Willyung Creek

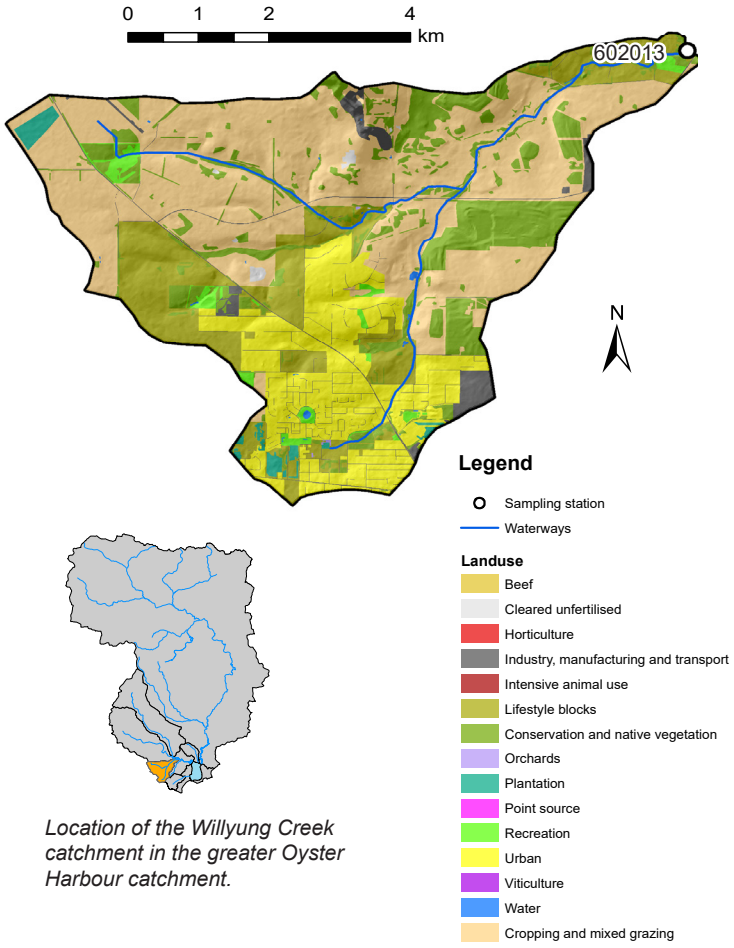
This data report provides a summary of the nutrients at the Willyung Creek sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site the creek flows into the King River which then discharges to Oyster Harbour.

About the catchment

Willyung Creek has a catchment area of about 35 km² which has been almost entirely cleared. The dominant land use is cropping and mixed grazing which covers nearly half of the catchment. The western edge of the suburbs of Albany fall in the southern portion of the catchment along with a large number of lifestyle blocks. In the agricultural areas, waterways mostly retain their natural form whereas they have been converted to drains in the urban areas. Fringing vegetation is missing or poor in most of the catchment.

Most of the catchment has soils with a high phosphorus-binding capacity, though there are areas of soils near the creek with a low phosphorus-binding capacity. In these areas, any phosphorus applied to the soils can be quickly washed into drains and other waterways.

Water quality is measured at site 602013, Willyung, just upstream of where the creek flows into the King River in Willyung.



Location of the Willyung Creek catchment in the greater Oyster Harbour catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Willyung Creek sampling site were classified as moderate to low (total nitrogen) and high to moderate (total phosphorus). The proportion of nitrogen present in a form that is readily used by plants and algae was large. The combination of agricultural and urban land use in the catchment coupled with the modification to the waterways and poor quality fringing vegetation were all contributing to the nutrient concentrations observed.

Facts and figures

Sampling site code	602013
Catchment area	35 km²
Per cent cleared area (2018)	97 per cent
River flow	Permanent
Main land use (2018)	Cropping and mixed grazing

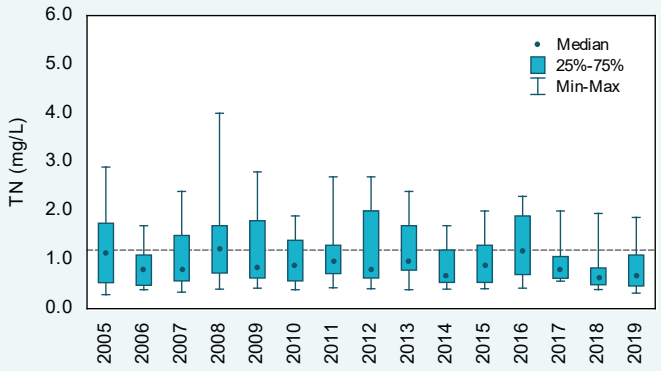
Willyung Creek

Nitrogen over time (2005–19)

Concentrations

Total nitrogen (TN) concentrations at the Willyung Creek sampling site fluctuated over the reporting period. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, 2007–18 TN concentrations were classified as moderate, with all other years classified as low. Only one annual median (2008) was above the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value.

Willyung Creek



Total nitrogen concentrations, 2005–19 at site 602013. The dashed line is the ANZECC trigger value.

The Willyung Creek sampling site, February 2019.

Nitrogen (2019)

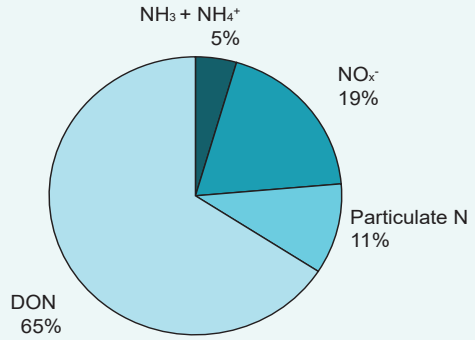
Types of nitrogen

Total N is made up of different types of N. Nearly a quarter of N was present as dissolved inorganic N (total ammonia – NH_3 + NH_4^+ and nitrate – NO_x^-). This type of N is readily bioavailable to plants and algae and was likely sourced from fertilisers and animal wastes. Dissolved organic N (DON) was the dominant type of N and consists mainly of degrading plant and animal matter but may also include other types. The bioavailability of DON varies depending on its type, some are highly bioavailable whereas others, like degrading plant and animal matter, often need to be further broken down.

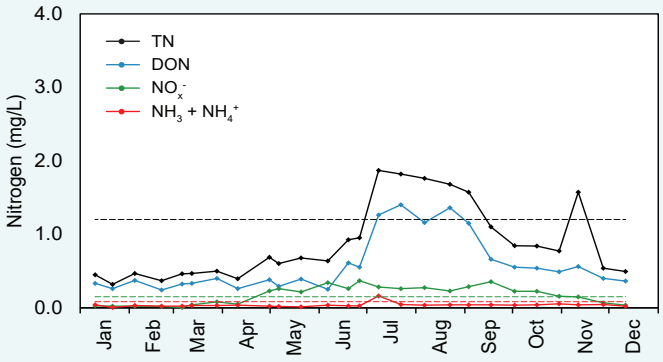
Concentrations

Total N, DON and nitrate concentrations showed a seasonal pattern in 2019 at Willyung Creek, increasing in April to June as rainfall and flow increased, then remaining high until September when they started falling again. The relatively rapid rise in N concentrations in early July is likely the result of a first flush effect, where N was washed from farmland where fertilisers and animal wastes had built up over the summer period as well as mineralisation of organic N in soils and drains over the same time period. It is likely that during the wetter months, much of the N was entering the creek via surface runoff at this site, with groundwater contributing proportionally less. N was also coming from in-stream sources. The reason for the peak in TN concentrations in November is unclear.

Willyung Creek



2019 average nitrogen fractions at site 602013.



2019 nitrogen concentrations at 602013. The dashed lines are the ANZECC trigger values for the different N species.

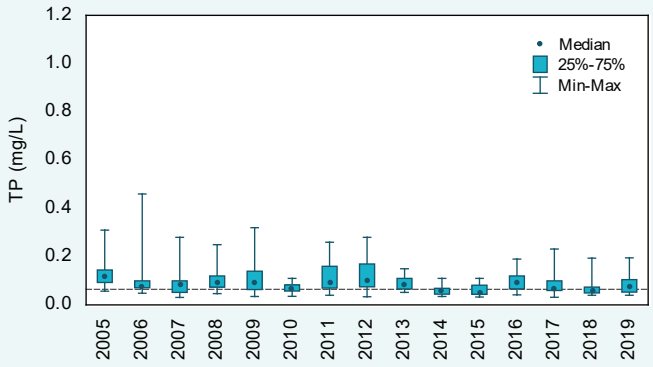
Willyung Creek near the sampling site. The fringing vegetation here is made up almost entirely of exotic species, November 2017.

Phosphorus over time (2005–19)

Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period at the Willyung Creek sampling site. Using the SWRWQA methodology, annual TP concentrations were classified as high until 2014 after which they were classified as moderate. With the exception of 2014, 2015 and 2018, all annual medians were above the ANZECC trigger value.

Willyung Creek



Total phosphorus concentrations, 2005–19 at site 602013. The dashed line is the ANZECC trigger value.

A riffle in Willyung Creek. Rock riffles like this can increase oxygen levels in the water, October 2006.

Phosphorus (2019)

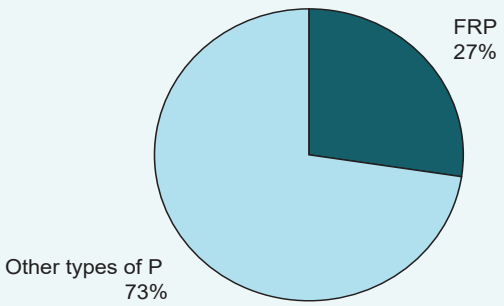
Types of phosphorus

Total P is made up of different types of P. At the Willyung Creek sampling site, about three-quarters of the P was present as either particulate P or dissolved organic P (DOP) or both (shown as 'Other types of P' in the chart below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood. The remainder 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-}) and is readily bioavailable. The phosphate was probably derived from animal waste and fertilisers as well as natural sources.

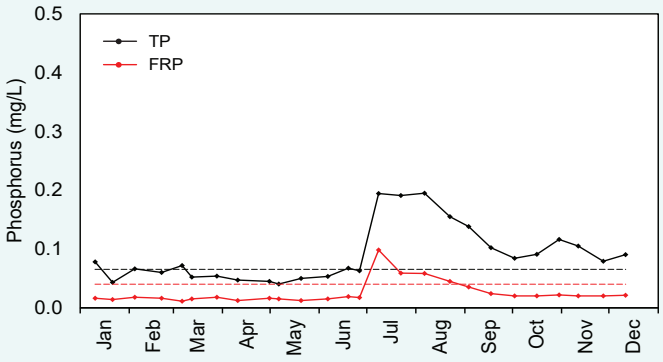
Concentrations

Total P and phosphate showed a seasonal pattern in 2019 at the Willyung Creek sampling site. Concentrations increased rapidly and peaked in July, when rainfall and flow would have been high, before falling again from August to September. It is likely that most of the P at this site was entering the brook via surface flows from surrounding land use, with groundwater contributing proportionally less during the wetter months. During the drier months, groundwater was contributing proportionally more P. In-stream sources were also contributing P.

Willyung Creek



2019 average phosphorus fractions at site 602013.



2019 phosphorus concentrations at 602013. The dashed lines are the ANZECC trigger values for the different P species.

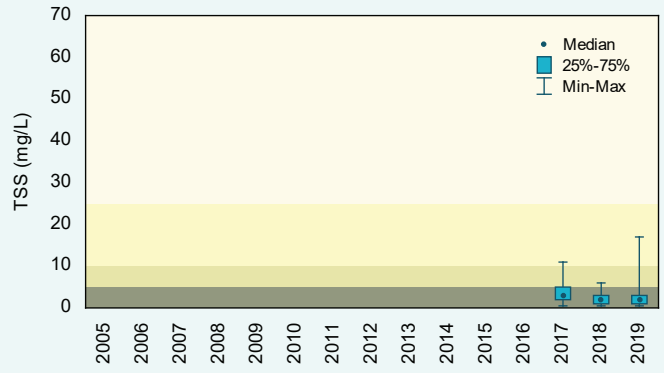
Willyung Creek in a rural residential area. The fringing vegetation consists mainly of exotic grasses and remnant trees, September 2006.

Total suspended solids over time (2005–19)

Concentrations

There were only three years with sufficient total suspended solids (TSS) data to graph at the Willyung Creek sampling site. All years were classified as having low TSS concentrations using the SWRWQA methodology.

Willyung Creek



Total suspended solids concentrations, 2005–19 at site 602013. The shading refers to the SWRWQA classification bands.

low moderate high very high

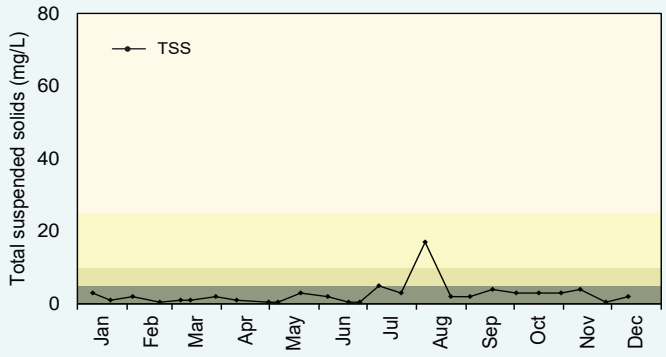
Willyung Creek upstream of the sampling site. The fringing vegetation along the far bank is in good condition at this location, September 2006.

Total suspended solids (2019)

Concentrations

In 2018 TSS concentrations fluctuated throughout the year without evidence of a clear seasonal pattern. The peak in August coincided with rainfall on the day of sampling so it is possible that there was particulate matter being washed into the creek at this time or that it was being dislodged from the creeks beds or banks. Likely sources of particulate matter at this site were surface flows as well as in-stream sources such as erosion.

Willyung Creek



2019 total suspended solids concentrations at 602013. The shading refers to the SWRWQA classification bands.

low moderate high very high

One of the staff gauges, previously used to measure water height at a disused sampling site on Willyung Creek, October 2006.

Willyung Creek

pH over time (2005–19)

pH values

pH at the Willyung Creek sampling site fluctuated over the reporting period. All annual medians fell within the upper and lower ANZECC trigger values.

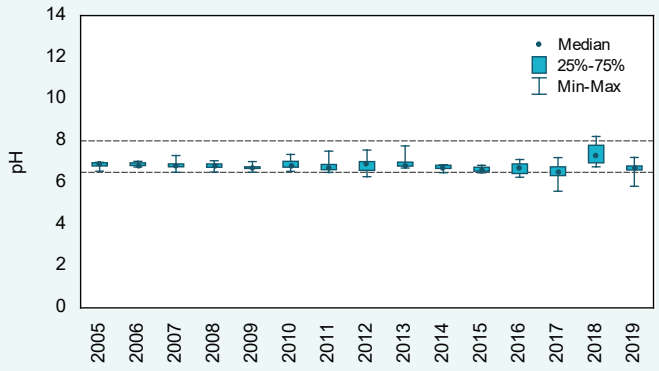
There is some concern that the probe used to collect the pH data from the catchments of Oyster Harbour (including the Willyung Creek site) from about October 2016 to October 2017 was not functioning correctly. This may have caused lower-than-actual pH values to be recorded. From October 2017, a new probe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

pH (2019)

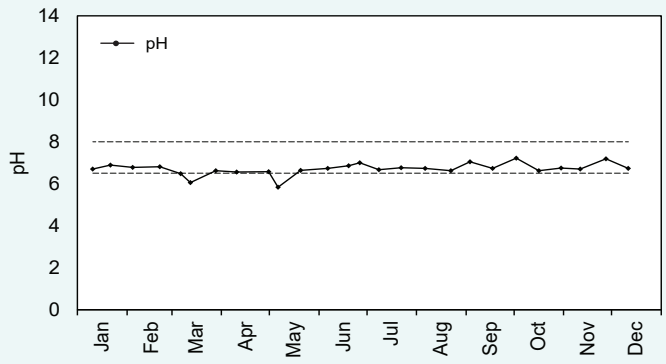
pH values

In 2019, pH values fluctuated during the year with a few samples in the first half of the year falling below the lower ANZECC trigger value.

Willyung Creek



pH levels, 2005–19 at site 602013. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 602013. The dashed lines are the upper and lower ANZECC trigger values.

Willyung Creek, near a disused sampling site, October 2006.

Willyung Creek

Salinity over time (2005–19)

Concentrations

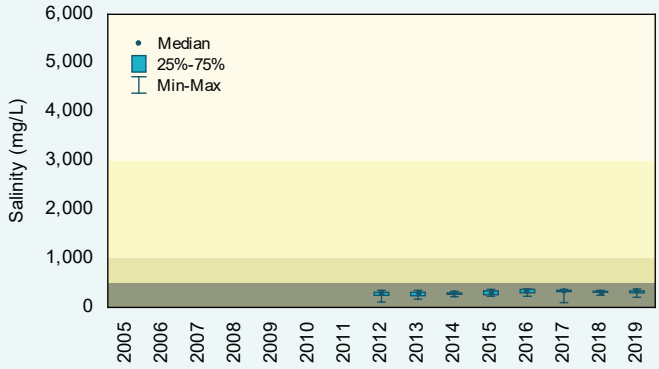
The Willyung Creek sampling site was fresh, with all years classified as fresh using the Water Resources Inventory 2014 salinity ranges (note, the 2018 nutrient reports used the SWRWQA bands).

Salinity (2019)

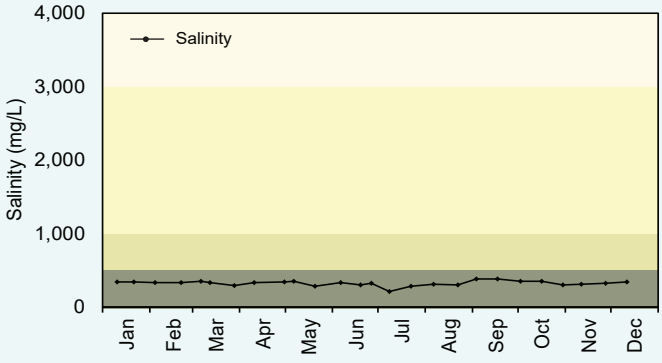
Concentrations

In 2019, salinity fluctuated slightly at the Willyung Creek sampling site, with no evidence of a seasonal trend. It is likely that salt at this site was coming from both surface water runoff and groundwater.

Willyung Creek



Salinity concentrations, 2005–19 at site 602013. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at site 602013. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

Willyung Creek at the sampling site at Dymesbury Lodge, December 2020.

Willyung Creek

Background

Healthy Estuaries WA is a State Government 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; 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 Oyster Harbour at estuaries.dwer.wa.gov.au/estuary/oyster-harbour

Healthy Estuaries WA partners with the Oyster Harbour Catchment Group 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 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

Variables were compared with the 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.

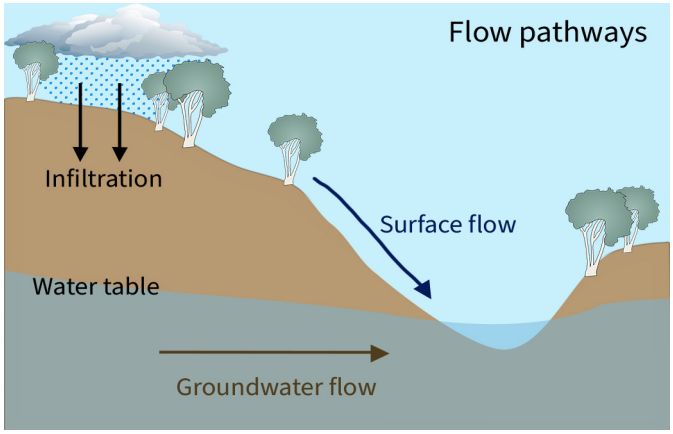
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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.



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