

Wilson Inlet catchment

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Nutrient report 2023

This data report provides a summary of nutrients in the waterways of the Wilson Inlet catchment in 2023. Excess nutrients are one of the most significant pressures on our waterways and estuaries and can lead to algal blooms and fish kills.

About the catchment

Wilson Inlet (Nullaki) has a catchment area of about 2,250 km². Nearly half of the catchment (47 per cent) has been cleared, mostly for livestock grazing, plantations, horticulture and residential land uses. Large areas of flat and waterlogged land have been artificially drained to enable agriculture, particularly in the south-east, which forms part of the Albany Drainage District. The clearing and drainage have changed the hydrological pathways (which determine how much and when water flows into the inlet), and increased the concentrations of nutrients in the waterways. Together with climate change, this puts pressure on Wilson Inlet. Soil types also influence nutrient concentrations (especially phosphorus) because some soil types bind phosphorus better than others, preventing it from entering waterways.

Five rivers enter Wilson Inlet: the Hay and Sleeman rivers and Cuppup Creek on the eastern side of the inlet, and the Denmark and Little rivers on the western side of the inlet. The two largest rivers, the Hay and the Denmark, drain about 88 per cent of the catchment. Scotsdale Brook and Sunny Glen Creek do not directly flow to the inlet but join the Denmark and Hay Rivers respectively, a few kilometres upstream of the inlet.

Water quality monitoring is carried out fortnightly at eight sites in seven subcatchments, the Denmark River subcatchment being the only one with two sites.



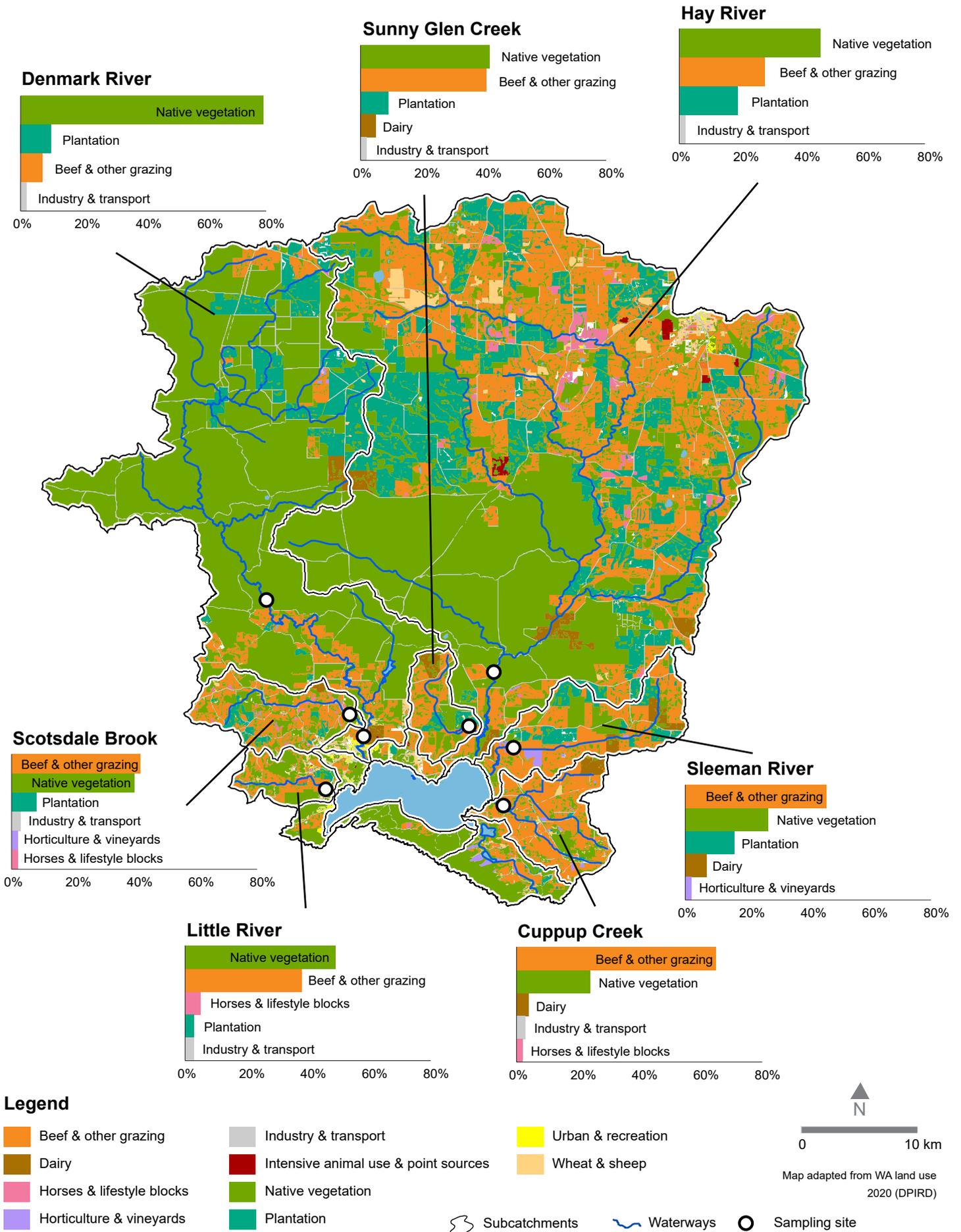
Key points:

- ⇒ Cuppup and Sunny Glen creeks and the Sleeman River are priorities for nutrient management
- ⇒ Nitrogen concentrations in the Hay River were higher in 2023 than previously
- ⇒ Nutrient concentrations in the Denmark and Scotsdale rivers remain low

Facts and figures

Catchment area	2,250 km ²
Per cent cleared area (2020)	47 per cent
Main rivers flowing into Wilson Inlet	Hay, Denmark, Sleeman and Little rivers and Cuppup Creek
River flow to Wilson Inlet (2023)	150 GL
Main land use (2020)	Native vegetation, beef and sheep farming and plantations

Wilson Inlet catchment land use map



The percentage land use graphs show the most common land use in each subcatchment. Graphs have only been prepared for the monitored subcatchments.

Map produced March 2024

Subcatchment summaries (2023)

Subcatchments are smaller areas of water catchments where all the rain falling in the local area flows to the same waterway.



Cuppup Creek

Cuppup Creek is a priority for management. It did not meet our nitrogen or phosphorus water quality objectives, which are nutrient concentrations we aim to achieve for healthy waterways. It also contributed the second largest phosphorus load and the largest load per square kilometre for both nitrogen and phosphorus.



Little River

Water quality in Little River is currently good, meeting both our nitrogen and phosphorus water quality objectives. It contributed only a small volume of water and a small nitrogen and phosphorus load to the inlet.



Denmark River

Overall the water quality in the Denmark River was good. It met both our nitrogen and phosphorus water quality objectives. While it contributed the equal largest volume of water (with the Hay River) to Wilson Inlet, it had a relatively small load per square kilometre for both nitrogen and phosphorus.



Scotsdale Brook

Water quality in Scotsdale Brook is currently good and met both our nitrogen and phosphorus water quality objectives. While it contributes a similar load per square kilometre to Sunny Glen Creek and Little River, nutrient concentrations were much lower than at Sunny Glen Creek.



Hay River

The water quality in the Hay River is still generally good, but for the first time, it didn't meet our nitrogen water quality objective. Ongoing monitoring will help us figure out if nitrogen concentrations are increasing or if this year's concentrations were just unusually high. It still meets our phosphorus water quality objective. It contributed the equal largest volume of water to the inlet (along with the Denmark River). While the nitrogen and phosphorus loads per square kilometre were small, the total load of nitrogen delivered to the inlet was the largest among all subcatchments, due to the large flow volume. The Hay River is also the saltiest of all subcatchments, and is classified as saline.



Sleeman River

The Sleeman River is a priority for management. The water quality is poor and did not meet our nitrogen or phosphorus water quality objectives. A large proportion of phosphorus was present as phosphate which can cause excess plant growth, algal blooms and fish kills. The Sleeman River contributed the second largest loads per square kilometre (behind Cuppup Creek).



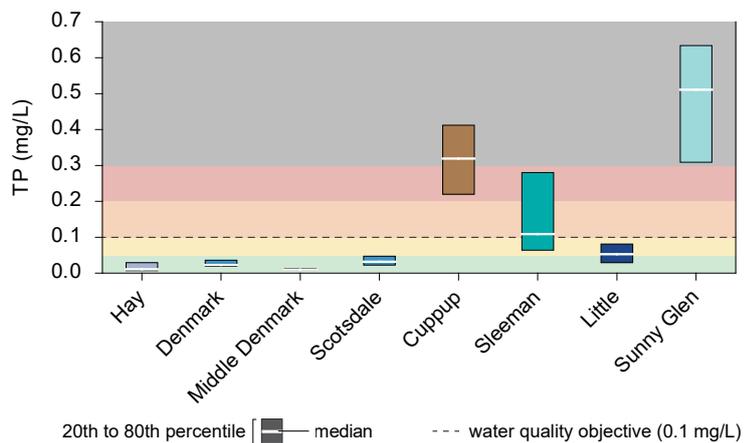
Sunny Glen Creek

Sunny Glen Creek is a priority for management. The water quality is poor and did not meet our nitrogen or phosphorus water quality objectives. It had the highest nitrogen and phosphorus concentrations of the monitored sites, and phosphorus concentrations appear to be increasing. Much of the phosphorus is present as phosphate which can cause excess plant growth, algal blooms and fish kills.

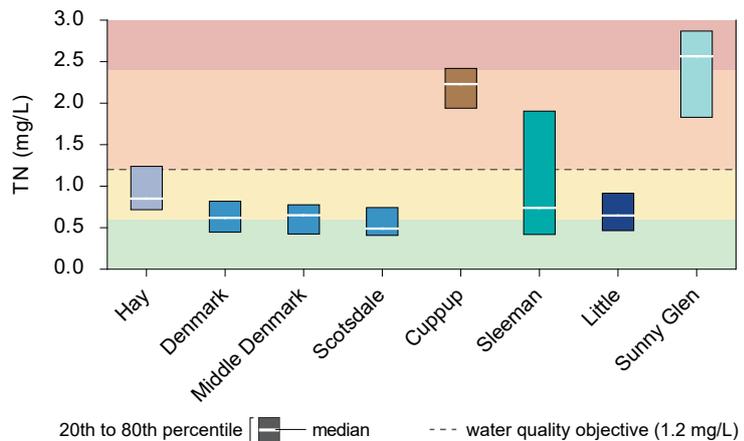
Nutrient concentrations (2023)

Nutrient concentrations varied significantly between the monitored sites. Cuppup and Sunny Glen had the highest median concentrations of both total phosphorus and total nitrogen. These sites, along with the Sleeman, also had the greatest variation in concentrations across the year. The combination of high median concentrations and a large range in concentrations is caused by the mix of agricultural land use, modification to waterways, and construction of drains in these subcatchments.

The median phosphorus concentration was in the low category at the Hay, Denmark and Scotsdale sites. All of these subcatchments have large areas of soils with a good capacity to bind phosphorus. These soils keep phosphorus, like that from fertilisers, from entering the groundwater or running off into waterways. The lowest nitrogen concentrations were also recorded at these sites.



2023 Total phosphorus concentrations



2023 Total nitrogen concentrations

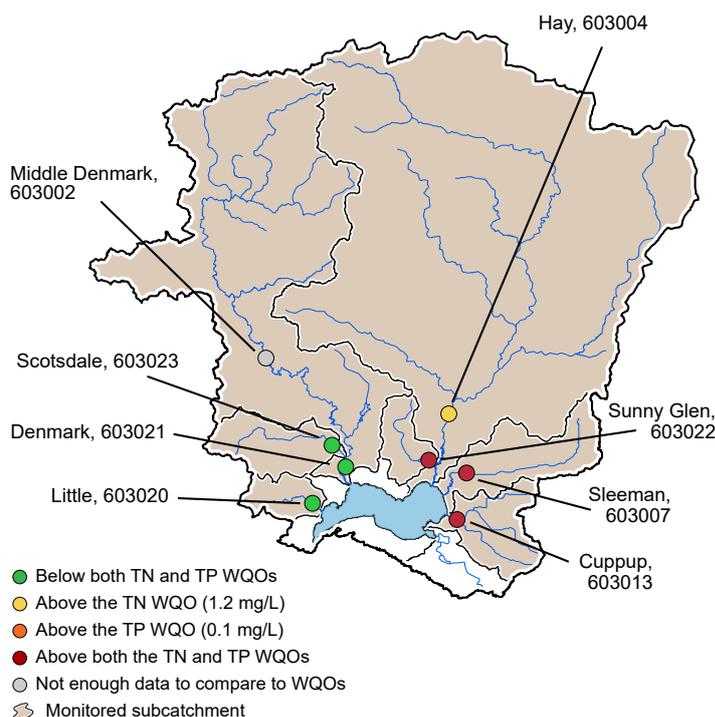
low moderate high very high extreme

Performance against water quality objectives (2021–23)

Water quality objectives (WQOs) are the nutrient concentrations we aim for to protect the health of the inlet. For Wilson Inlet, the WQOs were developed as part of the water quality modelling undertaken for the Wilson Inlet catchment. Performance against the WQOs were calculated by comparing the three-year (2021–23) wet month (June to October inclusive) medians to the relevant water quality objective.

Scotsdale, Denmark and Little met both their total nitrogen (1.2 mg/L) and total phosphorus (0.1 mg/L) WQOs. Sunny Glen, Sleeman and Cuppup did not meet either WQO and the Hay River met the total phosphorus but did not meet the total nitrogen WQO. This is the first time that the Hay River has been above the total nitrogen WQO. Ongoing monitoring will help us figure out if nitrogen concentrations are increasing in the Hay River or if the 2021-23 concentrations were just unusually high.

Note: the graphs above show all data (January to December inclusive) collected in 2023, whereas performance against the WQOs are calculated using three-year (2021–23) wet months (June to October) medians. We use a three-year median as it reduces the impact of natural variation between years. This is why a median may be below the WQO in the graphs yet the site may be shown as being above the WQO in the map, as is the case for nitrogen concentrations at Sleeman.

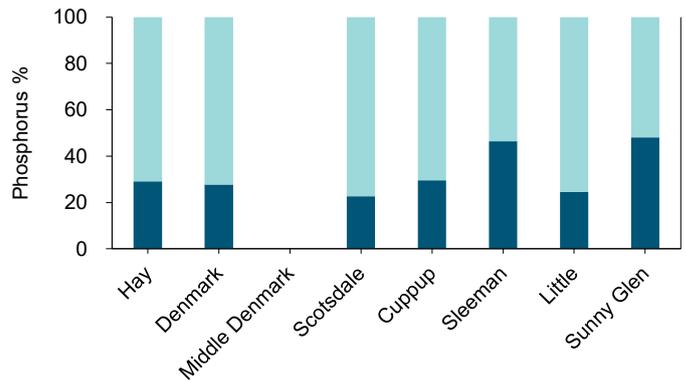


How each site performed against the TN (1.2 mg/L) and TP (0.1 mg/L) water quality objectives in 2021–23

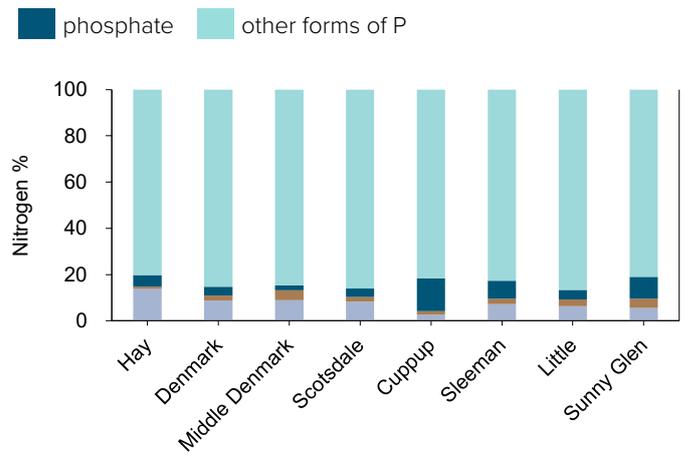
Wet month nutrient forms (2023)

The Sleeman and Sunny Glen sites had the largest proportion of phosphorus present as **phosphate** which can lead to algal blooms and fish kills. The soils along the waterways in both of these subcatchments tend to bind phosphorus poorly so any phosphorus added (such as in fertiliser) can quickly move to the waterways. These soils, in conjunction with the agricultural land uses present, are the main reason for the large proportion of phosphate present.

Dissolved organic nitrogen was the most common form of nitrogen during the wet months at all sites. The proportion of nitrogen present as **nitrate** which can lead to algal blooms and fish kills, was highest at the Hay site. Cuppup had the highest proportion of nitrogen present as **particulate nitrogen**, likely due to erosion along the drains and other waterways.



Proportion (percent) of different forms of phosphorus in the wet months (June to October) of 2023



Proportion (percent) of different forms of nitrogen in the wet months (June to October) of 2023

Total phosphorus and total nitrogen are made up of different forms, or fractions, of phosphorus and nitrogen. Understanding which forms occur helps us to determine the likely sources of the nutrients, and better target management actions.

Phosphate is readily used by plants and algae and can cause excess plant growth, algal blooms and fish kills. It is mostly derived from animal waste and fertilisers and, to a smaller extent, from natural sources. **Other forms of phosphorus** include either particulate phosphorus, dissolved organic phosphorus, or both. Particulate phosphorus usually needs to be broken down before it can be used by plants and algae. The bioavailability of dissolved organic phosphorus varies and is poorly understood.

Dissolved organic nitrogen comes from both natural and human sources, and consists of various compounds. Some, like urea (found in fertiliser and

animal urine), are bioavailable to algae. Others, like proteins and humic acids which mostly come from broken-down pasture and manure as well as natural vegetation, need to be broken down further before plants and algae can use them. **Particulate nitrogen**, which comes from plant and animal matter, also generally needs to be broken down before it can be used by plants and algae.

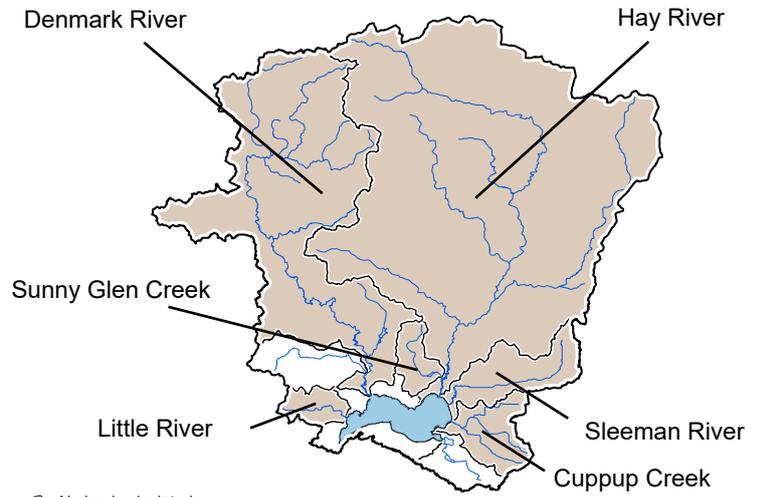
Dissolved inorganic nitrogen (**nitrate** and **total ammonia**) is readily used by plants and algae and can cause excess plant growth, algal blooms and fish kills. These nitrogen forms are typically at their highest levels when waterways begin to flow after autumn or winter rains. This is because, during summer, organic nitrogen in the soil and dry waterways breaks down into nitrate and total ammonia. Additionally, fertilisers and animal waste accumulate on agricultural land. When the rainfall starts, it washes this nitrogen into the waterways.

Flow and nutrient loads to the inlet (2023)

In 2023, the Hay and Denmark rivers together contributed the majority (68 per cent) of the total flow to Wilson Inlet. Cuppup Creek and Sleeman River contributed similar amounts to each other while Little River and Sunny Glen Creek had the smallest amounts of flow. Nutrient loads, which are the total amount of nutrients leaving a subcatchment each year, are calculated by multiplying the flow at a site by the nutrient concentration. This means that, in general, there's a close relationship between flow volumes and nutrient loads—subcatchments with large flows tend to have large nutrient loads and vice versa. However, if a subcatchment has very high nutrient concentrations, this may not always be true.

In 2023, most of the phosphorus load entering the Wilson Inlet came from Sleeman River and Cuppup Creek. Both of these sites had phosphorus concentrations above the water quality objective, with concentrations highest during the wet months when most of the flow (and load) was leaving the subcatchments. Even though the Hay and Denmark rivers had by far the largest flow volumes, their phosphorus loads were relatively small, because of their low phosphorus concentrations.

Nitrogen loads followed a similar pattern to flow volumes in 2023 with a few exceptions. The Denmark River & Scotsdale Brook site had a proportionally smaller load while Cuppup Creek and the Sleeman River had proportionally larger loads than flow volumes. This difference is due to the higher nitrogen concentrations at Cuppup Creek and Sleeman River.

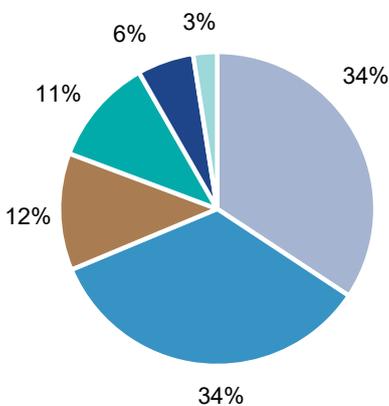


No load calculated
 Subcatchment where a load has been calculated

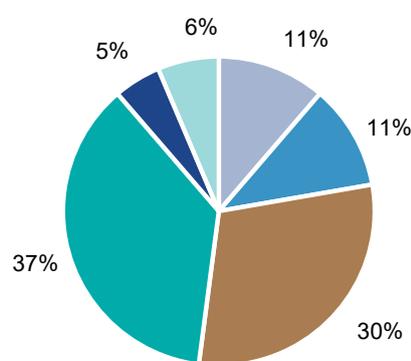
Subcatchments for which a load entering the inlet has been calculated

Despite having the worst nutrient concentrations, Sunny Glen Creek contributed only a small nitrogen and phosphorus load because of its small flow volume. While nutrient loads show where most of the nutrients are entering the inlet from, they are heavily influenced by changes in annual flow volumes. Concentrations, on the other hand, are less affected by flow variations and therefore provide a better measure for water quality objectives than loads do.

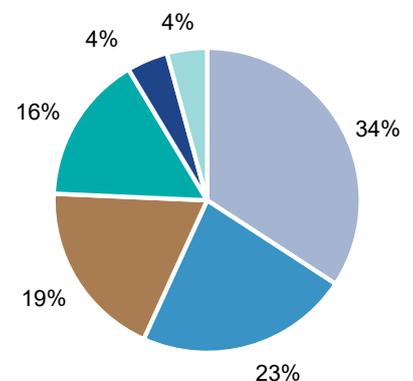
Note: while Sunny Glen Creek flows into the Hay River rather than directly into Wilson Inlet, it has been reported here because it flows into the Hay River below the Hay River sampling site. Scotsdale Brook flows into the Denmark River upstream of the Denmark River sampling site.



2023 flow



2023 TP loads



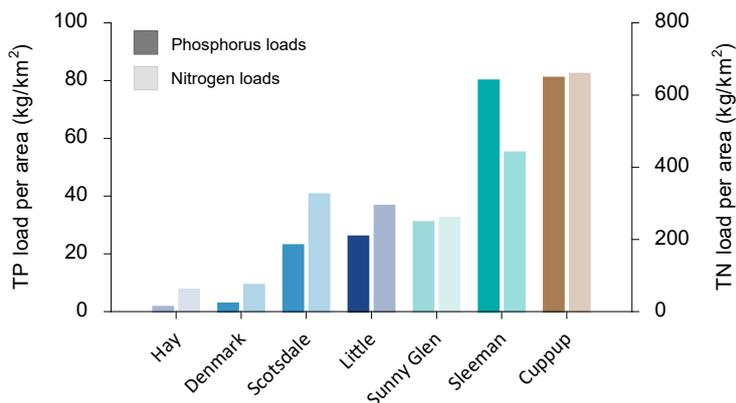
2023 TN loads



Nutrient loads per square kilometre (2023)

Another way to present nutrient load data is to divide the total annual load at a site by the area of land that contributes to that load, giving a load per square kilometre. This helps prioritise management actions as it allows us to identify those subcatchments where actions in the catchment to reduce nutrient losses are likely to have the biggest impact.

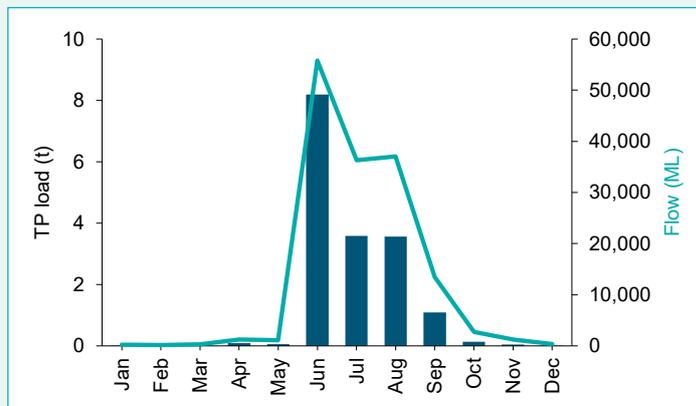
Cuppup Creek and the Sleeman River both contributed the largest phosphorus and nitrogen loads per square kilometre suggesting these should be prioritised for management. Sunny Glen Creek contributed slightly less but the high nutrient concentrations at this site mean it is still a priority for management. Both the Hay River and the Denmark River had relatively small loads per square kilometre.



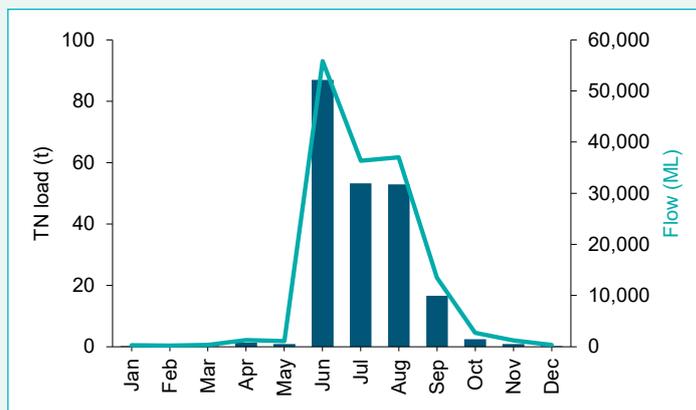
2023 loads per square kilometre for TP (dark columns, left hand axis) and TN (paler columns, right hand axis).

Monthly loads to the inlet (2023)

In 2023, the largest nitrogen and phosphorus loads entered the inlet during June when the flow volume was largest. As is clear from these graphs, loads are closely linked to flow so as the flow decreased, loads also decreased. In a typical year flow is largest during the wet months which is when most of the nutrients are entering the inlet. Once they reach the inlet the bioavailable forms are quickly included in the inlet's nutrient cycle, being used for algal and *ruppia* (seagrass) growth as well as being incorporated into the sediments. The nutrients continue to cycle in the inlet with some eventually being lost to the ocean when the sandbar is open, usually in particulate form.



2023 monthly TP loads (columns) and flow (line)



2023 monthly TN loads (columns) and flow (line)

Background

Healthy Estuaries WA is a State Government program to protect and improve the health of our estuaries. Collecting and reporting water quality data, such as in this report, helps build understanding of the whole system; both the catchment and the inlet. This allows investment to be directed towards the most effective actions in the catchments to protect and restore the health of our rivers, creeks and estuaries.

Nutrients (phosphorus and nitrogen) are compounds that are important for plants to grow. Excess nutrients entering waterways from animal waste, fertilisers and other sources can fuel algal growth, decrease oxygen levels in the water and harm fish and other species.

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 and industry groups 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 dairy effluent management visit westerndairy.com.au/healthy-estuaries-wa/
- To find out more about the ecological health of the rivers in the Wilson Inlet catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Information on the methods used can be found here: estuaries.dwer.wa.gov.au/nutrient-reports/data-analysis

Sites sampled

There are eight sites sampled in the Wilson Inlet catchment, as listed below. The number next to the site name is the unique Australian Water Resource Council code for that site.

Cuppup Creek

- Cuppup, 603013

Denmark River

- Denmark, 603021
- Middle Denmark, 603002

Hay River

- Hay, 603004

Little River

- Little, 603020

Sleeman River

- Sleeman, 603007

Scotsdale Brook

- Scotsdale, 603023

Sunny Glen Creek

- Sunny Glen, 603022

Want more?

If you would like to access the data used in the analyses in these reports please visit: wa.gov.au/service/natural-resources/water-resources/water-information-reporting. The numerical AWRC codes listed above can be used to search for the available data.