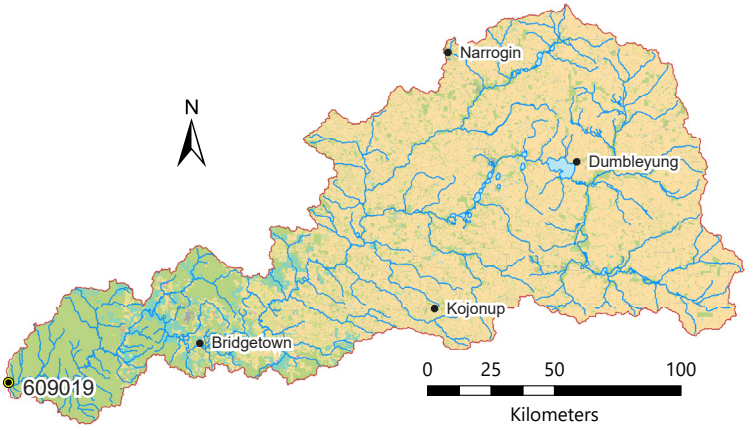
# Upper Blackwood River

This data report provides a summary of the nutrients at the sampling site at the bottom of the Upper Blackwood River in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream, the river continues through the Lower Blackwood River and into the Hardy Inlet. 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

The Upper Blackwood River has a very large catchment area, about 21,148 km$^2$ which extends east, out into the wheatbelt. The dominant land use is cropping which covers around three-quarters of the catchment area. Close to the sampling site, however, the dominant land use is native vegetation. Fringing vegetation is in excellent condition near the bottom of the catchment.

There are a number of towns on the Blackwood River, including Nannup and Bridgetown.

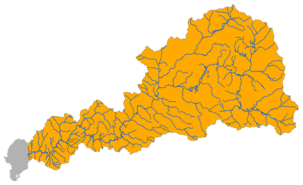
Water quality and flow is measured at site 609019, Hut Pool, where the Blackwood River passes under Great North Road in Nillup.

**Legend**

- Sampling station
- Dairy sheds
- Waterways

**Landuse**

- Annual horticulture
- Aquaculture
- Beef and sheep
- Cropping
- Dryland dairy
- Industry, Manufacturing and Transport
- Industry, Manufacturing and Transport
- Intensive animal use
- Lifestyle block and horses
- Native vegetation
- Orchard
- Tree plantation - hardwood
- Tree plantation - rehabilitation
- Urban
- Viticulture
- Water body



*Location of the Upper Blackwood River catchment in the greater Blackwood River catchment.*

## Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Hut Pool sampling site were low, though there were some total nitrogen samples which were high compared with the other sites in the Blackwood River catchment. The proportion of nitrogen present as oxides of nitrogen was low, though the concentrations were still high in the wetter months. Hut Pool was by far the saltiest of the Blackwood River sampling sites. Much of this salt was sourced from the upper catchment where clearing of deep-rooted native vegetation for agriculture has raised groundwater levels, mobilising salts stored in the soils and bringing them to the surface.

## Facts and figures

| | |
|---|---|
| Sampling site code | 609019 |
| Rainfall at Alexandra Bridge (2018) | 933 mm |
| Catchment area | 21,148 km$^2$ |
| Per cent cleared area (2001) | 81 per cent |
| River flow | Permanent |
| Main land use (2001) | Cropping |

# Upper Blackwood River

## Nitrogen over time (2004–18)

### Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at Hut Pool. While the annual median concentrations were consistently below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value, every year (with the exception of 2006) had some samples over the trigger value. Compared with the other sites in the Blackwood River catchment, TN concentrations at Hut Pool were low, with the 2018 median being the lowest of the nine sites sampled.

### Trends

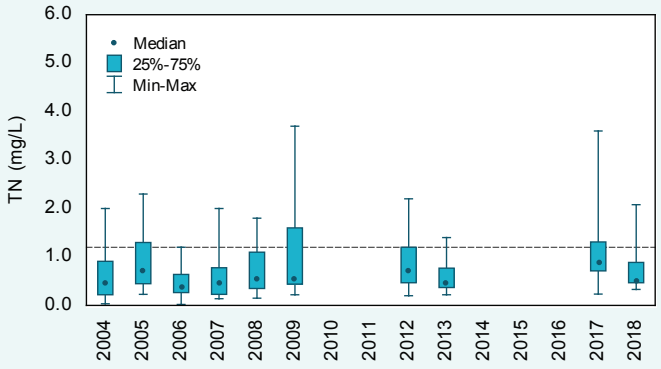
As there was a break in regular monitoring from 2010–11, and 2014–16 it was not possible to test for trends in TN concentrations at Hut Pool. A minimum of five years of data are required to test for trends.

### Estimated loads

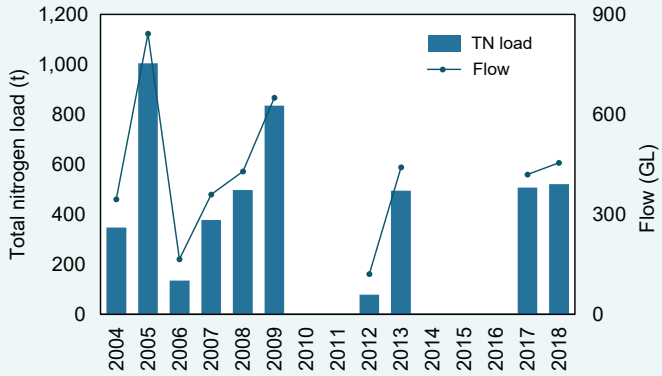
In 2018, the estimated TN load at the Hut Pool sampling site was 521 t and the load per unit area 25 kg/km$^2$. Hut Pool was one of only two sites in the Blackwood catchment with flow data, the other being Chapman Brook, which is a tributary of the Blackwood River. No comparisons have been made between the two sites because of the very different size and nature of their two catchments.

Annual TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

## Hut Pool




*Total nitrogen concentrations, 2004–18 at site 609019. The dashed line is the ANZECC trigger value for lowland rivers.*




*Total nitrogen loads and annual flow, 2004–18 at site 609019.*

*The road crossing at the Hut Pool sampling site, November 2018.*

# Upper Blackwood River

## Nitrogen (2018)

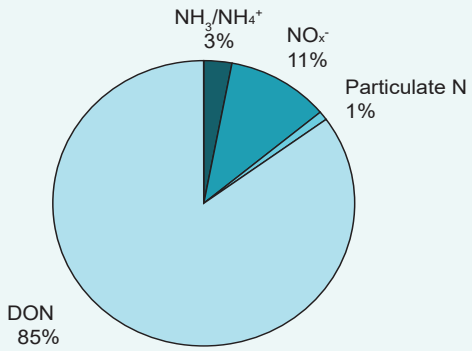
### Types of nitrogen

Total N is made up of many different forms of N. Hut Pool had the highest proportion of N present as dissolved organic N (DON) of the nine sites sampled in the Blackwood River catchment. Likely sources for this kind of N include degrading plant and animal matter which generally needs to be further broken down before becoming available to plants and algae. Some forms of DON, however, are highly bioavailable to plants and algae. The proportion of N present as oxides of N ($NO_x^-$) was the lowest of the Blackwood River catchment sites. This form of N tends to be highly bioavailable and is often sourced from fertilisers and animal wastes. It is possible that the heavily vegetated main channel of the Blackwood River upstream of this site was processing $NH_3/NH_4^+$ via plant uptake and $NO_x^-$ via plant uptake and denitrification.

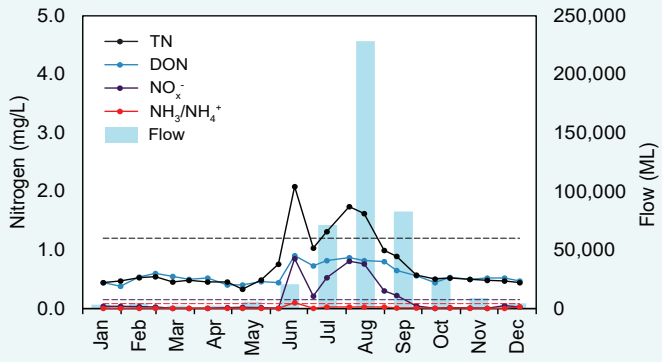
### Concentrations

Total N, DON and $NO_x^-$ all showed a seasonal pattern, peaking in June because of a first-flush effect before having a second peak in July to August, coinciding with the maximum flow volumes in the river. During the first-flush, N was mobilised following heavy rainfall at the start of the winter. Much of this $NO_x^-$ was probably the results of mineralisation of organic N in soils and drains over the summer period as well as runoff from the agricultural land upstream of the site. The DON was from organic N washing from soils and remnant wetlands. While the proportion of N present as $NO_x^-$ was low, the actual concentrations were still high during the wetter months, with many samples over the ANZECC trigger value during this time.

## Hut Pool




*2018 average nitrogen fractions at site 609019.*




*2018 nitrogen concentrations at 609019. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.*

*The road crossing at the Hut Pool sampling site during high flows, August 2018. The poles just visible in the water at the centre of the picture are the poles along the left side of the road.*

# Upper Blackwood River

## Phosphorus over time (2004–18)

### Concentrations

Total phosphorus (TP) concentrations were low at Hut Pool with the median TP concentration below the ANZECC trigger value in all years. The only year which had any samples over the trigger value was 2017.

### Trends

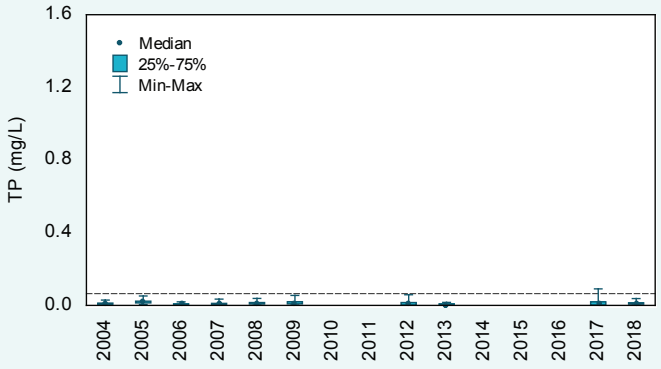
As there was a break in regular monitoring from 2010–11 and 2014–16 it was not possible to test for trends in TP concentrations at Hut Pool. A minimum of five years of data are required to test for trends.

### Estimated loads

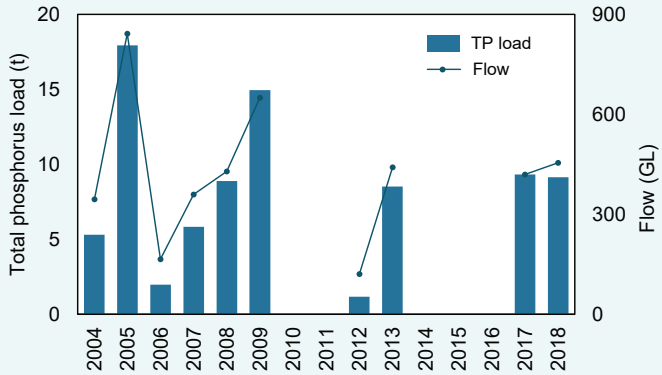
In 2018, the estimated TP load at Hut Pool was 9.1 t and the load per unit area was 0.4 kg/km$^2$. Hut Pool was one of only two sites in the Blackwood catchment with flow data, the other being Chapman Brook, which is a tributary of the Blackwood River. No comparisons have been made between the two sites because of the very different size and nature of the two catchments.

Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TP loads and vice versa.

## Hut Pool




*Total phosphorus concentrations, 2004–18 at site 609019. The dashed line is the ANZECC trigger value for lowland rivers.*




*Total phosphorus loads and annual flow, 2004–18 at site 609019.*

*Collecting a water quality sample at the Hut Pool sampling site, May 2019.*

## Phosphorus (2018)

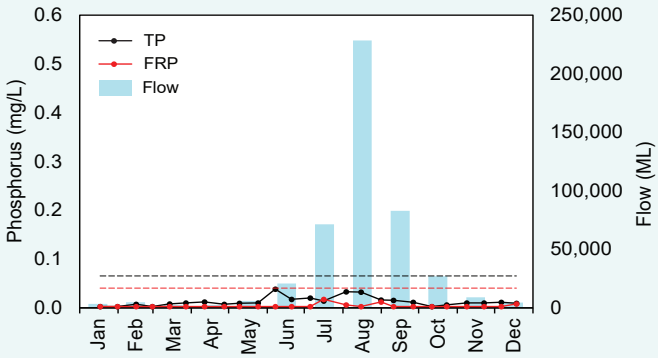
### Types of phosphorus

Total P is made up of different types of P. Because a large number of samples were below the limit of reporting in 2018, a phosphorus fraction pie chart was not generated for the Hut Pool site. At this site, four of the 25 TP samples and 21 of the 25 filterable reactive P (FRP) samples were below their limits of reporting (0.005 mg/L in each case).

### Concentrations

Total P and, to a lesser extent, FRP concentrations showed a slight seasonal response, being higher during the months with larger flow volumes. This suggests most of the P was entering the river via surface flows as well as in-stream sources such as erosion, with groundwater contributing proportionally less P. All samples collected in 2018 were well below their respective ANZECC trigger values.

## Hut Pool




*2018 phosphorus concentrations at 609019. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.*

*Filtering a water quality sample before sending it to the laboratory for analysis, May 2019.*

# Upper Blackwood River

## Total suspended solids over time (2004–18)

### Concentrations

Using the Statewide River Water Quality Assessment (SWRWQA) bands, the median total suspended solids (TSS) concentration at Hut Pool was classified as low for each of the years with sufficient data to graph. While there were some samples each year classified as high, the bulk of samples had very low concentrations.

### Trends

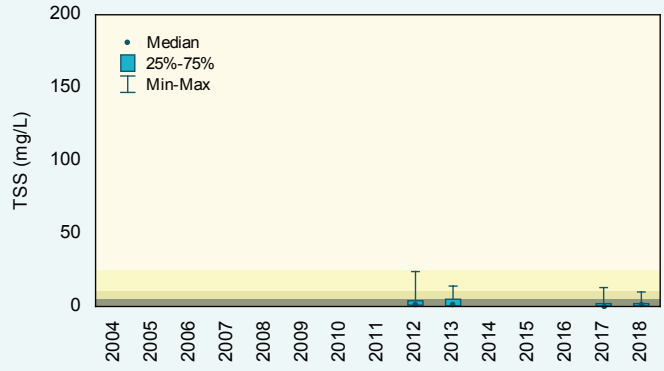
As Hut Pool was only sampled sporadically for TSS over the past 15 years, it was not possible to calculate trends in TSS concentrations at this site. A minimum of five years of data are required to test for trends.

### Estimated loads

In 2018, the estimated TSS load at Hut Pool was 2,864 t and the load per unit area was 135 kg/km$^2$. Hut Pool was one of only two sites in the Blackwood catchment with flow data, the other being Chapman Brook, which is a tributary of the Blackwood River. No comparisons have been made between the two sites because of the very different size and nature of the two catchments.

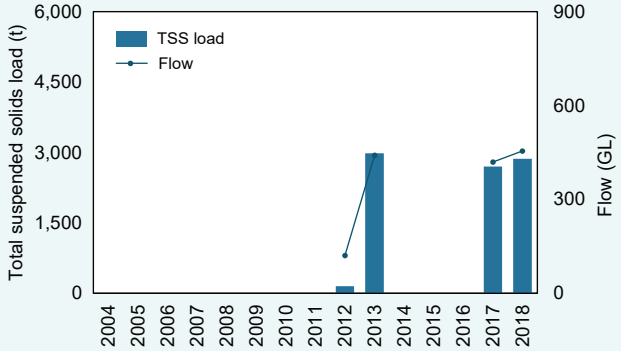
Annual TSS loads were closely related to flow volumes; years with large annual flow volumes had large TSS loads and vice versa.

## Hut Pool




*Total suspended solids concentrations, 2004–18 at site 609019. The shading refers to the SWRWQA classification bands.*

very high high moderate low




*Total suspended solids loads and annual flow, 2004–18 at site 609019.*

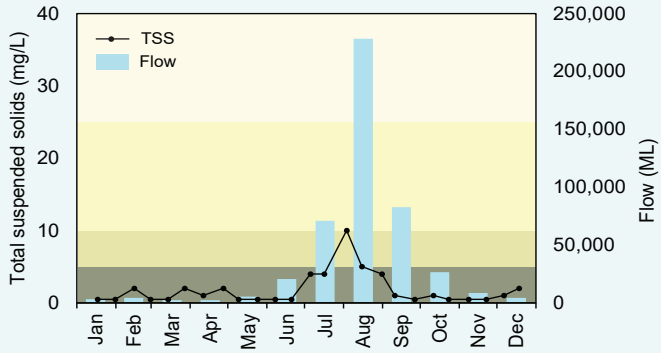

*Foam on the surface of the water at the Hut Pool sampling site, September 2019. This is a naturally occurring phenomenon.*

## Total suspended solids (2018)

### Concentrations

In 2018, most of the samples collected were classified as low using the SWRWQA bands. There was a seasonal pattern in TSS concentrations, with concentrations increasing after flow volumes increased before decreasing again a few months later. This suggests most of the particulate matter, which is detected as TSS by the laboratory, is entering the stream via surface flows and in-stream erosion.

## Hut Pool




*2018 total suspended solids concentrations at 609019. The shading refers to the SWRWQA classification bands.*

very high high moderate low

*Looking downstream from the Hut Pool sampling site, May 2019. Note the dense fringing vegetation growing along the bank.*

# Upper Blackwood River

## pH over time (2004–18)

### pH values

pH at Hut Pool fluctuated over the reporting period, though the median pH fell within the upper and lower ANZECC trigger values each year. There have been a few years (2005, 2012 and 2018) where there were some samples over the upper ANZECC trigger value.

### Trends

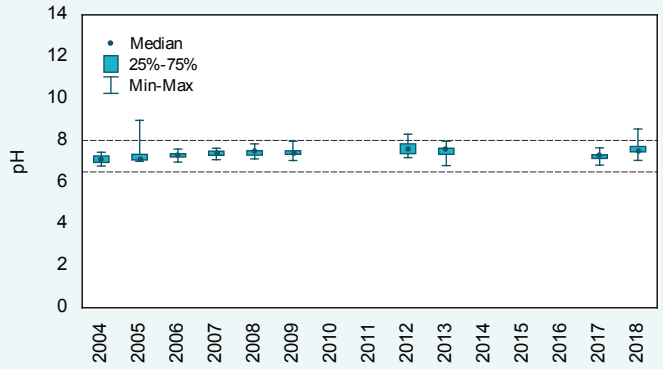
As there was a break in regular monitoring from 2010–11 and 2014–16 it was not possible to test for trends in pH at Hut Pool. A minimum of five years of data are required to test for trends.

## pH (2018)

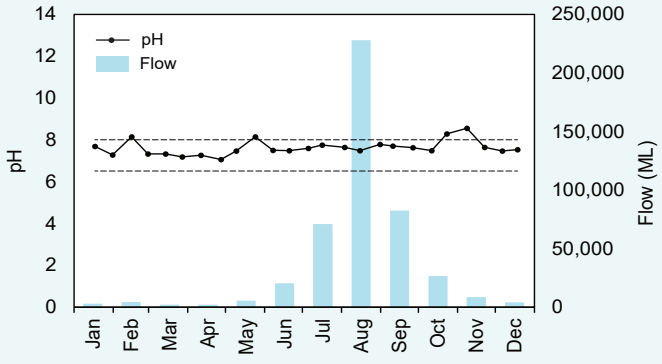
### pH values

There was no evidence of a seasonal pattern in pH at Hut Pool, with values fluctuating through 2018. There were a few samples over the upper ANZECC trigger value at different times of the year.

## Hut Pool




*pH levels, 2004–18 at site 609019. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.*




*2018 pH levels at 609019. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.*

*A weir on the Balgarup River in Kojonup. This is in the south-eastern portion of the Upper Blackwood River catchment, December 2019.*

# Upper Blackwood River

## Salinity over time (2004–18)

### Concentrations

Hut Pool was by far the saltiest of the nine sites sampled in the Blackwood River catchment. The median was classified as brackish for each of the years sampled. In 2018, the median was 2,630 mg/L, much higher than West Bay Creek which had the next highest median of 580 mg/L. The raised salinity at this site is because of the large amount of clearing which has occurred in the upper catchment. Removing the original deep-rooted vegetation has caused groundwater levels to rise, bringing along salts stored in the soils with them.

### Trends

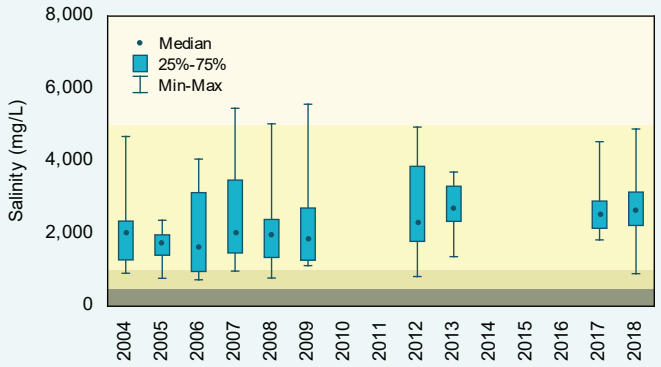
As there was a break in regular monitoring from 2010–11, and 2014–16 it was not possible to test for trends in salinity at Hut Pool. A minimum of five years of data are required to test for trends.

## Salinity (2018)

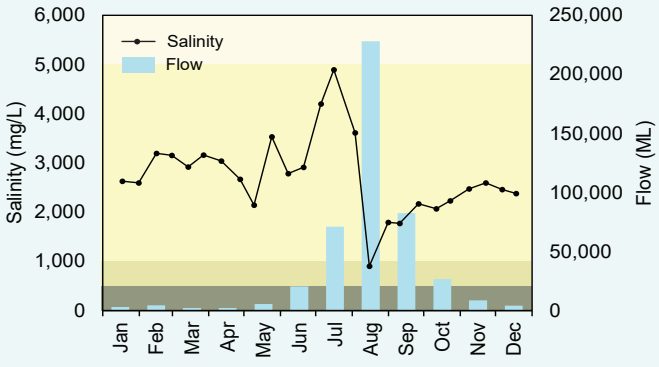
### Concentrations

Salinity at Hut Pool was affected by flow. In August, when flow was at its highest, salinity dropped, indicating that the water entering the river at this time via surface flows was fresher than the groundwater which would have been contributing a larger portion of the flow during the drier months. The likely reason for the peak in July is the first-flush effect where the start of winter rains flushed salt into the river from the surrounding catchment. All samples collected in 2018 were classified as brackish using the SWRWQA bands except for a single sample collected in August which was marginal. The increase in salinity after August is likely because of a combination of evapoconcentration and the increased proportion of water present in the river which was sourced from groundwater.

## Hut Pool




*Salinity concentrations, 2004–18 at site 609019. The shading refers to the SWRWQA classification bands.*




*2018 salinity concentrations at 609019. The shading refers to the SWRWQA classification bands.*

saline brackish marginal fresh

*The Blackwood River, just upstream of Nannup, May 2014.*

# Upper Blackwood River

## 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 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 Hardy Inlet at estuaries.dwer.wa.gov.au/estuary/hardy-inlet/

The Regional Estuaries Initiative partners with the Lower Blackwood Land Conservation District Committee (Lower Blackwood LCDC) to fund best-practice fertilisers, 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 Lower Blackwood LCDC go to lowerblackwood.com.au
- To find out more about the health of the rivers in the Hardy Inlet catchment go to rivers.dwer.wa.gov.au/assessments/results

## Methods

Where possible, 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 represent the acceptable pH range. Where there were no ANZECC trigger values available (for TSS and salinity) the SWRWQA classification bands were used to allow samples and sites to be classified and compared.

Trend testing was carried out using either the Mann or Seasonal Kendall tests as appropriate. Where there were flow data available and there was a flow-concentration relationship, the data were flow-adjusted before trend analysis.

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.

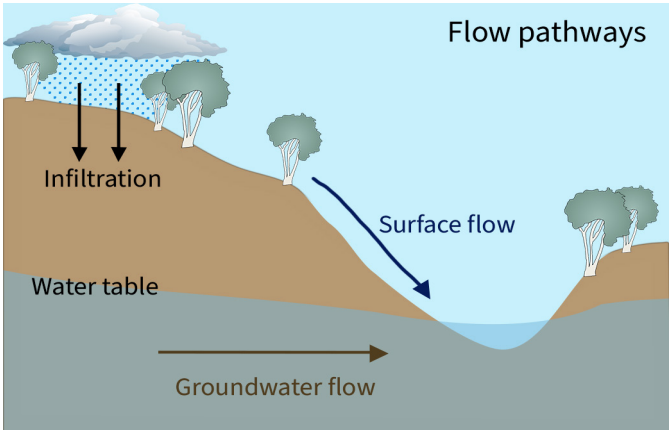
**Evapoconcentration**: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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