Water and health – two precious resources

While being an absolute necessity water can also be a carrier of disease. Less than 1% of the global freshwater is accessible in lakes, river channels and underground, and only about one third of the world's potential fresh water resources can be used for human needs. This is due to a mix of geographical, environmental and financial factors as well as to the increased pollution. As pollution increases, the amount of usable water decreases.

Beaches, lakes, swimming pools and other aquatic environments designated as bathing areas have large recreational values. Such areas must have a good hygienic quality and discharges into the aquatic environment of microorganisms and substances must be limited.

DHI is a WHO Collaborating Centre for Water and Health. We support WHO in integrating health into water resources management (IWRM) and river basin management as well as in developing tools for water quality management.

DHI has a wide experience in building competence and promoting technological development within all areas of water and environment. Emphasis is placed on the development and dissemination of knowledge and technologies within environmental chemistry, microbiology, ecology, water resources, hydraulic structures and hydrodynamics, and related areas.

DHI services and tools range from simple studies and analyses over highly advanced laboratory and pilot scale testing to decision support systems based on GIS, mathematical modelling systems and support tools.

Water resources – protection and management

Water source and water resources protection are essential if high quality water are to remain uncontaminated. Both groundwater and surface waters are vulnerable to pollution and both require localised and larger-scale actions to prevent pollution of drinking water and water for other human uses.

Water stress or water scarcity is increasing on a global scale. Aquifers, which supply drinking water or water for productive uses, are often exploited faster than they recharge. Likewise, in more arid areas food production increasingly has to be supplied with treated wastewater.

DHI has achieved a leading position within the field of *Integrated Water Resources Management (IWRM)* and is an advisory centre for the *Global Water Partnership* on this issue. Furthermore DHI is a *UNEP Collaborating Centre* which provides support to UNEP's work on IWRM and integrated coastal and river basin management (ICARM).

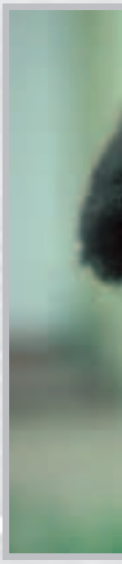
DHI provides extensive expertise together with information and decision support tools to assist in policy analysis, strategic planning and intersectoral water allocation comprising:

- National water policies and strategies
- Integration of health into IWRM
- Human and institutional capacity building
- River basin planning and management
- Implementation of the *Protocol on Water and Health*
- Integrated freshwater and coastal zone management
- Water resources monitoring

DHI has long term experience in the assessment of available water resources for *Water abstraction* from surface water systems for municipal drinking water systems, industries and irrigation and for downstream impacts of *water discharge* with respect to water quality, water levels sedimentation and salinity intrusion.

DHI has developed a unique holistic approach for the interaction between groundwater and its surroundings. Not only is the water quantity described in all components of the land-based hydrological cycle, but the water quality can also be assessed in an integrated description. Environmental impact from man-made interactions may be studied and groundwater-related issues such as

- Groundwater exploitation/resources/ recharge
- Groundwater protection and vulnerability mapping
- Soil and groundwater quality
- Transport of nutrients and pesticides to groundwater and streams
- Transport and fate of xenobiotics
- Saltwater intrusion
- Impact and risk assessment



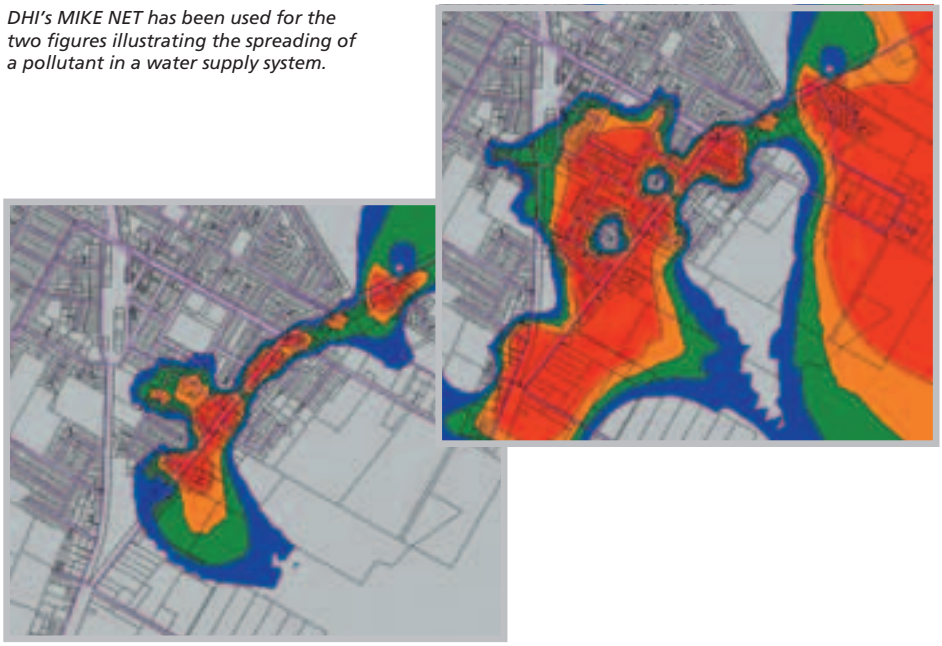
Safe drinking water

An effective means of ensuring the safety of drinking water supply is by using a comprehensive risk assessment and risk management approach encompassing all steps in water supply from catchment to consumer. Such approaches are termed *Water safety plans* as described in the *WHO third edition of Drinking Water Guidelines*.

DHI offers advanced consulting services related to water supply, often integrated into solutions comprising drainage and wastewater treatment:

- Integrated catchment planning
- Water treatment and water distribution networks
- Industrial water savings and reuse
- Modelling water supply systems
- Reservoir modelling
- Early warning of drinking water quality
- Drinking water quality and hygienic water quality
- Investigations and assessment of chemical substances
- Flow monitoring and water quality sampling
- Drinking water surveillance systems
- Real-time control, operation and management
- Risk assessment and management

DHI's MIKE NET has been used for the two figures illustrating the spreading of a pollutant in a water supply system.

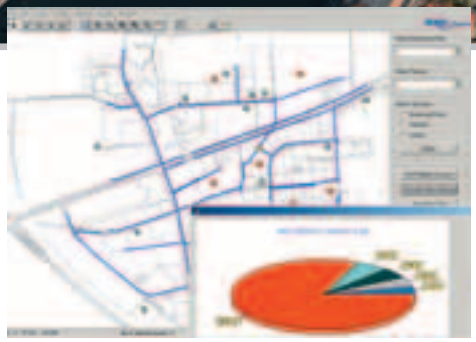


Safe bathing water

Beaches, lakes, swimming pools and other water environments designated as bathing areas must have good, hygienic quality. High-quality bathing water requires a low content of infectious organisms and harmful substances.

DHI offers advanced consulting services, laboratory testing and management tools within:

- Monitoring and modelling of bathing water quality
- Assessment of aesthetic values of recreation waters
- Monitoring and modelling of algae and cyanobacteria
- Tracking sources of microbial pollution and chemical substances
- Hygienic water quality
- Early warning systems for bathing water quality
- Bathing water quality forecasting
- Integrated freshwater and coastal zone management



Point sources in the area of Greater Copenhagen.
DHI has developed a GIS-based database tool (INDUSTRY) to overview discharges of heavy metals, xenobiotics and antibiotics from point sources in different areas of Greater Copenhagen.

Pollution sources – prevention, reduction and control

To minimise or eliminate health impacts caused by polluted water dentification of pollution sources, in assessment of their impacts and reduction of the emissions are essential.

DHI offers a wide range of services, tools and technologies for pollution prevention, reduction and control:

- Water pollution control policies, strategies and guidelines
- Cleaner production and reduction in use of materials and emissions
- Water savings and reuse
- Pollution source tracking in urban wastewater networks
- Wastewater collection systems
- Municipal and industrial wastewater treatment
- Monitoring and modelling stormwater overflows and discharges of untreated wastewater
- Identification and remediation of contaminated sites
- Controlling the disposal or reuse of sewage sludge
- Substitution considerations and product development of safe products.
- Water quality monitoring and control
- Environmental impact assessment taking health into consideration.

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DHI Software

Tools for water and health

- MIKE BASIN - GIS-based decision support tool for integrated water resources management and planning
- MIKE LOAD - GIS-based assessment tool to estimate point and nonpoint load in catchments. Provides overview of the load sources and the magnitude
- DaisyGIS - for modelling nitrate and pesticide leaching from agricultural areas
- MIKE SHE - integrated hydrological modelling of the entire land phase of the hydrological cycle
- MIKE 11 - for modeling inland surface waters such as rivers, channels, estuaries and reservoirs, flows, flooding, water quality and sedimentation
- MIKE 11 Reservoir - modelling tool for the optimisation of eg drinking water reservoirs
- Water Quality simulation, impact assessment, etc
- MIKE 21 - 2D modelling of free-surface flow, water quality, sediment and waves in rivers, estuaries, coastal waters and seas
- ECO Lab - a numerical laboratory. Provides facilities to describe eg human exposure of chemicals and microorganisms
- MIKE NET - for modelling water distribution systems. Based on the EPANET numerical engine
- MIKE URBAN - an integrated modelling system for urban water management
- Early Warning systems - for bathing water and drinking water. Based on meteorological data and registered discharges from sewage outfalls, the transport of the bacteria in the receiving waters is calculated and a forecast of the water quality is processed
- Mermaid - GIS-based database system for control of bathing water quality and administration of bathing water data
- Laboratory testing and testing kits
- Tests for analysis of selected microorganisms
- Training courses. A number of training courses relevant to water and health are conducted at DHI.

Please refer to DHI's website: www.dhi.dk.

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Water & Health
Tools and Solutions

Safe supply of drinking water

Safe bathing water

**Pollution sources –
prevention, reduction and control**

**Water resources –
protection and management**

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