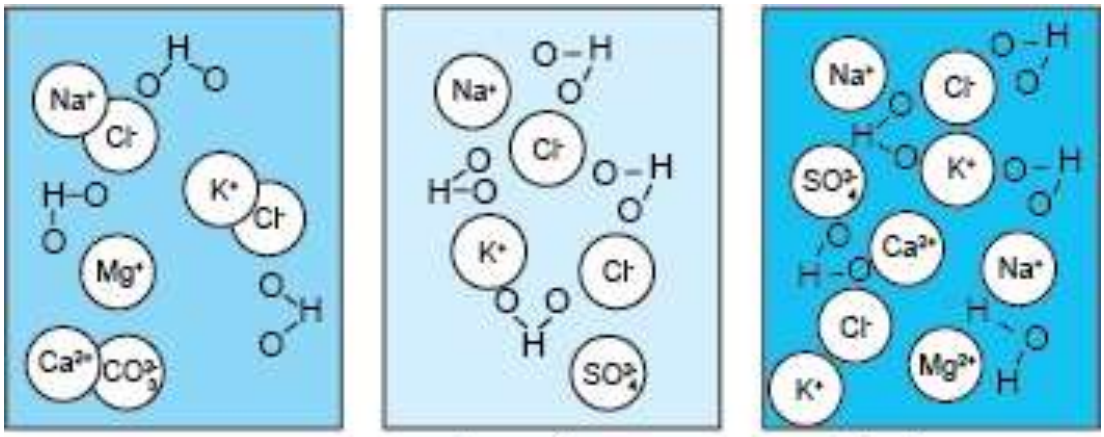
Water quality indicator: Electrical conductivity

What is electrical conductivity?

Electrical conductivity measures the ability of water to conduct an electrical current. The higher the concentration of dissolved charged chemicals (also known as salts) in the water, the greater the electrical current that can be conducted. Examples of charged ions that naturally occur in river water include calcium, potassium, chloride, sulphate and nitrate.



The higher the temperature of the water, the greater the ability of the water to conduct electrical charge. For this reason electrical conductivity is always reported at a reference temperature of 25 ^{o}C. The unit of measurement is microsiemens per cm (μS/cm). Electrical conductivity in a river can be quite variable, and still within natural levels that will not cause any harm. Typical values for a chalk river will be 100 – 2000 μS/cm.

Why do we measure electrical conductivity in rivers?

Significantly elevated electrical conductivity can indicate that pollution has entered the river. A measure of electrical conductivity cannot tell you what the pollutant is, but it can help identify that there is a problem that may harm invertebrates and/or fish. Electrical conductivity may be high in a river without any visible effects on the clarity of the river water, so it needs to be measured with a suitable sensor.

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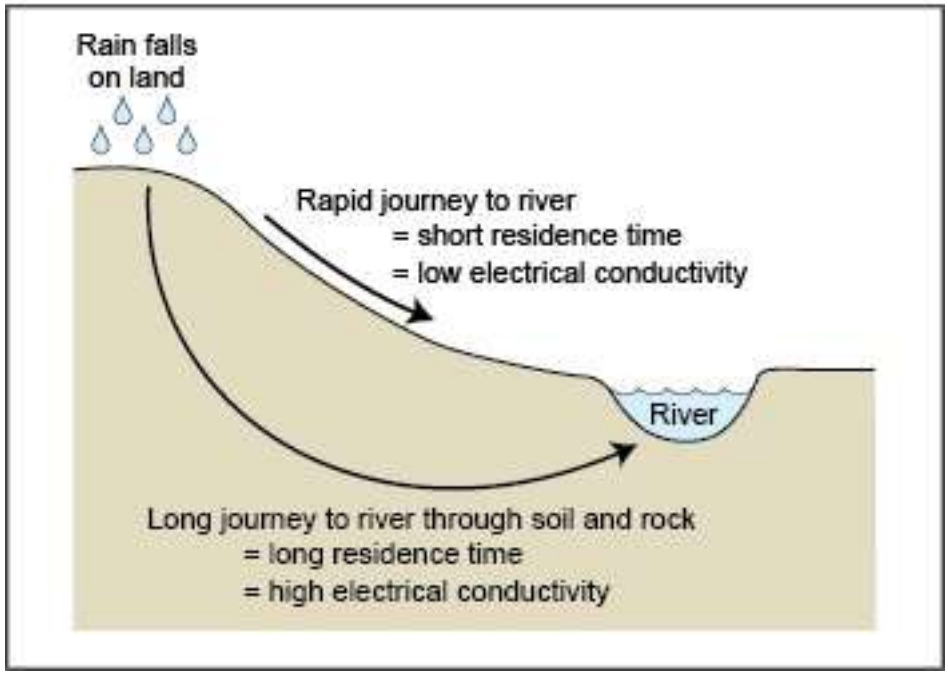
What are the natural controls on electrical conductivity in rivers?

Geology and soil type are the main natural controls on electrical conductivity in rivers. When it rains, water flows through and over the soil to our rivers, dissolving and picking up chemicals along its way. In regions underlain by chalk, rainwater will move into the soil, and then flow down to the chalk underneath. As water moves through the chalk it will dissolve magnesium and calcium carbonate, which raises the electrical conductivity. It generally takes decades for the water to move through the chalk to the river, so there is plenty of time for the water to dissolve the chalk. The residence time of water in rocks and soils is an important control on electrical conductivity.



How can human activity change electrical conductivity?

Any human activity that adds inorganic, charged chemicals to a river will alter the electrical conductivity. For example, electrical conductivity may be higher in a river downstream of a sewage treatment works due to chemicals such as chloride and phosphate from household products. Winter road runoff, containing salt, can be very high in electrical conductivity. If this runoff reaches rivers then it may, depending on the quantity of water, temporarily elevate the electrical conductivity in the river.