Water quality

Water quality is fundamental. Water quality sustains ecological processes that support native fish populations, vegetation, wetlands and birdlife. Similarly, many of our own uses depend on water quality that is suitable for irrigation, watering stock, drinking, fishing and recreation, and to meet cultural and spiritual needs.

It is important to recognise the environmental values and uses for different waterways that the community want to see protected. These include recreational use, healthy aquatic ecosystems, and water for drinking and irrigation.

What is water quality?

Water is essential to human life and the health of the environment. As a valuable natural resource, it comprises marine, estuarine, freshwater (river and lakes) and groundwater environments that stretch across coastal and inland areas. Water has two dimensions that are closely linked: quantity and quality. Water quality is commonly defined by its physical, chemical, biological and aesthetic (appearance and smell) characteristics. A healthy environment is one in which the water quality supports a rich and varied community of organisms and protects public health.

Water quality in a body of water influences the way in which communities use the water for activities such as drinking, swimming or commercial purposes. More specifically, the water may be used by the community for:

- supplying drinking water
- recreation (swimming, boating)
- irrigating crops and watering stock
- industrial processes
- navigation and shipping
- production of edible fish, shellfish and crustaceans
- protection of aquatic ecosystems
- wildlife habitats
- scientific study and education.

Why is water quality important?

Water quality is important not only to protect public health: water provides ecosystem habitats, is used for farming, fishing and mining, and contributes to recreation and tourism. If water quality is not maintained, it is not just the environment that will suffer. The commercial and recreational value of our water resources will also diminish.

What affects the quality of our water?

Water quality is closely linked to the surrounding environment and land use. Other than in its vapour form, water is never pure and is affected by community uses such as agriculture, urban and industrial use, and recreation. The modification of natural stream flows by dams and weirs can also affect water quality. The weather, too, can have a major impact on water quality, particularly in dry areas that are periodically affected by droughts.

Rivers frequently act as conduits for pollutants by collecting and carrying wastewater from catchments and, ultimately, discharging it into the ocean. Stormwater, which can also carry heavy loads of nutrients, organic matter and pollutants, finds its way into rivers and oceans, mostly via the stormwater drain network. Beach water quality in NSW may also be affected by bacteria from sewer overflows or other runoff into stormwater drains.

How does water quality affect aquatic ecosystems?

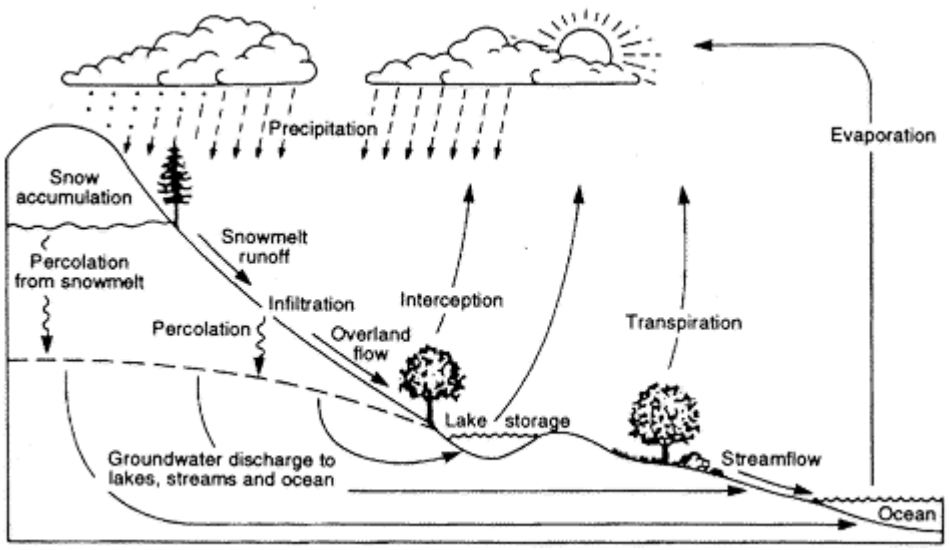
An ecosystem is a community of organisms – plants, animals, fungi and bacteria – interacting with one another and the environment in which they live. Protecting aquatic ecosystems is in many ways as important as maintaining water quality, for the following reasons:

- Aquatic ecosystems are an integral part of our environment. They need to be maintained if the environment is to continue to support people. World conservation strategies stress the importance of maintaining healthy ecosystems and genetic diversity.
- Aquatic ecosystems play an important role in maintaining water quality and are a valuable indicator of water quality and the suitability of the water for other uses.

- Aquatic ecosystems are valuable resources. Aquatic life is a major source of protein for humans. In most countries, including Australia, commercial and sport fishing is economically important.

How does water work?

This diagram illustrates the variety of physical processes related to the movement and storage of water within the environment.



Source: ANZECC & AWRC

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Temperature	Temperature is a physical property of water that has a profound effect on organisms that live or reproduce in the water. When water temperature becomes too high, certain fish suffer a variety of ill effects, ranging from decreased spawning success, to increased susceptibility to disease and toxins, to death. Water temperature also reduces the solubility of oxygen on which aquatic life depends and increases the toxicity of ammonia. Water temperature may enhance sensitivity to other toxic substances as well. Water is most hydrating when it is between 50 and 60°F.
Turbidity	Turbidity is a measure of the clarity of the water. As measured, it is a physical property, but a primary cause of turbidity is fine sediment suspended in the water column. Lack of clarity is often an aesthetic concern, particularly in lakes, but is also of consequence to aquatic life as it interferes with light penetration into the water and thus productivity of plants at the base of the food chain—less light often means fewer plants and animals, including fish.

	Turbidity is measured in Nephelometric Turbidity Units. According to the World Health Organization, water for human consumption should have turbidity levels below 1 NTU, though for some regions, up to 5 NTU is allowed if it can be proven to be disinfected. Slightly turbid water between 1 NTU and 50 NTU is healthy for most aquatic ecosystems, but turbidity can increase to higher levels temporarily after rain.
Bacteria	Bacteria are measured to determine the relative risk of getting sick. These bacteria originate from the wastes of animals or human pollution; Sources include inadequately treated sewage, improperly managed animal waste from livestock, pets in urban areas, aquatic birds and mammals, or failing septic systems. Some bacteria: Fecal Coliform, E.Coli, Enterococci Bacteria levels in water are tested based on coliform because they are easy to identify and behave the same way as pathogenic, or disease-causing, bacteria. The EPA standard for drinking water states that there must be no coliform present in a 100 mL sample, and fewer than 500 non-pathogenic and non-coliform bacterial colonies per mL.
pH	Water pH indicates the balance between hydrogen ions, which are acidic, and hydroxide ions, which are basic. A perfect balance of the two is at a pH of 7. Most aquatic organisms prefer a pH of 6.5 to 9. The EPA standard for drinking water is 6.5 to 8.5. Like temperature, water pH is a fundamental controlling property that affects many other chemical constituents (e.g., dominant form of ammonia and solubility of metals) as well as important biological processes such as the level of permeability of fish gills and amphibian skins (i.e., how well gases can flow through the gills/skin, allowing the organism to breathe).
Nutrients	Nutrients in water include various forms of the chemical elements: nitrogen and phosphorus—the same materials we apply as fertilizer to our lawns, gardens, and crops to foster plant growth. They have the same effect in water as they do on land, encouraging the growth of plants such as algae. Without nutrients, water would be sterile and not support life. Adding nutrients can be acceptable, even beneficial at times. If too many nutrients enter our waters due to human uses, the growth of aquatic plants becomes excessive. The plants eventually will die and their decay uses up oxygen dissolved in the water. Excessive aquatic plant growth is a leading cause in the depletion of oxygen needed for aquatic life. The root cause, however, is too much nitrogen or phosphorus. The EPA standard for nitrogen and nitrates in water is 10 mg/L, which is also the level at which aquatic environments start to suffer. Natural levels of nitrates in freshwater are less than 1 mg/L. s.

Toxic Substances	A toxic substance is any substance, material, or disease-causing agent. Many if not most substances that are toxic are also useful to us, before they enter our waters. Much can be done in our day-to-day lives to reduce the release of toxics into our environment. **Metals.** High concentrations of some metals such as copper and lead pose a threat to life, water supplies, livestock, and human health. Eating fish contaminated with certain metals can cause the metals to accumulate in humans, posing a significant health threat.
Salinity	Salinity is the concentration of salt in a substance, such as water. It is usually measured using conductivity per meter, in dS/m. Water containing salts is not harmful on its own, but many aquatic organisms need to be within a certain salt range to live healthily. Freshwater has less than .05% salt, and a conductivity under 1.01 dS/m. However, rivers that connect directly to the ocean, such as the Hudson, are partially brackish. Brackish water is saltier than freshwater, but still contains less than 3.5% salt, or 54.69 dS/m. Saline water is present in oceans such as the Atlantic Ocean, which has 3.3 to 3.7% salt, an average of 54.69 dS/m. The Dead Sea, which earned its name due to its high salt content making it uninhabitable, is 33.7% salt, or 528.13 dS/m. Salt enters freshwater bodies through the runoff of road salt, commonly used as a de-icer in the winter. This unnatural salt introduction can kill plants, algae, and fish. In drinking water supplies, a high salt content is dehydrating, makes water taste unpleasant, and can corrode pipes. Corrosion of pipes from an excess of chloride in water contributed to the contamination present in Flint, Michigan. There is no legal limit on the amount of sodium in drinking water, but the EPA recommends staying between .003 and .006%.
Hardness	Hardness is the concentration of minerals (largely calcium and magnesium) in water. While hard water reacts poorly with soap, making cleaning difficult, consuming these minerals in drinking water is beneficial to health. Up to 20% of the recommended daily intake of calcium and magnesium can be provided by water. Drinking hard water has been associated with lower cancer risk, lower blood pressure, and a lower risk of cardiovascular disease up to 170 mg of calcium carbonate per liter.