

Governor Broome

This data report provides a summary of the nutrients at the Governor Broome 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 stream discharges to the Scott River and subsequently the Hardy Inlet.

About the catchment

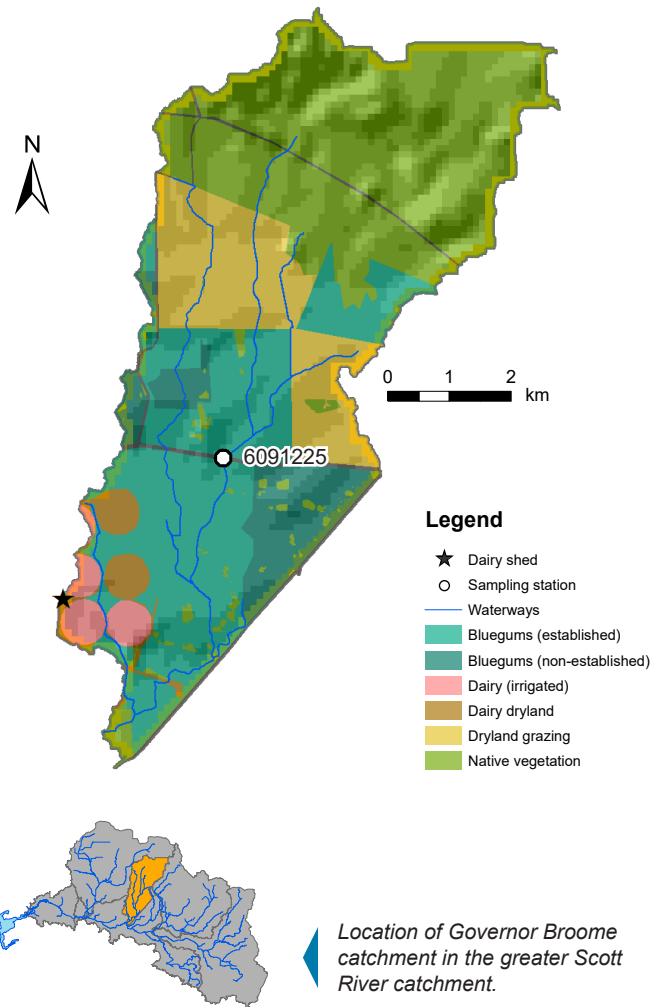
Governor Broome has a catchment area of about 46 km², about 40 per cent of which is covered in native vegetation, in the northern portion of the catchment. More than a third of the catchment is covered in bluegum plantations and there are large areas of dryland grazing. There is also dryland and irrigated dairy present as well as a dairy shed, though these are all downstream of the sampling site. In some areas, drains have been constructed to help reduce ponding in agricultural land. Much of the fringing vegetation has been lost along waterways in the agricultural areas.

Most of the soils in the cleared portion of the catchment have a low capacity to bind phosphorus. This is often so poor that any phosphorus applied to them can be quickly washed into drains and other waterways.

Water quality is measured at site 6091225, Governor Broome Road, just downstream of where the waterway passes under the road. Upstream of the site are bluegum plantations and dryland grazing, with native vegetation further upstream. Logging of the bluegum plantation commenced in August 2018.

Results summary

Nutrient concentrations at the Governor Broome Road sampling site were classified as high (total nitrogen) and moderate (total phosphorus). Most of the nitrogen was present as dissolved organic nitrogen, indicating much of the nitrogen is being sourced from degrading plant and animal matter. This is typical of a site that has some agricultural land uses further upstream but no nearby point sources of nutrient pollution. As 2019 was a low rainfall year, the site was only flowing on three sampling occasions.



Facts and figures

Sampling site code	6091225 (Governor Broome Road)
Catchment area	46 km ²
Per cent cleared area (2009)	59 per cent
River flow	Ephemeral
Main land use (2009)	Native vegetation, bluegum plantations and dryland grazing



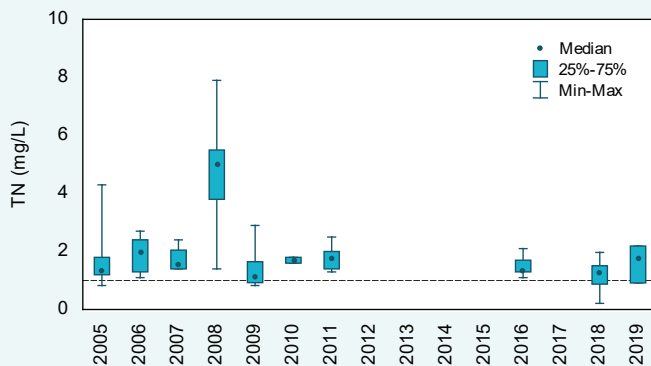
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Nitrogen over time (2005–19)

Concentrations

Annual total nitrogen (TN) concentrations at the Governor Broome Road sampling site were classified as high using the State Wide River Water Quality Assessment (SWRWQA) methodology. Further, the median was above the Water Quality Improvement Plan (WQIP) target for TN concentrations every year for which there were sufficient data to calculate it. 2008 was an outlier, with TN concentrations much higher in this year. The reason for these high concentrations is unknown. One possibility is that fertiliser was applied to the upstream blue gum plantations during this year (though there is no proof this was the case). The bluegum plantations upstream of the site were progressively logged from about August 2018, though it is unclear when the logging was completed.

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Total nitrogen concentrations, 2005–19 at site 6091225. The dashed line is the Scott River WQIP target for median TN concentrations.



The Governor Broome Road sampling site, dry in June.

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Nitrogen (2019)

Types of nitrogen

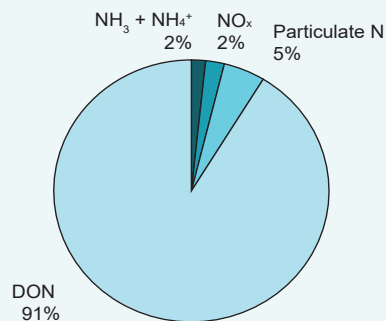
Total N is made up of different types of N. The dominant type of N was dissolved organic N (DON). This type of N consists of plant and animal matter which needs to be further broken down before it becomes available to fuel plant and algal growth as well as more bioavailable types. It is likely a lot of the N in this catchment is coming from plant and animal matter that is being washed or deposited into the stream and from organic N washing in from soils and remnant wetlands. The highly bioavailable types of N (nitrate, NO_x^- and total ammonia, $\text{NH}_3 + \text{NH}_4^+$) both contributed very little to the N present at this site; it is likely that nitrate is being denitrified in the watershed before it reaches the sampling location.

Concentrations

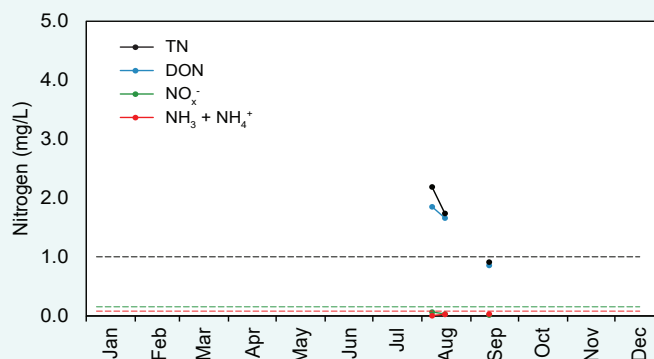
In 2019, TN and DON concentrations peaked when the stream started flowing in August and then slowly decreased during the year. It is likely N was being washed into the stream following rainfall at the start of the flow year. Much of this N was organic N washing from soils and remnant wetlands where it had built up over the summer and autumn period. As the year progressed, the proportion of water coming from groundwater would have increased. All dissolved N concentrations (nitrate and total ammonia) were low, below their Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values on each occasion the site was sampled.

Where there are no data shown in the graph, the site was not flowing. As 2019 was a low rainfall year, the site was only flowing on three sampling occasions.

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2019 average nitrogen fractions at 6091225.



2019 nitrogen concentrations at 6091225. The black dashed line is the Scott River WQIP target for TN, the red and green lines are the ANZECC trigger values total ammonia and nitrate.



The Governor Broome Road sampling site, wet in August.

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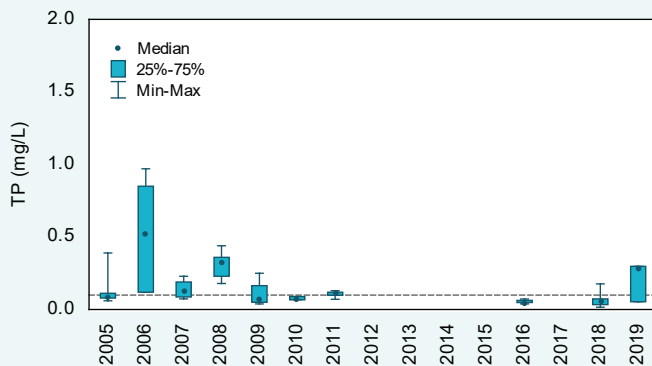
Phosphorus over time (2005–19)

Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period. Using the SWRWQA methodology, annual TP concentrations were classified as high before 2012 and the break in monitoring, and moderate in 2019. While it appeared that TP concentrations had improved since 2009, the 2019 concentrations were higher again. In fact, the 2019 annual median was the second highest of the Scott River catchment sites (the 2018 median was the second lowest). Ongoing monitoring will help determine if TP concentrations are actually increasing at this site. There were two years, 2006 and 2008, when all the samples collected were greater than the WQIP target. The reason for this is unknown. There was a corresponding peak in TN concentrations in 2008, which can possibly be attributed to fertiliser use in the bluegum plantations (though there is no proof that this was the case). The reason why 2006 had much higher TP concentrations than

surrounding years is unknown. The bluegum plantations upstream of the site were progressively logged from about August 2018, though it is unclear when the logging was completed.

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Total phosphorus concentrations, 2005–19 at site 6091225. The dashed line is the Scott River WQIP target for median TP concentrations.



Bluegum plantation in the Governor Broome catchment.

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Phosphorus (2019)

Types of phosphorus

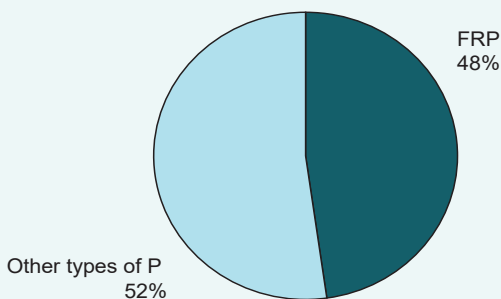
Total P is made up of different types of P. Governor Broome Road had the second highest percentage of P present as phosphate of the sites in the Scott River catchment. This is very different to 2018 when the site had the lowest percentage of phosphate (24 per cent). Why the percentage of P present as phosphate has increased is unknown; however, the stream was only flowing on three sampling occasions in 2019 (compared with six in 2018) so this may have had an impact. Phosphate is measured as filterable reactive phosphorus (FRP); in surface waters this is mainly present as phosphate (PO_4^{3-}) species and is readily bioavailable. The remainder of the P was present as either particulate P or dissolved organic P (DOP) or both (shown 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

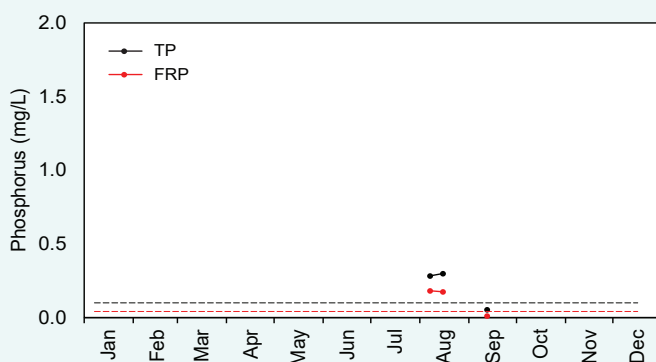
TP and phosphate concentrations were highest in August, shortly after the stream started to flow. It is likely that this was because of a first flush effect where rainfall flushed P into the stream from surrounding land use as well as mobilising P that was already present on the stream bed. It is likely P is coming from in-stream sources as well as entering the stream via both surface flows and groundwater.

Where there are no data shown in the graph, the site was not flowing. As 2019 was a low rainfall year, the site was only flowing on three sampling occasions.

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2019 average phosphorus fractions at site 6091225.



2019 phosphorus concentrations at 6091225. The black dashed line is the Scott River WQIP target for TP, the red is the ANZECC trigger value for phosphate.



Collecting a water quality sample for laboratory analysis.

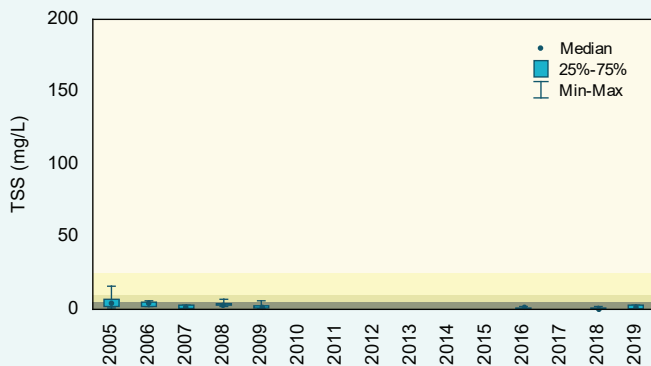
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Total suspended solids over time (2005–19)

Concentrations

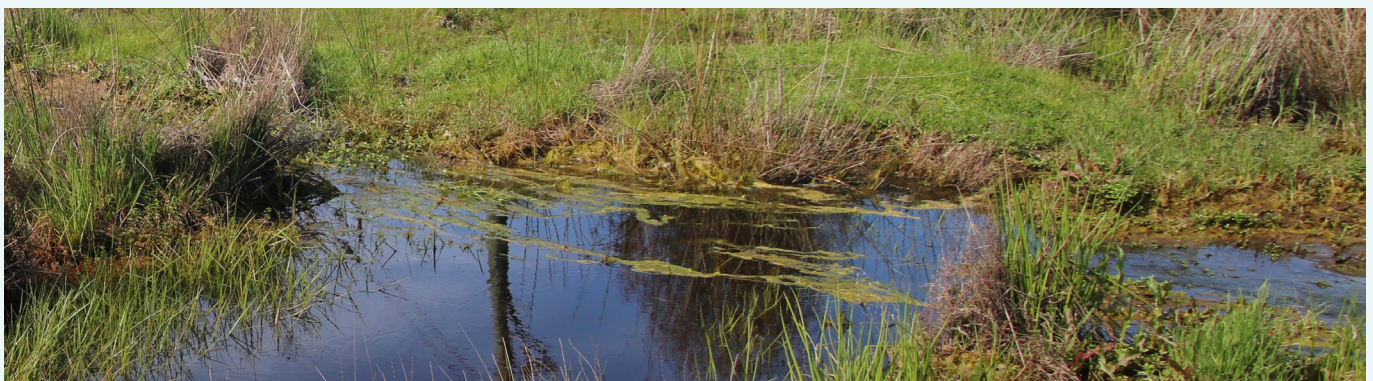
Total suspended solids (TSS) concentrations were low at the Governor Broome Road sampling site, with all available years classified as low using the SWRWQA methodology.

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Total suspended solids concentrations, 2005–19 at site 6091225. The shading refers to the SWRWQA classification bands.

low moderate high very high



Filamentous algae growing in the waterway in September.

Governor Broome

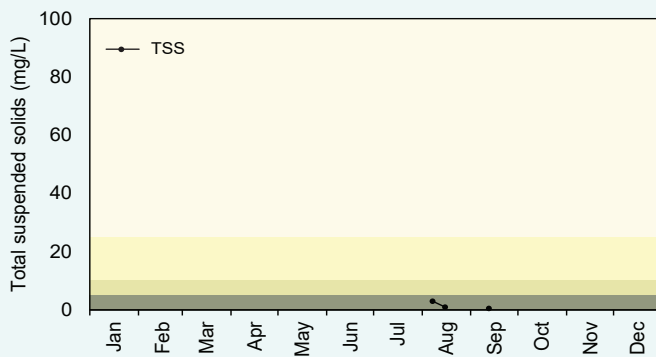
Total suspended solids (2019)

Concentrations

In 2019, all of the TSS samples collected fell into the low band. One of the three samples had a TSS concentration so low that it was below the laboratory limit of reporting (LOR) of 1 mg/L. It is likely particulate matter was entering the stream via surface flows as well as from in-stream sources such as erosion at this site.

Where there are no data shown in the graph, the site was not flowing. As 2019 was a low rainfall year, the site was only flowing on three sampling occasions.

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2019 total suspended solids concentrations at 6091225. The shading refers to the SWRWQA classification bands.

low moderate high very high



Bluegum plantation in the process of being logged in the Governor Broome catchment.

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pH over time (2005–19)

pH values

pH at the Governor Broome Road sampling site fluctuated over the reporting period. The median pH was between the upper and lower ANZECC trigger values each year.

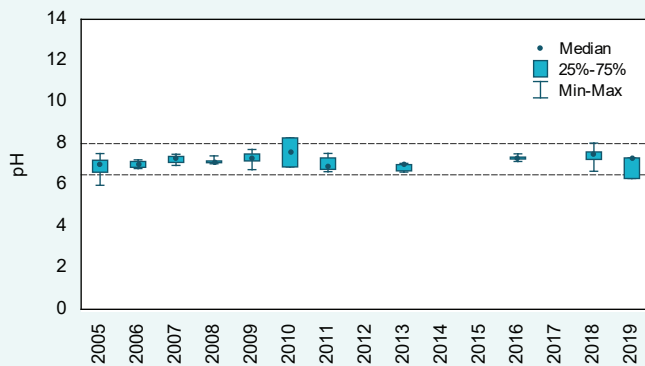
pH (2019)

pH values

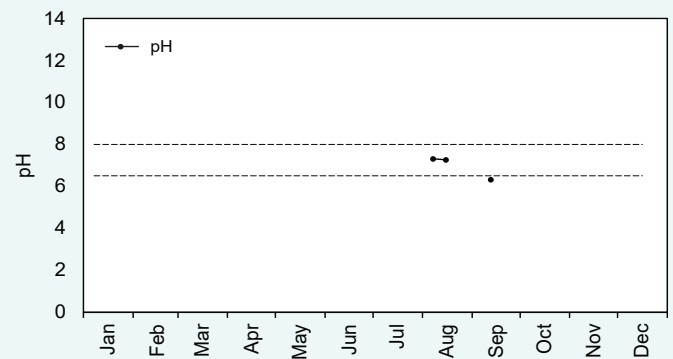
Two of the three samples collected in 2019 were between the upper and lower ANZECC trigger values. The last sample collected, in September, was just below the lower ANZECC trigger value.

Where there are no data shown in the graph, the site was not flowing. As 2019 was a low rainfall year, the site was only flowing on three sampling occasions.

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pH levels, 2005–19 at site 6091225. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 6091225. The dashed lines are the upper and lower ANZECC trigger values.



Young bluegum plantation in Governor Broome catchment.

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Salinity over time (2005–19)

Concentrations

The Governor Broome Road sampling site was fresh, with all years classified as fresh using the Water Resources Inventory 2014 salinity ranges (note, the 2018 nutrient report used the SWRWQA bands). While salinity fluctuated slightly over the reporting period it does not appear to be changing. In 2019, Governor Broome Road had the second lowest median salinity of all the sites sampled in the Scott River catchment (230 mg/L; Four Acres Road, which has an upstream catchment that is almost entirely covered in native vegetation, had a median salinity of 80 mg/L).

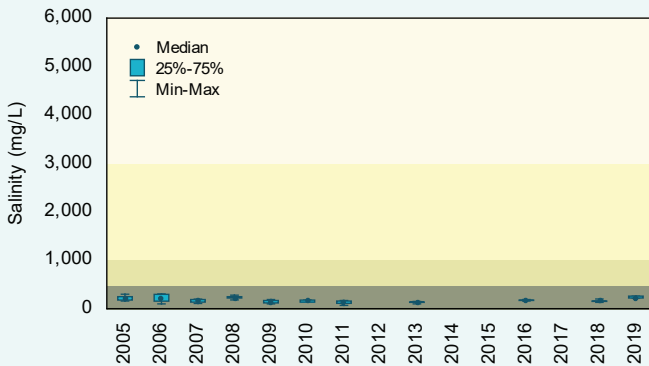
Salinity (2019)

Concentrations

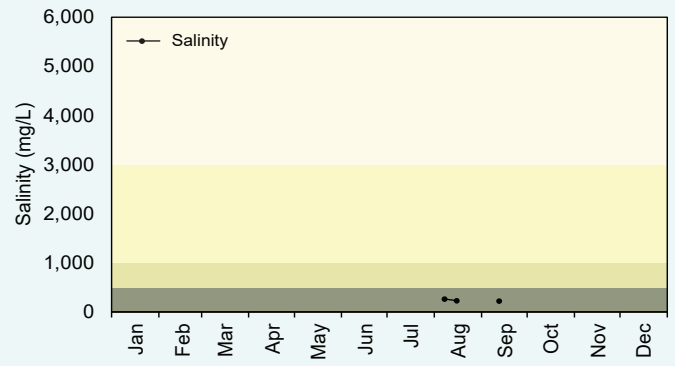
Salinity showed no seasonal pattern at the Governor Broome Road sampling site. All samples collected in 2019 fell into the Water Resources Inventory 2014 fresh salinity range.

Where there are no data shown in the graph, the site was not flowing. As 2019 was a low rainfall year, the site was only flowing on three sampling occasions.

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Salinity concentrations, 2005–19 at site 6091225. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at 6091225. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh
 marginal
 brackish
 saline



The waterway just downstream from the Governor Broome Road sampling site, September 2018.

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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 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 more information on the condition of Hardy Inlet at estuaries.dwer.wa.gov.au/estuary/hardy-inlet/

Healthy Estuaries WA partners with the Lower Blackwood Land Conservation District Committee (Lower Blackwood LCDC) 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 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

Variables were compared with the Scott River WQIP targets or 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 in the 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: 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 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.

