Middle Brunswick River

This data report provides a summary of the nutrients at the two Middle Brunswick River catchment sampling sites in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. The Wellesley River flows into the Brunswick River from the north. Downstream of this catchment, the Brunswick River flows into the Collie River. 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

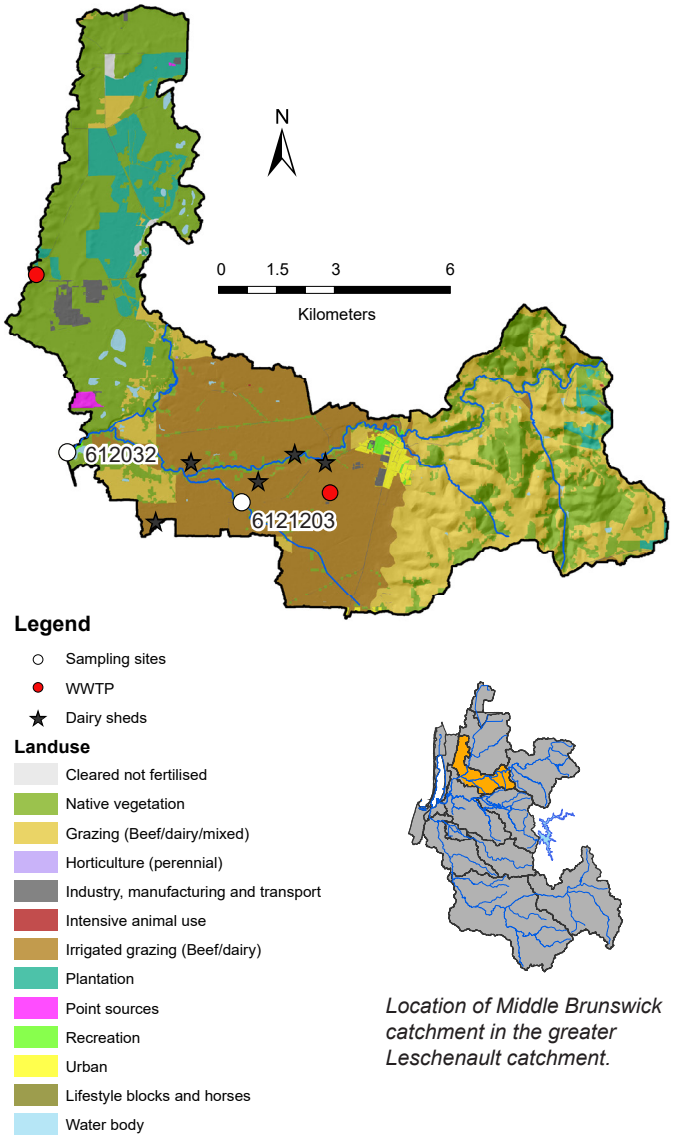
The Middle Brunswick River has a catchment area of about 99 km^2, more than half of which has been cleared, mostly for beef and dairy cattle grazing. About a third of the catchment is covered in native vegetation, the largest area of which lies in the north-west of the catchment. Part of the Collie Irrigation District lies over the central part of the catchment, below the Darling Scarp. The town of Brunswick Junction is on the Brunswick River. There are a number of dairy sheds in the catchment as well as the Brunswick Junction Waste Water Treatment Plant and the Brunswick Milk Processing Facility.

Most of the soils in the Swan Coastal Plain portion of the catchment have a low capacity to bind phosphorus, so any phosphorus applied quickly washes into drains and other waterways. The soils in the Darling Range and on the Darling Plateau are good at binding phosphorus. Fringing vegetation along the waterways has been largely lost or is degraded.

Water quality is measured at two sites. Elvira Gully (6121203) is on Elvira Gully where it passes under Clifton Road in Brunswick, and Cross Farm (612032) is on the Brunswick River where it passes under the Forrest Highway in Wellesley.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were moderate at the Brunswick River site and very high at the Elvira Gully site, caused by the intensive agricultural land use and modified nature of the waterways. Dilution by better quality water from the scarp is the likely reason for the lower concentrations found at the Brunswick River site.



Location of Middle Brunswick catchment in the greater Leschenault catchment.

Facts and figures

Sampling site code	612032 and 6121203
Catchment area	99 km^2
Per cent cleared area (2018)	64%
River flow	612032 flows year round, whereas 6121203 ceases to flow over summer
Main land use (2018)	Cattle grazing and native vegetation

Middle Brunswick River

Nitrogen over time (2004–18)

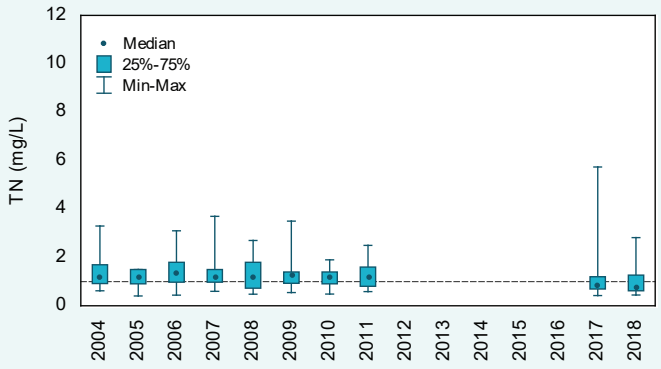
Concentrations

Total nitrogen (TN) concentrations were higher at the site in Elvira Gully than the one on the Brunswick River. At the Elvira Gully site, TN concentrations were very high with almost all samples collected above the Leschenault Water Quality Improvement Plan (WQIP) TN target for lowland rivers. At the Brunswick River site the annual median TN concentration was above the WQIP target from 2004–11, before the break in monitoring, but below in 2017–18. The Elvira Gully catchment has been almost completely cleared for agriculture, causing the very high TN concentrations observed. While the catchment immediately upstream of the Brunswick River site is similar to that of Elvira Gully, further upstream the catchment is more vegetated and consequently the river would have lower TN concentrations, diluting the poorer quality water from the Swan Coastal Plain.

Trends

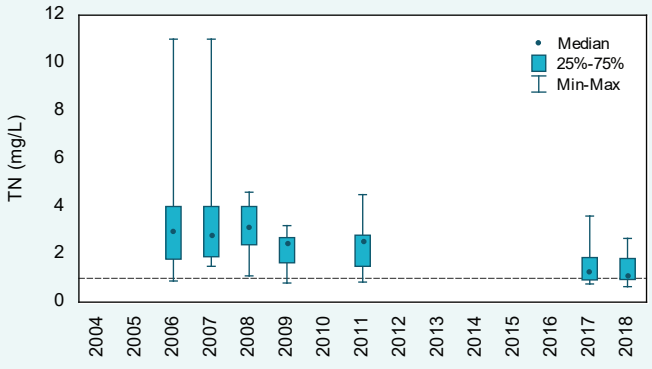
As the Middle Brunswick River sites were not sampled between 2012–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

Brunswick River



Total nitrogen concentrations, 2004–18 at site 612032, The dashed line is the Leschenault WQIP target for lowland rivers.

Elvira Gully



Total nitrogen concentrations, 2004–18 at site 6121203, The dashed line is the Leschenault WQIP target for lowland rivers.

Cattle with unrestricted access to the Brunswick River a few kilometres upstream of Brunswick Junction, December 2018. Cattle contribute nutrients directly to the river via their wastes as well as exacerbating erosion by trampling the rivers beds and banks.

Middle Brunswick River

Nitrogen (2018)

Types of nitrogen

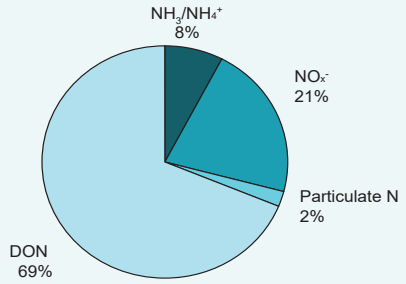
Total N is made up of many different forms of N. The composition of N was very similar at the two sampling sites in the Middle Brunswick River catchment. In 2018, most of the N was present as dissolved organic N (DON). This form of N consists mainly of plant and animal matter but may include other, bioavailable forms. Just under a third of the N was present as dissolved inorganic N (DIN – consisting of oxides of N, NO_x^-, and ammonia N, NH_3/NH_4^+). DIN is readily bioavailable for plants and algae, fuelling rapid growth. DON varies in its bioavailability. Plant and animal matter usually needs to be further broken down before becoming bioavailable, whereas other forms of DON, are readily bioavailable.

Concentrations

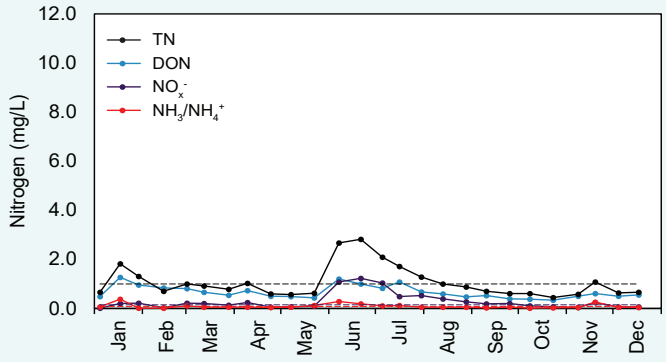
In 2018, N concentrations showed a very similar pattern at the two sites in the Middle Brunswick River catchment. Both sites showed a seasonal response, with TN, DON, NO_x^- and NH_3/NH_4^+ all increasing in June as rainfall and flow increased. This suggests that much of the N at this time was being washed into the rivers via surface runoff, with groundwater and in-stream sources contributing somewhat less. There was also a small peak in N concentrations in January. This is possibly linked to irrigation runoff or returns at this time.

Where there are no data shown in the Elvira Gully graph, the stream was not flowing.

Brunswick River

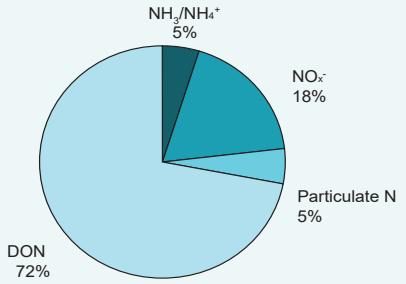


2018 average nitrogen fractions at site 612032.

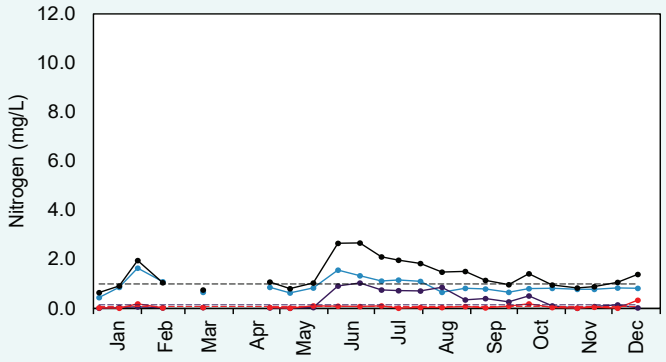


2018 nitrogen concentrations at 612032. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and purple are the ANZECC trigger values for lowland rivers.

Elvira Gully



2018 average nitrogen fractions at site 6121203.



2018 nitrogen concentrations at 6121203. The black dashed line is the Leschenault WQIP target for lowland rivers, the red and purple are the ANZECC trigger values for lowland rivers.

Middle Brunswick River

Phosphorus over time (2004–18)

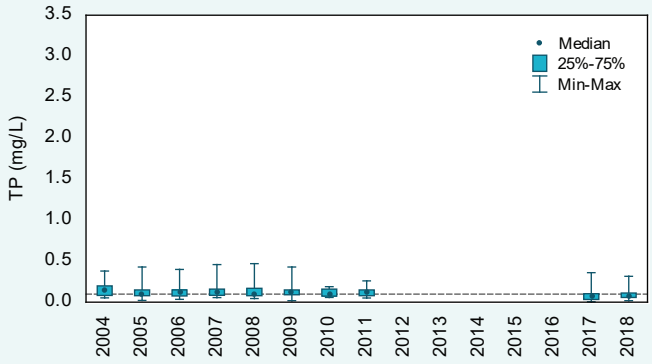
Concentrations

Total phosphorus (TP) concentrations differed at the two sampling sites in the Middle Brunswick River catchment. At the Brunswick River site, TP concentrations were moderate. Before the break in monitoring, all annual medians were only slightly above the WQIP TP target value for lowland rivers. In 2017 and 2018, the annual median was below the target. However, at the Elvira Gully site, all annual medians and most samples were above the WQIP target. There are likely two main reasons for the disparity in TP concentrations at these sites. Firstly, the entire Elvira Gully sub-catchment lies on soils with a poor phosphorus-binding capacity whereas the upper part of the Brunswick River catchment has soils with a high-phosphorus binding capacity. Secondly, the relatively undisturbed upper catchment of the Brunswick River likely contributes better water quality which dilutes the poorer quality water found in the agricultural coastal plain portion of the catchment.

Trends

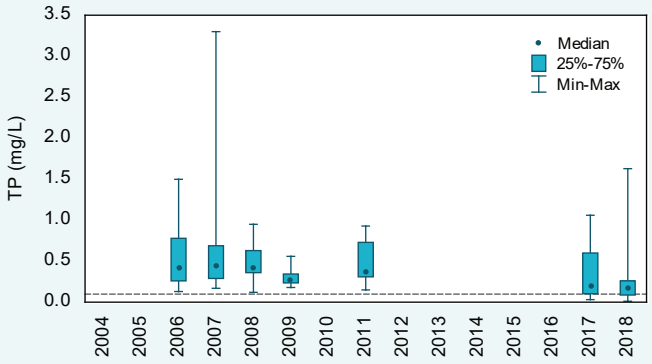
As the Middle Brunswick River sites were not sampled between 2012–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

Brunswick River



Total phosphorus concentrations, 2004–18 at site 612032. The dashed line is the Leschenault WQIP target for lowland rivers.

Elvira Gully



Total phosphorus concentrations, 2004–18 at site 6121203. The dashed line is the Leschenault WQIP target for lowland rivers.

Agricultural land in the Middle Brunswick River catchment, January 2009.

Middle Brunswick River

Phosphorus (2018)

Types of phosphorus

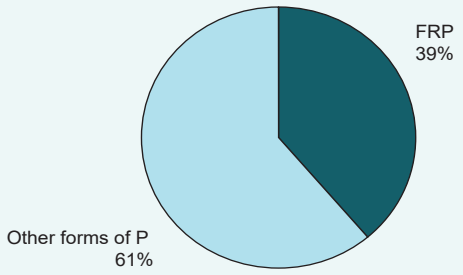
Total P is made up of different forms of P. The composition of P at the two sites in the Middle Brunswick River catchment was similar. At both sites, just over a third of the P was present as highly bioavailable filterable reactive P (FRP). This form of P is readily used by plants and algae to fuel rapid growth. The FRP was probably derived from animal waste and fertilisers as well as natural sources. The remaining P was present as either particulate P, dissolved organic P (DOP) or both (shown as 'Other forms of P' in the charts below). Particulate P generally needs to be broken down before becoming bioavailable to algae. The bioavailability of DOP varies and is poorly understood.

Concentrations

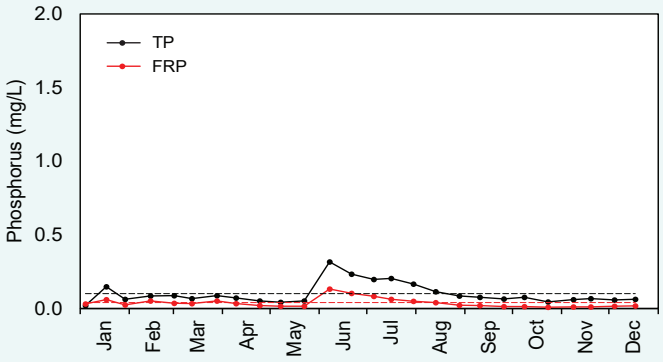
Overall, the pattern in TP and FRP concentrations over 2018 was similar in the two Middle Brunswick River catchment sites. TP and FRP concentrations increased in June as rainfall and flow increased, indicating that P was being washed into the streams from upstream agricultural land use via surface flows. As for N, both sites also had a smaller peak in January which is possibly linked to irrigation runoff or returns at this time. The Elvira Gully site also experienced a large spike in TP concentrations in July. The reason for this spike is unknown. It is likely that much of the P at both these sites is coming from fertiliser and animal waste from agricultural land use in the catchment, and that most of it is entering the streams via surface flows and irrigation runoff/returns.

Where there are no data shown in the Elvira Gully graph, the stream was not flowing.

Brunswick River

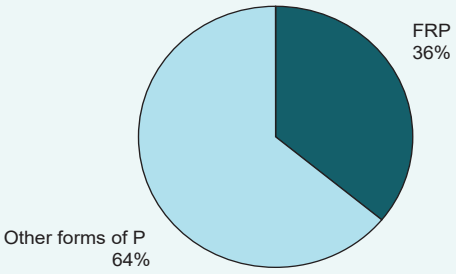


2018 average phosphorus fractions at site 612032.

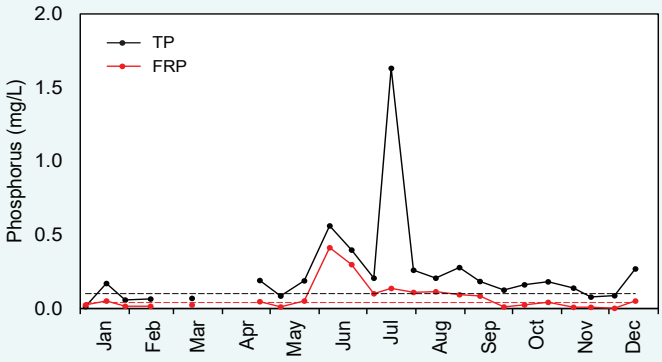


2018 phosphorus concentrations at 612032. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for lowland rivers.

Elvira Gully



2018 average phosphorus fractions at site 6121203.



2018 phosphorus concentrations at 6121203. The black dashed line is the Leschenault WQIP target for lowland rivers, the red is the ANZECC trigger value for lowland rivers.

Middle Brunswick River

Total suspended solids over time (2004–18)

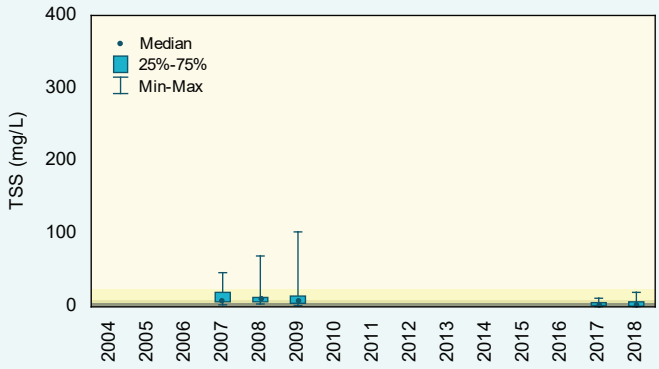
Concentrations

Total suspended solids (TSS) concentrations were higher at the Elvira Gully site than the Brunswick River site. At both sites, concentrations were higher before the break in monitoring. At the Brunswick River site, the 2007–09 annual medians were all classified as moderate using the Statewide River Water Quality Assessment (SWRWQA) classification bands. The 2017–18 annual medians were classified as low. At the Elvira Gully site, the 2007 annual median was classified as very high, the 2008–09 medians were high and the 2017–18 medians were moderate. The most likely reason for the difference in TSS concentrations between the two sites is the different land uses in the sub-catchments. Upstream of the Elvira Gully site, the catchment is almost entirely cleared for agriculture so there is a large potential for particulate matter to runoff into the stream, as well as in-stream erosion. Immediately upstream of the Brunswick River site the land use is also agriculture; however, further upstream the catchment is less disturbed so likely contributes water of better quality which will help dilute the poor quality water from the Swan Coastal Plain portion of the catchment. This leads to lower TSS concentrations at the sampling site.

Trends

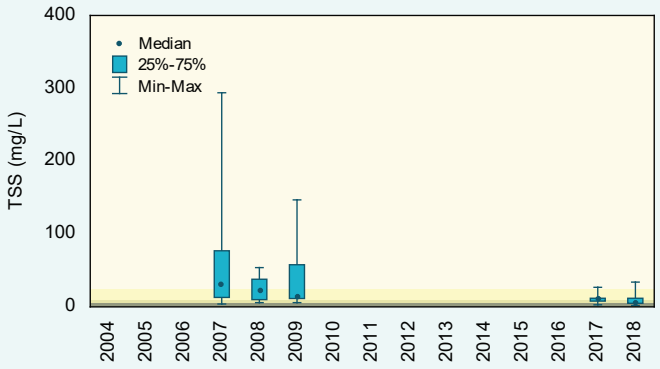
As the Middle Brunswick River sites were not sampled between 2010–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

Brunswick River



Total suspended solids concentrations, 2004–18 at site 612032. The shading refers to the SWRWQA classification bands.

Elvira Gully



Total suspended solids concentrations, 2004–18 at site 6121203. The shading refers to the SWRWQA classification bands.

very high high moderate low

The Brunswick River sampling site, December 2018.

Middle Brunswick River

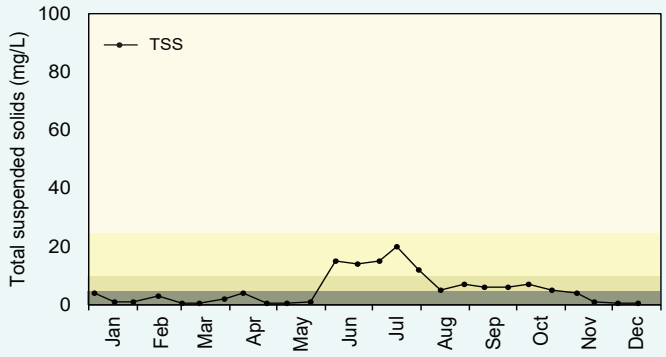
Total suspended solids (2018)

Concentrations

TSS concentrations showed different patterns at the two sampling sites in the Middle Brunswick River catchment. At the site on the Brunswick River, TSS showed a seasonal response, being generally low in the first part of the year before increasing as rainfall and flow increased in June. Concentrations then remained high during the wetter months before falling again later in the year. This suggests that much of the particulate matter was being washed into the stream via surface flows at this site. The Elvira Gully site showed a different pattern; again it was lower during the first part of the year but from about May there were a number of spikes in TSS concentrations during the rest of the year. This suggests that particulate matter was likely entering the stream via surface runoff as well as potentially coming from irrigation returns as well as in-stream erosion. If cattle have access to the stream then this will be exacerbating the erosion.

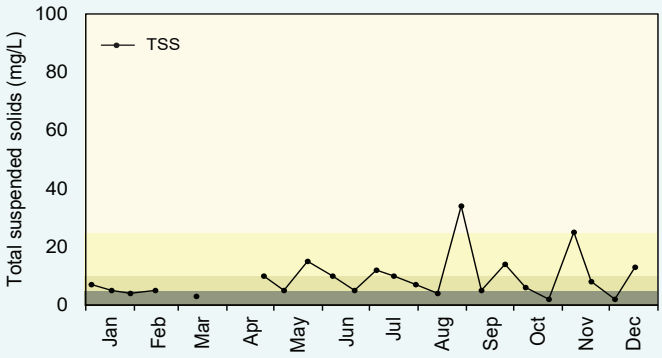
Where there are no data shown on the Elvira Gully graph, the stream was not flowing.

Brunswick River



2018 total suspended solids concentrations at 612032. The shading refers to the SWRWQA classification bands.

Elvira Gully



2018 total suspended solids concentrations at 6121203. The shading refers to the SWRWQA classification bands.

very high high moderate low

The Elvira Gully sampling site, November 2018. The channel is mostly overgrown by exotic grasses.

Middle Brunswick River

pH over time (2004–18)

pH values

The two sites in the Middle Brunswick Catchment had similar pH values. While pH values fluctuated over the reporting period, all annual medians fell within the upper and lower ANZECC trigger values.

Trends

As the Middle Brunswick River sites were not sampled between 2014–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

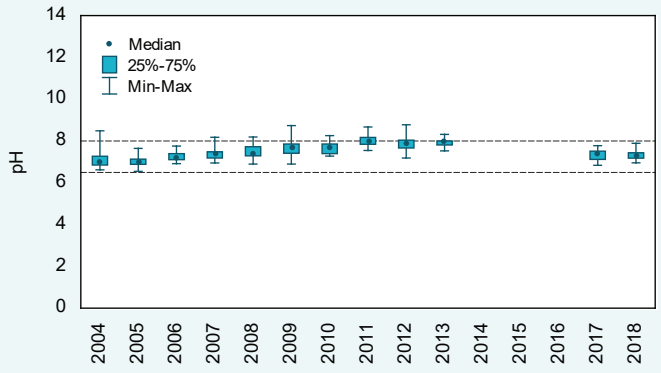
pH (2018)

pH values

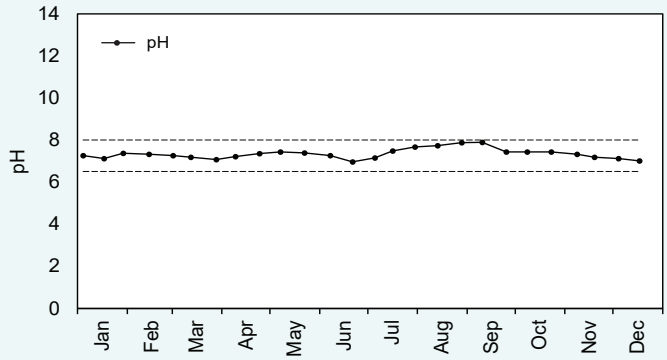
In 2018 pH values fluctuated at both sampling sites in the Middle Brunswick River catchment. All samples collected at both sites fell within the upper and lower ANZECC trigger values.

Where there are no data shown on the Elvira Gully graph, the stream was not flowing.

Brunswick River

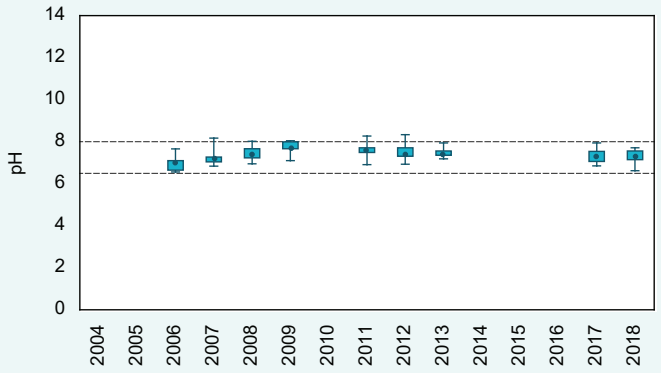


pH levels, 2004–18 at site 612032. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

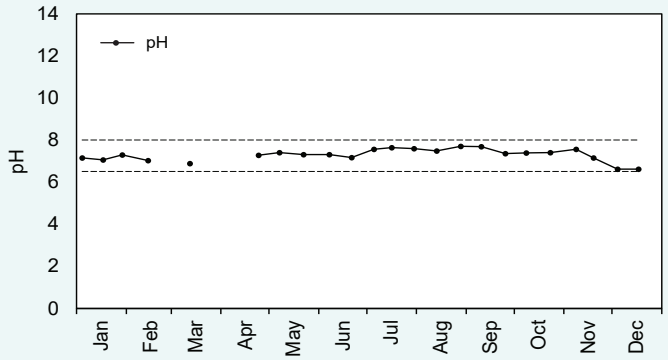


2018 pH levels at 612032. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Elvira Gully



pH levels, 2004–18 at site 6121203. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6121203. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Middle Brunswick River

Salinity over time (2004–18)

Concentrations

Median annual salinity was a little lower at the Elvira Gully sampling site than the site on the Brunswick River. This is driven by the fact that the Elvira Gully site ceases to flow for a time over summer, when salinity is at its highest. Otherwise, the salinity concentrations are similar at the two sites. The 2017–18 annual medians at the Brunswick River site were classified as brackish using the SWRWQA bands, whereas those years' annual medians were marginal at the Elvira Gully site.

Trends

As the Middle Brunswick River sites were not sampled between 2014–16 it was not possible to test for trends at these sites. A minimum of five consecutive years of data are required to test for trends.

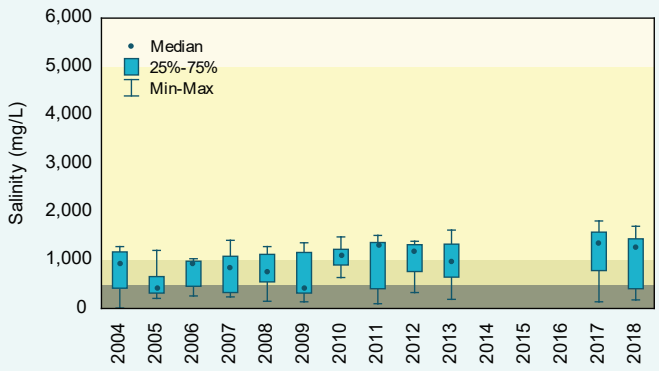
Salinity (2018)

Concentrations

Salinity at both sites was lowest over June to September, coinciding with winter rainfall and higher streamflow. At both sites, salinity was higher in the other months, when much of the water present was likely derived from groundwater and irrigation returns. This suggests that the surface water runoff at these sites is fresher than the groundwater and possibly the irrigation returns. Evapoconcentration of salinity may also be occuring in the drier months.

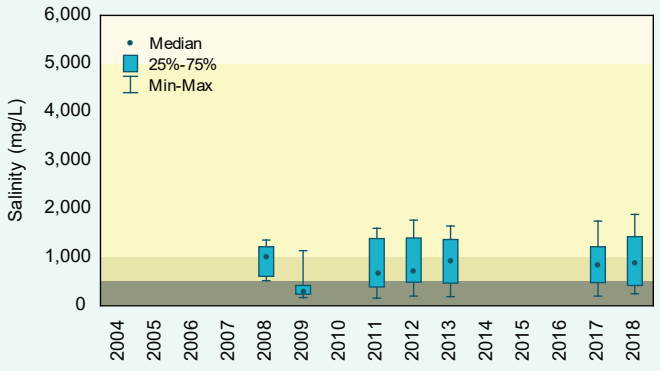
Where there are no data shown on the Elvira Gully graph, the stream was not flowing.

Brunswick River

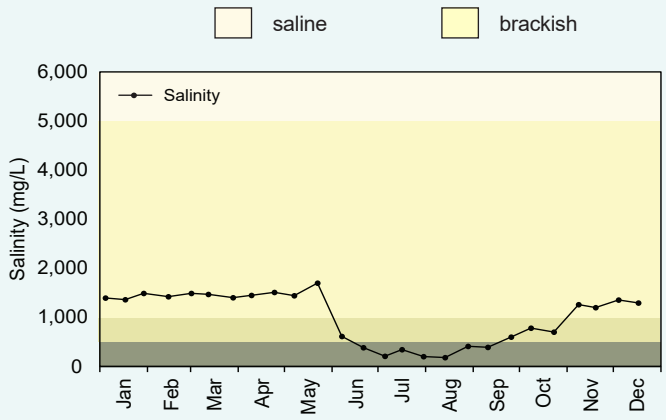


Salinity concentrations, 2004–18 at site 612032. The shading refers to the SWRWQA classification bands.

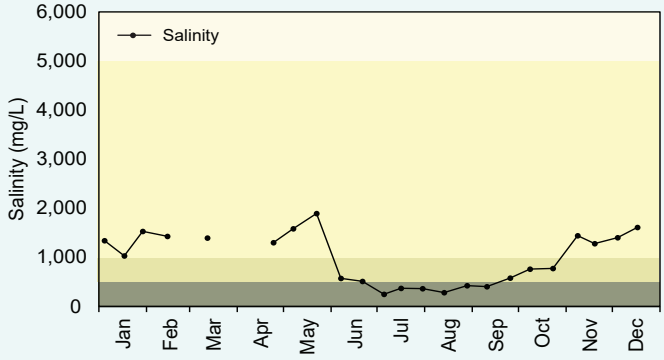
Elvira Gully



Salinity concentrations, 2004–18 at site 6121203. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 612032. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6121203. The shading refers to the SWRWQA classification bands.

Middle Brunswick 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 on 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 the Leschenault Estuary at estuaries.dwer.wa.gov.au/estuary/leschenault-estuary

The Regional Estuaries Initiative partners with the Leschenault Catchment Council 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 Leschenault Catchment Council go to www.leschenaultcc.org.au
- To find out more about the health of the rivers in the Leschenault Estuary Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Total phosphorus and total nitrogen concentrations were compared with the Leschenault Estuary WQIP targets. These targets represent the allowable annual median winter concentrations in both lowland (TN 1.0 mg/L, TP 0.1 mg/L) and upland (TN 0.45 mg/L, TP 0.02 mg/L) catchments. Sites were compared with the appropriate target. Where possible, other 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 represents the acceptable pH range. Where there were no ANZECC trigger values (for TSS and salinity), the SWRWQA classification bands were used to allow samples and sites to be classified and compared. For all parameters, the full year of data were used when comparing with targets, trigger values and classification bands.

Gaps in the data meant it was not possible to calculate trends for the Leschenault catchment sites. A minimum of five consecutive years of data are required.

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.

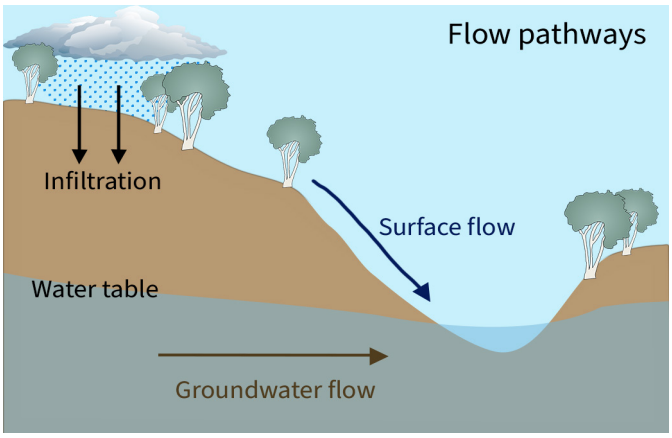
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

Laboratory limit of reporting: this is the lowest concentration (or amount) of an analyte that can be reported by the 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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