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# Clearing the Waters

## A focus on water quality solutions

### Executive summary

Every day, millions of tons of inadequately treated sewage and industrial and agricultural wastes are poured into the world's waters. Every year, lakes, rivers, and deltas take in the equivalent of the weight of the entire human population—nearly seven billion people—in the form of pollution. Every year, more people die from the consequences of unsafe water than from all forms of violence, including war. And, every year, water contamination of natural ecosystems affects humans directly by destroying fisheries or causing other impacts on

biodiversity that affect food production. In the end, most polluted freshwater ends up in the oceans, causing serious damage to many coastal areas and fisheries and worsening our ocean and coastal resource management challenges.

Clean, safe, and adequate freshwater is vital to the survival of all living organisms and the smooth functioning of ecosystems, communities, and economies. But the quality of the world's water is increasingly threatened as human populations grow, industrial and



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agricultural activities expand, and as climate change threatens to cause major alterations of the hydrologic cycle. Poor water quality threatens the health of people and ecosystems, reduces the availability of safe water for drinking and other uses, and limits economic productivity and development opportunities. There is an urgent need for the global community – both the public and private sector – to join together to take on the challenge of protecting and improving the quality of water in our rivers, lakes, aquifers, and taps. To do so we must commit to preventing future water pollution, treating waters that are already contaminated, and restoring the quality and health of rivers, lakes, aquifers, wetlands, and estuaries; this enables these waters to meet the broadest possible range of human and ecosystem needs. These actions will be felt all the way from the headwaters of our watersheds to the oceans, fisheries, and marine environments that help sustain humanity.

### Water quality challenges

A wide range of human and natural processes affect the biological, chemical, and physical characteristics of water, and thus impact water quality. Contamination by pathogenic organisms, trace metals, and human-produced and toxic chemicals; the introduction of non-native species; and changes in the acidity, temperature, and salinity of water can all harm aquatic ecosystems and make water unsuitable for human use.

Numerous human activities impact water quality, including agriculture, industry, mining, disposal of human waste, population growth, urbanization, and climate change. Agriculture can cause nutrient and pesticide contamination and increased salinity. Nutrient enrichment has become one of the planet's most widespread water quality problems (UN WWAP 2009), and worldwide, pesticide application is estimated to be over 2 million metric tonnes per year (PAN 2009). Industrial activity releases about 300-400 million tons of heavy metals, solvents, toxic sludge, and other waste into the world's waters each year (UN WWAP Water and Industry). About 700 new chemicals are introduced into commerce each year in the United States alone (Stephenson 2009).

Mining and drilling create large quantities of waste materials and byproducts and large-scale waste-disposal challenges.

Widespread lack of adequate disposal of human waste leads to contamination of water – worldwide, 2.5 billion people live without improved sanitation (UNICEF and WHO 2008), and over 80 percent of the sewage in developing countries is discharged untreated in receiving water bodies (UN WWAP 2009). Meanwhile, growing populations will potentially magnify these impacts, while climate change will create new water quality challenges.

### Water quality impacts

Water contamination weakens or destroys natural ecosystems that support human health, food production, and biodiversity. Studies have estimated that the value of ecosystem services is double the gross national product of the global economy, and the role of freshwater ecosystems in purifying water and assimilating wastes has been valued at US\$ 400 billion (2008\$) (Costanza et al. 1997). Freshwater ecosystems are among the most degraded on the planet, and have suffered proportionately greater species and habitat losses than terrestrial or marine ecosystems (Revenga et al. 2000). Most polluted freshwater ends up in the oceans, damaging coastal areas and fisheries.

Every year, more people die from the consequences of unsafe water than from all forms of violence, including war – and the greatest impacts are on children under the age of five. Unsafe or inadequate water, sanitation, and hygiene cause approximately 3.1 percent of all deaths – over 1.7 million deaths annually – and 3.7 percent of DALYs (disability adjusted life years) worldwide (WHO 2002). Livelihoods such as agriculture, fishing, and animal husbandry all rely on water quality as well as quantity. Degraded water quality costs countries in the Middle East and North Africa between 0.5 and 2.5 percent of GDP per year (WB 2007), and economic losses due to the lack of water and sanitation in Africa alone is estimated at US\$ 28.4 billion or about 5 percent of GDP (UN WWAP 2009). Women,

children, and the economically disadvantaged are the most affected by water quality impacts. Over 90 percent of those who die as a result of water-related diseases are children under the age of 5. Women are forced to travel long distances to reach safe water. And the poor are often forced to live near degraded waterways, and are unable to afford clean water.

### **Moving to solutions and actions**

Effective solutions to water quality challenges exist and have been implemented in a number of places. It is time for a global focus on protecting and improving the quality of the world's freshwater resources. There are three fundamental solutions to water quality problems: (1) prevent pollution; (2) treat polluted water; and (3) restore ecosystems.

#### **Focus on pollution prevention**

Pollution prevention is the reduction or elimination of contaminants at the source before they have a chance to pollute water resources – and it is almost always the cheapest, easiest, and most effective way to protect water quality. Pollution prevention strategies reduce or eliminate the use of hazardous substances, pollutants, and contaminants; modify equipment and technologies so they generate less waste; and reduce fugitive releases and water consumption. Pollution prevention will also require better design of human settlements to improve water infiltration and reduce non-point source pollution. As the world takes on the challenge of improving water quality, pollution prevention should be prioritized in international and local efforts.

#### **Expand and improve water and wastewater treatment**

Many water sources and watersheds are already of poor quality and require remediation and treatment. Both high-tech, energy-intensive technologies and low-tech, low-energy, ecologically focused approaches exist to treat contaminated water. More effort to expand the deployment of these approaches is needed; they need to be scaled up rapidly to deal with the tremendous amount of

untreated wastes entering into waterways every day; and water and wastewater utilities need financial, administrative, and technical assistance to implement these approaches.

#### **Restore, manage, and protect ecosystems**

Healthy ecosystems provide important water quality functions by filtering and cleaning contaminated water. By protecting and restoring natural ecosystems, broad improvements in water quality and economic well-being can occur. In turn, ecosystem protection and restoration must be considered a basic element of sustainable water quality efforts.

### **Mechanisms to achieve solutions**

Mechanisms to organize and implement water quality solutions include: (1) better understanding of water quality through improved monitoring; (2) more effective communication and education; (3) improved financial and economic tools; (4) deployment of effective methods of water treatment and ecosystem restoration; (5) effective application and enforcement of legal and institutional arrangements; and (6) political leadership and commitment at all levels of society.

#### **Improve understanding of water quality**

Ongoing monitoring and good data are the cornerstones of effective efforts to improve water quality. Addressing water quality challenges will mean building capacity and expertise in developing countries and deploying real-time, low-cost, rapid, and reliable field sampling tools, technologies, and data-sharing and management institutions. Resources are needed to build national and regional capacity to collect, manage, and analyze water quality data.

#### **Improve communication and education**

Among the most important tools for solving water quality problems are education and communication. Water plays key cultural, social, economic, and ecological roles. Demonstrating the importance of water quality to households, the media, policy makers, business owners, and

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farmers can have a tremendous impact in winning key improvements. A concerted global education and awareness-building campaign around water quality issues is needed, with targeted regional and national campaigns that connect water quality to issues of cultural and historical importance.

### **Use effective legal, institutional, and regulatory tools**

New and improved legal and institutional frameworks to protect water quality are needed from the international level down to the watershed and community level. As a first step, laws on protecting and improving water quality should be adopted and adequately enforced. Model pollution-prevention policies should be disseminated more widely, and guidelines should be developed for ecosystem water quality as they are for drinking water quality. Planning at the watershed scale is also needed to identify major sources of pollution and appropriate interventions, especially when watersheds are shared by two or more political entities. Standard methods to characterize in-stream water quality, international guidelines for ecosystem water quality, and priority areas for remediation need to be developed and deployed globally.

### **Deploy effective technologies**

Many effective technologies and approaches are available to improve water quality through pollution prevention, treatment, and restoration that range from ecohydrology approaches to conventional treatment. A focus on deploying approaches to collect, transport, and treat human wastes and industrial and agricultural water is critically important. This will require a focus on connecting communities, governments, and businesses to effective water quality technologies and approaches, developing new technologies when needed to meet specific environmental or resource needs, and providing technical, logistical, and financing support to help communities and governments implement projects to improve water quality.

### **Improve financial and economic approaches**

Many water quality problems are the result of inadequate access to financing to develop water-

treatment or restoration programmes, or from inappropriate pricing and subsidy programmes. Better understanding of the economic value of maintaining ecosystem services and water infrastructure is required, as are more effective water-pricing systems that permit sufficient cost recovery, ensure adequate investments, and support sustainable long-term operation and maintenance. Innovative regulatory approaches and standards are needed, for example, to entail payments for ecosystem services or to require polluters to internalize the costs of pollution.

### **Moving forward: clean water for today and tomorrow**

Water has always been at the center of healthy ecosystems and human societies, yet the freshwater resources on which we all depend are becoming increasingly polluted. As a global community, we need to refocus our attention on improving and preserving the quality of our water. The decisions made in the next decade will determine the path we take in addressing the global water quality challenge. That challenge requires bold steps internationally, nationally, and locally to protect water quality. Directing local, national, and international priorities, funding, and policies to improve water quality can ensure that our global water resources can once again become a source of life. Clean water is life. We already have the know-how and skills to protect our water quality. Let us now have the will. Human life and prosperity rest on our actions today to be the stewards, not polluters, of this most precious resource.

Acidification  
The process by which chemical compounds such as ammonia, nitrogen oxides, and sulphur dioxides are converted into acid substances. Industrial activities, especially mining and power production from fossil fuels, can cause acidification of freshwater systems and impair ecosystem health.

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*Clearing the Waters – A focus on water quality solutions* is available for download from the UNEP website:

[www.unep.org](http://www.unep.org)