

# WATER

NEWSLETTER, ENVIRONMENT & NATURE

THE IMPORTANCE OF WATER ISSUE #1, JUNE 2011

## THE IMPORTANCE OF WATER

"ADAPTING TO CLIMATE CHANGE"

RAMBOLL

# HOLISTIC COMMUNITY CONSULTANT



During the coming months, Ramboll's water experts will share their urban water management projects with you in a quarterly newsletter. The newsletter will also contain their views on water-related issues and policies.

The global demand for water services is rising rapidly. The demand is driven by several factors, including worldwide population growth, urbanisation, industry and irrigation. In North Western Europe, this demand is furthered by climate changes in the form of heavy rain storms and more stringent EU legislation aimed at managing flood risks and improving water quality.

At Ramboll, we have launched an initiative called **Urban Water Management**, because we believe we are uniquely qualified to undertake the water-related challenges faced by our customers and society at large, and that we have the capacity to support a comprehensive service offering, regardless of the size and complexity of the projects.

Urban Water Management comprises services such as waste water and storm water management, waste water treatment, urban water infrastructure, and a number of related subservices.

As always, the true uniqueness of Ramboll's value proposition lies in our customer partnerships. We think of ourselves as a local partner providing global knowledge. We do this by developing strong relationships with our customers and by fully understanding the local conditions, whilst at the same time leveraging the benefits of being a large organisation with global reach.

We hope you enjoy our first newsletter.

Yours sincerely,

A handwritten signature in cursive script, reading "Neel Strøbæk". The ink is a light, greyish-brown color.

Neel Strøbæk  
Service Area Director, Environment & Nature

# WASTE WATER TREATMENT PLANT IN UMEÅ, SWEDEN

**AS WE ALL KNOW, URBAN GROWTH CONSTITUTES ONE OF THE BIGGEST ENGINEERING CHALLENGES IN THE 21ST CENTURY. URBAN GROWTH HAS A PROFOUND EFFECT ON INFRASTRUCTURE, BUILDINGS, ENERGY, AND WATER - ALL AREAS THAT ARE ESSENTIAL TO PEOPLE EVERYWHERE.**



Experience and different kinds of expertise is required to facilitate the tackling of global challenges that we are facing. This is also the case when working for the city of Umeå in northern Sweden.

The city of Umeå is growing rapidly. The waste water discharge increases with the growing population, and the waste water treatment plant is running out of capacity. Since 2009, Ramboll has been working to help the city re-design the waste water treatment plant to increase the capacity from 115,000 to 160,000 connected individuals.

Umeå is gearing up to grow significantly by 2050, and the waste water plant project is an important part of the city's growth plans. The

project has dual purposes: it allows Umeå to grow in a sustainable way with limited environmental impact from waste water discharge. It also improves working conditions for the operations staff, creating a healthier working environment.

Work on the Umeå project was started by conducting a Feasibility Study and Environmental Impact Assessment (EIA). EIA is a tool applied to identify the environmental and social impacts of a project before decisions are made. It involved the assessment of environmental effects, comparison of alternatives, and identification of appropriate mitigation measures. In applying these analysis, EIA facilitates informed decision making.

The next step in the project process was to establish the preliminary design and start working on the detailed design of the expanded plant (this is expected to be finalised in the course of this year).

The project has involved experts from a number of departments within Ramboll, including Waste Water Process Design, Piping and Mechanical Engineering, Structural Design, Geotechnical Engineering, Civil Engineering, Electrical Engineering, Heating, Ventilation and Biogas Systems.

[By Petter Björkman  
Ramboll in Sweden](#)

# PREPARING COPENHAGEN FOR CLIMATE CHANGE

**In February 2011, the Municipality of Copenhagen published its Climate Adaptation Plan. The plan is addressing climate changes such as increased rainfall, higher sea levels, and warmer weather. In preparing for these changes now by starting to incorporate measures to tackle them, Copenhagen City expects to save money and contribute to the city's development at the same time.**

One future climate challenge comes in the form of flood risks, a serious consequence of heavier rainfall and rise in sea levels. Copenhagen is preparing for this by planning to use the increased quantities of water for more green areas and lakes. In addition to making the city a greener and nicer place for its inhabitants, this measure will also create more jobs.

Copenhagen is one of few Danish municipalities having decided to create and implement an extensive climate adaptation plan. It is an ambitious plan at that - both in scope and details. London is another European city taking similar steps, and it is expected that more European cities will follow the lead of such cities.

## **Climate adaptation strategies**

To take proper adaptation measures and reduce the cost of any damages in connection with increases in extreme rainfalls, Copenhagen Municipality has decided to follow three parallel strategies:

- **Sustainable urban drainage systems (SUDS)** - the introduction of drainage systems with local handling of rain water without connections to traditional sewer systems. This system reduces the risk of excess rain water causing overload to sewers. It is sustainable because energy and chemical consumption in waste water treatment plants is reduced. Ramboll has developed a complete catalogue of SUDS, including design

guides, for the implementation of this system.

- **Flood control "Plan B"** - this plan is intended to control the flood events so water from overloaded sewers is redirected and stored in places that can contain the water, such as parks and parking lots, etc.
- **Intelligent Waste Water Handling** - this project aims at optimizing the integrated operations of sewer systems and Waste Water Treatment Plants. It is a method of taking maximum advantage of existing systems before constructing new ones. The project has considerable environmental benefits because it will reduce overload of the plants. It involves Copenhagen Municipality, seven surrounding municipalities and their utility companies, and the two largest treatment plants in Denmark. Ramboll has developed a unique integrated model comprising sewer systems and treatment plants. The model can be used to calculate optimization scenarios - for example, by reducing the outlet of polluted water into the ocean by 30-50%.

## **Hydraulic calculations and cost-benefit analysis - input to adaptation plan**

Ramboll acts as a consultant on Copenhagen's Climate Adaptation Plan. We have provided substantial input to the plan, especially regarding the hydraulic and input to economic calculation of flooding damages caused by overload of sewer systems and rivers, etc. In addition to recommending specific



solutions, we have also calculated the effects of adaptation measures and the implementation costs.

The hydraulic calculations proved to be quite complex, in part due to the large area covered, the demand for high precision, and the combined effects of sea level rise and extreme rainfall.

The hydraulic flood modelling shows a number of flooded houses, roads, and technical installations. For each flooded installation, construction or building, it is possible to estimate the total costs of repair and loss of revenue (i.e. caused by waiting time on roads and in public transport).

Summarizing the total costs over a 100-year period, it will amount to an incredible 2.1 billion euro or 2.9 billion US\$ - net present value NPV. This is provided that the municipality maintains the present level of service with regards to flood prevention by ongoing sewer

enlargement corresponding to the increase in rainfall intensities.

Ramboll has suggested various solution strategies to lower the total cost of the adaptation plan. The results are shown in the table below. All results are in net present value (NPV) and estimated over a 100-year time span. For all scenarios, it is assumed that the municipality will ensure that the present level of service is maintained by sewer enlargement or similar projects.

If the adaptation is based exclusively on increasing sewer capacity and/or switching from combined to separate sewers, the NPV of adaptation will be 1.9 billion US\$, and yet, the total damage in NPV will be 1 billion US\$.

The total adaptation and damage costs based on sewer enlargement alone are almost equivalent to the total damage costs of not adapting at all. This is compared to a NPV of 1.4 billion US\$ with a combined/multifaceted solution.\*

The analysis and strategy indicate that sewer enlargement is not a lasting solution in protecting municipalities from flooding caused by extreme future weather conditions. This does not mean that no sewer enlargement or optimization of existing systems will take place.



A well-functioning sewer system still forms the basis of maintaining a constant service level with regards to flooding, wastewater treatment, and for meeting the environmental demands of a substantial reduction of overflow to recipients.

**Multifaceted solution**

At Ramboll, we firmly believe a multifaceted strategy is the most cost effective way to adapt to flood risks.

We have the competences to assist municipalities every step of the way when it comes to climate change

adaptation. In Denmark, we are doing this at all levels, covering everything from detailed technical solutions to strategy formulation and economic analysis. The same services can be provided to municipalities in other countries through collaboration with Ramboll offices around the world.

By [Christian Nyerup Nielsen](#)  
Ramboll in Denmark

\*Ramboll collaborated with COWI and Deloitte on these calculations.

Scenario	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Damages and Measures	Sewer	Sewer	Sewer	Source control
Damages and Measures		Basement valves	Basement valves	Basement valves
			Flood control	Flood control
Damages "Do nothing"	-2.9	-2.9	-2.9	-2.9
Adaption costs	1.9	2.1	2.5	1.2
Reduced damages	1.0	0.5	0.3	0.3
<b>Net savings</b>	<b>0.0</b>	<b>0.3</b>	<b>0.1</b>	<b>1.4</b>

Table: NPV in billion US\$ of adaptation strategies. Net savings are compared to not adapting at all

# WATER MANAGEMENT IN SAUDI ARABIA

IN RECENT YEARS, OUR ATTENTION HAS BEEN SO FOCUSED ON THE GLOBAL FINANCIAL CRISIS, RISING FOOD AND ENERGY PRICES, AND ON CLIMATE CHANGE, THAT WE HAVE ALMOST FORGOTTEN ABOUT ANOTHER GLOBAL SCARCITY, WATER.



The UN estimates that by 2025, two-thirds of the world's population could face living in countries with moderate or severe water shortage. If this prediction turns out to be true, water scarcity could prove to have more far-reaching consequences than the combined effects of economic crises and global warming.

There is no doubt that we need to rethink how we supply, use and manage water, if we want to continue meeting the challenges of a growing population and climate change.

Currently, the UN operates with the following classifications for water scarcity:

- Countries that are unable to extract more than 4,654 litres of water per person per day from its rivers and aquifers are identified as "water stressed"
- Countries with less than 2,738 litres available per person are "water scarce," and
- Countries with less than 1,369 litres are below the threshold that affects economic and social welfare of the country.

We know that several countries with renewable supply of water of less than 500 litres per person per day prosper and show no signs of water stress. This is because much of the water demand is embedded in food and other products, thus making national water demand increasingly linked to international trade and globalisation. This trade does not increase the global demand of water but rather shifts it geographically toward areas of production. At the same time, millions of people are suffering from inadequate supplies in water rich countries due to poor sanitation and distribution issues.

# GLOBAL TO LOCAL

Notwithstanding the above, it is at the regional and local scale where the real advances in water management can be achieved. Traditionally, water consumption, distribution and disposal have been managed locally using natural surface or groundwater supplies and subtle land management. This has later been complemented by water conveyance systems such as aqueducts. With increasing urbanisation, we replaced this arrangement by plumbing our conurbations with intricate systems for supply, distribution and disposal of water. As sanitation evolved, these systems were complemented by bolt on intensive treatment systems of varying performance and efficiency.

We have to remind ourselves that many of the systems we use, and the processes on which we base our designs, have evolved in western societies under conditions of excess energy and resource, on the assumptions of limitless supply, and with little regard for environmental damage.

Times have changed. On one hand, Ramboll has seen increased activities within the upgrading, maintenance and optimisation of these systems. On the other hand, we believe the real future opportunities are likely to be in a step change approach with new solutions and new technologies.

One example of this new approach comes from a recent concept master-planning work in Saudi Arabia where Ramboll was asked to develop water management and water supply solutions for a new renewable and sustainable city outside Riyadh.

After an initial site analysis and review of the development objectives, it was assessed that “land management” rather than “plumbing” would be the emphasis of our approach.

We based this on the premise that 100mm of precipitation annually far exceeds what would typically be required to supply a city with an integrated water management system linking potable water supply, utility and irrigation water supply, waste water management and recycling, and storm water capture, attenuation and reuse.

The key to our strategy was to maximise shallow aquifer recharge and retention within the site through a combination of water harvesting, landscaping, wadi damming, and vertical soak-aways. This would be complemented by recharges from the city internal water cycle, such as decentralised waste water treatment systems and irrigation infiltration. By abstracting from the replenished aquifer at the base of the wadi catchment, it should be possible to generate an internal water cycle for the city. In time, this could yield the city self-sufficient with water, and provide the platform for a truly sustainable urban community.

While this concept master-planning study has been well-received, we are still far from implementation. Still, this is how step changes start off.

By [Stepan Ruzicka](#)  
[Ramboll in the UK](#)



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#### **ABOUT RAMBOLL**

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. We employ close to 10,000 experts in these fields, and have a significant presence in Northern Europe, Russia, India and the Middle East.

With more than 200 offices in 23 countries, we emphasise local experience in combination with a global knowledge-base. We constantly strive to achieve inspiring and sustaining solutions which make a genuine difference to our customers, the end-users and society as a whole.

Ramboll operates within the areas of: Buildings & Design, Infrastructure & Transport, Energy & Climate, Environment & Nature, Industry & Oil/Gas, IT & Telecom and Management & Society. Visit: [www.ramboll.com](http://www.ramboll.com)

#### **ENVIRONMENT & NATURE**

Our company provides independent environmental consultancy services throughout the world. We hold a leading position in Europe, and are recognised experts in all areas related to 'Water', 'Environment', and 'Nature'. Our customers include public institutions, leading developers, major European organisations, and international financing institutions. Our more than 950 environmental specialists collaborate on innovative solutions from 76 offices in ten countries.

With a diverse customer base and a wide range of services, we actively contribute to setting the environmental agenda in Europe. We bridge the gap between the private and the public sector, and we pride ourselves on providing unbiased, independent expertise.

Our approach is customer focused, underpinned by strong project management, stakeholder engagement, and effective communications.

