

CLIMATE PROOFING AND COASTAL LANDSCAPE

ABOUT LYNETTEHOLM

On 4 June 2021, a broad political majority in the Danish Parliament passed the act on the construction of Lynetteholm. Lynetteholm will be constructed as a peninsula between Refshaleøen and Nordhavn with a coastal landscape facing Øresund, which will help protect Copenhagen from storm surge from the north. CPH City & Port Development will create the land area on Lynetteholm by utilising - in other words, recycling - surplus soil from Copenhagen and construction projects in and around the city.

Prior to Parliament's decision to construct the land area of Lynetteholm, environmental impact assessments were drawn up, illustrating how it is believed the construction of Lynetteholm will impact the surrounding environment. CPH City & Port Development will continuously monitor the construction work, thereby ensuring all environmental considerations.

The signatory parties to the agreement decided to initiate a strategic environmental assessment (SEA) of the future plans for Lynetteholm, which have not yet been politically decided.

LYNETTEHOLM AS CLIMATE PROOFING

In tandem with Nordhavn, the creation of Lynetteholm will form part of the overall climate proofing of Copenhagen against storm surges from the north. Storm surges often occur in connection

with storms. Strong, onshore winds drive masses of water from the open sea towards the coastal area.

RISK OF STORM SURGE

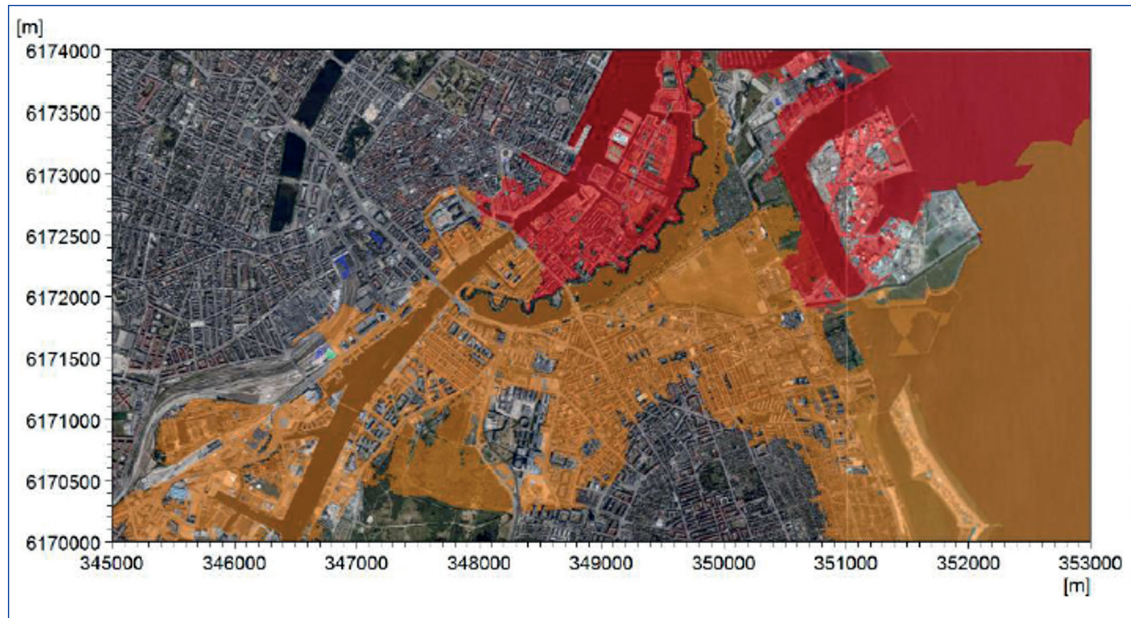
The risk of storm surge in Copenhagen is currently assessed to be greatest from the south. But the risk that Copenhagen will also be affected by storm surge from the north is increasing. In 2011, the 'Køge Bugt Kalveboderne' risk area was designated for the first time as one of ten areas in Denmark where there is a potentially significant risk of flooding. When the risk areas were updated in 2018 on the basis of the national assessment of the risk of flooding from the sea and watercourses, significant geographical changes occurred in the risk area, which went from covering Kalveboderne (in the south) to currently covering most of Copenhagen. This is described in the City of Copenhagen's risk assessment plan for storm surges (2021).

The City of Copenhagen's 2021 risk assessment plan also states that the global sea level has been rising over the past century, and the rate of increase has accelerated over the past decades. The City of Copenhagen storm surge plan is based on sea level rises up to the year 2100 of approximately 70 - 100 cm, depending on the calculation model used.

→ [Read more about the two calculation models for sea level rise in the 2021 risk assessment plan.](#)

The map below illustrates how major the flooding would be in Copenhagen if there were no storm surge protection and Storm Bodil were to return in the same strength at

a time when the water had risen by a metre above the current level in Copenhagen Harbour.



One of the most recent serious storms was Storm Bodil in 2013, when the northwest wind forced large amounts of water up to a height of 2 metres in Roskilde Fjord and 1.68 metres in Copenhagen Harbour. The edges of the quays around Copenhagen are approximately two metres above the current water level.

CONSEQUENCES OF STORM SURGE

The City of Copenhagen has prepared analyses that show that societally it is most useful to have external protection around Copenhagen rather than providing protection against storm surges with seawalls along all quaysides in the city and/or individual protection of the city's buildings. Lynetteholm will contribute to the external protection and replace a seawall that had previously been planned.

A storm surge entails a risk of extensive damage, delays and operational losses:

for example, for Kastrup Airport, the Metro, Banedanmark and DSB, and on the Øresund Bridge and the motorway network in general. There is also the risk of flooding large parts of Christianshavn, the city centre and Slotsholmen.

The City of Copenhagen's 2017 Storm Surge Plan estimates, that if Copenhagen is not protected against storm surge, the city will risk a loss of between DKK 7 and 12 billion over the next 100 years. The damages have been calculated solely for the City of Copenhagen and thus do not include losses in other municipalities. Nor are indirect losses included in the loss calculations.

By constructing Lynetteholm as a peninsula instead of a conventional seawall, it saves the people of Copenhagen the money that otherwise would have been spent on building a seawall in the area of Lynetteholm, since

financially the construction of Lynetteholm is self-contained. In several other municipalities, storm surge protection is paid for either through tax or directly by the individual landowner. In Copenhagen, this part of the climate proofing will be paid for by landfill, because CPH City & Port Development will be paid for managing the surplus soil used for filling Lynetteholm.

COASTAL LANDSCAPE EXTRACTS ENERGY FROM WAVES

Lynetteholm will be created with a coastal landscape facing Øresund together with a landscape behind that will provide climate proofing against future storm surges. The coastal landscape will be given different types of coastlines and will serve to curb storm surges, since the flat landscape with pebble and sandy beaches will extract some energy from the waves before they hit land. This means that the storm surge protection does not need to be as high as a normal seawall.

A coastal landscape will also provide Copenhagen with more nature and facilitate a completely different recreational use of the water, because the flat coast will allow visitors to get really close to the water. The landscape will also have a reef-like effect that will create new habitats for flora and fauna in the water.

AN ADAPTABLE COASTAL LANDSCAPE

The design and climate-proofing level of the coastal landscape will be dimensioned to withstand a so-called 100-year storm surge event in the year 2070. Here, the level of proofing (the highest point between the waterline and the soil fill behind) will vary between 2.5 and 3.5 metres. By comparison, a storm surge

protection along Lynetteholm with vertical sheet piles will have to be 4.3-metres high to provide protection against a 100-year storm flood event in the year 2070.

To provide protection against a 100-year event in the year 2200, the level of climate proofing would have to be raised even more, or a seawall built in front of it.

It is difficult to predict future sea level rises and storm surges accurately. That is why we have adopted a so-called adaptive proofing concept with coastal landscape that can be adapted and modified when new knowledge or new needs arise. This means that if storm surge incidents in the year 2200 prove more violent than anticipated, the coastal landscape can be raised locally, thereby protecting both Lynetteholm and the rest of the city.

The idea, which has not yet been politically decided, is for the area on Lynetteholm behind the coastal landscape to be developed in the future. This area is designed for a level of protection for a 1,000-year event in 2200.

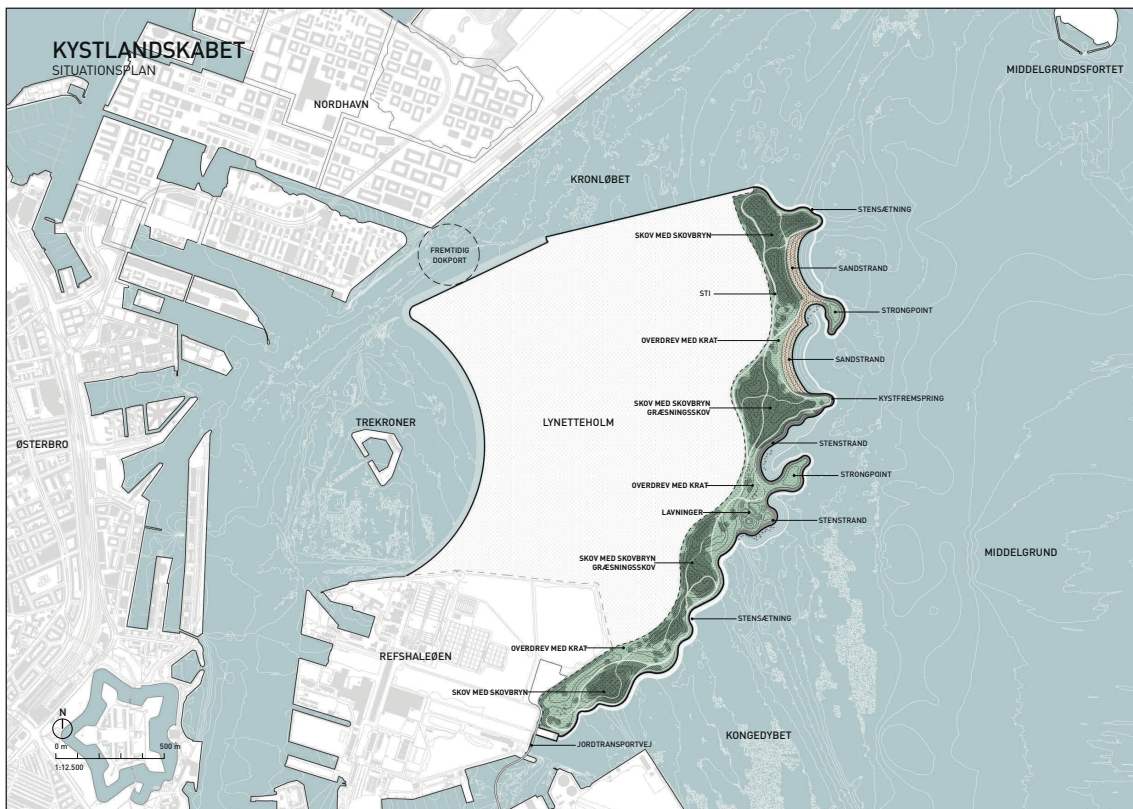
The visualisation below comes from CPH City & Port Development's proposal for the coastal landscape of Lynetteholm. The planting etc. in the proposal has not been finally decided and should therefore only be seen as a suggestion.

However, the physical structures of the coastal landscape have been decided. In other words, the actual construction of Lynetteholm's perimeter with dams, coastal protrusions, rocks, sandy beaches etc., all of which create the conditions for a coastal landscape to evolve. The coastal landscape is expected to make up approximately 60 hectares out of Lynetteholm's total 275 hectares.

LYNETTEHOLM

Fact sheet -Climate proofing and coastal landscape

Updated November 2021



Exactly what the final appearance of the planting, recreational facilities etc. will depend partly on a future structural plan for Lynetteholm.

SHIP-CAISSON

The distance between Lynetteholm and Nordhavn is short enough for a ship-caisson to be established in the long term, which can be closed in the event of a

storm surge, but wide enough to ensure entry and exit from the harbour. The City of Copenhagen's 2021 risk management plan states that in 2019 the City of Copenhagen commissioned an analysis that shed light on possible caisson solutions in Kronløbet between Nordhavn and Lynetteholm. The City of Copenhagen has not yet chosen which solution model to use.