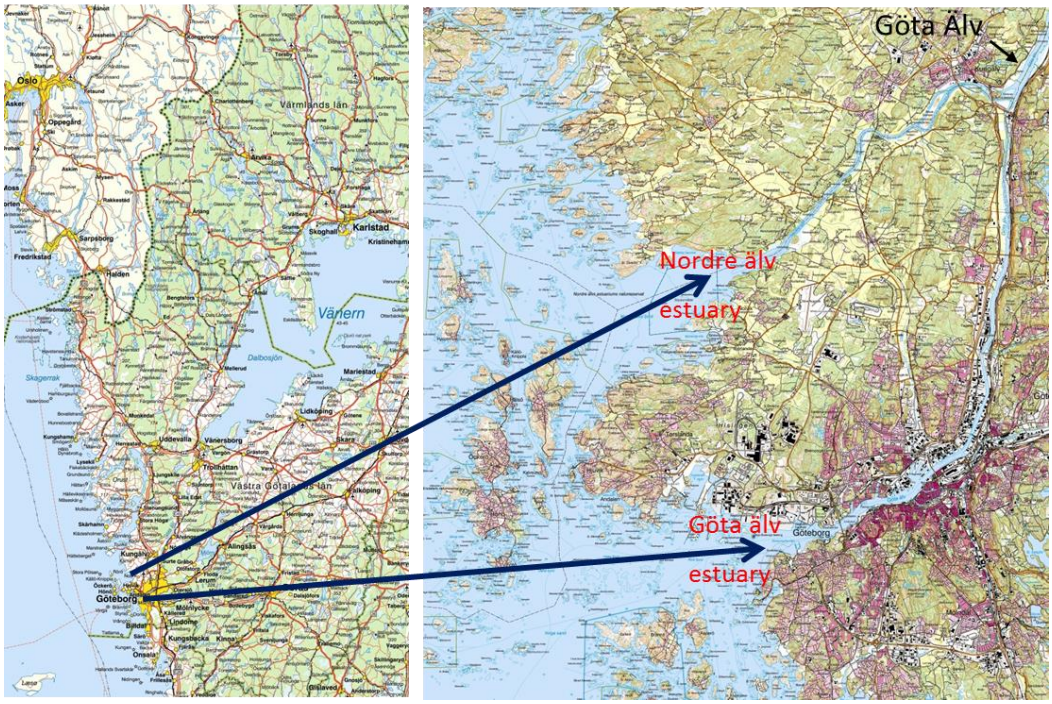


Figure 1 Göta älv and Nordre älv estuaries. The Göta äv flows from Lake Vänern and splits into Nordre älv and Göta älv just north of Göteborg. Lantmäteriet ©

The contexts of Göta älv and Nordre älv estuaries are very different. Göta älv estuary has great anthropogenic impacts from shipping, industrial activities, and urban settings in the central parts of Göteborg, and in the estuary is also the Göteborg harbor located, which is Scandinavia's largest port. In order to maintain the waterways dredging is currently needed.

The Nordre älv estuary on the other hand, is one of the few natural non-dredged estuaries in the North Sea region. It has neither been impacted by shipping and industry (apart from pollutants transported from upstream the river), nor from urban settings, and has a high environmental protection value.

The Nordre älv estuary comprises the lower part of the Nordre älv and the shallow fjord into which the river empties. In the estuary, there are plenty of shallow bays, islands and skerries. The landscape is flat with meadows and sandy beaches.

The estuary is dominated by a freshwater outflow, with little tidal influence and a large width to depth ratio. Seawater pushes up as a wedge along the bottom, without interfering with the overlying freshwater as the freshwater outflow increases the friction against the underlying water causing waves and salt water capture.

4.3 Problem description

In the estuaries of Göta älv and Nordre älv there are several factors that can have negative effect on the estuaries.

Already today, the central parts of Göteborg face impacts from flooding caused by increased sea level rise during low pressure, westerly wind and storm events. An example is the flood event in December 2103 when the storm Sven hit the region (see Figure 2).

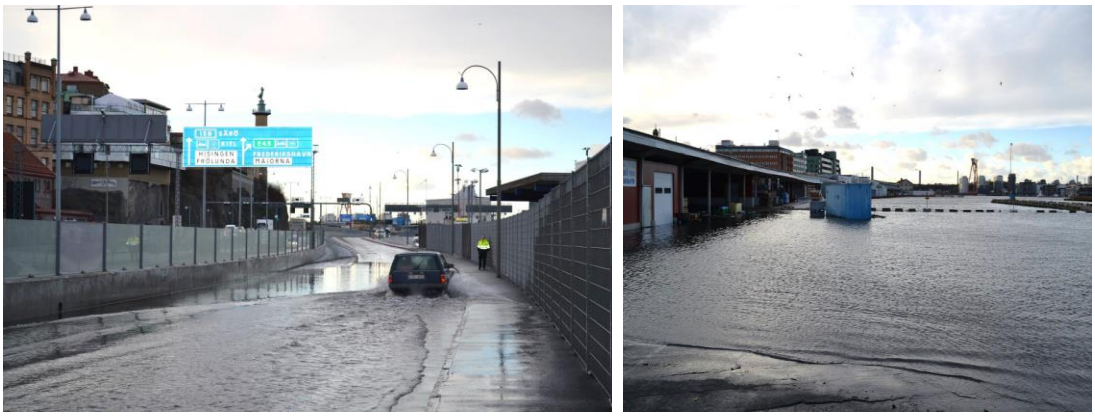


Figure 2. Increased sea level in the Göta älv estuary due to the extra-tropical cyclone Sven, Göteborg December 2013. Photo: Susanna Gelin

The city is managing the current events relatively well as most parts of the city has been built and adapted cope quite well with the present fluctuations . Climate change is projected to result in a 1 m sea level increase within ca 100 years, which in combination with storm events is expected to have costly impacts on the central parts of Göteborg (buildings, infrastructure). In parallel, the central parts of Göteborg along the Göta älv estuary shoreline is planned to be exploited (densified) and the consequences of flooding will increase even more.

Climate change will increase the flow in the river system, which in turn will increase the sediment transport and leaching of nutrients and contaminants to the Nordre älv estuary. Because the estuary is relatively shallow (almost half of the estuary has a depth of 2-3 m) it is extra vulnerable towards eutrofication and increased sedimentation. The increased sea level will also result in increased leaching of nutrients and contribute to increased erosion. Increased sea level due to projected climate change, combined with storm events, will also increase. The stormwater will increase both in total amount over the year and in amount per occasion. This will increase the runoff, and thereby the pollutant load in the estuary.

4.4 Solution options

Sea level rise

In order to allow for the exploitation in the central parts of city, the planners of Göteborg are currently working on a proposal for construction of an operable barrier (such as the Themes barrier or the Storm Surge Barrier Rotterdam) up- and downstream Göteborg to protect the central parts of Göteborg from flooding.

The Göteborg city administration has assessed the costs and benefits of such a solution for the Göteborg municipality. According to the cost-benefit analyses, such a large-scale solution seemed reasonable and feasible for Göteborg (Sweco, 2014). Based on this, suggestions on location and types of barriers have been assessed (Sweco, 2015). The assessment includes a rough and very brief discussion on the environmental impacts in the Göta älv and Nordre älv estuaries.

However, in a recent EU project, i.e. Architecture and roadmap to manage multiple pressures on lagoons (ARCH), impacts of sea level rise and the barriers have been identified (Haeger-Eugensson et al., 2013). Within the EMOVE project, additional potential impacts of climate change and barriers protecting Göteborg have been identified and a primary multi criterion assessment has been done through interviews, workshops and a diploma work (Norén, 2014). The result from this assessment shows that such a solution will have several negative impacts on the Nordre älv estuary.

The potential construction of an operable barrier (such as the Themes barrier or the Storm Surge Barrier Rotterdam) has not yet been formally communicated with Kungälv municipality. The fact that Göteborg municipality was considering this as a serious potential solution was drawn to Kungälv municipality's attention only through the EU project ARCH and further through the EMOVE project.

Other physical solutions provided at the Workshop held September 4, 2014, and Antwerp, March 4, 2015, were regulating the water flow in the Göta älv, planning that not allows building adjacent to the water (i.e. less buildings needing protective measures and enabling land areas that could allow flooding), acceptance of water in the city and adaptation of the city. It was also mentioned that combining functions can enhance the acceptance of measures. For example combining barriers with roads or recreational use.

Another important solution mentioned was mitigation as a preventive measure, i.e. to reduce the emissions to minimise the sea level increase due to climate change.

Stormwater and other "additional" water management solutions
Alternative methods to manage increased stormwater due to climate change and increased exploitation were compiled and preliminary assessed applying a multi-criteria methodology within EMOVE. The assessment was based on literature, modelling and the results from interviews and the first EMOVE workshop (Sept. 2014). The final assessment included the following alternatives:

- Business as usual, which implies expanding the current combined piping system, which also would demand a new storm water treatment plant in order to achieve the same water quality in the Göta älv estuary as today.
- Stormwater basins (of macadam) under parking areas instead of expanding the piping system.
- Dry ponds that will work as a stormwater reservoirs, thereby reducing the acute stormwater pressure on the current piping system during extreme weather events.

According to the multi-criteria assessment (environment, economy and social), the most sustainable solution is the dry pond. There are, however, several barriers for this solution including financial aspects among developers and landowners and fragmented responsibilities related to construction and maintenance of a dry pond.

Additional major solutions provided at the first workshop 4 September 2014 were:

- Identification and measures to decrease the major sources of "additional" water that goes into the sewage system and to the sewage treatment plant. This "additional" water includes direct impact of precipitation (stormwater), indirect impact of precipitation and leaked and drainage water supplements (Hansson et al., 2013).
- Clearer policies, rules/guidelines and demands on storm water management in the local plans and for land developments, i.e. increasing the demands on local management of stormwater

- Creating land areas that can allow flooding (such as parks and wetlands) to protect infrastructure and the built environment.

4.5 Opportunities

Governance a way forward

In Table 1 below, opportunities that can result in the most relevant solutions are provided. The results are based on interviews and the two workshops. As can be seen, the suggestions include management plans, physical planning, increased knowledge and more systematic knowledge bases and increased cooperation. Governance measures for flood risks can be found in allocation of responsibility of flood risks. This responsibility can be located at different levels (national, regional, local) and at private of public stakeholder

The final result from the workshops was that the main solution, to achieve a long term knowledge based solution (that may, or may not, be the barriers), is to set up stakeholder network/working groups: one with regard to the sea level rise, and one to improve the current network for sewage and "additional" water management in the region.

The group related to the sea level rise will allow for a better understanding of the positive and negative impacts of operable barriers/ports, and it will create a platform for identifying and assessing other potential risk reduction measures between a larger group of stake- and shareholders.

With regard to the "additional" water management issue, there is a requested approach to involve more stakeholder's views and user demands (e.g. Port of Göteborg, Environmental NGOs, municipal civil servants) into the existing network. This needs according to stakeholder views, to expand the number and stakeholder roles involved in the network.

Table 1. Compilation of responses on opportunities that can result in the most relevant solutions for achieving more effective and sustainable solutions (results from workshops and interviews).

Propositions to reduce the threats
Increase the dialogue and cooperation amongst different stakeholders
Increase the knowledge bases for decisions (including cost benefit analyses, holistic environmental assessments in a short and long term perspective and also the social aspects of the solutions)
Work together in concrete projects and research
Make documents that clearly state the division of responsibilities
Don't build near the water (i.e. improve planning)
Divide the costs among different stakeholders
Manage the tapping of the Göta älv
Create wetlands and resilient parks and other green/blue areas
Apply thoughtful planning
Include stormwater aspects early in the planning process
Hold seminars, enhance cooperation, develop new ideas together
Increased collaboration

Knowledge development
A clear vision from politicians
Provide developers/exploiters and entrepreneurs with tools and tool boxes to apply available solutions

4.6 Threats

According to the responses from the interviews and workshops there are six major threats that will work against finding and implementing the most long term sustainable solutions:

- There is a lack of resources to be able to work on the issues identified (climate change, sea level rise and "additional" water management).
- There are conflicts of interests among different stakeholders
- There are conflicts of interests among different impacts of climate change and the solutions to minimize the impacts
- There is fragmented and unclear responsibilities amongst different stakeholders
- There is no formal coordination
- Lack of time

Other threats mentioned were the impacts of media. This statement was based on the current situation during the EMOVE project. At the time, potential corruption among politicians and municipal companies was investigated and illuminated by the media. The ‘corruption publications’ was found to take attention from civil servants, instead of focussing on water and climate change issues.

4.7 Proposition to improve the measures

In Table 1 above the opportunities that can result in the most relevant solutions were compiled. In summary, there is a need of increased knowledge and information, increased and more systematic decision bases, and increased communication and cooperation.

Some specific suggestions were provided on the second workshop (Jan. 30, 2015) and are briefly described below.

To increase the knowledge basis, modelling and visualization is an important decision and communication tool. This will provide an important basis for where, and when, preventive measures needs to be taken. Modelling can also be a basis for identification of potential solutions, and for investigating/assessing which solutions that will be most effective and resulting in the least non-wanted impacts. Decisions taken must have a more long-term perspective than they usually have today.

A formal/authorised delegation or cooperation group for structured coordination, collaboration and communication amongst different stakeholders is needed. This should include different policy and political decision levels (i.e. national-regional-local), several municipalities, several different departments within the municipalities, several national-local authorities, the private sector and landowners. The co-operation and collaboration also needs to be time effective and the cooperation needs to be perceived as relevant.

An authority as neutral as possible and with experience and a holistic view is proposed to lead the cooperation. In the case of the sea level rise issues, the most relevant coordinating authority would be the County administration Board of Västra Götaland but could also be already existing networks in the region, an authority as Swedish Civil Contingencies Agency (MSB)) or an institute like the Swedish Geotechnical Institute (SGI).

The County administration Board of Västra Götaland covers most of the aspects and impacts of the sea level rise and potential solutions. It has a holistic view through many disciplines and departments and responsibilities covering both the estuaries of Nordre älv and Göta älv, and the municipalities of Kungälv and Göteborg, and also is the regional, national government representative.

Suggested tasks and implementation steps of such a sea level rise focus Group:

- Set goal and aim of the Group.
- Define a common vision.
- Define the common main problem, cause and consequences of the problem.
- Identify and assess further potential solutions including physical and governance.
- Incorporate the most optimal solutions into existing plans that also may need to be revised and updated accordingly.
- In the work, it is suggested to take into account good national and international examples, as well as provide good examples for others.
- Which (hopefully) will result in an integrated, stakeholder driven knowledge based, long-term plan.

In the collaborative planning process, it was also mentioned that it is of importance that the choices of solutions should be made based on which level and with whom lays the responsibilities within management of estuaries (Antwerp, March 4, 2015).

As a first step of an extension, or expansion, of an existing water management Group the following partners should be included: Förvaltningen Kretslopp och Vatten, Stadsbyggnadskontoret, Park och Naturförvaltningen, Trafikkontoret, Gatukontoret and Länsstyrelsen, private landowners and developers should also be included in a longer perspective. The sewage and stormwater plant Gryaab AB should be invited regularly to the Group.
Examples of questions to work with could be what is a reasonable amount of waste and stormwater to the treatment plant, coverage of the water management in physical plans, responsibilities, locations, how to develop more green solutions which also will contribute to increase the urban greenery and biodiversity in general. The aim should be to highlight and show good examples of supplementary water management in Göteborg.
Initiation of the Group was proposed to come from the city's central organization as this would signal the importance, and the Group was suggested to meet six times per year.

4.8 Benefit

The constitution of collaborative Groups would provide many benefits with regard to increased sea level rise and water management needs related to climate change and central exploitation in Göteborg), for instance:

- increasing the knowledge basis
- including more perspectives
- identifying barriers and potentials for a larger set of solutions
- contributing to reducing and/or overcoming existing and potential new conflicts of interest.
- contributing to identifying and clarifying responsibilities amongst different stakeholders and organisations.
- increasing the awareness, knowledge and basis for more long-term sustainable decisions, organisations and physical plans

4.9 Costs

Initially the major cost is the time needed for coordinating and participating in more meetings. In a longer time perspective, there may also be costs related to changes in the physical plans and costs related to changes in organizations. Some funding may be needed for impact assessments and cost benefit analyses. These costs may, however, be compensated by revenues due to reduced investment or risk-related costs.

From the Antwerp workshop (March 5, 2015) it was added that to get things done it may be necessary to bring in economics – to earn money through suggested adaptation measurers, or at least show the cost effectiveness of different solutions versus doing nothing or each other.

4.10 Stakeholders

The stakeholder organisations that have been involved in workshops and interviews referred to in this report are provide in Table 2.

The stakeholders that are suggested to be involved in the suggested collaborative groups are exemplified under section 8 above.

Table 2 Government agencies, businesses and interest groups who had representatives that participated in the interview and/or workshops.

Type of organisation	Level	Organisation
Authority	National	Trafikverket (Transport administration) Sjöfartsverket (Sea transport administration) Havs- och vattenmyndigheten (HaV) (Sea and water authority) Myndigheten för samhällsskydd och beredskap (Swedish Civil Contingencies Agency)
	Regional	Länsstyrelsen Västra Götalands län (County Administration Board) Västra Götalandsregionen (The Region of Västra Götaland)
	Local	Stadsbyggnadskontoret (City planning office) Förvaltningen kretslopp och vatten (Administration Circulation and Water) Park- och naturförvaltningen (Park and nature administration) Göteborgs miljöförvaltning (Environmental management) Ale kommun (Ale Municipality) Öckerö kommun (Öckerö Municipality) Kungälvs kommun (Kungälv Municipaility)
Companies		Göteborgs hamn (Göteborg Harbour) Gryaab AB (Sewage and stormwater treatment plant)
Interest organisations		Göta älvs Vatttenvårdsförbund/råd (Göta älv Water association/board) Hökälla grönt arbete och rehab (green jobs and rehab) Svenska Naturskyddsföreningen representant i Göta älvs VattenrådSwedish Society for Nature Conservation representative in Göta älv water board))

4.11 Agenda and monitoring

The first step is to establish the two groups. This is suggested to be done in the spring 2015.

There is no possibility to monitor the progress within the EMOVE project. The aim is however, to monitor through forthcoming workshops held by the Sea level rise focus Group.

5 References

Deltares (2011) Natuurherstel in de Westerschelde: de mogelijkheden nader verkend, 1204087, bijlagerapport

Van Buuren, M. W., Edelenbos, J., & Klijn, E. H. (2007). Managing knowledge in policy networks. Organising joint fact-finding in the Schelde Estuary.

Taal, M. (2014), EMOVE / stand van zaken Schelde-estuarium, EMOVE publication, in Dutch.

Ysebaert, T., Y. Plancke, L. Bolle, I. De Mesel, G. Vos, A. Wielemaker, D. van der Wal and P.M.J. Herman (2009). Habitatmapping Westerschelde – Deelrapport 2: Ecologie en ecotopen in het subtidaal van de Westerschelde. Nederlands Instituut voor Ecologie (NIOO-KNAW), Centrum voor Estuariene en Mariene Ecologie, Yerseke

Kahneman, D. (2011). Thinking, fast and slow. Macmillan.

Simon, H. A. (1955). A behavioural model of rational choice. The quarterly journal of economics, 99-118.

EMOVE Project (2014): Work Package 3 - European Joint Fact Finding Part 1 –Problem Identification Study conducted within the framework of the project EMOVE (Estuaries on the move) in the EU Interreg IVB North Sea programme.

EMOVE Project (2015): Work Package 3 – European Joint Fact Finding. Part 2 - Description of State, Impacts and Solutions. Study conducted within the framework of the project EMOVE (Estuaries on the move) in the EU Interreg IVB North Sea programme.

Ahlhorn, F. et al., 2011. *Klimasichere Region Wesermarsch. Die Zukunft der Wasserwirtschaft*, Oldenburg.

Ahlhorn, F., Meyerdirks, J. & Umlauf, I., 2010. *Speichern statt pumpen. Abschlussbericht*, Wilhelmshaven.

Bormann, H. et al., 2009. Climate Proof Areas - Konzeption von an den Klimawandel angepassten Wassermanagementstrategien im Norddeutschen Küstenraum. *Korrespondenz Wasserwirtschaft*, 2(7), pp. 363–369.

Bormann, H., Ahlhorn, F. & Klenke, T., 2012. Adaptation of water management to regional climate change in a coastal region – Hydrological change vs . community perception and strategies. *Journal of Hydrology*, 454-455, pp. 64–75.

Van der Brugge, R. & Ellen, G.J., 2013. *Implementation CANVAS*, Delft.

Diesing, G., 2008. *Oldenburgisch-Ostfriesischer Wasserverband 1948-2008. Eine Chronik*, Brake: OOWV.

EMOVE Project, 2015. *Estuaries on the Move. Work Package 3 - European Joint Fact Finding. Part 2. Description of State, Impacts and Solutions.* Study conducted within the frame work of the EMOVE project in the EU Interreg North Sea Region programme.

FGG Weser, 2009. *EG-Wasserrahmenrichtlinie für die Flussgebietseinheit Weser. Bewirtschaftungsplan 2009 für die Flussgebietseinheit Weser. Maßnahmen-programm 2009 für die Flussgebietseinheit Weser*, Hannover.

HPA et al., 2013. *Management of Estuaries. The need to understand nature & society. TIDE summary report*, Hamburg.

Kramer, J., 1992a. Entwicklung der Deichbautechnik an der Nordseeküste. In J. Kramer & H. Rohde, eds. *Historischer Küstenschutz*. Stuttgart: Verlag Konrad Wittwer, pp. 63–110.

Kramer, J., 1992b. Küstenschutz und Binnenentwässerung zwischen Ems und Weser. In J. Kramer & H. Rohde, eds. *Historischer Küstenschutz*. Stuttgart: Verlag Konrad Wittwer, pp. 207–254.

Kunz, H., 1995. Salinity and water levels in the Weser estuary during the last hundred years - Anthropogenic influences on the coastal environment. In B. L. Edge, ed. *Coastal Engineering*. Kobe: ASCE, pp. 3533–3547.

Lange, D. et al., 2008. The Weser Estuary. *Die Küste*, 74, pp. 275–287.

LSKN [Landesbetrieb für Statistik und Kommunikationstechnologie Niedersachsen] (2010): Tatsächliche Nutzung; http://www1.nls.niedersachsen.de/statistik (access: July 2010).

LSKN [Landesbetrieb für Statistik und Kommunikationstechnologie Niedersachsen] (2011): http://www1.nls.niedersachsen.de/statistik (access: May 2011).

Tenge, O., 1912. *Der Butjadinger Deichband. Geschichte und Beschreibung der Deiche, uferwerke und Siele im zweiten Oldenburgischen Deichbande und im Königlich Preußischen östlichen Jadegebiet* II. Oldenburgischer Deichband, ed., Brake: Oskar Berg Verlag.

Umlauf, I., Meyerdirks, J. & Ahlhorn, F., 2011. Identifikation zukünftiger Konflikt-potenziale im niedersächsischen Küstenbereich im Projekt “Speichern statt Pumpen.” *Coastline Reports*, 17, pp. 191–202.

van der Brugge R., Ellen, G.J, 2013, Implementation CANVAS, Delft

Hager-Eugensson, M., Lindblad, C., Liljeberg, M., Lindblad, M., Wolf, C., Norén, K., Tang, L., Sjöberg, K. 2013. State of the lagoon report for the River Nordre Älv estuary in Västra Götaland County, Swede, Report in ARCH (Architecture and roadmap to manage multiple pressures on lagoons. Göteborg: IVL Svenska Miljöinstitutet. http://www.ivl.se/download/18.21d4e98614280ba6d9e55e8/1393335827618/ARCH+Deliverable+D2-2+State-of-the-laoon+report+for+Nordre+%C3%A4lv_Sweden+Slutlig.pdf

Hansson, K., Rahmberg, M., Kaj, L., Brorström-Lundén, E., 2013. Screening 2013. Assessment of the occurrence of stormwater related substances in sewage sludge and effluent water. IVL. http://www.ivl.se/download/18.1acdfdc8146d949da6d4929/1414141995828/B2212+NV_Scr_13_Dagvatten.pdf

IPCC, 2013. Working Group I Contribution to the IPCC Fifth Assessment Report, Climate Change 2013: The Physical Science Basis, Summary for Policymakers.
Noren, 2014

SMHI, Naturvårdsverket, 2013 Fakta om klimatförändring. (Websida) http://www.klimatanpassning.se/polopoly_fs/1.36622!/IPCC_fakta_nr2.pdf

Norén, A-. Nordre älv i ett framtida klimat – En analys av riskerna för naturmiljön på grund av klimatförändringar och skyddsåtgärder. Diploma work thesis Göteborgs Universitet and EMOVE.

SWECO, 2014. Kostnads-nyttoanalys av översvämningsåtgärder i Göteborg – en pilotstudie. Rapport på uppdrag av Göteborgs stad

SWECO, 2015, Yttre portar mot havet för att skydda mot översvämning vid hög havsnivå. Rapport på uppdrag av Göteborgs stad