Beenup

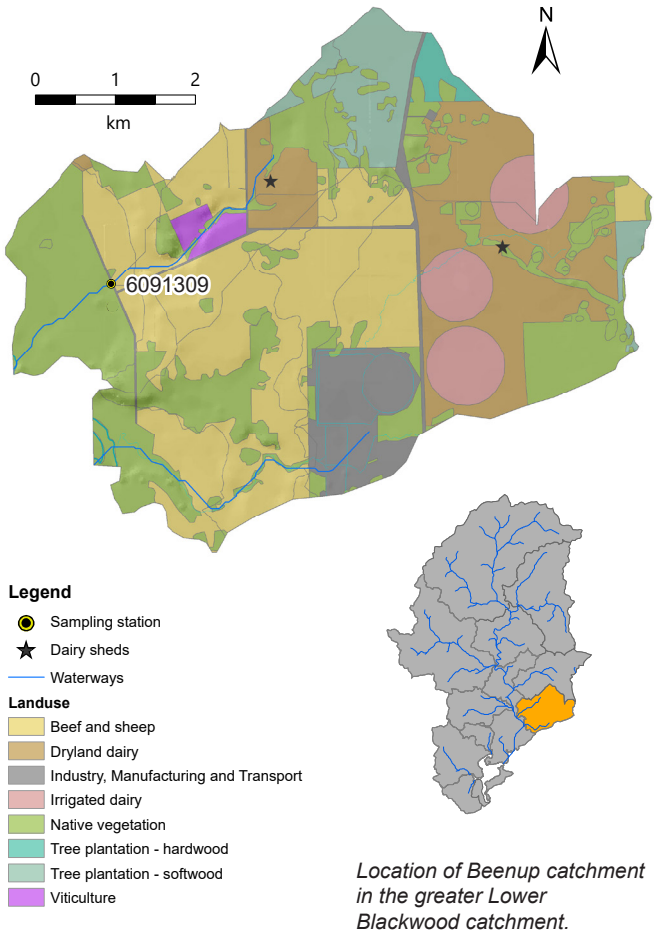
This data report provides a summary of the nutrients at the Beenup catchment sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site, the stream discharges into the Blackwood River and subsequently the Hardy Inlet.

About the catchment

Beenup has a catchment area of about 31 km^2, with native vegetation and beef and sheep grazing the major land uses, covering roughly a third of the catchment each. Dryland dairy is the next largest land use and there are two dairy sheds present in the catchment. Two main streams drain the Beenup catchment, of which only the northern one is monitored (there are also a number of minor streams present). Much of the fringing vegetation has been cleared, especially where the streams pass through agricultural land.

The soils in the catchment have a moderate to high capacity to bind phosphorus. This means that any phosphorus applied to them tends to be bound, reducing the amount that enters streams.

Water quality is measured at site 6091309, Payne Road, which is close to Payne Road, in Courtenay, on the northern stream in the catchment. Downstream of this site, the stream passes through the Scott National Park before discharging to the Blackwood River.



Location of Beenup catchment in the greater Lower Blackwood catchment.

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Payne Road sampling site in the Beenup catchment were classified as high (nitrogen) and moderate (phosphorus). Most of the nutrients were entering the stream from the agricultural land use upstream of the sampling site.

Facts and figures

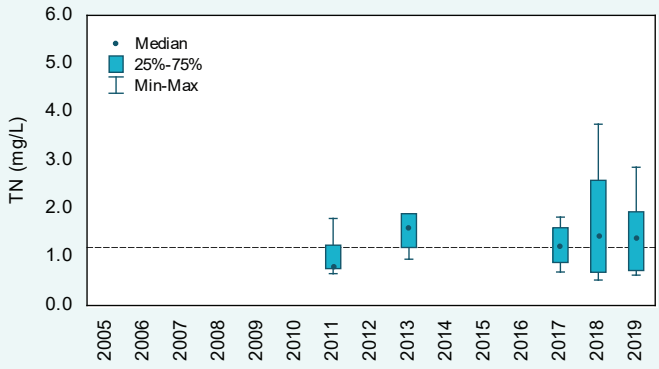
Sampling site code	6091309 (Payne Road)
Catchment area	31 km^2
Per cent cleared area (2001)	69 per cent
River flow	Ephemeral
Main land use (2001)	Native vegetation, beef and sheep grazing and dryland dairy

Nitrogen over time (2005–19)

Concentrations

Annual total nitrogen (TN) concentrations at Payne Road were classified as high using the State Wide River Water Quality Assessment (SWRWQA) methodology. While TN varied in the five years with sufficient data to graph, the median TN concentration was above the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value in all but one of these years. The site had the highest 2019 median TN concentration (1.4 mg/L) of the nine sites sampled in the Blackwood River catchment. The high TN concentrations can be attributed to the upstream agricultural land use. Also, the fact that much of the catchment is cleared, and the lack of fringing vegetation and fencing along waterways, allows nutrients to be washed into the stream quickly following rainfall.

Payne Road



Total nitrogen concentrations, 2005–19 at site 6091309. The dashed line is the ANZECC trigger value.

Collecting a water quality sample at the Payne Road sampling site, June 2019.

Nitrogen (2019)

Types of nitrogen

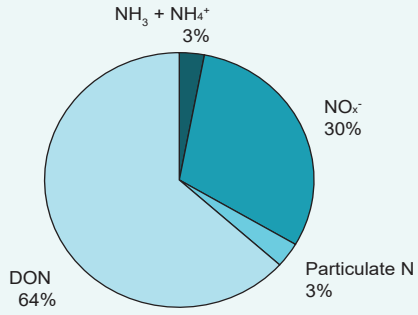
Total N is made up of different types of N. At Payne Road, nearly a third of N was present as nitrate (NO_x^-) which can be used by plants and algae to fuel rapid growth. Likely sources of nitrate in an agricultural catchment like Beenup include fertilisers and animal waste, with natural sources contributing less. Having a relatively large proportion of the N present as nitrate is typical of agricultural catchments like Beenup. Only a small amount of N was present as particulate N and total ammonia (NH_3 + NH_4^+). The largest proportion was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may also include other types. Most types of DON need to be further broken down to become available to plants and algae, though some types are readily bioavailable.

Concentrations

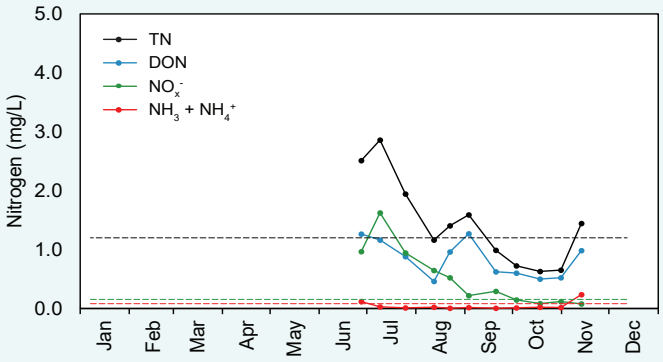
Nitrogen concentrations showed a seasonal pattern with TN and nitrate both peaking in July, shortly after the stream started flowing, before reducing again. These early peaks are indicative of a first flush effect where N was mobilised following heavy rainfall. For nitrate and total ammonia, much of 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 pasture which builds up with fertilisers and animal waste over the summer. DON was likely washed from soils and remnant wetlands where it had built up over the summer period. TN, DON and total ammonia all peaked again on the last sampling occasion, possibly a result of evapoconcentration or silt being dislodged from aquatic plants during sampling.

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

Payne Road



2019 average nitrogen fractions at site 6091309.



2019 nitrogen concentrations at 6091309. The dashed lines are the ANZECC trigger values for the different N species.

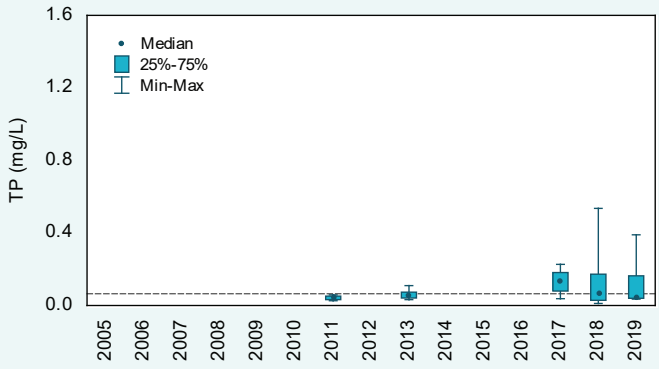
Dense growth of pennyroyal mint (Mentha pulegium), an environmental weed, at the sampling site, October 2019. High nutrient levels help promote this kind of growth.

Phosphorus over time (2005–19)

Concentrations

Annual total phosphorus (TP) concentrations were classified as moderate at Payne Road using the SWRWQA methodology. Only five years had sufficient TP data to graph; from these, it appears that TP concentrations increased between 2013 and 2017, when there was a gap in monitoring. Ongoing monitoring will help determine if water quality has deteriorated or if the higher TP concentrations in 2017–19 are part of the natural fluctuations at this site. In 2019, Payne Road had the second-highest median TP concentration of the nine sites monitored in the Blackwood River catchment (0.045 mg/L; only Courtney Road had a higher median of 0.092 mg/L).

Payne Road



Total phosphorus concentrations, 2005–19 at site 6091309. The dashed line is the ANZECC trigger value.

The Payne Road sampling site, November 2018. It stopped flowing shortly after this photograph was taken.

Phosphorus (2019)

Types of phosphorus

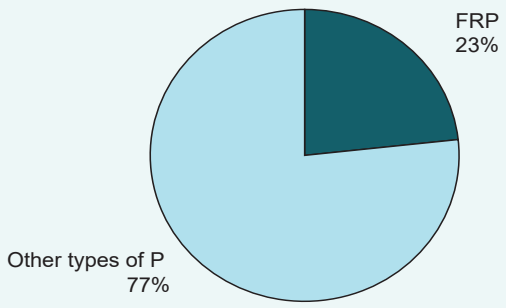
Total P is made up of different types of P. At Payne Road, nearly a quarter of the P was present as highly bioavailable phosphate; measured as filterable reactive P (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species. This type of P was likely sourced from fertilisers and animal waste as well as natural sources. The remaining 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. The bioavailability of DOP varies and is poorly understood.

Concentrations

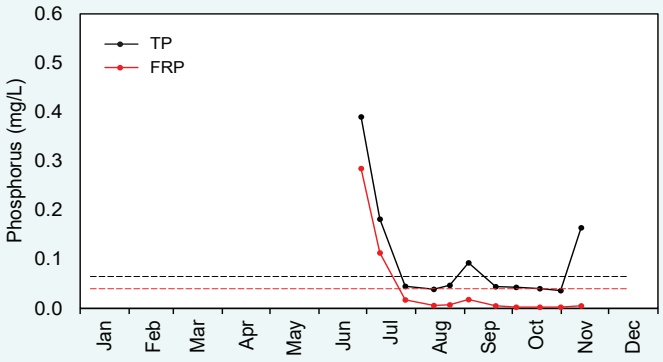
Total P and phosphate showed a similar pattern in 2019. Both were at their highest in June, when the stream first started to flow, before reducing. This suggests a large amount of P was entering the stream through a first flush effect, where nutrients that were present in the dry stream and on the ground surrounding the stream were flushed into the stream following heavy rainfall. TP concentrations increased again in November, on the last sampling occasion. This peak is possibly a result of evapoconcentration, or silt being dislodged from aquatic plants during sampling. The agricultural land use and lack of fringing vegetation and fencing along this stream will be contributing to the relatively high P concentrations observed at this site.

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

Payne Road



2019 average phosphorus fractions at site 6091309.



2019 phosphorus concentrations at 6091309. The dashed lines are the ANZECC trigger values for the different P species.

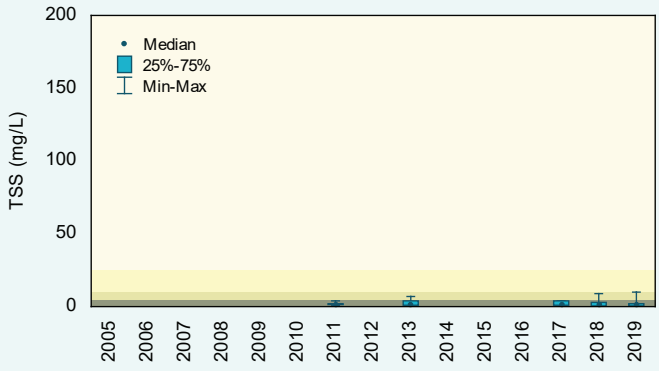
The Payne Road sampling site, August 2018. The water levels are much higher than in the previous photograph, taken in November 2018.

Total suspended solids over time (2005–19)

Concentrations

Annual total suspended solids (TSS) concentrations were classified as low using the SWRWQA methodology. Most of the samples collected in the five years where there were sufficient data to graph fell into the SWRWQA low band, with only very few in the moderate band.

Payne Road



Total suspended solids concentrations, 2005–19 at site 6091309. The shading refers to the SWRWQA classification bands.

low moderate high very high

Near the Payne Road sampling site, August 2019.

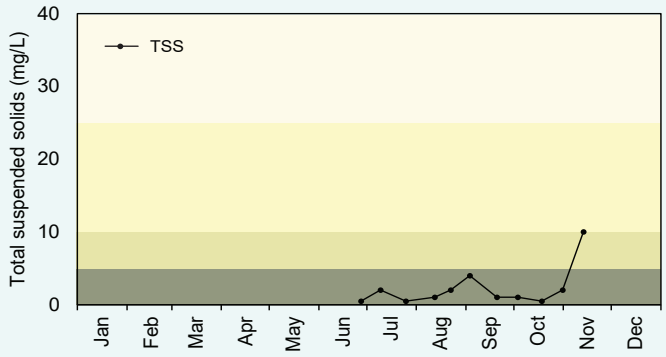
Total suspended solids (2019)

Concentrations

In 2019, all samples collected fell in the low band except for one in November which fell into the moderate band. This peak may be a result of evapoconcentration, or silt being dislodged from aquatic plants during sampling. It is likely that particulate matter was entering the stream via surface flow as well as coming from in-stream sources such as erosion.

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

Payne Road



2019 total suspended solids concentrations at 6091309. The shading refers to the SWRWQA classification bands.

low moderate high very high

The Payne Road sampling site, July 2019.

pH over time (2005–19)

pH values

pH at Payne Road fluctuated in the years for which there were sufficient data to graph. Initially, it appeared that pH might have increased following the gap in sampling from 2014–16; however, in 2019 they seem to have decreased again.

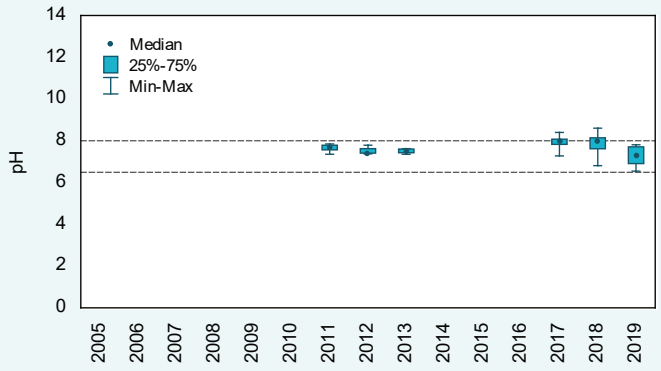
pH (2019)

pH values

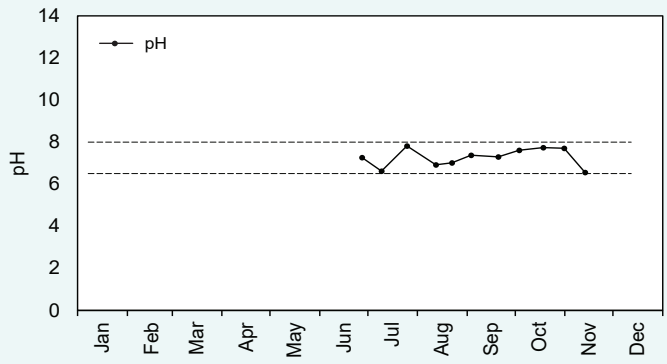
In 2019, all pH values fell within the upper and lower ANZECC trigger values. Values fluctuated over the year, with no clear seasonal pattern evident.

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

Payne Road



pH levels, 2005–19 at site 6091309. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 6091309. The dashed lines are the upper and lower ANZECC trigger values.

Algae growing attached to submerged plants at the Payne Road sampling site, October 2018.

Salinity over time (2005–19)

Concentrations

Salinity was consistently low at Payne Road, with all samples collected falling within the fresh band. All years were classified as fresh using the Water Resources Inventory 2014 salinity ranges (note the 2018 nutrient report used the SWRWQA bands). The 2019 median salinity at Payne Road was one of the lowest of the nine sites sampled in the Blackwood River catchment (250 mg/L; Courtney Road and McLeod Creek had the next lowest medians of 220 and 240 mg/L respectively).

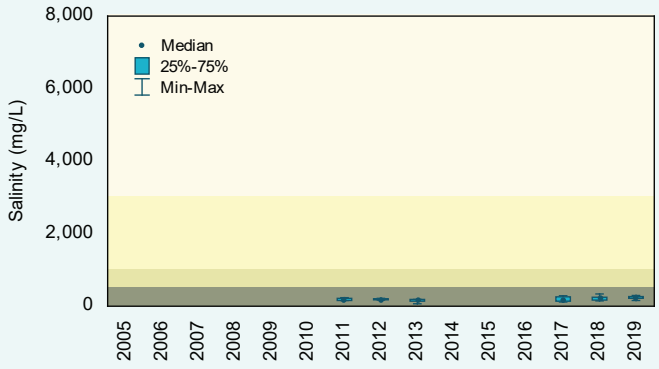
Salinity (2019)

Concentrations

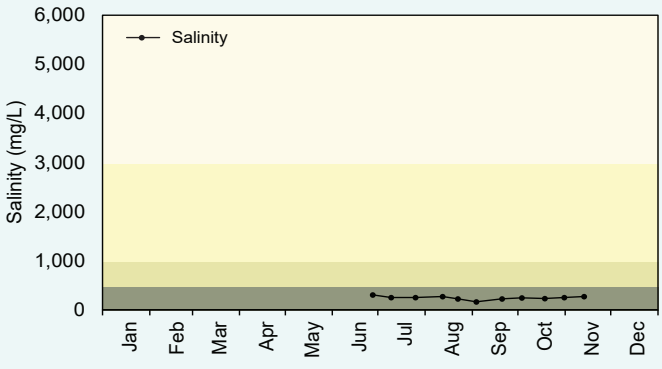
Salinity showed a slight inverse seasonal relationship, with concentrations being highest at the start and end of the flow year. This suggests that the start of the winter rains washed salts into the stream from surrounding land use as well as mobilising salts left behind in the stream after it dried the previous summer. Concentrations then decreased over winter as water levels rose, before increasing again slightly at the end of the flow year when the proportion of groundwater in the stream increased. At this time, evapoconcentration of the salts in the water will also be occurring.

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

Payne Road



Salinity concentrations, 2005–19 at site 6091309. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at site 6091309. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

High water levels, September 2019.

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. 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 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 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 per volume of 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.

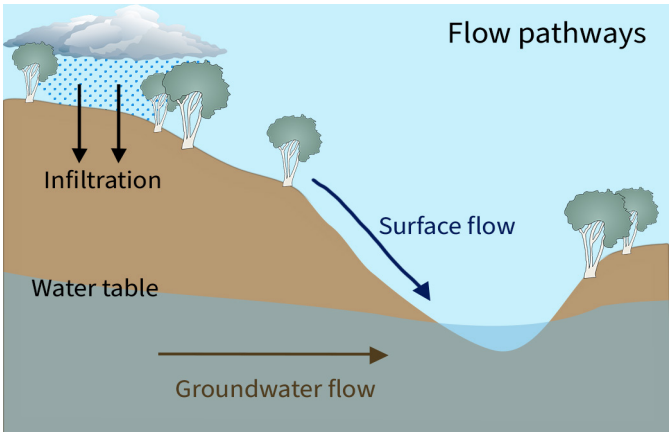
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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.



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