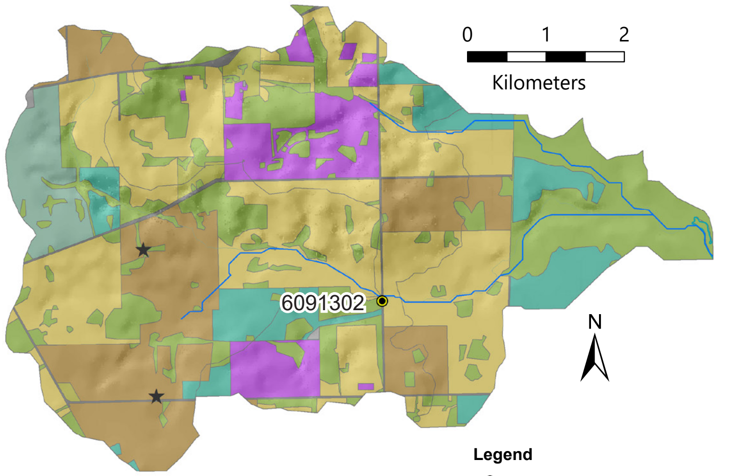
Department of **Water and Environmental Regulation**
Department of **Primary Industries and Regional Development**
GOVERNMENT OF WESTERN AUSTRALIA

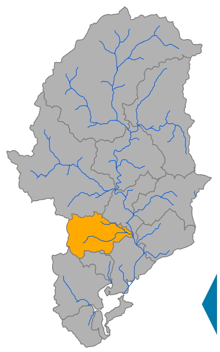
Hardy Inlet
Blackwood catchment
nutrient report 2018

REGIONAL ESTUARIES INITIATIVE

Glenarty Creek

This data report provides a summary of the nutrients at the Glenarty Creek sampling site in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of the site, the creek discharges to the Blackwood River and subsequently 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.





Location of Glenarty Creek catchment in the greater Lower Blackwood catchment.

About the catchment

Glenarty Creek has a catchment area of about 32 km^2 with grazing (beef, sheep and dryland dairy) covering just over half of the catchment. The other dominant land use is native vegetation which covers about a quarter of the catchment. Two dairy sheds are present in the upper catchment. There are two main watercourses in the catchment: Glenarty Creek which drains the southern portion of the catchment; and an unnamed stream which drains the northern portion of the catchment. The unnamed stream joins Glenarty Creek below the sampling site, just over a kilometre from where it discharges into the Blackwood River.

Much of the fringing vegetation has been cleared along the creek and its tributaries, with the exception of a few small sections in the upper catchment and the lower portion of the creek, just before it enters the Blackwood River in Karridale.

The majority of the soils in the catchment have a high phosphorus-binding capacity and so bind most of the phosphorus applied to them, reducing the amount that enters streams.

Water quality is measured at site 6091302, Glenarty Road Crossing, which is where Glenarty Creek passes under Glenarty Road in Kudardup.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were low at the Glenarty Creek sampling site. The concentration of ammonia nitrogen was high compared with the other sites in the Blackwood catchment and this was probably sourced from upstream agricultural land-uses.

Facts and figures

Sampling site code	6091302
Rainfall at Alexandra Bridge (2018)	933 mm
Catchment area	32 km^2
Per cent cleared area (2001)	74 per cent
River flow	Ephemeral
Main land use (2001)	Beef and sheep grazing, native vegetation and dryland dairy

Glenarty Creek

Nitrogen over time (2004–18)

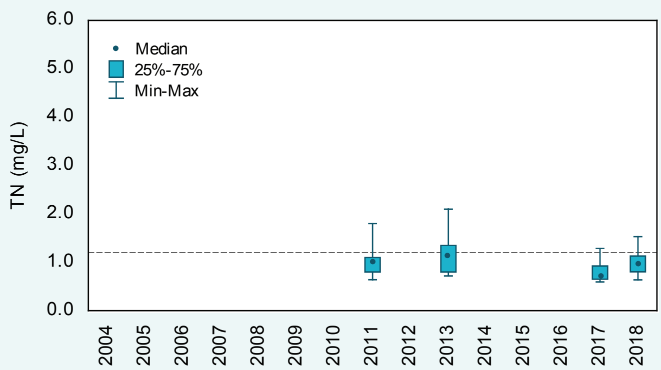
Concentrations

Total nitrogen (TN) concentrations in Glenarty Creek were moderate to high compared with the other nine sites in the Blackwood River catchment. The median TN concentration was below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value in the four years in which there were enough data to graph; however, each year had some samples over the trigger value. In 2018, Glenarty Creek had one of the highest median TN concentration (0.97 mg/L; behind Rushy Creek with 1.0 mg/L and Payne Road at 1.4 mg/L), though it was still below the ANZECC trigger value.

Trends

As Glenarty Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TN concentrations at this site. A minimum of five years of data are required to test for trends.

Glenarty Creek



Total nitrogen concentrations, 2004–18 at site 6091302. The dashed line is the ANZECC trigger value for lowland rivers.

Collecting a water quality sample at Glenarty Creek, June 2019.

Glenarty Creek

Nitrogen (2018)

Types of nitrogen

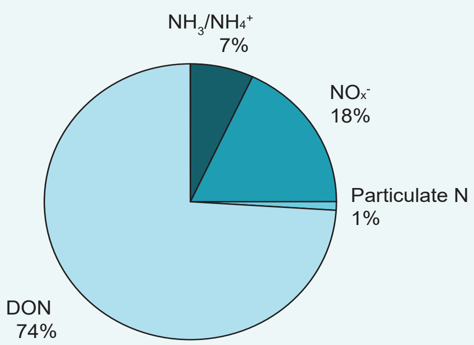
Total N is made up of many different types of N. In Glenarty Creek, the dominant form of N was dissolved organic N (DON). This form of N consists mainly of degrading plant and animal matter but may also include other forms. The bioavailability of DON varies depending on its form. Some forms are highly bioavailable whereas others, like degrading plant and animal matter, often need to be further broken down before they can be used by plants and algae. The percentage of N present as oxides of N (NO_x^-) was low compared with the other sites in the Blackwood River catchment but still consistent with an agricultural catchment. Glenarty Creek had the second highest average proportion of ammonia N (NH_3/NH_4^+); only Rushy Creek had a higher percentage at 23 per cent. Both NO_x^- and NH_3/NH_4^+ are readily bioavailable for plants and algae to fuel rapid growth and are likely sourced from fertilisers and animal wastes.

Concentrations

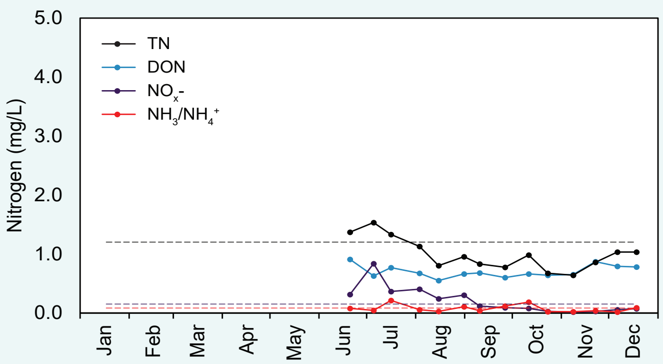
Total N and NO_x^- showed a seasonal pattern, being highest at the beginning of the period when the creek was flowing before reducing during the remainder of the year. The early peak in NO_x^- was because of a first-flush response where N was mobilised early in the flow year following heavy rainfall. Much of this N was probably the result of mineralisation of organic N in soils and streams over the summer period, and runoff of high-concentration waters from agricultural land which builds up with fertilisers and animal waste over the summer. NO_x^- was above the ANZECC trigger value for the first six sampling events of the year. DON and NH_3/NH_4^+ did not show as strong a seasonal response, tending to fluctuate during the year.

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

Glenarty Creek



2018 average nitrogen fractions at site 6091302.



2018 nitrogen concentrations at 6091302. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

The Glenarty Road Bridge on Glenarty Creek, August 2019.

Glenarty Creek

Phosphorus over time (2004–18)

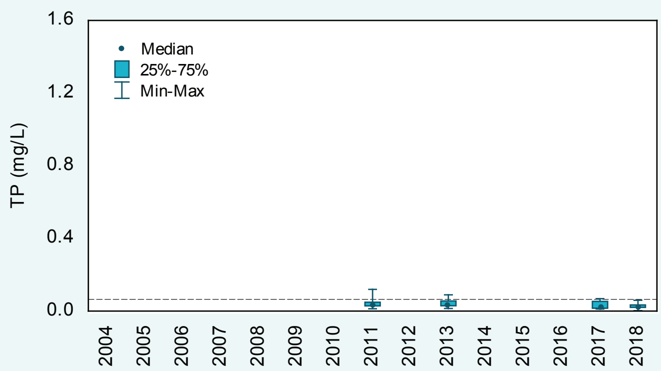
Concentrations

The median total phosphorus (TP) concentrations were below the ANZECC trigger value in each of the four years where there were sufficient data to graph. In 2018, all the samples were below the trigger value for the first time. Compared with the other sites in the Blackwood River catchment, TP was moderate, with Glenarty Creek having the third highest median TP concentration in 2018 (0.027 mg/L, behind Payne Road at 0.074 mg/L and Courtney Road at 0.087 mg/L).

Trends

As Glenarty Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TP concentrations at this site. A minimum of five years of data are required to test for trends.

Glenarty Creek



Total phosphorus concentrations, 2004–18 at site 6091302. The dashed line is the ANZECC trigger value for lowland rivers.

Glenarty Creek, January 2018. At this time there were only a few small puddles of water present.

Glenarty Creek

Phosphorus (2018)

Types of phosphorus

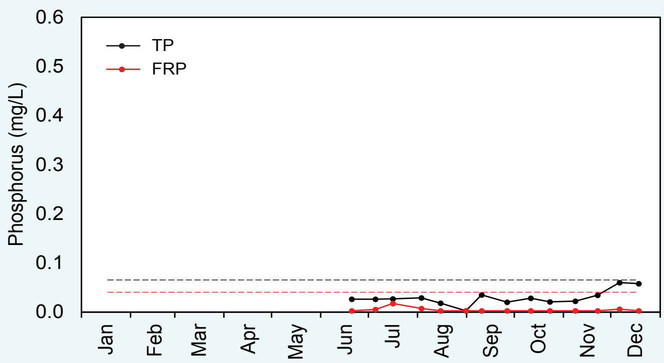
Total P is made up of different types of P. Because a large number of samples were below the laboratory limit of reporting in 2018, phosphorus fraction pie charts were not generated for the Glenarty Creek site. At this site, one of the 14 TP samples and 10 of the 14 filterable reactive phosphorus (FRP) samples were below their limits of reporting (0.005 mg/L in each case).

Concentrations

Total P concentrations were relatively stable throughout the year before increasing from late November and being at their highest in December (though still below the ANZECC trigger value). Total suspended solids (TSS) were also high at this time of the year, suggesting the peak in TP was caused by suspended matter in the water column. FRP was below the laboratory limit of reporting for almost the entire year. The highest concentration was recorded in July shortly after the creek started to flow. This is likely because of a first-flush effect where heavy rainfall washed P from upstream agricultural land use into the stream. The high P-binding capacity of the soils present in this catchment will be contributing to the low P concentrations.

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

Glenarty Creek



2018 phosphorus concentrations at 6091302. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.

Collecting a water quality sample at the Glenarty Creek sampling site, September 2018.

Glenarty Creek

Total suspended solids over time (2004–18)

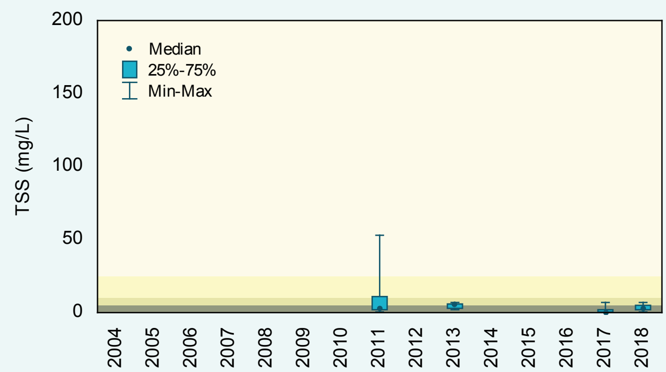
Concentrations

In Glenarty Creek, total suspended solids (TSS) concentrations were higher in 2011 than the other three years with sufficient data to graph. It is not possible to determine if 2011 was an unusually high year or if the concentrations of TSS have improved at this site ongoing monitoring may help to determine this. The only year the median was classified as moderate using the Statewide River Water Quality Assessment (SWRWQA) bands was 2013. In all other years, the median fell within the low band.

Trends

As Glenarty Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in TSS concentrations at this site. A minimum of five years of data are required to test for trends.

Glenarty Creek



Total suspended solids concentrations, 2004–18 at site 6091302. The shading refers to the SWRWQA classification bands.

very high high moderate low

Glenarty Creek, November 2018.

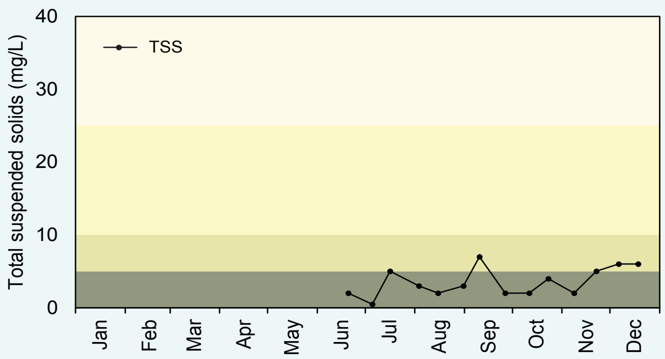
Total suspended solids (2018)

Concentrations

In 2018 there was no clear seasonal pattern in TSS concentrations in Glenarty Creek with concentrations fluctuating throughout the year. Most of the samples collected fell into the low band of the SWRWQA classification bands, though a few were classified as moderate. It is likely particles are being washed into the creek via surface flows as well as being mobilised in-stream by erosion.

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

Glenarty Creek



2018 total suspended solids concentrations at 6091302. The shading refers to the SWRWQA classification bands.

very high   high   moderate   low

A large gilgie (Cherax quinquecarinatus), caught as part of a river health assessment in Glenarty Creek, October 2017.

Glenarty Creek

pH over time (2004–18)

pH values

The median pH at Glenarty Creek fell between the upper and lower ANZECC trigger values for each year where there were sufficient data to graph. It appears pH may have increased in 2017–18 compared with 2011–13, though it is not possible to determine if this is because of an actual increase or just part of the natural fluctuations at this site. Ongoing monitoring will help determine if pH is increasing. A small number of samples were over the upper ANZECC trigger value in 2017 (one sample) and 2018 (two samples).

Trends

As Glenarty Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in pH at this site. A minimum of five years of data are required to test for trends.

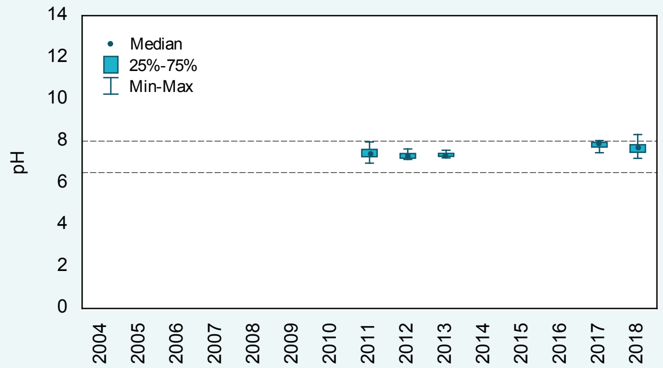
pH (2018)

pH values

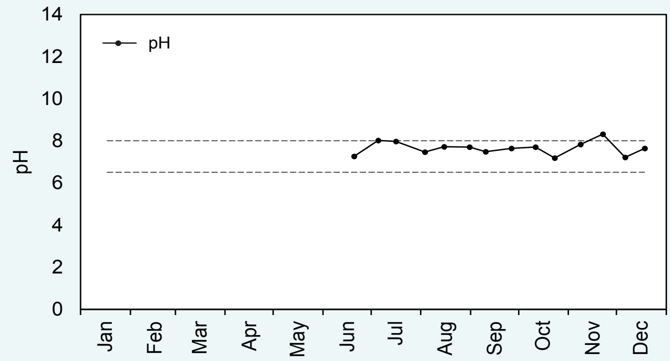
There was no evidence of a seasonal pattern in pH at Glenarty Creek in 2018, with values fluctuating throughout the year. All but two of the samples collected fell within the upper and lower ANZECC trigger values.

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

Glenarty Creek



pH levels, 2004–18 at site 6091302. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6091302. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Glenarty Creek, July 2018. Compared with the photograph on the right (taken in December 2018), water levels are higher and the water is less cloudy. There are also more grasses growing on the banks.

Glenarty Creek

Salinity over time (2004–18)

Concentrations

Salinity fluctuated slightly over the years where there were enough data available to graph. However, all samples collected (and hence all medians) fell within the low band of the SWRWQA classification bands. The water in the creek at this site was consistently fresh.

Trends

As Glenarty Creek was only sampled sporadically over the past 15 years, it was not possible to calculate trends in salinity at this site. A minimum of five years of data are required to test for trends.

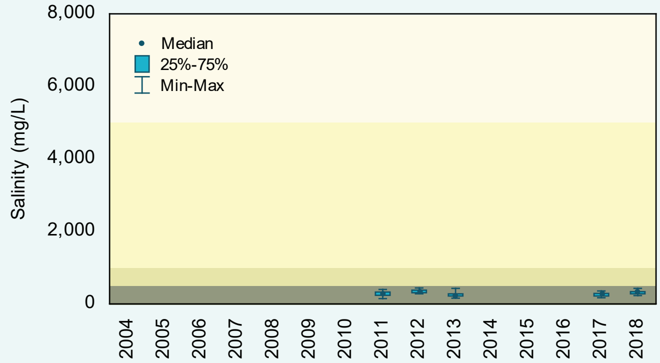
Salinity (2018)

Concentrations

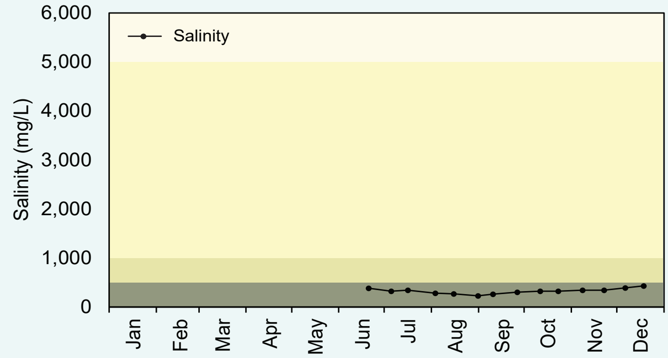
Salinity concentrations did not show a strong seasonal pattern at this site, being low year-round. It is likely that salt is entering the creek via surface flows as well as from in-stream sources (such as any salts left behind in the creek bed when it dried the previous summer) and groundwater. The slight increase in salinity observed from about October may be because of evapoconcentration or the higher proportion of groundwater present at this time.

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

Glenarty Creek



Salinity concentrations, 2004–18 at site 6091302. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at site 6091302. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

Glenarty Creek, December 2018. Compared with the photograph on the left (taken in July 2018), water levels are lower and the water has more suspended sediments in it. There are also less grasses growing on the banks.

Glenarty Creek

Background

The Regional Estuaries Initiative is a State Government program to improve the health of waterways and estuaries in the south-west of Western Australia. Healthy Estuaries WA is a Royalties for Regions program launched in 2020 and will build on the work of the Regional Estuaries Initiative. Collecting and reporting water quality data, such as in this report, helps build understanding of the whole system. By understanding the whole system, we can direct investment towards the most effective actions in the catchments to protect and restore the health of our waterways.

You can find the latest data on the condition of 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

Where possible, parameters were compared with the ANZECC trigger values for lowland rivers in south-west Australia. These values provide a value above which there may be a risk of adverse effect. For pH there is both an upper and lower trigger value which represent the acceptable pH range. Where there were no ANZECC trigger values available (for TSS and salinity) the SWRWQA classification bands were used to allow samples and sites to be classified and compared.

Trend testing was carried out using either the Mann or Seasonal Kendall tests as appropriate. Where there were flow data available and there was a flow-concentration relationship, the data were flow-adjusted before trend analysis.

Annual loads were calculated by multiplying daily flow with daily nutrient concentrations and aggregating over the year. Measured daily concentrations were not available as samples were collected fortnightly at best, so daily concentration data were calculated using the locally estimated scatterplot smoothing algorithm (LOESS).

Glossary

Bioavailable: bioavailable nutrients refers to those nutrients which plants and algae can take up from the water and use straight away for growth.

Concentration: the amount of a substance present in the water.

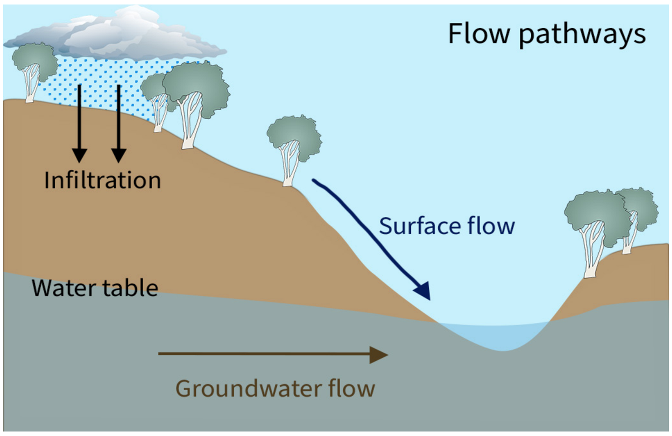
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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

Load: the total mass of a substance passing a certain point.

Load per unit area: the load at the sampling site divided by the entire catchment area upstream of the sampling site.

The schematic below shows the main flow pathways which may contribute nutrients, particulates and salts to the waterways. Connection between surface water and groundwater depends on the location in the catchment, geology and the time of year.



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