Kalgan River

This data report provides a summary of the nutrients at the Kalgan River sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of the site, the river flows into Oyster Harbour. 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

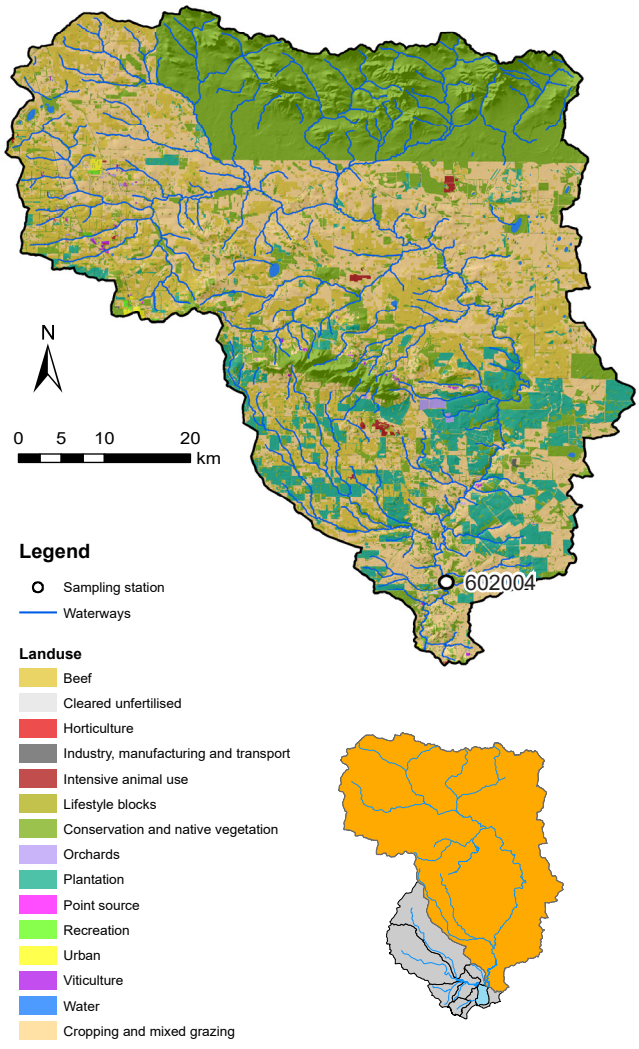
The Kalgan River has a catchment area of about 2,490 km^2, about three-quarters of which has been cleared for agriculture. It is by far the largest of the Oyster Harbour catchments. The dominant land uses are cropping and mixed grazing, and conservation and native vegetation. There are also a number of blue gum plantations, mostly in the lower half of the catchment. The large area of conservation and native vegetation at the top of the catchment is part of the Stirling Range National Park and the smaller area near the centre of the catchment is the Porongurup National Park. The waterways have mostly retained their natural form and there is fringing vegetation along much of their length, though in places it is in poor condition or missing, especially on smaller waterways.

Most of the catchment has soils with a reasonably high capacity to bind phosphorus. This means that any phosphorus applied to them tends to bind to the soils, helping prevent it from entering the waterways.

Water quality is measured at site 602004, Stevens Farm, a little over 1 km north of where the river passes under South Coast Highway, in Kalgan.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Kalgan River sampling site were low (total phosphorus) to moderate (total nitrogen). The total nitrogen loads were large, though the load contributed by each square kilometer of catchment was small. The Kalgan River was by far the saltiest of the Oyster Harbour catchments.



Location of the Kalgan River catchment in the greater Oyster Harbour catchment.

Facts and figures

Sampling site code	602004
Catchment area	2,490 km^2
Per cent cleared area (2018)	77%
River flow	Permanent
Annual flow (2018)	16 GL
Main land use (2018)	Cropping and mixed grazing and conservation and native vegetation

Kalgan River

Nitrogen over time (2004–18)

Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at the Kalgan River sampling site. Concentrations were moderate, with all but one annual median (2016) below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value. The 2018 annual median was the second highest of the six sites sampled in the Oyster Harbour catchment.

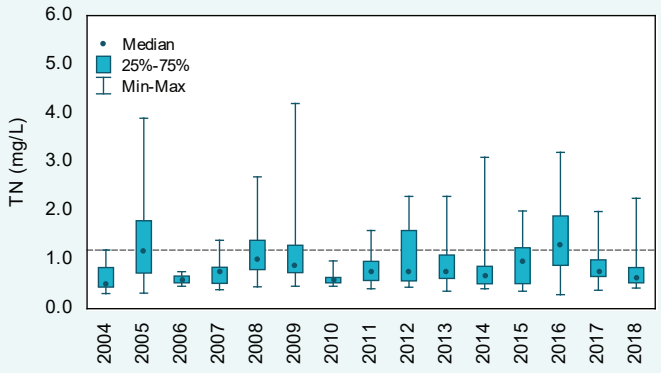
Trends

There was no trend in TN concentrations at the Kalgan River sampling site over the short- (2014–18) or long-term (2004–18).

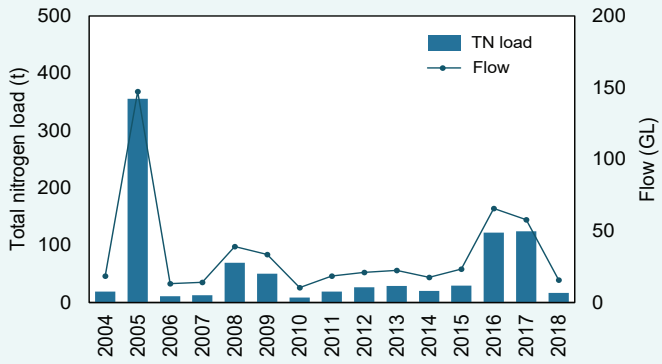
Estimated loads

Estimated TN loads at the Kalgan River sampling site were large compared with the other sites in the Oyster Harbour catchment. In 2018, the Kalgan River had the largest TN load of the three sites where it was possible to calculate loads (17 t; the King River site had the next largest load of 7 t). The large load was mostly because of the large flow volume (in 2018 the flow from the Kalgan River at 16 GL was almost three times larger than the next largest volume, the King River with 5 GL). The load per unit area was small, however, with the Kalgan River having the smallest load per unit area in 2018 (7 kg/km^2; Mill Brook had the next smallest load per unit area of 16 kg/km^2). The small load per unit area can be attributed to the large catchment area. The Kalgan River is by far the largest of the Oyster Harbour catchments. TN loads were closely related to flow volume, years with high annual flow had large TN loads and vice versa.

Kalgan River



Total nitrogen concentrations, 2004–18 at site 602004. The dashed line is the ANZECC trigger value for lowland rivers.



Total nitrogen loads and annual discharge, 2004–18 at site 602004.

Cleaning debris off the weir at the Kalgan River sampling site. High flows can wash debris onto the weir, which impacts flow measurements, November 2015.

Nitrogen (2018)

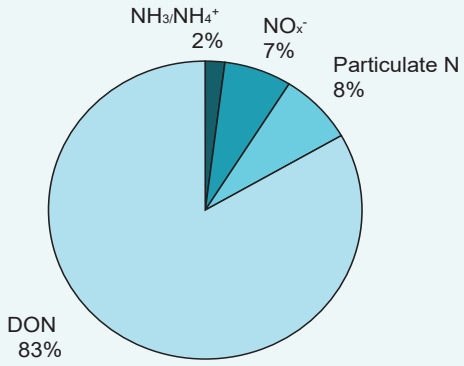
Types of nitrogen

Total N is made up of different forms of N. The dominant form of N in the Kalgan River was dissolved organic N (DON). DON consists mainly of degrading plant and animal matter but may also include other forms. The bioavailability of DON varies depending on its form, some are highly bioavailable whereas others, like degrading plant and animal matter, often need to be further broken down. The proportion of N present as bioavailable dissolved inorganic N (ammonia N, NH_3/NH_4^+ and total oxides of N, NO_x^-) was very low. Likely sources of this kind of N include fertilisers and animal wastes

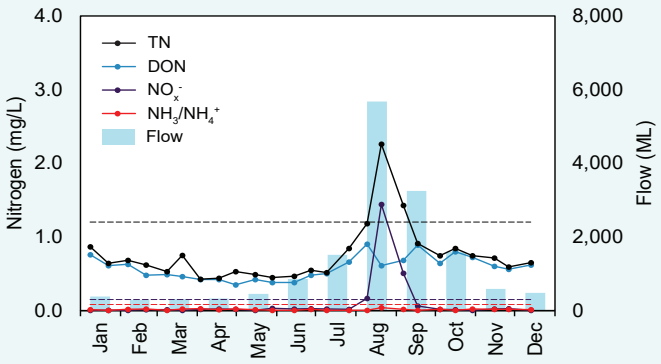
Concentrations

Total N, NO_x^- and, to a lesser extent, DON concentrations showed a seasonal pattern, increasing after the onset of winter rains and the increase in flow, and then decreasing again from about September. It was only during August and September, when flow volumes were at their greatest, that TN and NO_x^- concentrations were over the ANZECC trigger value. NO_x^- concentrations were highest in August, coinciding with the highest flow volumes. There had also been heavy rain in the week leading up to this sampling occasion and it was raining when the sample was collected. This suggests that most of the NO_x^- at this site was entering the river via surface water runoff, with groundwater and in-stream sources contributing proportionally less.

Kalgan River



2018 average nitrogen fractions at site 602004.



2018 nitrogen concentrations and monthly discharge at 602004. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

The Kalgan River gauging station during high flows, September 2017.

Kalgan River

Phosphorus over time (2004–18)

Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period at the Kalgan River sampling site, though they were consistently low. All annual medians and most samples, were below the ANZECC trigger value. In 2018, the Kalgan River had the smallest annual median TP concentration of the six sites in the Oyster Harbour catchment.

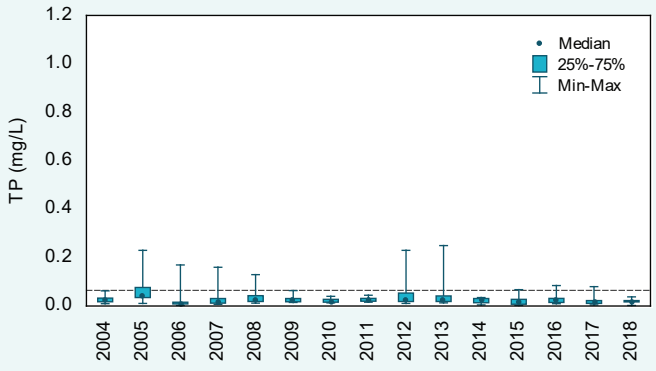
Trends

There was no trend in TP concentrations at the Kalgan River sampling site over the short- (2014–18) or long-term (2004–18).

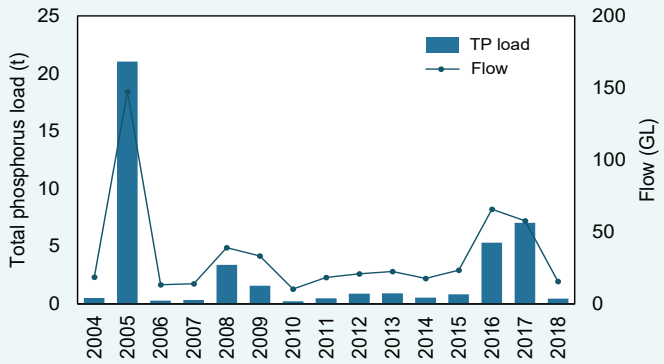
Estimated loads

Estimated TP loads at the Kalgan River sampling site were moderate compared with the other sites in the Oyster Harbour catchment. In 2018, the Kalgan River had the second largest TP load of the three sites where it was possible to calculate loads (0.46 t; the King River site had the largest load of 0.80 t). The load per unit area was small, with the Kalgan River having the smallest load per unit area in 2018 (0.2 kg/km^2; Mill Brook had the next smallest load per unit area of 1.3 kg/km^2). The small load per unit area can be attributed to the large catchment area. The Kalgan River is by far the largest of the Oyster Harbour catchments. TP loads were closely related to flow volume, years with high annual flow had large TP loads and vice versa.

Kalgan River



Total phosphorus concentrations, 2004–18 at site 602004. The dashed line is the ANZECC trigger value for lowland rivers.



Total phosphorus loads and annual discharge, 2004–18 at site 602004.

The Kalgan River weir during low flow, May 2018.

Phosphorus (2018)

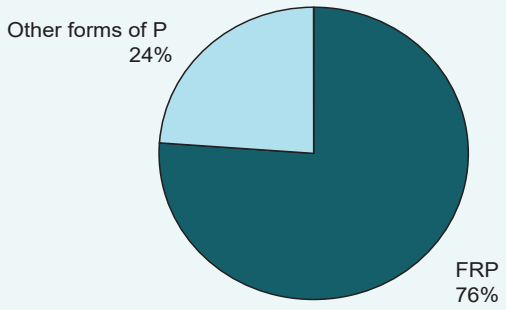
Types of phosphorus

Total P is made up of different forms of P. At the Kalgan River sampling site, about three-quarters of the P was present as filterable reactive P (FRP), the highest proportion of the Oyster Harbour sites. FRP is readily bioavailable, meaning that plants and algae can use it to fuel rapid growth. The FRP at this site was probably derived from animal waste and fertiliser as well as natural sources. It is also worth noting that while the proportion of P present as FRP was high, the actual concentrations were low, with all samples well below the ANZECC trigger value. The remaining P was present as either particulate P, dissolved organic P (DOP) or both (shown as 'Other forms of P' in the chart below). Particulate P generally needs to be broken down before becoming bioavailable to algae. The bioavailability of DOP varies and is poorly understood.

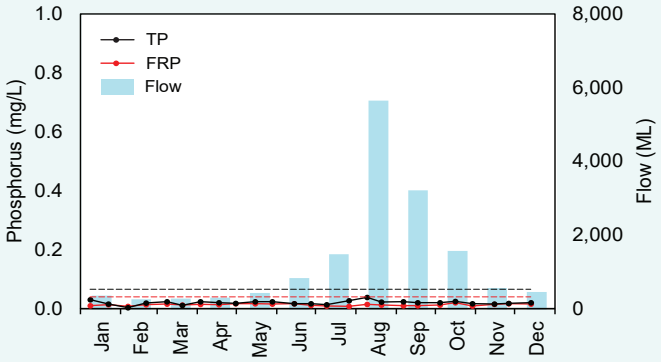
Concentrations

Total P and FRP concentrations were consistently low in 2018 at the Kalgan River sampling site. All samples collected were below their respective ANZECC trigger values and concentrations varied only slightly over the year. There was a small peak in TP concentrations in August, which coincided with the highest flow volumes of the year. It is likely that P was entering the river via both surface and groundwater flows as well as coming from in-stream sources.

Kalgan River



2018 average phosphorus fractions at site 602004.



2018 phosphorus concentrations and monthly discharge at 602004. The dashed lines are the ANZECC trigger values for the different P species in lowland rivers.

The Kalgan River weir completely drowned out during high flows, September 2017. This photograph was taken from a similar spot to the one on the previous page.

Kalgan River

Total suspended solids over time (2004–18)

Concentrations

Total suspended solids (TSS) concentrations at the Kalgan River sampling site were generally low, with all annual medians falling into the low band of the Statewide River Water Quality Assessment (SWRWQA) bands. However, the annual range in concentrations was quite large.

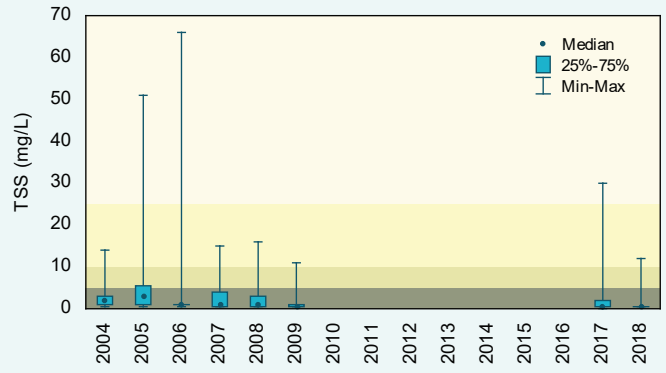
Trends

Because of the break in monitoring from 2010–15, it was not possible to calculate trends in TSS concentrations at the Kalgan River sampling site. A minimum of five consecutive years of data are required to test for trends.

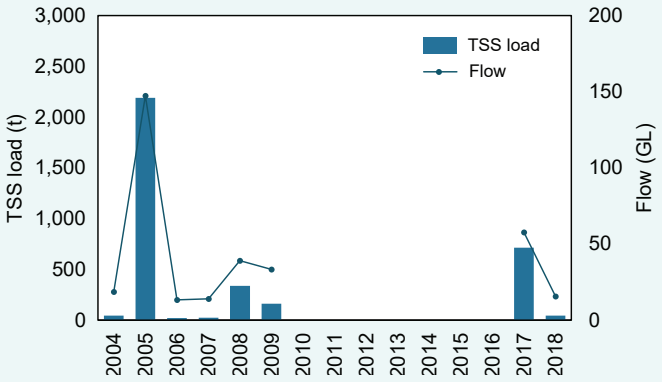
Estimated loads

Estimated TSS loads at the Kalgan River sampling site were large compared with the other sites in the Oyster Harbour catchment. In 2018, the Kalgan River had the largest TSS load of the three sites where it was possible to calculate loads (44 t; the King River site had the next largest load of 31 t). The large load was driven largely by the large flow volume (in 2018 the flow from the Kalgan River, at 16 GL, was about three times larger than the next largest volume the King River at 5 GL). The load per unit area was small, however, with the Kalgan River having the smallest load per unit area in 2018 (18 kg/km^2; Mill Brook had the next smallest load per unit area of 79 kg/km^2). The small load per unit area can be attributed to the large catchment area; the Kalgan River is by far the largest of the Oyster Harbour catchments. TSS loads were closely related to flow volume, years with high annual flow had large TSS loads and vice versa.

Kalgan River



Total suspended solids concentrations, 2004–18 at site 602004. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual discharge, 2004–18 at site 602004.

very high high moderate low

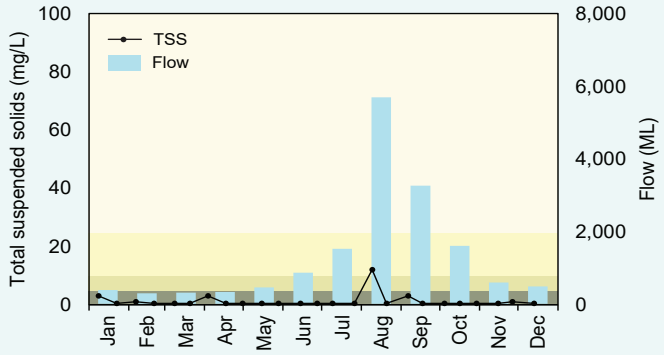
Livestock grazing is one of the main land uses in the Kalgan River catchment, August 2016.

Total suspended solids (2018)

Concentrations

Total suspended solids concentrations were low for most of 2018, with almost all samples being classified as low using the SWRWQA classification bands. The peak in TSS in early August coincided with heavy rainfall in the previous week and rainfall on the day of sampling. It is likely that this rain washed particulate matter into the river via surface flows and that the high flows at this time dislodged particulate matter from the stream bed and banks.

Kalgan River



2018 total suspended solids concentrations and monthly discharge at 602004. The shading refers to the SWRWQA classification bands.

very high high moderate low

Aerial view of Chelgiup Creek, a tributary of the Kalgan River. Note the thin band of fringing vegetation along the creek, March 2020.

Kalgan River

pH over time (2004–18)

pH values

pH at the Kalgan River sampling site fluctuated over the reporting period; however, almost all samples collected fell within the upper and lower ANZECC trigger values.

There is some concern that the probe used to collect the pH data from the catchments of Oyster Harbour (including the Kalgan River site) from about October 2016 to October 2017 was not functioning correctly. This may have caused lower-than-actual pH values to be recorded. From October 2017, a new probe was used. Although there is no way of verifying the 2016 and 2017 pH data, they have still been presented here.

Trends

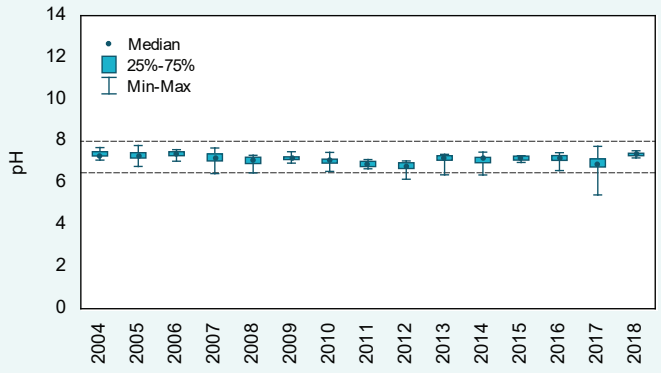
There was no trend in pH values over the short- (2014–18) or long-term (2004–18) at the Kalgan River sampling site.

pH (2018)

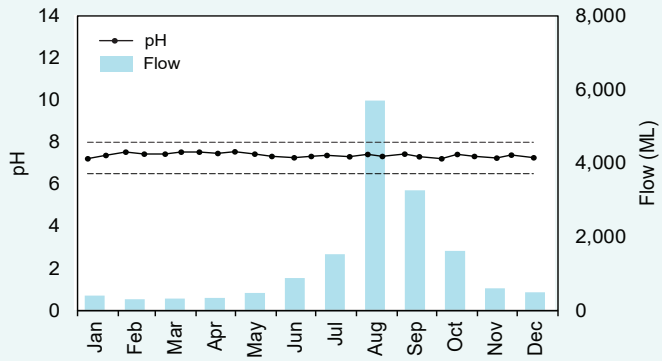
pH values

In 2018, all samples collected at the Kalgan River sampling site fell within the upper and lower ANZECC trigger values. There was very little variation observed in pH over the year with only slight fluctuations present.

Kalgan River



pH levels, 2004–18 at site 602004. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels and monthly discharge at 602004. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Chelgiup Creek, a tributary of the Kalgan River. Note the dominance of exotic grasses in the fringing vegetation, March 2020.

Kalgan River

Salinity over time (2004–18)

Concentrations

The Kalgan River was by far the saltiest of the five catchments sampled in the Oyster Harbour catchment. All annual medians fell into the brackish band of the SWRWQA classification bands; however, most years had some samples that fell into the saline band. It is likely that much of the salts at this site are being washed downstream from the inland portion of the catchment where historical clearing has led to salinisation within the catchment.

Trends

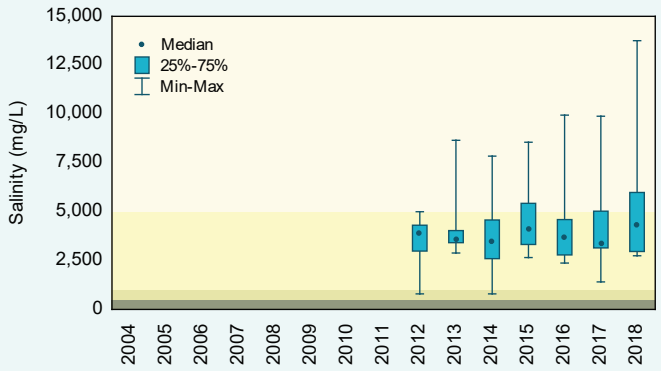
There was no short-term (2014–18) trend in salinity concentrations at the Kalgan River sampling site.

Salinity (2018)

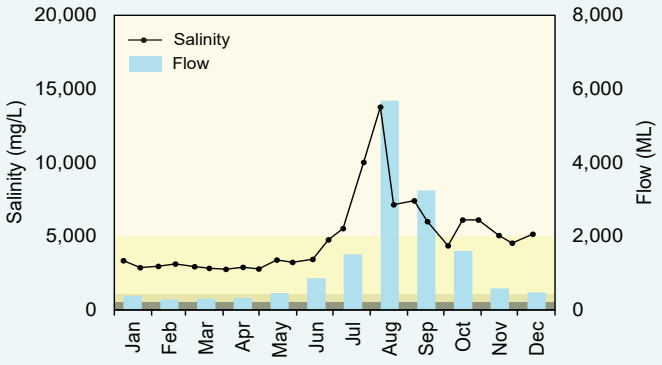
Concentrations

Salinity showed a seasonal response at the Kalgan River sampling site with concentrations increasing about June, when rainfall and river flow increased before peaking in early August and then dropping again. It is likely that much of the salt is coming from further up in the catchment where historical clearing has caused salinisation. Rainfall washed the salt into the river from surrounding land, where it had accumulated over the drier months.

Kalgan River



Salinity concentrations, 2004–18 at site 602004. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations and monthly discharge at site 602004. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

The Kalgan River at the sampling site. Note the mostly intact riparian vegetation at this location, August 2016.

Kalgan 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 Oyster Harbour at estuaries.dwer.wa.gov.au/estuary/oyster-harbour/

The Regional Estuaries Initiative partners with the Oyster Harbour Catchment Group 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 Oyster Harbour Catchment Group go to ohcg.org.au
- To find out more about the health of the rivers in the Oyster Harbour 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.

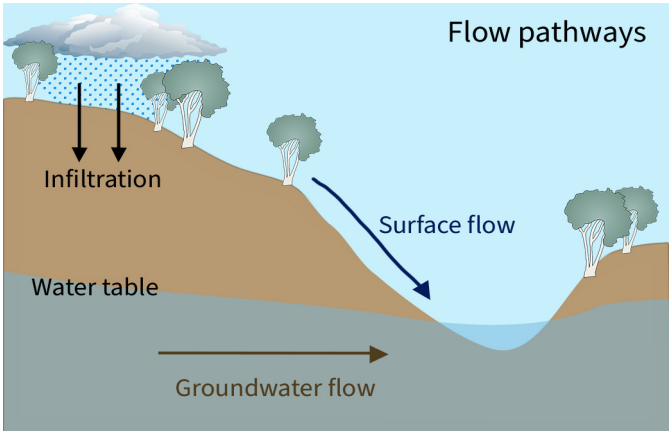
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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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