Drakesbrook–Waroona Drain

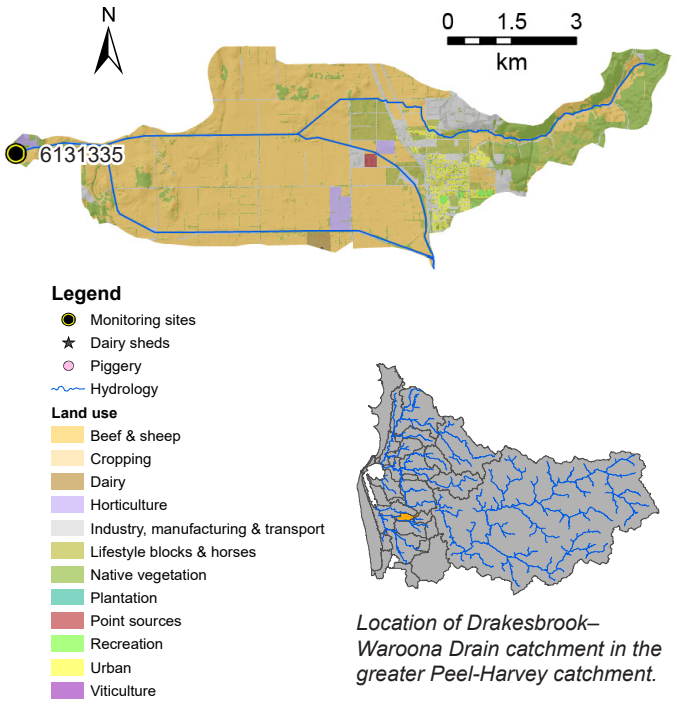
This data report provides a summary of the nutrients at the Drakesbrook Drain sampling site in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site, the drain discharges into the Harvey River and, from there, into the Harvey Estuary.

About the catchment

Drakesbrook–Waroona Drain has a catchment area of about 40 km^2, just more than 80 per cent of which has been cleared for agriculture, mainly beef and sheep grazing. The Waroona Waste Water Treatment Plant is also 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 good capacity to bind phosphorus. This means that any phosphorus applied to them tends to be bound to the soils, reducing the amount entering the waterways.

Water quality is measured at site 6131335, Drakesbrook Drain, downstream of the confluence of Drakesbrook and Waroona drains. The site is located where the drain passes under Dorsett Road, in Waroona.



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

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) at the Drakesbrook sampling site were classified as moderate. The proportion of nitrogen present in a bioavailable type 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.

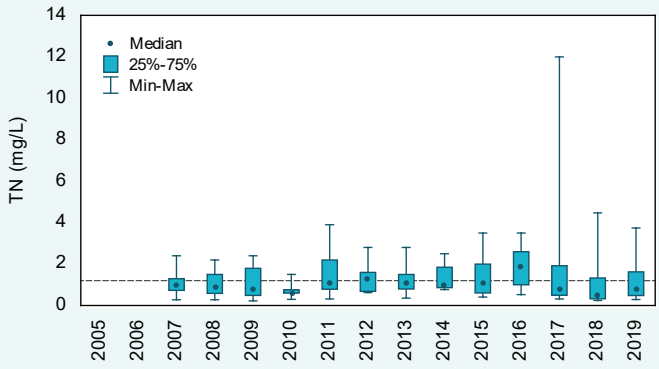
Drakesbrook–Waroona Drain

Nitrogen over time (2005–19)

Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period in Drakesbrook Drain. The annual medians were below the Bindjareb Djilba (Peel-Harvey estuary) Protection Plan water quality target for TN concentrations 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 greater than the water quality target. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, each year was classified as having moderate TN concentrations. The range in concentrations was much greater in 2017 than other years, though the reason for this is unclear.

Drakesbrook Drain



Total nitrogen concentrations, 2005–19 at site 6131335. The dashed line is the protection plan TN target.

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

Drakesbrook–Waroona Drain

Nitrogen (2019)

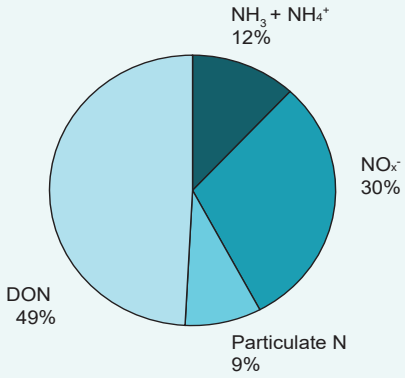
Types of nitrogen

Total N is made up of different types of N. Drakesbrook Drain had the highest proportion of N present as highly bioavailable dissolved inorganic N (DIN – consisting of total ammonia, NH_3 + NH_4^+ and nitrate, NO_x^-) of the 12 sites in the Peel-Harvey catchment where N fraction pie charts were constructed. This type 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 types of N. The bioavailability of DON varies depending on its type; some are highly bioavailable whereas others, like degrading plant and animal matter, often need to be further broken down.

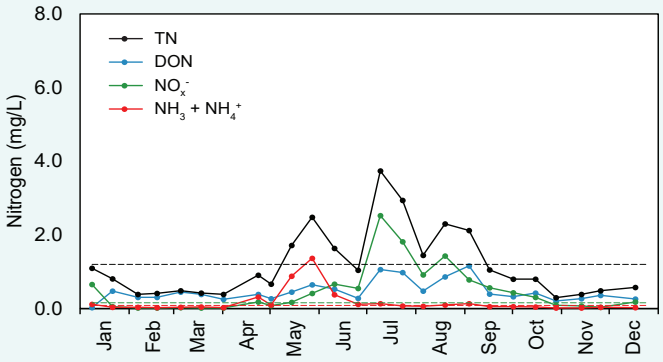
Concentrations

Total N, DON and nitrate showed a seasonal pattern, being highest during the wetter months. There was a peak in total ammonia in May and one in nitrate in July. It is likely that N was exhibiting 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. It is possible that the two peaks, one in May and one in July, were because of different parts of the catchment contributing flow at these times. The peak in May also corresponded with a peak in total suspended solids concentrations. The reason for the peak in January is unknown. The dip in TN, DON and nitrate in August was probably the result of a dry spell which caused parts of the catchment to dry out, therefore no longer contributing nutrients. This dip was present at many of the Peel-Harvey catchment sites in both N and phosphorus concentrations.

Drakesbrook Drain



2019 average nitrogen fractions at site 6131335.



2019 nitrogen concentrations at 6131335. The black dashed line is the protection plan TN target, the red and green lines are the ANZECC trigger values for total ammonia and nitrate.

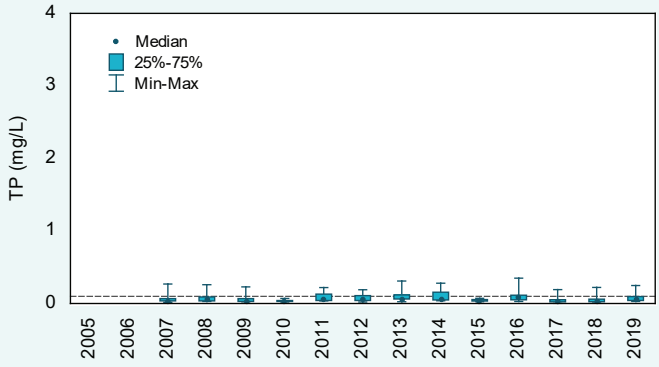
View upstream from the sampling site, September 2018.

Phosphorus over time (2005–19)

Concentrations

Using the SWRWQA methodology, total phosphorus (TP) concentrations were classified as moderate. However, compared with the other 12 sites in the Peel-Harvey catchment, TP concentrations at Drakesbrook Drain were low. Further, the annual median TP concentrations were below the protection plan water quality target for TP concentrations every year for which there were data. In 2019, the site had the third lowest median TP concentration; only the sites in Mayfield Drain and in the Middle Murray River catchments had lower median TP concentrations.

Drakesbrook Drain



Total phosphorus concentrations, 2005–19 at site 6131335. The dashed line is the protection plan TP target.

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 (2019)

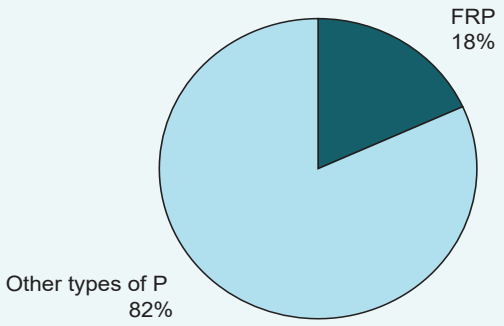
Types of phosphorus

Total P is made up of different types of P. At the Drakesbrook Drain sampling site, just under a fifth of the P was present as phosphate, which was the lowest percentage of the 13 sites sampled. Phosphate is measured as filterable reactive phosphorus (FRP) which, in surface waters, is mainly present as phosphate (PO_4^{3-}) species. Phosphate is readily bioavailable and 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.

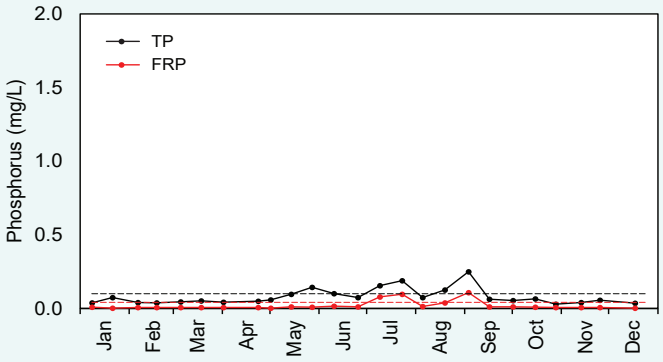
Concentrations

Total P and phosphate showed a seasonal pattern in 2019 which was very similar to that exhibited by TN. P concentrations were low at the start of the year before peaking in May, July and September. 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. The dip in TP and phosphate concentrations in August was probably the result of a dry spell which caused parts of the catchment to dry out, therefore no longer contributing nutrients. This dip was present at many of the Peel-Harvey catchment sites in both N and P concentrations.

Drakesbrook Drain



2019 average phosphorus fractions at site 6131335.



2019 phosphorus concentrations at 6131335. The dashed black line is the protection plan TP target, the red is the ANZECC trigger value for phosphate.

A vineyard adjacent to Waroona Main Drain, September 2020.

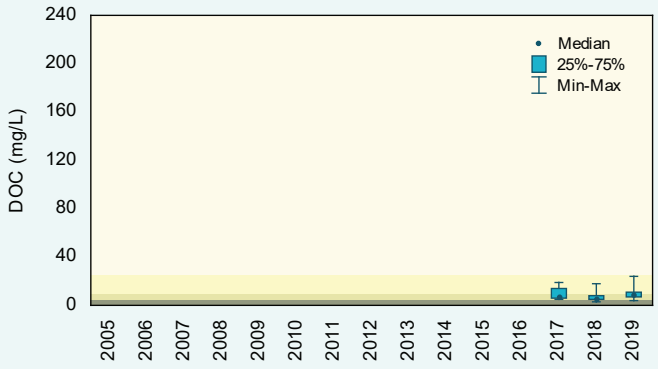
Drakesbrook–Warooona Drain

Dissolved organic carbon over time (2005–19)

Concentrations

There were only three years with sufficient dissolved organic carbon (DOC) data available to graph at the Drakesbrook Drain sampling site. Using the SWRWQA methodology, DOC concentrations were classified as moderate. However, compared with the other sites in the Peel-Harvey catchment, DOC concentrations were low, with 2019 having the equal second lowest annual median (the same as the South Dandalup River sampling site).

Drakesbrook Drain



Dissolved organic carbon concentrations, 2005–19 at site 6131335. The shading refers to the SWRWQA classification bands.

low moderate high very high

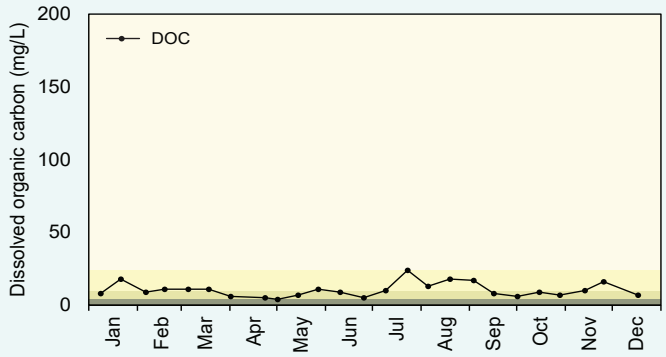
Looking downstream from Dorsett Road Bridge. The fringing vegetation is mostly exotic species such as Watsonia and grasses with a few native trees in the background, September 2018.

Dissolved organic carbon (2019)

Concentrations

DOC concentrations showed evidence of a seasonal pattern at the Drakesbrook Drain sampling site. Concentrations were lower at the beginning of the year before increasing in 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 from agricultural land and natural organic matter in soils and wetlands. 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



2019 dissolved organic carbon concentrations at 6131335. The shading refers to the SWRWQA classification bands.

low moderate high very high

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.

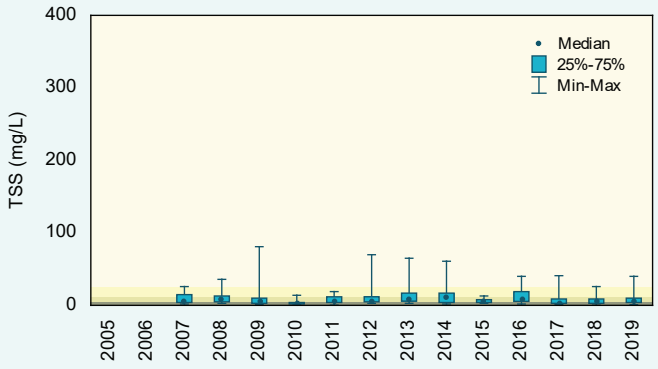
Drakesbrook–Waroona Drain

Total suspended solids over time (2005–19)

Concentrations

Total suspended solids (TSS) concentrations fluctuated at the Drakesbrook Drain sampling site. Annual concentrations were classified as moderate using the SWRWQA methodology.

Drakesbrook Drain



Total suspended solids concentrations, 2005–19 at site 6131335. The shading refers to the SWRWQA classification bands.

low moderate high very high

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

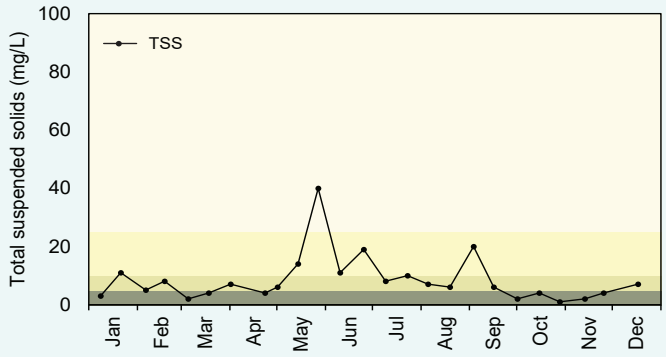
Drakesbrook-Waroona Drain

Total suspended solids (2019)

Concentrations

In 2019, there was a slight seasonal pattern present in TSS concentrations at Drakesbrook Drain. Concentrations peaked in May (coinciding with a peak in N concentrations), after which concentrations were slightly higher than the drier parts of the year. 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



2019 total suspended solids concentrations at 6131335. The shading refers to the SWRWQA classification bands.

low moderate high very high

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 (2005–19)

pH values

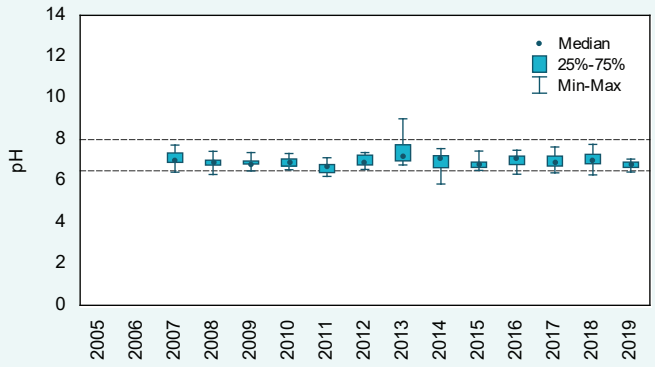
pH at Drakesbrook Drain fluctuated over the reporting period, though the annual median was between the upper and lower Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value in each year.

pH (2019)

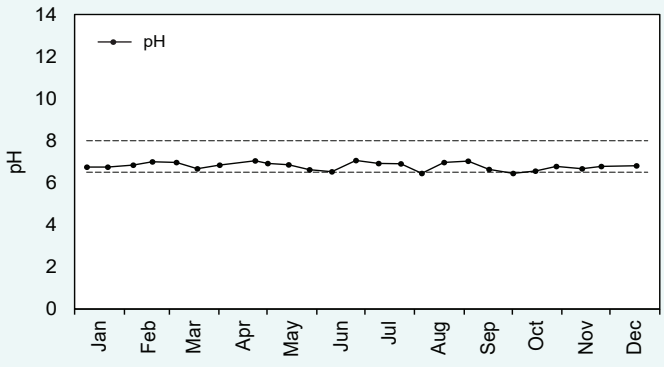
pH values

pH did not show a clear seasonal pattern in Drakesbrook Drain. Almost all samples collected fell within the upper and lower ANZECC trigger values.

Drakesbrook Drain



pH levels, 2005–19 at site 6131335. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels at 6131335. The dashed lines are the upper and lower ANZECC trigger values.

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

Drakesbrook–Waroona Drain

Salinity over time (2005–19)

Concentrations

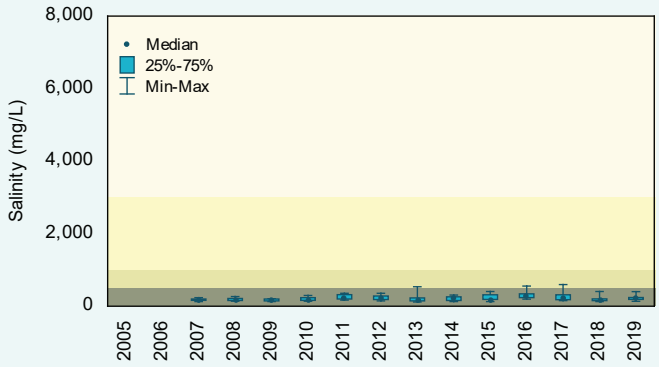
While salinity fluctuated at Drakesbrook Drain, it was consistently low with all years classified as fresh using the Water Resources Inventory 2014 salinity bands (note: in 2018, the SWRWQA ranges were used).

Salinity (2019)

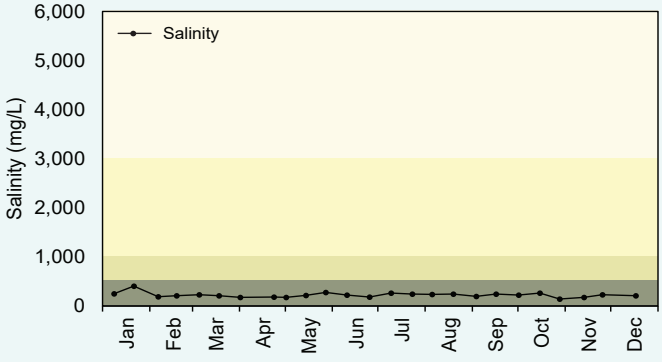
Concentrations

Salinity was fairly constant during 2019 at Drakesbrook Drain. The reason for the small peak in January is unknown. It is likely that salts were entering the drain year-round via both surface and groundwater flows.

Drakesbrook Drain



Salinity concentrations, 2005–19 at site 6131335. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations at 6131335. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

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

Drakesbrook–Waroona Drain

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

Healthy Estuaries WA partners with the Peel-Harvey Catchment Council 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 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

Variables were compared with the Bindjareb Djilba (Peel-Harvey estuary) Protection Plan concentration targets or ANZECC trigger values where available, or the SWRWQA bands or the 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.

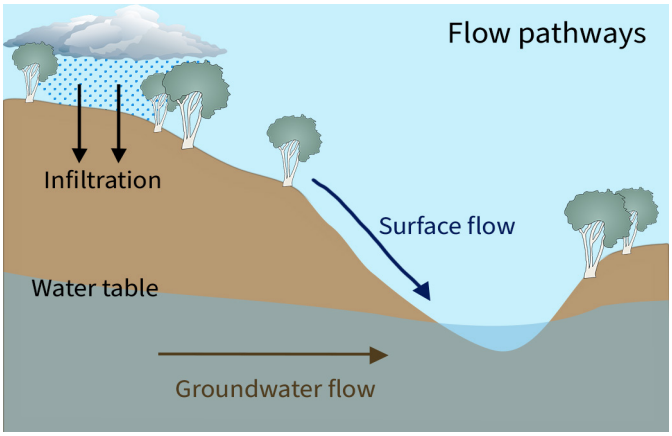
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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.



Drakesbrook–Waroona Drain
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