River water quality and pollution sources

River water quality can be determined by a number of elements. Generally the following determinants are considered when looking at the quality of river water but only some of them are actually used for WFD classification.

Determinand	Used for WFD compliance
Ammonia	Yes
Dissolved oxygen saturation	Yes
Soluble reactive phosphorus	Yes
Nitrate	No
Nitrite	No
pH	Yes
Suspended solids	No
Temperature	No
Alkalinity	No
Conductivity	No
Hardness	No

Potential pollutants that can affect the health of a river are:

Nutrients: The main potentially-polluting nutrients in relation to water are nitrogen, ammonia (a gas containing nitrogen and hydrogen), phosphorus and sulphur. They arise from the natural breakdown of crop residues and soil organic matter, rainfall, fertilisers, urine and manure, silage, landfill sites, wastewater and industrial effluents, power generation and other fuel-burning activities.

For example, nutrients are the principal cause of eutrophication which is the enrichment of lakes, rivers and the marine environment leading to increased plant growth and the occurrence of algae.

Pesticides: These include herbicides, insecticides and fungicides that are used in gardens, in agriculture, in roadside and trackside (railway) maintenance, and in parks and golf courses.

Heavy metals: Heavy metals are widely-used ingredients for chemical compounds used in industry. Industrial contaminated land can be a source of heavy metals leaching into the environment. They also exist naturally in soils at low concentrations. They can be found in fuel, chemicals, waste materials and batteries. In high concentrations they are toxic to humans, animals, fish and plants.

Suspended solids: Suspended solids are mineral and organic particles that remain suspended in water. They sink only very slowly or are easily re-suspended by water turbulence. Suspended solids might be eroded soil or decayed leaves. Wastewater from sewage works and industry might also carry suspended solids into water bodies. Suspended solids cause water to be turbid and this cloudiness reduces light levels. Turbidity can also be a sign of other pollution since nutrients, pesticides and metals can be attached to the suspended particles.

Settleable solids: These are mineral or organic solids which can settle onto the beds of rivers and lakes where they can prevent fish spawning.

Oxygen depleting substances: Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) tests are analytical methods for measuring the amount of oxygen consumed during the microbial or chemical breakdown of oxygen-depleting substances in water, such as sewage and farm slurry. High levels of BOD and COD indicate a heavily polluted water body making it less suitable for aquatic life.

Pathogens: These are present in faeces from human and animal sources, including wildlife. They can enter water through sewage effluent or manures, slurry and other farm wastes. They may also be carried directly off fields by heavy rainfall or enter water bodies where stock and wildlife have direct access for drinking purposes.

Temperature: Temperature is not strictly a pollutant in the general meaning of the term but it can affect the health of the aquatic environment. Shallow water tends to be warmer than deep water as it is heated more readily by the sun. For the same reason, particularly in summer, the surface water of lakes is warmer than that at the bottom.

Hydrocarbons: These include vegetable and mineral oils (including petrol, diesel, white spirit, heating and lubricating oil). These can get into the river system via surface water drains.

The table on the following page shows some examples of sources of pollution and the potential effects on river water quality.

Sources of pollution	Point source or diffuse	Potential pollutant/ effect
Effluent discharges from sewage treatment works	Point source	Nitrogen (N) and Phosphorus (P), pathogens, litter, suspended solids and settleable solids.
Fish farming	Point source	N, P, oxygen-depleting substances, pathogens, suspended and settleable solids.
Industrial effluent discharges treatment	Point source	N, oxygen-depleting substances and a broad spectrum of chemicals, suspended solids etc, temperature changes.
Industrial processes	Point source	Broad spectrum of chemicals released to air and water.
Oil storage facilities	Point source	Hydrocarbons
Domestic misconnections	Point source – connection of domestic appliances and toilets to rainwater drains	N, P, oxygen-depleting substances, pathogens, suspended and settleable soilds.
Urban stormwater discharges	Point source – arising from storm water run-off (from paved areasand roofs in urban areas) entering the sewer network.	N, P, oxygen-depleting substances, heavy metals, hydrocarbons, pathogens, persistent organic pollutants, suspended solids, settleable solids, litter.
Agricultural fertilisers	Diffuse	N, P
Organic waste recycling to land	Diffuse	N, P, pathogens
Pesticide use	Diffuse	Broad spectrum of chemicals
Soil cultivation	Diffuse	Soil, N, P
Farm wastes and silage	Point/ Diffuse	N, P, oxygen-depleting substances, pathogens, suspended and settleable solids.
Leaking pipelines	Point/Diffuse	Oil, sewage, hydrocarbons