3.8 Improve understanding of contributing role of local waterways to flooding in Holbaekfjord

3.9 Develop a coordinated local solution to address flooding in Holbaekfjord

Holbæk municipality

State of the art

The coastal areas in Holbæk Municipality are referred to as fjord coasts and are more protected coastal profiles than the coasts facing the open sea. On fjord coastal stretches it is possible salt meadows are formed, which is the case in several places in Holbæk Municipality. Flooding of these areas are a natural part of the coastal ecosystem and the flora and fauna that grow and lives on the salt marshes. The floods occur naturally based on the conditions created by the dynamics between land and water. During the storm Bodil in 2013, several stretches were along the fjord coasts flooded, including a summer house area at Kisserup and several houses along Strandmøllevej in Holbæk city. The Danish coastal nature is an example of wild nature and free dynamics in the landscape. Climate change will cause more or less permanent flooding of the current completely coastal nature types, and thus the areas between the waterline and infrastructure and cultivated areas slowly become smaller. It will also result in e.g salt marshes in many places will disappear, and new habitat types will emerge. The coastal dynamics will as as a result of climate change become more frequent and violent, and on some coastal stretches will the floods thus result in material destruction as was the case during the storm Bodil.

In the geographical risk mapping, all types of sources of flooding have been assessed at a screening level. For rainwater, seawater and streams, the estimates are annual damage costs have been calculated. The risk for these can therefore be assessed across sources of danger. For groundwater, due to the type of data, a more qualitative approach to the analysis has been carried out.

Rainwater and seawater

The significant risks are primarily associated with flooding caused by rainwater and rising water levels in the fjords. Both sources of danger have so far constituted a relatively low risk of flooding,

however, seawater will become a significant one source of flood risk in the future. The sea level rise will result in contemporary extreme events in the future will become future everyday events. The estimated damages for rainwater are estimated to increase slightly over the next 100 year. Damages as a result of rising sea levels, on the other hand, will increase by more than one tenfold.

Streams

The mapping concludes that there is, and will not be, significant risk associated with flooding from streams. Then floods from these only to a very limited extent will lead to damage to buildings and infrastructure. However, it is assessed from an overall perspective, and is thus not synonymous

with the fact that individual landowners will not be able to experience flooding from nearby water course. However, the mapping concludes that there will be a risk of flooding of agricultural lands. Cultivation capacity will therefore be a challenge in the future in some of the flood-prone agricultural areas close to streams. The future municipal planning will in future reflect these challenges, and agricultural areas that are affected will be transferred to another purpose.

Groundwater

For groundwater, the ground water table close to the ground has been investigated. it is concluded that landowners in Holbæk Municipality today will primarily be exposed to ground water close to the ground along the coasts and along the river valleys. Especially along the coasts it can be expected to rise as the water level in the fjords rises. Groundwater is generally highest in winter.

Consequences

The expected water level rise in the Isefjord, including Holbæk fjord, of around 1 meter above the next 100 years, will mean that many of the municipality's coastal natural areas will disappear. In Holbæk Municipality, there are over 530 ha of areas registered as salt meadows. In the year 2120, approx. 42% of these are permanently under water and thus have disappeared. This is a challenge since sea level rises are happening so quickly that nature will not be able to migrate inland in pace with the water rises. Not all places have space for this either, for e.g. urban and agricultural areas. Sea level rise is not expected to stop in 100 years. On the other hand, we can take risks that they continue hundreds of years into the future. It is therefore important that we keep an eye on this and considering how we can make room for nature to may migrate into the country as and when

the most coastal areas disappear. More specifically for the municipality's coastal Natura 2000 areas, Udby Vig på Tuse Næs is special exposed. Here, approx. 10% of its area will be lost to the water rises during the next 100 years. These 10% covers i.a. over 53% of the grassland areas and 66% of the salt meadows. Nature types as well habitats for species that form the basis for the designation of the natura 2000 area. We have many coastal nature sites. Large parts are salt meadows, which are meadows that periodically is flooded with salty water from the fjord. Salt-sensitive species thrive here, Strandeng, annual salt meadow vegetation and tidal flats are this type of vegetation. At higher water levels the salt meadow vegetation is expected to have moved further up the landscape. Also species such as for example, the green-spotted toad will be affected. When the waterholes are flooded more often, they will become too salty and thus the waterholes will become too salty to breed in.

City and infrastructure

If our cities are not designed so that the rainwater can run and collect in places where it does not damage, we may risk that houses and roads will be under water. The sewage systems are only designed to handle everyday rain. It is therefore essential that terrain-based water management and alternative solutions are considered in the design of our cities on an equal footing other infrastructure. Heavier rain events also mean heavier peak loads on drainage systems too paved surfaces, including road surfaces and parking lots. Many places outside the city buildings, drainage takes place via seepage ditches or nearby rainwater basins. In the event of heavy rain, water can collect in depressions on and around roads that are not laid

sufficiently high compared to the surrounding terrain. Where drainage occurs via road grating, more can be done concentrated rain events mean that the line capacity cannot keep up. This will lead to accumulation of rainwater on the road surface, which in the worst case can cause the road to collapse cannot be used temporarily or that rainwater collects in unwanted places and causes damage on roads or buildings.

Risks of water pollution in connection with flooding

This includes disease risks associated with overflows in connection with cloudbursts, which can cause contaminated bathing water. As well as disease risks (e.g. Leptospirosis) when stocking up sewage when basements are flooded.

Personal costs associated with flooding

In many cases, people affected by flooding, especially in private homes, are also hard hit affected psychologically, because it has great costs when you lose possessions and have to have them renovated the house after the damage that has occurred. It can be resource-intensive to be in a process where one's home is not livable, as well as in some cases you can find yourself in a situation where the house loses value or becomes difficult to sell because it is prone to flooding. As a starting point, you should never plan for new buildings in exposed areas, and here you have to be good internal dialogue in connection with local planning help to identify risk areas, so the challenges are dealt with already at the start of the planning phase.

But many existing residential areas are currently exposed and here is a good emergency plan and proactive action essential for the prevention of repeated floods, so that people do not stay affected by large subsequent insurance cases and renovation processes.

Solutions

Vulnerable groups

It is important that there is a special focus on the municipality's vulnerable groups in the further work with the prioritization of which efforts should be made. There can be, for example, geographical areas which are assessed to be at risk of flooding, but where the citizens themselves do not have the capacity to ask the municipality for help. In the specific risk mapping prepared in the present strategy is social and economic context disregarded. The designations are thus based solely on risk, but in a further assessment of which concrete projects must be prioritized, must be vulnerable

groups are thus included as one of the criteria taken into account. In addition, the risk mapping has been reviewed specifically with a special focus on the municipality nursing homes, schools, daycare centers, etc. to map municipal facilities such as mat be at risk. For concrete adaptation projects, it is also important to have the physical availability in mind, so that high water walls or raised curbs are not arranged without consideration of how this will affect the accessibility of citizens.

Recreational measures in connection with the establishment of climate adaptation projects

In some cases, the only solution will be to establish permanent preventive facilities. It may be rainwater basins that can alleviate flooding during cloudbursts, expansion of wetlands in connection with congested streams or dyke projects in connection with storm surges. In these cases, project development must always seek as many synergies as possible, i.e. technical function be developed with a view to promoting recreational use and natural content. This allows you to create new options for health-promoting parameters such as physical activity in a new pathway that connected to the facility, establishment of accommodation options that create the opportunity for a break or stay together with others. All measures which, in the finished facility, benefit the users and which provide new possibilities for health-promoting use.

The risk mapping for flooding has resulted in designations of a number of geographical focus areas, described below. The mapping should be considered a screening and all the areas will therefore, in continuation of this strategy, undergo a more in-depth analysis, to clarify the real extent of the problem as well as the reason behind it. For the same reason they are geographical focus areas not sharply geographically described as several different conditions may have impact on how such a demarcation should be, e.g. sewage catchment, runoff conditions, land use etc. All matters which will be clarified in the further work with the geographical ones focus area. The screening must be regarded as a working tool for Holbæk Municipality to get what is needed overview of flood-related risk in the municipality.