Lower Scott

This data report provides a summary of the nutrients at the two Lower Scott sampling sites in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of the site on the Scott River, the river flows into the Hardy 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 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.

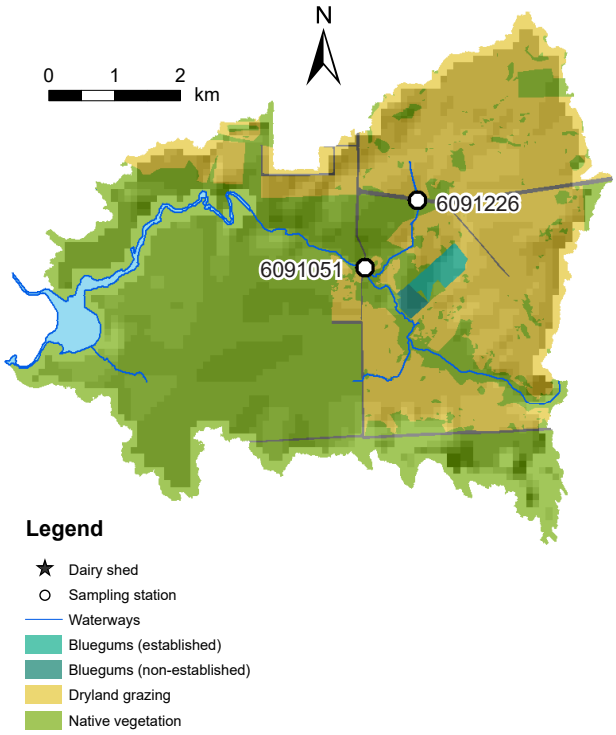
About the catchment

The Lower Scott catchment has an area of about 38 km^2 and starts just downstream of the gauging station at Brennans Ford. Nearly half the catchment is covered in native vegetation, mostly in the southern side. Other major land uses are dryland dairy and dryland grazing. The Scott River has reasonably intact fringing vegetation; however, the tributary that enters from the north has lost much of its fringing vegetation along its upper half.

Water quality is measured at two sites. Site 6091051, Brennans Bridge, is on the Scott River, about 5 km downstream of the gauging station at Brennans Ford. This site takes the entire catchment's flow and represents what is leaving the catchment and entering the Hardy Inlet. The second site, 6091226, Woodhouse, is on the northern tributary, downstream of where it flows under Governor Broome Road. Land use upstream of this site is mostly dryland dairy, with a dairy shed also present.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the two sites in the Lower Scott catchment were high. Concentrations were worse at Woodhouse (on a tributary to the Scott River) than Brennans Bridge (on the Scott River itself). The higher nutrient concentrations at Woodhouse are because of the highly modified catchment, including the presence of dryland grazing and a dairy shed upstream of the site.



Location of Lower Scott catchment in the greater Scott River catchment.

Facts and figures

Sampling site code	6091051 (Brennans Bridge) 6091226 (Woodhouse)
Rainfall at Brennans Ford (2018)	850 mm
Catchment area	38 km^2
Per cent cleared area (2009)	50 per cent
River flow	Ephemeral
Main land use (2009)	Native vegetation, dryland grazing, dryland dairy

Nitrogen over time (2004–18)

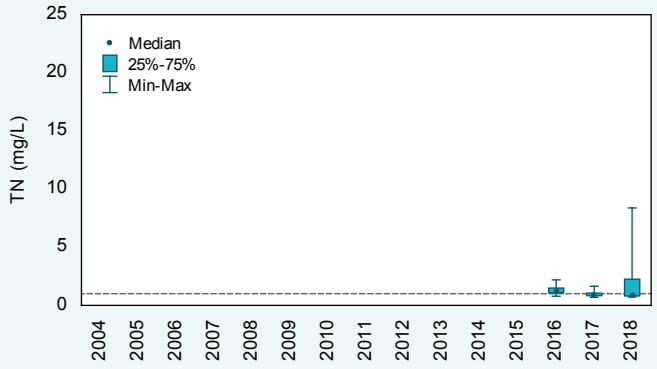
Concentrations

Total nitrogen (TN) concentrations were moderate at Brennans Bridge and high at the Woodhouse sampling sites. The median TN concentration was below the Water Quality Improvement Plan (WQIP) target in 2017 and 2018 at Brennans Bridge. It was above the target in all years for which there were data at Woodhouse. Further, all the samples collected between 2016–18 were above the target at Woodhouse whereas at Brennans Bridge there were some samples below the target each year. Compared with the other sites sampled in the Scott River catchment, the 2018 median TN at Woodhouse was the second highest (2.7 mg/L) and at Brennans Bridge it was the second lowest (0.92 mg/L). TN concentrations fluctuated at Woodhouse over the past 15 years. There is some evidence that TN concentrations have increased at this site but this cannot be verified by trend testing until there are five consecutive years of data available.

Trends

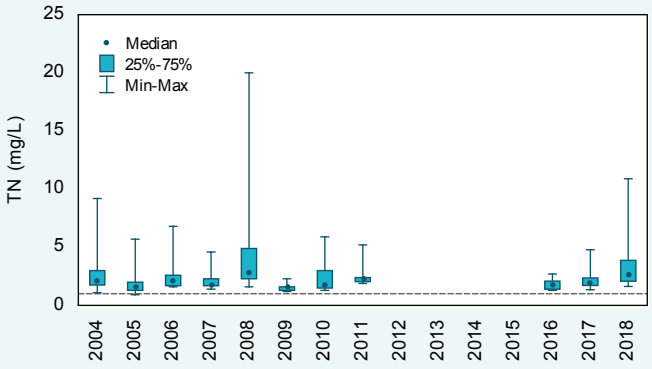
Because of the absence of TN data before 2016 at Brennans Bridge and the gap in monitoring between 2012–15 at Woodhouse, it was not possible to calculate trends in TN concentrations at either site as a minimum of five years of data are required to test for trends.

Brennans Bridge



Total nitrogen concentrations, 2004–18 at site 6091051. The dashed line is the Scott River WQIP target for median TN concentrations.

Woodhouse



Total nitrogen concentrations, 2004–18 at site 6091226. The dashed line is the Scott River WQIP target for median TN concentrations.

The Woodhouse sampling site in August.

Nitrogen (2018)

Concentrations

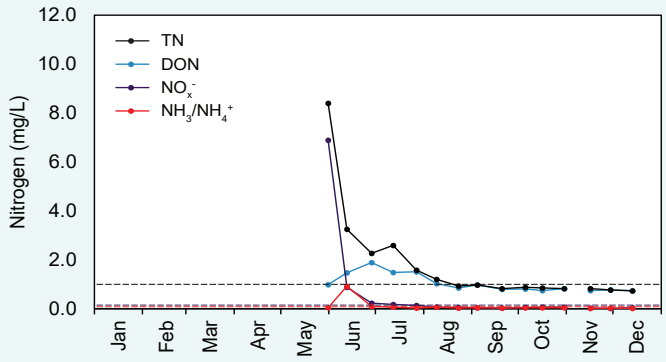
Concentrations of all forms of N were higher at Woodhouse than Brennans Bridge because of the very different size and nature of their catchments. The concentrations at Brennans Bridge show what is leaving the Scott catchment and entering the Hardy Inlet. Both sites showed a first-flush effect where N was mobilised following heavy rainfall. Much of this N was probably the result of mineralisation of organic N in soils and drains over the summer period, and runoff of high-concentration waters from upstream agricultural areas which build up with fertiliser and animal waste over summer.

The reason for the second peak at Woodhouse in July and the smaller one in October are unclear. They may be because of the presence of a dairy shed upstream of the site hosing effluent into the stream or perhaps fertilisers runoff from surrounding farmland, especially if it was applied shortly before the sample was taken.

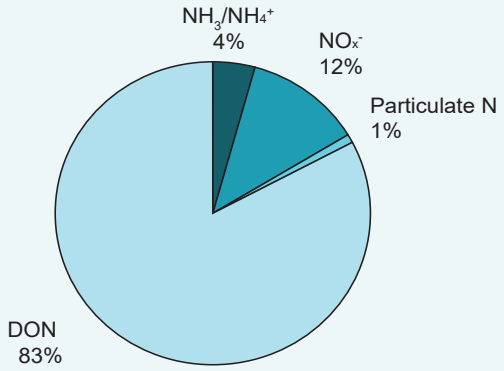
Types of nitrogen

Total N is made up of many different types of N. Woodhouse, which drains mainly agricultural land, had one of the higher proportions of N present as dissolved inorganic N (oxides of nitrogen, NO_x^-, and ammonia N, NH_3/NH_4^+) of the sites in the Scott catchment. This was likely because of the land uses such as dryland dairy and a dairy shed upstream of this site which contributed runoff rich in dissolved N. Brennans Bridge represents what is leaving the Scott catchment and entering the Hardy Inlet. It is possible the heavily vegetated main channel of the Scott River upstream of this site was acting like a large linear wetland, processing NH_3/NH_4^+ via plant uptake and NO_x^- via plant uptake and denitrification.

Brennans Bridge

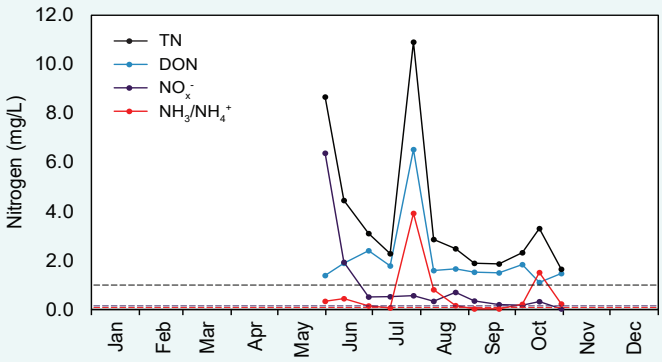


2018 nitrogen concentrations at 6091051. The black dashed line is the Scott River WQIP target for TN, the red and purple lines are the ANZECC trigger values for lowland rivers for NH_3/NH_4^+ and NO_x^-.

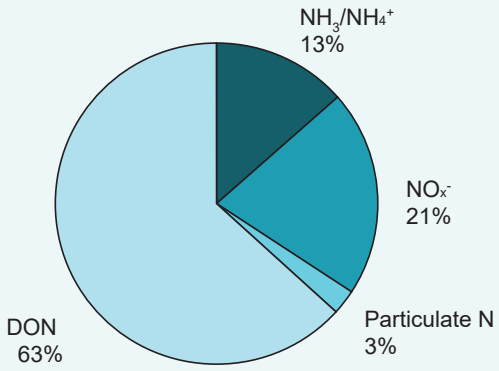


2018 average nitrogen fractions at site 6091051.

Woodhouse



2018 nitrogen concentrations at 6091226. The black dashed line is the Scott River WQIP target for TN the red and purple lines are the ANZECC trigger values for lowland rivers for NH_3/NH_4^+ and NO_x^-.



2018 average nitrogen fractions at site 6091226.

Phosphorus over time (2004–18)

Concentrations

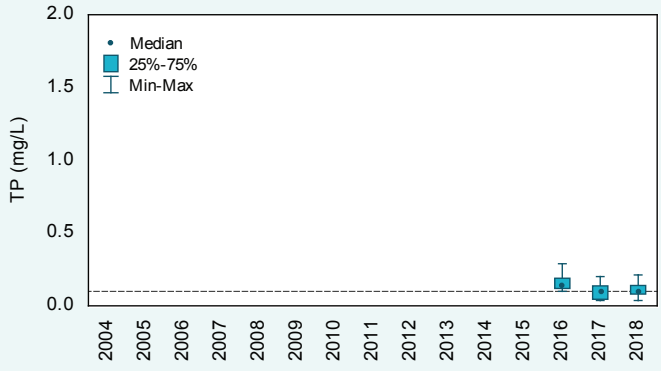
Recent total phosphorus (TP) concentrations were higher at Woodhouse than at Brennans Bridge because of the very different size and nature of their catchments. The concentrations at Brennans Bridge show what is leaving the Scott catchment and entering the Hardy Inlet. At Brennans Bridge, the median TN concentration between 2016–18 was just above the WQIP target.

At Woodhouse, the median was clearly over the WQIP target and, in 2017 and 2018, all samples collected were over the target. TP concentrations fluctuated, with 2008 being an outlier with higher TP concentrations than surrounding years. The reason for this outlier year is unknown. Since the break in monitoring at Woodhouse, the annual range of TP concentrations appears to have decreased.

Trends

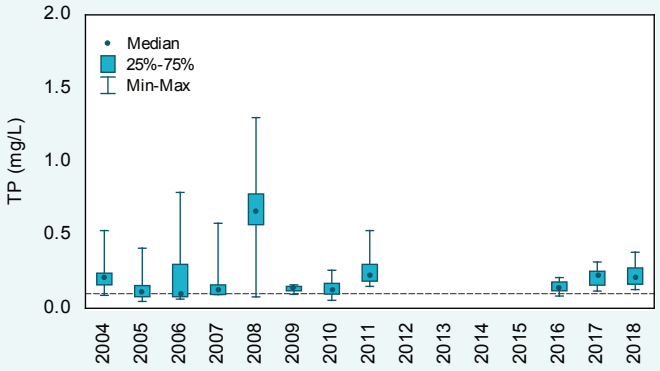
Because of the absence of TP data before 2016 at Brennans Bridge and the gap in monitoring between 2012–15 at Woodhouse, it was not possible to calculate trends in TP concentrations at either site as a minimum of five years of data are required to test for trends.

Brennans Bridge



Total phosphorus concentrations, 2004–18 at site 6091051. The dashed line is the Scott River WQIP target for median TP concentrations.

Woodhouse



Total phosphorus concentrations, 2004–18 at site 6091226. The dashed line is the Scott River WQIP target for median TP concentrations.

The Brennans Bridge sampling site during high flows in September.

Phosphorus (2018)

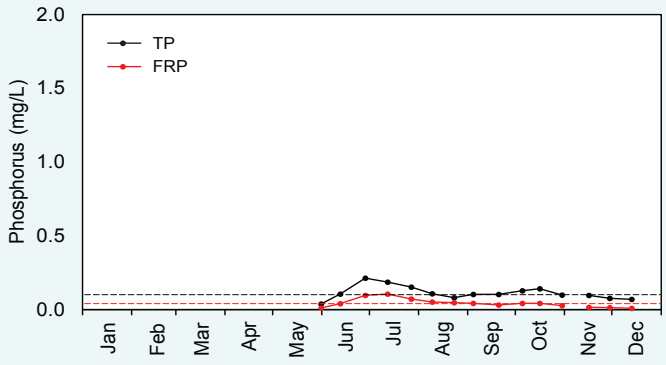
Concentrations

Both sites showed similar patterns in TP and filterable reactive phosphorus (FRP) concentrations over the year. Both had a peak in late June to early July before concentrations decreased again. The reason for this early peak is unclear. At Woodhouse, there was a second peak in TP concentrations later in October, as streamflow reduced. This second peak may be because of fertiliser being applied as the waterlogging of the catchment eased. It is also possible that suspended sediment or detritus which had been caught up on aquatic plants growing at the site was disturbed while sampling as there is a corresponding peak in total suspended solids concentrations. The concentrations present at Brennans Bridge represent what is leaving the Scott catchment and entering the Hardy Inlet.

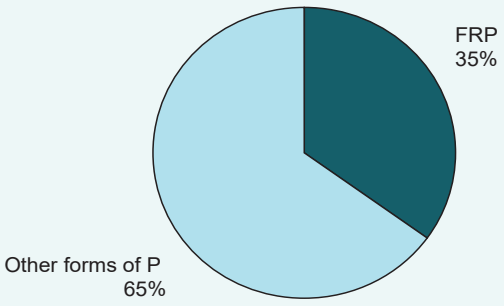
Types of phosphorus

Total P is made up of different types of P. The two sites have very different catchments both in terms of their size and nature. The processes determining the types and concentrations of P present at the two sites will be very different. The proportion of P present as bioavailable FRP in 2018 was the same at both sites, 35 per cent. This form of P is easily used by plants and algae to promote growth. The remainder of the 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. The proportion of P present as FRP suggests that both these sites have disturbed catchments upstream.

Brennans Bridge

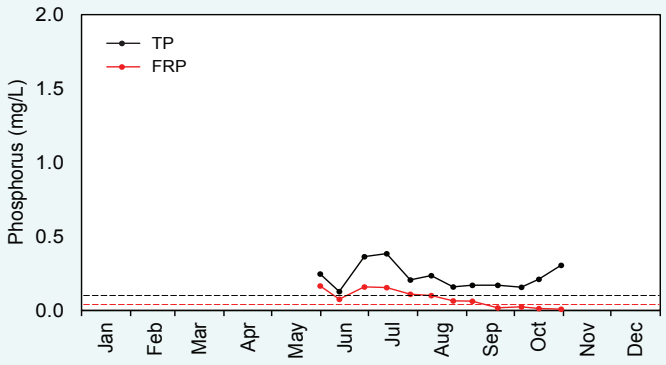


2018 phosphorus concentrations at 6091051. The black dashed line is the Scott River WQIP target for TP, the red is the ANZECC trigger value for lowland rivers for FRP.

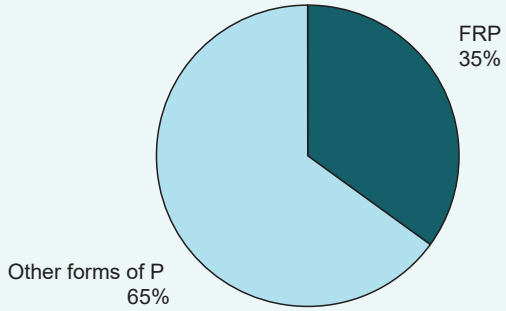


2018 average phosphorus fractions at site 6091051.

Woodhouse



2018 phosphorus concentrations at 6091226. The black dashed line is the Scott River WQIP target for TP, the red is the ANZECC trigger value for lowland rivers for FRP.



2018 average phosphorus fractions at site 6091226.

Total suspended solids over time (2004–18)

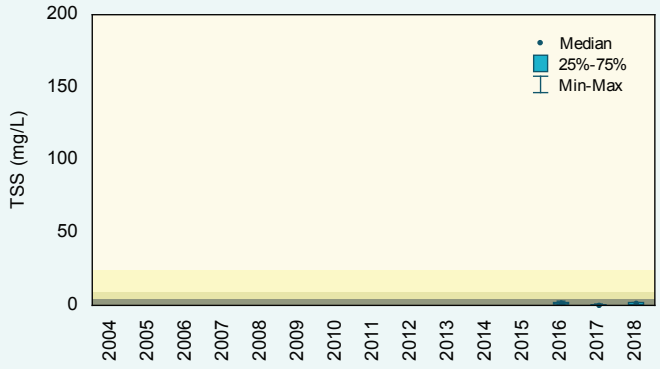
Concentrations

Total suspended solids (TSS) concentrations at Brennans Bridge were low, with all samples collected classified as low using the Statewide River Water Quality Assessment (SWRWQA) classification bands. At Woodhouse, TSS concentrations were higher, with the median concentration classified as low in six of the years where data were available and moderate in the other three. TSS concentrations were higher in 2018 at Woodhouse than in previous years, though not as high as in 2004–06.

Trends

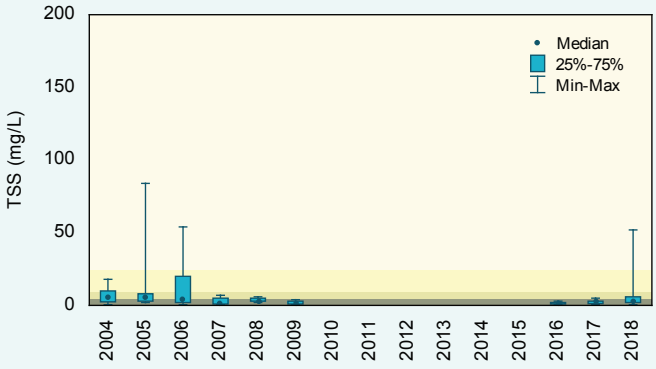
Because of the absence of TSS data before 2016 at Brennans Bridge and the gap in monitoring between 2010–15 at Woodhouse, it was not possible to calculate trends in TSS concentrations at either site as a minimum of five years of data are required to test for trends.

Brennans Bridge



Total suspended solids concentrations, 2004–18 at site 6091051. The shading refers to the SWRWQA classification bands.

Woodhouse



Total suspended solids concentrations, 2004–18 at site 6091226. The shading refers to the SWRWQA classification bands.

very high high moderate low

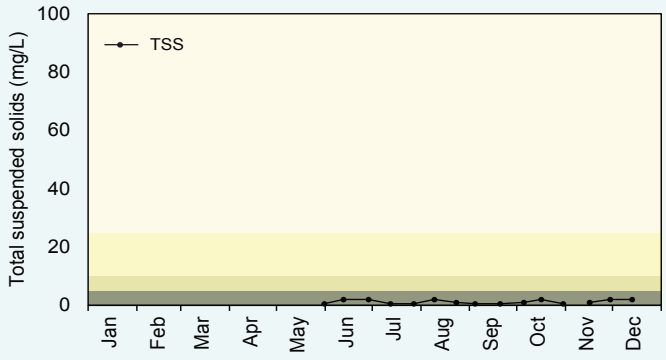
Grazing is one of the major land uses in the Lower Scott catchment.

Total suspended solids (2018)

Concentrations

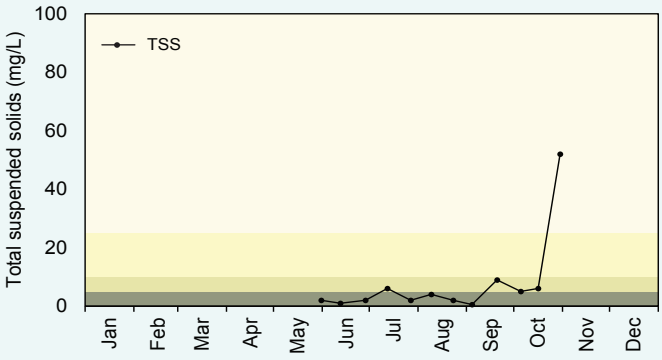
In 2018, all TSS samples were classified as low at Brennans Bridge and there was no evidence of a seasonal pattern at this site. At Woodhouse, TSS concentrations also showed no seasonal pattern, though they did fluctuate during the year. The peak in TSS in October was likely because of suspended sediment or detritus, which had been caught up on aquatic plants growing at the site, being disturbed while sampling.

Brennans Bridge



2018 total suspended solids concentrations at 6091051. The shading refers to the SWRWQA classification bands.

Woodhouse



2018 total suspended solids concentrations at 6091226. The shading refers to the SWRWQA classification bands.

very high high moderate low

The Scott River near the Brennans Bridge sampling site. Fringing vegetation is present along much of the Scott River.

Lower Scott

pH over time (2004–18)

pH values

At both sites pH fluctuated over the past 15 years. The annual medians at both sites were between the upper and lower Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values.

Trends

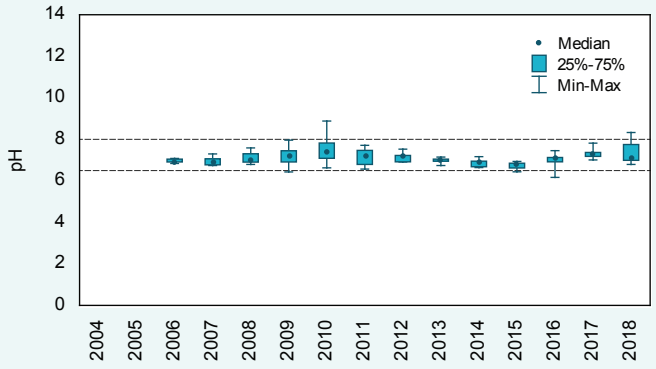
There were small increasing trends in pH levels at both sites over the short-term (2014–18, trend of 0.1 pH units per year). It is likely that these trends are just part of the natural fluctuations at these sites and not evidence that the sites are becoming more alkaline. Ongoing monitoring of pH at these sites will help determine if the pH is actually increasing or not.

pH (2018)

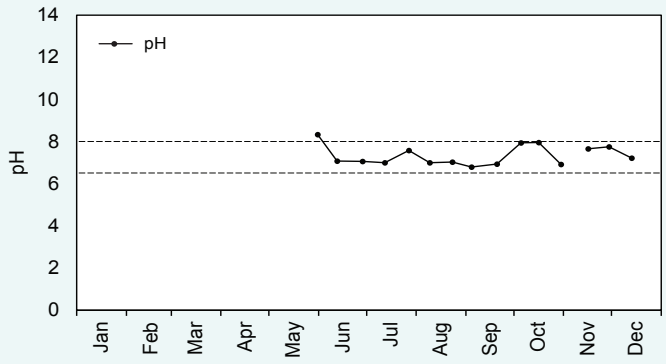
pH values

pH varied similarly at the two sites in the Lower Scott catchment, fluctuating through the year with no evidence of a seasonal pattern. At Woodhouse, all samples were between the upper and lower ANZECC trigger values. This was also the case at Brennans Bridge, with the exception of the first sample collected in May which was just over the upper ANZECC trigger value.

Brennans Bridge

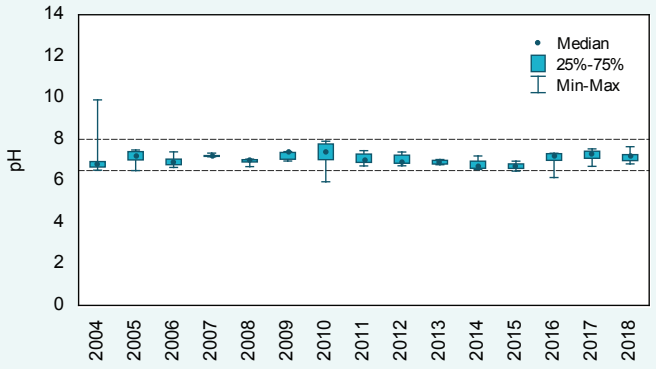


pH levels, 2004–18 at site 6091015. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

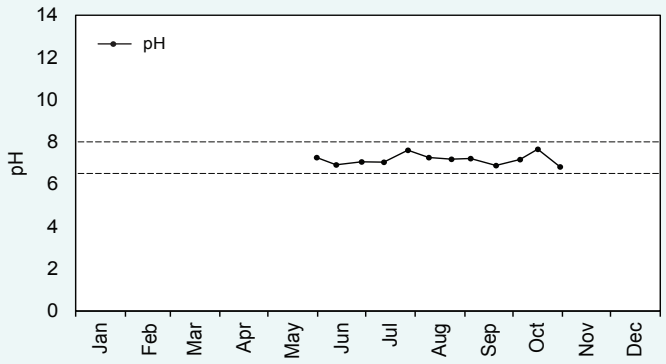


2018 pH levels at 6091051. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Woodhouse



pH levels, 2004–18 at site 6091226. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6091226. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Lower Scott

Salinity over time (2004–18)

Concentrations

Using the SWRWQA classification bands, the annual medians at both sites in the Lower Scott catchment were classified as fresh each year. Salinity fluctuated slightly at both sites over the reporting period with no evidence of a trend.

Trends

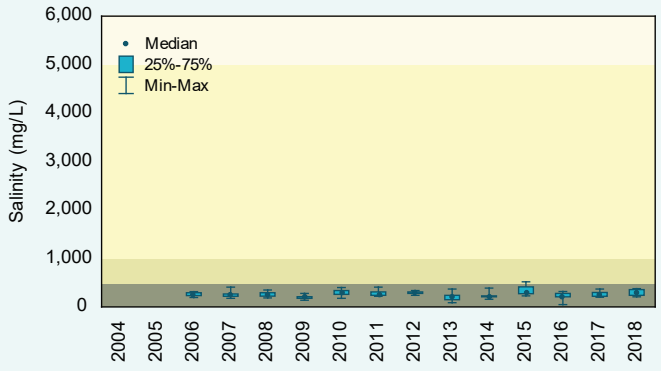
There were no long- (2009–18) or short-term (2014–18) trends present in salinity at either site in the Lower Scott catchment.

Salinity (2018)

Concentrations

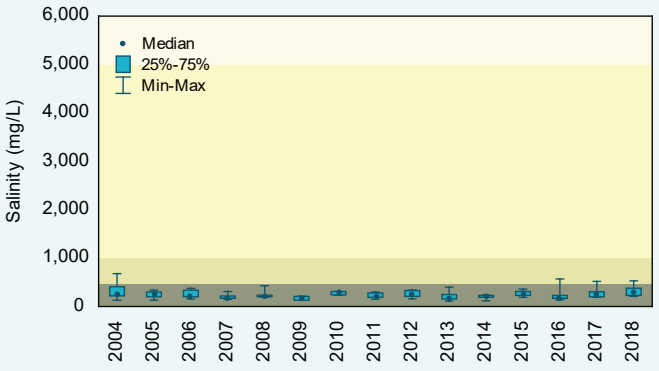
At Brennans Bridge there was no evidence of a seasonal pattern in salinity with all samples being classified as fresh using the SWRWQA classification bands. At Woodhouse there was evidence of a slight reverse seasonal pattern, with salinity being higher at the beginning and end of the flow year than in the middle. All samples were classified as fresh, with the exception of the first and last samples collected which were marginal. At this site it is possible the slightly higher salinity at the beginning of the year was because of the first-flush mobilising salts that had been left behind when the stream dried up the previous year as well as washing salts off surrounding land. The slight increase at the end of the year may be because of either evapoconcentration or an increase in the proportion of groundwater flows, or both.

Brennans Bridge

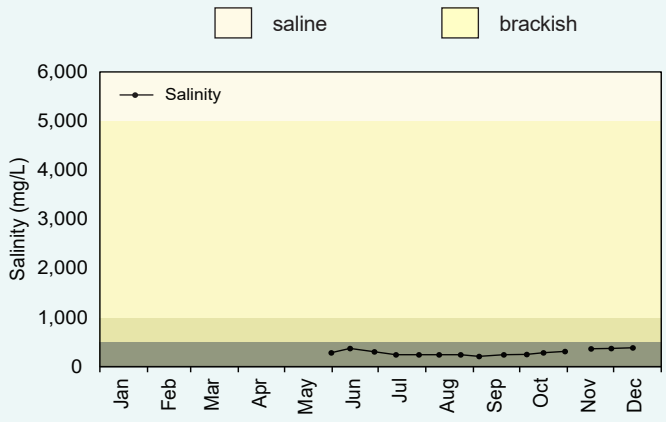


Salinity concentrations, 2004–18 at site 6091051. The shading refers to the SWRWQA classification bands.

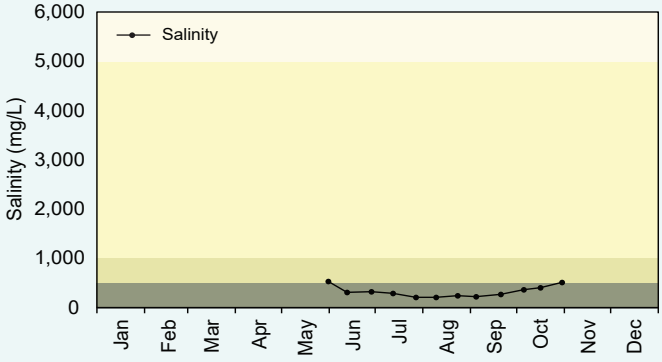
Woodhouse



Salinity concentrations, 2004–18 at site 6091226. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6091051. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6091226. The shading refers to the SWRWQA classification bands.

Lower Scott

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 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 Hardy Inlet at estuaries.dwer.wa.gov.au/estuary/hardy-inlet/

The Regional Estuaries Initiative partners with the Lower Blackwood Land Conservation District Committee (Lower Blackwood LCDC) to fund best-practice fertilisers, 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 Lower Blackwood LCDC go to lowerblackwood.com.au
- To find out more about the health of the rivers in the Hardy Inlet catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Total nitrogen and TP concentrations were compared with the Scott River WQIP targets. These targets represent the historical median winter concentration where lyngbya blooms were not observed in the upper Hardy Inlet. They were developed for use at Brennans Ford but have been used at all Scott River sites to allow for comparisons between sites. 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 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 concentrations 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.

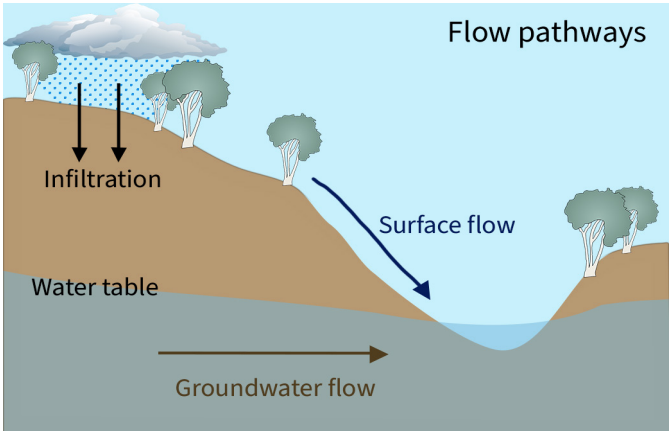
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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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