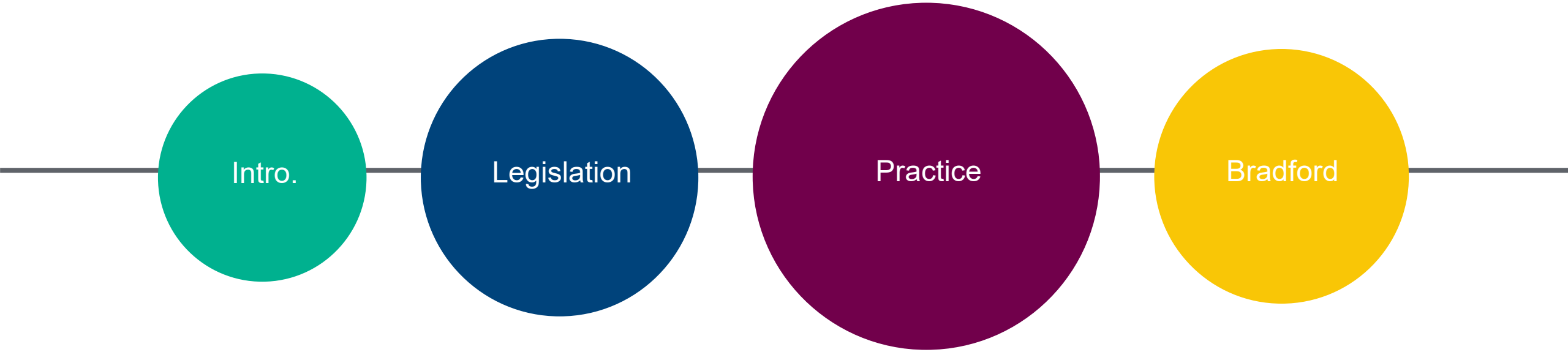
# Water Quality in England Part 1

Amy Jones

December 2022

# Contents



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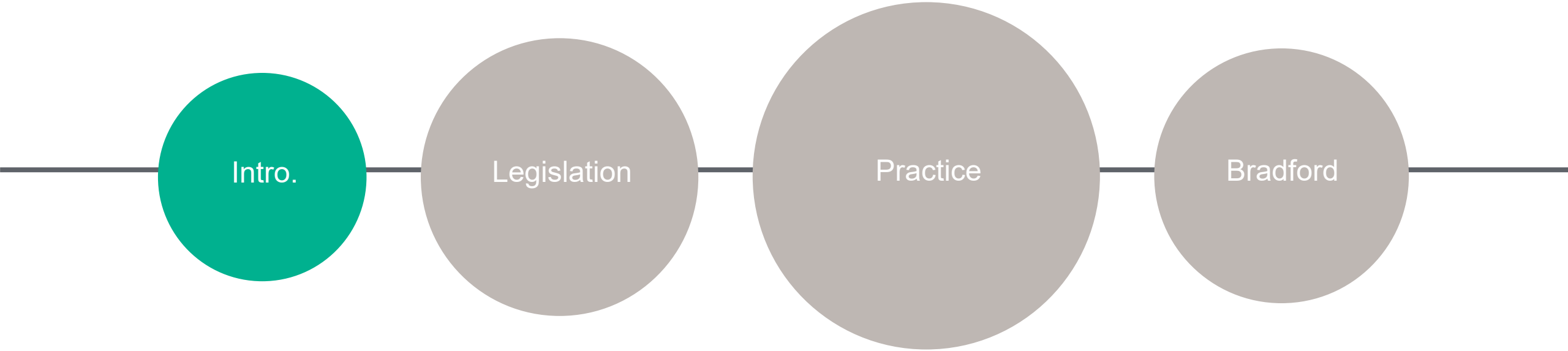
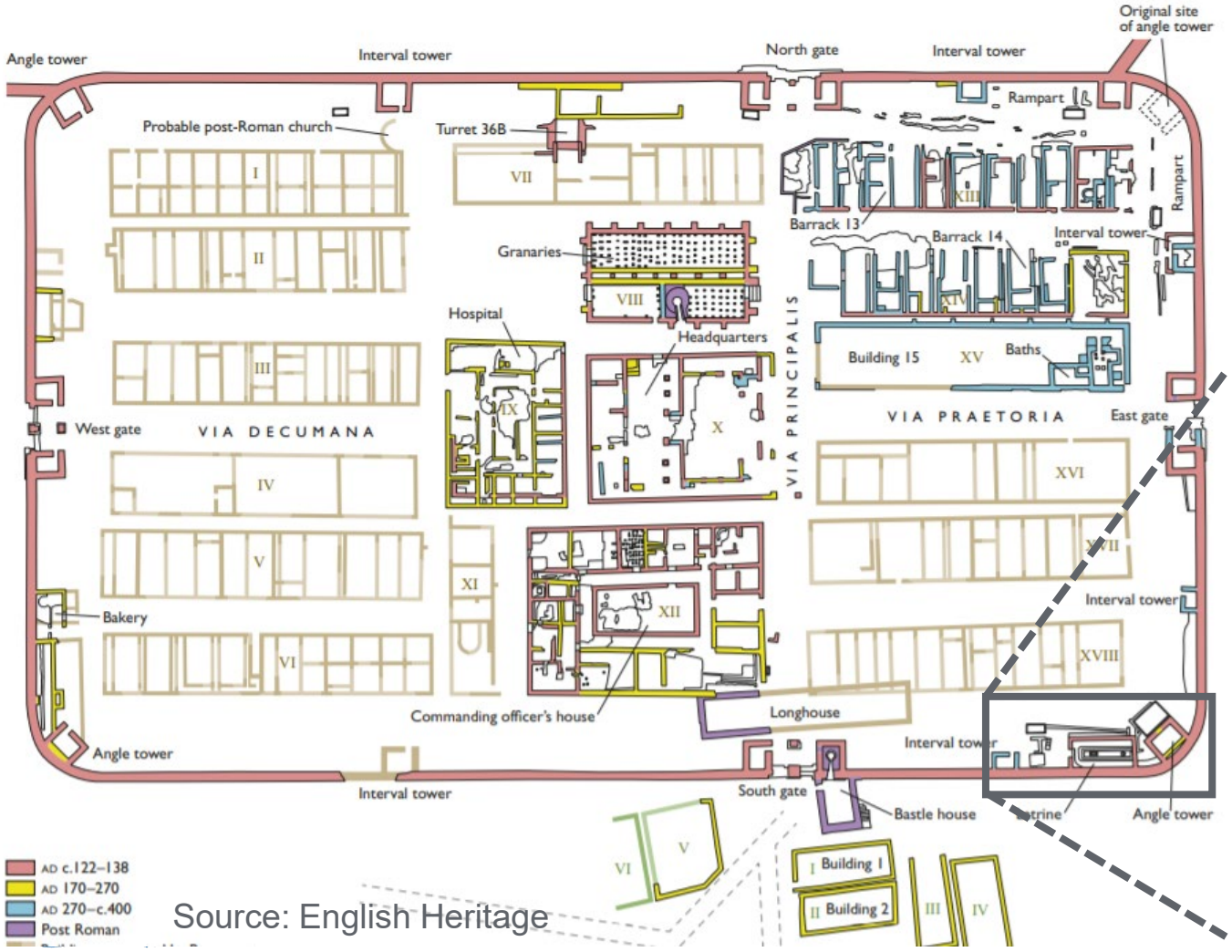


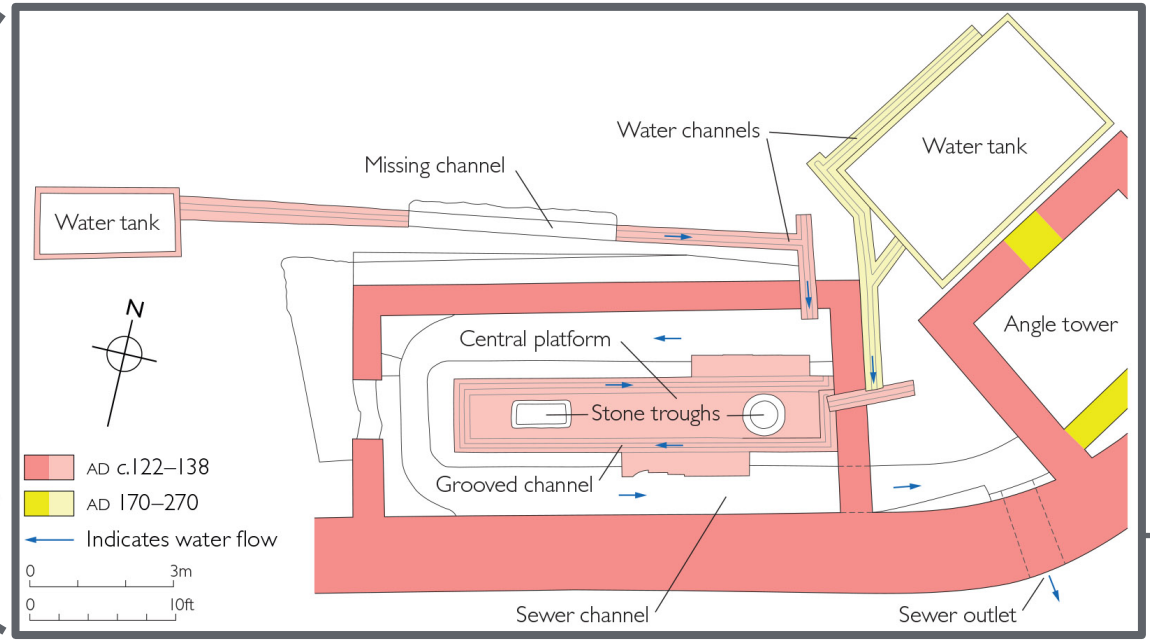
# In this section

- History
- Sources of pollution
- Key physical and chemical processes

# History

## AD 122




Source: English Heritage

# History

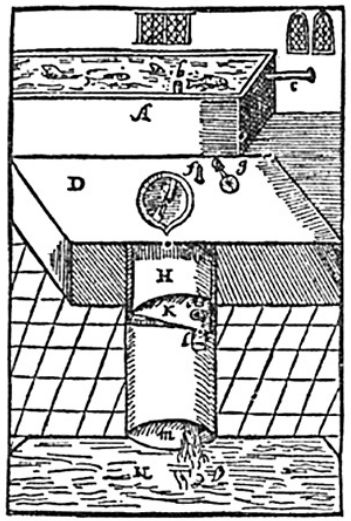
1590s

Sir John Harington thought to have invented flushing toilet (called 'Ajax')

Monasteries ('Reredorter' latrines)

Source: https://www.english-heritage.org.uk/visit/places/muchelney-abbey/things-to-do/

Castles



*A priuie in perfection*

A. the Cesterne.
B. the little washer.
C. the wast pipe.
D. the seate boord.
E. the pipe that comes from the Cesterne.
F. the Screw.
G. the Scallop shell to couer it when it is shut downe.
H. the stoole pot.
I. the stopple.
K. the current.
L. the sluce.
M.N. the vault into which it falles: alwayes remember that ( ) at noone and at night, emptie it, and leaue it halfe a foote deepe in fayre water. And this being well done, and orderly kept, your worst priuie may be as sweet as your best chamber. But to conclude all this in a few wordes, it is but a standing close stoole easilie emptyed.

And by the like reason (other formes and proportions obserued) all other places of your house may be kept sweet.

Source: https://www.historytoday.com/archive/death-sir-john-harington

# History

Early 1800s
Industrial revolution

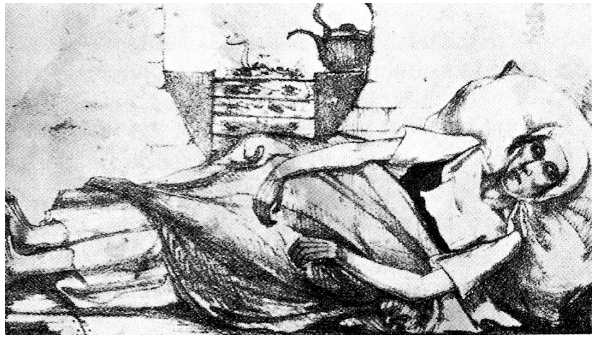
1831
Cholera

1858
'Great Stink'

1875
Public Health Act

Coalbrookdale by night, Philippe-Jacques de Loutherbourg, 1801

Source: https://collection.sciencemuseumgroup.org.uk/objects/co65204/coalbrookdale-by-night-oil-painting



Drawing of a girl dying of cholera - Sunderland, c 1831

Source: https://wellcomecollection.org/works/rf7sxqs6

*Diphtheria – Scrofula - Cholera*

Father Thames introducing his offspring to the fair city of London
Punch 1858

https://www.historic-uk.com/HistoryUK/HistoryofBritain/Londons-Great-Stink/


Victorian engineers – esp. Sir Joseph William Bazalgette (1819 – 1891)
*'Sewers and water mains are as vital to the lives of cities as arteries and veins are to the lives of individuals.'*

David Cannadine

Source: http://news.bbc.co.uk/1/hi/magazine/7235243.stm

# History

1945 Water Act

1948 River Boards Act

1951 Rivers Act

1960 Clean Rivers Act

1961 Rivers Act

1963 Water Resources Act

A string of Victorian reservoirs in the Elan valley in Wales hold 50 million cubic feet of water to supply the city of Birmingham. Constructed 1893


A poster published around 1900

More 'national' approach to water supply. Abstraction licenses.

River Boards set up with responsibility for pollution control and powers to sample effluent

First discharge permits

National policy for water use. Rivers Boards replaced by Rivers Authorities and Water Resources Board created

# History

## 1973 Water Act


10 water authorities created, responsibility for water and wastewater. Plan investment in 5-yearly cycles, split by river basins.

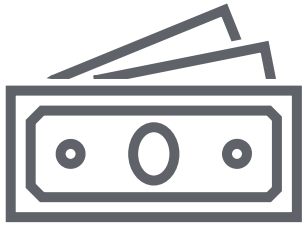
Source: https://www.ofwat.gov.uk/wp-content/uploads/2015/11/rpt_com_devwatindust270106.pdf

## 1973 Joined European Community

New directives to follow:

- Drinking water quality
- Discharges of dangerous substances to aquatic environment
- Bathing waters
- Quality of freshwater for fish

## 1974 Control of Pollution Act



Waste on land, pollution of water, noise and atmospheric pollution. Made it an offence to cause or knowingly allow pollution to happen: 'polluter pays'.

## 1983 Water Act

Started transformation of water industry from public service to business organisation.

Cost-benefit to be considered when planning investment.

## 1985 River Quality Survey

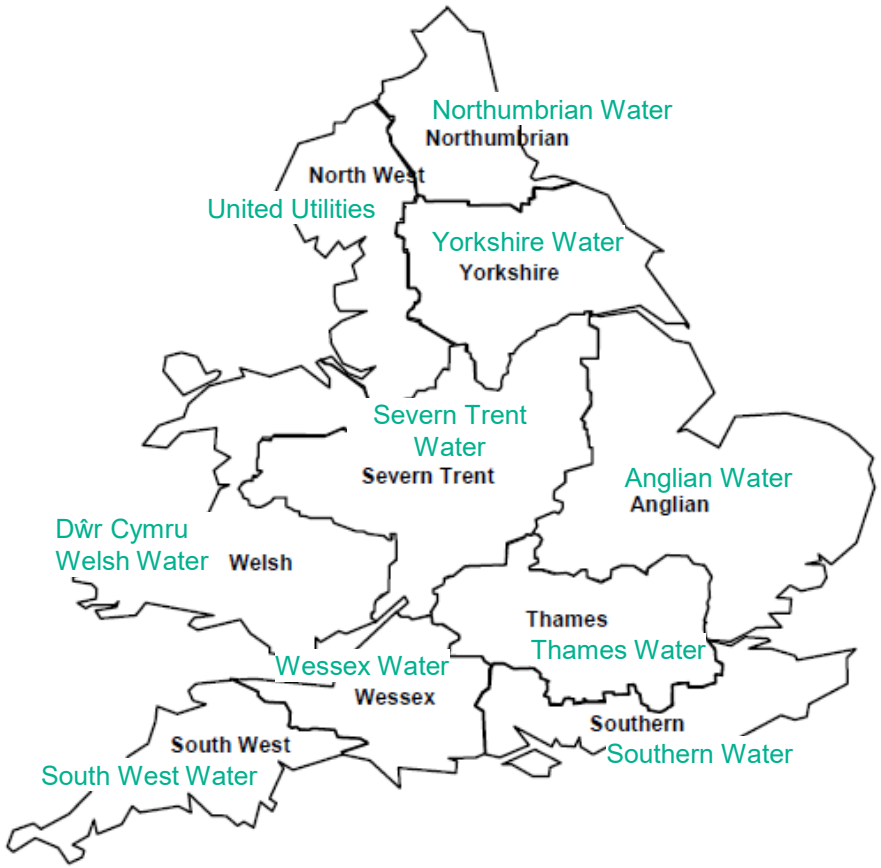
903km out of 40,000km had deteriorated. First time since 1958 that more rivers getting worse than getting better.

742 of 6407 sewage treatment works failed discharge permits.

EC decided to prosecute UK government for pollution in mid-1980s.

# History

1989 Water Act




Privatisation

Wastewater service providers shown left (there are additional clean water providers)

Secretary of State for Environment - overall responsibility for regulation of drinking water quality

National Rivers Authority (now Environment Agency) - pollution and environmental control

Director General of Water Services (now Ofwat) – economic regulator

Statutory water quality classifications and objectives for the first time

Economic regulation – ‘robust assessment of each company’s comparative performance enables price caps to be set that are challenging to the companies to ensure that customers’ bills are no higher than they need to be.’

# Factors that can influence water quality

Trader discharges (consented)

Background quality in the river

Diffuse runoff from agriculture

Abstraction of water for drinking or industry


Inflows from urban areas:
- Treated water from wastewater treatment works (consented)
- Untreated runoff from roads
- Combined sewer overflows (consented)

# Key parameters for UpStream

| Parameter | Example sources | Impact | Relationship to other parameters |
|---|---|---|---|
| **pH** | Acid rain. Acidification by emissions of sulphur dioxide and oxides of nitrogen. Calcium, potassium & manganese in soils reduce acidity. | Can affect solubility and toxicity of chemicals and heavy metals. 'Impact on biological communities.' Drinking water has to be pH 6.5 – 9.5. | Correction factors apply to ammonia standards based on pH. pH change of 1% causes 10% change in concentration of unionised ammonia. |
| **Conductivity** | Chloride or phosphate from household products in sewage. Salt used to de-ice roads in winter. | General indicator of quality. Measure of mineral salts in water. | Increasing water temperature makes it more conductive. |
| **Turbidity** | Anything that makes water more cloudy – sediment, air bubbles, etc. | Reduced light => plants and algae can't grow => no food for other aquatic life. Speculation that higher turbidity reduces hunting success. Indicator of wider water health. | Nitrogen and phosphorus both stimulate vegetation growth. |
| **Temperature** | Sun! Wastewater/urban runoff, trade discharges. | Affects which organisms can live in a water body. Influences chemistry – more reactions in warmer water. Drought can be catastrophic. | Correction factor for ammonia FiS standard based on temp. See conductivity. Less DO in warm water, and un-ionised ammonia increases. |
| Ammonia | Fertilisers. Sewage. Can occur naturally as ammonium salts. | Algal growth (see nitrogen). Unionised ammonia (tiny part of total ammonia concentration) particularly toxic to fish. Ammonia decay uses DO. | See nitrogen. Ammonia decay uses DO – see next slide. |
| Nitrogen | Naturally in all source waters, also fertilisers, sewage, wastewater, animal waste, atmospheric deposition. Also used when making explosives and glass. Sodium nitrite is food preservative. | High nitrogen levels can stimulate too much algal growth, leading to low DO and blocked light. Algal blooms – toxins harmful to human and animal life. | Nitrogen can occur as ammonia ($NH_3$), nitrates ($NO_3$) and nitrites ($NO_2$). |
| Phosphorus | Occurs naturally. Detergents in 1950s-80s. Fertilisers. Sewage. | Fast growth of algae and other plants, reducing DO and blocking light, impacting on aquatic life (eutrophication). Algal blooms – toxins harmful to human and animal life. | - |
| Dissolved Oxygen (DO) | See next slide for processes that increase and reduce DO. | Organisms need oxygen to survive! | Ammonia FiS standards vary based on DO. High temperatures reduce DO. |

# River processes

## Chemical

- Dissolved Oxygen (DO) is vital for aquatic life.
- Biological Oxygen Demand (BOD) decay – how much oxygen is used by organic matter as it decays. (Also COD – Chemical Oxygen Demand.)
- Sediment Oxygen Demand – consumption of DO by bed sediment.
- Ammonia decay / nitrification – DO is consumed by ammonia as it converts to nitrate.
- Benthic oxygen demand – removal of DO due to respiration of benthic (sediment and sub-surface) organisms.

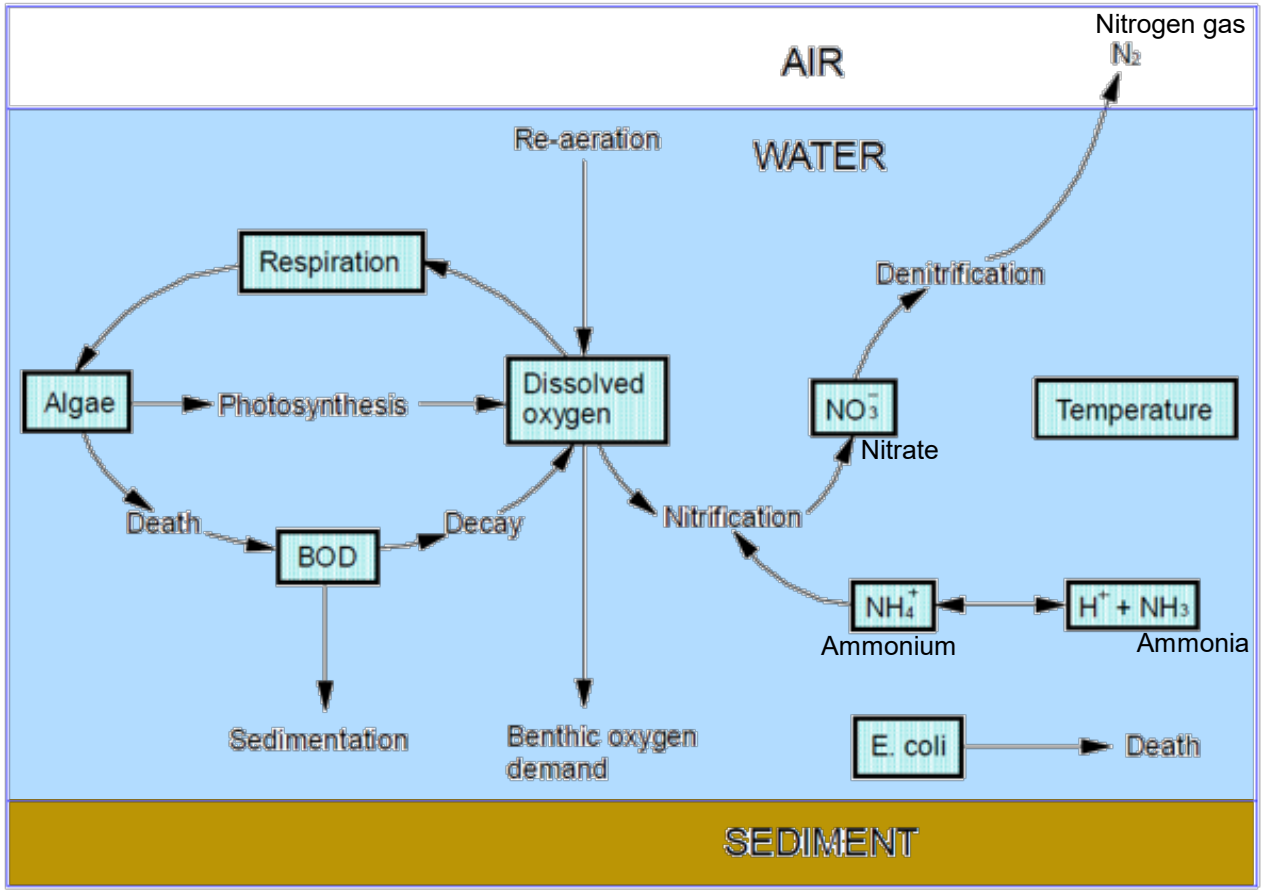



**Figure 4. Principal in-river processes**

## Physical

- Advection – transport of pollutants due to flow.
- Dispersion – 'spreading out' of pollutants caused by turbulence/different velocities within flow.
- Diffusion – Movement from high concentration to low concentration (low impact compared to other processes).
- Re-aeration – air re-enters flow due to turbulence.

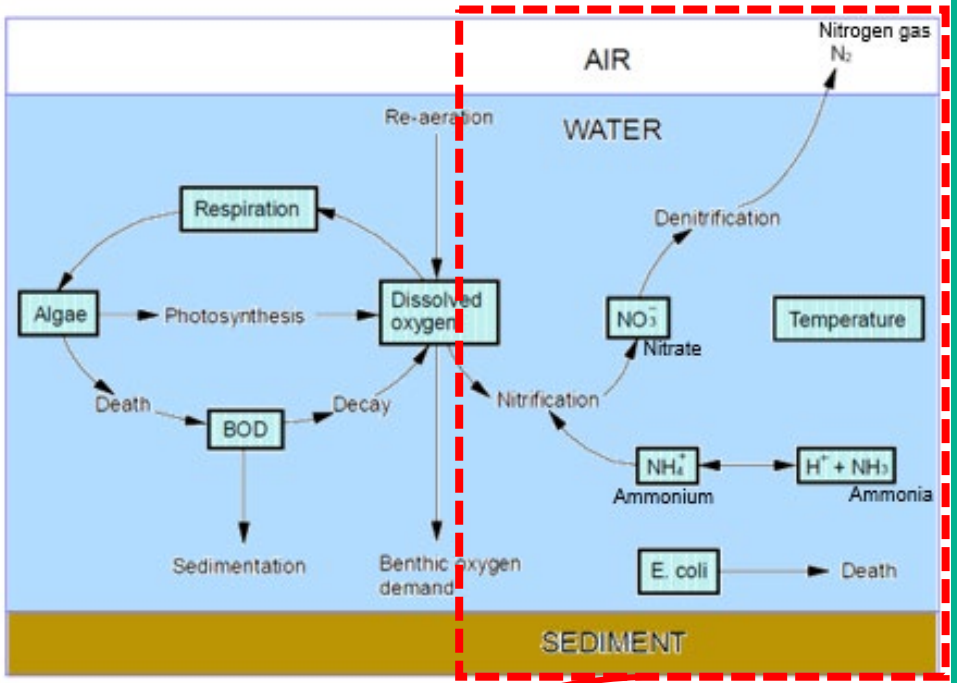



**Figure 4. Principal in-river processes**

## Nitrogen cycle

- As organic nitrogen (e.g. amino acids, DNA) is decomposed by microorganisms inorganic nitrogen is released as ammonia in the process known as **ammonification**.
- **Nitrification** is a microbial process by which reduced nitrogen compounds (primarily ammonia) are sequentially oxidized to nitrite and nitrate. Ammonium exerts a **demand on oxygen** in water as it is transformed to oxidised forms of nitrogen.
- **Denitrification** is the microbial process of reducing nitrate and nitrite to gaseous forms of nitrogen, principally nitrous oxide ($N_2O$) and nitrogen ($N_2$).
- Uptake and utilization of nitrate and ammonia by organisms.

# Ammonia and the nitrogen cycle

- Ammonia can exist in two forms in water, $NH_4^+$ and $NH_3$.
- $NH_4^+$ is called **ionized ammonia (ammonium)** because it has a positive electrical charge, and $NH_3$ is called **unionized ammonia** since it has no charge.
- The two forms combined ($NH_3$ and $NH_4^+$) make up **total ammonia**.
- **Unionized ammonia** is particularly toxic - difficult for aquatic organisms to sufficiently excrete, leading to toxic build-up in internal tissues and blood, and potentially death – **direct toxic effect.**
- **Ionized ammonia (ammonium)** exerts a demand on oxygen in water as it is transformed to oxidised forms of nitrogen – the **Nitrogen Cycle.**

### Nitrate and Nitrite

- Other forms of nitrogenous waste
- **Indirect** effect on aquatic ecosystems - **eutrophication**

### Organic Nitrogen

- Amino acids and DNA – **ammonification**

### Measurements

- **Total Kjeldahl Nitrogen (TKN)** = Organic + Ammonia Nitrogen
- **Inorganic Nitrogen** = Nitrate + Nitrite
- **Total Nitrogen** = TKN + Inorganic Nitrogen

# Impact of intermittent discharges (inc. CSOs)

**Reduction in dissolved oxygen due to:**

- Degradation of dissolved BOD
- Degradation of BOD attached to sediments
- Resuspension of polluted bed sediments
- Low DO levels in spilled storm sewage

**Rapid increase in river concentrations** of ammonia, bacteria, COD, suspended sediments, plus can be heavy metals and other toxic substances

Impact will vary from site to site, depending on characteristics of river/receiving water and the sewage discharge.

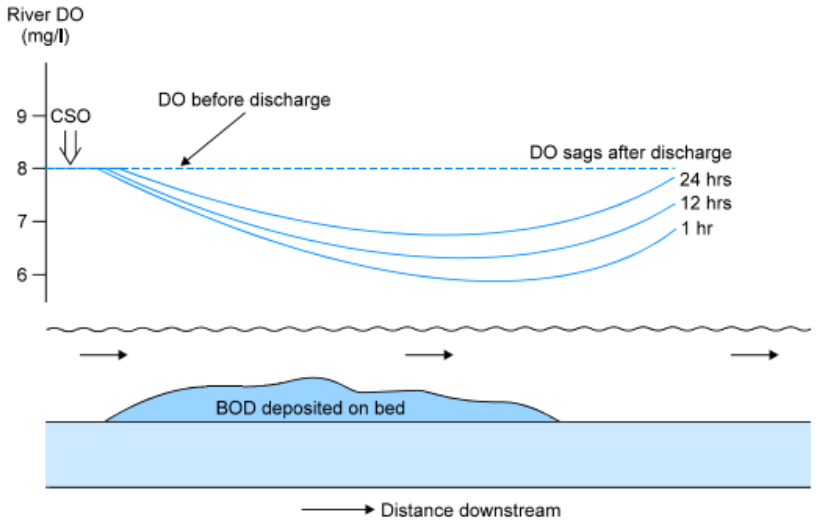



**Figure 5.8** **Potential DO sag after a CSO discharge where most of the BOD settles to the river bed**

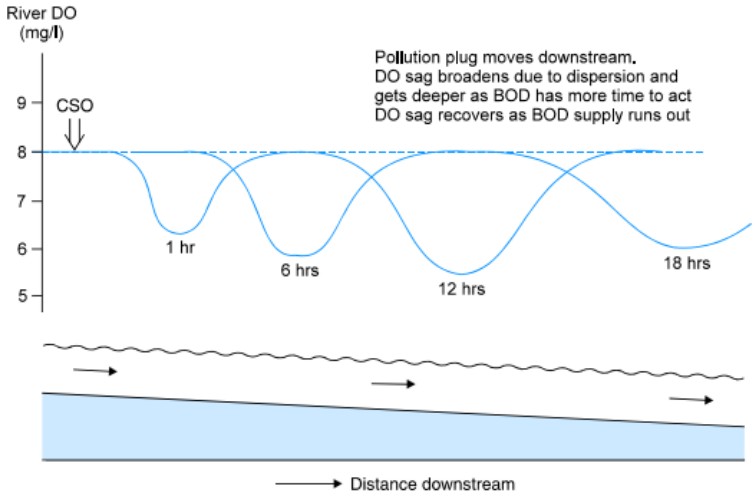



**Figure 5.9** **Potential DO sag after a CSO discharge where most of the BOD remains in suspension**

Source: http://www.fwr.org/UPM3/Section5.pdf

# Information sources + further reading

- Great Stink: https://historicengland.org.uk/images-books/archive/collections/photographs/the-great-stink/
- Housesteads Roman Fort: https://www.english-heritage.org.uk/visit/places/housesteads-roman-fort-hadrians-wall/history/
- Blog about best historical toilets in UK! https://blog.english-heritage.org.uk/top-10-toilets-through-time/
- Sir John Harington, inventor of flushing toilet: https://www.britannica.com/biography/John-Harington
- Cholera: http://www.historyhome.co.uk/peel/p-health/cholera3.htm
- William Farr and death certificates: https://www.britannica.com/biography/William-Farr
- John Snow's work proving that cholera was transmitted through contaminated water: https://www.rcseng.ac.uk/library-and-publications/library/blog/mapping-disease-john-snow-and-cholera/
- Development of water industry in England and Wales: https://www.ofwat.gov.uk/wp-content/uploads/2015/11/rpt_com_devwatindust270106.pdf
- UKTAG guidance - http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20Environmental%20Standards%20Phase%203%20Final%20Report%2004112013.pdf
- https://consult.environment-agency.gov.uk/++preview++/environment-and-business/challenges-and-choices/user_uploads/phosphorus-pressure-rbmp-2021.pdf

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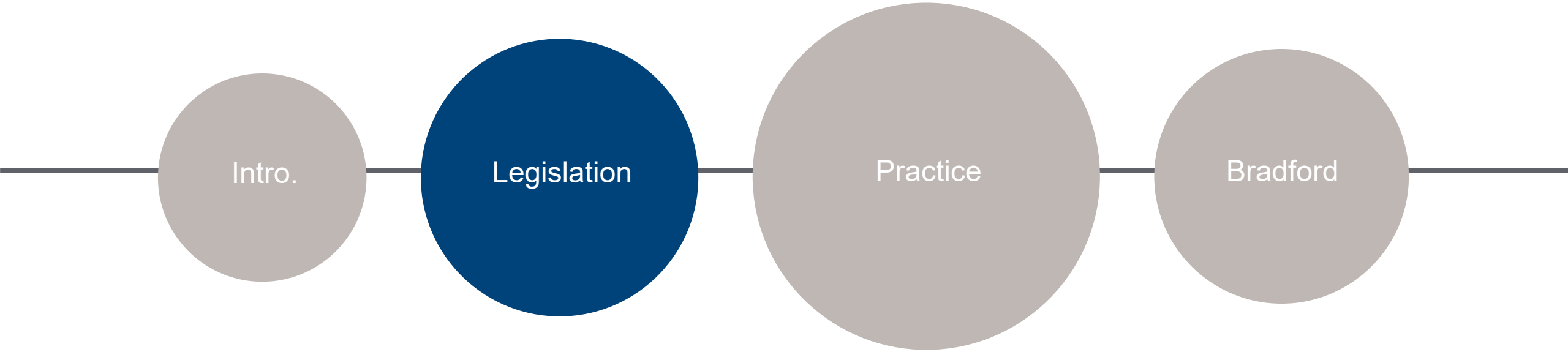

# Legislation

- Environment Act
- Water Framework Directive
- Bathing Water Directive
- Urban Wastewater Treatment Directive
- Combined Sewer Overflows
- What happens if you break the law

# Environment Act (2021)

- Approved by UK parliament 09/11/2021
- Covers air quality, water, biodiversity, resource efficiency and waste reduction, and soil health and quality
- Water:
  - Each wastewater company has to produce a drainage and sewerage management plan
  - Have to reduce overflow discharges and the adverse impact of those discharges
  - Publish information about overflow spills within an hour of them starting
  - Continuously monitor water quality upstream and downstream of overflows (dissolved oxygen, temperature, pH, turbidity, ammonia and 'anything else specified in regulations made by Secretary of State')
  - Changes to guidance re. water abstraction

"CHAPTER 4

STORM OVERFLOWS

**141A Duty on sewerage undertakers to take all reasonable steps to ensure untreated sewage is not discharged from storm overflows**

(1) A sewerage undertaker must demonstrate improvements in the sewerage systems and progressive reductions in the harm caused by untreated sewage discharges.

(2) The Secretary of State, the Director and the Environment Agency must exercise their respective functions under this and any other Act to secure compliance with this duty.

**141B Storm overflow discharge reduction plan**

(1) The Secretary of State must prepare a plan for the purposes of—

(a) reducing discharges from the storm overflows of sewerage undertakers whose area is wholly or mainly in England, and

(b) reducing the adverse impacts of those discharges.

Doesn't say how much spills have to be reduced by

(2) The reference in subsection (1)(a) to reducing discharges of sewage includes—

(a) reducing the frequency and duration of the discharges, and

(b) reducing the volume of the discharges.

(3) The reference in subsection (1)(b) to reducing adverse impacts includes—

(a) reducing adverse impacts on the environment, and

(b) reducing adverse impacts on public health.

(4) The plan may in particular include proposals for—

(a) reducing the need for anything to be discharged by the storm overflows;

(b) treating sewage that is discharged by the storm overflows;

(c) monitoring the quality of watercourses, bodies of water or water in underground strata into which the storm overflows discharge;

(d) obtaining information about the operation of the storm overflows.

**Monitoring quality of water potentially affected by discharges**

(1) In Chapter 4 of Part 4 of the Water Industry Act 1991, after section 141EA insert—

**"141EB Monitoring quality of water potentially affected by discharges from storm overflows and sewage disposal works**

(1) A sewerage undertaker whose area is wholly or mainly in England must continuously monitor the quality of water upstream and downstream of an asset within subsection (2) for the purpose of obtaining the information referred to in subsection (3).

*ironment Bill*
*t 5 – Water*

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(2) The assets referred to in subsection (1) are—

(a) a storm overflow of the sewerage undertaker, and

(b) sewage disposal works comprised in the sewerage system of the sewerage undertaker,

where the storm overflow or works discharge into a watercourse.

(3) The information referred to in subsection (1) is information as to the quality of the water by reference to—

(a) levels of dissolved oxygen,

(b) temperature and pH values,

(c) turbidity,

(d) levels of ammonia, and

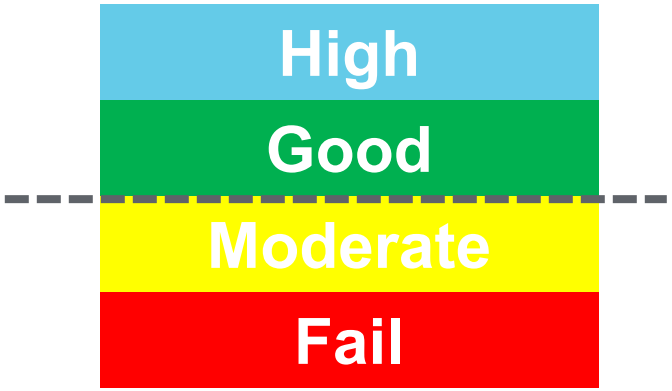
(e) anything else specified in regulations made by the Secretary of State.

https://www.legislation.gov.uk/ukpga/2021/30/part/5/enacted
https://www.gov.uk/government/news/world-leading-environment-act-becomes-law

# Water Framework Directive (2000)

- Improved on earlier, piecemeal EU water legislation.
- Expanded protection to all waters and set objectives to be achieved by specified dates.
- Protects inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater.
- Original target for 'good status' by 2015:
  - Biological quality (fish, benthic invertebrates, aquatic flora)
  - Hydromorphological quality such as river bank structure, river continuity or substrate of the river bed.
  - Physical-chemical quality such as temperature, oxygenation and nutrient conditions.
  - Chemical quality - maximum concentrations for specific water pollutants.
- 2015 targets not met for range of reasons – natural conditions, technical feasibility, disproportionate cost, time to respond to improvement measures ...
- Each determinand classified individually with bandings which define whether high, good, etc.
- Environment Agency undertakes assessments using three years of previous sample data from set sample locations.
- Directive requires member states to create a 'river basin management plan' for all river basins that is prepared, implemented and reviewed every six years.

**WFD assessment criteria. Need to achieve good or high.**



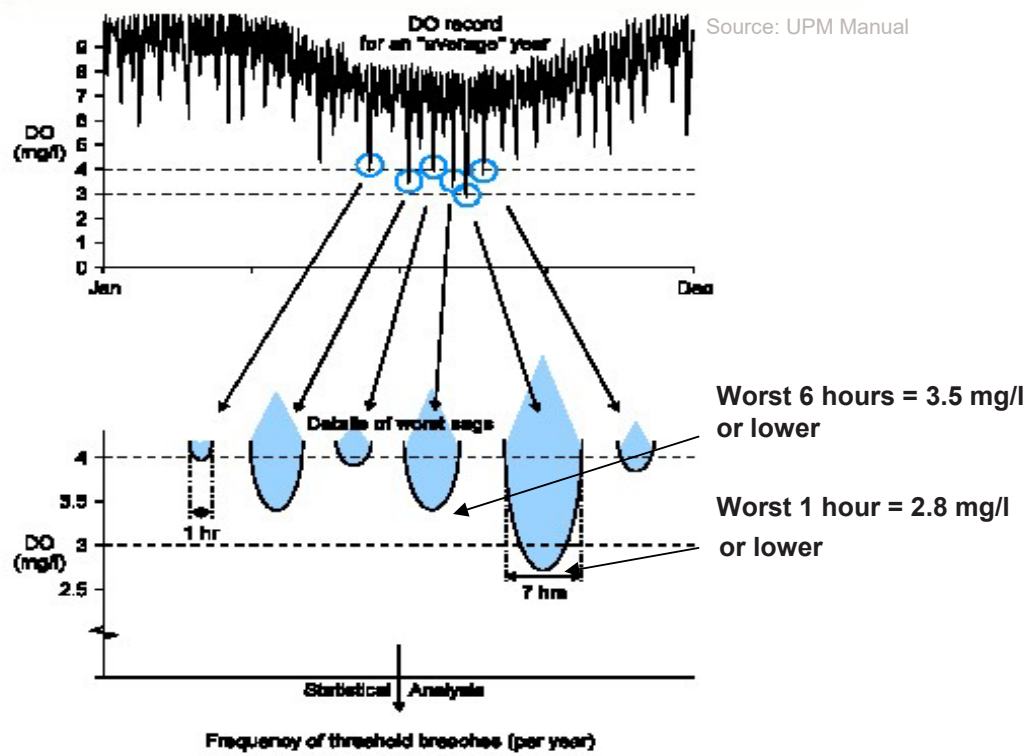
# WFD – setting standards and UKTAG

- UK Technical Advisory Group (UKTAG) is a UK-wide Water Framework Directive (WFD) policy group, including scientists and the Environment Agency.
- It developed the standards that we need to meet in the UK, to comply with the WFD.
- Standards are based on biological data or – where there is insufficient data – 'current scientific understanding of the causes of ecological change.'
- https://wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20Environmental%20Standards%20Phase%203%20Final%20Report%2004112013.pdf
- Following a review of more than 300 chemicals, UKTAG has set standards for 29 specific pollutants: ammonia, arsenic, chlorine, chromium(III), chromium(VI), copper, cyanide, cypermethrin, diazinon, 2,4-dichlorophenol, 2,4-dichlorophenoxyacetic acid (2,4-D), dimethoate, iron, linuron, mecoprop, permethrin, phenol, toluene, zinc, benzyl butyl phthalate, carbendazim, chlorothalonil, 3,4-dichloroaniline, glyphosate, manganese, methiocarb, penimethalin, tetrachloroethane and triclosan.
- Review considered hazardous properties (toxicity, persistence, potential to accumulate in organisms) and potential exposure of the environment to the substance (based on monitoring data and patterns of use).
- Ambient Background Concentrations defined.

# WFD / UKTAG Standards

| Standard | |
|---|---|
| High percentile (90% and 99%) | Count number of timesteps failure applies for.<br>Allowed to fail for 10% / 1% of year<br>Parametric (normal distribution) or non-parametric methods |
| Fundamental Intermittent Standards (FIS) | Standards vary depending on type of fishery:<br>• Sustainable cyprinid<br>• Sustainable salmonid (fishery or spawning grounds)<br>• Marginal cyprinid<br>Three standard durations – 1hr, 6hr, 24hr<br>Three return periods – 1 month, 3 months, 1 year<br>(See UPM tables 2.2 and 2.3) |
| *Care required to correctly count number of events causing failure. | |

Hypothetical DO profile for a river illustrating meaning of Fundamental Intermittent Standards




Source: UPM Manual

FIS standards for salmonoid fishery

| Return Period | 1 hour | | | 6 hour | | | 24 hour | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 mth | 3 mths | 1 year | 1 mth | 3 mths | 1 year | 1 mth | 3 mths | 1 year |
| Dissolved Oxygen Concentrations (mg/l) | 5.0 | 4.5 | 4.0 | 5.5 | 5.0 | 4.5 | 6.0 | 5.5 | 5.0 |
| Un-ionised ammonia concentrations (mg NH3-N/l) | 0.065 | 0.095 | 0.105 | 0.025 | 0.035 | 0.040 | 0.018 | 0.025 | 0.030 |

https://wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20Environmental%20Standards%20Phase%203%20Final%20Report%2004112013.pdf

# Bathing Water Directive (2006)

- Natural water bodies where large number of people bathe
- More intense monitoring: E. Coli, cyanobacteria, macro-algae, marine phytoplankton, glass/litter
- Bathing waters classified as ‘poor’, ‘sufficient’, ‘good’ or ‘excellent’
- Bathing period defined as 15th May – 30th September (warm weather, more likely to swim)
- Bathing water classification visible to public
- ‘Poor’ bathing waters have to be improved
- Used to be coastal areas only, but first river bathing water designated in 2020

## Yorkshire swimming spot to get bathing water status in UK first

**Campaigners in Ilkley hope River Wharfe designation will ‘trigger a clean-up’ of local sewage system**

People sunbathing and paddling in the River Wharfe in Ilkley in June. Photograph: Paul Ellis/AFP/Getty Images

A stretch of river in Yorkshire will become the first in the UK to be given bathing water status in a major success for campaigners trying to stop releases of untreated sewage into inland waters.

December 2020 - https://www.theguardian.com/environment/2020/dec/22/yorkshire-river-wharfe-ilkley-bathing-water-status-uk-first

# Urban Wastewater Treatment Directive (1991)

- Collection, treatment and discharge of domestic wastewater and wastewater from certain industrial sectors
- Have to collect and treat flows from areas with more than 2,000 people (or equivalent load, from trade).
- Secondary treatment required for all areas with > 2,000 population equivalent (p.e.) and more advanced treatment if > 10,000 p.e.
- Requires pre-authorisation for all discharges of urban wastewater, discharges from the food processing industry, and industrial discharges.
- Monitoring performance of treatment plants.
- Controls re. sewage sludge disposal and re-use.
- ‘Best technical knowledge not entailing excessive costs.’

- Revised directive issued October 2022, inc. reducing greenhouse gas emissions and cutting microplastic emissions.

# Can you put anything down your drain?

Water Industry Act (1991)

106 – Subject to the provisions of Chapter III of this Part, nothing in subsection (1) above shall entitle any person—

(a) to discharge directly or indirectly into any public sewer—

(i) any liquid from a factory, other than domestic sewage or surface or storm water, or any liquid from a manufacturing process; or

(ii) any liquid or other matter the discharge of which into public sewers is prohibited by or under any enactment; or

(b) where separate public sewers are provided for foul water and for surface water, to discharge directly or indirectly—

(i) foul water into a sewer provided for surface water; or

(ii) except with the approval of the undertaker, surface water into a sewer provided for foul water; or

(c) to have his drains or sewer made to communicate directly with a storm-water overflow sewer.

111 – You're not allowed to put anything nasty into a public sewer or any drain that connects to a public sewer.

121 – Conditions may be applied to trade consents, e.g. composition of the trade effluent, connection point, highest rate, time of day at which trade effluent can be discharged into sewers, etc.

Factories need permission

Don't mix rainwater with foul water

Special conditions can be applied to trade discharges

# Combined Sewer Overflows

**Environmental Permitting (England and Wales) Regulations 2016**

Unsatisfactory overflows:

- Operate in dry weather
- Breach permit conditions
- Cause significant visual or aesthetic impact due to solids or sewage fungus
- Significantly contribute to deterioration in biological or chemical status of receiving water, failure of bathing water quality standards or failure to meet shellfish standards
- Failure in quality of coastal or transitional waters
- Cause pollution of groundwater

Urban Pollution Manual (UPM) to be used to plan work on storm overflows

Current design standards for overflows vary depending on environmental impact and discharge significance:

- Minimum retained flow of 'Formula A' (see right)
- Three standards: Formula A, 99-percentile or fundamental intermittent standards
- No more than three significant (>50m$^3$) spills in bathing season for good bathing waters, or prove no impact with water quality impact modelling
- No more than 10 spills to shellfish waters
- Aesthetic control: 6mm screening in 2D (or 10mm, depending on receiving waters)
- Maintenance needed
- Have to monitor how often spills happen (Event Duration Monitoring)

Note: also have 'emergency overflows' used, for example, when pumping station fails. Guidance on these on same website.

Formula A (l/d) = 1360P + DWF + 2E

Where DWF = Dry Weather Flow (l/d) = PG + I + E

P = Population

E = Trade effluent (l/d)

I = Infiltration (l/d)

G = Consumption rate (l/h/d)

https://www.gov.uk/government/publications/water-companies-environmental-permits-for-storm-overflows-and-emergency-overflows/water-companies-environmental-permits-for-storm-overflows-and-emergency-overflows

# Wastewater treatment works

Not applicable to Bradford, but if you want to know more about how wastewater treatment works permits are set and monitoring requirements:

- https://www.gov.uk/government/publications/waste-water-treatment-works-treatment-monitoring-and-compliance-limits/waste-water-treatment-works-treatment-monitoring-and-compliance-limits
- https://www.gov.uk/government/publications/calculating-dry-weather-flow-dwf-at-waste-water-treatment-works/calculating-dry-weather-flow-dwf-at-waste-water-treatment-works

# Water treatment works

- https://www.gov.uk/government/publications/water-companies-water-treatment-works-discharge-limits-for-environmental-permits/water-companies-water-treatment-works-discharge-limits-for-environmental-permits

# If you break the law …

Press release

## Severn Trent Water fined £1.5 million for sewage discharges

Environment Agency successfully prosecutes Severn Trent Water for sewage discharges.

From: Environment Agency
Published 8 December 2021

Sewage was discharged into a number of watercourses in Worcestershire

- Severn Trent Water fined £1.5 million for illegal sewage discharges
- Approx 360,000 litres of sewage discharged into one brook

Severn Trent Water Limited has been fined £1.5 million for sewage discharges from 4 sewage treatment works in Worcestershire between February and August 2018. The water company has also been ordered to pay prosecution costs of £58, 365.

https://www.gov.uk/government/news/severn-trent-water-fined-1-5-million-for-sewage-discharges

## Southern Water fined record £90m for deliberately pouring sewage into sea

**Privatised firm dumped billions of litres of raw sewage off north Kent and Hampshire coasts to avoid costs and penalties**

- **Timeline: from privatisation to pollution fines**
- **'The sea was milky white': how the scandal unfolded**

The beach at Whitstable, Kent. Photograph: Andrew Sparkes/Alamy

Southern Water has been fined a record £90m for deliberately dumping billions of litres of raw sewage into protected seas over several years for its own financial gain.

https://www.theguardian.com/environment/2021/jul/09/southern-water-fined-90m-for-deliberately-pouring-sewage-into-sea