Economic and Social Research Council

MOST 科技部 Ministry of Science and Technology

Water Quality Parameters of Interest & Those Currently Being Monitored with WaterBoxes

July 2022

UpStream

Community-led monitoring to improve water quality

公民主導水質量測

Temperature
(Currently being monitored)

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What impact can it have?
Temperature impacts on the biological and chemical processes that determine the health of a watercourse. It can also directly impact on the metabolism, reproduction and, ultimately, survival of aquatic species.

Potential sources
Sunshine! Also air temperature, channel shape, velocity and depth of water. Discharges of sewage, trade effluent and highway runoff can all impact on water temperature.

Acceptable values
UK: Temperatures for salmonid waters, such as Bradford's Becks, generally shouldn't exceed 21.5°C. Sudden changes (more than about 1.5-3°C) should also be avoided.

Taiwan: In Taiwan, water to be used for irrigation shouldn't exceed 35 ˚C, but no limits exist for other uses. Water temperature in the Touqian River generally oscillates between 12-28 ˚C at the upstream end, and between 13-30 ˚C in the downstream section.

Relationship to other parameters
Increasing water temperature makes it more conductive and reduces dissolved oxygen and pH. High turbidity may lead to increased temperature.

pH
(Currently being monitored)

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What impact can it have?
pH is a measure of how acidic or alkaline a substance is. If a watercourse becomes too acidic (too low pH) or alkaline (too high pH) then aquatic creatures will struggle to survive.

Potential sources
Acid rain can reduce pH, increasing acidity. Calcium, potassium and manganese in soils can reduce acidity. Local geology may also impact the pH of rivers.

Acceptable values
High or low pH readings are an indication of watercourse pollution.

UK: pH values for Bradford's Becks should be 5.95-6.60 most of the time.

Taiwan: pH values for the Touqian river should be 6.5-9.0 most of the time.

Generally, drinking water should have a pH of between 6.5 and 8.5, whereas a slightly wider range is acceptable for irrigation water (of around 6.0-9.0).

Relationship to other parameters
A pH change of 1% causes a 10% change in concentration of unionised ammonia. Temperature changes can also cause changes in pH.

Electrical Conductivity

(Currently being monitored)

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What impact can it have?

The conductivity of water refers to its ability to conduct an electrical current. It can provide an indication of the amount of dissolved substances such as chemicals and minerals being present in the water.

Potential sources

Naturally occurring minerals (such as salts) as well as pollutants can increase the conductivity of water. When these substances dissolve in the water, they turn into negatively or positively charged ions which affect conductivity. Examples of ions affecting water conductivity include potassium, magnesium, sodium, carbonate, chloride and sulphate. In particular, mineral- and chemical-rich industrial discharges have high potential of increasing conductivity. As a result, measuring conductivity can be a good indicator of the level of water pollution.

Acceptable values

Pure water has an extremely low electrical conductivity because of the lack of impurities in it. Generally, drinking water should have a conductivity of less than 1 mS/cm, while rain water typically has a conductivity of between 2-100µS/cm. It is important to understand natural (baseline) conductivity levels; deviations from it can be indicative of pollution.

Relationship to other parameters

High temperature generally increases conductivity. Additionally, high levels of compounds such as ammonia and phosphates are often linked to higher conductivity (as they can break down into ions).

Turbidity
(Currently being monitored)

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What impact can it have?

Turbidity is the measure of relative clarity of a liquid; water with high turbidity is cloudy or opaque. High turbidity affects light penetration and may limit ecological productivity, habitat quality and recreational value. Turbidity readings can provide an indication of potential pollution in a water body.

Potential sources

Material that causes water to be turbid may include silt, tiny organic and inorganic matter, algae, dissolved coloured compounds, plankton and other tiny organisms. Turbidity may increase during wet weather, as higher flows may drag more material. Discharges of sewage, trade effluent and runoff can all increase turbidity.

Acceptable values

Natural turbidity levels can vary largely from river to river as a result of local geology, river morphology and flow conditions. A clear mountain stream might have a turbidity of around 1 NTU, whereas large, lowland rivers river might have dry-weather turbidity of over 10 NTUs.

It is important to understand natural (baseline) turbidity levels; deviations from it can be indicative of pollution.

Relationship to other parameters

High turbidity increases water temperature due to the particles absorbing sunlight. Higher temperatures of water result in less oxygen content. Suspended particles also scatter light, preventing it from reaching plants and algae, further reducing oxygen content. Other pollutants, notably metals and bacteria, also attach to the particles that cause high turbidity.

Dissolved Oxygen
(Not currently monitored)

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What impact can it have?

Dissolved oxygen (DO) is a key indicator of a watercourse's ability to support life. It is the amount of oxygen present in the water and available for aquatic life.

Potential sources

A shallow, babbling brook with lots of waterfalls and rapids will generally have higher dissolved oxygen content than a deep, slow-moving river. DO is normally higher near the water surface.

Lots of algal growth (e.g. stimulated by fertilisers) can reduce DO, so less is available for other forms of life.

Acceptable values

High dissolved oxygen content can be an indicator of a healthy waterbody.

UK: DO levels for Bradford's Becks should be above 4 mg/l most of the time.

Taiwan: DO levels in the downstream section of the Touqian River (from 200 m downstream of Xizhou Bridge) should be above 4.5 mg/L. In the upper section of the river, DO should be above 5.5 mg/L.

Relationship to other parameters

High temperatures reduce dissolved oxygen. Levels fluctuate seasonally and over the course of the day as oxygen (like most gases) dissolves more easily in cold water. Ammonia, decay of aquatic life and activity in river bed sediments can all reduce dissolved oxygen.

Nitrogen compounds

(Ammonia, Unionised Ammonia, Ammonium*, Nitrates*)

*Sensors for these parameters are currently being tested

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What impact can it have?

Nitrogen compounds can stimulate algal growth, leading to reductions in dissolved oxygen available for aquatic life. Unionised ammonia, which makes up a tiny part of the total ammonia concentration, is particularly toxic to fish. Ammonia decay ('denitrification') also reduces dissolved oxygen and releases nitrogen gas.

Potential sources

Nitrogen compounds are present in commercial fertilisers. They also occur naturally due to breakdown of organic matter, and as ammonium salts. They can also enter rivers through combined sewer overflows.

Acceptable values

Generally, high concentrations of nitrogen compounds are an indication of watercourse pollution.

UK: According to the Water Framework Directive, total ammonia concentrations for Bradford's Becks should be less than 0.2 – 1.5 mg/l most of the time.

Taiwan: The concentration of ammonia nitrogen in the Touqian river (river type B&C) should be less than 0.3 mg/L. Additionally, the upper thresholds of ammonia nitrogen and total nitrogen, respectively, for human consumption and irrigation, are 0.1 mg/L and 3.0 mg/L.

Relationship to other parameters

pH is a major factor that determines the proportion of different forms of Nitrogen (e.g., ammonia, unionised ammonia, ammonium). A pH change of 1% causes a 10% change in concentration of unionised ammonia. Ammonia can reduce dissolved oxygen.