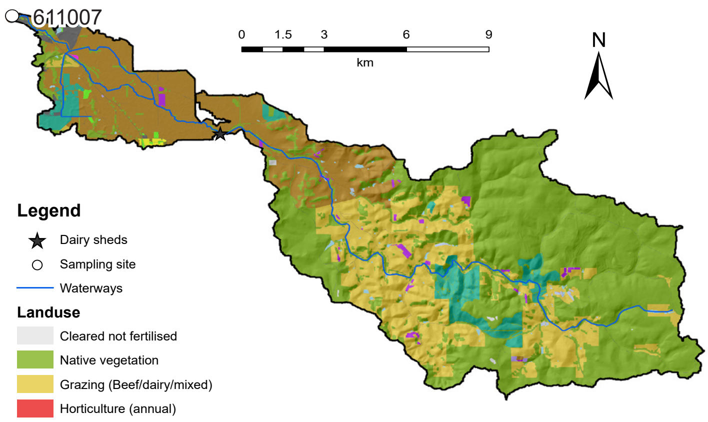
GOVERNMENT OF WESTERN AUSTRALIA
Department of **Water and Environmental Regulation**
Department of **Primary Industries and Regional Development**

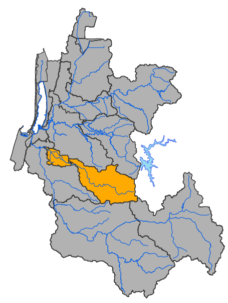
Leschenault Estuary catchment nutrient report 2019

HEALTHY ESTUARIES WA

Ferguson River

This data report provides a summary of the nutrients at the Ferguson 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 the site, the river discharges into the Preston River.





Location of Ferguson catchment in the greater Leschenault catchment.

About the catchment

The Ferguson River has a catchment area of about 138 km^2, nearly half of which is covered by native vegetation. This vegetation is mostly present in the upper catchment, on the Darling Scarp and Plateau. Land use in the coastal plain portion of the catchment consists mostly of agriculture, predominantly beef and dairy cattle grazing with one dairy shed in the catchment. The Collie River Irrigation District lies, in part, on the coastal plain portion of the Ferguson River catchment and there is a discharge point into the Lower Ferguson River, just upstream of the sampling site.

Fringing vegetation has been lost or is badly degraded along much of the river and tributaries, especially on the coastal plain. Most of the catchment has soils with a high capacity to bind phosphorus applied to them, helping to reduce the amount entering waterways.

Water quality is measured at site 611007, South Western Highway Ferguson, near where the river passes under the Boyanup-Picton Road in Picton.

Results summary

Nutrient concentrations were moderate (total phosphorus) and moderate to low (total nitrogen). Loads per square kilometre were large in 2019. The proportion of nitrogen present in a bioavailable type was reasonably large, caused by the agricultural land use in the catchment and the highly modified nature of the river systems.

Facts and figures

Sampling site code	611007 (SW Hwy Ferguson)
Catchment area	138 km^2
Per cent cleared area (2018)	48%
River flow	Permanent
Main land use (2018)	Native vegetation and cattle grazing

Estimated loads and flow at Ferguson River

611007	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	29	14	28	17	30	5.2	20	17	30	24	8.9	21	18	24	9.0
TN load (t)	40	17	42	21	46	3.6	29						25	33	8.3
TP load (t)	1.87	0.76	1.92	1.00	2.10	0.13	1.46						1.23	1.52	0.32

Nitrogen over time (2005–19)

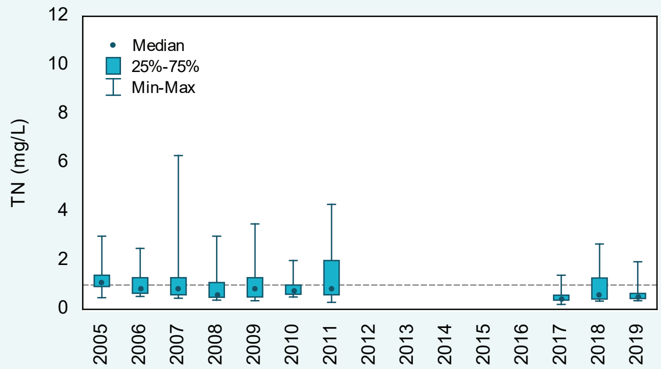
Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at the Ferguson River sampling site. All annual medians (with the exception of 2005) were below the Leschenault Water Quality Improvement Plan (WQIP) TN target for lowland sites, though there were some samples over the target each year. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, annual TN concentrations were classified as moderate before the break in monitoring and low since then. In 2019, the Ferguson River site had the fourth lowest median TN concentration of the 10 sites sampled in the Leschenault catchment. Only the sites in the Middle and Upper Preston and the site in the Middle Collie River catchment had lower median TN concentrations.

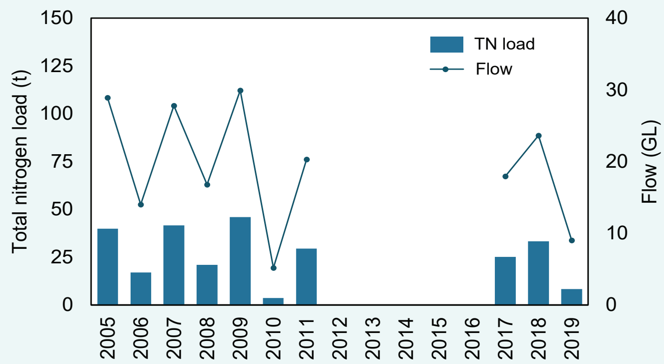
Estimated loads

The estimated TN loads at the Ferguson River sampling site were small to moderate compared with the other three sites with flow data in the Leschenault catchment. In 2019, the estimated TN load (8.3 t) was the second smallest, only the Upper Preston had a smaller load of 5.7 t. The 2019 load per square kilometre for the Ferguson River catchment was the second largest of all the catchments at 60 kg/km^2. Only the Middle Collie River site had a larger load per square kilometre of 84 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.

Ferguson River



Total nitrogen concentrations, 2005–19 at site 611007, The dashed line is the Leschenault WQIP target for lowland rivers.



Total nitrogen loads and annual flow, 2005–19 at site 611007.

The weir at the Ferguson River sampling site, November 2018.

Nitrogen (2019)

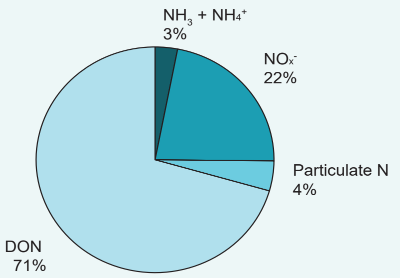
Types of nitrogen

Total N is made up of different types of N. At the Ferguson River sampling site, just over two-thirds of the N was present as dissolved organic N (DON). This type of N consists mainly of plant and animal matter but may include other bioavailable types. About a quarter of the N was present as dissolved inorganic N (DIN – consisting of nitrate, NO_x^-, and total ammonia, $NH_3 + NH_4^+$). DIN is readily bioavailable for plants and algae, fuelling rapid growth. It is worth noting that total ammonia concentrations were generally low, with 10 of the 26 samples collected below the laboratory limit of reporting (LOR). DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before becoming bioavailable, whereas other types of DON are readily bioavailable.

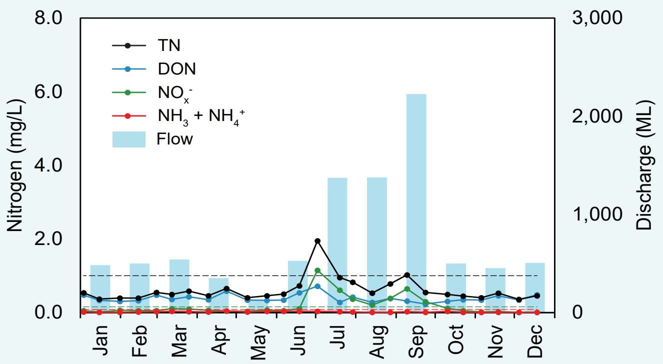
Concentrations

Total N, DON and nitrate all showed a seasonal response in 2019, increasing as rainfall and flow increased before decreasing again later in the year. The peak in early July was likely because of a first-flush response where N was mobilised 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 of high-concentration waters from agricultural land where fertiliser and animal wastes build up over the summer. The pattern observed in N concentrations at this site suggest that most of the N was entering the river via surface flows, with groundwater and in-stream sources contributing proportionally less.

Ferguson River



2019 average nitrogen fractions at site 611007.



2019 nitrogen concentrations and monthly flow at 611007. The black dashed line is the WQIP target for lowland rivers, the red and green are the ANZECC trigger values for total ammonia and nitrate.

The Ferguson River near Dowdells Line in Henty, October 2009.

Phosphorus over time (2005–19)

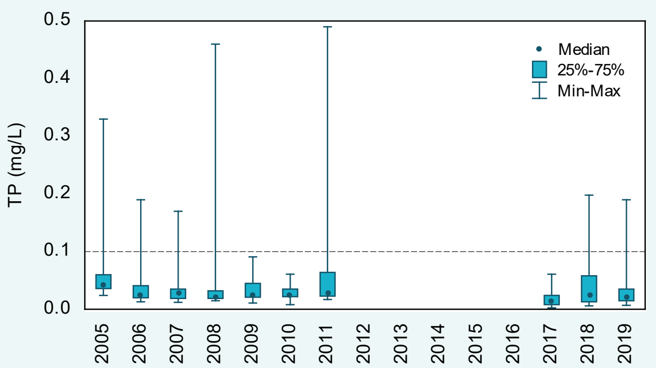
Concentrations

Annual total phosphorus (TP) concentrations at the Ferguson River sampling site were classified as moderate using the SWRWQA methodology. While all annual median concentrations were below the WQIP TP target for lowland sites, most years had some samples over the target. The 2019 median concentration was the fourth lowest of the 10 sites sampled. Only the sites in the Middle and Upper Preston and the Middle Collie River catchments had lower 2019 median concentrations.

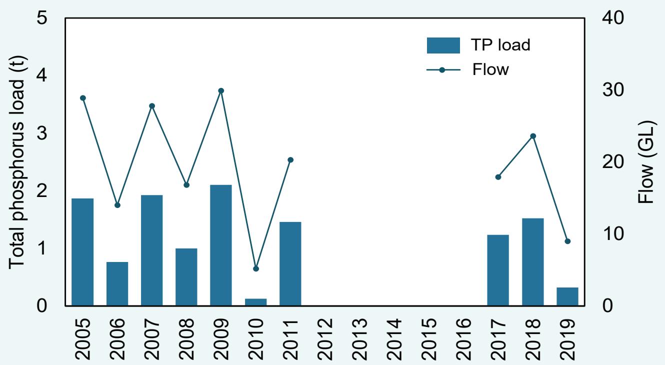
Estimated loads

The estimated TP loads at the Ferguson River sampling site were moderate compared with the other three sites with flow data in the Leschenault catchment. In 2019, the Ferguson River site had the second largest TP load of 0.32 t. Only the Middle Preston River site had a larger load of 0.50 t. Loads were smaller at the Upper Preston River site (0.10 t) and the Middle Collie River site (0.26 t). The larger load at the Middle Preston River site was because of its larger flow volume (24.9 GL compared with 9.0 GL at the Ferguson River site in 2019). TP concentrations at the Ferguson River site were higher than the Middle Preston River site. In 2019 the load per square kilometre at the Ferguson River site was the largest of the Leschenault sites (2.3 kg/km^2). The Middle Collie River site had a similar load per square kilometre (2.0 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.

Ferguson River



Total phosphorus concentrations, 2005–19 at site 611007. The dashed line is the Leschenault WQIP target for lowland rivers.



Total phosphorus loads and annual flow, 2005–19 at site 611007.

A freshwater mussel (Westralunio carteri) collected from the Ferguson River in Henty. This species is listed as vulnerable and plays an important role as a filter feeder, October 2009.

Phosphorus (2019)

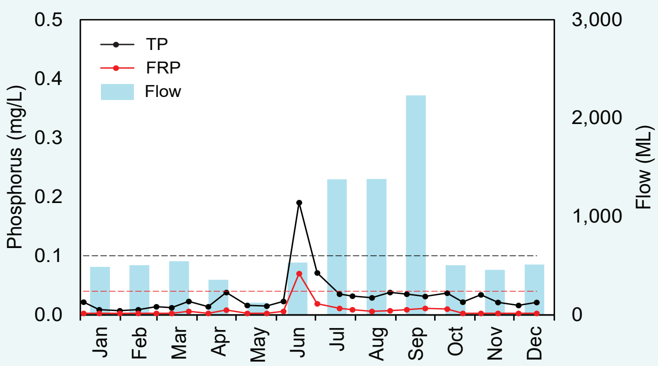
Types of phosphorus

Total P is made up of different types of P. At the Ferguson River site, 14 of the 26 phosphate samples were below the limit of reporting (0.005 mg/L) which is why a P fraction pie chart was not generated. Phosphate is measured as filterable reactive phosphorus (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species. Phosphate is readily bioavailable and is typically sourced from fertilisers, animal waste and natural sources.

Concentrations

Total P and phosphate concentrations were low, below the WQIP lowland river TP target and the Australian and New Zealand Environment and Conservation Council (ANZECC) phosphate trigger value for much of the year. The spike in early July was probably because of a first-flush effect where P was mobilised following heavy rainfall. Much of this P was likely from fertilisers used on upstream agricultural land use. During the wetter months, surface runoff and in-stream sources were likely the major sources of P, with groundwater contributing proportionally less at this site.

Ferguson River



2019 phosphorus concentrations and monthly flow at 611007. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for phosphate.

Farmland along the edge of the Ferguson River in Henty, October 2009.

Ferguson River

Total suspended solids over time (2005–19)

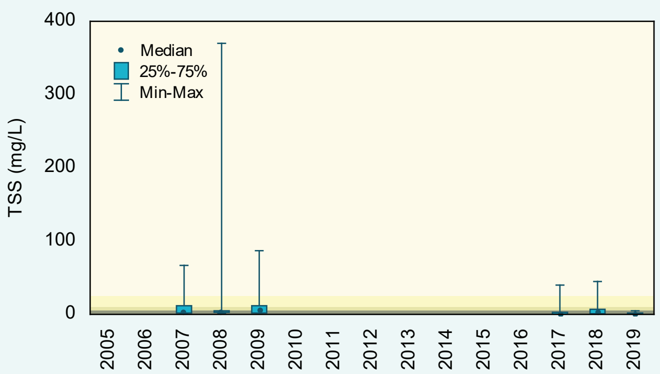
Concentrations

Using the SWRWQA methodology, all years were classified as having a low TSS concentration at the Ferguson River site. The range in TSS concentrations appears to have reduced over the break in monitoring from 2010–16. Compared with the other sites in the Leschenault catchment, TSS concentrations at the Ferguson River sampling site were low. The 2019 annual median TSS concentration was the fourth lowest at 2 mg/L (only the two sites on the Preston River and the Middle Collie River sites had lower median concentrations).

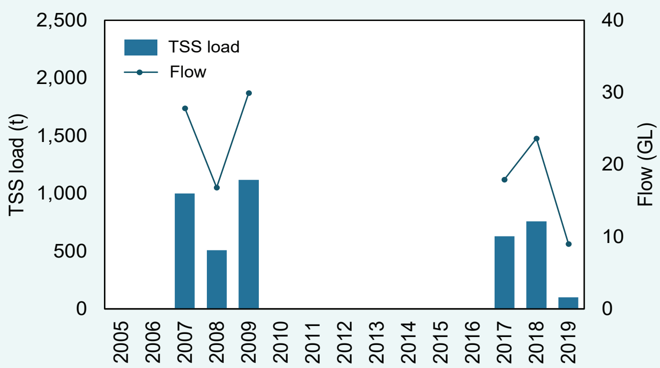
Estimated loads

The estimated TSS loads at the Ferguson River site were moderate compared with the other three sites in the Leschenault Catchment with flow data. In 2019, the TSS load was 100 t, only the Middle Preston site had a larger load of 217 t. The load per square kilometre at the Ferguson River site was large (726 kg/km^2), the largest of the Leschenault sites. The Middle Collie site had the next largest load per square kilometre of 399 kg/km^2. Annual TSS loads were closely related to flow volumes; years with high annual flow had large TSS loads and vice versa.

Ferguson River



Total suspended solids concentrations, 2005–19 at site 611007. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 611007.

low moderate high very high

The Ferguson River in Henty. The fringing vegetation has been replaced by exotic grasses, October 2009.

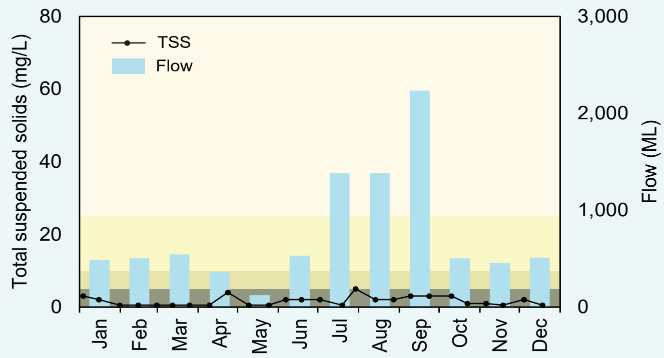
Ferguson River

Total suspended solids (2019)

Concentrations

Unlike in 2018, the 2019 TSS concentrations did not show a clear seasonal pattern, being low and fluctuating slightly during the year. It is possible that the lower TSS concentrations in 2019 were caused by the smaller flow volumes with both rainfall and flow being much lower in 2019 than 2018 at the Ferguson River site. Most of the TSS at this site was likely coming from surface runoff and in-stream erosion.

Ferguson River



2019 total suspended solids concentrations and monthly flow at 611007. The shading refers to the SWRWQA classification bands.

low moderate high very high

Erosion along the bank of the Ferguson River in Henty, October 2009.

Ferguson River

pH over time (2005–19)

pH values

pH values at the Ferguson River sampling site fluctuated over the reporting period. All annual median concentrations fell between the upper and lower ANZECC trigger values though there were samples that fell outside the trigger values in some years.

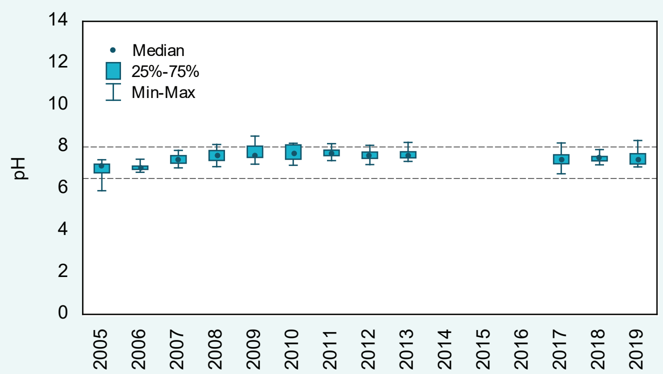
pH (2019)

pH values

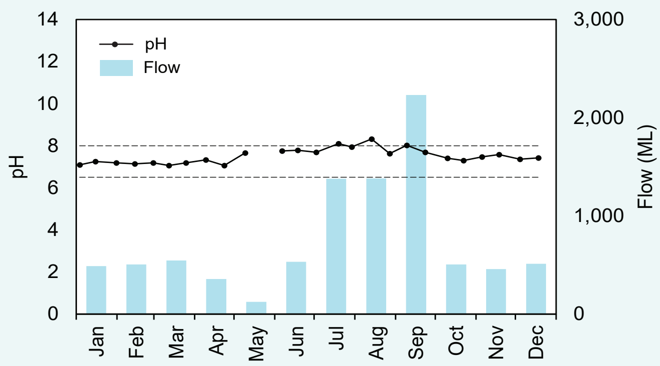
In 2019, there was evidence of a seasonal pattern in pH values at the Ferguson River site. pH was higher during the wetter months. This was not evident in the 2018 data. Most samples collected fell within the upper and lower ANZECC trigger values, with the exception of three samples collected in July, August and September respectively which were above the upper ANZECC trigger value.

The missing data point in May was because the probe malfunctioned on this sampling occasion. The site was flowing.

Ferguson River



pH levels, 2005–19 at site 611007. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 611007. The dashed lines are the upper and lower ANZECC trigger values.

Conducting a river health assessment on the Ferguson River in Henty. The fyke net is used to catch fish and crayfish, October 2009.

Ferguson River

Salinity over time (2005–19)

Concentrations

The annual median salinity fluctuated over the reporting period; however, the annual range in salinity remained fairly constant. Using the Water Resources Inventory 2014 salinity ranges, all years with adequate data were classified as marginal (note, in 2018, the SWRWQA bands were used).

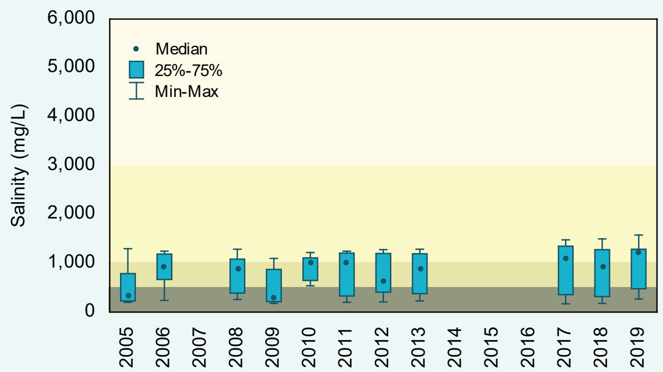
Salinity (2019)

Concentrations

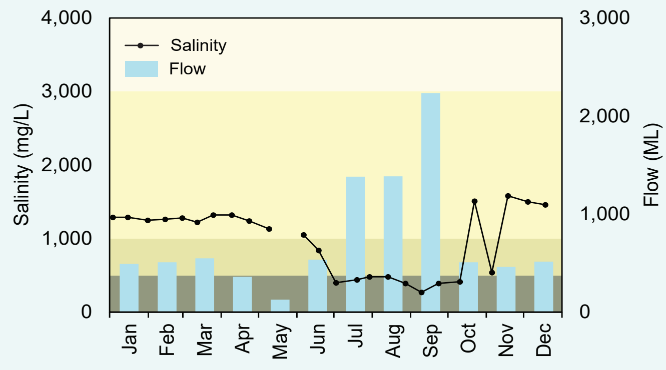
Salinity showed an inverse relationship to flow at the Ferguson River sampling site. Salinity was relatively low from July to early October when rainfall and flow were at their greatest, with all samples falling into the fresh range of the Water Resources Inventory 2014 salinity ranges. Earlier and later in the year, samples fell into either the marginal or brackish ranges. At these times, most of the water in the river was either groundwater or irrigation returns, suggesting that either (or both) of these sources are more saline than the surface water runoff. Evapoconcentration may also be playing a role, with salinity increasing as water levels drop. The peak in October was likely a result of evapoconcentration and increased groundwater contribution. Salinity was lower again in early November, as about 25 mm of rain fell a few days before this sample was collected, before rising sharply as water levels dropped once more.

The missing data point in May was because the probe malfunctioned on this sampling occasion. The site was flowing.

Ferguson River



Salinity concentrations, 2005–19 at site 611007. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations and monthly flow at 611007. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh | marginal | brackish | saline

A small froglet of the Crinia genus, found in the Ferguson River in Henty, October 2009.

Ferguson 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 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.

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 the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

Healthy Estuaries WA partners with the Leschenault Catchment Council 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 Leschenault Catchment Council go to leschenaultcc.org.au
- To find out more about the health of the rivers in the Leschenault Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Variables were compared with the Leschenault Estuary water quality improvement plan concentration targets or ANZECC trigger values where available, or the SWRWQA bands or the 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.

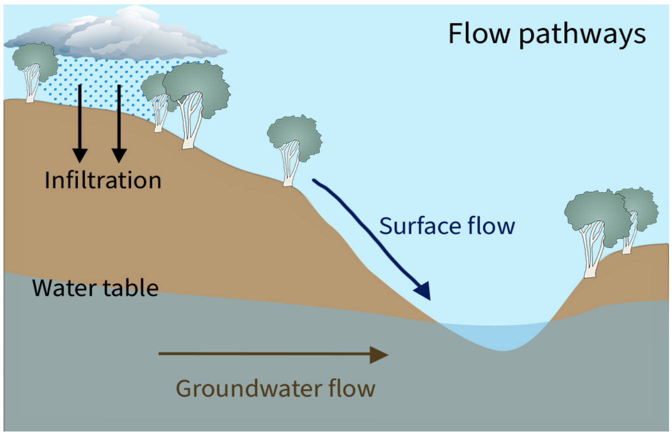
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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.



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