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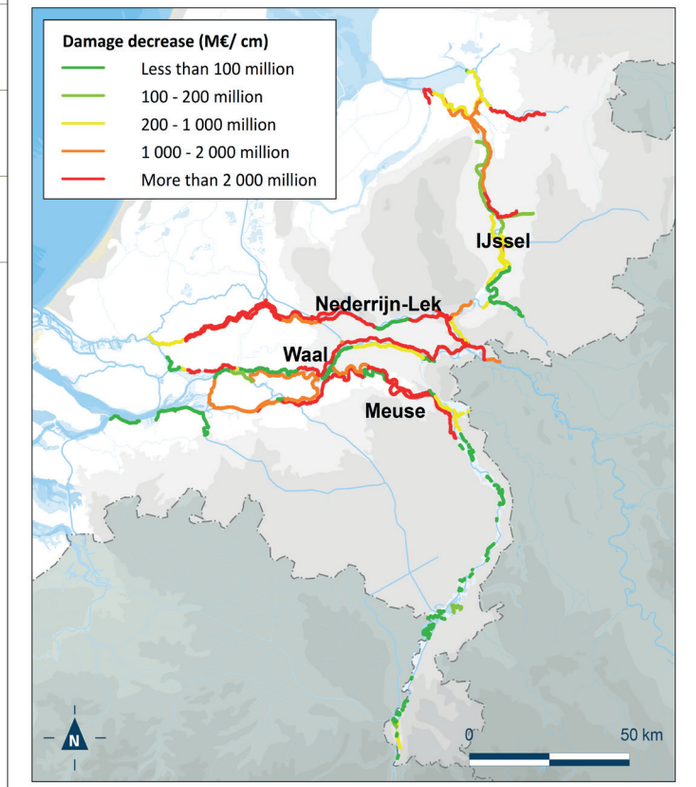
How cost effective is river widening?

The Rivers Delta Programme was completed in 2014. The aim of this programme was to develop a flood risk management strategy that reduces flood risks along the major rivers in the Netherlands and that also ensures that the new standards for flood risk management are met by the year 2050. The preferred strategy consists of a combination of strengthening dikes and widening rivers. However, as widening rivers is more expensive than strengthening dikes, questions arose about the cost effectiveness of the first. Deltares developed methods to compute two benefits of widening rivers: 1) a reduction in the costs of strengthening dikes and 2) additional risk reduction resulting from lower water levels. The ministry uses this information in a cost-benefit analysis to support their decision-making procedures about widening rivers in the next few decades.

In the Netherlands, dike reinforcements are needed to meet the new standards for flood risk management. The extent of the reinforcement can be reduced by widening rivers since this lowers water levels. Deltares first developed a method that calculates the reduction in dike-reinforcement costs obtained by widening rivers. The method combines information about dike-failure probabilities at different water levels with the probability that these water levels may occur. This procedure is followed for different failure mechanisms. If the total failure probability exceeds the statutory standard, the method computes the required dike reinforcement and the associated costs. The cost reduction obtained by widening a river is then computed by comparing the costs for different dike reinforcement options (in other words, with and without a wider river). The method provided, for the first time, an impression of the reinforcements currently required for all embankments on the major rivers in the Netherlands.



Lower water levels reduce not only the reinforcement required but also the impact of flooding. Lower water levels reduce the flow of water through the breach and therefore the depth, and sometimes the extent, of flooding. A large number of flood simulations were used to quantify the reduction of the impact and the results were combined with the computed flood probability to determine the reduction in the flood risk.

The work was undertaken for the Ministry of Infrastructure and the Environment (WVL/DGRW). A consortium led by Deltares and including HKV, Arcadis and Royal HaskoningDHV developed the method for computing the reduction in costs for dike reinforcements. The collaboration between these organisations ensured that the latest knowledge about failure mechanisms was combined with knowledge about the local dike systems.

Until now, no adequate tools were available to compute the costs for dike reinforcements and the benefits (in other words, the reduction of flood impact) that are essential for risk-based decision-making. The new methods provide essential information that will not only be used to assess the benefits of widening rivers but also, for example, to assess the cost effectiveness of changes in discharge distribution over the three branches of the Rhine in the Netherlands.

Further reading:

Asselman & Klijn (2016) Making room for rivers: quantification of benefits from a flood risk perspective. Proceedings of the Floodrisk2016 conference, Lyon. https://doi.org/10.1051/e3sconf/20160712001