

Main sources of water pollution and their effects on the environment

Main sources (causes) of water pollution

Description of typical effects

Water Pollution: Diffuse Sources

- **Agriculture:**
 - Livestock
 - Cultivation of land to grow crops
 - Processing, storage & transport of products
 - Generation, disposal & storage of waste
- **Town & Country Planning/ Land use – Urban development:**
 - Contaminated run-off from urban areas (e.g. streets and yards)
 - Deposition of acid pollutants from air
 - Leaks or overflows from the sewerage system
- Other sources include forestry, peat harvesting and sea and coastal water transport.

- **Agriculture:**
 - **Contamination with nutrients** (e.g. from fertilisers, animal manures, slurries and effluent from livestock feeds) leading to increased concentrations of nutrients in water and eutrophication of surface water bodies.
 - **Depletion of oxygen levels in water** caused by high levels of organic matter in water.
 - **Soil erosion** resulting in an increase of suspended solids in water leading to increased sedimentation, smothering of gravels in rivers and lakes/ lochs, reduction in light penetration in estuaries and coastal waters and increased sedimentation causing fish to suffocate, damage of spawning sites/ insect habitats and stunting aquatic plant growth (affecting oxygen production levels).
 - **Microbiological contamination of waters** affecting the amenity value of the water environment and posing a risk to human health and ecosystems resulting from losses of micro-organisms from faecal matter to bathing, drinking and shellfish waters.
 - **Water contamination with pesticides and veterinary medicines** (inc. sheep dip) affecting human health and ecosystems.
- **Urban development:**
 - **Water contamination with heavy metals, oil and other hydrocarbons** (e.g. Polycyclic aromatic hydrocarbons -PAHs) associated with hydrocarbon spills and especially with the combustion of hydrocarbons, affecting aquatic ecosystems.
 - **Water contamination with pesticides** affecting human health and ecosystems.
 - **Microbiological contamination and depletion of oxygen in waters** resulting from leaks or overflows from the sewerage system affecting human health, ecosystems and the amenity value of the water environment.

Main sources of water pollution and their effects on the environment

Main sources (causes) of water pollution

Description of typical effects

Water Pollution: Point Sources

- | | |
|---|--|
| <ul style="list-style-type: none"> • Utilities industry – Collection & treatment of sewage: discharges from sewage treatment works and private sewage discharges • Manufacturing industry: discharges from factories (particularly chemicals and food & drink sectors) • Generation, disposal & storage of waste (inc. on land and designated marine sites) • Mining and mineral extraction • Management of freshwater/ saltwater fish & shellfish farms (inc. use of chemicals) • Land contamination | <ul style="list-style-type: none"> • Oxygen depletion in waters affecting aquatic ecosystems. • Water contamination with nutrients encouraging algae growth, affecting aquatic ecosystems (e.g. smothering fish habitats), drinking water resources and causing nuisance. • Water contamination with toxic substances such as heavy metals, persistent organic substances which are not degraded during sewage treatment or inadequately treated industrial discharges. These can have a toxic effect on animals and plants and/ or accumulate within the food chain. • Microbiological contamination (e.g. bacteria, viruses associated with sewage or aquaculture) affecting human health and/ or aquatic wildlife. • Contamination of sediments with heavy metals/ persistent organic chemicals. • Groundwater and surface water contamination resulting from leachate from landfills or contaminated soils (e.g. ammonia, toxic compounds, organic chemicals, BOD, nutrients). • Water contamination resulting from acid mine drainage (e.g. low pH, heavy metals, ochre) leading to an impact on ecosystems, human health and the amenity value of the water environment. |
|---|--|

Water Resources

- | | |
|--|---|
| <ul style="list-style-type: none"> • Energy generation (e.g. hydropower schemes) including the abstraction of water and construction & operation of impoundments). • Utilities industry – Water supply (public and private) including abstraction of surface water and groundwater and storage of water in reservoirs. • Agriculture – Crop irrigation | <ul style="list-style-type: none"> • Hydropower schemes can lead to low flow and/ or highly variable flows in rivers and/ or highly variable water levels in reservoirs, affecting aquatic ecosystems and the recreation/ amenity value of the water environment. • Water abstraction can lead to: <ul style="list-style-type: none"> ▪ Exacerbation of low levels of water in rivers by direct abstractions with the potential to damage the ecology of rivers and associated wetlands. ▪ Reduction in base-flow of groundwater to surface waters caused by abstraction leading to a reduction in river flows. ▪ Reduction in the amount of water available for others to abstract. • Variation in water levels in lakes/ lochs and reservoirs leading to regular drying out of the shoreline, preventing the growth of plants and spawning of fish. |
|--|---|

Main sources of water pollution and their effects on the environment

Main sources (causes) of water pollution

Description of typical effects

Hydromorphology

- | | |
|--|--|
| <ul style="list-style-type: none"> • Town & country planning/ Land use: <ul style="list-style-type: none"> ▪ Historical engineering and urban development (e.g. diversion/ canalisation of rivers, culverts, embankments, canals, coastal defences, ports) ▪ Land claim ▪ Urban development • Agriculture (inc. flood embankments, hard bank protection, straightening and realignment of rivers, removal of bankside vegetation, farm run-off, land drains and culverts) • Energy generation (inc. impoundments and infrastructure in/ in proximity of water bodies) | <ul style="list-style-type: none"> • Historical engineering and urban development: <ul style="list-style-type: none"> ▪ Loss of floodplain wetlands and associated biodiversity from the construction of embankments. ▪ Loss of in-channel habitats due to: <ul style="list-style-type: none"> ▪ Dredging ▪ Increased erosion during floods ▪ Gravel removal ▪ Loss of bankside vegetation, often with increased risk of bank erosion downstream and resultant loss of in-channel habitat supporting fish, invertebrates and aquatic plants. ▪ Loss of sensitive intertidal ecosystems (e.g. salt marshes, mudflats) associated with land claim. • Structures that impede the migration of fish and other organisms (e.g. culverts, dams and small weirs) and which may also affect erosion and deposition rates, and result in a loss of sediment supply downstream. <ul style="list-style-type: none"> ▪ Loss of in-channel habitats and significant changes to erosion and sediment deposition in the surrounding channel as a result of channel straightening. ▪ Increased inputs of fine sediments, increased risk of bank erosion, loss of bankside habitats and elevated water temperatures as a result of removal of bankside vegetation. ▪ Potential increase in the risk of flooding due to the construction of embankments, culverts and other engineering activities. • Agriculture: <ul style="list-style-type: none"> ▪ Loss of natural hydromorphological features through channel straightening, dredging, erosion control and flood embankments resulting in channel destabilisation (erosion or aggradation) and loss of important habitats on which animals and plants depend. ▪ Bank trampling/ riparian damage by livestock and activities in riparian zone. ▪ Loss of natural bankside vegetation, which is an important natural buffer between agricultural land and the river. |
|--|--|

Main sources of water pollution and their effects on the environment

Main sources (causes) of water pollution	Description of typical effects
Flooding	
<ul style="list-style-type: none"> • Town & Country Planning/ Land use – Urban development and historical engineering (e.g. development on floodplains, inadequate culverting/ flood defence measures, increase in impermeable surfaces) • Agriculture (e.g. use of floodplains, inadequate culverting/ flood defence measures, increase in surface runoff, intensification and change in land use) • Climate change: Flood risks due to river and coastal flooding, and to intense rainfall overloading drainage systems, are predicted to increase during the 21st century. • Other sources of flooding include mining & mineral extraction (i.e. cessation of mine pumping) and failure in drainage systems (e.g. sewers) or flood defences. 	<ul style="list-style-type: none"> • Loss of/ damage to material assets (e.g. buildings, roads, farmland) • Human health risks include death and injuries and a potential increase in infectious diseases. • Loss of in-channel habitats due to increased erosion during floods affecting fish, invertebrates and aquatic plants.

Sources:

SEPA (2007) Significant water management issues in the Scotland river basin district.

Scottish Executive Central Research Unit (2002) Climate Change: Flood Occurrence Review.