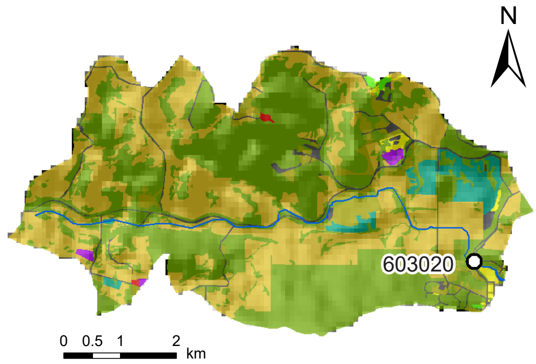
Department of **Water and Environmental Regulation**
Department of **Primary Industries and Regional Development**
GOVERNMENT OF WESTERN AUSTRALIA

Little River

This data report provides a summary of the nutrients at the Little River sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of this site, the river discharges to Wilson Inlet.



Location of Little River catchment in the greater Wilson Inlet catchment.

About the catchment

Little River has a catchment area of about 32 km^2 which is largely cleared for agriculture. The dominant land uses in the catchment are beef cattle grazing (covering about 36 per cent of the catchment) and fragmented areas of native vegetation (which make up a little under half of the total catchment area). Also present are some lifestyle blocks near the lower end of the catchment. While there are no water-supply dams in the catchment, there are a few dams on Little River in the mid to upper catchment. The river flows into the western basin of Wilson Inlet in Ocean Beach.

Most of the catchment has soils which have a good capacity to bind phosphorus applied to them, helping to reduce the amount entering waterways.

Water quality is measured at site 603020, just upstream of Ocean Beach Road in Ocean Beach, about 1 km before the river discharges into Wilson Inlet.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) in Little River were classified as low to moderate (nitrogen) and moderate (phosphorus). The nutrient loads were small to moderate (total nitrogen) and moderate (total phosphorus) compared with the other monitored catchments. However, because of the marginal nutrient concentrations and small catchment size, the loads per square kilometre were moderate. Nutrient concentrations were influenced by the land use in the catchment.

Facts and figures

Sampling site code	603020
Catchment area	32 km^2
Per cent cleared area (2014)	51 per cent
River flow	Flows year-round
Main land use (2014)	Beef cattle grazing and native vegetation

Estimated loads and flow at Little River

603020	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	7.6	3.5	4.6	9.0	9.1	3.7	7.4	7.9	9.5	4.4	4.2	8.7	7.4	5.5	4.0
TN load (t)	8.5	3.4	4.7	11	11	3.6	8.4	9.0	11	4.2	4.0	10	8.1	5.8	3.7
TP load (t)	0.75	0.30	0.41	0.91	0.91	0.30	0.73	0.77	0.94	0.36	0.34	0.86	0.69	0.49	0.32

Nitrogen over time (2005–19)

Concentrations

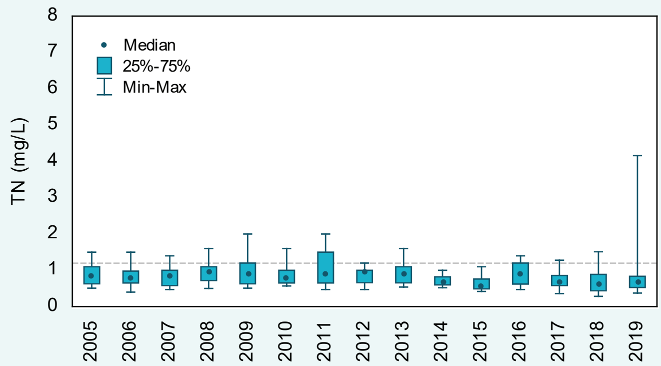
Total nitrogen (TN) concentrations fluctuated over the reporting period in Little River. Most years had some samples over the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value; however, the annual median TN concentrations were always below the trigger value.

Annual TN concentrations were classified as moderate from 2008–17 using the State Wide River Water Quality Assessment (SWRWQA) methodology. All other years were classified as low. Compared with the other monitored sites in the Wilson Inlet catchment, TN concentrations were low.

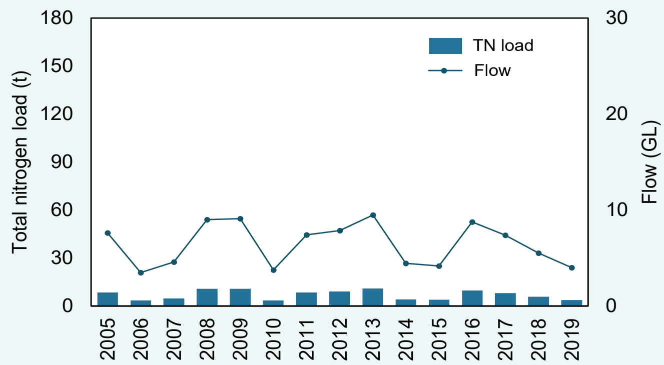
Estimated loads

Estimated TN loads at the Little River sampling site were small to moderate compared with the other sites in the Wilson Inlet catchment. In 2019, it had the second smallest TN load of the six monitored catchments (3.7 t, only Sunny Glen Creek had a smaller load of 1.2 t). However, it had the third largest TN load per square kilometre, 116 kg/km^2. Annual TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

Little River



Total nitrogen concentrations, 2005–19 at site 603020. The dashed line is the ANZECC trigger value.



Total nitrogen loads and annual flow, 2005–19 at site 603020.

Looking upstream from the sampling site during high flow, August 2017.

Nitrogen (2019)

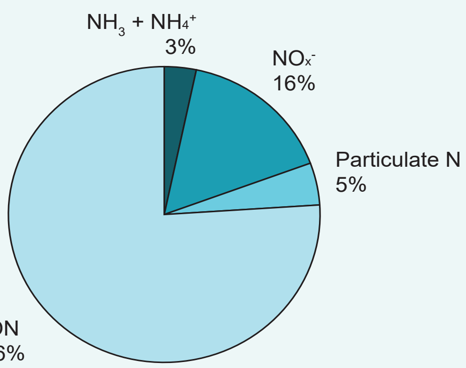
Types of nitrogen

Total N is made up of different types of N. In Little River, most of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may include other, bioavailable, types. Particulate N is composed of plant and animal detritus. Most types of particulate N and DON need to be further broken down to become available to plants and algae, though some DON types are readily bioavailable. Of the monitored catchments, Little River had the second largest portion of N present as nitrate (NO_x^-), behind Cuppup Creek (19 per cent). The portion of N present as total ammonia (NH_3 + NH_4^+) was low. Together, nitrate and total ammonia make up dissolved inorganic N which is bioavailable to plants and algae and can be used to fuel rapid growth.

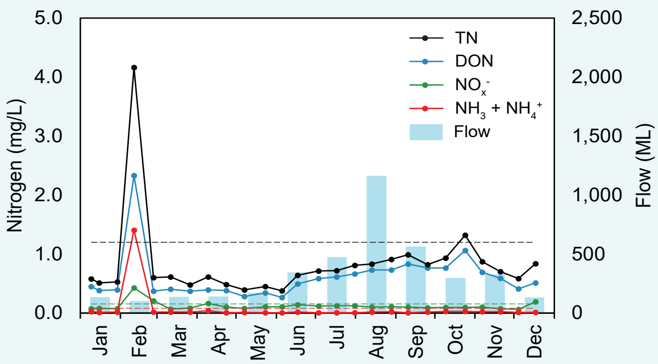
Concentrations

N concentrations varied throughout the year, with evidence of a seasonal pattern in TN and DON concentrations which were generally higher during winter and spring when flow was greater. This suggests that most of the DON was entering the river via surface flows from surrounding land use at this time, with groundwater playing a greater role in contributing N in the drier months when streamflow was less. In-stream sources contributed N year-round. Nitrate concentrations were fairly stable throughout the year. The exception to the above information was the peak in all types of N in early February. The reason for this peak is unclear, it was not associated with a flow or rainfall event. Possibly it was because of some form of discharge upstream of the sampling site as the concentrations recorded are unusually high for this sampling site.

Little River



2019 average nitrogen fractions at site 603020.



2019 nitrogen concentrations and monthly flow at 603020. The dashed lines are the ANZECC trigger values for the different N species.

Looking downstream from the sampling site during high flow, August 2017.

Phosphorus over time (2005–19)

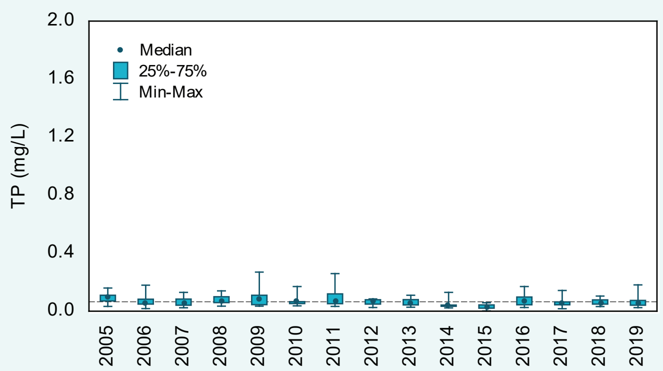
Concentrations

Total phosphorus (TP) concentrations fluctuated slightly over the reporting period. The annual median TP concentrations were above the ANZECC trigger value for more than half of the reporting period and, with the exception of 2015, all years had some samples over the trigger value. Using the SWRWQA methodology, all years were classified as having moderate TP concentrations.

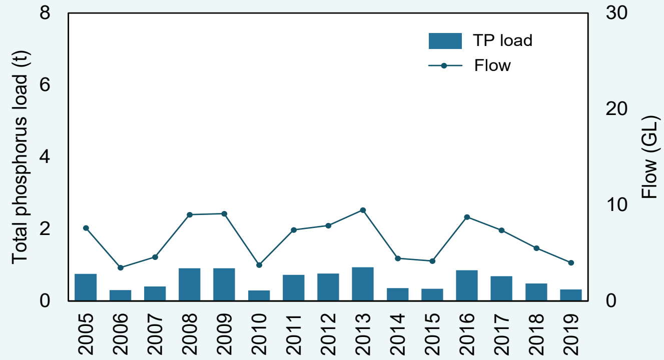
Estimated loads

Estimated TP loads at the Little River sampling site were moderate compared with the other Wilson Inlet catchments. Little River had a TP load of 0.32 t, the third largest TP load in 2019 (Cuppup Creek had a load of 0.77 t, and Sleeman River a load of 1.36 t). It also had the third largest load per square kilometre in 2019 of 10 kg/km^2 (after Cuppup Creek with 12 kg/km^2 and the Sleeman River with 18 kg/km^2). Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TP loads and vice versa.

Little River



Total phosphorus concentrations, 2005–19 at site 603020. The dashed line is the ANZECC trigger value.



Total phosphorus loads and annual flow, 2005–19 at site 603020.

An old wooden bridge over the Little River in a Karri-dominated forest, July 2019.

Phosphorus (2019)

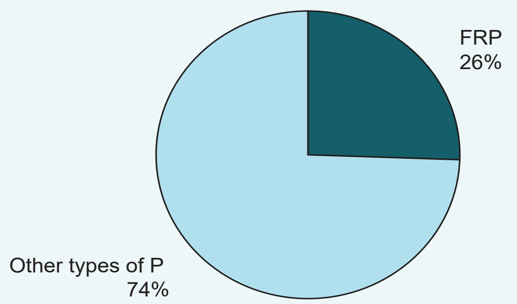
Types of phosphorus

Total P is made up of different types of P. In Little River, about a quarter of the P was present as phosphate; measured as filterable reactive phosphorus (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species and is readily bioavailable. Phosphate was likely derived from animal waste and fertilisers as well as natural sources. The remaining P was present as either particulate P or dissolved organic P (DOP) or both (labelled as 'Other types of P' in the pie chart below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

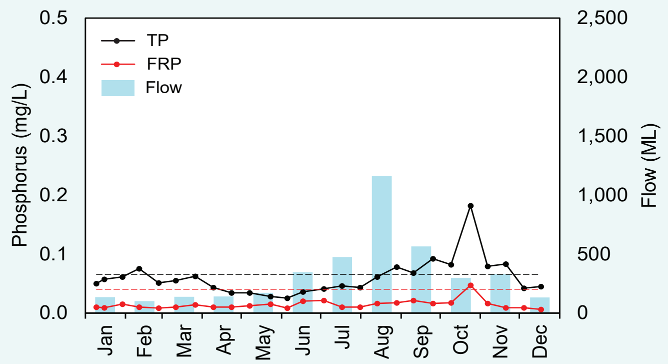
Concentrations

Both TP and phosphate concentrations had a slight seasonal pattern in Little River, with the highest concentrations recorded in winter and spring when rainfall and flow were greatest. There was also a peak in P concentrations in October, which coincided with rainfall on the day of sampling and a peak in water levels. This suggests that P was washed into the river from surrounding land use or from a drain or similar discharging into the river. It is likely that most of the P was entering Little River through surface flows during the wetter months, with groundwater playing a more significant role during summer and autumn. P was also coming from in-stream sources such as erosion year-round.

Little River



2019 average phosphorus fractions at site 603020.



2019 phosphorus concentrations and monthly flow at 603020. The dashed lines are the ANZECC trigger values for the different P species.

The culverts under the bridge at the Little River sampling site, June 2017.

Total suspended solids over time (2005–19)

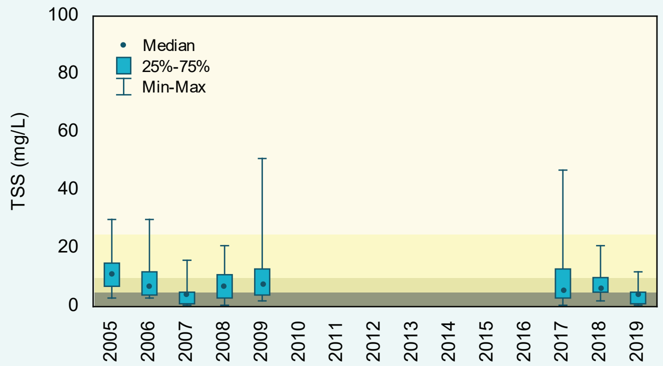
Concentrations

Total suspended solids (TSS) concentrations were classified as moderate using the SWRWQA methodology and fluctuated over the reporting period. Between 2010 and 2016, TSS was only collected sporadically so the data were not graphed.

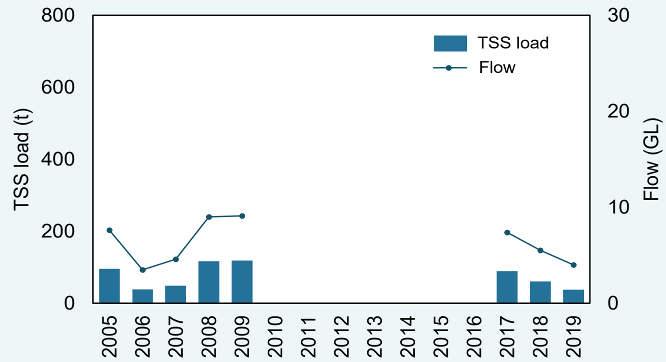
Estimated loads

Estimated TSS loads at the sampling site on Little River were moderate compared with the other sites sampled in the Wilson Inlet catchment. In 2019, the catchment had the third largest TSS load of the six monitored catchments of the Wilson Inlet (38 t). The river had the largest TSS load per square kilometre of 1,188 kg/km^2 (Cuppup Creek had the next largest with 1,032 kg/km^2). Annual TSS loads were closely related to flow volumes; years with large annual flow volumes had large TSS loads and vice versa.

Little River



Total suspended solids concentrations, 2005–19 at site 603020. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 603020.

low moderate high very high

The Little River catchment. Cattle grazing is one of the dominant land uses in the catchment.

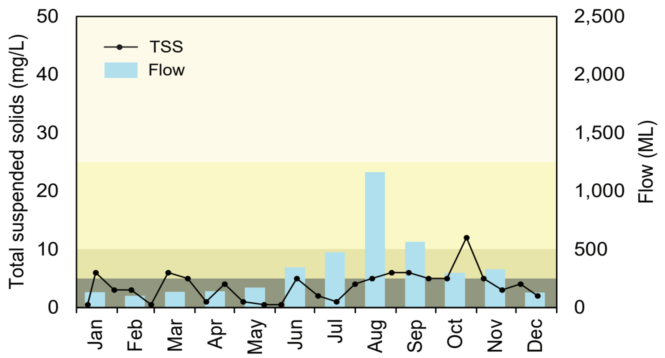
Total suspended solids (2019)

Concentrations

Like in 2018, TSS did not show a clear seasonal pattern in Little River. There was a peak in TSS concentrations in October, which coincided with rainfall on the day of sampling and a peak in water levels. This suggests that particulate matter was washed into the river from surrounding land use or disturbed from in-stream sources. It is also possible a drain or similar discharged into the river at this time.

It is likely particulate matter was entering the river through surface runoff from surrounding land as well as from in-stream erosion the whole year. While most of the river has been fenced to prevent stock access, the fringing vegetation is quite sparse along some sections which will allow particulates to run off from surrounding cleared farmland into the river.

Little River



2019 total suspended solids concentrations and monthly flow at 603020. The shading refers to the SWRWQA classification bands.

low | moderate | high | very high

Little River at the sampling site. Note the dense fringing vegetation, August 2017.

Little River

pH over time (2005–19)

pH values

In the early part of the reporting period, all samples fell between the upper and lower ANZECC trigger values. Since 2008, most years had samples which were below the lower ANZECC trigger value, with the exception of 2019, where all samples fell within the trigger values again. This suggests that pH at this site is generally within the bounds required for a healthy ecosystem.

There is some concern that the probe used to collect the pH data from the catchments of Wilson Inlet (including the Little River site) was not functioning correctly from about October 2016 to October 2017. This may have caused the low pH values shown in the graphs below. After October 2017, a new probe was used and the pH values increased and stabilised. Although there is no way of verifying the 2016–17 pH data, they have still been presented here.

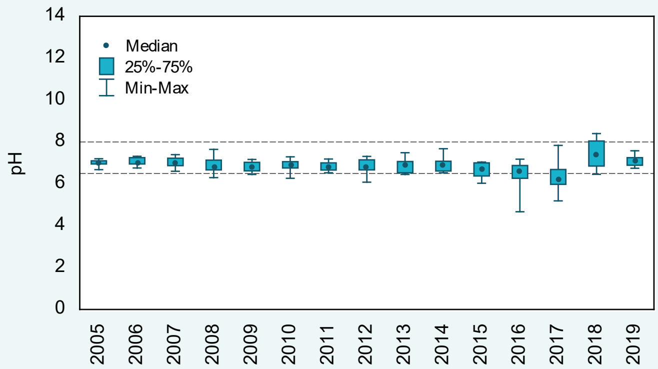
pH (2019)

pH values

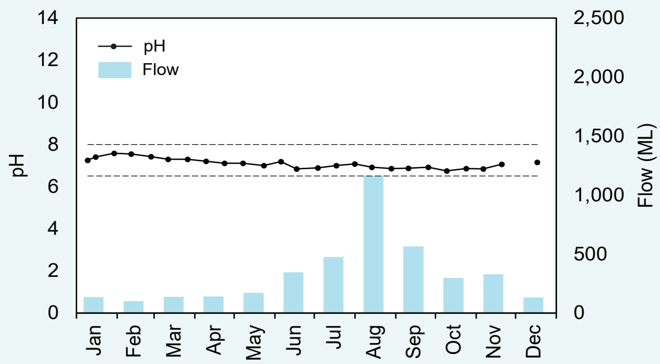
pH was highest in the first half of the year, decreasing from about May when the proportion of flow contributed by surface water runoff started to increase. This suggests the pH of the groundwater may be higher than the surface water in the Little River catchment.

The missing data point in early December was because of the probe malfunctioning on that sampling occasion.

Little River



pH levels, 2005–19 at site 603020. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 603020. The dashed lines are the upper and lower ANZECC trigger values.

Collecting flow measurements using a StreamPro Acoustic Doppler Current Profiler, July 2016.

Little River

Salinity over time (2005–19)

Concentrations

Salinity in Little River was fresh, with all years classified as fresh using the Water Resources Inventory 2014 salinity ranges (note, the 2018 nutrient report used the SWRWQA bands). In 2019, Little River had the lowest median salinity of the sites sampled (270 mg/L; Scotsdale Brook had the next lowest median of 300 mg/L).

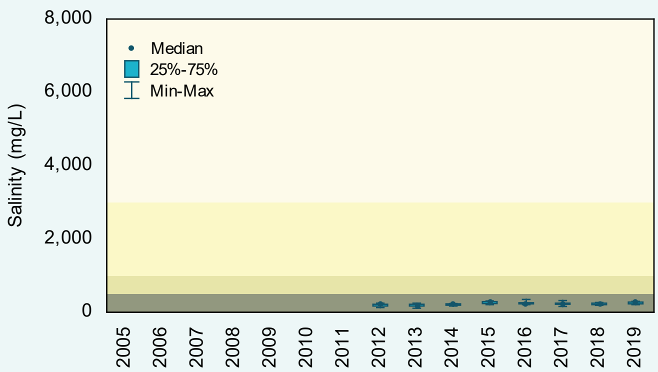
Salinity (2019)

Concentrations

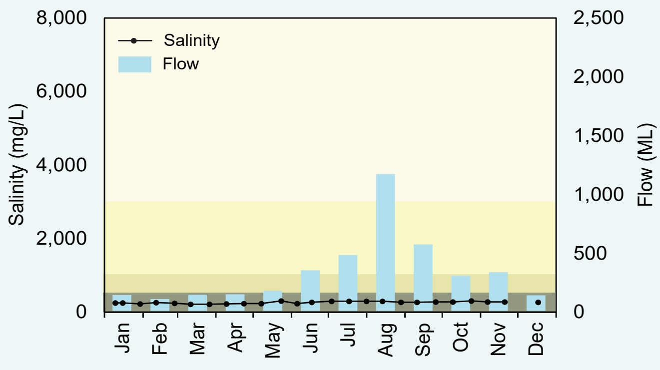
In 2019, all samples collected fell within the fresh band. While the salinity varied a little over the year, there was no clear seasonal pattern present. It is likely salt was entering the river via surface flows as well as groundwater year-round.

The missing data point in early December was because of the probe malfunctioning on that sampling occasion.

Little River



Salinity concentrations, 2005–19 at site 603020. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations and monthly flow at 603020. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

The culverts at the Little River sampling site during high flow, August 2018.

Little River

Background

Healthy Estuaries WA is a State Government program launched in 2020 and builds 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; both the catchment and the estuary. 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.

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 the water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as these help us better understand the processes occurring in the catchment.

You can find information on the condition of Wilson Inlet at estuaries.dwer.wa.gov.au/estuary/wilson-inlet/

Healthy Estuaries WA partners with the Wilson Inlet Catchment Committee to fund best-practice management of fertiliser, dairy effluent and watercourses on farms.

- To find out how you can be involved visit estuaries.dwer.wa.gov.au/participate
- To find out more about the Wilson Inlet Catchment Committee go to wicc.org.au
- To find out more about the health of the rivers in the Wilson Inlet catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Variables were compared with ANZECC trigger values where available, or the SWRWQA bands or 2014 Water Resources Inventory ranges. They were classified using the SWRWQA methodology. Standard statistical tests were used to calculate trends and loads. For further information on the methods visit estuaries.dwer.wa.gov.au/nutrient-reports/data-analysis

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

First flush: material washed into a waterway by the first rainfall after an extended dry period. The first flush is often associated with high concentrations of nutrients and particulate matter.

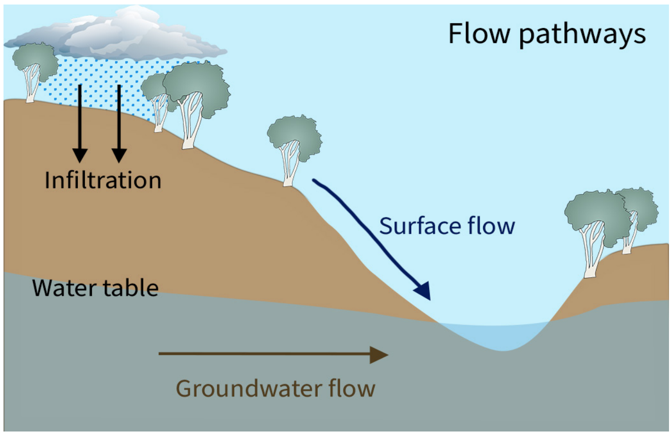
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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

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

Nitrate: The measurement for the nutrient nitrate actually measures both nitrate (NO_3^-) and nitrite (NO_2^-), which is reported as NO_x^-. We still refer to this as nitrate as in most surface waters nitrite is present in very low concentrations.

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.



estuaries.dwer.wa.gov.au
catchmentnutrients@dwer.wa.gov.au
#WAestuaries | 6364 7000

Little River Issue 2
Publication date: October 2023
ISSN: 2209–6779 (online only)