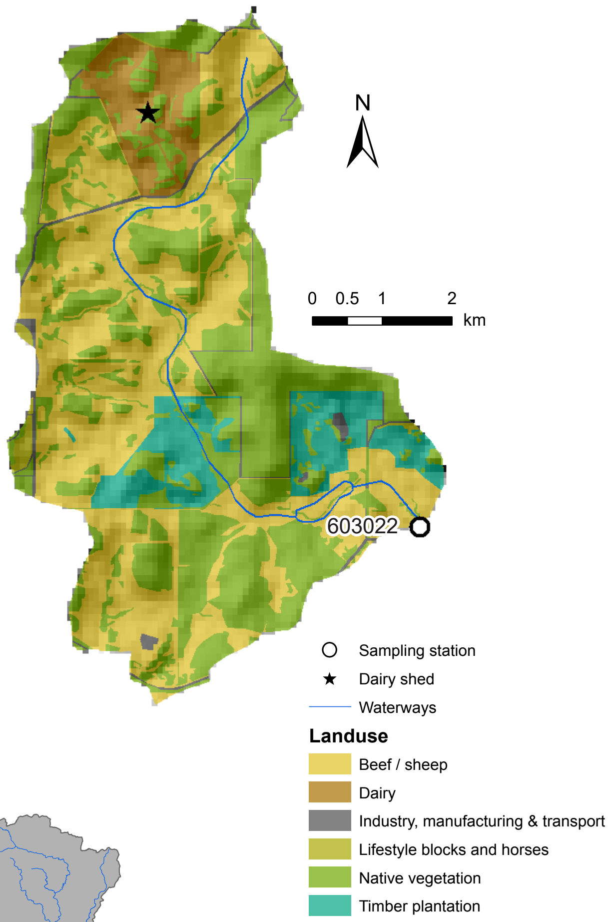
GOVERNMENT OF WESTERN AUSTRALIA
Department of **Water and Environmental Regulation**
Department of **Primary Industries and Regional Development**

Sunny Glen Creek

This data report provides a summary of the nutrients at the Sunny Glen 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 this site, the creek enters the estuarine portion of the Hay River which then discharges to Wilson Inlet.



About the catchment

Sunny Glen Creek has a catchment area of about 35 km², more than 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.

Most of the soils in the catchment bind phosphorus poorly, meaning that any phosphorus applied to them can travel to the waterways.

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 classified as high to 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 square kilometre 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
Catchment area	35 km²
Per cent cleared area (2014)	58 per cent
River flow	Ephemeral, dries over summer
Main land use (2014)	Beef cattle grazing and native vegetation

Estimated loads and flow at Sunny Glen Creek

603022	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	3.3	0.9	1.0	5.5	6.5	1.3	3.6	2.9	4.1	0.7	0.7	3.5	3.1	1.0	0.6
TN load (t)	7.5	1.9	2.4	12	14	2.8	8.0	6.4	9.2	1.4	1.5	7.9	6.9	2.3	1.2
TP load (t)	0.74	0.19	0.23	1.16	1.37	0.28	0.79	0.62	0.88	0.14	0.14	0.79	0.66	0.23	0.12

Nitrogen over time (2005–19)

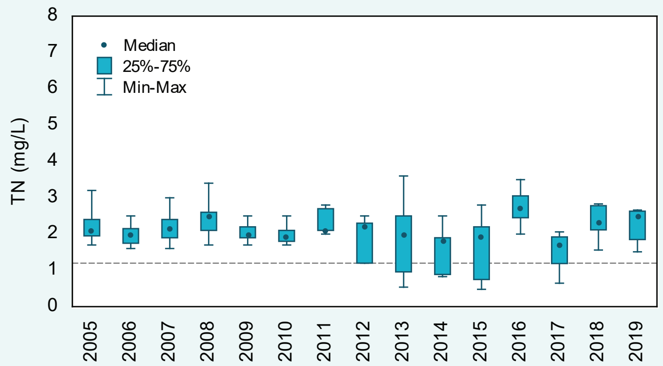
Concentrations

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. Using the Statewide River Water Quality Assessment (SWRWQA) methodology, 2008–14 were classified as very high and all other years were classified as high. The 2019 median was the highest of the sampled sites in the Wilson Inlet catchment (2.5 mg/L).

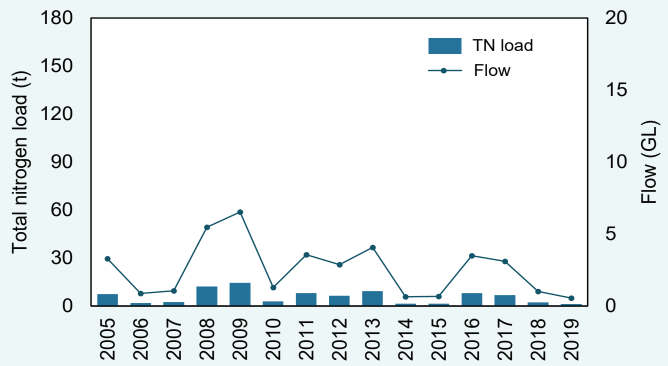
Estimated loads

Estimated TN loads at the sampling site on Sunny Glen Creek were small compared with the other Wilson Inlet catchments. In 2019, the load was 1.2 t, the smallest of the six monitored catchments of the Wilson Inlet (the next largest load was at Little River, 3.7 t). The small load was because of the small flow volume (in 2019, Sunny Glen Creek had the smallest flow of the Wilson Inlet catchments, less than a sixth of the flow of the next catchment, Cuppup Creek); TN concentrations were high. The creek had a moderate load per square kilometre, with 34 kg/km^2 in 2019 (only the Denmark River at 11 kg/km^2 and the Hay River at 6.0 kg/km^2 had smaller loads per square kilometre). Estimated TN loads were closely related to flow volumes; years with large annual flow volumes had large TN loads and vice versa.

Sunny Glen Creek



Total nitrogen concentrations, 2005–19 at site 603022. The dashed line is the ANZECC trigger value.



Total nitrogen loads and annual flow, 2005–19 at site 603022.

The Sunny Glen Creek sampling site, July 2017.

Sunny Glen Creek

Nitrogen (2019)

Types of nitrogen

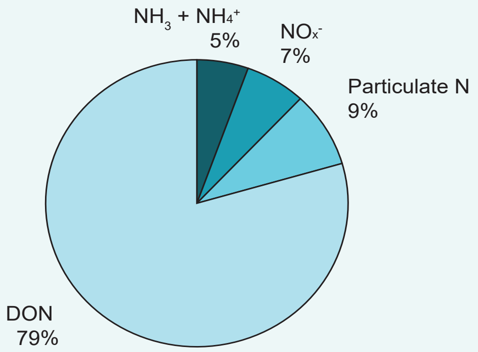
Total N is made up of different types of N. In Sunny Glen Creek, most of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may include other, bioavailable types. Particulate N is composed of plant and animal detritus. Most types of particulate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

Concentrations

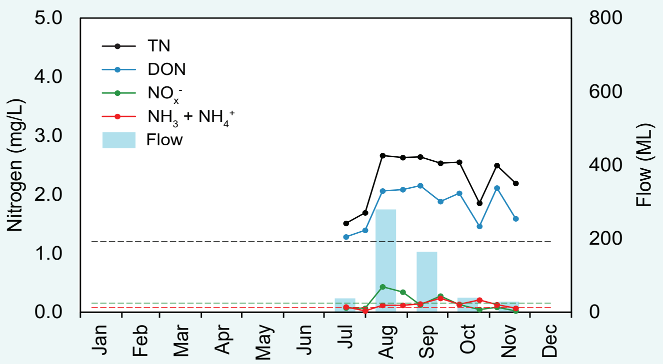
Concentrations varied during 2019 with evidence of a seasonal pattern in all types of N. These increased after the creek started to flow in July and August, then decreased later in the year. This suggests that most of the N was entering the creek via surface flows from surrounding land uses as well as from in-stream sources and groundwater. Concentrations were high, with all TN and most total ammonia samples over their respective ANZECC trigger values. The reason for the dip in TN and DON concentrations in October is unclear though it was raining on that day.

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

Sunny Glen Creek



2019 average nitrogen fractions at site 603022.



2019 nitrogen concentrations and monthly flow at 603022. The dashed lines are the ANZECC trigger values 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 (2005–19)

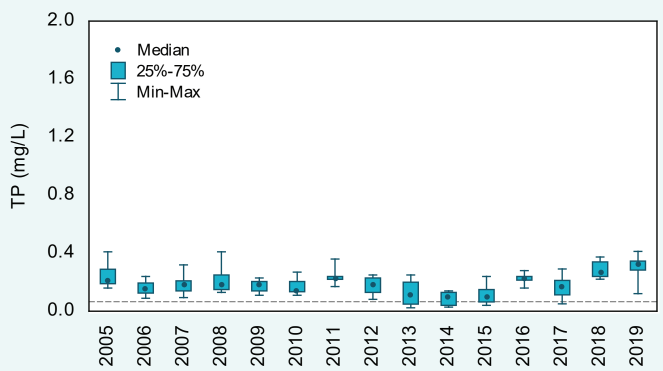
Concentrations

Annual total phosphorus (TP) concentrations were classified as very high using the SWRWQA methodology from 2005–06 and from 2018–19. From 2007–17, they were classified as high. While concentrations fluctuated over the reporting period, 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 2019 median was the highest of the monitored sites (0.324 mg/L); the Sleeman River had the next highest median of 0.118 mg/L.

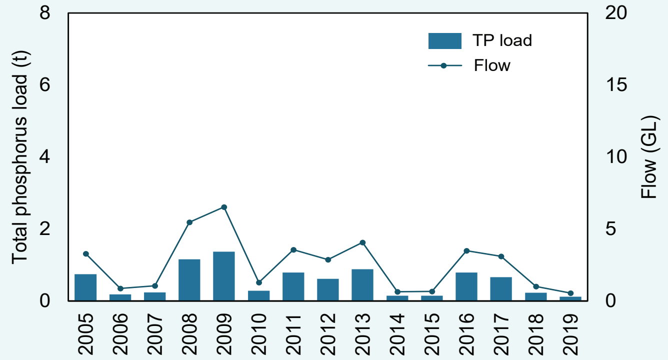
Estimated loads

Estimated TP loads at the site on Sunny Glen Creek were small compared with the rest of the Wilson Inlet catchments. In 2019, the load was 0.12 t, the smallest TP load of the six monitored catchments of the Wilson Inlet (the Hay River had a similar load of 0.13 t). This small load was because of the small flow volume (in 2019 Sunny Glen Creek had the smallest flow volume of the Wilson Inlet catchments, less than a sixth of the flow of the next catchment, Cuppup Creek). The creek, along with Scotsdale Brook, had the equal third smallest load per square kilometre, with 3.4 kg/km^2 in 2019 which was moderate compared with the other Wilson Inlet catchments. Annual TP loads were closely related to flow volumes; years with large annual flow volumes had large TP loads and vice versa.

Sunny Glen Creek



Total phosphorus concentrations, 2005–19 at site 603022. The dashed line is the ANZECC trigger value.



Total phosphorus loads and annual flow, 2005–19 at site 603022.

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

Sunny Glen Creek

Phosphorus (2019)

Types of phosphorus

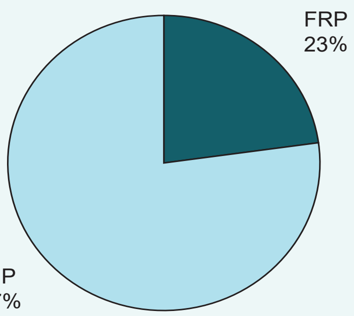
Total P is made up of different types of P. In Sunny Glen Creek, just under a quarter of the P was present as phosphate; measured as filterable reactive phosphorus (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species and is readily bioavailable. Phosphate was probably derived 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 (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

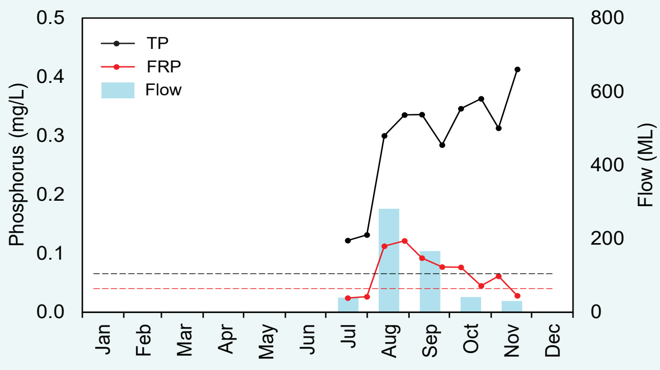
Both TP and phosphate concentrations varied seasonally in Sunny Glen Creek, with concentrations increasing after the creek started flowing in July. Phosphate concentrations then behaved in a similar way to 2018, dropping over the remainder of the year. TP concentrations continued to increase, however, with the highest concentration recorded in November, just before the creek dried up. There were no TP and only three phosphate samples 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. Groundwater would also have been contributing P.

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

Sunny Glen Creek



2019 average phosphorus fractions at site 603022.



2019 phosphorus concentrations and monthly flow at 603022. The dashed lines are the ANZECC trigger values 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 (2005–19)

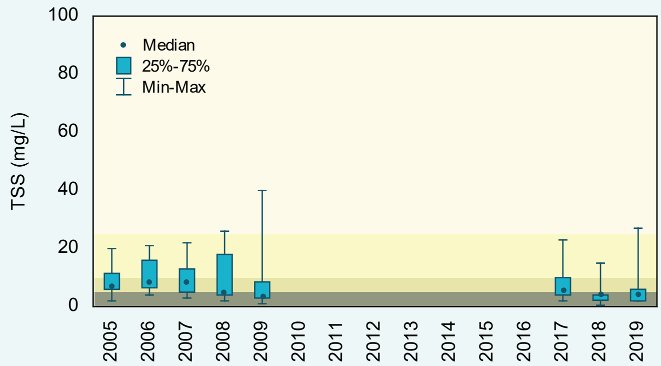
Concentrations

Total suspended solids (TSS) concentrations fluctuated over the reporting period. TSS concentrations were classified as moderate using the SWRWQA methodology in all years except 2019, when they were classified as low. Between 2010 and 2016, TSS was collected sporadically so the data have not been graphed.

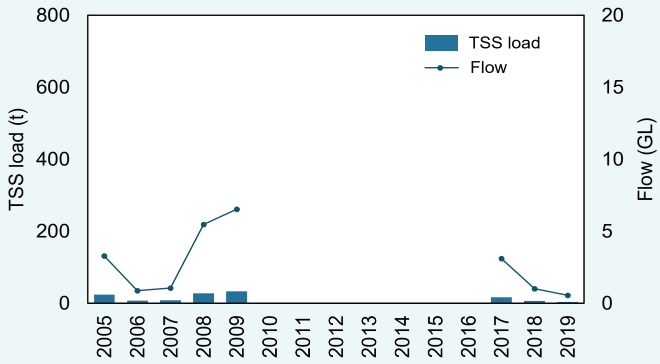
Estimated loads

Estimated TSS loads at the site on Sunny Glen Creek were small compared with the other sites in the Wilson Inlet catchment. In 2019, the load was 4 t, the smallest TSS load of the six monitored catchments of the Wilson Inlet (the next largest load was at the Hay River site with 9 t). This small load was because of the small flow volume (in 2019, Sunny Glen Creek had the smallest flow volume of the Wilson Inlet catchments, less than a sixth of the flow of the next catchment, Cuppup Creek). The creek had the third smallest load per square kilometre, 114 kg/km^2 in 2019 (the Denmark River had 35 kg/km^2 and the Hay River 7 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.

Sunny Glen Creek



Total suspended solids concentrations, 2005–19 at site 603022. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 603022.

low moderate high very high

High water levels in Sunny Glen Creek, August 2017.

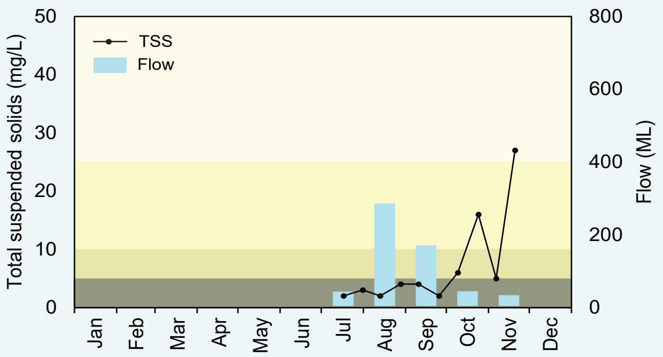
Total suspended solids (2019)

Concentrations

In 2019, TSS concentrations showed a similar pattern to 2018, being low in the first part of the flow year, and then increasing in October. This increase later in the year may be because of evapoconcentration or perhaps more livestock is accessing the creek for water and, by doing so, damaging the beds and banks of the creek, releasing particulate matter.

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

Sunny Glen Creek



2019 total suspended solids concentrations and monthly flow at 603022. The shading refers to the SWRWQA classification bands.

low moderate high very high

Sunny Glen Creek during high flows, August 2019.

Sunny Glen Creek

pH over time (2005–19)

pH values

pH fluctuated in Sunny Glen Creek over the reporting period. Almost all years had a portion of their samples below the lower ANZECC trigger value.

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) was not functioning correctly from about October 2016 to October 2017. 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.

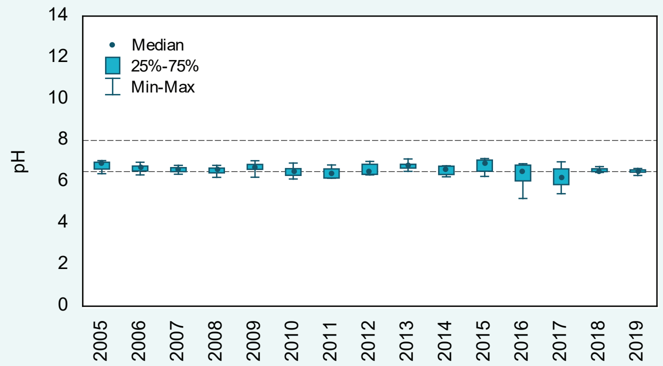
pH (2019)

pH values

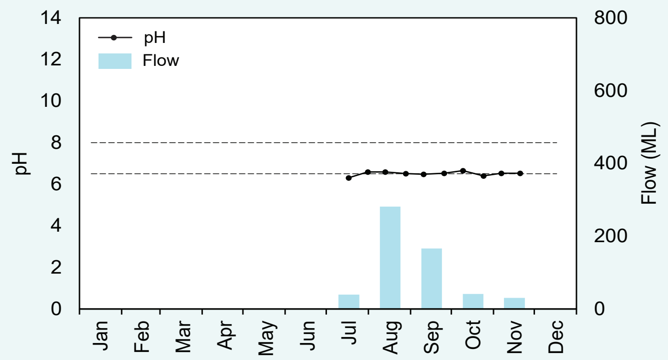
All the pH readings in 2019 were very close to the lower ANZECC trigger value, with three just below it. There was very little variation in pH throughout the year.

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

Sunny Glen Creek



pH levels, 2005–19 at site 603022. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 603022. The dashed lines are the upper and lower ANZECC trigger values.

Sunny Glen Creek, completely dry, May 2018.

Sunny Glen Creek

Salinity over time (2005–19)

Concentrations

Salinity fluctuated widely in Sunny Glen Creek over the reporting period, 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 Water Resources Inventory 2014 salinity ranges, all years were classified as marginal (note, the 2018 nutrient reports used the SWRWQA bands).

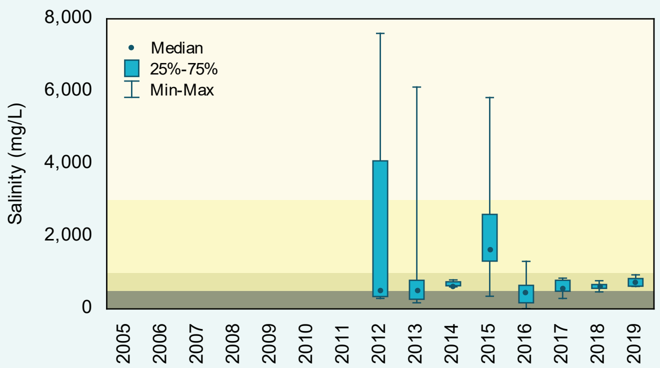
Salinity (2019)

Concentrations

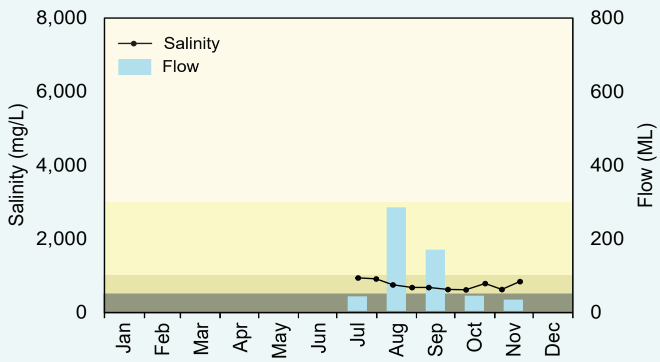
In 2018, all salinity samples collected fell into the marginal band. Salinity showed little variation during the year. Salts are likely entering the creek via surface water runoff as well as from groundwater.

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

Sunny Glen Creek



Salinity concentrations, 2005–19 at site 603022. The shading refers to the Water Resources Inventory 2014 salinity ranges.



Salinity concentrations, 2005–19 at site 603022. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

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

Sunny Glen Creek

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.

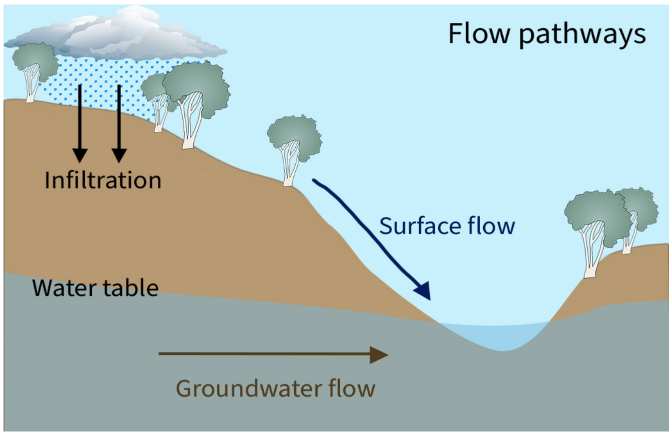
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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.



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