East Tributary

This data report provides a summary of the nutrients at the East Tributary 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, East Tributary discharges into the Blackwood River and, subsequently, the Hardy Inlet. Nutrients (nitrogen and phosphorus) are compopunds 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

East Tributary has a catchment area of about 41 km^2. The two dominant land uses are beef and sheep grazing and native vegetation, which cover about 40 per cent of the catchment each. This includes a portion of the South Blackwood State Forest in the north-east corner of the catchment. Some sections of the streams still have fringing vegetation along them but much of it has been lost, especially where they pass through agricultural land.

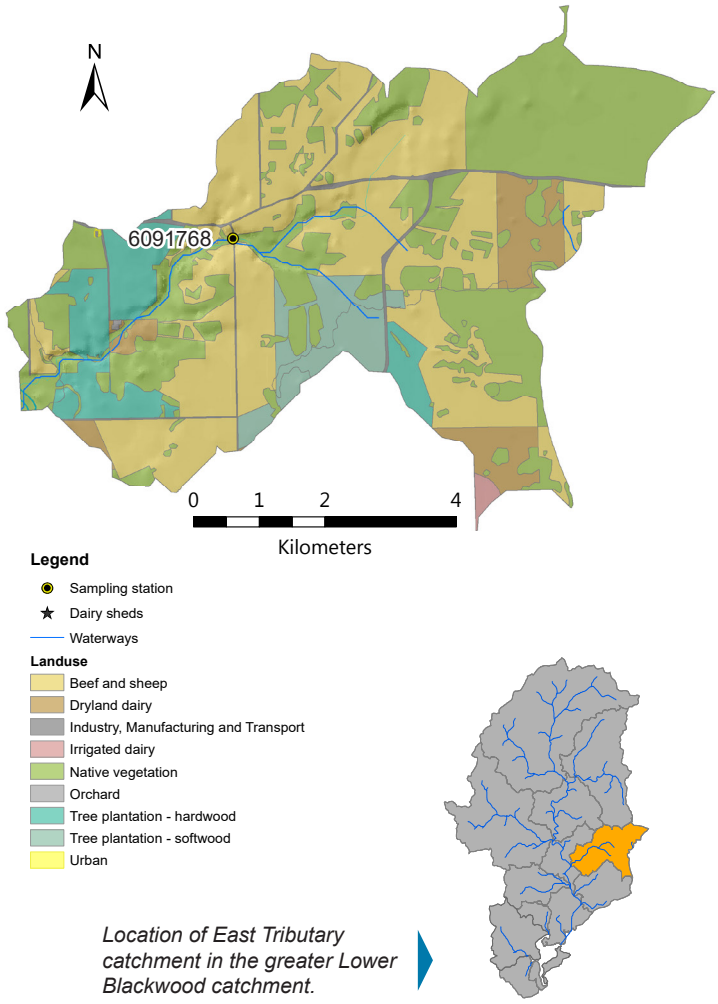
Most of the soils in the catchment have a high phosphorus-binding capacity, with the exception of a small area in the south-east portion. Soils with a high phosphorus-binding capacity tend to bind most of the phosphorus applied to them, reducing the amount that enters the streams.

The East Tributary flows through the Scott National Park before discharging to the Blackwood River in Courtenay.

Water quality is measured at site 6091768, Courtney Road, which is close to the Brockman Highway, in Courtenay. This site is a few kilometres upstream of the confluence with the Blackwood River.

Results summary

Nutrient concentrations in the East Tributary catchment were high for nitrogen and very high for phosphorus. Filterable reactive phosphorus (the bioavailable form of phosphorus) concentrations were high during the wetter months when runoff from surrounding farmland was contributing most of the nutrients found in the stream.



Location of East Tributary catchment in the greater Lower Blackwood catchment.

Facts and figures

Sampling site code	6091768
Rainfall at Alexandra Bridge (2018)	933 mm
Catchment area	41 km^2
Per cent cleared area (2001)	61 per cent
River flow	Permanent
Main land use (2001)	Beef and sheep grazing and native vegetation

East Tributary

Nitrogen over time (2004–18)

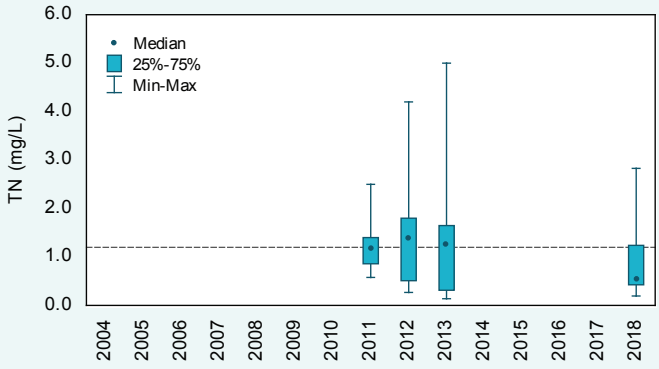
Concentrations

The median total nitrogen (TN) concentration was on or just above the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value from 2011–13. In 2018, TN concentrations appeared lower, with the median below the ANZECC trigger value for the first time. Ongoing monitoring will help determine if the lower concentrations observed are because of an improvement in water quality, or part of the natural fluctuations at this site. Compared with the other nine sites in the Blackwood River catchment, median TN concentrations were low, with the 2018 median being one of the lowest (0.56 mg/L; Hut Pool had a median of 0.51 mg/L and Chapman Brook 0.57 mg/L). However the range in TN concentrations was large.

Trends

As Courtney Road 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 calculate trends.

Courtney Road



Total nitrogen concentrations, 2004–18 at site 6091768. The dashed line is the ANZECC trigger value for lowland rivers.

Cattle with unrestricted access to streams damage banks, causing erosion as well as contributing nutrients through their waste, March 2019.

Nitrogen (2018)

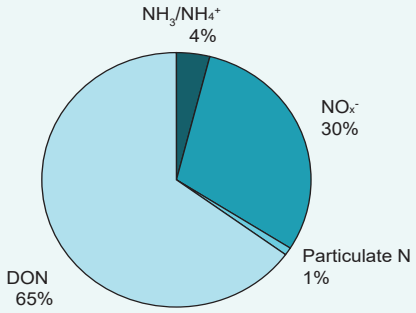
Types of nitrogen

Total N is made up of many different forms of N. At Courtney Road, nearly a third of the N was present as oxides of nitrogen (NO_x^-). This form of N is readily available for plants and algae to use to fuel rapid growth. Likely sources for this kind of N include fertilisers and animal waste from upstream land use. Nearly two-thirds of the N was present as dissolved organic N (DON) which consists mainly of degrading plant and animal matter but may also include other forms. The bioavailability of DON varies depending on its form. Some 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.

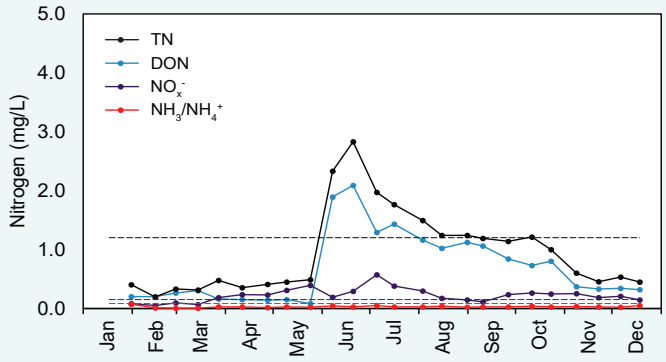
Concentrations

Total N, DON and, to a lesser extent, NO_x^- showed a seasonal response, increasing and peaking in June. This is typical of a first-flush effect where N was mobilised following heavy rainfall. Much of this N was probably the result of organic N washing from soils and remnant wetlands where it had built up over the summer months. Ammonia N (NH_3/NH_4^+) was low all year and showed little seasonal variation. NO_x^- concentrations were high, above the ANZECC trigger value for 17 of the 24 sampling occasions in 2018.

Courtney Road



2018 average nitrogen fractions at site 6091768.



2018 nitrogen concentrations at 6091768. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

Grazing is one of the dominant land uses in the East Tributary catchment, May 2019.

East Tributary

Phosphorus over time (2004–18)

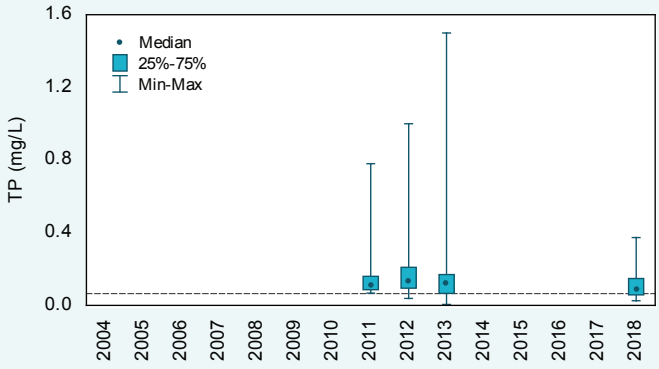
Concentrations

Total phosphorus (TP) concentrations were high at Courtney Road compared with the other sites in the Blackwood River catchment. The median was above the ANZECC trigger value in each of the four years which had sufficient data to graph. The range in TP concentrations were also large, with the site having the highest TP concentrations recorded in the Blackwood River catchment. The range in TP concentrations appears lower in 2018 than previous years; however, it is not possible to confirm if this is because of an actual improvement or just the natural fluctuations at the site. Ongoing monitoring will help determine this. The median was still high, however, with the 2018 median being the highest of the nine sites sampled in the Blackwood River catchment (0.087 mg/L; the next highest median was 0.074 mg/L at Payne Road).

Trends

As Courtney Road 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 calculate trends.

Courtney Road



Total phosphorus concentrations, 2004–18 at site 6091768. The dashed line is ANZECC trigger value for lowland rivers.

The culverts under Courtney Road, October 2019.

East Tributary

Phosphorus (2018)

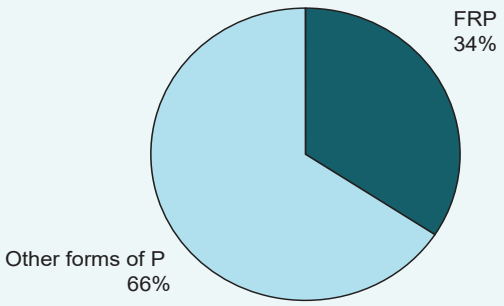
Types of phosphorus

Total P is made up of different types of P. At Courtney Road, about two-thirds of the P was present as either particulate P or dissolved organic P (DOP). Particulate P generally needs to be broken down before becoming bioavailable to algae. The bioavailability of DOP varies and is poorly understood. The remainder of the P was present as filterable reactive P (FRP) which is readily bioavailable, meaning plants and algae can use it to fuel rapid growth. Most of the FRP was probably derived from fertilisers and animal waste.

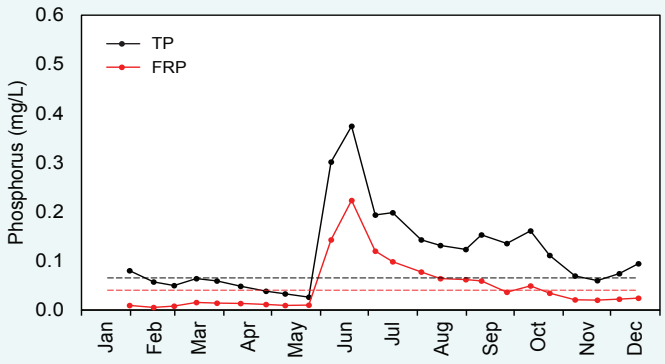
Concentrations

Both TP and FRP showed a seasonal response, increasing rapidly in June following the onset of winter rains and increased stream flow. At this time, a first-flush effect was rapidly washing P into the stream from upstream agricultural land use as well as mobilising P already present in the stream. It is likely surface flows as well as in-stream sources such as erosion were the main sources of P at this site while groundwater contributed proportionally less P. Both TP and FRP were above their respective ANZECC trigger values for a portion of the year.

Courtney Road



2018 average phosphorus fractions at site 6091768.



2018 phosphorus concentrations at 6091768. The dashed lines are the ANZECC trigger values for lowland rivers for the different P species.

The sampling site is situated where the stream passes under Courtney Road, where the parked car is in this photograph, April 2019.

East Tributary

Total suspended solids over time (2004–18)

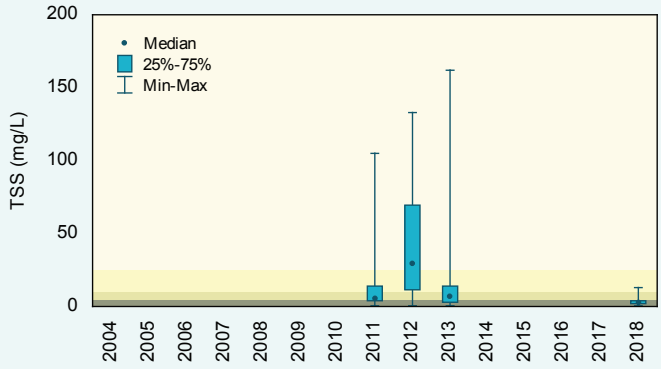
Concentrations

Total suspended solids (TSS) concentrations were high at Courtney Road, with the site having the equal highest median in 2018 (3 mg/L; the same as Glenarty Creek). Using the Statewide River Water Quality Assessment (SWRWQA) bands, the median was classified as moderate in 2011 and 2013, very high in 2012 and low in 2018. TSS concentrations appear to have improved, with 2018 having a lot lower TSS concentrations then previously. It is not possible to determine if the improvement observed is because of an actual change in TSS concentrations or part of the natural fluctuations at this site. Ongoing monitoring will help determine if water quality at this site is improving.

Trends

As Courtney Road 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 calculate trends.

Courtney Road



Total suspended solids concentrations, 2004–18 at site 6091768. The shading refers to the SWRWQA classification bands.

very high high moderate low

Using a probe to record water quality at Courtney Road, June 2019.

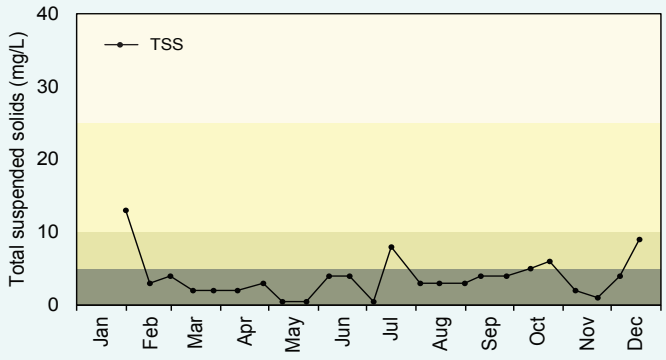
East Tributary

Total suspended solids (2018)

Concentrations

There was no obvious seasonal pattern in TSS concentrations at Courtney Road in 2018, with concentrations fluctuating through the year. Most of the samples collected were classified as low using the SWRWQA bands, with four classified as moderate and one as high. The reason for the peaks observed in TSS are unknown.

Courtney Road



2018 total suspended solids concentrations at 6091768. The shading refers to the SWRWQA classification bands.

very high high moderate low

Looking downstream from the Courtney Road sampling site. Almost all the fringing vegetation here is exotic grasses, October 2019.

East Tributary

pH over time (2004–18)

pH values

The annual median pH at Courtney Road was within the ANZECC trigger values in each of the four years in which there were sufficient data to graph. Each year had some samples over the upper ANZECC trigger value and in 2012 there were also some samples below the lower ANZECC trigger value.

Trends

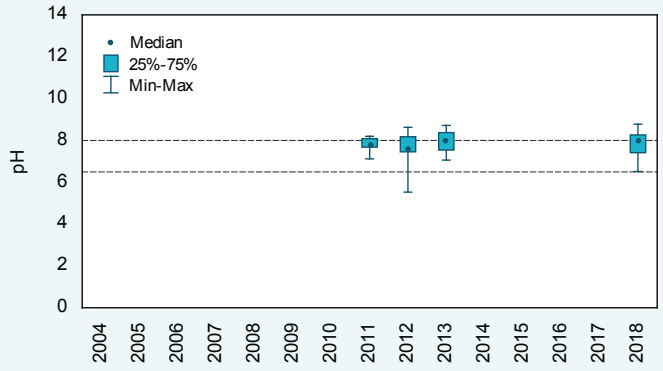
As Courtney Road was only sampled sporadically over the past 15 years, it was not possible to calculate trends in pH this site. A minimum of five years of data are required to calculate trends.

pH (2018)

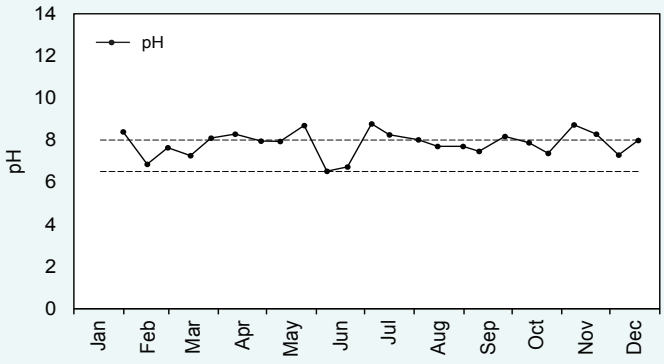
pH values

There was no evidence of a seasonal pattern in pH at Courtney Road, with values fluctuating throughout the year. There were a number of samples which were above the upper ANZECC trigger value.

Courtney Road



pH levels, 2004–18 at site 6091768. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6091768. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Low water levels near the Courtney Road sampling site, January 2018. While the site was flowing on this occasion, it was too shallow to collect a water quality sample.

Salinity over time (2004–18)

Concentrations

Using the SWRWQA bands, Courtney Road was classified as fresh each year in which there were sufficient data to graph, with all samples falling into the fresh band. Salinity was low compared with the other nine sites sampled in the Blackwood River catchment, with the 2018 median being one of the lowest recorded (220 mg/L; only Payne Road had a lower median salinity of 215 mg/L).

Trends

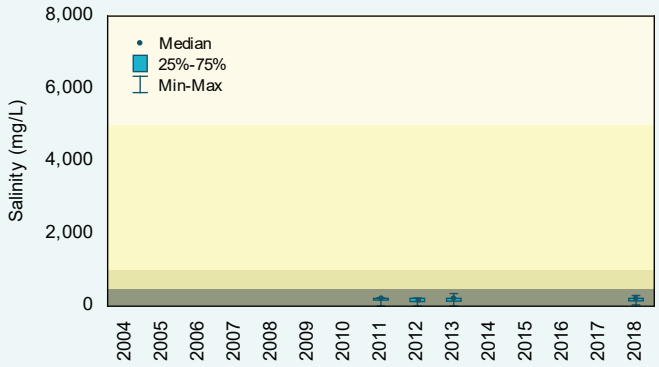
As Courtney Road was only sampled sporadically over the past 15 years, it was not possible to calculate trends in salinity at this site. A minimum of five years of data are required to calculate trends.

Salinity (2018)

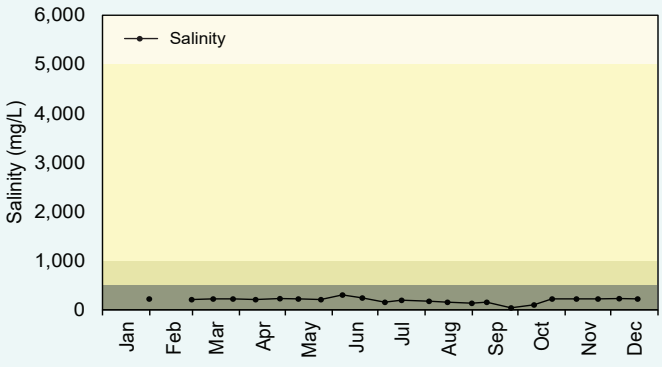
Concentrations

Salinity did not show a seasonal relationship at this site, fluctuating slightly through the year but being consistently low. This was one of the freshest sites sampled in 2018.

Courtney Road



Salinity concentrations, 2004–18 at site 6091768. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6091768. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

High water levels at the Courtney Road sampling site, August 2018. The white flowers are Arum lilies, an introduced species from southern Africa which is a declared pest.

East Tributary

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.

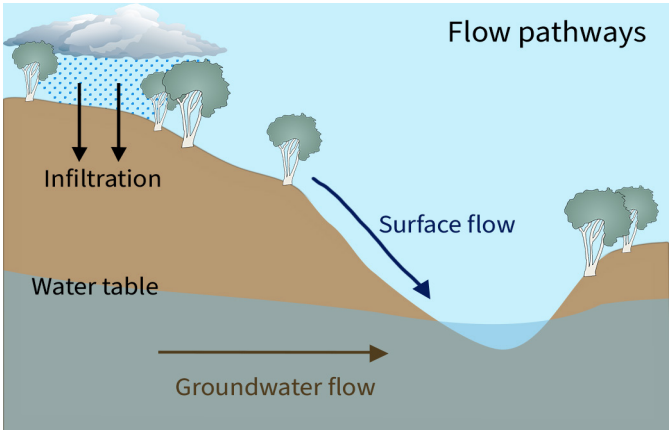
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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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