Drakesbrook–Waroona Drain

This data report provides a summary of the nutrients at the Drakesbrook 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 drain discharges into the Harvey River and, from there, into the Harvey Estuary. 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

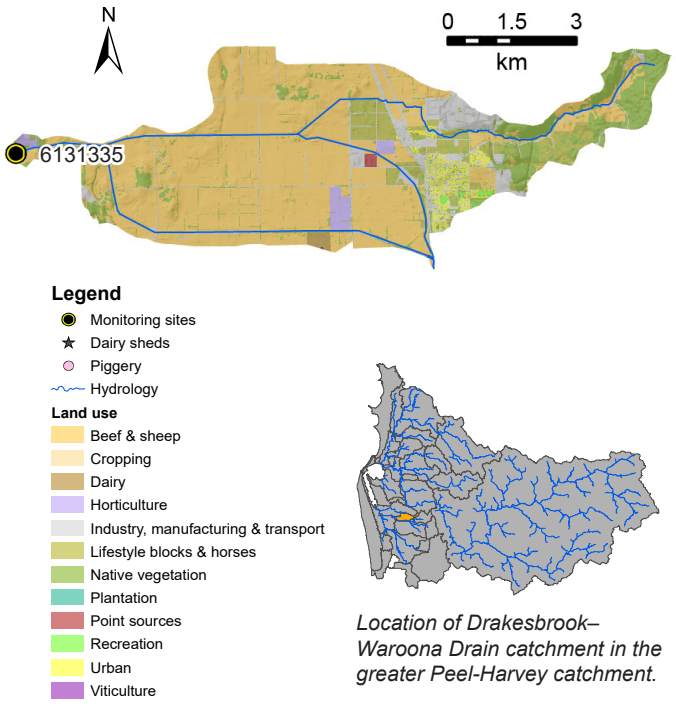
Drakesbrook–Waroona Drain has a catchment area of about 40 km^2, about 80 per cent of which has been cleared for agriculture, mainly beef and sheep grazing. The Waroona Waste Water Treatment Plant is in the catchment. The southern waterways (Waroona and Drakesbrook drains) are highly modified drains, whereas the northern waterway (Hull Brook) retains its natural form on the scarp before being converted to a drain on the coastal plain. Numerous drains have been constructed on the coastal plain to rapidly remove water from farmland and deliver it to the two main drains. There is only limited, highly modified fringing vegetation along the drains on the coastal plain. Upstream of the point where Drakesbrook and Waroona Drains fork (outside of the reporting catchment) is Drakesbrook Dam (Lake Moyanup) and, further upstream, Waroona Dam (Lake Navarino).

Most of the catchment has soils with 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 6131335, Drakesbrook Drain, downstream of the confluence of Drakesbrook and Waroona drains. The site is where the drain passes under Dorsett Road, in Waroona.

Results summary

Nutrient concentrations at the Drakesbrook sampling site were low (total phosphorus) to moderate (total nitrogen). The proportion of nitrogen present in a bioavailable form was large. The agricultural land use and highly modified nature of the drainage network will all be contributing to the large proportion of bioavailable nitrogen at this site.



Location of Drakesbrook–Waroona Drain catchment in the greater Peel-Harvey catchment.

Facts and figures

Sampling site code	6131335
Catchment area	40 km^2
Per cent cleared area (2015)	84 per cent
River flow	Permanent
Main land use (2015)	Beef and sheep grazing

Drakesbrook–Warooona Drain

Nitrogen over time (2004–18)

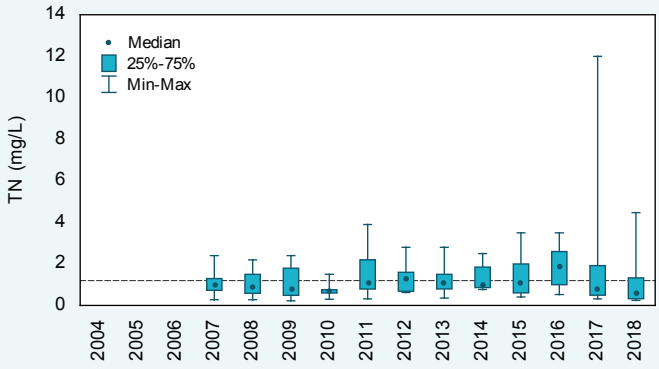
Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period in Drakesbrook Drain. The annual medians were below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value every year except 2012 and 2016. While the medians were generally low compared with the other sites in the Peel-Harvey catchment, each year had a number of samples over the ANZECC trigger value. The range in concentrations was also much greater in 2017 than other years, though the reason for this is unclear.

Trends

There was a short-term (2014–18) decreasing trend present in TN concentrations of 0.14 mg/L/yr. This may be because of natural fluctuations at this site or an actual decrease in TN concentrations. Ongoing monitoring will help determine if the water quality is getting better at this site. There was no long-term (2007–18) trend present.

Drakesbrook Drain



Total nitrogen concentrations, 2004–18 at site 6131335. The dashed line is the ANZECC trigger value for lowland rivers.

The sampling site viewed from the top of the bund next to Dorsett Road, May 2020.

Drakesbrook–Waroona Drain

Nitrogen (2018)

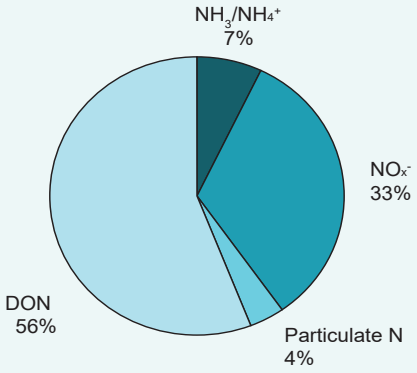
Types of nitrogen

Total N is made up of many different types of N. Drakesbrook Drain had the highest proportion of N present as highly bioavailable dissolved inorganic N (DIN—consisting of ammonia N, NH_3/NH_4^+ and oxides of N, NO_x^-) of the 13 sites in the Peel-Harvey catchment. This form of N is commonly sourced from fertilisers and animal wastes as well as mineralisation of organic N in soils. The proportion of N present as dissolved organic N (DON) was relatively small; this type of N consists mainly of degrading plant and animal matter but may include other forms of N. 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.

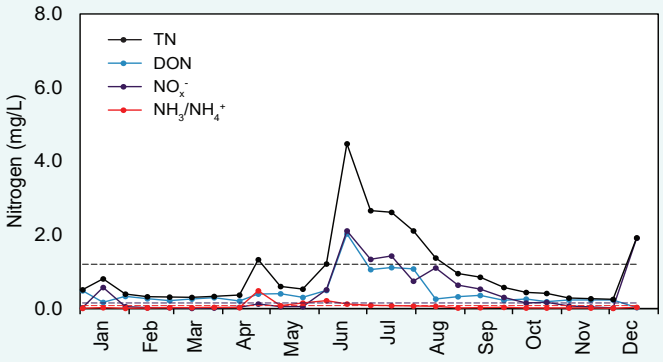
Concentrations

Total N, DON and NO_x^- showed a seasonal pattern, being highest in June, when winter rainfall commenced. This peak 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 drains over the summer period, and runoff of high-concentration waters from agricultural land. After the initial peak, concentrations slowly fell for the remainder of the year. The small peak in January was because of unseasonably heavy rainfall at this time. The reason for the peak in TN and NH_3/NH_4^+ in April is unknown.

Drakesbrook Drain



2018 average nitrogen fractions at site 6131335.



2018 nitrogen concentrations at 6131335. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

View upstream from the sampling site, September 2018.

Drakesbrook–Waroona Drain

Phosphorus over time (2004–18)

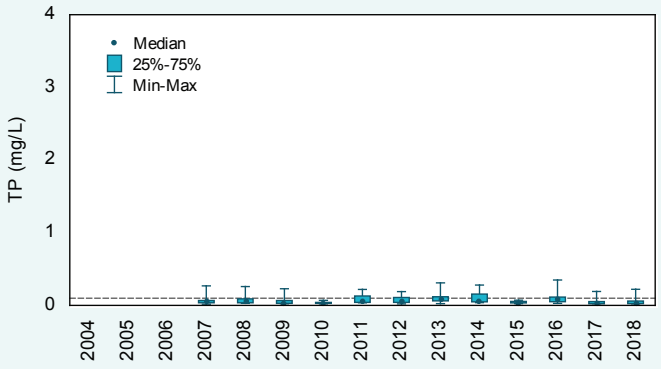
Concentrations

Total phosphorus (TP) concentrations fluctuated over the reporting period but were consistently low. The annual median total phosphorus (TP) concentrations were below the Peel-Harvey Water Quality Improvement Plan (WQIP) winter median target every year for which there were data. The number of samples over the target was small each year and, in 2010 and 2015, all samples collected were below the target. Compared with the other 13 sites in the Peel-Harvey catchment, TP concentrations at Drakesbrook Drain were low. The site had the third lowest median TP in 2018, only the sites on Mayfield Drain and in the Middle Murray River catchment had lower median concentrations.

Trends

There was a short-term (2014–18) decreasing trend present in TP concentrations of 0.005 mg/L/yr. This may be because of natural fluctuations at this site or an actual decrease in TP concentrations. Ongoing monitoring will help determine if the water quality is getting better at this site. There was no long-term (2007–18) trend present.

Drakesbrook Drain



Total phosphorus concentrations, 2004–18 at site 6131335. The dashed line is the Peel-Harvey WQIP target for winter median TP concentrations.

View downstream from the Drakesbrook Drain sampling site. Note the dense blackberry bushes growing along the banks. These are not native to Australia, May 2020.

Drakesbrook-Waroona Drain

Phosphorus (2018)

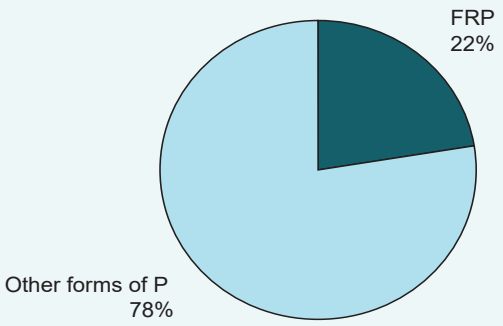
Types of phosphorus

Total P is made up of different types of P. At the Drakesbrook Drain sampling site, just under a quarter of the P was present as highly bioavailable filterable reactive P (FRP), which was the equal lowest percentage of the 13 sites sampled, along with the site in the South Dandalup Catchment. This form of P is readily used by plant and algae to fuel growth and is 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 to algae. The bioavailability of DOP varies and is poorly understood.

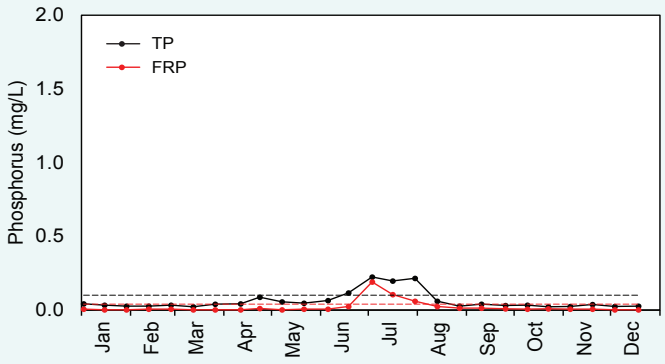
Concentrations

Total P and FRP showed a seasonal pattern in 2018. Both were low at the start of the year before increasing in June. They remained relatively high until reducing again in August after which they remained low. This suggests that most of the P is entering the drain via surface flows from surrounding land use during this time, with groundwater concentrations comparatively lower.

Drakesbrook Drain



2018 average phosphorus fractions at site 6131335.



2018 phosphorus concentrations at 6131335. The dashed black line is the Peel-Harvey WQIP target, the red line is the ANZECC trigger value for lowland rivers.

A vineyard adjacent to Waroona Main Drain, September 2020.

Drakesbrook–Waroona Drain

Dissolved organic carbon over time (2004–18)

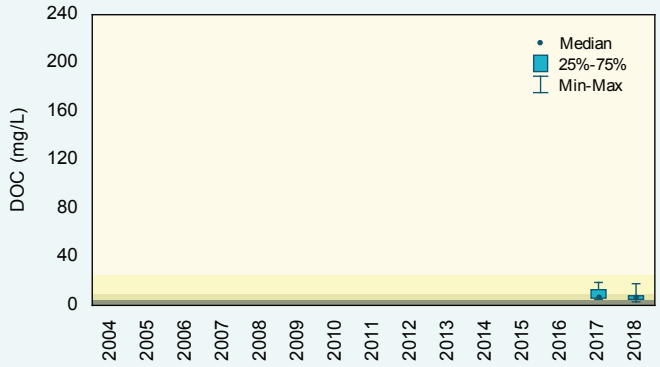
Concentrations

There were only two years with sufficient DOC data available to graph at the Drakesbrook Drain sampling site. In both years, the annual median DOC concentration was classified as moderate using the Statewide River Water Quality Assessment (SWRWQA) classification bands. Each year had some samples that fell in the high classification band; however, the annual range in DOC concentrations was low at this site. Compared with the other sites in the Peel-Harvey catchment, DOC concentrations were low, with 2018 having the lowest annual median (the same as the Mayfield Drain sampling site).

Trends

It was not possible to calculate trends in DOC concentrations at the Drakesbrook Drain site because there were only two years of data present. A minimum of five years of data are required to test for trends.

Drakesbrook Drain



Dissolved organic carbon concentrations, 2004–18 at site 6131335. The shading refers to the SWRWQA classification bands.

very high high moderate low

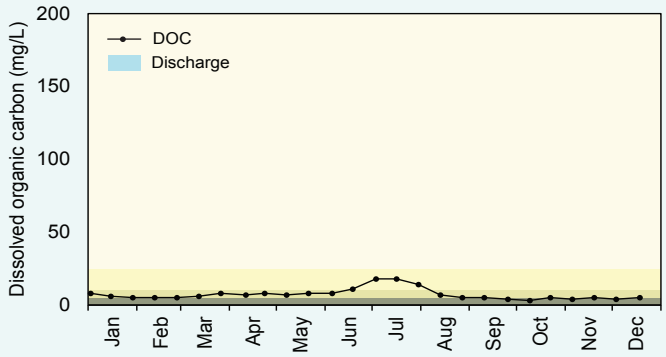
Looking downstream from Dorsett Road Bridge. The fringing vegetation is mostly exotic species such as Watsonia and grasses with a few native trees in the background, September 2018.

Dissolved organic carbon (2018)

Concentrations

Dissolved organic carbon concentrations showed a seasonal pattern at the Drakesbrook Drain sampling site. Concentrations were lowest at the beginning of the year before increasing in June and July when rainfall and flow started to increase in the catchment. After this, concentrations reduced again. DOC is sourced mainly from degrading plant and animal matter, including natural organic matter in soils and wetlands, with many wetlands on deep sands typically generating high DOC concentrations. It varies widely in its bioavailability. At the Drakesbrook Drain sampling site, DOC was coming from surface flow and groundwater as well as in-stream sources.

Drakesbrook Drain



2018 dissolved organic carbon concentrations at 6131335. The shading refers to the SWRWQA classification bands.

very high high moderate low

Looking downstream from Dorsett Road Bridge, May 2020. Compared with the photo taken in 2018 (on the previous page) the fringing vegetation is now dominated by introduced blackberry.

Drakesbrook–Waroona Drain

Total suspended solids over time (2004–18)

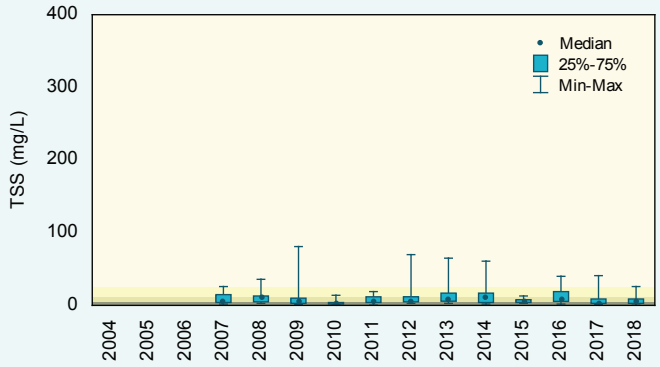
Concentrations

While total suspended solids (TSS) concentrations fluctuated at the Drakesbrook Drain sampling site, they were generally moderate with most annual medians classified as moderate using the SWRWQA classification bands.

Trends

There was no trend in TSS concentrations at Drakesbrook Drain over either the short- (2014–18) or long-term (2007–18).

Drakesbrook Drain



Total suspended solids concentrations, 2004–18 at site 6131335. The shading refers to the SWRWQA classification bands.

very high high moderate low

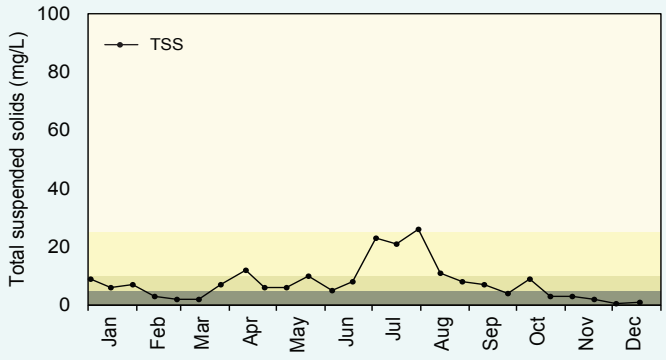
Beef cattle grazing is one of the main land uses in the Drakesbrook–Waroona Drain catchment, September 2020.

Total suspended solids (2018)

Concentrations

In 2018, there was a seasonal pattern present in TSS concentrations at Drakesbrook Drain. Concentrations were highest in the middle of the year when flow volumes would have been at their greatest. This suggests that much of the particulate matter was either being washed into the drain from surrounding land use or was being mobilised by the higher flow volumes present in the wetter months. There were also small peaks at other times of the year; the reason for these peaks is unclear.

Drakesbrook Drain



2018 total suspended solids concentrations at 6131335. The shading refers to the SWRWQA classification bands.

very high high moderate low

Waroona Drain. Note the sand slug in the bottom of the drain. This is from erosion further upstream with the sand being deposited in slower-moving sections of the drain like this one, September 2020.

Drakesbrook–Waroona Drain

pH over time (2004–18)

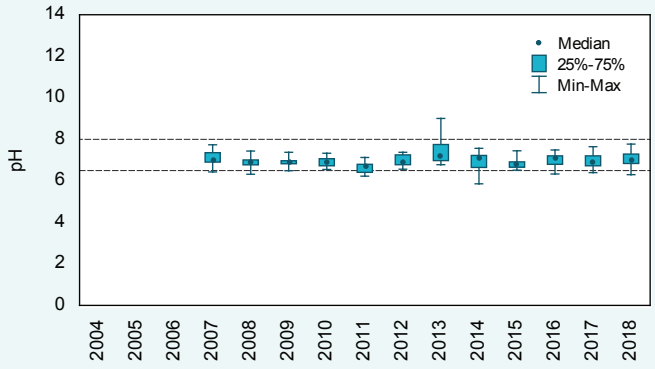
pH values
pH at Drakesbrook Drain fluctuated over the reporting period, though the annual median was between the upper and lower ANZECC trigger value in each year.

Trends
There was no trend in pH at Drakesbrook Drain over either the short- (2014–18) or long-term (2006–18).

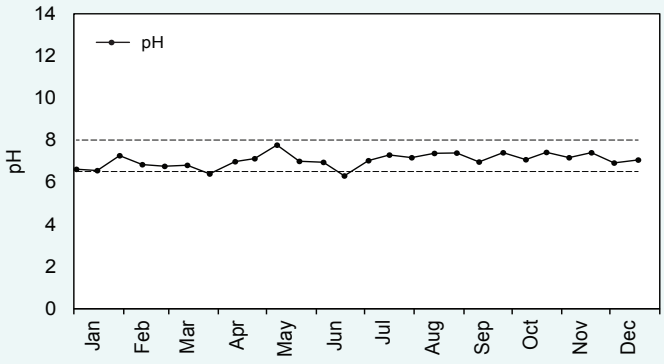
pH (2018)

pH values
pH did not show a clear seasonal pattern in Drakesbrook Drain. There was more variability in pH in the first six months, though the reason for this is unclear. Almost all samples collected fell within the upper and lower ANZECC trigger values.

Drakesbrook Drain



pH levels, 2004–18 at site 6131335. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels at 6131335. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

A treatment pond at the Waroona Waste Water Treatment Plant, September 2020.

Drakesbrook–Waroona Drain

Salinity over time (2004–18)

Concentrations

While salinity fluctuated at Drakesbrook Drain, it was consistently low with almost all samples collected and all annual medians being classified as fresh using the SWRWQA bands.

Trends

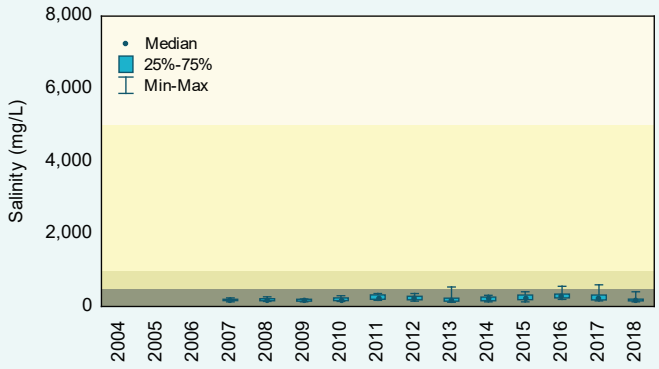
There was a short-term (2014–18) decreasing trend present in salinity of 14 mg/L/yr. This may be because of natural fluctuations at this site or an actual decrease in salinity. Ongoing monitoring will help determine if this site is getting less salty.

Salinity (2018)

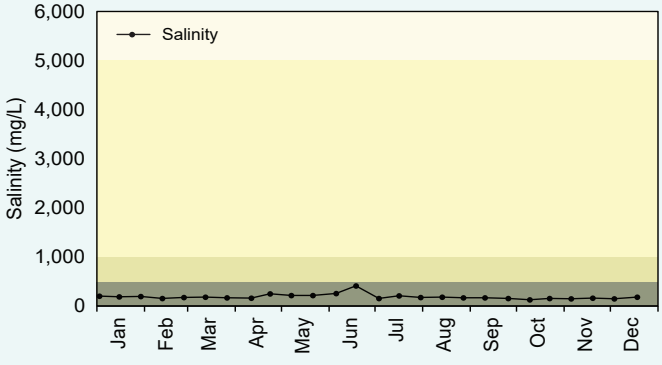
Concentrations

Salinity was fairly constant during 2018 at Drakesbrook Drain. The small peak in June coincided with high DON and NO_x^- concentrations during the first flush, suggesting that salt that had accumulated on surrounding farmland was also flushed into the drain at this time. It is important to note that, even at this time, salinity was low and classified as fresh.

Drakesbrook Drain



Salinity concentrations, 2004–18 at site 6131335. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations at 6131335. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

The Waroona Drain flowing through farmland, note the dominance of exotic grasses in the fringing vegetation, September 2020.

Drakesbrook–Waroona Drain

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 Peel-Harvey estuary at estuaries.dwer.wa.gov.au/estuary/peel-harvey-estuary/

The Regional Estuaries Initiative partners with the Peel-Harvey Catchment Council 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 Peel-Harvey Catchment Council go to peel-harvey.org.au
- To find out more about the health of the rivers in the Peel-Harvey Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Total phosphorus concentrations were compared with the Peel-Harvey WQIP target. This target represents the median winter concentration that is required for each of the subcatchments to meet their load reduction target. 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 DOC, 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.

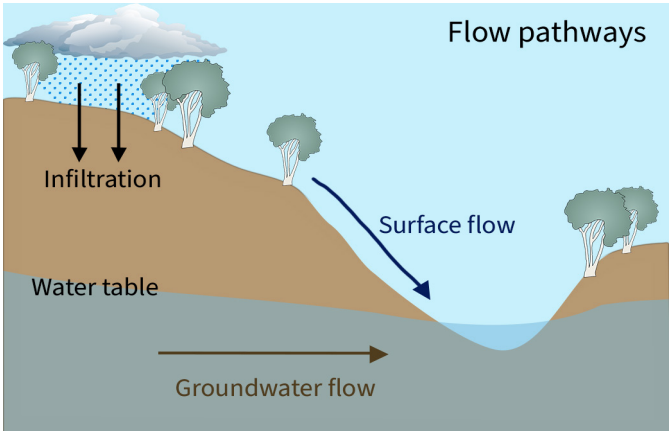
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

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.



Drakesbrook–Waroona Drain
Issue 1
Publication date: May 2021
ISSN: 2209–6779 (online only)