

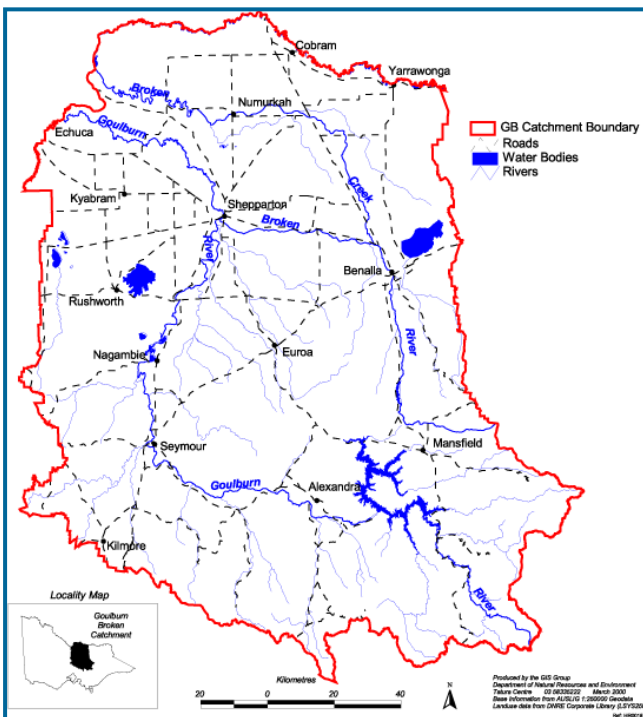
# FACT sheet



## OUR CATCHMENT - Water quality

### What is a catchment?

A catchment is an area of land bound by hills or mountains from which all runoff water flows to the same low point. The low point may be a dam, a river or the mouth of a river where it enters the sea. We live in the Goulburn Broken Catchment which starts near Mansfield and ends at the Murray River.



### Water quality in the Goulburn Broken

Land use varies greatly in the Goulburn Broken catchment and what happens in one part of the catchment is likely to affect the health of the rest of the catchment.

In order to survive, plants and animals need specific ranges of environmental conditions, all of which can be measured using various physical and chemical tests.

Biological tests can also be taken, measuring changes in the water quality by counting the population of animals that live in our waterways. The variety (numbers of different types) of animals present or their lack of, is another good indicator of water quality.

### Water quality monitoring in this catchment

By monitoring the quality of water in our rivers and creeks we can gain a better understanding of the overall health of the catchment. There are a number of physical and chemical water quality parameters that are regularly monitored in our catchment and include:

- Dissolved Oxygen
- Turbidity
- Salinity
- Phosphorus (nutrients)
- pH (acidity)
- Temperature



### DISSOLVED OXYGEN

Dissolved Oxygen (DO) is the small amount of oxygen gas dissolved in water. It is essential for the respiration of fish, aquatic animals, microorganisms and plants. To maintain a healthy and diverse aquatic ecosystem, dissolved oxygen must be maintained at high levels. If DO falls, the more sensitive species of animals will die out and at extremely low DO levels, only a very few hardy species may be present. Therefore dissolved oxygen levels are a useful indicator of general water quality.



### Dissolved oxygen in our waterways

DO levels in natural waters depend on three main factors:-

- The speed of uptake of oxygen into the water from air. This depends on agitation at the water's surface. Shallow flowing streams usually have high oxygen levels while stagnant pools have reduced oxygen.

- The speed that oxygen is used up in the water. Bacteria will use up oxygen in water. If large amounts of organic matter enter the watercourse from point sources such as sewage plants and animal feedlots, there will be a high bacterial population and so greater oxygen usage.
- Photosynthesis of plants and algae. Aquatic plants and algae release large amounts of oxygen into the water in daylight hours as a by-product of photosynthesis. Peak DO levels occur in early afternoon and minimum levels before sunrise. Since plants produce oxygen during the day through photosynthesis and use it up at night with respiration, the time of the day often determines the amount of DO in the water.

The temperature of the water also affects oxygen levels. Scientific studies suggest that 4.5mg/L dissolved oxygen is the minimum amount that will support a large and diverse fish population. The DO level in good fishing waters generally averages about 9mg/L. When DO levels drop below about 3mg/L, even the hardy fish die.

### Testing for dissolved oxygen

There are two types of tests that can be used to measure the amount of dissolved oxygen in our waterways.

One test can tell us precisely how much oxygen is dissolved in water, but it does not indicate how much DO the water is capable of holding at the temperature of the test. This type of test can be performed using a DO meter or by a chemical reaction (below).

Another way of determining DO in a waterway is by measuring the percentage saturation which gives an indication of the availability of oxygen to aquatic organisms.



## TURBIDITY

Turbidity is the cloudiness of water and is the result of suspended material in a waterway. This suspended material decreases the ability of light to pass through the water which can limit plant growth. Less plant growth affects the fish and invertebrate communities which feed on and live in the plants. Turbidity may be caused by silt, micro-organisms, plant material and chemicals. However, the most frequent causes of turbidity in rivers and other water bodies are algae and inorganic material from soil weathering and erosion.

Certain catchment management practices such as the retention of vegetation along streams, farming practices such as contouring and stubble retention and the effective treatment of effluent from wastewater management facilities can all help to control and reduce turbidity levels.

### Turbidity in our waterways

High levels of turbidity have a two-fold effect on water -

- It loses its ability to support a large variety and number of aquatic organisms. Where there is less light penetrating the water, there will be less photosynthesis occurring and this reduces the level of oxygen in the water.
- The water becomes warmer because any suspended material absorbs heat from the sun. This also decreases the amount of oxygen dissolved in water.

### Testing for turbidity

Turbidity is usually measured with an instrument called a Nephelometer or turbidity meter. This instrument determines the scattering of light and is measured in standard Nephelometric Turbidity Units (NTU). Normal levels of turbidity can vary from less than 1 in clear pristine streams to very much greater than 200 NTU in murky rivers after flood events.

A turbidity tube can also be used to measure turbidity and gives quite good readings. It can certainly show trends if the water quality is getting worse.



## SALINITY

Conductivity is one way to measure the inorganic materials including calcium, bicarbonate, nitrogen, phosphorus, iron, sulphur and other ions dissolved in a water body.

Salinity is measured by placing a conductivity probe in a water sample and measuring the flow of electricity between the electrodes.



### Salinity in our waterways

Salinity is the component of conductivity that is critical to the survival of some aquatic plants and animals. Many species can survive only within certain salinity ranges so changes in salinity levels result in changes to the variety and types of species found.



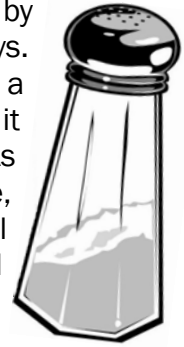
Salinity problems occur where deep rooted vegetation is removed from the land and through some farming practices such as flood irrigation. This means that much more water can infiltrate the soil and causes the watertable to rise. This water can move towards the surface, bringing with it large amounts of salt from underground storage. After the water evaporates, high concentrations of salt remain which can eventually find its way into water courses.



Variation in conductivity can result through changes in geology of an area. It can also be due to seepage of groundwater, industrial and agricultural effluent, stormwater runoff and sewage effluent flowing into a stream.



Salinity problems are caused by too much salt in our waterways. It affects our waterways in a similar manner to the way it affects agricultural land. As water becomes more saline, important plant and animal species begin to disappear and they are replaced by more tolerant, but often less desirable species.



### Testing for salinity

Salinity or electrical conductivity (EC) is measured with a meter in micro siemens per centimeter units ( $\mu\text{S}/\text{cm}$ ). The natural conductivity of fresh water varies from very low values (30 EC) to very high values (2000 EC) which is unsuitable for irrigation. Bore water often has much higher values (10,000 EC) and the conductivity of seawater is around 50,000 EC.

Conductivity measurements are affected by temperature so the water temperature needs to be measured at the same time as conductivity.

## PHOSPHORUS

Phosphorus is a nutrient that occurs naturally at low concentrations in waterways and is essential for all forms of life. Phosphorus comes from processes like the weathering of rocks and from the decomposition of organic matter such as plant litter. Other sources of phosphorus entering a river system may include:

- irrigation drains
- runoff from agricultural land
- intensive agricultural industries
- wastewater management facilities
- stormwater drains
- runoff from forests
- geological sources





## Phosphorus in our waterways

Phosphorus is present in streams as soluble phosphates, phosphorus bound to sediments and phosphates occurring in living organisms. Increased levels of phosphorus in streams may result from erosion, discharge of sewage, detergents, urban stormwater and rural runoff containing fertilisers and animal and plant material.

When the concentration of phosphorus becomes too high, problems such as algal blooms, excessive growth of aquatic weeds and the loss of species diversity occurs.

## Testing for phosphorus

Soluble, or ortho, phosphorus can be measured by a chemical reaction and a colour change in the field.



To measure phosphates a water sample is digested with acid and a spectrometer is used to determine the colour change after a chemical reaction has occurred in the laboratory.

## Water quality monitoring data

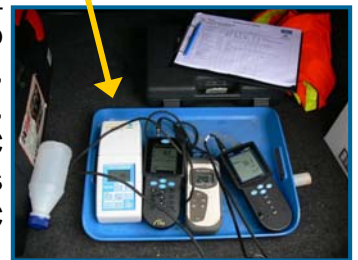
Water quality data is collected right around the Goulburn Broken Catchment. Both employed and volunteer monitors use the equipment described above to measure various parameters in the creeks, rivers and drains in the area. This data is used to determine the health of our waterways, to observe trends in water quality and to help catchment managers make decisions about works to help improve catchment health.

## In the field

In many cases the monitors have the equipment in the boot of their car and drive around from site to site, making comparisons from the top of the waterway to the bottom. A decrease in quality is evident in almost every situation and matches the theory that a waterway is of higher quality in the upper regions and deteriorates as it flows through a catchment.



Monitoring equipment here includes (left to right) turbidity meter, dissolved oxygen meter, pH meter and EC meter. Temperature is shown on the EC screen.



## For further information

Please visit the Goulburn Valley Water website: [www.gvwater.vic.gov.au](http://www.gvwater.vic.gov.au)

or contact a Goulburn Valley Water Education Officer:

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