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## MANABAS COAST

### Baseline Assessment for all pilots

An initial activity of WP2 is a description and baseline assessment of each study pilot that will be used as the baseline to assess progress during the project and can aid in the future cooperation between the study pilots. The assessment also serves to establish the status of mainstreaming of NbS into the pilots. The assessment survey is divided up into three parts: 1) Description of the pilots, 2) Questions concerning how the enablers are currently addressed in the pilots, and 3) Brief questions about the MANABAS framework (inspired by ISBAM).

### Part 1: Pilot description

*Our aim is to mainstream nature-based solutions on the different coasts of northwest Europe. Therefore we need a description of the coastal system. This is divided into two sections: A) description of the coastal (natural) system of the pilot, and B) description of the governance system.*

Name of pilot: *Greater Copenhagen – Storm Surge Protection*

Location of pilot: *East Denmark, Zealand - 55.680784, 12.577375 (Copenhagen)*

*Please include a satellite map/orthophoto or aerial photo of the area in order to see vegetation, houses, gully's, bars etc. Provide coordinates for the center of the map and the corresponding coordinate system*

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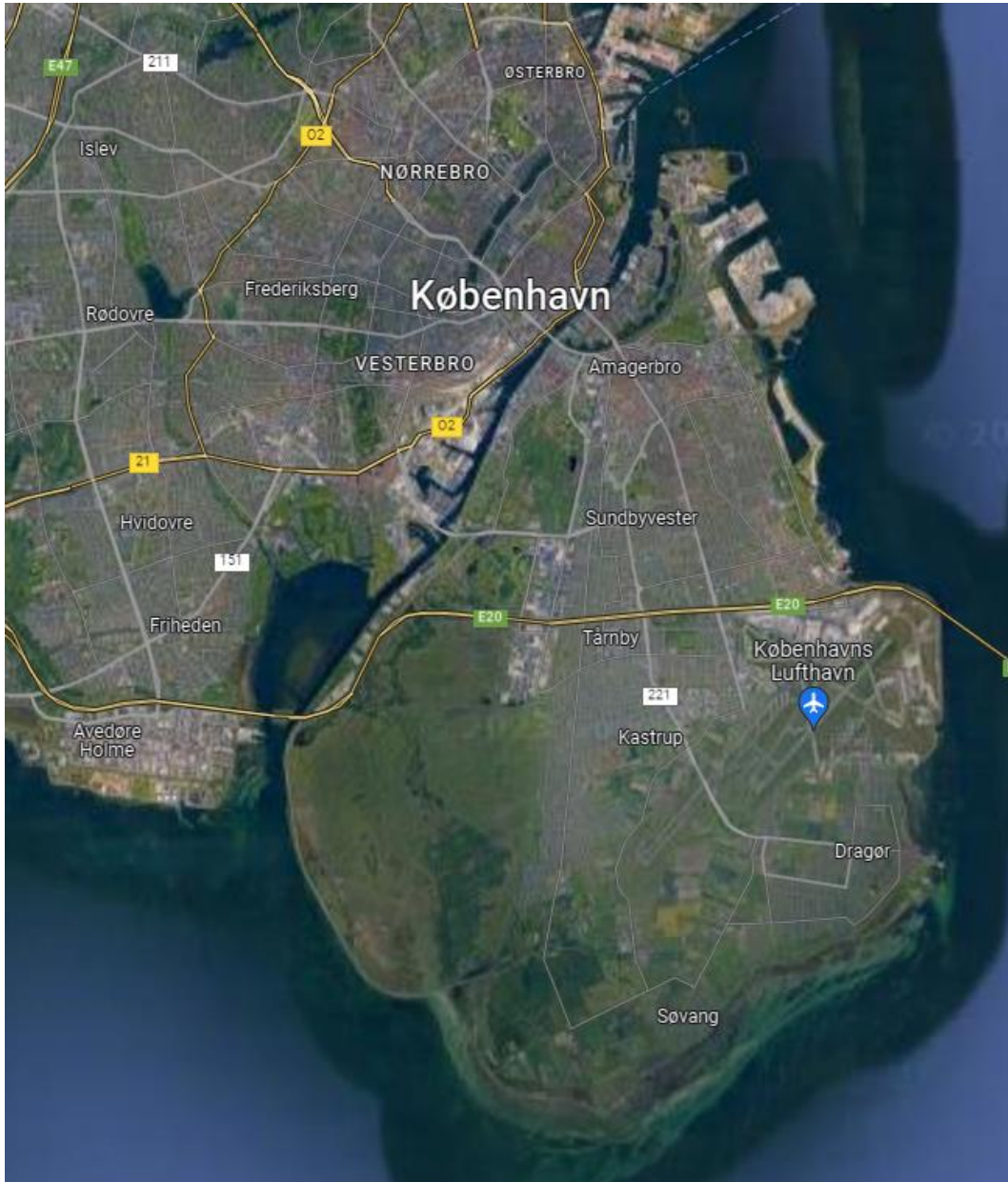


Figure 1: Overview of project area (Google.com/maps)

Pilot aims/objective:

*The aim is to protect the greater Copenhagen area from flooding during storm surge events by establishing a storm surge protection .*



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*The project's original homepage states (Sund og Bælt):*

*"The safeguarding of the Copenhagen area concerns significant national values in the form of, among other things, cultural heritage, socially necessary properties/companies and critical infrastructure facilities of great societal importance.*

*As a result of rising sea levels by the year 2100, all these values must be protected against storm surges with a significantly higher level of protection than exists today.*

*The Ministry of Transport is therefore coordinating the implementation of a feasibility study of an overall storm surge plan for the central part of the capital. The feasibility study covers the four municipalities of Hvidovre, Dragør, Tårnby and Copenhagen.*

*The feasibility study will be carried out from 2022-2024. Upon completion, the results of the feasibility study are submitted to the government and municipal councils for political decision on the implementation of the project."*

Which nature-based solutions will you be working with in MANABAS? *As the project is state-owned, the four municipalities are project partners on equal terms alongside the project's other partners, i.e., the metro company, national railroad, Copenhagen Airport and Sund & Bælt, who oversees the building and maintenance of large national infrastructure projects such as tunnels and bridges. The approach to include nature-based solutions is different, and perhaps, in some instances harder than what would be the case during municipality-owned projects.*

*The four municipalities, however, share a vision in which NbS will be implemented where it is possible. In 2020/2021 the municipalities made a vision report, in which NbS is the main contributor to coastal protection.*

### A. Description of the coastal system

*Please briefly describe those areas that are relevant for your pilot:*

- The landscape including geology, morphology, and biology.
- The hydrodynamic forcing from tide, water level, wind and waves. If possible, include some statistical values

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- Describe the sediment dynamics: Macro or micro sediment budget, conceptually or detailed volumetric monitoring. Include any dredging
- Describe the current coastal protection being used in the study pilot.

### *Hvidovre:*

*Hvidovre is primarily paved or built-up, with a reclaimed extension in the south of the municipality, separated from the mainland by a highway. While Avedøre Holme is surrounded by a dike, the remaining coastline varies between beach, small dikes, and harbour.*

*Kalveboderne is characterized by low water levels ranging between -5 m to 0 m<sup>1</sup>. The whole area is classified as a Natura2000 due to the presence of e.g., ridges, low water levels. Skrædderholmen, located in Kalveboderne, will be under or above sea-level, depending on the general water-levels. The main sediment composition in Kalveboderne is muddy sand according to GEUS (2021)<sup>2</sup>, and the sediment budget is positive, as the hydrodynamic forcings are low. Sediments are moved alongshore to Hvidovre and deposited in the ridges at Avedøre Holme as well as along the shore of Tårnby and Dragør.*

### *Dragør:*

*Dragør's coastline ranges from untouched wetlands in the west and the harbour and buildings in the east. An almost continuous dike, with varying heights, constitutes the coastline. In figure 3, it can be seen that Natura2000 covers large stretches along Dragør's coast, and only the north eastern part is not within the Natura2000 classifications. The coast is shallow and the sediment supply positive, with sandy deposits, and large ridges. The sediments are transported from both the north via Øresund and from Hvidovre.*

### *Tårnby:*

*Tårnby has coasts facing Køge Bugt to the west and Øresund to the east. The western coast shares many similarities with the dynamics found at Hvidovre, as it is located at the inlet to Kalveboderne. But contrary to the sheltered area of Kalveboderne, the sediment present is primarily sand<sup>3</sup>. The coastline is one large dike, as this part of Tårnby is reclaimed. The coastline on the eastern side of Tårnby, however, is partly a beach and partly diked as a mean of protection to the infrastructure that is located in the south east of Tårnby. The sediments are sand (northern part) and till/diamicton to the south*

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<sup>1</sup> Rambøll (2020). *Stormflodssikring af Kalveboderne – Spor 2 Samfundsøkonomi: Oversvømmelser og skadesomkostninger.*

<sup>2</sup> GEUS, Geological Survey of Denmark and Greenland (2021). *Seabed sediment map of Denmark.*

<sup>3</sup> GEUS, Geological Survey of Denmark and Greenland (2021). *Seabed sediment map of Denmark.*

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where the dikes are located.

### Copenhagen:

The coastline of Copenhagen consists of the outer area facing Øresund, and the inner harbour, with outlets to Øresund in the north and to Kalveboderne in the south. Depending on the distance to the coast, the sediments consist of muddy sand (landwards) and sand (seawards), the inner harbour is, due to the sheltered location, muddy sand. Seawalls constitute the majority of Copenhagen's coastline, with only small stretches of manmade beaches at Amager Strandpark and Svanemøllen, furthermore, large, extensive areas are being reclaimed.

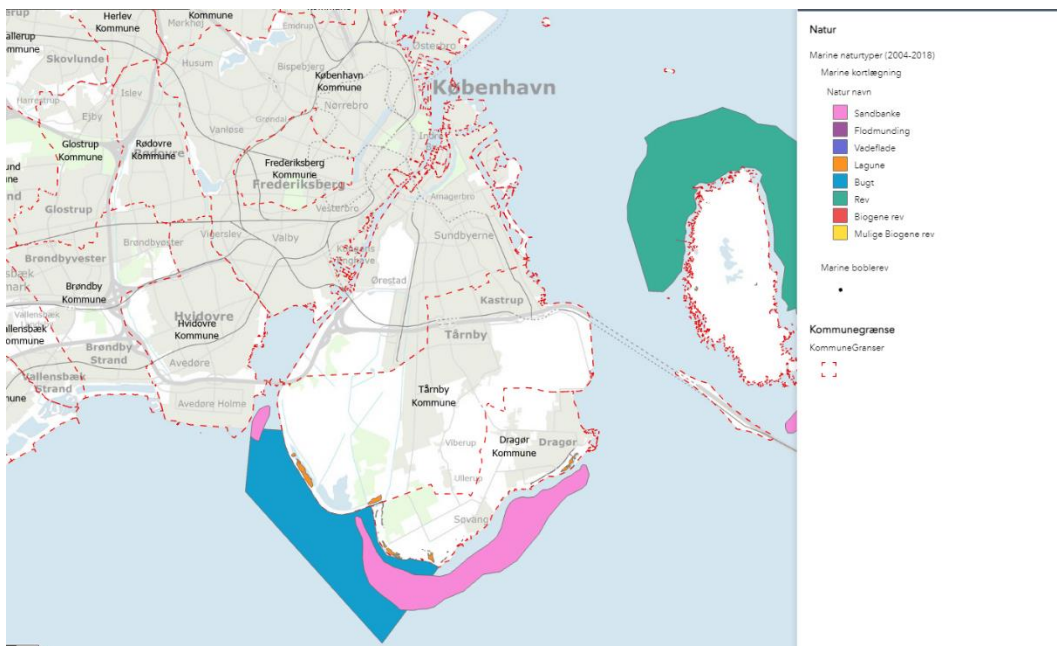


Figure 2: Overview of marine naturetypes in the project area. Sandbanke = sandbar; Bugt = Bay; Lagune = Lagoon(Kystplanlægger – Miljøministeriet)

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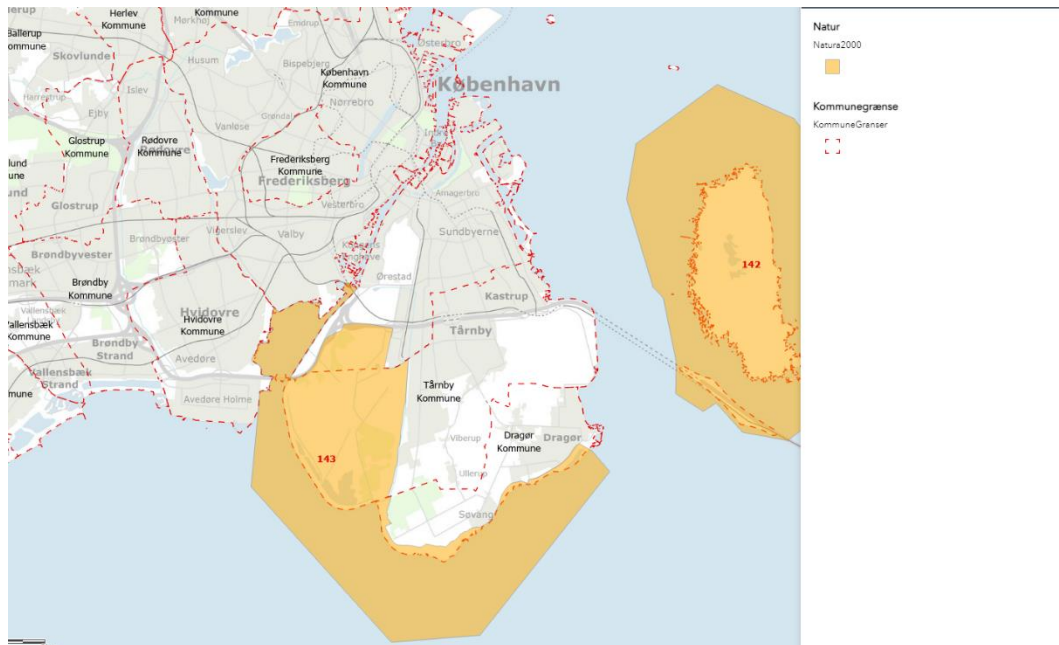


Figure 3: Natura2000 classified areas (Kystplanlægger – Miljøministeriet)

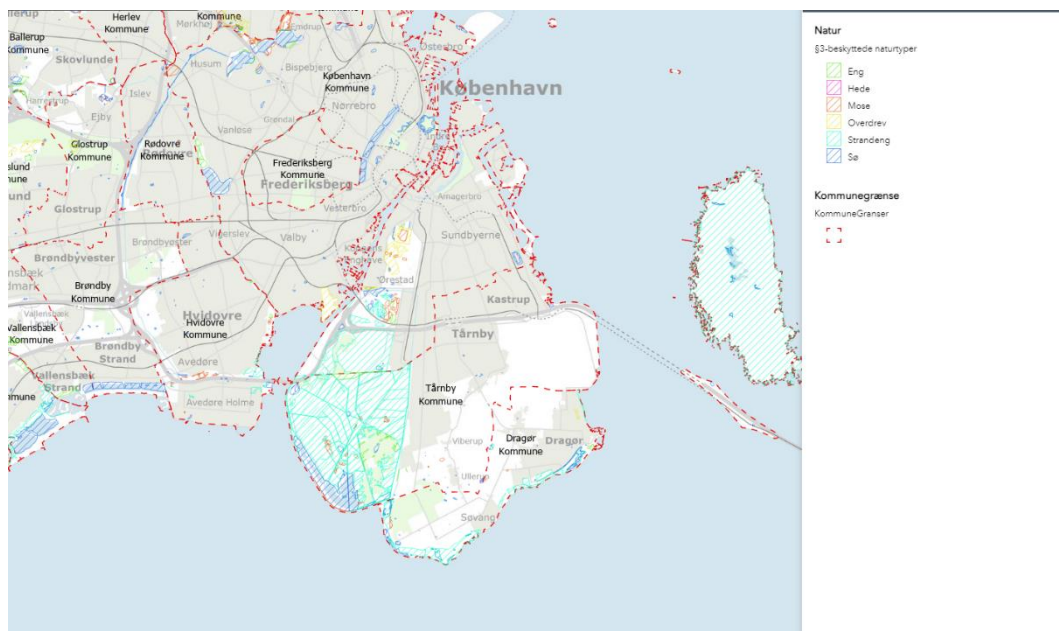


Figure 4: Overview of terrestrial §3 naturetypes in the project area. Eng = Meadow; Overdrev = Grassland; Strandeng = saltmarsh; Sø = lacustrine/lagoon (Kystplanlægger – Miljøministeriet)



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- Which current NBS solutions are already present (it can be a non-engineered original landscape)  
*There are not many natural or nature-based solutions along the coastlines of the four municipalities.  
The original landscape of Dragør's wetland is closest to being undisturbed, to some degree this can be said about Kalveboderne as well, although it is influenced by the development of the inner harbour. Both Svanemøllen beach and Amager strandpark could be defined as NbS.*
- Describe how study pilot is monitored.  
*No active monitoring is currently in place. However, both Svanemøllen beach and Amager Strandpark are actively maintained, while development plans for Amager Strandpark are in the making.*
- Describe the current risk of flooding and erosion.  
*As the project covers four municipalities the risks and consequences vary. Figure 5 and figure 6 shows the Danish Coastal Authorities assessment of flooding risk of the whole project area. While figure 5 is the risk for a 100 year-event in 2020, figure 6 is the risk in 2070. The most distinguished difference between the two is flooding seen at Tårnby, specifically Kastrup, and the flooding of the inner city of Copenhagen. However, it is important to keep in mind that there is a difference whether the event happens from the south or the north of the project area.  
  
*Erosion is not an issue worth mentioning in the area.**

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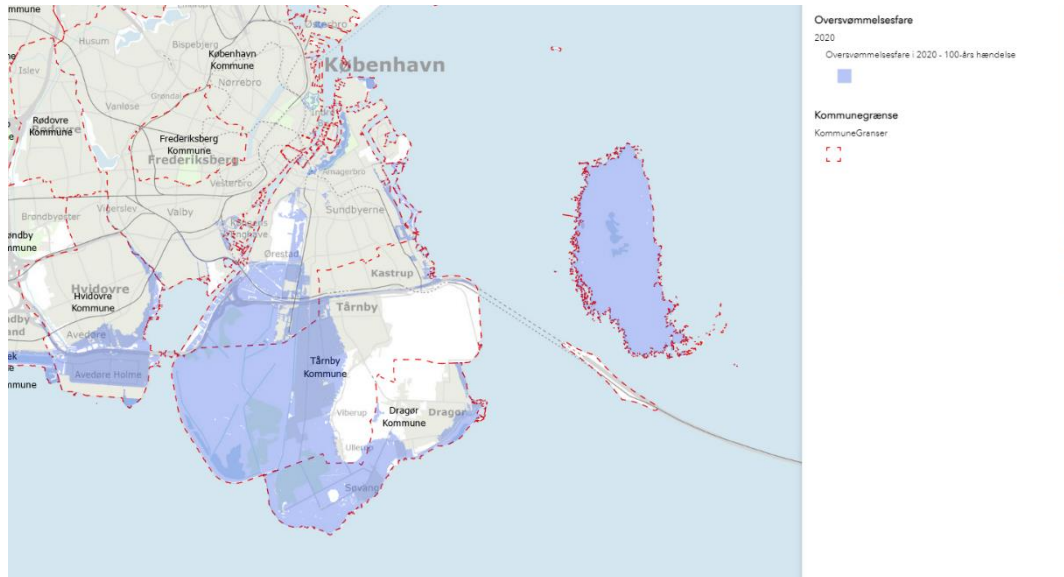


Figure 5: Flooding risk in 2020 – 100 year event (Kystplanlægger – Miljøministeriet)

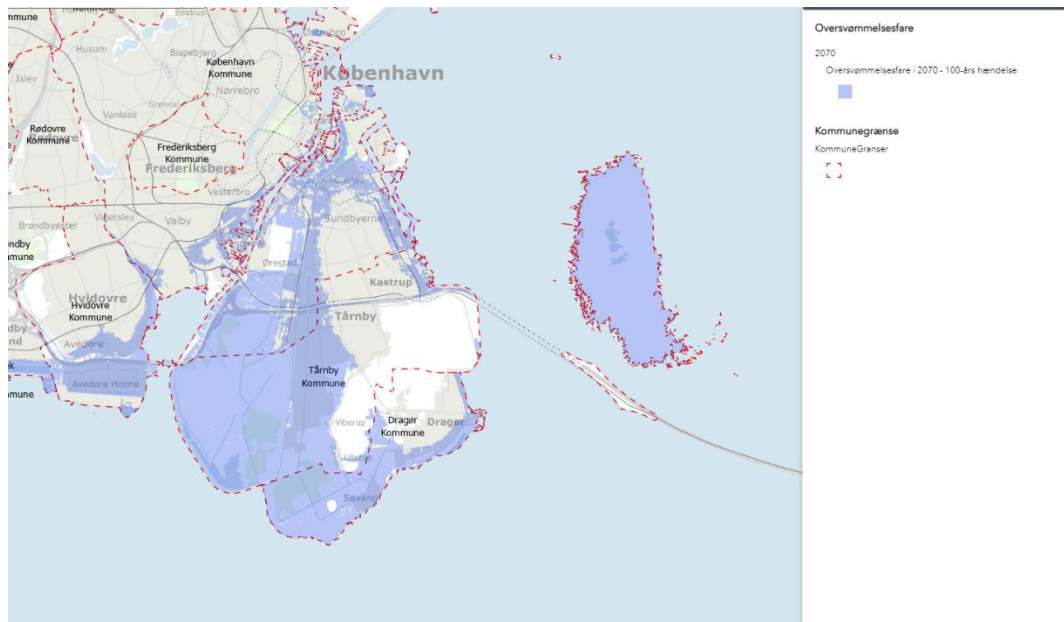


Figure 6: Flooding risk 2070 – 100 year event (Kystplanlægger – Miljøministeriet)

- Which human activities impact your coastal system?
  - Describe important culture and historical aspects in the study pilot
- As can be seen on figure 7, the area is historically important, furthermore, a lot of infrastructure, industries, emergency response and listed/protected buildings are located in the area. Hence, a flooding of*



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*the area would cause significant damage. However, the importance of the area also heavily influences the natural system, where, as previously mentioned, large areas are reclaimed and diked, resulting in a disturbance of the natural coastal morphology. Furthermore, dredging and the disposal of dredged materials also disrupt the natural system. For Copenhagen, the establishment of Lynetteholmen and the harbour is undergoing various impact studies. These studies will be finished in 2070.*

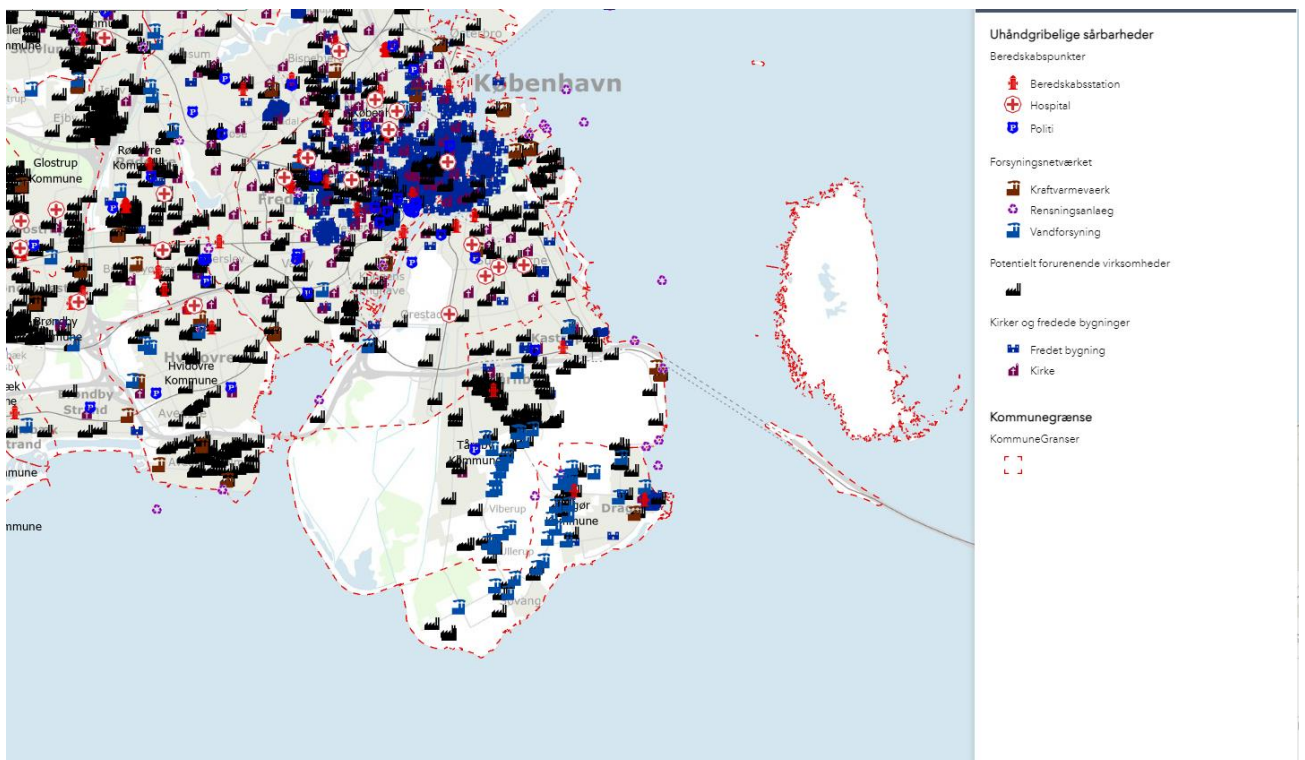


Figure 7: Intangible Vulnerabilities. (Kystplanlægger – Miljøministeriet)

### B. Description of the governance context

*Please briefly describe those areas that are relevant for your pilot:*

1. Who are the landowners of the land?



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*The landowners range from private, the municipality to the state. While all distributed across the whole area, the municipalities own the most.*

2. What are the main land uses in the pilot area (i.e., agriculture, nature reserve, infrastructure),  
*Infrastructure and industries would be two of the main land uses. However, a lot of the area is also categorized as Natura2000 and §3 (figure 2, 3 and 4). Especially in Copenhagen and Tårnby, the coastal areas are part of their urban development strategies. In the southern part of Dragør, there is little agriculture, mainly grasslands.*
3. What are the current laws and regulations that govern the use of nature-based solutions in the pilot (i.e. Natura 2000, planning)?  
*Natura2000, §3, culture heritage, nature preservation and the development plans for the municipalities.*
4. What is the current status of using nature-based solutions in your pilot area (ie to what extent are they mainstreamed into existing policy?)  
%
5. What are the current goal conflicts (ie protecting cultural vs natural areas, or protecting private land vs municipal-owned land, or agricultural uses vs nature preservation?) How are these dealt with?  
*As we are still in the beginning of the project, these are not known or not relevant yet. However, the project's scale will of course shift the way we approach to goal conflicts, depending on their importance or impact. Many will be specified during the socio-economic evaluation.*
6. How are the stakeholders identified and involved  
*Large stakeholders are invited to participate in the project, while smaller stakeholders are invited to participate in bi-lateral meetings.*
7. Briefly describe the socio-economic development in the area.
8. What do you experience as the main barriers to mainstreaming NbS in your pilot?  
*It is not possible to name one thing as a barrier, rather it is the combination of having a state owned project with many big and important stakeholders whose interest is mainly focused on the end result – storm surge prevention – and not on the product itself. Space and costs can also be blamed.*

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### C. Implementation scheme

*Please describe your timeline for implementing NbS during MANABAS and beyond (i.e. starting point, estimated finalization, monitoring period)*

*As of now, there is no timeline as we do not know how the project proceeds. The municipalities hope to implement as much NbS as possible in the project and have risk reduction plans that urge the municipalities to reduce their risk of flooding by 2030/2032.*

### Part 2: Enabler Assessment

*Please consider the barriers identified in Part 1B (question #18). The enablers below are meant to be ways to overcome these barriers. However, these enablers are not set in stone and will be further developed, augmented and /or changed during the MANABAS Coast project. There may be other enablers that are more important in certain pilots or for mainstreaming NBS. We will explore these during our project. In this assessment we want to get an initial idea of how these proposed enablers by EcoShape play out in your pilot and for mainstreaming NBS on a large scale.*



#### Enabler 1: Technology and system knowledge

- Which types of technology or systems knowledge are important in your pilot? (i.e. Sediment cell, salt marsh protection, salt marsh dynamics, sand nourishment, enhanced dune development)



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*We currently lack a broader understanding of the processes between the municipalities, as well as an in depth hydrodynamic evaluation of the processes. The biodiversity is also important, especially in combination with the hydrodynamics, in order to establish a baseline for the implementation.*

- Are there any knowledge and technology gaps in your pilot that need to be addressed? Please briefly describe.  
*See above.*

### Enabler 2: Multistakeholder approach

- Who are the main stakeholders in your pilot?  
*The main stakeholders are the municipalities and the infrastructure owners. As a result, thereof the state, who are project owner.*
- How will you engage your stakeholders in the project?  
*They are project participants.*

### Enabler 3: Management, monitoring, and maintenance

- What routines does your pilot have in place for management, monitoring and maintenance of the NbS?  
Nothing yet
- How do you measure the success of your pilot? Do you have any indicators for successful mainstreaming of NbS?

*The question is hard to answer from the perspective of the project, as we haven't decided on any NbS yet.*



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### Enabler 4: Institutional embedding

- How do current institutional arrangements already facilitate mainstreaming of NbS? Please describe and mention the key institutions  
%
- How committed is your organization to mainstreaming NbS within MANABAS Coast and after the project ends?  
%

### Enabler 5: Business Case

- Do you face problems with funding in your pilot? Please briefly describe, including the general sources of funding.  
*Not yet, the project includes a group that discusses the distribution of contribution. According to the danish coastal protection act, the ones who pay are the ones who directly benefit from the protection. These would be the properties along the coastline.*
- How will your pilot and/or continued mainstreaming be funded after the MANABAS Coast project?  
%

### Enabler 6: Capacity building

- What types of capacity building would your pilot need in order to facilitate mainstreaming of NbS?  
*Political focus on the positive aspects of NbS.  
Positive implication of NbS compared to other solutions.*

### Enabler ranking



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To what extent are the above enablers important for mainstreaming NbS in your region? Please rank (1 is least important, 10 is most important)

Enabler 1: Technology and system knowledge

1 2 3 4 5 6 7 8 9 10

Enabler 2: Multistakeholder approach

1 2 3 4 5 6 7 8 9 10

Enabler 3: Management, monitoring and maintenance

1 2 3 4 5 6 7 8 9 10

Enabler 4: Institutional Capacity

1 2 3 4 5 6 7 8 9 10

Enabler 5: Business case

1 2 3 4 5 6 7 8 9 10

Enabler 6: Capacity Building

1 2 3 4 5 6 7 8 9 10

### Suggestion for additional enablers

Are there any aspects of mainstreaming enablers from your pilot that you can already suggest? If so please briefly state these:



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### Part 3 MANABAS mainstreaming framework (inspired by earlier work e.g. ISBAM)

*Within MANABAS Coast we are working on a framework that helps in mainstreaming NBS. To develop this framework, we need information on the pilots as well as the ambitions and goals of the different organization involved. We build on work already done in the past such as the ISBAM approach, which was developed in the Interreg BwN project (see also the brochure in the appendix for a further explanation or online). Just as the enablers, the MANABAS mainstreaming framework is still a work in progress.*

*As a starting point for the MANABAS framework, 3 leading principles from ISBAM are evaluated. We would like to know if these principles can also be applied across the entire northwest Europe coasts and how they can be improved. .*

*Three leading principles have been identified that are deemed important to enable mainstreaming of NBS:*

MANABAS Coast principle 1: "Act at a landscape (system) scale, including both the natural and socio-economic system/context"

- Do you identify with this principle?  
*yes*
- Is this principle applied (to a certain degree) within your pilot? And within your organization? If yes, how?  
*Socio-economical analysis is performed*
- In managing your assets, how are the system-wide effects and benefits taken into account?  
*The involvement of four municipalities in the project allow for larger scale understanding of the influence on the system.*
- On a scale from 1 (room for improvement) to 10 (superb), do you think your organization adheres to this principle? Why?

1 2 3 4 5 6 7 8 9 10  
*We cannot give an answer to this*

MANABAS Coast principle 2: "Integrate management of multiple assets and functions within the landscape system context"



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- Do you identify with this principle?  
*Yes*
- Are relevant organisations/institutions efficiently cooperating to jointly address system-wide challenges? If yes, which challenges and how?  
*It is what our project tries to do.*
- If you see room for improvement in the integrated management of multiple landscape assets, what would be the necessary steps to take according to you? Briefly state  
*Access to knowledge about the natural systems, especially for partners who do not usually work in the field and therefore does not know a lot about the processes*
- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?  
1 2 3 4 5 **6** 7 8 9 10

### MANABAS Coast principle 3: "Embrace and leverage upon the natural dynamics of the system"

- Is this principle applicable to your situation/organization?  
*To a certain extent*
- What are the main natural processes that should be considered? Are these well-known with all the stakeholders?  
*No, depending on the stakeholder's prior interest in the area, the natural processes may not be completely known/understood. Sediment transport and hydrodynamics would be two important processes.*
- How are using natural processes incorporated in the management practices within your organisation?  
%
- On a scale from 1 (room for improvement) to 10 (superb) how much is this principle applicable to your organization?  
1 2 3 4 5 6 **7** 8 9 10

Additional MANABAS Coast mainstreaming questions:





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- In your view, what is essential in the mindset or way of working of people (policy makers, managers, professionals, general audience) to promote mainstreaming of NBS? Do stakeholders need more information on mainstreaming?  
*They need more information on the benefits of Nbs. If Nbs is not commonly applied, the value of it cannot be recognized in comparison to the (perhaps) cheap grey option or at least more well-known solutions. It is easier to understand how a wall/large stones/etc. can minimize/stop the flooding, in comparison to Nbs.*
- What other leading principle(s) would you suggest?  
%
- How can we make these principles more applicable to the context of pilots?  
%
- Finally: What does mainstreaming mean for your pilot? Please briefly describe.