



DHI SOLUTION

## PLUVIAL FLOOD MANAGEMENT

Evaluating impacts of extreme rain events and managing urban surface runoff efficiently

Pluvial flooding is an increasing problem for cities around the globe causing huge economical losses and in extreme cases, risk to human life. Using our software and knowledge, entire cities can efficiently be screened, identifying the most problematic areas with regards to flood risk. We can help you form strategies to manage surface runoff and find solutions to create flood-safe urban developments.

### PLUVIAL FLOODING: AN URBAN CHALLENGE

Pluvial flooding refers to flooding events that are caused by extreme rainfall. Such floods occur when the ground cannot absorb rainwater effectively or urban drainage systems are overwhelmed by excessive water flow. Pluvial flooding also occurs when the ground is saturated by melting snow and consequent low permeability.

Floods caused by extreme rain events are an increasing problem for cities worldwide. Increasingly dense urban developments, as well as a fast changing climate are stress factors which put intensify the issue of pluvial flooding. Climate change and extreme rain events are new topics on the urban planning agendas almost everywhere globally.



Flooding in Copenhagen 2011 Photo: © Polfoto-Mogens Flindt/Scanpix

### SUMMARY

#### CLIENT

- Government agencies
- Municipalities
- Consultants

#### CHALLENGE

- Inadequate measures to manage surface runoff
- Need to identify areas vulnerable to pluvial flooding (flooding that occurs due to heavy rainfall)
- Need to take appropriate measure to alleviate resulting flood situations

#### SOLUTION

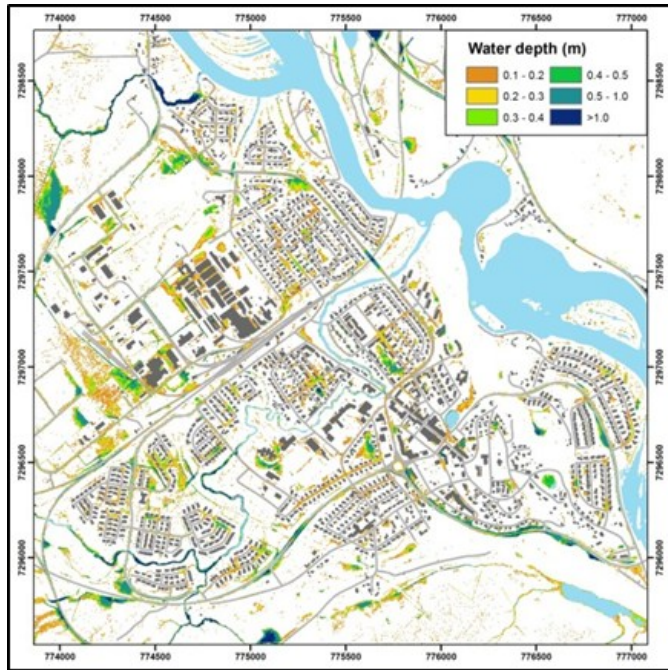
Evaluating the impact of extreme rain events and, calculating of flood depths and flow paths using our knowledge and software tools

#### VALUE

- Efficient mapping of large geographical areas with limited time effort
- Proper identification of areas vulnerable to pluvial flooding
- Ability to prepare appropriate strategies to effectively manage urban surface runoff

**SCREENING OF PLUVIAL FLOODING IN URBAN AREAS**

Mapping the effects of extreme rain events can be time-consuming and thereby costly, if models of storm water systems for entire cities are to be established. In many cases, necessary information on the geometry of pipes and gullies are also unavailable. During an extreme rain event, only a limited portion of the rain volume is gathered by – or has time to infiltrate the existing storm water system. This makes it possible to apply a methodology (using our modelling software) where only the surface runoff of the excess part of the rainfall volume is simulated. This enables mapping of large geographic areas with limited time and effort.



Calculation of maximum water depths following an extreme rain event

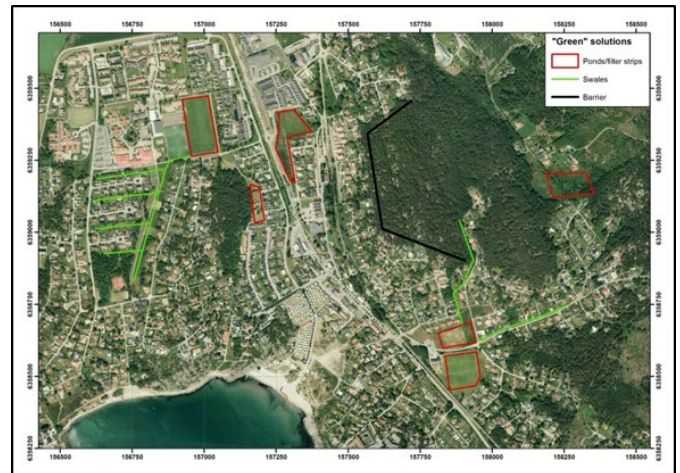
**CLIMATE CHANGE – THE IMPACTS ON PLUVIAL FLOODING**

Effects of climate change are becoming more and more prominent and its future impacts can be predicted to a large extent. Some places will become drier, whereas others will become wetter with intensified rainfalls. At DHI, we have access to the latest results obtained from a wide range of regional climate models. Applying bias correction and statistical downscaling, climate model data can be used to simulate an ensemble of future extreme rainfall events in urban areas. In so doing, we can evaluate the impacts of climate change on the pluvial flood situation.

**MITIGATION MEASURES**

Increasing the capacity of sewer and drainage systems require large investments. There are many advantages in handling as much of the rain volume on the surface as possible. Flood map results (such as water depths and flow paths) are obtained by using our modelling software. These results form the basis for establishing a strategy to manage surface runoff within existing and planned developments. Key green spaces are identified and locations of new green areas are proposed. Conclusions are drawn with respect to which areas are safe to develop and which should be avoided – from a pluvial flood perspective.

In new developments, the degrees of freedom are higher with regards to land use and elevation planning. In such cases, there is a higher possibility of making space for water. With our software and knowledge, different elevations and land use scenarios can be simulated in order to find the best possible ways to reduce the impact of heavy rain. Specific sustainable urban drainage solutions (SUDS) such as swales and retention ponds can also be simulated to investigate the flood-reducing effect.



Example of SUDS