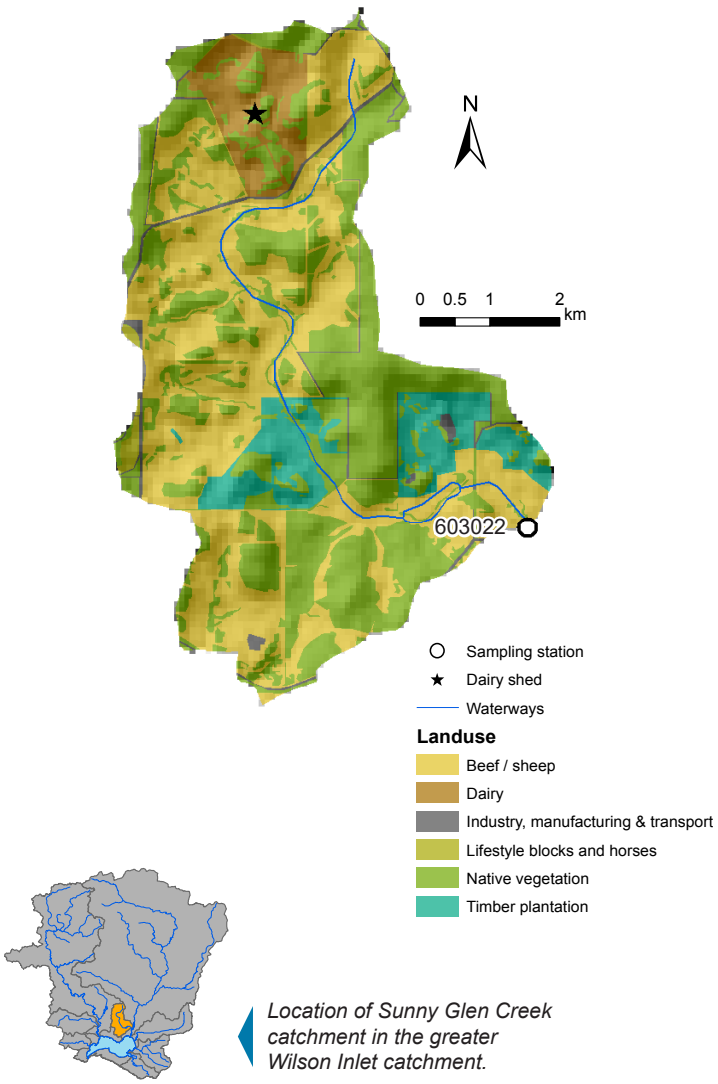
Sunny Glen Creek

This data report provides a summary of the nutrients at the Sunny Glen Creek 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 this site, the creek discharges to Wilson 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 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.

About the catchment

Sunny Glen Creek has a catchment area of about 35 km^2, over half of which has been cleared for agriculture, mostly for beef cattle grazing. There is a large area of native vegetation (timber reserve) present in the centre of the catchment as well as smaller, fragmented areas elsewhere. There are also areas of plantation and a dairy. Large stretches of the creek have little or no fringing vegetation remaining. Sunny Glen Creek discharges into the estuarine portion of the Hay River, near Pratts Road in Hay, downstream of the Hay River monitoring site.

Water quality is measured at site 603022, a couple of hundred meters upstream of where it crosses Pratts Road in Hay.



Location of Sunny Glen Creek catchment in the greater Wilson Inlet catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) in Sunny Glen Creek were very high. While the nutrient loads at the site were small compared with the other monitored catchments, the high nutrient concentrations make this a catchment of concern. The nutrient loads per unit area were moderate, caused by the high nutrient concentrations but small flow volumes and catchment area. The reasons for the high nutrient concentrations are the intensive agricultural land use in the catchment and the modified nature of the creek.

Facts and figures

Sampling site code	603022
Rainfall at Denmark (2018)	776 mm
Catchment area	35 km^2
Per cent cleared area (2014)	58%
River flow	Ephemeral, dries over summer
Annual flow (2018)	1.0 GL
Main land use (2014)	Beef cattle grazing and native vegetation

Sunny Glen Creek

Nitrogen over time (2004–18)

Concentrations

Total nitrogen (TN) concentrations were high in Sunny Glen Creek, with 10 of the past 15 years having all samples collected above the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value. The 2018 median was one of the highest of the sampled sites (2.3 mg/L, the same as Cuppup Creek).

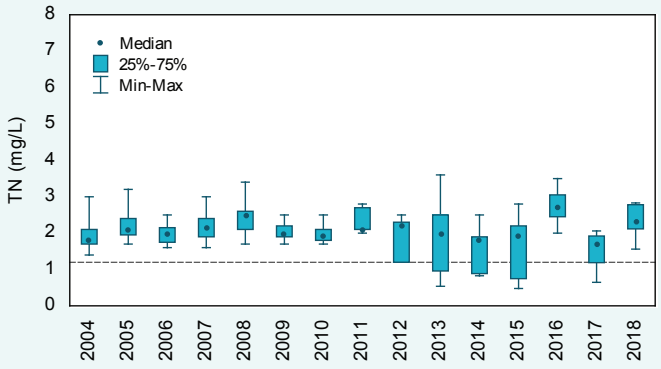
Trends

There were no short- (2014–18) or long-term (2004–18) trends in TN concentrations in Sunny Glen Creek.

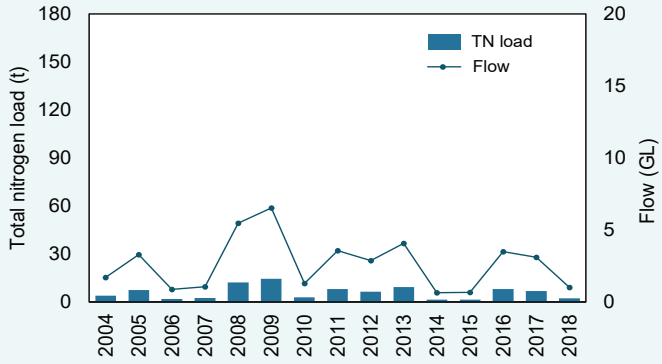
Estimated loads

Estimated TN loads at the sampling site on Sunny Glen Creek were small compared with the other Wilson Inlet catchments. In 2018, the load was 2 t, the smallest TN load of the six monitored catchments of the Wilson Inlet (the next largest load was from Little River, 6 t). The small load was because of the small flow volume (in 2018, Sunny Glen Creek had the smallest flow of the Wilson Inlet catchments, less than a fifth of the flow of the next catchment, Little River). The creek had the third smallest load per unit area, with 66 kg/km^2 in 2018 (the Denmark River had 19 kg/km^2 and the Hay River 15 kg/km^2). Estimated TN loads were closely related to flow volumes; years with high annual flow had large TN loads and vice versa.

Sunny Glen Creek



Total nitrogen concentrations, 2004–18 at site 603022. The dashed line is the ANZECC trigger value for lowland rivers.



Total nitrogen loads and annual flow, 2004–18 at site 603022.

The Sunny Glen Creek sampling site, July 2017.

Nitrogen (2018)

Types of nitrogen

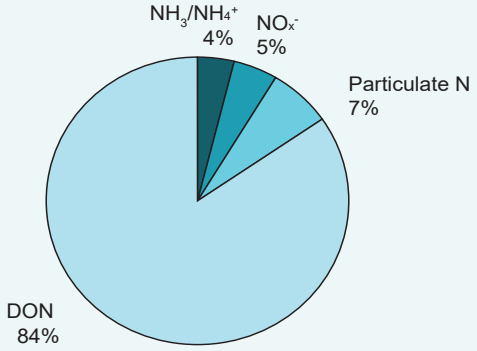
Total N is made up of many different types of N. In Sunny Glen Creek, most of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may include other, bioavailable forms. Particulate N is composed of plant and animal detritus. Most forms of particulate N and DON need to be further broken down to become available to plants and algae, though some DON forms are readily bioavailable. Only a small proportion of N was present as dissolved inorganic N (consisting of ammonia N – NH_3/NH_4^+ and oxides of nitrogen – NO_x^-), which is bioavailable to plants and algae and, like some forms of DON, can be used to fuel rapid growth.

Concentrations

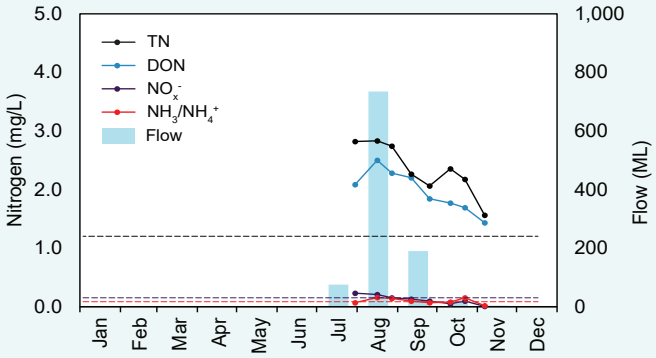
Concentrations varied during 2018 with evidence of a seasonal pattern in TN, NO_x^- and DON concentrations. These increased after the creek started to flow in July and August, then decreased for the rest of the year. This suggests that most of the NO_x^- and DON was entering the creek via surface flows from surrounding land uses as well as from in-stream sources and groundwater. Ammonia N (NH_3/NH_4^+) concentrations fluctuated during the year.

Where there are no data shown on the graph, the creek was not flowing.

Sunny Glen Creek



2018 average nitrogen fractions at site 603022.



2018 nitrogen concentrations and monthly flow at 603022. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

Looking upstream at the sampling site. Rain has created pools but the creek has not started to flow yet, July 2018.

Sunny Glen Creek

Phosphorus over time (2004–18)

Concentrations

Total phosphorus (TP) concentrations were high in Sunny Glen Creek. While concentrations fluctuated over the past 15 years, the median concentration was above the ANZECC trigger value in all years reported. In fact, only four years had any samples below the ANZECC trigger value (2013–15 and 2017). The 2018 median was one of the two highest of the monitored sites (0.268 mg/L; Cuppup Creek had a median of 0.340 mg/L).

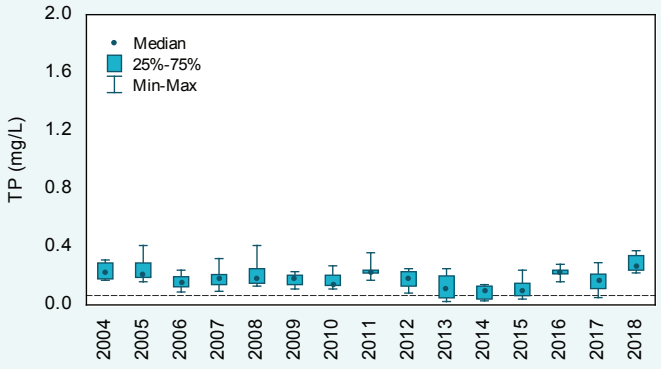
Trends

There was an increasing short-term (2014–18) trend in TP concentrations of 0.035 mg/L/yr. This may be part of the natural fluctuations at this site or an actual increase in TP concentrations. Ongoing monitoring will help determine if water quality at this site is getting worse. There was no long-term (2004–18) trend present.

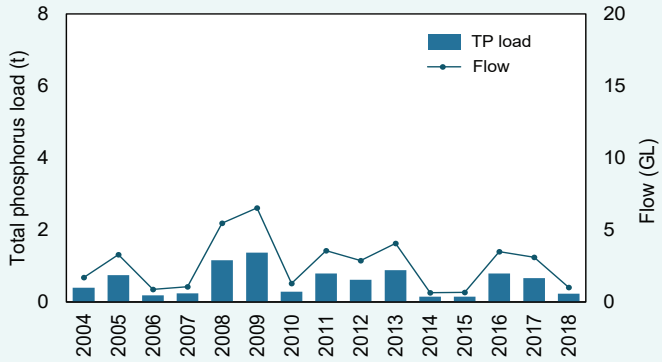
Estimated loads

Estimated P loads at the site on Sunny Glen Creek were small. In 2018, the load was 0.23 t, the smallest TP load of the six monitored catchments of the Wilson Inlet (the next smallest load was from the Hay River at 0.39 t). This small load was because of the small flow volume (in 2018 Sunny Glen Creek had the smallest flow of the Wilson Inlet catchments, less than a fifth of the flow of the next catchment, Little River). The creek had the third smallest load per unit area, with 7kg/km^2 in 2018 (the Denmark and Hay rivers had 0.6 kg/km^2 and 0.3 kg/km^2 respectively). Annual TP loads were closely related to flow volumes; years with high annual flow had large TP loads and vice versa.

Sunny Glen Creek



Total phosphorus concentrations, 2004–18 at site 603022. The dashed line is the ANZECC trigger value for lowland rivers.



Total phosphorus loads and annual flow, 2004–18 at site 603022.

The gauging station at the Sunny Glen Creek sampling site, July 2018.

Phosphorus (2018)

Types of phosphorus

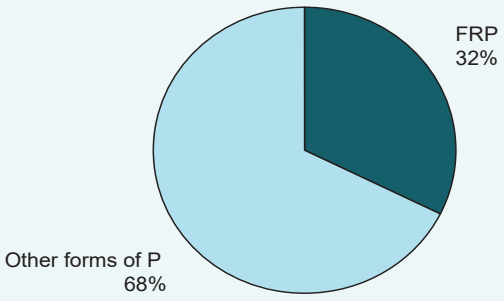
Total P is made up of different types of P. In Sunny Glen Creek, about a third of the P was present as filterable reactive phosphorus (FRP) which is readily bioavailable, meaning plants and algae can use it to fuel rapid growth. FRP was probably derived from animal waste and fertilisers as well as natural sources. The remaining P was present as either particulate P or dissolved organic P (DOP) or both. Particulate P generally needs to be broken down before becoming bioavailable to algae. The bioavailability of DOP varies and is poorly understood.

Concentrations

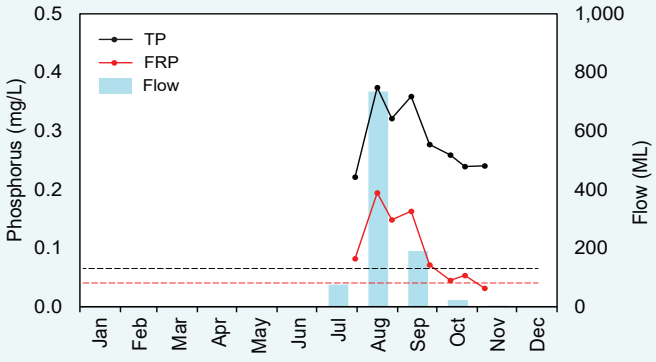
Both TP and FRP concentrations varied seasonally in Sunny Glen Creek, with concentrations increasing after the creek started flowing in July before decreasing again in September. There was zero TP and only one FRP sample below their ANZECC trigger values. Most of the P was entering the creek from surface flows as well as in-stream processes such as erosion which were exacerbated by high flows. As the relative contribution of groundwater increased, the FRP and TP concentrations decreased.

Where there are no data shown on the graph, the creek was not flowing.

Sunny Glen Creek



2018 average phosphorus fractions at site 603022.



2018 phosphorus concentrations and monthly flow at 603022. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.

Sunny Glen Creek sampling site, January, 2017. The creek is not yet flowing but note how much suspended sediment is present in the water.

Sunny Glen Creek

Total suspended solids over time (2004–18)

Concentrations

Total suspended solids (TSS) concentrations were moderate in Sunny Glen Creek compared with the other Wilson Inlet catchment sites. Using the Statewide River Water Quality Assessment (SWRWQA) bands, median TSS concentrations were moderate in all years except 2009 and 2018. The 2018 median was the third highest of all sites sampled (4 mg/L; the only sites with higher medians were Cuppup Creek and Little River, both with 7 mg/L). Between 2010 and 2016, TSS was collected sporadically so the data have not been graphed.

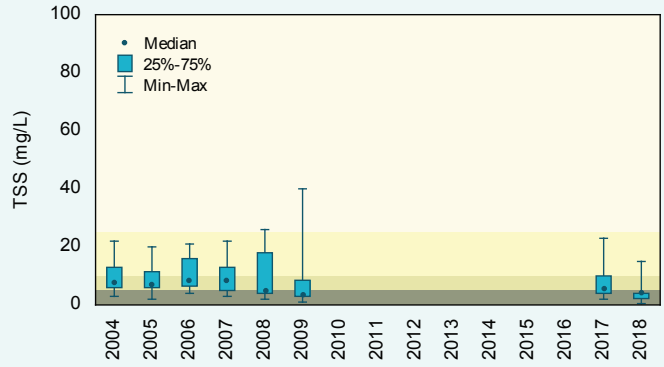
Trends

As TSS was sporadically collected between 2010 and 2016, it was not possible to perform trend tests.

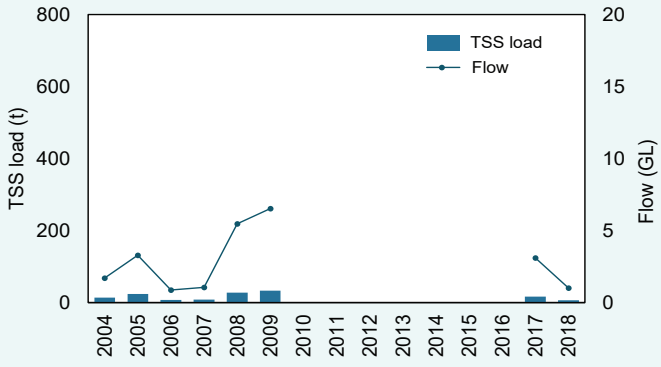
Estimated loads

Estimated TSS loads at the site on Sunny Glen Creek were small compared with the other sites in the Wilson Inlet catchment. In 2018, the load was 7 t, the smallest TSS load of the six monitored catchments of the Wilson Inlet (the next largest load was at the Hay River site, 44 t). This small load was because of the small flow volume (in 2018, Sunny Glen Creek had the smallest flow of the Wilson Inlet catchments, less than a fifth of the flow of the next catchment, Little River). The creek had the third smallest load per unit area, 200 kg/km^2 in 2018 (the Denmark River had 85 kg/km^2 and the Hay River 35 kg/km^2). Annual TSS loads were closely related to flow volumes; years with high annual flow had large TSS loads and vice versa.

Sunny Glen Creek



Total suspended solids concentrations, 2004–18 at site 603022. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2004–18 at site 603022.

very high high moderate low

High water levels in Sunny Glen Creek, August 2017.

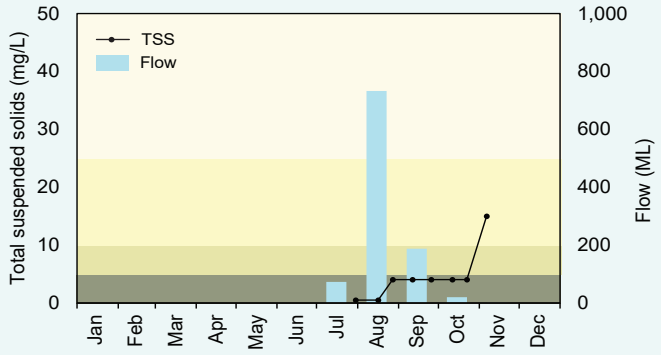
Total suspended solids (2018)

Concentrations

In 2018, all the TSS samples were in the low classification band except for the past sample, collected early in November, which was classified as high. The reason why this sample was high is unknown.

Where there are no data shown on the graph, the creek was not flowing.

Sunny Glen Creek



2018 total suspended solids concentrations and monthly flow at 603022. The shading refers to the SWRWQA classification bands.

very high high moderate low

Sunny Glen Creek during high flows, August 2019.

Sunny Glen Creek

pH over time (2004–18)

pH values

Over the past 15 years, pH fluctuated in Sunny Glen Creek. Almost all years had a portion of their samples below the lower ANZECC trigger value. The lower than usual pH values in 2016 and 2017 were likely caused by a faulty probe (see comment under 'pH (2018)').

Trends

There were no trends in pH at Sunny Glen Creek over either the short- (2014–18) or long-term (2004–18).

pH (2018)

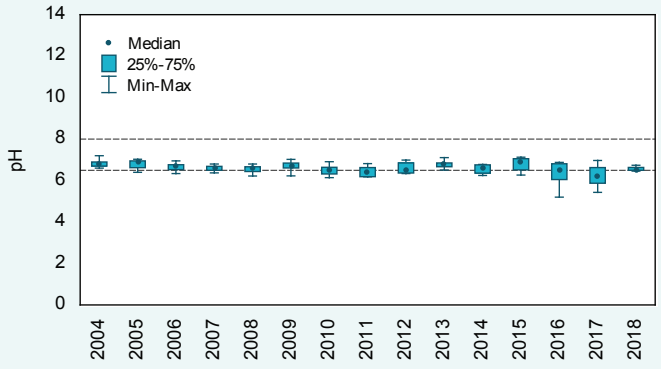
pH values

All the pH readings in 2018 were very close to the lower ANZECC trigger value, with half just below it. There was very little variation in pH throughout the year.

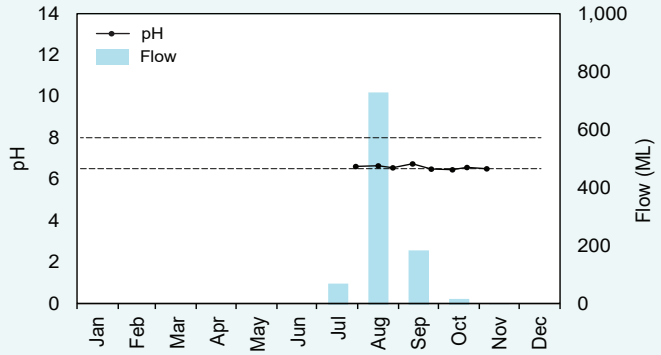
Where there are no data shown on the graph, the creek was not flowing.

There is some concern that the probe used to collect the pH data from the catchments of Wilson Inlet (including the Sunny Glen Creek site) from about October 2016 to October 2017 was not functioning correctly. This may have caused the pH to be recorded as lower than it actually was. After October 2017, a new probe was used and the pH increased and stabilised. Although there is no way of verifying the 2016–17 pH data, they have still been presented here.

Sunny Glen Creek



pH levels, 2004–18 at site 603022. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels and monthly flow at 603022. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Sunny Glen Creek, completely dry, May 2018.

Sunny Glen Creek

Salinity over time (2004–18)

Concentrations

Salinity has fluctuated widely in Sunny Glen Creek, with some years having only a very small range in salinity (e.g. 2014 and 2018) and others a large range (e.g. 2012 and 2015). Using the SWRWQA bands, the median salinity has varied from fresh to brackish. Salinity was not recorded between 2003–11.

Trends

Trend testing showed that there were no trends in salinity in Sunny Glen Creek.

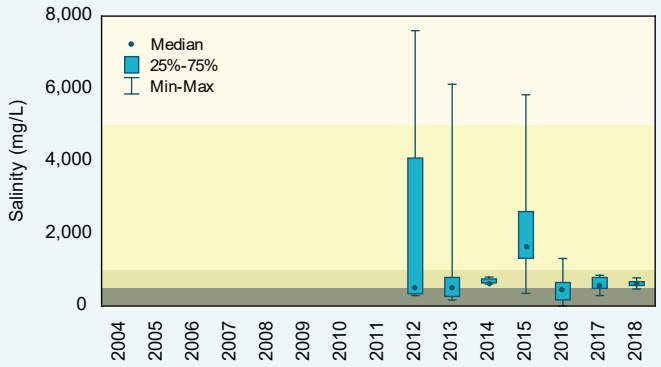
Salinity (2018)

Concentrations

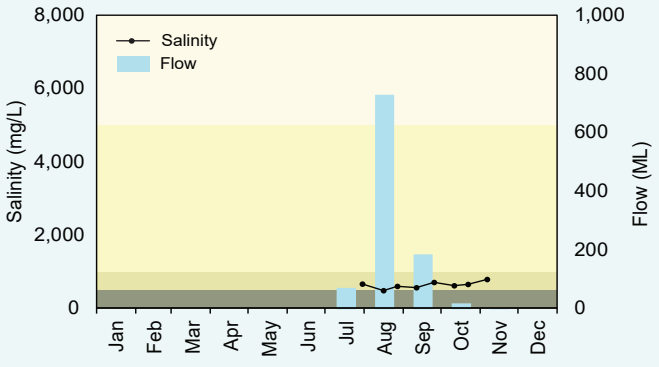
In 2018, all salinity samples collected fell into the marginal band with the exception of the one collected in early August which was fresh. Salinity showed little variation during the year.

Where there are no data shown on the graph, the creek was not flowing.

Sunny Glen Creek



Salinity concentrations, 2004–18 at site 603022. The shading refers to the SWRWQA classification bands.



Salinity concentrations, 2004–18 at site 603022. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

The Sunny Glen Creek sampling site. With the exception of the trees, the fringing vegetation is exotic.

Sunny Glen Creek

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 Wilson Inlet at estuaries.dwer.wa.gov.au/estuary/wilson-inlet/

The Regional Estuaries Initiative partners with the Wilson Inlet Catchment Committee 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 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

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.

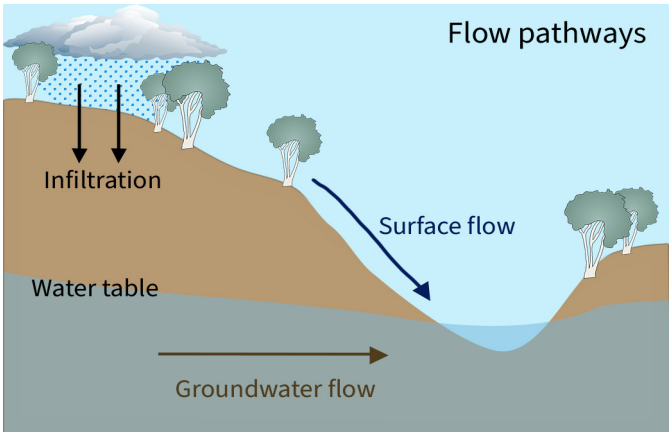
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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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