

## Open surface water system in a new city. An example in local level

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*Traditionally, precipitation has been drained through pipes in the ground, but a different principle has been chosen for Fornebu city, leading the surface water through gutters, canals and ponds to a central pond located in the middle of the development. Why? Because we expect about 20% more precipitation by year 2100.*

### From airport to hypermodern city

Fornebu is a peninsular area in the suburban municipality of Bærum in Norway, bordering the western parts of the municipality of Oslo. Formerly Oslo Airport Fornebu (FBU) served as the main airport for Oslo region and the country since 1939 and until the evening of October 7 1998, when it was closed down. Overnight, a grand moving operation was performed, so that the following morning, the new main airport, located inland at Gardermoen (OSL), opened for operations as main airport.

*Illustration 1: Fornebu in the region of Oslo and surface water system as a big central park*



As of the turn of the millennium, the Fornebu area is being developed as a centre for information technology and telecom industry, as well as some housing project developments nearby with 6500 houses for nearly 16.000 habitants, 25.000 jobs and several big areas for recreation. The new headquarters of Norway's multinational firms as telecom giant Telenor, Statoil, Aker Kværner and Norske Skog are located in the area. Fornebu will be ready built in 2025.

### Delaying surface water

With increased amounts of precipitation due to climate changes, it is also important that measures for delaying the surface water are established in the developed area so that the size of gutters, canals and ponds, as well as the water variations in the central pond, are small. The surface water must be cleaned before it is released to the parks and recreational areas.

### Closed or open solutions

Traditionally, surface water in developed areas in Norway has been drained through pipes in the ground. The disadvantages of this solution is that the water is removed from the natural cycle, the water as a natural element is removed from people, the system is vulnerable to capacity issues in the event of flooding and has limited pollution retention. Alternatively, the surface water can be handled according to nature's own principles in open gutters, canals and ponds. The advantage of such solutions is that the surface water becomes a resource for

experiences, play and biodiversity. This results in better wellbeing, increased flood safety, better water quality and reduced discharge of pollution.

### **Advice for designing and operating facilities**

The report addresses challenges and experience with open solutions and recommends how they should be implemented.

Gutter solutions are often used for collection and transport of surface water. Such gutter systems should be planned with designated flood routes that become functional for extraordinary precipitation and snow conditions. In the event of major water volumes, gutters are designed as canals or natural streams in park/recreational areas.

The challenges involve dimensioning the gutters so that the water does not appear as a mere trickle and also ensuring that an uncontrolled flood risk does not occur. It is also important to maintain good water quality as this has an impact on the aesthetic experience. In residential areas, safety must be emphasised and the facilities must be safe both during summer and winter.

### **Ponds**

An important element in open surface water systems is permanent water surfaces in the form of ponds. In development and park areas, water surfaces are considered exciting and lively elements. The water surface should be located at a high level in the terrain and be surrounded by clear prepared marginal zones, as these are attractive available areas. The planning process should clarify whether the area will be used for swimming or not.

Retention is necessary in open solutions to moderate floods. All development will result in quicker run-off and higher intensity (floods) due to sealed surfaces. To avoid very large dimensions of gutters, canals or ponds, it must be possible to store the surface water in the event of major precipitation and to empty this when the precipitation stops. The advantage is also that the period with running water is prolonged.

### **Function and operation planning**

The challenge is to distribute the retention capacity over many links in the chain. If the retention capacity is exceeded in the event of extreme run-off, flood crests could also be routed to parks/recreational areas with infiltration. Function and operation must be planned from the start and must be carried out effectively. It may be rational to combine operation of open surface water solutions with the operation of roads, squares, and parks/recreational areas.

On roads with heavy traffic, there may be a need to clean the surface water before routing it out to parks/recreational areas. It must be a goal for such ponds to be experienced as positive landscape elements.

### **Furthermore, the report addresses the following topics:**

- Water quality and water treatment, with water quality-improving measures
- Dimensioning and design of ponds, with description of experiences with such ponds in Norway and abroad, as well as recommended measures
- Operation of surface water solutions, with experiences from operation of such facilities and recommended measures

- Local solutions for residential areas, with options for outlet of surface water and open surface water handling (design, preconditions and framework conditions).

To read about experiences and recommendations within all areas, download the report on the Directorate of Public Construction and Property's website [www.statsbygg.no](http://www.statsbygg.no)

You will find the report on open surface water solutions in Norwegian here:

[http://statsbygg.no/FilSystem/files/prosjekter/fouprosj/miljo/10415\\_Rapport\\_Overflatevann.pdf](http://statsbygg.no/FilSystem/files/prosjekter/fouprosj/miljo/10415_Rapport_Overflatevann.pdf)

with the following name: (Åpne overvannsløsninger - erfaringer og anbefalinger) The report is not translated to English.

*Illustration 2: The new city and the main pond in the middle of the central park built in 2010*



Illustration and Photo: Statsbygg.

### **About the report**

The document in the link is the final report from the R&D project "Open surface water solutions – experiences and recommendations". The project is financed by the Directorate of Public Construction and Property (Statsbygg) and Statsbygg infrastructure Fornebu and initiated through the development on Fornebu (Municipality of Bærum) where open surface water solutions are already built.

In the report, the main principles at Fornebu are addressed as examples. The technical assessments and recommendations have been provided on a general basis, so that the results will be useful for other corresponding development projects. Today other cities/municipalities such as Trondheim have used the experiences of Fornebu in Bærum.