Millars Creek

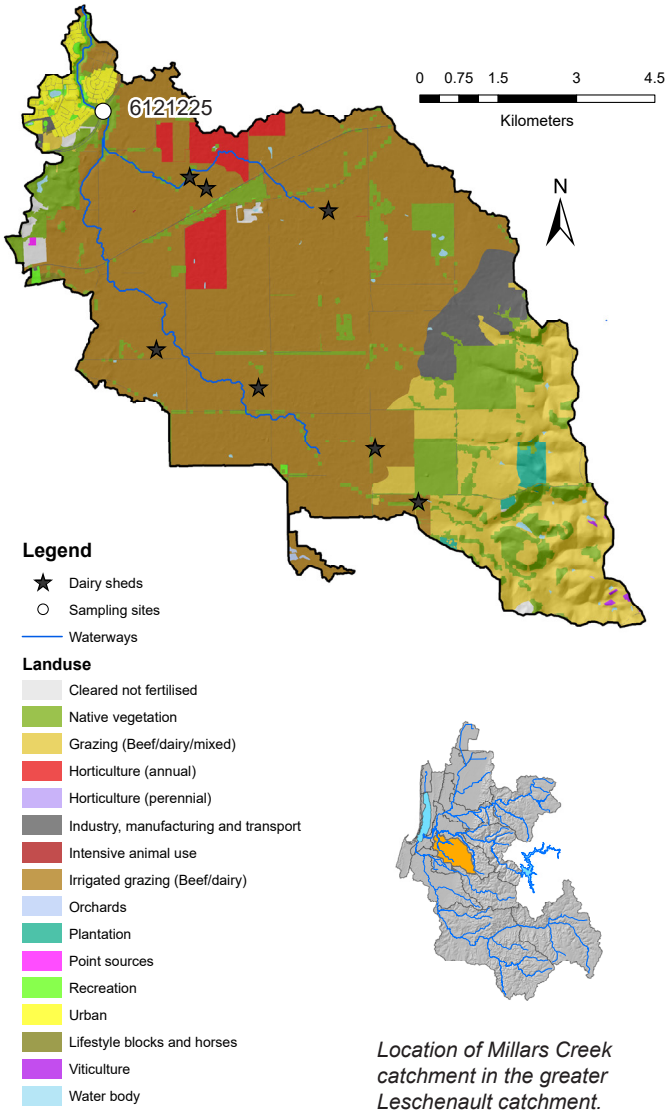
This data report provides a summary of the nutrients at the Millars Creek sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Millars Creek discharges into the Collie River. Nutrients (nitrogen and phosphorus) are compounds that are important for plants to grow. Excess nutrients entering waterways from effluent, fertilisers and other sources can fuel algal growth, decrease oxygen levels in water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as they help us better understand the processes occurring in the catchment.

About the catchment

Millars Creek has a catchment area of about 70 km^2, with cattle grazing being the major land use, covering nearly three-quarters of the catchment. Native vegetation is the next largest land use. Millars Creek discharges into the Collie River in Millbridge, a suburb of Bunbury. The Collie River Irrigation District extends into the catchment and provides water for the irrigated grazing. There are a number of dairy sheds present in the catchment.

The fringing vegetation along Millars Creek has been mostly lost or is in poor condition and the irrigation channels lack fringing vegetation. Soils in the northern portion of the catchment mostly bind phosphorus poorly, whereas soils in the southern portion generally bind phosphorus well. When soils don't bind well, any phosphorus applied to them tends to move to waterways.

Water quality is measured at site 6121225, Millars, where Millars Creek passes under Forrest Highway in Dardanup. Downstream of the site, Millars Creek flows through the suburb of Millbridge before discharging to the Collie River.



Location of Millars Creek catchment in the greater Leschenault catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Millars Creek sampling site were high. The proportion of both nitrogen and phosphorus that were present in a bioavailable form was large. The poor water quality at this site can be attributed to the highly modified nature of the waterways, intensive agricultural land use and low coverage of remnant vegetation.

Facts and figures

Sampling site code	6121225
Catchment area	70 km^2
Per cent cleared area (2018)	85 %
River flow	Permanent
Main land use (2018)	Cattle grazing and native vegetation

Millars Creek

Nitrogen over time (2004–18)

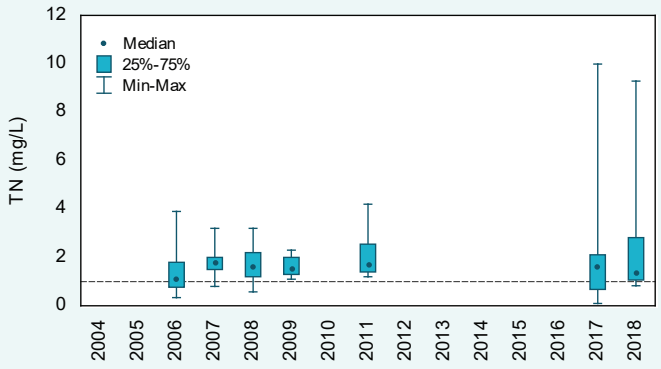
Concentrations

Total nitrogen (TN) concentrations at the Millars Creek sampling site were high to very high. All annual medians were above the Leschenault Water Quality Improvement Plan (WQIP) TN target for lowland rivers and the site recorded the highest TN concentrations of any individual samples in both 2017 and 2018. The high TN concentrations at this site can be attributed to the agricultural land use in the catchment and the highly modified nature of the waterways which flow through it.

Trends

As the Millars Creek site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

Millars Creek



Total nitrogen concentrations, 2004–18 at site 6121225, The dashed line is the Leschenault WQIP target for lowland rivers.

The Millars Creek sampling site, November 2011. Note the poor quality fringing vegetation, the erosion on the far bank as well as the sand deposited in the creek on the right.

Nitrogen (2018)

Types of nitrogen

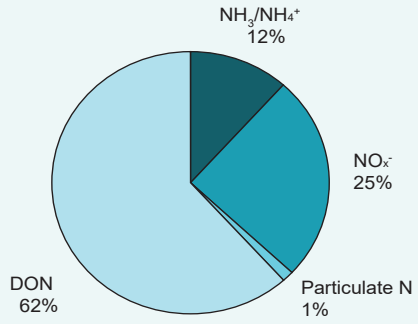
Total N is made up of many different forms of N. The proportion of N present as highly bioavailable dissolved inorganic N (DIN—consisting of oxides of N, NO_x^-, and ammonia N, NH_3/NH_4^+) was large. DIN is usually sourced from fertilisers and animal wastes. High proportions of DIN are commonly seen in agricultural catchments. Most of the remainder of the N was present as dissolved organic N (DON). DON consists mainly of plant and animal matter but may include other forms. DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before it becomes available whereas other forms of DON are readily bioavailable.

Concentrations

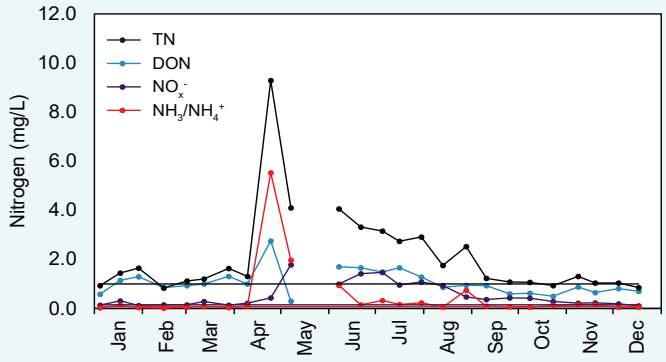
There was a large peak in TN, NH_3/NH_4^+ and DON concentrations in April. The reason for this peak is unclear, though it may have been caused by a discharge event upstream of the sampling site. A seasonal pattern was present during the rest of the year, with concentrations highest in June when rainfall and flow increased. At this time, N was mobilised from the catchment following heavy rainfall. Much of this N was probably the result of mineralisation of organic N in soils and drains over the summer period, and runoff from agricultural land where fertilisers and animal wastes build up over the summer period, as well as organic N washing from soils and remnant wetlands.

The missing data point in May was because the site was inaccessible at this time.

Millars Creek



2018 average nitrogen fractions at site 6121225.



2018 nitrogen concentrations at 6121225. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and purple are the ANZECC trigger values for lowland rivers.

The Collie River, near the Millars Creek discharge point, January 2009. The bank on the right has slumped and there are plants growing on the large sand deposit in the centre of the river.

Phosphorus over time (2004–18)

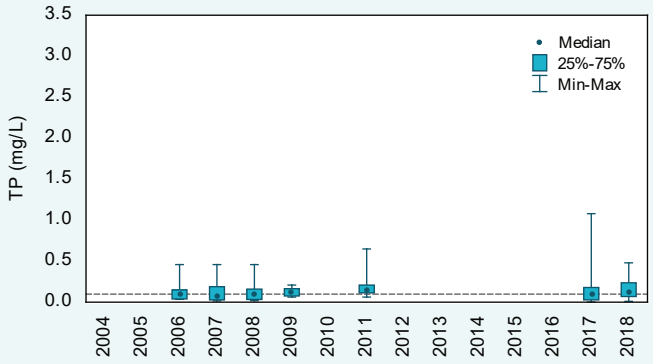
Concentrations

Total phosphorus (TP) concentrations were high at the Millars Creek sampling site. Only two of the seven years which had sufficient data to graph had an annual median below the WQIP TP target for lowland rivers, though each year had some samples below the target.

Trends

As the Millars Creek site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

Millars Creek



Total phosphorus concentrations, 2004–18 at site 6121225. The dashed line is the Leschenault WQIP target for lowland rivers.

A fyke net set in the Collie River, near the Millars Creek discharge point. This net is captures fish and crayfish which are recorded before being returned to the water alive, March 2017.

Phosphorus (2018)

Types of phosphorus

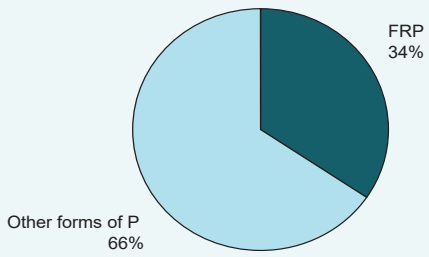
Total P is made up of different forms of P. At the Millars Creek sampling site, about a third of the P was present as highly bioavailable filterable reactive P (FRP). This form of P is readily used by plants and algae to fuel growth and is likely sourced from fertilisers and animal waste as well as natural sources. The remaining P was present as either particulate P or dissolved organic P (DOP) or both (shown as 'other forms of P' in the pie chart below). Particulate P generally needs to be broken down before becoming bioavailable to plants and algae. The bioavailability of DOP varies and is poorly understood.

Concentrations

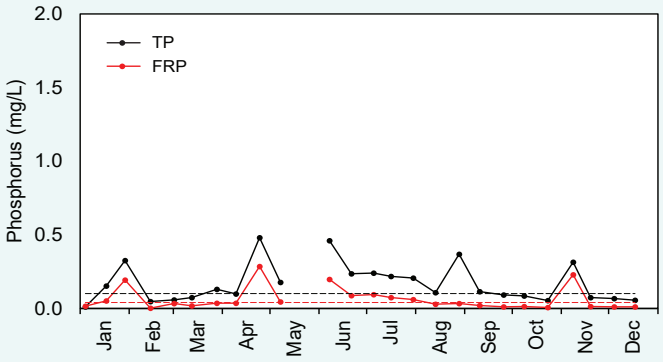
Total P and FRP showed similar patterns in 2018. They both fluctuated throughout the year with numerous peaks. The peak in April coincides with a peak in N concentrations, though the reason for the peak is unclear. It is possible that this, and other peaks, were because of some form of discharge upstream of the sampling site, especially on those occasions when both TP and FRP concentrations were high. It is likely that P is entering the creek via a number of pathways, including surface and groundwater flows as well as in-stream sources. The large phosphorus-binding capacity of the soils in the catchment upstream of the sampling site are likely having a positive impact on the P concentrations seen at this site.

The missing data point in May was because the site was inaccessible at this time.

Millars Creek



2018 average phosphorus fractions at site 6121225.



2018 phosphorus concentrations at 6121225. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger values for lowland rivers.

A south-western goby, Afurcagobius suppositus, caught in the Collie River, near the Millars Creek discharge point, as part of a river health assessment, February 2018.

Total suspended solids over time (2004–18)

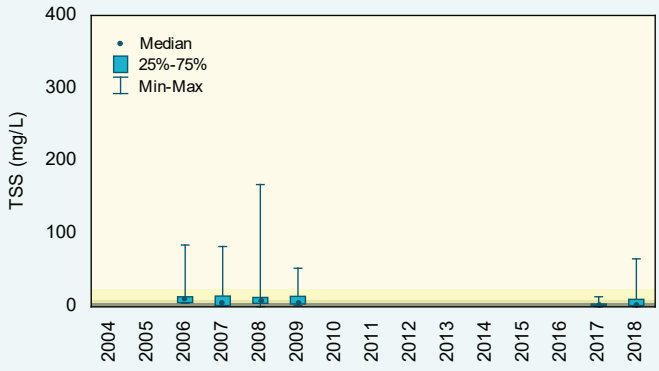
Concentrations

Total suspended solids (TSS) concentrations were high at the Millars Creek sampling site. Before the break in sampling, the annual medians were classified as moderate using the Statewide River Water Quality Assessment (SWRWQA) bands. In 2017 and 2018, after the break in sampling, the annual medians were classified as low. All years had some samples that fell in the very high band.

Trends

As the Millars Creek site was not sampled between 2010–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

Millars Creek



Total suspended solids concentrations, 2004–18 at site 6121225. The shading refers to the SWRWQA classification bands.

very high high moderate low

In the Millars Creek catchment, there is little fringing vegetation. A thin band of trees separates the Collie River from surrounding farmland near the Millars Creek discharge point, January 2009.

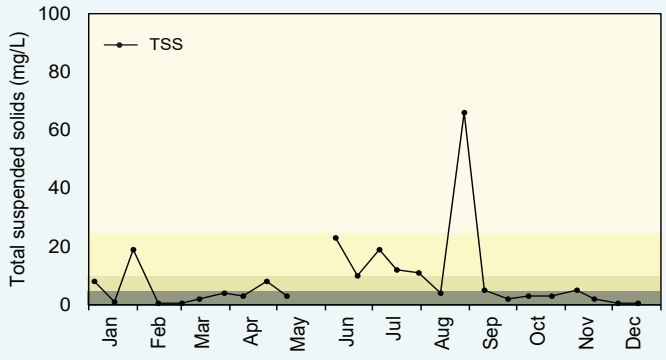
Total suspended solids (2018)

Concentrations

There were two noticeable spikes in TSS concentrations at the Millars Creek sampling site, one in late January and one in late August. The reason for these peaks is unclear, they may be because of a discharge event upstream of the sampling site or some form of disturbance to the creek causing erosion. For the remainder of the year, there was evidence of a seasonal pattern in TSS concentrations, with concentrations higher during the middle of the year when rainfall and flow were at their highest.

The missing data point in May was because the site was inaccessible at this time.

Millars Creek



2018 total suspended solids concentrations at 6121225. The shading refers to the SWRWQA classification bands.

very high high moderate low

A degraded section of the Collie River, near the Millars Creek discharge point. The fringing vegetation is poor and the bank in the foreground has been trampled by cattle, February 2018.

Millars Creek

pH over time (2004–18)

pH values

pH at the Millars Creek sampling site fluctuated in the years for which there were data. All annual medians and most of the samples were between the upper and lower ANZECC trigger values.

Trends

As the Millars Creek site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

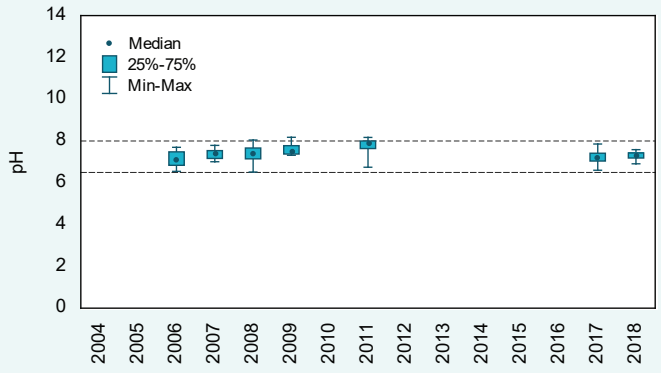
pH (2018)

pH values

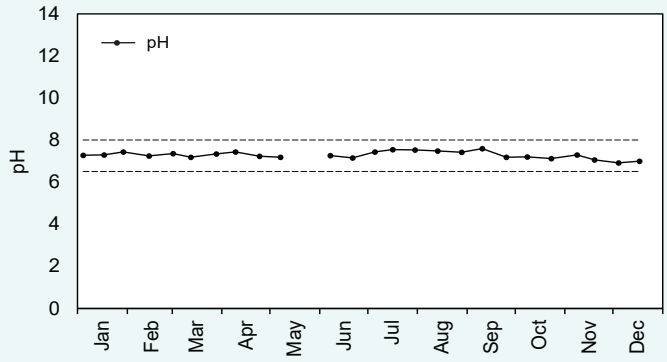
In 2018, pH values fluctuated slightly during the year. There was no evidence of a seasonal pattern and all samples collected fell within the upper and lower ANZECC trigger values.

The missing data point in May was because the site was inaccessible at this time.

Millars Creek



pH levels, 2004–18 at site 6121225. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6121225. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Millars Creek at the sampling site where it passes under Forrest Highway, November 2018.

Millars Creek

Salinity over time (2004–18)

Concentrations

The Millars Creek sampling site was one of the most saline of the sites in the Leschenault catchment (along with the sites on the Middle Brunswick and Wellesley Rivers). Using the SWRWQA bands, all annual medians at the Millars Creek site were classified as brackish, though there were some samples collected each year that were classified as marginal and fresh.

Trends

As the Millars Creek site was not sampled between 2012–16 it was not possible to test for trends at this site. A minimum of five consecutive years of data are required to test for trends.

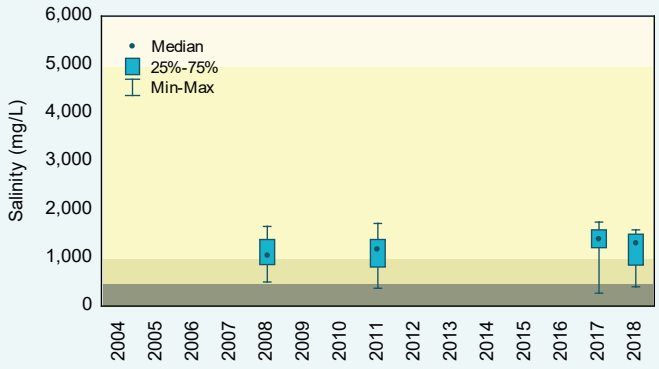
Salinity (2018)

Concentrations

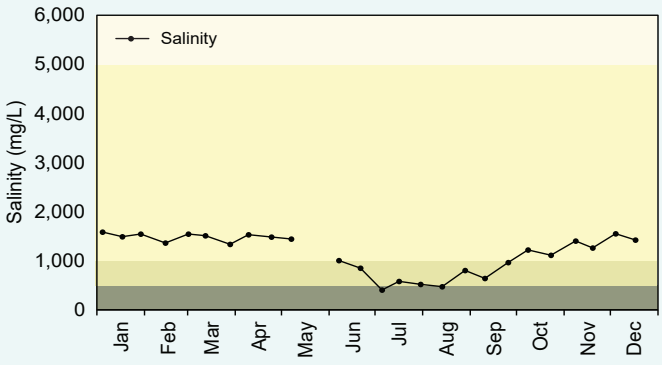
Salinity concentrations were higher in the earlier and later part of the year when rainfall and flow were at their lowest. At this time, much of the water present at the sampling sites would have been from groundwater and irrigation. In June, when rainfall and flow increased, salinity reduced. This suggests that the surface water runoff at this site is fresher than the groundwater and possibly the irrigation returns.

The missing data point in May was because of the site being inaccessible at this time.

Millars Creek



Salinity concentrations, 2004–18 at site 6121225. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at site 6121225. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

Cattle grazing is one of the major land uses in the Millars Creek catchment, January 2009.

Millars Creek

Background

The Regional Estuaries Initiative is a State Government program to improve the health of waterways and estuaries in the south-west of Western Australia. Healthy Estuaries WA is a Royalties for Regions program launched in 2020 and will build on the work of the Regional Estuaries Initiative. Collecting and reporting on water quality data, such as in this report, helps build understanding of the whole system. By understanding the whole system, we can direct investment towards the most effective actions in the catchments to protect and restore the health of our waterways.

You can find the latest data on the condition of the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

The Regional Estuaries Initiative partners with the Leschenault Catchment Council to fund best-practice fertiliser, dairy effluent and watercourse management on farms.

- To find out how you can be involved visit estuaries.dwer.wa.gov.au/participate
- To find out more about the Leschenault Catchment Council go to www.leschenaultcc.org.au
- To find out more about the health of the rivers in the Leschenault Estuary Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Total phosphorus and total nitrogen concentrations were compared with the Leschenault Estuary WQIP targets. These targets represent the allowable annual median winter concentrations in both lowland (TN 1.0 mg/L, TP 0.1 mg/L) and upland (TN 0.45 mg/L, TP 0.02 mg/L) catchments. Sites were compared with the appropriate target. Where possible, other parameters were compared with the ANZECC trigger values for lowland rivers in south-west Australia. These values provide a value above which there may be a risk of adverse effect. For pH there is both an upper and lower trigger value which represents the acceptable pH range. Where there were no ANZECC trigger values (for TSS and salinity), the SWRWQA classification bands were used to allow samples and sites to be classified and compared. For all parameters, the full year of data were used when comparing with targets, trigger values and classification bands.

Gaps in the data meant it was not possible to calculate trends for the Leschenault catchment sites. A minimum of five consecutive years of data are required.

Annual loads were calculated by multiplying daily flow with daily nutrient concentrations and aggregating over the year. Measured daily concentrations were not available as samples were collected fortnightly at best, so daily concentration data were calculated using the locally estimated scatterplot smoothing algorithm (LOESS).

Glossary

Bioavailable: bioavailable nutrients refers to those nutrients which plants and algae can take up from the water and use straight away for growth.

Concentration: the amount of a substance present in the water.

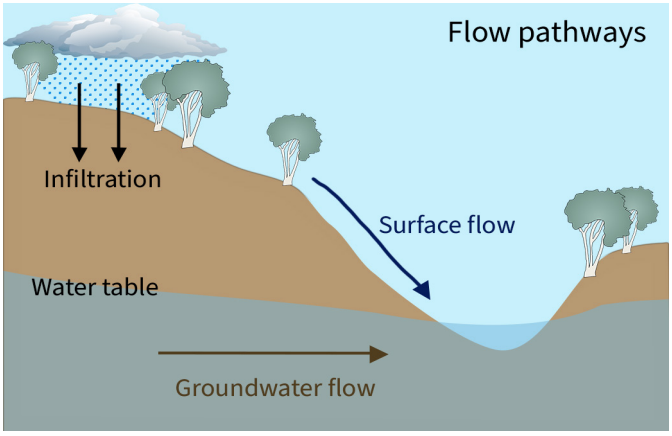
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

Laboratory limit of reporting: this is the lowest concentration (or amount) of an analyte that can be reported by the laboratory.

Load: the total mass of a substance passing a certain point.

Load per unit area: the load at the sampling site divided by the entire catchment area upstream of the sampling site.

The schematic below shows the main flow pathways which may contribute nutrients, particulates and salts to the waterways. Connection between surface water and groundwater depends on the location in the catchment, geology and the time of year.



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