Testing levee strength in "Living Lab Hedwige-Prosperpolder"

In the coming years, something special will happen on the Belgian-Dutch border. Prior to the depoldering of the adjacent Hedwige-Prosperpolder, large-scale breaching tests and monitoring exercises are being conducted on the existing levee along the Scheldt.

As part of the Sigma Plan, the Flemish government is currently preparing the depoldering of the Hedwige-Prosperpolder, says Ludolph Wentholt. “The current levee along the Scheldt will disappear. Further inland there will be a new levee of about 6 kilometers. Parts of the old levee are then dug out. We can use this levee for breaching tests and monitoring exercises. A great opportunity. ”

Wentholt works as a Research Coordinator for Flood Defense at the Foundation of Applied Water Research. Stowa, together with the Flanders Hydraulics Research from Antwerp, is the driver of the project. In total, thirteen organisations from the Netherlands, Flanders, England and France are involved and more than thirty observer partners. The idea of using this depoldering for breaching tests has been around for some time.

In the run-up to depoldering Lillo and Wijmeers such tests have already taken place in Flanders in 2011 and 2015. STOWA and several water authorities in the Netherlands carried out levee failure tests in 2015 in the Leendert de Boerspolder, near Schiphol. The polders had to make way for extra water storage. The knowledge and insights provided by the failure tests were encouraging. Wentholt: “In this case it is a completely different levee (flood defense, ed.), where other failure mechanisms are concerned. Not the stability is the major risk here, but the occurrence of breaches in the levee due to wave overtopping and continuous overflow. ”

Breach testing

In the Hedwige-Prosperpolder, which has been transformed into a Living Lab, wave overtopping and overflow tests are used to further investigate the origin and growth of breaches. According to the Flemish breach expert Patrik Peeters, the current models fall short to properly predict breach formation in flood defenses. While the risk of wave overtopping and overflow due to sea level rise is expected to increase. “Because we lack knowledge on this point, we assume fairly conservative assumptions in the standardisation and testing of the strength of primary flood defenses,” says the researcher at the Flanders Hydraulics Research and initiator of the breaching tests. “We want to gain a clearer insight into the actual strength and what determines it. In this way we help flood defense

managers to make more informed choices when prioritising and implementing levee improvements. But also for carrying out the management and maintenance."
With regard to the latter, the test levee is located exactly on the border of the Netherlands and Belgium. This enables us to compare the management and maintenance conducted on both sides of the border (in particular the frequency of the mowing management) and the type of facings (more clay vs. more sand). Peeters: "We hope to find an answer to the question of what the differences mean for the erosion resistance of the levee facings. The stronger the facing, the smaller the chance of breaches occurring. For example, you can maintain the levee strength through sophisticated management and maintenance, without immediately having to switch to drastic strengthening measures. "

Salt marshes

As mentioned, the wave overtopping and overflow tests from the project must provide more insight into questions such as: how does a levee respond to exceptional overtopping and overflow conditions? What determines the formation and growth of breaches and thus the ultimate strength of the flood defense? So far, the flood plain has not been taken into account in determining the strength. Peeters: "This is simply because we don't know how to calculate with that.
In the Living Lab we can investigate the effect of the presence of salt marshes in front of the flood defense on breaching. We can compare this with a part of a levee without any presence of salt marsh. We expect a salt marsh to reduce the width growth. " Market parties regularly come up with innovative or alternative methods and techniques to strengthen, or maintain the strength of levee facings. Peeters: "In the Living Lab, we offer these parties the opportunity to test their products under realistic, but controlled conditions."

Emergency management

What is special about the Living Lab is that not only failure tests are carried out, but that emergency response can also be practiced under controlled, but very realistic conditions. Bart Vonk of Rijkswaterstaat, Marc Balemans of Defense/Water risk Training Expertise center (WTEc) and Marian Booltink of Hoogheemraadschap De Stichtse Rijnlanden are closely involved in this part of the Living Lab.
Booltink: "Based on their own experiences, and the insights they gain during the exercises, various teams of international levee experts, specialists and levee guards will develop the best possible monitoring instructions for the levee guards who are the eyes and ears in the event of imminent calamities and who keep an eye on these flood defenses. We record everything in words and images, for example for e-learning purposes. It is extremely important that we transfer the acquired knowledge to levee guards of the future. Because in the Netherlands we hardly have any experience with real levee damage. In that respect, we can learn a lot from our foreign partners. "

Bresdefender
The Living Lab also tests the effectiveness and reliability of some existing and new emergency measures. We will practice using the "Bresdefender". This is a pontoon that the army uses to transport heavy equipment over the water. This can be applied in a weighted condition (filled with water instead of air) against a weakened body of the dike to prevent or delay a dike breach. The idea is inspired by the story of the sailor who in 1953 sailed his small inland vessel in a breach of the dike near the Hollandse IJssel, thereby preventing a disaster. TU Delft, Defense/WTEc will investigate whether it is a protecting or delaying method in the event of a breach.

Finally
Implementing the acquired knowledge and insights is an important part of this project. Ludolph Wentholt: “The new knowledge may be included in the International Levee Handbook, the most important reference work for flood defense managers. We will also ensure that knowledge and insights are given a place in the study programs where flood defense managers of the future are educated. This is how we ensure that water managers and military personnel are armed against the upcoming flood defense challenges. ”

The Living Lab Hedwige-Prosperpolder receives a contribution of 3.9 million euros from the European Interreg 2 Seas program 2014-2020, co-funded by the European Regional Development Fund under grant contract No [2S07-023]. The total budget is 6.5 million euros. Interreg 2 Seas is intended for the coastal area along the Channel and North Sea to make it more climate adaptive. More information is available at www.interreg2seas.eu.

<<Text for pictures and tekst boxes>>

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Photo 1:
The current levee along the Scheldt will disappear. A great opportunity for testing. (Photo: VILDA - Yves Adams)

Box:
IN BRIEF - Living Lab
The Flemish government is preparing the depoldering of the Hedwige-Prosperpolder

The current levee along the Scheldt will disappear
Further inland there will be a new levee
In "Living Lab" the origin and growth of breaches is further investigated

Photo 2:
Marian Booltink: "It is extremely important that we transfer the acquired knowledge to levee guards of the future."

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Text photo
Patrik Peeters: “Because we lack knowledge on this point, we assume fairly conservative assumptions when standardizing and testing the strength of primary barriers. ”

Text box
Grenspark Groot-Saefthinge
After the depoldering, the Hedwige-Prosperpolder will become part of the Grenspark Groot-Saeftinghe. With 4,500 hectares, this will become one of the largest tidal nature reserves in Western Europe. The nature reserve also contributes to a climate-robust Scheldt delta. It is expected that the tidal area at high water will cause a water level reduction of about 10 centimeters further down the Scheldt. Flanders is also working on climate robustness in many other places along the Scheldt and its affluants. This is all part of the Sigma Plan, the Flemish version of 'Room for the River'. More information is available at www.sigmaplan.be.