

DHI CASE STORY

# TREATING URBAN STORM WATER RUNOFF

Using compact filtering technology for storm water treatment

In recent years, Denmark has experienced an increase in the intensity of precipitation. In cities across the country, this has also meant a rise in storm water runoff. Without the proper equipment in place to deal with this increase, many combined sewer systems become overloaded. Adapting the Danish wastewater infrastructure to meet this change is essential. In order to help Denmark's wastewater infrastructure adjust, we tested two filtering technologies: Flexible Fibre Filter Module and Hydrotech Disc Filters. These compact systems allow for decentralised treatment of storm water. Treating storm water results in better water quality in the environment and improves municipal wastewater treatment plant operations.

## TREATING URBAN STORM WATER RUNOFF WITH COMPACT FILTERING TECHNOLOGIES

The way in which storm water runoff is treated, reused and discharged is a topic of concern for countries around the world. Treating storm water runoff, however, poses unique challenges for cities. As the storm water passes over paved areas and roofs, it collects particles and chemicals. This must be filtered out before the water is discharged back into the environment.



Schematic illustration of Hydrotech Disc Filter © Hydrotech/Krüger A/S

### SUMMARY

#### CLIENT

Collaboration with Krüger A/S and Nordvand A/S for the Environmental Protection Agency of the Danish Ministry of Environment

#### CHALLENGE

- Hydraulic overload of sewer systems and municipal wastewater treatment plants due to increasing precipitation
- Unwanted discharge of storm water runoff into the environment

#### SOLUTION

Testing and analysis of two filtering technologies for decentralised handling of storm water

#### VALUE

- Increased efficiency of wastewater treatment plants
- Improved quality of storm water discharged into the environment
- Reduced hydraulic overload in sewer systems

#### LOCATION / COUNTRY

Copenhagen, Denmark



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In the Copenhagen catchment area, the majority of storm water is discharged into combined sewer systems, which causes frequent hydraulic overload. This can reduce the efficiency of the municipal wastewater treatment plants. The increased intensity of precipitation in recent years has magnified this problem.

The Environmental Protection Agency of the Danish Ministry of Environment wanted to examine ways to adapt the wastewater infrastructure in Denmark. As part of a development project with Krüger A/S and Nordvand A/S, we tested two filtering technologies: Flexible Fibre Filter Module (3FM) and Hydrotech Disc Filter.

Neither system had previously been used to treat storm water from paved areas. To test their effectiveness for the decentralised treatment of storm water in urban areas, we installed the systems in two municipalities in Denmark: Gentofte and Gladsaxe.

### **ANALYSING 3FM AND HYDROTECH DISC FILTERS**

In the Gentofte Municipality, we installed the 3FM system, which retains Total Suspended Solids (TSS) using flexible nylon fibres. It can retain particles as small as 3-5µm. A combination of compressed air and treated storm water automatically backwashes the filter.

The treatment efficiency of the 3FM system was 50-70% for TSS. This corresponded to an outlet concentration of 5-10mg TSS per litre. The treatment efficiency for Total Phosphorus (TP) and Chemical Oxygen Demand (COD) was below 20%. For copper (total) and zinc (total) a reduction of more than 60% was registered.

By adding a coagulant (chemicals that promote particle clotting and settling) in the 3FM system, we reached a water quality level that fulfilled the environmental quality standard for freshwater bodies for TSS, phosphorous and bisphenol A. For polycyclic aromatic hydrocarbons (PAH), a removal of 34%-96% was obtained for individual compounds.



illustration of Flexible Fibre Filter Module © Hydrotech/ Krüger A/S In Gladsaxe Municipality, we installed the Hydrotech Disc Filter. Water is directed into the central drum and from there into the filter discs. The filter panels mounted on both sides of the disc retain particles as small as 10µm. Pressure loss over the filter membrane determined the back wash frequency. The filter is automatically backwashed while in operation.

The treatment efficiency was 50-60% for TSS. This corresponded to an outlet concentration of 10-15mg TSS per litre. For TP, the treatment efficiency varied considerably between 28% and 64%. It was below 15% for COD. For copper (total) and zinc (total), a maximum reduction of 45% was observed. The reduction was less than 35% for four PAHs.

By adding a coagulant and flocculant (chemicals that help particles clump together), we achieved a water quality level that fulfilled the quality standard for freshwater bodies for TSS and phosphorous.

With respect to PAH, the system achieved a removal rate of almost 75% for individual compounds. Treatment reduced benzo(b,j,k)fluoranthene to a level below the detection limit.



Hydrotech Disc Filter © Hydrotech/Krüger A/S

## **PROMISING FILTERING TECHNOLOGY**

Both filtering technologies can help improve the operational efficiency of storm water runoff treatment. Backed with on-line monitoring, operations can be optimised. This can help improve water quality in the environment.

In many cities, space is at a premium, restricting the opportunity to update filtering technology. As both filtering systems are compact, they are perfect for use in decentralised storm water runoff treatment in urban areas.

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