



# Project Floris

Flood Risks and Safety in the Netherlands

## Flooding in the Netherlands - probabilities and consequences



# Flood Risks and Safety in the Netherlands

Absolute safety from flooding does not exist



In recent years many parties have invested heavily in creating order in the system of dikes in the Netherlands. In the interest of safety, plans are currently being drawn up to create additional space for the major rivers in the country. Attention is also focusing on the coastal and IJsselmeer areas. However, absolute safety from floods caused by high water does not exist, especially in a country whose surface area is largely below sea level. It is therefore important to make a careful assessment of the probabilities of flooding



In 'A different approach to water', which concerns water policy in the 21<sup>st</sup> century, the cabinet has indicated that it will arrange to map out the probabilities of flooding and potential weak links for each dike ring in the Netherlands. It will also bring into focus the consequences of flooding, to get a clearer picture of the costs and benefits of investments in safety.

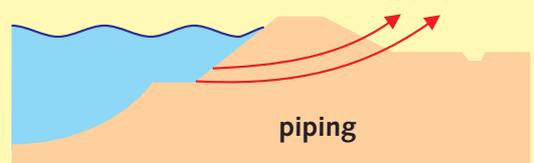
In the *Flood Risks and Safety in the Netherlands* (Floris) project, initiated by the Directorate-General for Public Works and Water Management, along with the water boards and provinces, a calculation will be made of the probabilities and consequences of flooding for all 53 dike rings. Together, the probability and consequence will constitute the risk of flooding. This will be done by using a new computational method that accurately quantifies the probabilities of flooding.

This will represent an expansion of the safety approach developed by the Delta Committee in the 1960s. With the insights that dike managers can gain with this new methodology, they can anticipate changes in the risk of flooding caused by climate change, population increase and the increased economic value of the area in question.

In collaboration with the water boards and provinces, the initial aim of the project is to acquire a detailed picture of current safety from flooding in the Netherlands. To this end, the parties will work together to refine new research methods for determining the probabilities and risks of flooding. Following this, they will examine the dike rings to see how reliable they are and to identify any weak points. To this day, little is known about the safety of hydraulic structures (e.g. locks and pumping stations) in particular, even though they are major elements in dike rings. In addition, the results of Floris will provide a basis for reconsidering socially desirable safety levels. Floris will also contribute to the decision-making process concerning measures to retain or increase safety, relative to costs and benefits.

# New Computational Methodology

Various mechanisms determine the probability of flooding



In 2000, in a study called **Flooding risks** - a study of the probabilities and consequences, the independent Technical Advisory Committee on Water Defences (TAW) argued in favour of a new method for calculating the risks of flooding. According to the study, the safety approach should no longer be based on exceeding frequencies but on the probabilities of flooding. This meant that, instead of looking at the highest water levels that dikes can retain, one should look at the probability of flooding of an area. They examined four mechanisms that could result in flooding of an area: overflow and overtopping, sliding, erosion of dike revetment and piping. They also looked at the failure mechanisms of hydraulic structures. The probabilities were then considered relative to the consequences. The Delta Committee had already made this recommendation in the 1960s. Recent knowledge now makes it possible to implement this new method.

In the TAW study, the new computational methodology was tested in four areas. The methodology was quite practicable, but it required further development and testing. The former State Secretary of Transport, Public

Works and Water Management then decided to have calculations done for the flooding risks of all 53 dike rings in the Netherlands, covering a total length of more than 3,000 kilometres. This formed the basis for the Floris project. The Floris methodology enables the tracing of weak links in the dike rings. However, the calculations are complex. Also, since the loads and properties of dikes or hydraulic structures are not known exactly, failure can never be predicted with certainty.

Uncertainty margins will therefore play a major role in the debate that follows the Floris findings. The contributions of water boards and provinces will be essential in this. What is a reasonable expectation for the probability of danger and how reliable are the findings? Ultimately, it is important that all the parties concerned accept the computational results. In this way, there will be a common picture of the safety risks. In the future, this will enable better consideration of the measures that the Netherlands must take to control flooding.

# Who does what?

The state, provinces and water boards will work together on flood risks and safety



**Co-ordination** of the extensive, complex project, *Flood Risks and Safety in the Netherlands* (Floris), is the responsibility of the Road and Hydraulic Engineering Institute of the Directorate-General for Public Works and Water Management. In this context, the Road and Hydraulic Engineering Institute is responsible for implementing the total project, supplying the instruments and hydraulic preconditions. It will also disseminate the project results and support policy-related and political debates. The Floris Project Bureau was set up to handle the daily implementation and organisation of the computational work. Specialists from various sections of the Directorate-General for Public Works and Water Management are working on developing the methodology and the use of the Floris findings. In particular, the Flood Protection Department of the Road and Hydraulic Engineering Institute will play an important role in this. The Technical Advisory Committee on Water Defences is responsible for independently testing the quality of the methodology employed and the results produced.

In charge of the water defences, **the water boards** are responsible for the safety of the dike rings in their areas.

They are actively engaged in implementing the calculations. Via the Union of Water Boards, they have agreed to co-operate in collecting data for the Floris project. Where necessary, the management of the water boards will prepare measures based on the results.

The **provinces** contribute to the stocktaking of possible consequences and to debates about the results of the calculations. As area directors, they can also contribute to the creation of transparent safety policy.

The **municipalities**, which are especially involved because of their responsibility for evacuation and contingency plans, will become involved at a later stage in the discussions about the results from the project, *Flood Risks and Safety in the Netherlands* (Floris).

There will be a European call for tenders to select engineering firms to work on the project. The firms will mainly concentrate on doing the calculations. An additional aim of the **engineering firms'** involvement will be to bring about a transfer of knowledge from the Department of Public Works to the consulting sector.

## Parallel implementation of the four tracks



### Four Intrinsic Tracks

*The Flood Risks and Safety in the Netherlands (Floris)* Project has identified four intrinsic tracks for attaining the desired results. These four tracks run parallel to each other and will be implemented in tandem. In the first instance, there has been a calculation of the probabilities of flooding of all dike ring areas in the Netherlands. Simultaneously, there will be an assessment of the existing hydraulic structures. The results of the second track will be integrated with the first to attain a complete safety picture. While a third track will aim to determine the consequences of flooding, efforts in the fourth track will focus on coping with uncertainties accompanying the creation and use of the project results.

#### Track 1

### Determining the probabilities of flooding of all 53 ring areas

The parties concerned will employ a newly developed methodology designed to assess the probabilities of future flooding as accurately as possible. This will provide an overview of the probability of flooding per dike ring area. Moreover, the contributions of the separate dike sections and hydraulic structures to the total probability of the flooding of each dike ring area will be made transparent. In this way, there will be a complete, mutually comparable picture of all dike ring areas under consideration and of all dike sections within the dike rings. This analysis will provide insight into the weak points within the total system of primary water defences.

A determination of the (financial and social) consequences will be made for each dike ring area



#### Track 2

### Assessing the Hydraulic Structures

The aim of this track is to reach an assessment of the damming quality and reliability of existing hydraulic structures. The assessment will be based on an estimate of the contribution made by each hydraulic structure to the probability of flooding of the dike ring in question. Based on a questionnaire, the data will be collected on all hydraulic structures in the Netherlands. Which hydraulic structure belongs to which dike ring? What are the dimensions and what is the history of each hydraulic structure?

#### Track 3

### Determining the Consequences of Flooding

The third track used by the Road and Hydraulic Engineering Institute, together with the water boards, provinces and engineering firms, entails the development and application of methods for determining the consequences of flooding. The financial and social consequences will be determined for each dike ring area. With the probability of flooding, this will result in a determination of the risks of flooding for each dike ring area (probabilities x consequences = risks).

The method used to determine the consequences is an extension of the previously developed *Standard Method for Predicting Damage and Casualties as a Result of Flooding*. Possible measures will also be explored in order to tackle weak points in the dike ring. In that connection, the costs and benefits will be weighed. Finally, the flooding risks identified by the study will be compared to other safety risks in the Netherlands.

#### Track 4

### Coping with Uncertainties

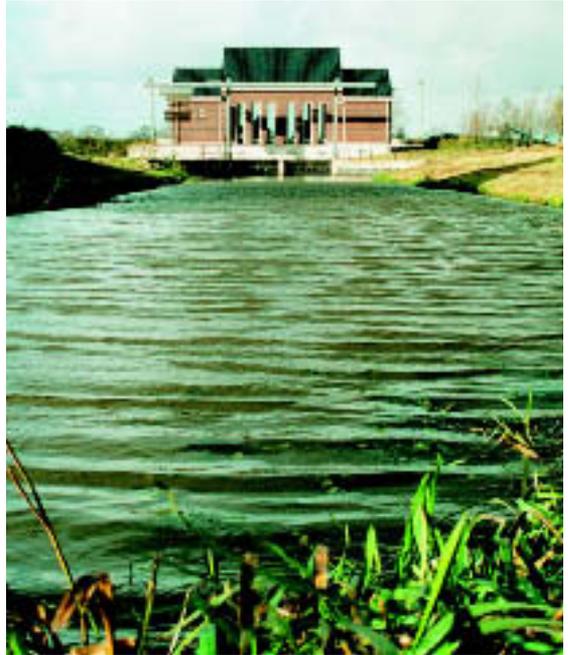
This track entails the development of a view designed to manage the results, given the uncertainties in the data that form the basis for the computational results. This makes it necessary to have greater insight in the nature and scope of uncertainties. Possible ways of influencing the uncertainties will also be examined. This view will provide insight into the use potential of the Floris results in weighing safety improvements against flooding.

Based on the results of these four tracks, it will be possible to obtain the best survey of flooding to date in the Netherlands. This will provide insight into the probabilities of flooding and into the weakest links in the various dike ring areas. Based on this, rough estimates can be made of the costs of improvement. Moreover, the information from the various studies could form the basis for discussions about whether to tackle these weak links. Furthermore, the Floris findings will provide an important basis in support of a debate about socially desired safety against flooding, also in relation to other safety risks in the Netherlands.

*Teamwork among the Directorate-General Water, the Road and Hydraulic Engineering Institute of the Directorate-General for Public Works and Water Management, the provinces, municipalities and water boards concerning implementation of the project and presentation of the results will require extreme precision. That will also apply to relations with other water projects such as Creating Space for Rivers. For this reason, constant attention will be given to communication and mutual alignment.*

# Time Frame

Total insight by 2004



The **Directorate-General Water**, the Road and Hydraulic Engineering Institute of the Directorate-General for Public Works and Water Management, the provinces and water boards have outlined a time frame for all activities of the *Flood Risks and Safety in the Netherlands* (Floris) project. The aim is to get a complete picture in 2004 of all risks of flooding in the Netherlands.

In 2000, an action plan was drawn up for the Floris project. In January 2001, preparations for the project got underway. Six months later the Floris Project Bureau started its activities. During 2002, a calculation of the probabilities of flooding of a first group of dike rings has been made, the so-called front runners. This involves six dike ring areas that, together, cover a significant part of the river area. In the Floris project, these dike ring areas are part of a pilot project for the further testing and completion of the computational methodology. The calculation for the other 47 dike ring areas will take place after the pilot project in two successive rounds scheduled in 2003 and 2004. To ensure an optimum approach to the work, project groups have been set up for each dike ring area or combination of dike ring areas, with representatives of water boards, provinces and the Directorate-General for Public Works and Water Management. There should be complete insight into flooding safety in the Netherlands no later than 2004.

