EUROPEAN WATER RESOURCES AND POLICY

What is the current water situation?

The current water situation in Europe, according to a European Commission brochure, is described as:

- 20% of all surface water in the EU is seriously threatened with pollution
- Ground water supplies around 65% of all Europe's drinking water
- 60% of European cities overexploit their ground water resources
- 50% of wetlands have "endangered status" due to ground water overexploitation
- The area of irrigated land in southern Europe has increased by 20% since 1985

At the continental scale, Europe has abundant water resources. These resources are unevenly distributed, both between and within countries. This uneven distribution is accounted for by differences in precipitation. Average annual rainfall ranges from 118 inches in western Norway to 3-16 inches over much of central Europe and around 4-6 inches in central and southern Spain. In 1982 a major assessment of ground water resources within the nine member states was undertaken by the Directorate-General for the Environment. It consisted of a general survey and individual reports from each member state. The major focus was on quantity, rather than quality while the current focus of monitoring programs is on water quality and protection measures. This new focus has come about as many aquifers have been found to be contaminated by pollution.

What is water usage and availability?

To determine water resource sustainability, water availability and population must be examined. *Europe's Environment: The fourth assessment*, a European Environment Agency (EEA) report, states that Europe uses a relatively small portion of its total renewable water resources each year. Total water appropriations for public water supply in 2002 were 3.5 billion m^3/year (9.6 trillion gallons/year). In comparison, the total water appropriations for public water supply in the US in 2000 were 15.8 trillion gallons/year. The amount of water available per capita varies widely due to the uneven distribution of water resources and population. Demand is high around urban centers, and two-thirds of the 493 million people in the European Union (EU) lives in urban areas (compared to 81% in the US). This puts Europe's urban population at 325 million and the US's urban population at 243 million. Countries such as Iceland and Norway have abundant supplies to meet demand, while the Mediterranean islands of Cyprus and Malta and the densely populated countries Germany, Italy, Spain, and the southern United Kingdom have the least available water per capita. Some countries with water shortages are able to store more than 40% of their long term annual average in reservoirs.

Overall in Europe water use is characterized by 65% ground water, 35% surface water, and a very small amount from the desalination of salt water. In countries such as Denmark and Iceland, ground water supplies over 90% of demand. The total surface water and ground water use by different sectors in Europe is:

- 64% agriculture
- 20% energy
- 12% public supply
- 4% industry

When looking at specific countries, such as Greece, irrigation accounts for 80% of total water demand. Irrigation accounts for 68% of water used in Spain, 52% in Portugal, and more than 50% in Italy.

For comparison, the US uses 79% surface water and 21% ground water. The total surface water and ground water use by different sectors in the US is:

- 34% agriculture
- 48% energy
- 11% public supply
- 5% industry

What are the significant stressors to water resources?

Water quality is a key determinant of availability for use. In Europe there have been significant stressors on surface and ground water documented. Policy solutions related to these issues are described in the next section. An environmental analysis of the EU Member States found multiple stressors to surface and ground water quality and quantity throughout the EU. The main stressors identified were agricultural practices, point source pollution, hydromorphological alterations, and water appropriation. Key issues in ground water sustainability in individual countries are highlighted in Figure 2.

- Agricultural practices are leading to a number of significant problems in surface water and ground water. Non point source pollution from nutrient and pesticide runoff, especially nitrates, is a problem throughout the EU.
- Point source pollution from industrial and municipal waste water is still a significant problem in some countries.
- Structural and physical modifications include river regulation, channelization, damming, regulation of water flow and level, and embankments. It has become clearer that the heritage of industrialization of the past 200 years has considerably degraded European waters which used to be healthy ecosystems.
- Water overexploitation has negatively impacted the environment. Lowering of ground water levels, salt water intrusion into aquifers, and the drying up of water courses have been seen in some areas. Overexploitation is associated with irrigation and also with tourism in some places. Tourists have been estimated to consume almost twice as much water as residents in some areas. For example, an average city dweller in Spain uses 250 liters (66 gallons) of water per day while the average tourist uses 440 liters (116 gallons). It is believed that tourists use more water because of the hot climate and the tendency of tourists to use more water on holiday than they do at home.

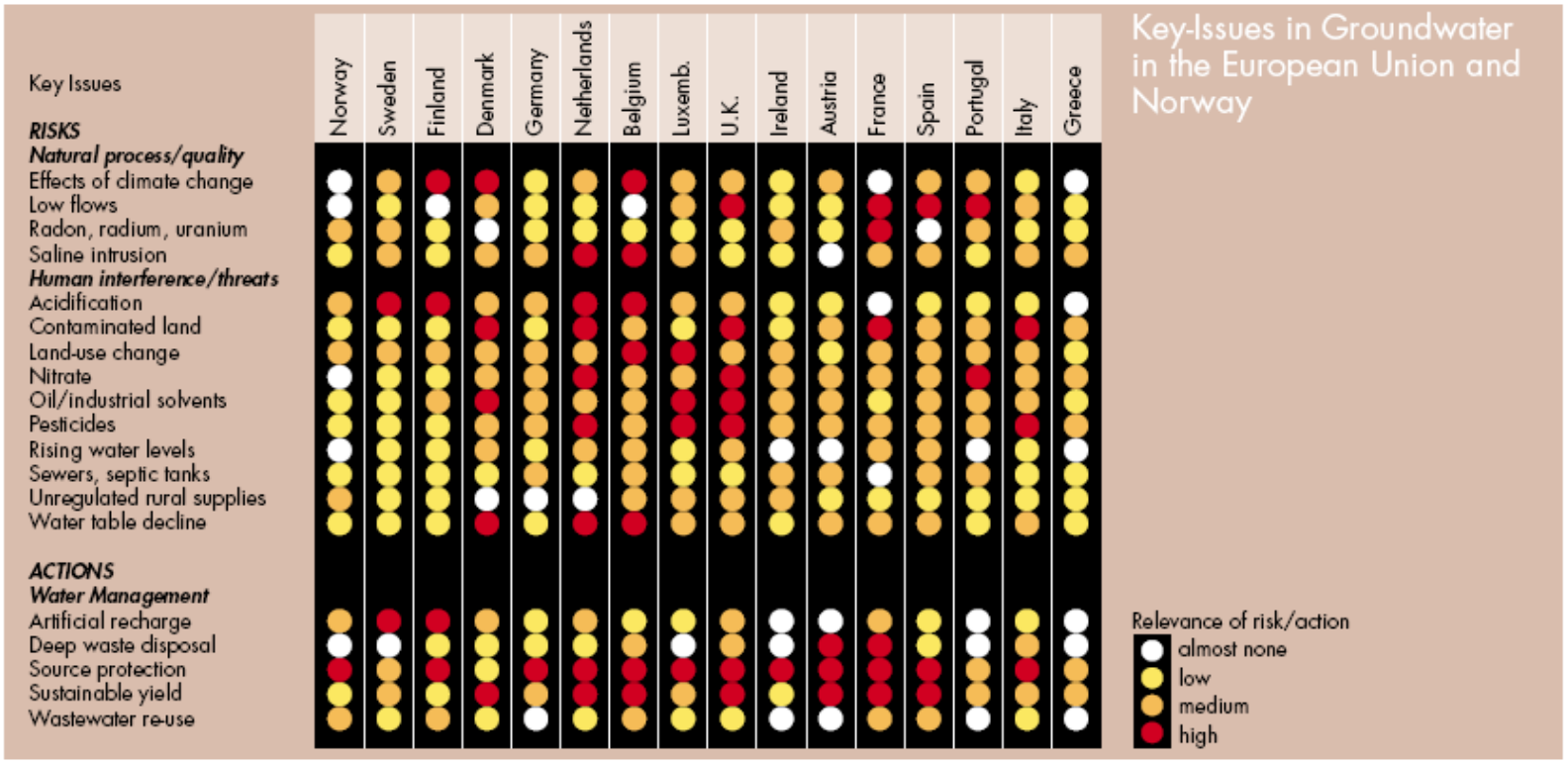

Figure 2. Key issues in ground water in the European Union and Norway

What kind of water inventory has been done?

Hydrogeological Mapping of Europe

Much is already known about ground water resources throughout Europe. The Hydrogeological Map of Europe project was initiated in 1960 by the International Association of Hydrogeologists to compile the large number of hydrogeological maps that already existed in almost all European Countries (Fig. 1). The general purpose of the map was to provide a representation of ground water in Europe with related geology. The main objective was to show the location, geographic extent, movement, and chemical content of the major ground water bodies, classified according to the main types of aquifers. The map is composed of 27 map sheets with explanatory notes covering the whole European continent and parts of the Near East. Very detailed information concerning aquifers, ground water, springs, surface water, artificial structures (such as wells, dams, canals, and pipelines), and geological features are included in the map. Information on extent of ground water, ground water chemical composition, and quality and temperature are included in the map. This map provides important information for resource use and planning because it contains water quantity and quality information. The map sheets are being used for policy decisions concerning water resources.

In Western and Central Europe there is consistent data on water quality that has been collected by individual countries over time. Data has been collected annually for 3,500 river stations in 32 countries, more than 1,000 lake stations, and around 1,100 ground water bodies. Data are stored within the EEA's Waterbase for access by national and regional bodies. Strengthening of water monitoring and information management has been recognized as being needed to assess current progress in sustainable water resources management.

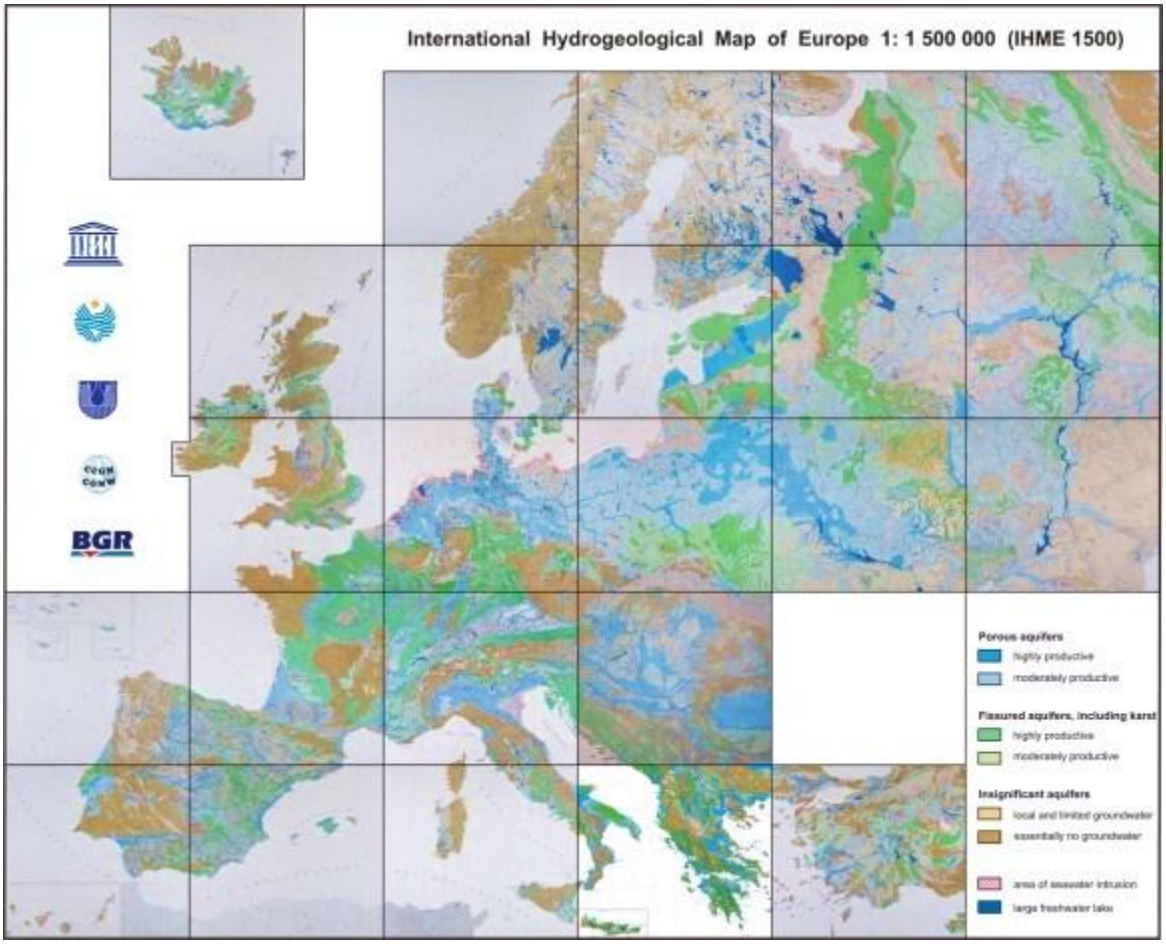

Figure 1. Hydrogeological Map of Europe

Key to Map

POROUS AQUIFERS

highly productive

moderately productive

FISSURED AQUIFERS incl. KARST

highly productive

moderately productive

INSIGNIFICANT AQUIFERS

local and limited groundwater

essentially no groundwater

area of seawater intrusion

large freshwater lake

What is the current public policy related to water?

Progress is being made in improving the quality and quantity of Europe's water resources. Much of the improvement has been made by programs aimed at reducing the stressors on water resources from households and industry. Many European ground water bodies, rivers, lakes, estuaries, and coastal and marine waters are still significantly impacted by human activities. The EU Water Framework Directive (WFD) advances European policy with the concepts of ecological status and water management at the river basin level. This is the first time that these concepts are being included in the European legislative framework. Ecological status must include an assessment of the biological communities, habitat and hydrological characteristics of water bodies as well as physical and chemical properties. Measures will have to be targeted at maintaining sustainable water levels and flows and at maintaining and restoring habitats. The success of the WFD is dependent on proper implementation by countries. Thus a common implementation strategy was developed and is currently in progress.

The EU Water Framework Directive is a new approach to protect all waters—rivers, lakes, coastal waters, and ground water throughout the European Union. It was adopted in 2000 and member states must design a system of management for river basins. It sets clear objectives clean water to be achieved for all European waters by 2015. It also aims to get the public involved in water management. The WFD is currently being implemented throughout Europe.

The WFD has been incorporated into all national legislation and establishes a legal framework to protect and restore clean water across Europe. In particular, it provides for:

Sustainable approach to manage an essential resource: It not only considers water as a valuable ecosystem, it also recognizes the economy and human health depending on it.

Holistic Ecosystem Protection: It ensures that the fresh and coastal water environment be protected in its entirety, meaning all rivers, lakes, estuaries, coastal, and ground waters are covered. Surface water quality and ground water quantity are part of the WFD.

Ambitious objectives, flexible means: The achievement of "good status" by 2015 provides objectives that are concrete and provide for flexibility in achieving them in a cost effective way. The WFD classification system for water quality includes five status categories:

- High—biological, chemical, and morphological conditions associated with **no** or **very low** human pressure; this is also the reference condition or benchmark as it is the best status achievable (reference conditions are type specific which makes them different for different types of rivers, lakes, or coastal waters in order to represent the diversity of ecological regions in Europe)
- Good—slight deviation from the reference condition
- Moderate—moderate deviation from the reference condition
- Poor—substantial deviation from the reference condition
- Bad—severe deviation from the reference condition

The right geographical scale: The natural scale for water management is the river basin (watershed). Ground water and coastal waters are assigned to the nearest or most appropriate river basin district. This is particularly challenging for transboundary and international rivers. One hundred and ten river basin districts have been established across the EU. Size varies from very small (1,000 km^2) to the largest one, the Danube (>800,000 km^2).

Polluter pays principle: The introduction of water pricing policies with the element of cost recovery and the cost-effectiveness provisions are milestones in the application of economic instruments for the benefit of the environment. This will contribute to sustainable management of scarce resources. The water pricing policy is based on the polluter pays principle which charges for water services and pollution control. In many cases the fees for discharge of effluent or the appropriation and use of water are used to fund the necessary investment in infrastructure, or to pay for the costs of regulation and control.

Participatory processes: active participation of all businesses, farmers, and other stakeholders, environmental NGOs, and local communities.
The program objective is to support countries in the adoption and implementation of sound water management practices. Member States have a schedule for reporting to the Commission on the progress of their implementation.

River Basin Management Plans are a significant outcome of the WFD and must contain information about the water resources. They must include:

- A general description of the River Basin District: Surface water maps of location boundaries, ecoregions and surface water types, reference conditions for different water types, and ground water maps of locations and boundaries
- Summary of significant stressors and impacts from human activities: point and non point sources of pollution, impacts on water quantity and impacts from other types of human activity
- Identification and maps of protected areas within the river basin: drinking water appropriation areas, areas with economically significant aquatic species, recreational waters, nutrient-sensitive areas, and areas designated for the protection of habitats or species
- Maps of monitoring networks and monitoring results: ecological and chemical status for surface water, chemical and quantitative status of ground water, and status of protected areas
- Summary of an economic analysis of water use which includes estimates of volume, prices, and costs associated with water services, and estimates of relevant investment to account for long term forecasts of supply and demand for water
- Summary of program of measures which are introduced to prevent or limit the inputs of pollutants and/or the deterioration of the status of ground water
- Summary of public information and consultation process as well as results

In each of the Member States, administrative units must be established for River Basin Districts. One example of changes the WFD brings to Member States is in Sweden. Water administrators are spread among a number of organizations and across many different levels in Sweden. The main authorities in long term water planning are the 290 municipalities which represent the local level of the national administrative organization. Since 1987 the responsibility for planning of land and

water were integrated and managed by municipalities. With the new WFD the 290 geographical units for water planning have been reduced to five River Basin Districts. This is a large change in scale, with water planning taken away from the very local level and introduced to a regional level based on large regions. Instead of an integrated approach to the planning of land and water, these issues are now being handled separately. The former municipalities will continue to play an important role in planning issues related to land and water, but their formal power has been limited substantially.

Progress to date on the WFD is described on the chart below.

MAIN FINDINGS AND KEY MESSAGES


positive development in state or decreased pressure


no clear development in state or pressure


negative development in state or increased pressure


important finding (bad)


important finding (good)

Ecological Quality

	There is a large gap between what is required by the water framework directive in terms of monitoring and classification of ecological status, and what is currently undertaken by countries.
	River water quality in Europe is improving in most countries.
	The impact of agriculture on Europe's water resources will have to be reduced if good surface water status and good groundwater status are to be achieved. This will require the integration of environmental and agricultural policies at a European level.
	There is a large nitrogen surplus in the agricultural soils of EU countries that can potentially pollute both surface and groundwaters.

Nutrients and Organic Pollution

	Wastewater treatment in all parts of Europe has improved significantly since the 1980s.
	However, the percentage of population connected to wastewater treatment is relatively low in Belgium, Ireland, southern Europe and in the accession countries.
	The quality of Europe's rivers and lakes has improved markedly during the 1990s as a result of the reduction in loads of organic matter and phosphorus from wastewater treatment and industry.
	Nitrate concentrations in rivers have remained relatively stable throughout the 1990s and are highest in those western European countries where agriculture is most intensive.
	Loads of both phosphorus and nitrogen from all quantified sources to the North Sea and Baltic Sea have decreased since the 1980s.
	Nutrient concentrations in Europe's seas have generally remained stable over recent years, though a few stations in the Baltic, Black and North Seas have demonstrated a slight decrease in nitrate and phosphate concentrations.
	A smaller number of stations in the Baltic and North Seas showed an increase in phosphate concentrations.
	There is no evidence of a decrease (or increase) in levels of nitrate in Europe's groundwater.
	Nitrate in drinking water is a common problem across Europe, particularly from shallow wells.
	The quality of designated bathing waters (coastal and inland) has improved in Europe throughout the 1990s.

	Despite this improvement, 10 % of Europe's coastal and 28 % of inland bathing waters do not meet (non-mandatory) guide values.

Hazardous substances

	There have been significant reductions in the discharges/releases to water and of emissions to air of hazardous substances such as heavy metals, dioxins and polyaromatic hydrocarbons from most North Sea countries and to the North East Atlantic since the mid 1980s.
	The loads of many hazardous substances to the Baltic Sea have been reduced by at least 50 % since the late 1980s.
	There is very limited information on the loads of hazardous substances entering the Mediterranean and Black Seas, and none on how these have changed over recent years.
	Pollution of rivers by heavy metals and a few other heavily regulated chemicals is decreasing.
	For the many other substances that are present in Europe's water no assessment of change can be made, due to a lack of data.
	Pesticide and metal contamination of drinking water supplies has been identified as a problem in many European countries.
	There is some evidence that the reduction in loads to water of some hazardous substances is leading to decreases in the concentrations of these substances in marine organisms in some of Europe's seas.
	Contaminant concentrations above limits for human consumption are still found in mussels and fish, mainly from estuaries of major rivers, near industrial point discharges and in harbours.

Water quantity

	Eighteen percent of Europe's population live in countries that are water stressed.
	Over the last decade there were decreases in water abstracted for agriculture, industry and urban use in central accession and western central countries, and in water used for energy production in western southern and western central countries.
	There was an increase in agricultural water use in south-western countries.
	Large areas of the Mediterranean coastline in Italy, Spain and Turkey are reported to be affected by saltwater intrusion. The main cause is groundwater over-abstraction for public water supply and in some areas abstractions for tourism and irrigation.
	Measures to control demand for water, such as water pricing, and technologies that improve water use efficiency are contributing to reductions in water demand.
	Agriculture pays much lower prices for water than the other main sectors, particularly in southern Europe.
	In some countries, losses of water by leakage from water distribution systems can still be significant, exceeding 40 % of supply.

Information

	Over the past eight years implementation of Eurowaternet has led to marked improvements in information about Europe's water.
	Eurowaternet is based on existing country monitoring and will in the future be adapted to meet the reporting needs of the water framework directive.
	The EEA is developing a core set of water indicators to help streamlining of European water reporting and to make it more policy relevant.

Water Resources and Management in Norway

Water Resources

The Kingdom of Norway has a land area of 148,896 square miles (roughly the size of Montana) and a population of 4.7 million people, the second lowest of any European country after Iceland. Precipitation varies throughout the country but averages about 55 inches/year (Minnesota ranges from 18-32 inches/year). According to the Norwegian Water Resources and Energy Directorate (NVE), freshwater is abundant in Norway. The NVE estimates that about 97 trillion gallons of surface water and 6.6 billion gallons of groundwater resources exist in the country.

The NVE collects data on surface water such as water levels and discharge, water temperature, ice on lakes and rivers, sediment transport, and snow and glaciers. The Geological Survey of Norway (NGU) collects data and monitors ground water through three national networks. The importance of ground water monitoring is described as a necessary action to ensure the proper and sustainable exploitation of the resource. As it is part of water management in Norway, it is used to drive policy decisions and will likely increase with implementation of the EU Water Framework Directive.

Water Use

About 85% of the water supply in Norway comes from surface water and about 15% comes from ground water. The reason for the limited use of ground water, according to the Geological Survey of Norway, is ready access to abundant fresh surface water. However, recently ground water is increasingly being used in rural areas due to water quality issues and because water supply based on ground water is often more economical.

The Norwegian municipal water supply reports used from different sectors:

- 42% Households
- 7% Food industry
- 11% Other industries
- 9% Agriculture and other users
- ~31% Leakage

Water Management

Along with abundant water resources, the responsibility for water management covers all levels of government. The NVE, part of the Ministry of the Environment, has the national responsibility for hydrology in Norway. Local governments and the county and municipal level have authority under the Building and Planning Act. The Water Resources Act is the general statute governing fresh water resources including ground water. In addition a number of other acts and authorities are related to water resource management. These are:

The Protection Plan for Water Resources is administered by the Ministry of Petroleum and Energy and protects a number of watercourses against hydropower developments.

The Planning and Building Act governs land use in general. Through planning, provisions can be made on the use and protection of watercourses. Responsible authorities are municipalities, counties, and the Ministry of the Environment.

The Pollution Control Act includes provisions on emissions to watercourses. The Ministry of the Environment is the highest administrative authority for this act and the Norwegian Pollution Control Authority is the subordinate agency.

The Outdoor Recreation Act governs the public right of "free passage, bathing, passage by boat, etc." on watercourses. Fishing is regulated by the **Act relating to Salmonids and Fresh-water Fish**. Watercourses can be protected as part of a protected area pursuant to the **Nature Conservation Act**. Highest administrative authority for these acts is the Ministry of the Environment with the Directorate for Nature Management and the County Governors as the subordinate agencies.

The government has shown a commitment to improving water quality and is part of international treaties concerning air pollution, biodiversity, climate change, endangered species, hazardous wastes, marine dumping, ship pollution, and wetlands. To protect and restore water quality in fresh water bodies and marine areas, the Norwegian government is working to make sure water bodies are healthy enough to maintain species and ecosystems, and take into account human health and welfare (Table 1).

Table 1: Strategic goals to enhance water quality in fresh water bodies and marine areas.

Environmental goal	Indicators	Status
Reduce inputs of nutrients	Inputs of nitrogen to North Sea areas and inland lakes adversely affected by eutrophication.	Reduction of nitrogen inputs
	Inputs of phosphorus to North Sea areas and inland lakes adversely affected by eutrophication.	Reduction of phosphorus inputs
Avoid damaging oil spills	Number and volume of acute oil spills from the offshore industry, shipping and land-based industry.	Acute oil spills
	Volume of oil discharged with produced water and displacement water.	Operational discharges

In addition, implementation of the EU Water Framework Directive in Norway will add to Norwegian policies for cleaning up damaged water systems and securing healthy water bodies. The main water body impacts are due to past physical alterations for water uses such as navigation, hydropower, and flood control. Norwegian authorities have carried out pilot characterizations of eight river basins, which constitute 10% of total water bodies. These pilot projects identified location and boundaries of water bodies, differentiation of water bodies into types with different reference conditions, establishment of type-specific reference conditions for water bodies, and assessment of the current status of the water bodies. Norway is still in the process of transposing the WFD into national law. The possibilities for enhanced water

management in Norway according to the Norwegian Institute for Urban and Regional Research are:

- A potential for better coordination between water management/planning and the land use within river basins
- A potential to improve the regional planning system through River Basin Management Plans
- The creation of a river basin committee, with representatives from relevant sector authorities, counties, and municipalities
- A potential for broad planning processes and participation on regional and local levels
- A potential to secure a better coastal zone management program