

## Reducing urban flood risk through innovation procurement

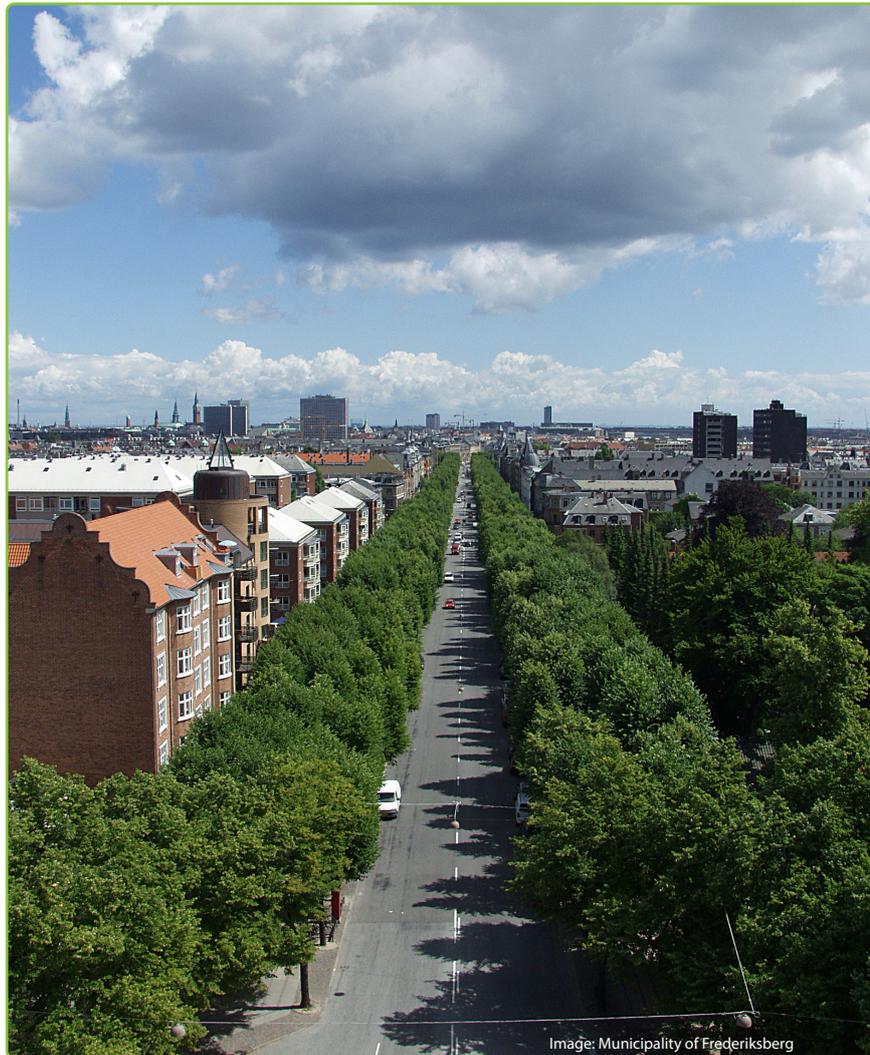
Municipality of Frederiksberg (Denmark)

### Background

The [Municipality of Frederiksberg](#), with a population of over 100,000 people, is one of 29 municipalities which make up the [Capital Region of Denmark](#).

Like many European cities, Frederiksberg is challenged by heavy rainfall combined with an old sewage network not designed to handle the amount of water it now receives. This leads to urban flooding, like on the 2nd July 2011, when large parts of Frederiksberg were left under water after 135mm of rain fell in a very short period. The risk of urban flooding is likely to increase as climate change alters rainfall patterns.

To protect against future flooding, the Municipality has launched a number of projects to improve rainwater management. By improving the city's 'green' and 'blue' infrastructure (such as vegetation and water features) rainwater can be captured, and its flow can be diverted from sewers or slowed down. The Municipality aims to handle 30% of rainwater 'locally', meaning, without relying on the sewage system to drain water from streets. Between 2016 and 2036, it has allocated almost €300 million (2.2 billion DKK) for these improvements, 15-20% of which is reserved for developing innovative new future-proof solutions.



### Procurement objectives

As an ideal solution suitable for dense city streets was not yet available on the market, Frederiksberg used an innovation partnership model in order to procure a customised solution for heavy rainfall management.

An innovation partnership approach allows research and development activities to be combined with a purchase, in a way which adheres to procurement rules around equal treatment and transparency (as set out by Art. 31 of [Directive 2014/24/EU](#)). It involves three phases: a competitive phase, where suitable partners are selected; a research and development phase, where the solutions are developed in collaboration with the contracting authority; and a commercial phase, where the selected partner(s) provide the final product or service. In the final phase, the contracting authority has the right, but not obligation, to purchase additional units for further deployment.

Prior to the competitive phase, in February 2017 Frederiksberg conducted a market dialogue with different market actors, including companies, universities and others, in order to make sure their approach reflected state-of-the-art knowledge. Over two days of market dialogue, participants were introduced to the innovation partnership concept, including the benefits, risks, conditions and financing. Interested parties were invited through an open call to submit requests for pre-qualification. Only pre-qualified bidders could submit bids, which would then be subject to negotiation.

By focusing more time and resources up-front, Frederiksberg aimed to ensure that the new solutions developed through the innovation partnership could be purchased directly at the end of the process, without having to do a further procurement procedure to upscale their preferred solution.

The resulting tender focused on functional specifications, such as the amount of water which should be caught by the system, and the need for continuous watering of trees.

## Criteria used

### Subject matter of the contract:

Innovation Partnership for developing, testing and implementing water management solutions.

### Selection criteria:

To ensure technical and professional ability of selected suppliers, applicants had to submit between one and four references demonstrating the execution of relevant research and innovation projects within the past three years. A research and innovation project was considered relevant if it resulted in the applicant launching an innovative product or solution on the market. Such projects may be funded by the applicant's own resources, or funded partly or in full by a third party (including grant money or customer payments). In addition, the applicants had to submit one reference for construction work.

### Technical specifications:

In order to encourage innovative solutions, technical specifications focused on minimum functional requirements, including:

- solutions are able to withhold at least 0.5 cubic meters of rainwater from the sewage network per meter of road;
- solutions can remove water from the roadway in heavy rainfall (15 mm per half hour) within a 30-minute period;
- solutions can be established in the existing road structure (in a densely built-up area) and be built within a maximum of five weeks at junctions and three weeks in road sections;
- solutions can withstand heavy traffic (annual average 3500 passenger trucks and 300 trucks per day);
- solutions comply with applicable technical, environmental and regulatory requirements; and,
- solutions must cost no more than €1140 (8500 DKK) per 0.5 cubic meters of water handled. This price was agreed in collaboration with the water utility company which is in charge of the sewage system.

*“Co-development was a key factor in the success of this procurement. Using an innovation partnership model allowed the municipality to combine its knowledge and experience with other actors and find innovative solutions which meet the municipality's specific needs.”*

### Award Criteria:

Contracts for the development phase were awarded on the basis of best price-quality ratio, applying the following criteria and weightings:

- Potential for effectiveness (50%): the extent to which the solution meets the described challenge.
- Deployability, including flexibility and modularity (20%): the extent to which the solution can be deployed in dense areas, in a short timeframe without significant disruption, as well as its scalability and maintenance requirements.
- Robustness in project execution (20%): the extent to which the supplier has demonstrated its ability to develop the innovative solution in the stipulated time frame, understand the contracting authority's needs and involve stakeholders, and apply employee competence and safety considerations in project execution.
- Maximum price for the solution (10%).

The first three criteria were assessed according to a 1-10 scale, where 10 points were awarded for proposals which met the criterion with no or a few insignificant exceptions, and 1 point for proposals with an unsatisfactory fulfilment of the criterion. A formula for comparing prices was included as an appendix, in which the lowest maximum price is awarded 10 points, while a maximum price twice as high as the lowest price is awarded 5 points, and 10 times as high is awarded 1 point.

Frederiksberg expected five consortiums to apply, and in the end, exceeded this by receiving expressions of interest from eight. Five consortia were invited to enter negotiations, and four accepted the invitation. Of these four, one was not able to meet the minimum requirements presented in the tender. Contracts were signed in November 2017 with two bidders to develop solutions.

### Results

The first solution was an easy-to-build flexible system for storing water in small retention basins, and using this to water city trees. The retention basins are dug into the city's streets and lined with a membrane. The basin is filled with gravel, compacted mulch able to carry traffic loads, and plastic cubes, which together create a "sandwich" of different layers. On top of all this, a tree is planted. Thanks to the sandwich construction, capillary watering is provided to the top layer of the basin in the first four years. After this, when the trees roots are deeper, the sandwich construction delivers water to the lower level. After heavy rainfall, a sustainable drainage system (SuDS) flow regulator is used to release water from the retention basin slowly over a 24-hour period.

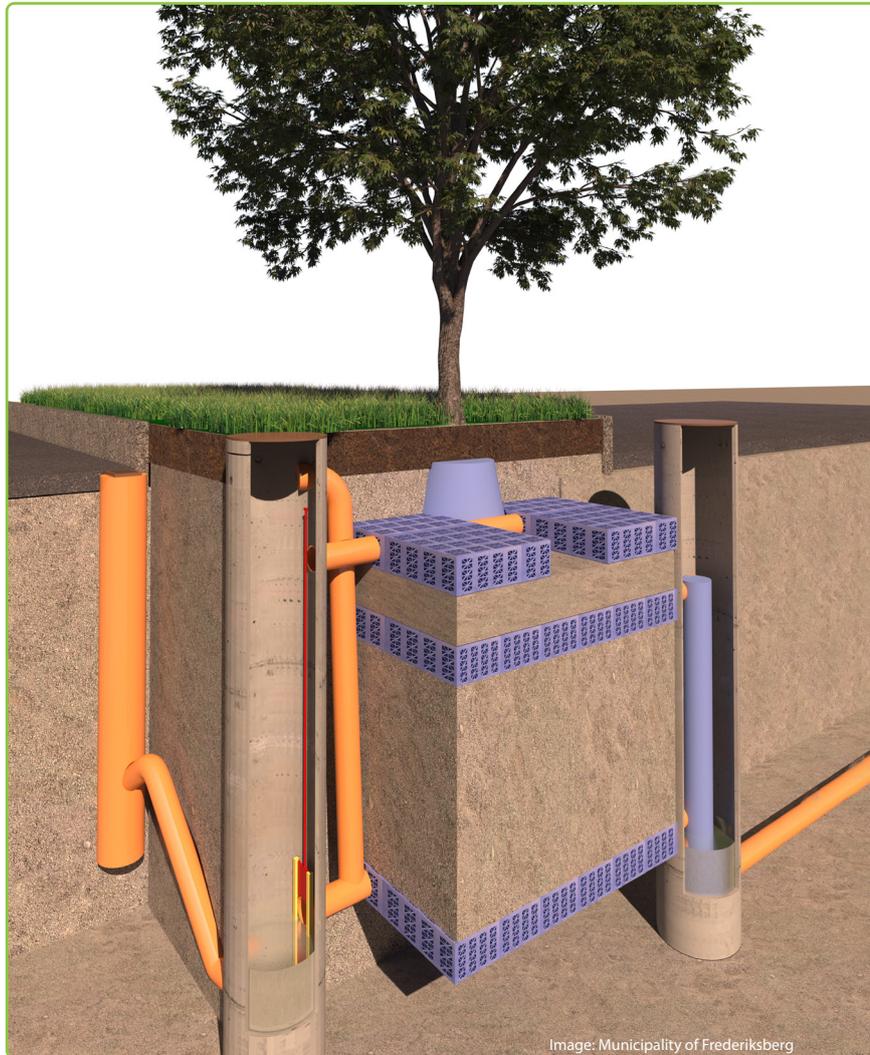


Image: Municipality of Frederiksberg

The second solution channels surface water from roads through a cleaning device, and then into a system which waters city trees. After this, it flows into a number of underground 'delay tanks' which release into existing drains. In order to ensure that the existing drain system is not overloaded in a storm surge situation, the release from the reservoirs is delayed to match existing capacity in the drain network.

Both solutions were co-developed with the Municipality, and were tested at the same time in the same locations, which were selected as representative of the majority of city streets where the solution would be deployed.

As both consortiums managed to develop useable solutions, the municipality now has the option under the framework agreement to buy additional products and solutions from both for the next four years without conducting a separate tender. As part of the contract signed with both consortiums, further development will continue over the next four years, with the goal of increasing the effectiveness and decreasing the price.

In addition, four other municipalities and utility companies have signed an option of purchase based on the innovation partnership contract, enabling them to use the same framework agreement to purchase new solutions for their city. Together, the value of the contracts is €1,866,600.

By using an innovation partnership approach, the city acquired an effective system which was cost effective and implemented in a short amount of time. It took just 20 months from the market dialogue in February 2017 to the solutions being implemented in October 2018. This was the first Innovation Partnership to be completed in Denmark, and second in Europe. As a result of this successful approach, Frederiksberg one the Innovation Procurement of the Year prize in the [2019 Procura+ Awards](#).



## Environmental impacts

Each retention basin can take up as little as 0.8 m<sup>2</sup> of space, providing flood mitigation and also supporting a greener city. Using rainwater to water trees reduces operation and maintenance costs of city trees during dry periods (saving time, water, and CO<sub>2</sub> in terms of the trucks used for these maintenance operations), and reduces pressure on existing drainage networks by diverting water through transpiration (evaporation from trees). Trees in city streets also provide shade and cool down the city on hot days.

## Lessons learned

Co-development was a key factor in the success of this procurement. Using an innovation partnership model allowed the municipality to combine its knowledge and experience with other actors and find innovative solutions which meet the municipality's specific needs. The fact that dialogue with private companies was possible beforehand and throughout the tender made it possible to create much better solutions.

An important lesson was that the model should be explained many times, and expectations should be repeatedly addressed. Co-development is a new way of working, and requires a shift in mindset.

As this was one of the first times the innovation partnership model has been used, Frederiksberg engaged an external legal expert to help handle the co-development process. This increased the upfront costs of this procedure. However, in the long run, the municipality expects to save money, as it will not need to run another procedure for several years, and it can choose from two custom made solutions already tested in situ.

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For related information, please see European GPP criteria for [Road Design, Construction and Maintenance](#), the [Technical Background Report](#) and the [Procurement Practice Guidance Document](#).